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**COASTAL PLAINS CENTER**



**for MARINE  
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SERVICES**

**REPORT OF THE  
CONFERENCE  
ON MARINE RESOURCES  
OF THE  
COASTAL PLAINS STATES**

DECEMBER 9-10, 1976

JACKSONVILLE, FLORIDA

Sponsored by the  
Coastal Plains Center  
for Marine Development Services  
in Cooperation with  
Virginia  
North Carolina  
South Carolina  
Georgia  
Florida

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Coastal Plains Center for Marine Development Services

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## **FOREWORD**

The Coastal Plains Marine Center is supported by the Coastal Plains Regional Commission to provide continuing technical assistance to the public agencies, academic institutions, and private enterprises engaged in managing, exploring, and developing marine resources in Virginia, North Carolina, South Carolina, Georgia, and part of Florida. The Center accomplishes its overall purpose by transferring information and by coordinating the sharing of expertise across State lines. It acts as a focal point for scientific and technical information on the marine environment of the Region, its resources, and its economic potential. The Center provides advisory and consulting services and processes requests for information, free of charge, on all matters dealing with marine environmental development of the Region. It establishes and maintains communications between individuals and organizations in the Region, both public and private, that are engaged in marine science and engineering research, development, education, industry, and management. Through such means as the sponsorship and conduct of this Conference and the publication and distribution of this Report, it stimulates interest in the use of available technology for the development of marine resources.

The purpose of this Conference was to serve as a means through which Federal, State, and local government administrators, scientific researchers, and representatives from private industry, as well as private citizens, could address some of the major coastal and marine issues facing the Coastal Plains States. The Conference brought together leaders in marine fields from both inside and outside the Coastal Plains Region and having many different backgrounds and approaches to the problems addressed. These participants exchanged recent findings and ideas, and through the wider dissemination of this Report, much of this information is being made available to a much greater audience.

This Conference was coordinated and this Report compiled by Philip G. Hill of the Center staff. The entire Center staff participated in the editing of the presentations for publication. The Center expresses its thanks here for their participation to the co-sponsoring States of Virginia, North Carolina, South Carolina, Georgia, and Florida; and to all of the session chairmen and speakers whose names are listed in the Table of Contents of this Report.

BEVERLY C. SNOW, JR.  
Executive Director  
Coastal Plains Center for  
Marine Development Services

January 31, 1977

## KEYNOTE ADDRESS

By **WALLACE W. HENDERSON**  
*Assistant Secretary of Administration*  
*State of Florida*

On behalf of Governor Askew, I would like to welcome you to Florida. The announcement concerning this Conference stated that "this Conference is designed to provide a means through which Federal, State, and local government administrators, scientific researchers, and representatives of private industry, as well as private citizens, can communicate recent findings and ideas regarding some of the major coastal and marine issues facing the Coastal Plains States." Your presence here is encouraging because it indicates an awareness of the necessity for a cooperative approach to the solution of common problems.

Because you deal on a day-to-day basis with marine resources, you are well aware that we in the Southeast have an abundance of both living and non-living marine resources. You also must know that increased development and utilization of these resources are essential for the continued economic well-being and future growth of Florida, of the Coastal Plains States, and of the Nation. In the development of these resources and in the protection of the environment that must accompany such development, it is obvious that a cooperative approach is the only realistic approach. Neither a single agency, a single locality, nor a single level of government can adequately address the development and protection of our marine resources. These resources recognize no political boundaries. Most programs carried out in a limited area will have an impact beyond the boundaries of the political entity that initiates such a program. The Coastal Plains Regional Commission, by supporting the Coastal Plains Marine Center, the sponsor of this Conference, and by supporting many other joint efforts, has demonstrated that it is an effective mechanism for promoting cooperation.

While I make no claim to expertise in the area of marine resources, I am aware of a number of issues that are of immediate importance to Florida. Florida, as you know, is heavily dependent upon its marine resources. With the exception of Alaska, we have the largest coastal area of any state in the United States. We in Florida are also experiencing extreme population growth in this area. Seventy-five percent of our population—over six million people—live in our coastal zone. The attractiveness of our coastal areas is one of the major reasons for tourists to visit and people to live in Florida.

Because we are aware that this area is one of the most naturally productive and the most environmentally sensitive portions of our State, the Legislature and the Governor have in recent years sought to strengthen Florida's ability to wisely manage and utilize the natural resources that occur on or adjacent to our coastline.

In 1970, the Florida Legislature created a Coastal Coordinating Council to develop a program to protect the coastal zone. In 1972, legislation was enacted providing for land and water management, and designation of environmentally critical areas. In 1974, Governor Askew served as the Chairman of a Committee on Land and Natural Resources for the Southern Growth Policies Board. That Committee recommended comprehensive planning to coordinate the actions of state and local governments to preserve these sensitive areas. The State of Florida is now in its third year of partnership with the Federal Government under the Coastal Zone Management Program, and we are looking forward to implementation of our coastal zone plan in 1978.

While the enactment of legislation and statements of policy do indicate a desire for action to preserve our marine resources, we often find that in the implementation stages we must not only be aware of other jurisdictions but also must recognize that conflicts will inevitably arise among users of a set of resources as complex as our marine resources. Once we acknowledge the existence of these conflicts, we are then in a position to develop reasonable plans and programs. The fact that there are legitimate differences as to what must be done with or to our marine resources does not mean that the goals of economic development and environmental protection must be in conflict. Instead, our plans and our programs will only be successful if we strike a balance between these two goals.

No one would argue that achieving such a balance will be easy. No one argues that the problems are not complex. While most of you are aware of the problems surrounding the utilization of marine resources, it may be useful to consider some examples of conflicts that we in Florida and you in the other Coastal Plains States must resolve.

With respect to our fishery resources, these are common resources and belong to all people. Florida law requires that we protect and utilize the living

marine resource for the benefit of all its citizens. Yet in attempting to implement this law we find disagreement among the major user groups. The basic disagreement stems from the fact that although this is a renewable resource, there appears to be an upper limit on production. Based on the best data available, we know that most of our fishery resources have been relatively stable in production over the past ten to fifteen years. In the same period we have witnessed a rapidly increasing fishing effort. This means that the same catch is being divided among more and more individuals. The pressure on a relatively stable resource is the reason for increasing animosity between sport and commercial fishermen, as segments of each group press for the elimination of the fishing effort of the other group. To compound the problem, we have the recent passage of Public Law 94-265 extending the U.S. fishery; we have a tourist industry that is, to some extent, dependent on the sport fishing industry; and we have the seafood consumer who also has an interest in policy in this area. Our job is to find a balance and to protect the interests of each of these groups. It will not be an easy job, nor is it made any easier by the need to develop and utilize our non-living marine resources.

With respect to these non-living resources, we have an abundance of sand, gravel, shell material, and phosphate in the nearshore area, and a high probability of petroleum and natural gas in the eastern Gulf of Mexico, in the Southeast Georgia Embayment, and in the Blake Plateau areas of the Atlantic. These resources will be developed, but again we must be certain that in their development we consider the impact on other industries and on the environment.

We must also be certain that the development of oil and natural gas does not unduly impact on or stress those self-perpetuating naturally renewable resources which are important to Florida's economy. These include the fishery resources mentioned earlier and many of the environmental qualities that are essential to our tourist industry.

Means must be found and implemented to assure the environmental and economic integrity of Florida's nearshore and onshore coastal areas as the Outer Continental Shelf petroleum and natural gas

resources are developed. Further, we will have to develop policy to provide assistance to those who may be adversely affected by catastrophic events or other pollution occurrences resulting from Outer Continental Shelf activities.

While we seek to develop and utilize known resources and to deal with current problems, we must also monitor the advance of new technology and must be constantly alert for new opportunities. In an article appearing last month in the Wall Street Journal, there is a discussion of ocean thermal energy conversion as a possible answer to the need for a long-term, non-polluting, non-fossil fuel energy source. The concept of utilizing the naturally occurring temperature differences in the ocean is sound and has been proven through numerous experiments and model demonstrations. In fact, a successful model plant was built off Cuba in 1930. Application of this on a major scale still remains to be proven, but the possibilities are exciting.

One study has indicated that it would be feasible to build 4,500 floating electric-power plants of commercial size in an area of the Gulf Stream off Georgia and Florida. Calculations indicate that enough energy could be produced to provide twice the amount of electricity of U.S. current consumption. While this technology may not prove to be practical or possible, if it is possible, the impact on the Southeast will be staggering. This is only an example of the kind of development we must continuously evaluate.

The point is that while we may face many problems with respect to development and protection of our marine resources, we also will be provided with many opportunities. Florida and the other Coastal Plains States must be willing to share the twin National burdens of energy and natural resource development. The results of what we do in Florida, both favorable and unfavorable, will have an impact on the other Southeastern States, just as Florida will be affected by the decisions of those States.

In this situation the need for coordinated planning activity has never been greater. Let us hope that, collectively, we may rise to the challenge presented, to the benefit of the public we serve.



## COASTAL PLAINS RESOURCES: A WASHINGTON PERSPECTIVE

By **THE HONORABLE NATHANIEL P. REED**

*Assistant Secretary of the Interior for Fish and Wildlife and Parks*

The resources of the Coastal Plains States can be characterized as being special, yet having problems typical of other parts of the Country. There is no question that these resources are special in many ways. Fishery, wildlife, and recreational resources found in this Region are unique in the Country. Such bountiful resources here suggest economic opportunities, because those resources have not yet been seriously abused by man, at least relative to other regions of the Country.

However, all is not well, as you know, for the coastal resources of this Region have become suddenly vulnerable to the enormous appetites of the newest "New South". Critical decisions concerning competing uses—navigation and port development, energy facility siting, resort development, recreational facilities—are being made by our generation without regard, I fear, for the future consequences of those decisions. With 50% of our Nation's population living within 50 miles of the coast, demands upon coastal resources are going to increase, not decrease. These issues arise in every coastal region of the Country, but nowhere with such urgency and at such risk as in the Southeast. Ours is, indeed, a threatened environment.

Our collective focus on coastal resources is not yet very sharp. Indeed, there are those in Washington who believe that no progress at all has been made. I believe, however, that within the past ten years there has emerged National concern for sound management of the coastal zone. Early in that period, overall public awareness of threats to coastal resources and their associated environment became well established. More recently, we have begun to demand that government respond to those threats. Passage of the Coastal Zone Management Act in 1972 was a benchmark in the development of a National policy which recognizes the values of coastal zone resources, and their vulnerability to unplanned development.

As a consensus has developed which dictates that we protect our coastal resources, so too have there appeared advocates for a number of special interests which are threatened by the conservationists' approach. Let me assure them—and you—that I do not advocate, nor does the Coastal Zone Management Act dictate, a "no-build" alternative. Rather, we ask that those responsible for the future of the Nation's coastal resources—shoreline,

estuarine, and upland—make no little plans, allowing the piecemeal destruction of precious natural areas whose environmental significance is just now coming to be understood.

Is it too late to save Virginia's barrier islands, North Carolina's outer banks, the untouched sea islands of South Carolina and Georgia, and that which remains of Florida's unspoiled coast, east and west? I think not.

It should be clear that these coastal resources cannot be saved and wisely managed by mere reaction to each new threat. In recent years, we have come to appreciate the value of planning in the coastal zone which anticipates emerging conflicts. We know, too, that the public can contribute meaningfully in making natural resource use decisions.

Sound planning and public participation are two indispensable elements in development of a successful public policy for the protection of coastal resources.

Many of you know that I went to Washington more than five years ago, having first served here in the State Government, at a time when we all shared heavy thoughts about the role of our Federal Government in shaping National environmental policy. The National Environmental Policy Act (NEPA) was but 16 months old in April of 1971, and Earth Day was a National celebration of the realization, at long last, that our environmental health was at least as important to the well-being of man as material prosperity.

Indeed, President Nixon's environmental messages of 1971 and 1972 constituted a Federal agenda so broad and ambitious that I can commend them to you now—five years later. At long last, it seemed, we were prepared to deal with environmental issues, including the management of shrinking coastal resources, as a National priority. At long last, we could build upon the halting experiments of a few innovative state governments to develop the National ideal so clearly enunciated by NEPA.

Today, I can say to you that much of what we hoped to accomplish at the Federal level has been accomplished. The concept of planning is no longer anathema, and public participation has been assured. A host of Federal laws mandates that Federal agencies consider the environmental

consequences of their actions; and these laws—enforced sometimes only at the insistence of citizen activists, but enforced nonetheless—have made a difference.

"The Corps cares", my friends across the Potomac now tell me, and so do tens of other Federal agencies whose earlier motives might not have been so charitably described. The record of the past few days, as I watch the Corps attempt to stuff the pork barrel to assist a floundering canal project, belies their clarion of environmental care.

A concern for environmental quality has become institutionalized in Washington, an integral part of doing business at any self-respecting Federal agency. Whether this concern is made manifest by lip service to NEPA ("technical sufficiency") or by substantial compliance will continue to depend upon careful public scrutiny. However, the framework is in place, and the tools are within reach of every citizen.

The extent to which this framework and these tools can be utilized effectively in protecting critical natural resources is demonstrated by the Supreme Court's recent decision to let stand a Fifth Circuit Court of Appeals decision which interprets broadly, but correctly, Section 7 of the Endangered Species Act of 1972. Critical habitat of the Mississippi sandhill crane had been threatened by an interchange for Interstate 10 in Mississippi. A suit to compel compliance with Section 7 was brought by the National Wildlife Federation against the Federal Department of Transportation. In the words of an editorial in Tuesday's New York Times, "road-builders and others who have for so long had the right-of-way in preference to the environment are on notice that the highest court in the land does not automatically recognize concrete as a sacred substance or the clover leaf as the National flower".

I am not so proud as to believe that benchmarks in the evolution of public policy are coterminous with the periods of my public service, but I do sense, as I prepare to leave Washington, that we are about to embark upon a second phase in the development of environmental policy. This phase was presaged, I submit, by passage of the Coastal Zone Management Act.

A Federal policy having been firmly established that the Nation's coastal resources are worthy of careful stewardship, responsibility for the implementation of that policy was assigned to state and local government.

It is an appealing formula, this marriage of convenience between the Federal Government and the states, and it may just prove after all to be the only means by which to achieve our common objectives.

It has worked well in the coastal zone, and it is being used increasingly to solve other resource management problems. Last week, for instance, Secretary Kleppe was able to announce simultaneously the adoption of strict mined-land reclamation standards for Federal coal leases, and agreement by the State of Wyoming to the enforcement of those standards by means of equally stringent State laws.

Such a partnership is dependent for its success, of course, upon the enthusiastic participation of competent state government. I adhere to the conventional dogma that the Federal Government does what state government could not or would not do. Those state officials who complain bitterly about the concentration of authority in Washington often did nothing to stem the flow by acting responsibly in Tallahassee, or Raleigh, or Richmond, or Columbia, or Atlanta. If we are to succeed in attacking the problems of the coastal zone as the Congress intended, we must demand that state government accept the challenge.

With few exceptions—South Carolina has yet to adopt comprehensive coastal zone legislation—the coastal states have demonstrated their commitment to the concept of cooperative coastal zone planning; and, as the result of newly adopted consistency requirements, coastal states can be assured that their management plans will be recognized by those Federal agencies whose programs have impact in the coastal zone.

Of vital importance to the success of Federal-state cooperation in the coastal zone is the existence of a responsive, capable Federal "establishment" with which to deal on matters of mutual interest. I know from experience as a State official in Florida, that the best of intentions are sometimes thwarted by the seeming rigidity of a Federal bureaucracy too large, too far away, and too insensitive.

I know now, after five years in Washington, that such problems do exist, but also that they can be overcome by determination on the part of Federal officials to implement the spirit of the "New Federalism", no matter how irksome the institutional obstacles.

As I mentioned earlier, there are those in Washington who believe that our coastal zone infrastructure could be improved by means of a massive reorganization at the Federal level. In introducing S. 3889, his bill to establish a Department of the Environment and Oceans, Senator Hollings observed, particularly with respect to NOAA and EPA, that "it appears that everyone is in charge with the result that no one is in charge". It may well be true, as the Senator also asserts, that "changes in policy have not yet been matched by

improvements in the institutions which administer these laws." If it strikes you as strange that the "Father of NOAA" would now suggest the adoption of his fledgling by a new super-agency, recall that there is a penchant in Washington for shuffling agencies like so many cards in a deck. Unfortunately, this shuffling sometimes results in a bad hand. While NOAA itself is a likely agglomeration of reasonable related components, its kinship to other programs at the Department of Commerce is dubious at best.

Further, when the Bureau of Commercial Fisheries became the National Marine Fisheries Service at NOAA, we sanctioned the establishment of an artificial division between sport and commercial fisheries that is recognized neither by the fish themselves nor by the states with which we deal. The deal smelt at the time and smells worse today.

This division of labor has seriously retarded implementation of the Endangered Species Program, as the separation of coastal zone management from upland land use has hampered efforts to achieve a viable National land use policy. I know from having talked with many of you that such Federal fragmentation has had a spillover effect in state government. Not one, but several sets of relationships must be maintained to achieve the desired result.

The current impulse to establish a Federal Department of the Environment and Oceans has been preceded by President Nixon's early proposals—first for a Department of Natural

Resources, and later for a Department of Energy and the Environment.

Please understand that I do not deny the need for an orderly arrangement of the Federal functions embraced by these proposals, nor would I defend maintenance of the status quo. I do urge, however, that in our haste to reorganize, we not lose sight of program priorities or of the need for a good fit with corresponding state programs. Senator Hollings's proposal boasts some internal inconsistencies, grouping together as it does a number of agencies (NOAA, the National Park Service, the Fish and Wildlife Service, the Bureau of Outdoor Recreation, the Coast Guard, and certain functions of the Corps of Engineers and the Bureau of Reclamation) with both developmental and regulatory responsibilities.

I accept Senator Hollings's assurance that his bill is a starting point for discussion about reorganization at the Federal level, and urge that you likewise avail yourselves of the opportunity to comment.

Whether by Federal reorganization, by more effective state government, by greater public participation, or by a combination of these, I am confident that, working together, we can establish a pattern for the management of coastal resources which will earn for us the gratitude of future generations.

Frankly, there is too much to lose. If "from sea to shining sea" is to be an accurate description of this great Country, then the time is now. With your conviction and hard work, we can make the coastal zone an area of National priority.

# COASTAL AWARENESS AND INFORMATION

By MICHELE M. TETLEY

*Technical Information Coordinator  
Office of Coastal Zone Management  
National Oceanic and Atmospheric Administration*

When I first saw the topic of the session on which I was asked to speak, I had a sudden vision of all our coastal planners, clothed in white robes, seated in a quiet circle on a high coastal bluff, mystically raising their coastal consciousness.

Actually, it is no laughing matter, as we all know, since comprehensive coastal planning and management cannot be successfully carried out unless the affected public both understands and supports the concept.

Developing coastal plans is not easy, but as our state managers are discovering, the most difficult task may be convincing the public of the need for management. Plans and planners experience a difficult confrontation with reality when they go out for public review. Frequently they are face-to-face with a set of attitudes and values that date back hundreds of years. These attitudes were well suited to a young expanding country, but must now be altered in order to acknowledge the competition for limited space and resources by the diversity of users in the coastal zone. As a wit once remarked, "The main trouble with today is that the future is not what it used to be!" That certainly holds true when discussing our dwindling natural resources and coastal lands. Democracy has spoiled us by leading us to believe that we are free to do or have anything if we are willing to fight hard or pay enough for it. That era is basically over in the coastal areas.

It is not easy to update deeply rooted value systems. It is most certainly not done speedily, which is essentially what the Coastal Zone Management Act (CZMA), by virtue of its time frame, appears to warrant.

Many of you may be aware of the fact that the public involvement requirements of the CZMA have been a chief stumbling block for those coastal states which had hoped to come in for early approval of their state coastal plans. To date, only the State of Washington has been able to clear this hurdle and obtain an approved management plan. The facts that the State Shorelines Management Act was originally a citizens' initiative, and that the legislation required local master plans to be drawn up by local Citizens Advisory Committees, aided Washington's progress in public involvement considerably.

Recognizing the problems the states were encountering as they mounted their public involvement activities, the Office of Coastal Zone Management (OCZM) has begun a coastal awareness effort at the National level. This is a multifaceted effort which is aimed at developing tools, mechanisms, and resources that will be of use to the state programs in their public involvement efforts. It should be noted too that individual states are also developing specialized approaches to this problem and have come up with an amazing array of techniques, some more successful than others.

Among the projects that OCZM is funding is a project with the Smithsonian to develop a set of regional traveling pictorial and descriptive exhibits. Each of these exhibits will be keyed to the unique coastal problems and resources within a region and are designed to travel to museums, county fairs, and other display areas.

Another project we are pursuing is with the University of Delaware Sea Grant Program. They are developing a K-through-12 student curricula for teachers that will attempt to address the various aspects of coastal resources and management. This initial contract is tailored for the Mid-Atlantic Region, but we plan ultimately to have specialized curricula with accompanying audio-visual materials available in all of our regions.

Among still other projects, we have a film which you have probably seen entitled It's Your Coast. We have also put together a series of radio and television spots for our state programs to use. The League of Women Voters, under a contract from OCZM, is conducting a series of coastal seminars for the public in New York State to test the feasibility of utilizing a non-partisan entity in the public involvement process. Finally, plans are now underway for a National Coast Week in the spring of 1978. This will be a multimedia coastal blitz which should raise the public's awareness considerably. You will undoubtedly be hearing more about this as the plans develop.

While exhibits, films, and public seminars are extremely useful in arousing public interest in the coastal zone, there are some inherent shortcomings if the coastal awareness effort ends there. Exhibits move on, films come to an end, and speakers catch the next plane. The coastal landowner, the

commercial fisherman, the developer, and the local environmentalist whose interest or ire has been raised, frequently do not have anywhere to turn for answers to the multitude of questions that surface after he or she has digested the message on coastal management.

Public awareness on coastal issues cannot be achieved by way of one-shot inoculations. The concept is too complex and the ramifications are too far reaching for the hit-and-run approach. If we are indeed going to achieve a change or an evolution of the personal and public sense of values, as it would appear we must in order to effectively carry out any resource management, coastal or otherwise, then somehow we must devise a system within a state or a region that can successfully respond to the day-to-day questions that arise in the coastal population. Generating public concern is easy, particularly when you have something as potentially controversial as coastal management. Cultivating this concern and channeling it into useful and productive activity make for a completely different and more complex problem, and one in which few planners are skilled. We are doing all we can at the National level to help the states in this regard. It is a formidable task.

I would like, at this time, to describe to you a project I am working on, which, while certainly not the answer to our coastal awareness problems around the country, should at least help.

As you may be aware, in OCZM we have a service and a collection called the Coastal Zone Information Center. Designed originally to handle the information needs of the National staff, it soon grew, through the needs of the states, to serving the various state coastal management programs. As coastal zone management became more and more important, we also added the Federal agencies, public interest groups, and universities to our constituents. When the Outer Continental Shelf oil and gas controversy surfaced, and for all intents and purposes landed in Coastal Zone Management's lap, we realized that informationally we had a tiger by the tail.

The addition of the energy crisis to the already numerous and critical information needs of our state coastal managers, and those of the public, created an information void that we, at the Federal level, could not begin to fill. Recognizing this need, the National Advisory Committee on Oceans and Atmosphere, in its 1975 Annual Report, called for an enhanced National coastal zone management information effort. Unfortunately, while the Coastal Zone Information Center attempts to serve these various publics, it cannot begin to provide the in-depth specialized coverage needed at the state and

local levels. It can and does provide the National overview and perspective, but it simply cannot identify or collect the plethora of materials now being generated on the subject throughout the Country.

Fearing we would soon be drowned in the growing tide of requests, I decided that the most logical approach would be to combine the NOAA elements which had interests, responsibilities, and expertise within the coastal areas that would apply to coastal zone management problems. I discussed the idea with the Environmental Data Service (EDS) and Sea Grant to get their opinions. They were enthusiastic about the idea, and last March I wrote a concept paper proposing a system of interlocking Regional Coastal Information Centers. I proposed:

1. To set up a system of five or six interlocking Regional Coastal Information Centers to more speedily and specifically handle the information needs of the states.
2. To utilize the three NOAA elements whose missions provide states with coastal information and data: OCZM, EDS, and Sea Grant. This sponsorship would include both funding and services.
3. To house these centers in existing Sea Grant institutions to utilize already existing resources and communication networks. The centers would specifically fall within the jurisdiction of the Sea Grant Marine Advisory Service associated with the institution.
4. To transfer OCZM and EDS monies to Sea Grant for incorporation into the receiving institution's grant.

This concept fell on friendly ears for a variety of reasons. For one thing, it was logical, and it also sounded good. It was sort of like motherhood and apple pie. How could you be against it? It had occurred to me that the greatest common denominator among the three organizations was composed of data and information. Sea Grant generates and disseminates it; EDS organizes it, stores it, and disseminates it; and the Coastal Zone Management Programs use it as well as produce some of their own. I was thus suggesting an alliance of the suppliers, the storers, and the users.

For initial planning purposes we decided to consider approximately five Regional Coastal Information Centers: one serving New England, one serving the other Atlantic States, one serving the Gulf, one serving the Great Lakes, and one serving the Pacific.

The major subject areas that would be covered by the Centers would be coastal resources, land use,

and urban and regional planning. There would of course be regional differences and specializations dictated by the particular needs or the makeup of a region. The depth and the scope of a particular center would depend partly on the institution and the clientele. These centers would be expected to act first and foremost in a clearinghouse or referral function. While some materials would be routinely collected, one of the major efforts would be to identify the existing sources of information and expertise and to develop cooperative networks of information exchange. The individuals involved in the centers would be responsible for locating all possible regional sources of coastal information and familiarizing themselves with the scope and accessibility of these sources. The centers would tie into the National Coastal Zone Information Center and EDS for materials generated at the National level by Federal agencies and organizations, and to other Regional Coastal Information Centers for their resources. In addition, centers would be able to utilize EDS's automated OASIS system for quick turnaround on bibliographic requests.

In addition to answering requests, performing literature searches, and compiling specialized source lists, the centers would carry out a low-level, selective dissemination of information for the state coastal zone programs as well as the Sea Grant institutions in their respective regions.

The centers would act as regional depositories for all state CZM program documents and would be responsible for also being familiar with the unpublished support data and information in each state. At a future date, if money and inclination were present, the centers could act as centralized depositories for such data. The centers could also act as regional depositories for documents from the Sea Grant programs within their regions.

Each of the three NOAA sponsors have something to contribute to this effort. Sea Grant has a relatively long history of coastal and marine research, and has developed considerable resources in the field. This, coupled with its publications and marine advisory services activities, which both disseminate information and identify informational needs, make it a most logical program to house these centers. The efforts could immediately hook up to the existing networks developed by Sea Grant Programs over the years, and provide both Sea Grant and its constituencies with improved information services. The Environmental Data Service has a variety of responsibilities within NOAA. Among them is the upkeep and availability of OASIS and ENDEX. These two computerized services, the first bibliographic, the second data, provide a valuable adjunct to any information

service and would be particularly useful in broadening regional information resources. The Office of Coastal Zone Management, while not a research or data-gathering organization, has, through its state programs, generated a certain amount of each, and also runs the Coastal Zone Information Center, the focal point for coastal information. OCZM, through its planning and management mission, creates the essential constituency which would use these information centers.

Last May we let a contract with the University of Michigan Coastal Zone Laboratory in Ann Arbor to carry out a feasibility study for such an information center in the Great Lakes, and also to do some preliminary thinking and planning on how we would interlock a National system of Regional Coastal Information Centers. Cheryl Alexander of the Coastal Zone Laboratory is presently surveying the Great Lakes potential user groups regarding their information needs. She has also put together an annotated bibliography on regional centers and information networking. This preliminary contract will be finished in another 4 to 6 weeks, and barring some cataclysmic event, NOAA will probably fund its first Regional Coastal Information Center to start up in early 1977.

We are also currently in conversation with the University of Rhode Island's Sea Grant Program, which has been delegated by the New England Marine Advisory Services as being the logical institution in the Region to handle the New England Regional Coastal Information Center. We expect a proposal from them in the next two months and in all probability will let a grant to them in early 1977.

This concept has been a popular one, and we have had both preliminary proposals and discussions with the Virginia Institute of Marine Science, the Louisiana State University Sea Grant Program, the University of California Sea Grant Program, and the University of Washington Sea Grant Program. We hope to give them some preliminary planning money in late 1977 to begin to tighten up the concept of coastal information services within their regions.

It should be pointed out here, if I have not made it already clear, that the emphasis of the services of these centers will be on planning and management rather than the traditional scientific research that most of us have dealt with in the past. I discovered early on, that information for decision-making and planning, is considerably different from the types of information and data that are traditionally used by researchers in the coastal and marine fields.

The coastal zone management discipline is a fast-moving and mercurial one. Our state and National staffs need current information on a vast array of

subjects, and usually they need it yesterday. They also need someone to help handle their own growing tide of requests from the citizenry, whose queries sometimes simple, sometimes complex, represent a workload that many states are ill-equipped to handle. The Regional Information Centers could lighten the state loads considerably by handling all of the routine requests if a state so wished. Centralizing such activities represents a considerable savings in time and effort.

There is no way that the small efforts that we envision putting into the regions could begin to handle all the load that is provided by the coastal programs and the public. This is why we envision them as providing a strong clearinghouse and referral function. We would expect them to use the

Federal field libraries, and university and state resources heavily for coastal and marine information and data.

While these Regional Coastal Information Centers will not be able to perform miracles in the coastal awareness area, they should provide a useful resource to which the public as well as the planners can turn.

As the states increase their local public involvement activities, there will be a simultaneous spurt of public interest and queries. We are only doing half our job if we have not made provisions for responding to this need. A well-informed public is the best ally a planner can have, for the best-laid plans gather dust until the citizenry is ready to back them.

# SHARING POWER: THE CITIZEN'S EMERGING ROLE IN THE DECISION-MAKING PROCESS

By HANS N. NEUHAUSER

*Director  
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One wag has suggested that citizen participation can be described as being like organized religion, something that is considered to be a good thing as long as it does not interfere with the business at hand.

Sherry Arnstein (1) described the problem in somewhat more disconcerting terms:

"The idea of citizen participation is a little like eating spinach; no one is against it in principle because it is good for you. Participation of the governed in their government is in theory, the cornerstone of democracy—a revered idea that is vigorously applauded by virtually everyone. The applause is reduced to polite handclaps, however, when this principle is advocated by the have-not blacks, Mexican-Americans, Puerto Ricans, Indians, Eskimos and whites. And when the have-nots define participation as redistribution of power, the American consensus on the fundamental principle explodes into many shades of outright racial, ethnic, ideological and political opposition."

Arnstein then describes a number of different citizen participation strategies that she arranges in a ladder sequence according to their actual involvement of people, with manipulation of the citizen at the bottom of the ladder, and citizen control at the top.

The perception of where the citizens are on the ladder of citizen participation differs considerably, depending upon whether one is a government official on the inside viewing citizens on the outside or whether one is a citizen viewing one's own abilities to influence decisions. It is the perception of the role of the citizen held by the citizen that is important, rather than what role might be mandated or available. The cliché "you can't fight city hall" exemplifies a perception that, while untrue in fact, is operationally valid because most people believe it to be true.

Those of us working on improving the operations of government, whether from within or without, must improve the perception of the citizen's role in decision-making as held by the citizen. Later, I will give some examples of why this must be done. The perception should be improved by enabling the citizen to trust the process of participation. In other

words, the citizen needs to see that his concerns are being addressed rather than ignored. The best way to develop this is through the personal experience of the citizen. The citizen learns little by being on the receiving end of assurances that his views will be considered.

Citizens are becoming increasingly more concerned that their lives are out of their control; that, for instance, coastal zone management plans are being developed by planners rather than by the people who ultimately will be affected by the plans, or that Outer Continental Shelf development will take place whether we like it or not. This concern is leading to more demands to be let in on the process of government. The Congress has reflected this Nationwide interest by mandating the availability of information such as that provided by the National Environmental Policy Act, the Freedom of Information Act, and various sunshine-in-government laws, and in the provisions for meaningful citizen involvement in such programs as Coastal Zone Management (CZM) and Water Quality (P.L. 92-500).

The Federal Government has done a much better job in involving the citizen in its decision-making processes that have either state or local governments. This is at first surprising, given the commonly held feeling that local government is best because it is closest to home, and thus able most effectively to recognize and deal with local needs and desires. Yet upon analysis, the Federal Government's general success in involving citizens may be due to the reduced influence of special interests, comparative to the interests of the public at large.

The states and local governments are, by comparison, doing a poor job of involving the governed. In most cases where citizens are consulted, it is either in the form of talks with a narrow group of persons and social contacts, or it is in the form of appointed boards or councils. Of the public participation strategies in effect in Georgia, less than 17% involve opportunities for any member of the general public to be involved (2). This is a miserable record, and needs to be changed.

While citizens are requesting greater opportunities for participation, we should realize that



with those opportunities come responsibilities. These include becoming familiar with the program, learning of the program's status and problems, and participating in the opportunities made available. Citizen participation opportunities must be provided at frequent intervals in the development and implementation of a plan. But a planner or manager should not expect that the participation in the formulation of programs of complex nature (e.g., 208 planning) or uncertain goals (a state's CZM program) will be numerically extensive. Rather, the planner should expect and actively facilitate the active involvement of citizen representatives in the early phases. These citizen representatives (representatives of particular group interests, such as timber processors, shrimp harvesters, conservation groups, minorities, labor unions, etc.) can serve as opinion leaders within and sometimes outside their constituency. They can alert both the agency and friends and associates, at early signs of trouble or prior to stages when large numbers of citizens need to be heard from. The identification of these citizen representatives can be facilitated by a process called snowballing, in which known representatives are asked to name others.

Let me present a case study of a citizen participation event that involved the planning for Cumberland Island National Seashore. I do so not out of conviction that this is the only methodology to use, but out of a desire to illustrate how certain principles of citizen participation can be applied to a real-world situation. The Cumberland Island case study began in 1972, as a result of two separate actions: first, the enactment by the Congress of the establishment of the Cumberland Island National Seashore, the southern-most barrier island on the Coast of Georgia, and second, the publication of a Conservation Foundation critique (3) of the National Park Service in which was advocated better opportunities for public involvement in the planning and management of the National Parks. The Conservation Foundation then received a second grant to investigate whether their System-wide recommendations would work on a particular unit of the National Park System.

With the assistance of the Georgia Conservancy, the Conservation Foundation then assembled four study teams to look at Cumberland Island National Seashore. These teams consisted of people with divergent backgrounds and responsibilities, such as leaders from both State and local levels of government, landowners, conservationists, recreationists, and educators. At first, the study teams found that both the plans and the process by which those plans were being developed were closed to citizen inspection. Frustration led to an

appeal made to Washington-level representatives of the Department of the Interior. Gradually, the process was opened to the teams. When it was, what the teams found was illogical. For example, the Park Service was planning to develop the Island—putting campgrounds here, a sewage treatment plant there, and so on—without any knowledge of the basic resources of the Island. The Park Service was intending to make the vast majority of the major decisions on the future of the Island without knowing what the soils were or what they were capable of accommodating, without knowing where and why, and without knowing the extent or the location of historical and archaeological sites on the Island. Once these inadequacies had been discovered, it took an additional 17 months, additional appeals to Washington, a confrontation between this evening's guest speaker, Mr. Reed, and the Commissioner of the Georgia Department of Natural Resources, and the appointment of a new Director of the National Park Service before the process was revised for Cumberland, and an additional six months before the planning process was revised System-wide. The revised process necessitated that the Cumberland planners go almost back to the beginning, formulating their plans both on clearer understanding of the Island's resources and on what the users wanted.

The new process involves obtaining citizen input at frequent stages in the development of the plan, and involves working very closely with State and local governments, and with citizens on more frequent occasions.

Certain benefits resulted from the new process. They include:

1. The plan bore greater resemblance to what the users desired.
2. Public comment had improved the plans for the Seashore.
3. Public comment had helped to change the attitudes of many Park Service managers.
4. The citizens had assisted the Park Service in identifying many of the problems and had helped the planners sense their magnitude and importance.
5. The citizens learned more about the problems and constraints of the Park Service. Tough Park Service decisions were buttressed by broad citizen approval. Citizens became much more supportive of the goals and objectives of the Park Service.
6. The citizens began to trust the process by which the Seashore was being planned. Citizens began to be convinced through their own experience that the agency would be

responsive to their expressions.

7. The decision-making authority is now being shared with others, including State and local governments and users.

There were also certain costs involved in the development of the new process. Unfortunately, most of the costs were unnecessary. They can be avoided if meaningful citizen involvement is assured from the beginning. These costs included:

1. The National Park Service had to discard over three years worth of planning in order to start afresh, and do things right.
2. The public was not, to any appreciable extent, able to use the facility that they had purchased because one set of development plans had to be discarded and an entire new set generated.

An unfortunate element of this story is what it took to trigger the changes. It took two Foundation grants of significant magnitude, three paid employees working almost full-time for several months, and two conservation organizations using personal contacts with top-level agency administrators in Washington. It also took an inordinately large amount of time of top State officials. The citizen normally does not have these resources to draw on. By involving the citizens

before the plans were formulated and maintaining contact with them until the plans were approved, all of the frustration on Cumberland Island could have been avoided.

In summary, then, meaningful citizen participation can be viewed as being helpful, supportive of, and in the long run necessary for the successful implementation of programs. Without it, we can anticipate delays and additional costs in the short run, and in the long run, a disillusionment with the agency in particular and government in general. The results of this disillusionment could pave the way towards apathy and the conditions that would favor an Orwellian "1984" dictatorship, or it could result in frustration and revolution.

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# RAISING THE LEVEL OF PUBLIC AWARENESS MEANS PUBLIC PARTICIPATION

By **GEORGE M. HAGERMAN**

*Public Participation Coordinator*

*Virginia Coastal Resources Management Program*

I am delighted to have this opportunity to participate in this Conference on Marine Resources of the Coastal Plains States.

Raising the level of public awareness means public participation. By public participation, I mean not only public information, but also finding out what the public thinks and what it desires to happen in the coastal area. State and local governments can only raise their own level of awareness when they become aware of the citizens' requirements and aspirations.

I am not talking about the type of public participation where an advertisement for a public hearing is inserted in the classified section of the newspaper. This type of public hearing will consist of a few speakers who will probably make negative remarks because they have been provided with very little, if any, prior information. Frequently, the staff officer conducting the public hearing has already made up his mind and is only holding it in order to satisfy the letter of the law. Nor am I discussing public participation whereby the staff has drafted a plan and the public information effort concentrates on trying to sell this plan to the public.

I will discuss public participation where, ideally, there is true collaboration between the staff developing the plan and the public who will be impacted or affected by this plan when it is implemented.

Public participation is very appropriate when talking about a coastal resources management program. We cannot really manage coastal resources. The oyster will not move where you tell him; in fact, he can only survive in certain areas. We cannot order fish to change their spawning habits. We cannot legislate ducks and geese into certain migratory patterns. Instead, we direct the citizens in the coastal areas. We tell them where they can go and what they can do. Fortunately, we live in a democracy, and people may not do those things that you want them to do unless you can convince them that this really is in their best interest. Programs must be explained to them; and they must have an opportunity to ask questions and to make timely comments during the development of the planning effort. Communication between them and the planning agency must be such that the public instinctively knows that their interests and desires

are being given adequate consideration.

The first step in any public participation program is to identify the public. Incidentally, you are going to hear the word "public" a great deal during the next few minutes. Please bear with me, as it is the only word that fits the subject matter. Actually, there are many "publics," and the public participation program must be designed to reach all of these. It is appropriate to approach each of these "publics" in different ways. The approach will be dependent upon the role that the planning agency perceives a particular "public" playing during the plan development.

There are four main "publics" that normally must be considered. In order of importance, they are:

1. Local officials.
2. Citizens who will be impacted by the implementation of the plan.
3. Interest groups.
4. General public.

The local official and impacted citizen "publics" are really about equal in importance; however, I will discuss the "public" of local officials first.

Local officials include city councils, boards of supervisors, county executives, planning commissions, planning officers, and their staffs. Their daily schedules are hectic, and they tend to move from crisis to crisis. It can be very difficult to make them stand still long enough to educate them on the ramifications of a complex coastal resources management program, much less get their views. Of course, in due time they come face-to-face with the plan when their government must take action on it. If there has been no public participation program aimed at this "public," the best that can be hoped for is a grudging approval; the worst, an insurmountable roadblock. To obtain solid public participation from this "local official type public," one should work out the timephasing of this program well in advance. Do not snow them with too much information too fast. Lead up to presenting them with alternatives that they can understand. They make ideal members for a citizen policy group that is collaborating in plan development. Occasionally, talk to the more influential members of this "public" on a one-to-one basis; get their opinions; and answer their questions. It may be possible to make presentations to the entire council or planning

board during one of their regular meetings. Always remember that this "public" frequently has the power of life and death over your pet project.

The "impacted citizen public" is almost equally important. Occasionally, the impacted citizens may include groups such as commercial fishermen or tourist industries. In any case, the initial objective is to establish a two-way communication with this "public." Provide ample opportunity for them to send you their names and addresses. For example, in Virginia we obtained copies of the National Wildlife Federation pamphlet, Estuary, What a Crazy Place; these being distributed with inserts requesting citizens to write for additional information on Virginia's coastal resources management program. We are also preparing attractive natural resources poster maps of Tidewater Virginia. We will distribute bookmarks which state that a free natural resources map of Tidewater Virginia can be obtained by writing to the Office of the Secretary of Commerce and Resources. Once names and addresses are obtained, then brochures, newsletters, fact sheets, and other explanatory material can be forwarded. At appropriate stages, it is important to send out questionnaires to this "public." These questionnaires should concern very specific issues in order to receive pertinent comments. Every opportunity should be made to speak to groups and organizations comprising this "public." At these meetings, plenty of time must be allowed for questions and comments. In public participation, there is nothing better than eyeball-to-eyeball discussion. Comments received from this "public" will sooner or later reveal interested, articulate citizens who could make significant contributions to a policy board, a citizens' committee, or even to a technical group. Make use of them.

The "interest group public" includes conservation organizations, the League of Women Voters, civic leagues, garden clubs, and may include technical groups such as planning or engineering associations, or even real estate boards. Making contact with these groups is usually not much of a problem. They tend to keep abreast of major planning efforts. It is beneficial to ensure that some of the more technical groups, who may be influential in the community, participate in this public participation effort. Provide all of these groups with the same information that was provided to the "impacted citizen public." Since they are already organized, this "public" makes an ideal audience for presentation and discussion of issues. The average profile of this "public" will be an upper-middle-class, professional, well-educated person, deeply concerned with the future of his community

and state. The various groups within this "public" will be diverse in their outlook and goals. Provision should be made for these groups to inter-react to discuss their contrasting views. Panel discussions in workshops are ideal vehicles for accomplishing this goal. However, as a word of caution, do not alienate any part of this public, as lawsuits are becoming a way of life, and they are time-consuming and expensive. Members of this "public" should also be represented on boards and committees that are a part of the public participation program.

The last "public" to be considered is the "general public." This includes every citizen not in any of the other groups that I have discussed. Public involvement for this "general public" should be mostly educational in nature in order to increase their awareness of the program. Newspaper articles, radio and television announcements or documentaries, and public meetings are some of the more obvious means of carrying out this education. Brochures, newsletters, summaries of the plan, interim reports, et cetera, made available in libraries, chamber of commerce headquarters, city halls, et cetera, can also be used to reach this public. If a member of this public becomes convinced that he has a stake in this program and wants to be heard, he will probably migrate to one of the other "publics." The importance of this public should not be underestimated. They will read or listen to program material, usually without comment. However, should one of the other "publics" take an adversary position relative to the project, segments of this "general public" might join in to make it a real "public outcry" in opposition to the project.

Now that the "publics" have been identified and we have some ideas on how to get their attention in order to orient and educate them, we are ready for their participation. One cannot just get a group together and say, "Participate." What do you hope to accomplish from a meeting or workshop where the citizens speak?

I am going to list six possible goals for meetings and workshops. Each will be a bit more difficult to achieve as we go down the list.

The easiest thing to accomplish is to give the public an opportunity to register complaints, however, unfounded they may seem. This type of meeting can also relieve pressures that have arisen between competing citizens or competing organizations. It reduces the possibility of alienating individuals and groups. Of course, this minimizes the possibility of lawsuits.

On a more positive basis, and not much more difficult to achieve, is the use of the meeting to identify citizens' problems, values, and needs. It is a

matter of survival of the program that this goal be achieved. It is also most important that program staff officials be as responsive as possible to these citizens' concerns.

The third goal to be considered is the generation of new ideas by public participation. The public, being on their "home turf," frequently possesses information that is not apparent to staff personnel working in an office a few hundred miles away. This information, among other things, can include unrecognized sources of data, unanticipated impacts, and feasible trade-offs.

The next goal in ascending order of difficulty is collaboration and comment on the proposed plan. This is definitely a continuing project that must be initiated early in the planning cycle. Actually, the advisory group formed to achieve this goal should collaborate with the staff on the formulation of recommendations. This will indicate good faith on the part of the staff and should consolidate public support.

The next goal, the evaluation of alternatives, follows naturally from collaboration and review. If the program staff is unaware of public values, needs, and aspirations, it will have difficulty in determining alternatives which are socially, politically, and economically realistic. An advisory group which has collaborated on plan development will help in overcoming this obstacle.

The final goal to be achieved is conflict anticipation and resolution. Early in the planning process, competing citizens or "publics" must have a chance to discuss their differences. Tact and skill will be required to anticipate and resolve contrasting views before they become critical. In all probability, not all conflicts can be resolved. Skill will be required to select a course of action that adversely affects the fewest number of citizens.

This has been a very brief outline of some of the high points and pitfalls that are a part of public participation. Public participation will not just happen. It is necessary to write a good, solid development plan to guide the program. The costs of the "attention-getters" and other aspects of the public information and public participation sections of the program should be listed. Public participation costs money, and these costs should be evaluated ahead of time. There is never enough money to do everything. If costs are estimated ahead of time, then a balanced program can be generated without exceeding the budget.

Otherwise, one expensive brochure could wipe out all available funds. The development plan should include a time schedule for implementation. All too often, public participation programs begin with a big splash and then dry up, because a continuing plan has not been formulated. For example, workshops take time; a good, well thought-out workshop takes about three months to properly prepare. Another important item in the implementation section of the development plan is the composition of mailing lists. For example, in Virginia we are using the mailing list of the Virginia Institute of Marine Science in mailing out information bulletins. Of course, we are also very carefully cultivating our own mailing list derived from names who answer our "attention-getters."

In closing, let me point out that even when using all of the information that I have discussed and much, much more, it is possible, even probable, that there will be failure. A workshop can be organized and publicized by the media and invitation brochures, and then no one shows up. This can mean that the theme of the workshop did not strike a responsive public nerve, or it may be that the meeting was scheduled on a beautiful, warm spring day when there were too many competing events. Do not get discouraged; keep trying and reschedule. In the long run, a public participation program is essential to the success of any new major program, be it a public or private venture. The necessity for private industry to utilize public participation should not be underestimated. I can think of two private major projects in Virginia where the lack of assessing public attitudes and public involvement has literally cost these companies millions of dollars due to delays forced by citizen groups which are objecting to the development of these projects.

As a final thought, a public participation program should be considered while the proposed project is still a gleam in the eye of its creator, be he a public or private official. Do not develop a program in isolation and spring it on an unsuspecting public at the last minute. This will only frustrate them and may lead to counter-productive action on their part. Keep in mind that the lack of a public participation program, or a poorly conceived one, can delay or even kill a project. On the other hand, with good planning and proper timing in the execution of a public participation program, the public can become a supportive and contributing partner.

# ARE WE BUILDING TOWARDS A HURRICANE DISASTER?

By NEIL FRANK

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*National Hurricane Center*

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Senator Waddell made an interesting observation this morning when he expressed his amazement at the ignorance of people who live along the coasts. I have also found this to be true in relation to people's knowledge and beliefs about hurricanes.

When you mention hurricanes, most people think of big winds. Hurricanes are indeed big winds. In Darwin, Australia, for example, a hurricane on Christmas Day of 1974 destroyed about 85% of that city. This was all wind damage so, indeed, you do have big winds associated with hurricanes. But even more significant than the wind is the water associated with hurricanes. If you live inland, it is water associated with rainfall and river flooding; but more important to us who live along the coasts, it is the storm surge. Nine out of ten people who are killed in a hurricane are killed by the storm surge. This is a dome of water maybe 50 miles wide that sweeps across the coast near the point where the eye of the hurricane makes landfall.

What does a storm surge do? Let us go back to 1969 to the Richelieu Apartments on the Mississippi coast. Twenty-five people ignored the pleas of civil defense people to get out and, instead, decided to stay in the apartments and have a hurricane party. The building they were in was a three-story, brick front, substantial-looking building. In front was a four-lane highway and, in back of the beach, was an eight-foot seawall. Then, the hurricane storm surge brought twenty-five feet of water across the coastline and there was nothing left of the apartment building but the foundation slab. Twenty-three people died. One of the survivors was a ten-year-old boy. He was rescued by a man from a nearby house who, along with his wife, two teenage daughters, and son, had remained in their home. When the water hit their house it disintegrated and the father was separated from his family and thrust along by the water until he bumped into something solid and took hold of it. This turned out to be the top of a tree. He heard a cry, reached out, and grabbed his own son. The rest of his family died. He heard another cry and rescued the ten-year-old boy from the apartments.

The second survivor from the apartments was Mary Ann Gerlach. She and her husband had decided to stay because they were hurricane veterans. They were in Jacksonville, Florida in 1964

when Hurricane Dora made landfall around St. Augustine. In other words, they were on the fringe of a minor storm and they felt that made them veterans. When the water hit the second floor of the Richelieu Apartments, the building began to break apart so Mary Ann jumped out into the water and left her husband, who could not swim, to drown. She was in the water twelve hours before being deposited on the beach four-and-a-half miles from where the apartments were located.

Another example is a church where twenty-one people sought refuge and 14 died, including the minister's wife and the wife and 11 children of the caretaker—a tremendous tragedy. The real tragedy in this case, however, is the fact that only 150 feet away from the church was a designated civil defense shelter. Six-hundred people were in this shelter. They got wet and had a very scary time, but all are alive today. The difference between life and death for 14 people, in this case, was only 150 feet.

We have a people problem along our coasts, as was mentioned by Mr. Henderson this morning. Senator Waddell, as I recall, mentioned that one of the resources along the beachfront is people, and we should not forget that. We have had a tremendous increase in the numbers of people living along our beachfronts. In one measured ten-year period there was an overall 13% increase in the number of people in the United States while, along the beachfronts there was a 40% increase in the number of people. We now have new population centers in every coastal section of every State from Texas to Maine.

In the south part of Texas, off Brownsville, is Padre Island, where 3500 people now live. Services are available now and it is ready for a population explosion. Rockport, Texas, a dredge-and-fill operation off Corpus Christi, plans for about 10,000 people to eventually live here. I went there to look at some property. I like to do this at the coastal developments to find out what potential buyers are being told. I asked those who were selling land there if they had a hurricane problem. The salesman laughed at me and said he had been there for 12 years and had never seen water in the streets. Do you know that Rockport is about 30 miles south of Port Lavaca and that, in 1961, Hurricane Carla pushed 20 feet of water into the Port Lavaca area?

They are building on the west end of Galveston

Island also. The worst hurricane disaster this country has had was on Galveston Island in 1900. They built a seawall there after that hurricane to protect the city and people are now beginning to forget that disaster and are building out beyond the seawall. There is one condominium located beyond the seawall now.

In Florida, there are 50,000 to 60,000 people located on the offshore islands around the Tampa Bay area whose only escape routes are two-lane roads over very marginal bridges. Today, 3500 people live on Sanibel Island, Florida and, in the summer, there may be 10,000 people there. Their escape route is a narrow two-lane road over a bridge back to the mainland, some 13 miles to where they can fan out at all. On Marco Island on the southwest Florida coast, 35,000 people are scheduled when development is complete. As you drive into the development there is a huge and very substantial bridge. I do not think a hurricane will wash away that bridge. But when you come off the bridge you are on a road that is no more than a foot or two above the water level so, even though the bridge may stay put, you are not going to be able to get to it because the road is going to go under water.

At Hilton Head Island, South Carolina, I investigated buying property a few summers ago. There are about 10,000 or 11,000 people on the south end of Hilton Head in one of the most beautiful developments in the United States. I asked the real estate man there if they had a hurricane problem. He said, "Yes, I guess so, if you consider a big blow which people mention in their old legends as a problem" and laughed. I asked him if he would evacuate if he was notified to do so. He said, "I see no reason why I should". Then I told him that in 1893 twenty feet of water went over this island and over 2,000 people were killed and he said he had never heard of that. I asked where he was from and he said he had come from Cincinnati and had been at Hilton Head four years. He is a case of that ignorance which Senator Waddell mentioned.

We can go on up the coast to North Carolina. At Figure Eight Island, the causeway leading from the new development there goes over the type of bridge which turns on its axis—a very marginal escape route.

We have population concentrations along some beaches today that I am not sure we can evacuate. For example, in the Florida Keys there are some 60,000 people, 20,000 of whom live in mobile homes. Their escape route is a narrow two-lane road that was built many years ago. There are 60 bridges along that road, 40 of which are in need of major repair. Next summer, if you go to the Keys, you will find that probably a half-dozen of those bridges are

really one-lane because the other lane is blocked off for repair.

What is the hurricane experience of those who live along the beach fronts today? In order to determine that, we decided to look at how many have experienced a major hurricane. First, we stratified the severity of hurricanes on a relative scale of one to five—one being a minimal storm and five being the worst you ever expect to have. Then, we defined a major hurricane as one in the three to five range and examined some of our coastal areas to see what the hurricane experience level might be.

To do this, we plotted population graphs for every coastal county from Texas to Maine. One of the extreme examples which came to light was Broward County, Florida, just north of the Miami area and where Ft. Lauderdale is located. There are almost 1,000,000 people in Broward County today. The last time they experienced a direct hit by a major hurricane was in 1950 when the population was 80,000 people. Over 90% of the people living there today have never seen a major hurricane. In the Miami-Ft. Lauderdale area we have 2,000,000 people. There were 600,000 people there in 1950 so 70% of the current residents are in an inexperienced category. The same is true in the Tampa Bay area where there are now about 1,000,000 people. The last major hurricane to strike there was in 1921. Nearly 90% of the people around Tampa Bay have never seen a major hurricane.

In the State of Florida alone there are 5.5 million coastal residents and 4.3 million, 80% of the people in the most hurricane prone State in the United States, are in the low experience category. Or, in the region from the northeast Florida coast up through the Georgia coast, there has not been a bad hurricane during this century. I was in Savannah last year and, while I was there, a local newspaper made a survey of residents of Tybee Island. The conclusion was that most of those people are not going to get off Tybee Island in the event of a hurricane.

Essentially, the whole area further up the coast, including Virginia, Maryland, Delaware, New Jersey, and New York, has not had a major hurricane this century. It is frightening to go to Norfolk, Virginia and find that evacuation plans there are based on experiences in the 1930's. Norfolk had a storm in the 1930's, one which was between a two and a three on my relative scale of one to five—a relatively minor storm as storms go.

In the coastal areas of the United States we have 36½ million people and 28 million of these are in a low experience category—78% of our coastal residents today have never experienced a major hurricane. The tremendous increase in population

in our coastal areas has occurred during a relative lull in hurricane activity. The major hurricanes that have struck the United States over the last 15 years have all been in the Gulf of Mexico. It has been over 15 years, during the decade of the 1950's, since we have had a flurry of hurricane activity along the East Coast of the United States and since the decade of the 1940's that we have had major hurricanes over Florida. Let us see what lessons we might learn from one of the coastal communities that has expanded during this lull of hurricane activity and where the residents are relatively inexperienced.

In the Panhandle of Florida, Hurricane Eloise struck the Panama City area in 1975. This was the first major hurricane to strike Florida in over a decade and the first in Panama City during this century. There are three lessons we can learn from this experience.

First, there was poor planning in the development of the Panama City Beach area. Panama City Beach, often called the "Miracle Strip" because of the growth that has occurred there, is fairly typical of beaches that I have seen in Virginia, North Carolina, South Carolina, Georgia, and Florida in that a system of sand dunes 10 to 20 feet high runs behind and parallel to the beach front. Of course, we know that a sand dune is nature's way of preserving the beach and it also gives those of us who live there a measure of protection from storms.

One of the first things that builders did here was bulldoze the sand dunes so that guests at the motels could have instant access to the water. The Roundtownner Motel, for example, was built right where the sand dune had been. Then, 16 feet of water associated with Hurricane Eloise swept across the coast, undermined the foundation of the east wing, and it fell in. The west wing was undermined and collapsed and water went through the ground floor of that facility, literally sweeping everything out. This is the kind of damage that can result from storm surge. I understand that the owner of the facility has sued the insurance company. You see, he had wind damage coverage, but he did not have storm surge insurance. His claim is that a tornado caused the damage. There may have been a tornado which contributed to the damage but I really do not believe a tornado blew the sand from under the foundation; I believe that water did that.

The second lesson is that building codes were inadequate. For example, builders were permitted to put foundations of homes right on top of the sand dune with no pilings, much to the regret of many unsuspecting buyers who returned to find their homes toppled. Another example was a restaurant which had pilings along its beach side but not under

the entire building so that, when the sand eroded from under the building, its center collapsed. We know that pilings are effective as evidenced by those buildings which were built on pilings and, while a lot of sand was eroded from under them, remained in place. Even rather modest beachfront cottages on pilings withstood the storm while very expensive commercial buildings were destroyed.

The third lesson to be learned from the Panama City Beach example is that enforcement of the existing building codes was inadequate. In other words, inspection was poor. Several of the buildings in the Panama City Beach area, after Hurricane Eloise had removed sand from under them, showed examples of poor building practices which the builders never expected to be seen. Such things as exposed concrete reinforcing rods, missing concrete crossmembers which were obviously never poured and, in one case, a building which did not even rest squarely on its foundation pilings, were in evidence.

We had an opportunity to see what a hurricane could do to one of the highrise buildings that are increasingly common along our coasts. We have often wondered whether we could send people to the upper floors of one of these highrise buildings as a safe place. We examined a 13-story highrise after Eloise and, at first glance, it looked as though it had survived reasonably well even though the seawall was destroyed and the ground floor was gutted by water. When we looked closer, however, we saw that, of the 90 pilings under that building, 30 of them had cement missing from the top. In other words, one-third of the designed strength of that building was not even there. It is speculated that, after the foundation pilings were in place and the forms were laid to pour the crossmembers, that sand blew into the forms. Then, before he poured the concrete for the crossmembers, the builder forgot to clean out the forms so that concrete never got down to the tops of those pilings. This certainly raises questions about sending people up in one of these buildings as opposed to getting them out of the area entirely. Or, if you cannot get them out, what will you do with them if this is not a reasonable way for people to respond? Poor planning, inadequate building codes, poor inspection—these are very vital lessons.

Panama City Beach is not just an exception. On the Florida West Coast you can find buildings that are built right out into the surf. Some are built on what is called a Hollywood piling. What is a Hollywood piling? This is merely a horizontal slab of concrete about three to four feet thick. In Dade County you can buy a condominium in a building that is built on a compressed sand piling. I had never heard of a compressed sand piling but I found



that, in this case also, the term piling is a complete misnomer. The term applies to sand which has been mechanically compressed to make it rock hard and this is a valid building principle back away from the water. I question, however, whether it is valid right on the beach.

At Wrightsville Beach, North Carolina, a Holiday Inn has been built exactly where an old inlet, created by Hurricane Hazel in 1954, was once located.

In Mississippi, I saw a house which, the man who built it was confident, was completely hurricane proof. When Hurricane Camille struck, the man's brother called to warn him that this was to be a bad hurricane. He told his brother not to worry since he had monitored the construction of his house, had extra steel put into it, and knew that it would survive a hurricane. He stayed with his wife, his wife's brother, and two neighbors. All five died.

Building codes were designed to give you a measure of protection against wind damage—not storm surge. I do not know of any building code that takes into account the storm surge.

We are in the day and age of the billion-dollar

hurricane. Hurricane Camille in 1969 and Betsy in 1965 were both billion-dollar hurricanes. As long as we continue to build right on the beach fronts we will continue to have escalation in the dollar damage caused by hurricanes. I am not opposed to beach front development; in fact, I am in favor of it. But I do think that, if we build there, we must be aware of the fact that someday we can suffer damage.

At the same time as the dollar damage caused by hurricanes has increased, the loss of lives has decreased. Since the turn of the century when the Galveston disaster killed 6,000 people, the decrease has been steady. What we fear now is that in the near future we may have another disaster that will equal or surpass the Galveston disaster.

My appeal to you today is to join with us at the Weather Service, and those in the disaster agencies and get on with developing means to protect our people on the coasts. As you continue this program through today and tomorrow, I would like to encourage you to remember that we do have a people resource along our coasts about which we should be concerned.

# EXPLORATION AND DEVELOPMENT OF OIL AND GAS RESOURCES ON THE OUTER CONTINENTAL SHELF

By OTTO R. HARRISON

*Vice-Chairman  
Clean Atlantic Associates*

Good afternoon. I am here today representing Clean Atlantic Associates, an oil spill cooperative of which I am Vice-Chairman. For over 17 years I have worked in the petroleum exploration and production industry, and currently I am Operations Manager for Exxon Company, U.S.A.'s Southeastern Division. This afternoon I plan to discuss exploration and development of oil and gas resources on the Outer Continental Shelf and some of the techniques used to handle an oil spill should one occur.

Oil and gas exploration and production activities are being conducted throughout the world with over 50 nations currently having offshore production. Exploration is under way off the coasts of approximately 65 nations.

## U.S. OFFSHORE PRODUCTION

To date, United States offshore production has been principally from the Gulf of Mexico, the Pacific off the coast of Southern California, and in Alaska's Cook Inlet. Over 20,000 wells have been drilled in the offshore waters of the United States. Over 80% of these wells have been in the Gulf of Mexico off the coasts of Louisiana, Texas, and Florida. There have been over 3,000 offshore platforms installed. However, only 1,000 of these are the large multi-well structures which we envision will be used in the Atlantic. The remaining structures are one-well templates utilized in relatively shallow waters of the Gulf of Mexico in the early days of development. Cumulative production from these offshore platforms now exceeds 7 billion barrels of hydrocarbon liquids and 36 trillion cubic feet of gas. During 1975, offshore wells accounted for 495 million barrels of oil production, or 16% of the total domestic production. Gas production during the same period was 4.3 trillion cubic feet, or 21% of total domestic output. The U.S. Geological Survey, in Circular 725 of June 20, 1975, has estimated that there are significant amounts of oil and gas offshore that are still undiscovered. For example, a potential of 2 to 4 billion barrels of oil and 5 to 14 trillion cubic feet of natural gas is estimated for the Atlantic coast.

## OFFSHORE EXPLORATORY DRILLING

The purpose of exploratory drilling is to deter-

mine whether oil or gas are present and, hopefully, to define the areal extent and volume of reserves in place. Oil and gas are found at varying depths in hydrocarbon strata. The depth below the ocean floor to these strata can vary from as little as a few thousand feet to as much as several miles. The oil or gas is not found in pools like large tanks; rather, it is found along with water in the tiny pore spaces between the sand grains:

As offshore exploratory drilling has grown, the industry has moved from barge type rigs capable of drilling in 8 feet of water, to the posted type rig capable of drilling in up to 40 feet of water, and then to the jack-up, semi-submersible, and floating drillship concepts. These latter three types of exploratory rigs are those which are most probable for use in the Atlantic offshore area. With its legs in the raised position, a jack-up rig floats and can be towed to its offshore location. Once on location, the legs are jacked down to the sea floor and the hull is raised out of the water. A semi-submersible rig floats on pontoons, just below the water, and can be towed to its location. Once on location, the pontoons are ballasted so that the rig floats about half-way out of the water. A semi-submersible rig is held on location by anchors. A floating drill ship consists of a ship-shape vessel with a drilling rig mounted amid ships. There is an opening in the hull of the vessel for conducting drilling operations. Like the semi-submersible, the floating drill ship is kept on location by anchors. A buoyant drilling riser extends from the ship's hull down to the ocean floor where it attaches to a subsea blowout preventer. A blowout preventer is a series of valves designed to seal off the upper part of the hole being drilled if high pressure strata are encountered. This is a very large piece of equipment.

Wells are drilled with a drill bit on the end of a section of drilling pipe. As the bit drills the hole deeper, additional sections of drill pipe are added at the top and drilling mud is pumped down the drill pipe, out the bit, and up the space between the drill pipe and the wall of the hole. This drilling mud provides a balancing force to the fluid pressure in the underground strata and provides a medium for carrying the drilled rock cuttings to the drilling rig at the surface. Periodically, as the depth increases, steel casing is lowered into the hole and cemented to

seal off open formations. Once the cement is set, a smaller drill bit is inserted into the hole and drilling continues. Deep wells may require several different casing strings.

### OFFSHORE DEVELOPMENT

Once an oil or gas field is discovered and determined to be commercial, development activities will begin. In order to begin development drilling, a platform is needed. Large parts of the Outer Continental Shelf, and most of the potentially productive areas in the Atlantic can be developed by structures like those used in the Gulf of Mexico. These platforms are steel space frame structures and consist of two basic components, the jacket section or that portion extending from the ocean floor to the water surface, and the deck section or that portion above the water surface. These platforms are constructed at fabrication yards on land and are transported to the offshore location on a barge. Once at the location, the platform is launched from the barge and is uprighted through a combination of flooding the jacket legs and lifting by a derrick barge. The deck section of the platform is also fabricated on land prior to being installed on the jacket.

After platform construction is completed, development drilling can begin. Several wells can be drilled from a single platform using a technique called directional drilling. It is not uncommon for directional wells to reach their ultimate location over one mile from the platform. When a well reaches its total depth at the producing formation, it is frequently desirable to test the productive capability of the sand prior to running casing to determine whether the formation will, in fact, produce commercial quantities of hydrocarbons. If the well encounters commercial quantities, casing is run in the hole and cement is pumped out the bottom into the space between the casing and the hole to seal off the subsurface strata. A path for movement of the oil or gas into the casing must be provided. This is done by a tool called a perforating gun which opens channels through the casing and cement into the producing formation. When a well is completed, a series of valves, called a Christmas tree, is placed on it. The cellar deck of the platform contains the Christmas tree for all wells on the platform.

More than one platform may be installed to contain all the necessary facilities. One platform would be the drilling platform with the drilling rig installed, while the second platform would contain the necessary producing equipment. In some cases the wells and the associated producing equipment are located on a single platform.

Hydrocarbons are usually transported to shore

through pipelines installed using a pipeline lay barge. Personnel who work offshore are transported to and from shore in crewboats or in helicopters. Large work boats with flat, open cargo decks are used to move material and supplies to the platform.

### OIL SPILL CLEANUP

Oil spills from offshore oil and gas exploration and production operations are not a common occurrence. Data compiled by the U.S. Geological Survey for the period 1964 through 1975 for the Gulf of Mexico indicate that there were 26 major pollution incidents during that time. A major pollution incident is defined as a spill of more than 100,000 gallons of oil. The total volume of oil spilled in these incidents was approximately 342,000 barrels, or less than one-one hundredth of one percent of the offshore production.

Since we do recognize that spills can happen, despite all of the precautions taken to prevent them, the offshore oil industry has organized oil spill cleanup cooperatives where needed. These cooperatives provide the exploration and production industry with the capability for fast and effective containment and cleanup of oil spills that may occur. Clean Gulf Associates was formed in 1972 to provide this capability in the Gulf of Mexico and Clean Atlantic Associates was formed in 1975 to provide similar capability on the Atlantic. Clean Gulf has purchased several million dollars worth of equipment and Clean Atlantic is currently acquiring in excess of one million dollars worth of equipment for the Mid-Atlantic lease sale area. An additional two million dollars has been authorized to purchase equipment for the North and South Atlantic lease sale areas. This equipment will be acquired and placed at onshore locations prior to any drilling operations in these areas.

In responding to any oil spill, it is very important to act rapidly. The Fast Response Unit is designed to provide this quick action. These units fit on a workboat and can travel to the scene at the maximum boat speed with all equipment on the deck. Once on scene, the equipment is deployed and skimming operations can begin. Slightly smaller units, which can be stored on an offshore rig, or platform, have also been built to provide for even faster response.

For large spills additional equipment may be needed. Containment booms are often used to help limit the spread of the oil. There are several types of these booms which may be suitable for use offshore and the oil spill cooperatives are continually evaluating new ideas. In fact, Clean Atlantic Associates is purchasing two new types of booms

for use in the Atlantic. We believe that both of these booms are very promising and they could greatly improve offshore oil spill cleanup operations if they work as well as expected.

Clean Gulf Associates has a large barge-mounted oil skimming system called the High-Volume Open Sea Skimmer or HOSS. This barge has several hundred feet of oil spill containment boom on board. When this boom and the floating skimmer, also located on the barge, are deployed, this unit is capable of collecting large volumes of oil. Clean Atlantic Associates is currently evaluating several alternative systems which could provide similar

capabilities.

If an oil spill should reach shallow waters, smaller containment booms are needed to contain the spill and shallow draft skimmers are needed to clean up the oil. Clean Gulf Associates owns quite a bit of this type of equipment. Because of the large amount of equipment available in the mid-Atlantic area, Clean Atlantic Associates has not purchased any. If there is not an adequate amount of equipment available in the North or South Atlantic areas, Clean Atlantic will acquire the necessary items.

# RED TIDE—A NATURAL COASTAL NUISANCE

By DALE S. BEAUMARIAGE

Chief

Bureau of Marine Science and Technology  
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I believe the problems that red tides pose to coastal communities can best be appreciated if you imagine with me the following scenario: On the morning of your first full day of a Florida vacation, you awaken in the beach front hotel room that you checked into the evening before and want to enjoy the early quiet of the beach. You step forth from your air-conditioned room to face the gently rolling Gulf of Mexico and take a deep breath of expectantly invigorating fresh salt air. Suddenly you gasp and choke! Sneezing and coughing in the onshore breeze you wander closer to the water where a terrible sight assaults your now watering eyes. Thousands of dead fishes are floating in on the incoming tide! Their bloated carcasses are littering the beautiful beach. Hastily, you return to your room to find your wife ill. She has strange tingling sensations and is nauseous and dizzy. You find after treatment that she had gotten sick from eating those freshly harvested oysters or clams you purchased the evening before from the restaurant where the manager assured you he gathered his own shellfish.

What's going wrong? Is the sea poisoned like that famous diver said on television? Why can't someone do something to stop this terrible plague which you have now learned is called red tide?

This imaginative scene could easily happen; perhaps not as shockingly as I have described it because many efforts help prepare people for the impact of red tide, especially to protect public health. Red tides are indeed a real hazard to coastal economies not just in Florida, but in New England, Canada, California, Japan, Indonesia, Africa and Europe. I will speak only about Florida red tides where economic losses to the tourist industry have been estimated to run as high as 20 million dollars. The fishing industry also suffers immeasurable losses through general rumor of bad shellfish, regardless of location. Seafood sales have been reportedly affected from Virginia to Texas because of rumored shellfish poisoning and many people won't buy finfish reported to be killed by red tide regardless of the fact no dying fishes are ever harvested.

Throughout the world red tides are caused by the concentration of microscopic phytoplankton called dinoflagellates which produce minute amounts of

toxin. These one celled plant-like organisms are routinely a constituent of coastal plankton communities and only cause problems when concentrated in vast number (ranging up to several million cells per liter). Florida red tides are caused by *Gymnodinium breve* which kill fishes at concentrations of more than 250,000 cells per liter by paralysis of their nervous system so the respiratory processes cease and the fish suffocates. Longer exposure at lower cell densities can also kill fish by interfering with blood oxygen transport. Most invertebrates seemingly are not killed directly by *G. breve* toxin, but can die when decaying fishes exhaust dissolved oxygen in any body of water with low flushing rates or no vertical overturn, such as beneath a stable isotherm.

Shellfish which filter seawater, such as clams or oysters, are not killed by the organisms they ingest or toxic water they pass across their gills. However, they do concentrate the toxin within their tissues and can thus pass it on to animals which eat them. If people eat them, sickness of the type I described in the introductory scenario then develops. The dinoflagellate that causes Florida's red tides does not produce as severe a toxin as *Gonyaulax tamarensis*, the one causing New England and eastern Canada's red tides. People have died from eating shellfish containing its toxin and outbreaks of *G. tamarensis* are often referred to as "paralytic shellfish poisoning". No deaths have been caused by Florida red tides.

The potential for red tides to occur in Florida exists every year and apparently existed before the State was populated. The earliest recorded fish kill was in 1844. Man's activities have therefore not increased the probability of their occurrence.

When necessary environmental stimulation initiates the development of larger than usual concentrations of these plantlike cells, followed by oceanographic conditions that support such concentrations, a monotypic "bloom" of *Gymnodinium breve* persists in southwest Florida coastal waters 10-40 miles offshore. Favorable winds and tides can then transport the highly concentrated cell patches inshore where they can survive in coastal waters having salinities above 25 parts per thousand and temperatures greater than 17°C. They can also be transported by currents elsewhere in the eastern

Gulf of Mexico and even through the Florida Keys into the Gulf Stream causing outbreaks along our east coast as happened in 1972. We don't believe red tides can occur along the east coast in any other fashion, however, because the causative organism predominates in the Gulf of Mexico.

Scientists at our St. Petersburg Marine Research Laboratory are engaged in many facets of red tide research, from gaining a better understanding of *Gymnodinium breve* longevity and reproductive strategies, to ways in which this perfectly natural phenomenon can be accepted with minimization of its economic impact through ameliorative programs.

One of the cornerstones of our work, accepted internationally as the most potentially productive avenue in toxic dinoflagellate research, is determining the life cycle of *G. breve*. A good possibility exists that resting cysts of this organism are discretely distributed in compatible sediments along the west Florida shelf 10-40 miles offshore. After this is confirmed through ultrastructure and culture analysis of both the motile cells and a corresponding dormant cyst, investigation of the specific physical and chemical stimuli that initiate and support the extranormal concentrations of the motile form can be undertaken to predict red tide development and termination.

Control of such a natural phenomenon is both impractical and imprudent to expect; therefore, our red tide research is oriented toward prediction and amelioration of the economic impact upon tourism and the fishing industry. Ecologically, the impact of red tides is tolerable, but economically it can be disastrous. The impact on public health, although less severe than in other parts of the world where this phenomenon occurs, is significant enough to also warrant refining our predictive abilities to effectively deal with those aspects when red tides wash ashore to cause respiratory discomfort along the beaches or create a need to close shellfish waters to clam and oyster harvesting.

One way of minimizing public health threats of red tide is the development of reliable, cost-effective methods to predict where well formed red tides will impact coastal regions. Through a cooperative study with NASA's Goddard Space Flight Center, we hope to detect red tide patches through aerial remote sensing. If successful, this work could lead to the development of a satellite sensor specifically built to receive the "spectral signature" of *Gymnodinium breve* blooms in the eastern Gulf of Mexico. Thus, the location and dissipation of red tides (an oceanographic imbalance) could be monitored from a geosynchronous satellite much the way major climatological imbalances (like hurricanes) are tracked today. Aside from the knowledge of location and duration of red tides for issuance of health impact alerts, such information would help coastal communities orient low altitude aerial surveillance to vector vessels equipped with special surface trawls to collect the dead fishes accumulating in patches offshore, thus greatly facilitating sanitary removal and possible useful conversion of the carcasses into fertilizer. This would keep many beaches clear that often receive fishes killed by offshore red tides that themselves never become established inshore.

The primary key to lessening the economic impact of red tides is to educate the public not to expect simplistic answers to complex natural phenomena, but rather to have them viewed in a perspective similar to that afforded tropical storms. In order to achieve this we are augmenting our research efforts with the release of informational brochures to answer the most frequently asked questions about red tide. One of these is titled, Red Tide? Answers to Questions Most Frequently Asked About This Marine Phenomenon. Copies are available free upon request to our information specialist at our St. Petersburg Marine Research Laboratory, 100 8th Avenue, S.E., St. Petersburg, Florida 33701.

# PROBLEMS ASSOCIATED WITH DEVELOPING GROUNDWATER RESOURCES IN THE COASTAL COUNTIES OF SOUTH CAROLINA

By ALLEN ZACK  
Civil Engineer  
U.S. Geological Survey

Continued economic development of the South Carolina coastal counties will depend upon the ability of engineers, water-well drillers, and geohydrologists to provide large quantities of high-quality groundwater for municipalities and industries.

The U.S. Geological Survey and the South Carolina Water Resources Commission have made progress in understanding cause-and-effect relationships within aquifers and in solving problems in water geochemistry through the cooperatively-funded Capacity-Use Investigations. These studies, which are outgrowths of the 1969 South Carolina Groundwater Use Act, have recently been completed in Horry and Georgetown Counties and are progressing in Beaufort, Hampton, Colleton, and Jasper Counties. Before these studies were initiated, there had been no systematic data-collection program in these areas, and engineers had difficulty in planning the development of the groundwater resource. Engineers have actually considered abandoning groundwater supplies in favor of developing relatively expensive surface water resources because of what appear to be numerous groundwater availability and chemical quality problems along the coast.

Proponents of surface water development point out that the unusually high percentage of low capacity and inefficient wells presently being used in the project area is evidence of a deteriorating groundwater resource. Most of the "groundwater problems," however, are not attributable to the groundwater resource but rather to problems with well construction. Misunderstanding of well construction problems has led to a misinterpretation of the existing supply of groundwater.

Lack of a sufficiently detailed data base has contributed to this misunderstanding of developmental problems. The current investigations have revealed that thin sandstone beds containing high fluoride waters occur within aquifers generally containing high quality water. Also, occasional zones of high chloride water in permeable sands have been identified between confined, freshwater aquifers. Had these facts been available prior to intensive development, along with a better definition of aquifer hydraulic

characteristics, some problems of interaquifer flow via the gravel packs in multi-screen wells, as well as additive drawdown effects of closely spaced wells, could have been avoided.

It is difficult to design a well in a multi-layered system so that it is safe against contaminate sources outside the aquifer screened. Several wells near the ocean pump saline water because of gravel filters (packs) that extend far above the well screens and that are in contact with sands containing high chloride water of high head. In these wells, water of higher head enters the gravel filter when the pump is idle and travels through the gravel filter toward water bearing zones of lower head. This water infiltrates the freshwater formations at a rate dependent on the hydraulic conductivity and head difference. When pumping commences, the infiltrated salty water is pumped from the screened freshwater sands until the native formation is recovered. The same phenomenon occurs by the inadvertent screening of salty formations. In many instances the salty water, which has been pumped from otherwise freshwater formations, has incorrectly been attributed to saltwater encroachment.

Additive drawdown effects have occurred when wells screened in the same aquifer are closely spaced, causing the cones of depression to coalesce. During the summer months of 1975 several domestic and industrial wells near the Intracoastal Waterway at Myrtle Beach experienced water level declines that caused the wells to pump air. To property owners, it appeared that the water supply was disappearing. All of the wells were very closely spaced and were completed in the shallowest Black Creek sand, 300 to 400 ft. in depth. Also, several large municipal wells in the vicinity (approximately 1 mile away) obtained part of their water from these sands. The additive drawdown effects of the pumping wells during periods of peak demand lowered the water level below the pump intakes of some wells.

The difficulties encountered in the latter example in the Myrtle Beach area are not the result of a diminishing groundwater supply as may have been mistakenly interpreted but are problems concerning one aquifer which has been overdeveloped and

the setting of pump intakes too shallow to accommodate the prevailing range of fluctuation of the water level of the area. Utilization of deeper aquifers for future water supplies would help alleviate the stress imposed on the heavily pumped, shallow Black Creek sand and would contribute to maintaining shallower water levels.

One problem always present in well drilling is that of well development. During drilling, proper mud control allows the formation of a mud cake on the borehole walls. This minimizes invasion of the drilling mud into sandy formations and protects against hole collapse and erosion. Where aquifer sands are very fine, as they are throughout much of the Coastal Plain area, great difficulty is encountered when the drilling fluids have to be recovered from the aquifer material during development. Removal of the mud is particularly difficult in wells with thick gravel filters. If drilling fluids are not removed, well production will be less and drawdown greater than that obtainable under conditions of complete development. Again, excessive drawdown during pumping has often been mistakenly attributed to a diminishing groundwater supply.

Well screens placed opposite clays and other formations of low hydraulic conductivity have often been responsible for low-yielding wells with excessive drawdown. Some of the most effective guides the engineer and water well contractor have in locating and assessing water bearing formations are geophysical logs. Although it is often helpful to have an accurate driller's log to select the screen setting, geophysical logs, when properly used, can be used to reliably determine most borehole characteristics and can be used as a guide in screening the most favorable water-producing zones.

The foregoing problems with well construction can be controlled by careful well design, adequate well development, the correct location of well screens, and by obtaining sufficient lithologic data to pinpoint conditions on which design must be based. However, apart from well construction problems, there are several other problems related to the development of the groundwater resource that must be overcome before large quantities of high quality water can be developed and delivered. To assist engineers in doing their jobs effectively, geohydrologists must have sufficient data to be able to make accurate predictions of the effects of pumping on water levels and should determine the areal and temporal distribution of high quality water throughout the geologic section.

In Horry and Georgetown Counties, estimates of groundwater availability are complicated by cause-

and-effect relationships that do not comply with traditional groundwater flow theory based on homogeneous isotropic, and non-leaky aquifers. Vast quantities of water are induced into the aquifer system when groundwater withdrawals are made. It is suspected that this water is derived from a combination of head dependent leakage through adjacent clays, a line source of recharge in the Pee Dee River Basin, and possibly from a general lowering of the water table. Because it is presently impossible to determine the source of this water or to calculate its effect on water levels, regional water level decline cannot be predicted from estimated future groundwater withdrawals. With long-term aquifer tests and tests of the degree of hydraulic conductivity continuity aquifers, measurements of hydraulic leakage can be made and cause-and-effect relationships will be better understood. In addition, with the collection of more comprehensive water level and water use data, flow net analyses of the area can be made to verify estimated average values of regional transmissivity.

Groundwater availability estimates are likewise complicated by water quality problems. Along most of the South Carolina Coastal Plain, the subsurface distribution of high quality water is known in part. Much progress has been made during the Capacity-Use Investigations, particularly during the test drilling programs financed by the Coastal Plains Regional Commission, but several difficult groundwater quality problems persist.

Although vast quantities of water are stored in aquifers in Horry and Georgetown Counties, only the Black Creek aquifer system contains water of consistently suitable quality. However, there are places where connate saltwater has not been completely flushed from many of the sands throughout this unit. Where the water within the Black Creek Formation is fresh, fluoride, often in concentrations in excess of 3.0 mg/l, has caused some concern among local, State and Federal officials. The occurrence of high fluoride groundwater appears to be associated with calcareous sandstones containing the mineral collophane. The action of sulfuric acid, derived from decomposition of pyrite, on soluble fluoride minerals facilitates the release of fluoride. It has been demonstrated at specific well sites that if wells can be screened in aquifers devoid of sandstone, it is possible to develop lower fluoride water.

If the relationship between calcareous sandstone and high fluoride groundwater is verified, geophysical logs from this source might be used to map the areal and subsurface distribution of fluoride from this source. Likewise, if it is possible to precisely estimate the concentration of dissolved



solids of groundwater *in situ* using geophysical logs, the areal and depth distribution of chloride in the concentration range of 100-300 mg/l could be mapped. Although it is easy to use neutron and gamma-gamma logs to locate impervious sandstone in the borehole, local peculiarities of lithology and stratigraphy make it impossible to estimate dissolved solids concentrations with the conventional standard electric log. However, the effects which invalidate the standard electric log for this purpose have been minimized using the induction-resistivity log. It is anticipated that other focussing electric logs would do equally well.

In the event that it proves too costly to reduce fluoride concentrations in well water by selective screening, mixing of water from various aquifers might be effective in adjusting the fluoride concentration of water withdrawn from the Black Creek aquifer. Water in the overlying Pee Dee aquifer is low in fluoride and dissolved solids, but high in hardness, iron, and sulfate. However, aeration and filtration could remove the iron and sulfate. This water could then be mixed with that from the Black Creek aquifer.

In the southern part of the State, shallow Tertiary-limestone aquifers are often the only source of fresh groundwater. Unfortunately, they are hydraulically connected with the ocean. Heavy withdrawals near the freshwater-saltwater interface apparently have caused saltwater encroachment in these areas and have threatened future groundwater development. The deeper Black Creek aquifer system may have experienced a very small amount of saltwater encroachment in response to heavy groundwater withdrawals although it has not actually been measured in any wells in Horry and Georgetown Counties. Factors involved in controlling saltwater encroachment in these areas

are being studied by the U.S. Geological Survey and the South Carolina Water Resources Commission.

In summary, the South Carolina Water Resources Commission is aware of the need for judicious long range planning as it realizes that the life of the Black Creek aquifer system and other Coastal Plain aquifers are dependent upon sound management and conservation practices. Intelligent long range planning should anticipate future withdrawals and their cumulative drawdown effects. It should include environmental considerations and an appraisal of the longevity of the supply. Changes in water rights and water laws should be anticipated and the importance of the supply in relation to anticipated economic changes should be approximated.

The advantages of continued groundwater development should be kept in perspective. Locally in Horry and Georgetown Counties, detrimental situations exist where the groundwater environment is threatened by multi-screened and gravel packed wells which provide an avenue for saltwater contamination of fresh groundwater supplies. A potentially detrimental situation also exists where water levels are lowered excessively in areas of heavy groundwater withdrawals. In such a situation it may be uneconomical to further develop groundwater supplies.

Wells throughout the project area are often inefficient and deliver a poorer quality of water than now could be obtained at the well site owing to the availability of additional data on which to base well design and construction.

It appears, therefore, that there is a need for improved groundwater management practices as defined by the South Carolina Ground-Water Use Act.

# GROUNDWATER IN EASTERN NORTH CAROLINA— PRESENT AND FUTURE PROBLEMS

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Groundwater is the major source of water supply in the Coastal Plains Region of North Carolina. It is the only source for many urban and rural communities. The accent of future economic development of the Region will depend upon the efficiency with which the resource is managed. If the existing and proposed uses lead to excessive depletion of water quantity or excessive deterioration of water quality, the entire economy dependent on it will be affected. The management of groundwater resources requires an understanding of the short-term and long-term effects of the use on both quantity and quality.

Of the groundwater aquifers in North Carolina the Castle Hayne aquifer is the most important. The Castle Hayne limestone extends over nearly the entire coast of North Carolina. The aquifer is wedge-shaped, beginning in the west and gradually thickening toward the east. At the coastline, the aquifer is about 450 feet thick. The depth to the top of the aquifer ranges from less than 20 feet below sea level in the west to about 600 feet in the eastern part of the area. The Castle Hayne aquifer is an artesian aquifer and has connections with both the underlying Beaufort Formation and the overlying Pungo River and Yorktown Formations. Whenever one of the wedges is reversed, there can be leakage into the Castle Hayne aquifer from above, as well as from below, but throughout most of the area, the downward leakage is the stronger of the two.

By far the largest use of groundwater in the area is for phosphate mining and fertilizer production. The phosphate formation being mined sits right on top of the Castle Hayne aquifer and because open pit mining is used, water must be pumped from the Castle Hayne aquifer for depressurization of the pit. Texasgulf, Inc., which operates the mine, has been pumping about 60-70 million gallons a day from the aquifer since 1965. This constitutes about 85% of the total withdrawal. Texasgulf has just finished a project of expansion and the North Carolina Phosphate Corporation is investing \$250 million in mining and beneficiation of the ore in an area just two and one-half miles from the Texasgulf mine. North Carolina Phosphate intends to start production next year and operate three mines simultaneously. Another company, is seriously

considering launching a large phosphate mining operation on its property as well, but because its extraction techniques of the ore are going to be wet techniques, its groundwater requirements are modest. In the projected growth of other industrial and agricultural uses of groundwater in the area, it is anticipated that the magnitudes of withdrawals from the Castle Hayne aquifer will almost double in the next seven or eight years.

In the dewatering scheme at the Texasgulf mine, there are about 13 or 14 wells. The mining pit advances as the ore is taken out with the total length of the mine being about three-fourths of a mile. Seawater is about one-half mile from it. There are four such pits and the cones of depression resulting from groundwater withdrawals of all of these mines are eventually going to coalesce. As a result of the concentrated heavy withdrawal, the piezometric surface has been drawn down to about 240 feet below mean sea level from about 70 feet above mean sea level in the Texasgulf mining area. Because the pressure in the Castle Hayne aquifer was higher than the pressure in both the overlying and underlying formations, the water leaked into the upper formations, but now, as a result of the depressurizing of the aquifer at about 150 feet, the direction of flow has reversed and the configuration of flow has been completely changed.

Additional pumping by the North Carolina Phosphate Corporation will create another sizable area in this artesian aquifer system that falls below 250 feet mean sea level. The upper Castle Hayne aquifer contains relatively fresh water, but also contains large zones of high chloride content, mostly beneath the Pamlico Estuary. In response to the large withdrawals, hydraulic gradients are set up which cause brackish water to move laterally, toward the points of discharge. The Castle Hayne aquifer is in direct hydraulic contact with the overlying Yorktown and Pungo Formations and the underlying Beaufort Formation which act as semi-confining areas. Because of the concentrated groundwater withdrawals, the vertical hydraulic gradients have reversed causing water of varying quality and composition to leak into the aquifer. There is conclusive evidence to show that the Pamlico Estuary has had old connections with the

Castle Hayne aquifer. Initially there was an upward leakage from the aquifer into the estuary but, as a result of the heavy pumping, the hydraulic gradients have reversed for a measured portion of the estuary. The direction of flow is now from the estuary to the aquifer. The situation will be further aggravated by the additional heavy withdrawals by the North Carolina Phosphate Corporation.

The Castle Hayne aquifer, itself, can be divided into two parts, the upper Castle Hayne aquifer and the lower Castle Hayne aquifer. The freshwater in the upper Castle Hayne aquifer overlies the brackish water in the lower Castle Hayne aquifer and also lies above the Beaufort Formation. As a result of the withdrawals above the interface, the interface between fresh and brackish water has risen upward. After North Carolina Phosphate begins its operation, there will be four or five mines simultaneously in operation and the modification of water quality will expand over a substantial area. A large volume of fresh water flow has been restricted with the drawdown caused by pumping at the Lee Creek mine of Texasgulf and increased withdrawals by the North Carolina Phosphate Corporation will cause the zone of drawdown to move further eastward intercepting the area of poor quality water and allowing the seawater intrusion to move further inland. At present, inadequacies help very little to delineate the fresh water transition zone in each case with the Castle Hayne aquifer. Thus, inland progress of the transition zone is difficult to quantify. Mechanisms that can give rise to consideration of groundwater quality in the Castle Hayne aquifer are:

1. The lateral movement of lenses of brackish water up into the freshwater zone of the aquifer itself.
2. The vertical movement of the estuarine water from the Pamlico Estuary.
3. The regional migration of brackish waters downward from overlying and underlying formations.
4. The upcoming of brackish water into the lower Castle Hayne aquifer in the vicinity of mines.
5. The saltwater encroachment in the areas along the coast.

The region has been declared a capacity use area in accordance with the provisions of the North Carolina Water Use Plan. The Environmental Management Commission has the authority to regulate the use of water by those organizations using in excess of 100,000 gallons of water a day. The Management Commission has much authority in regulating the withdrawals, such as timing the withdrawals with maximum pumping rates and the spacing of wells in an area. It also has the

authority to control the elevation below which water cannot be withdrawn. So far, the issuance of permits has been used only to monitor the amount of withdrawals and no attempt has been made to regulate, control, or ration the water supplies.

As a more complete utilization of the groundwater resources in the Coastal Plain of North Carolina becomes a reality, the establishment of a governing policy for its optimum use becomes a necessity. Increased large scale concentrated withdrawals will alter the course of water to other users, as well as effect the reliability of these users receiving the necessary quantity and quality of groundwater at proper times. Therefore, policy objectives for improving the allocation of water and revising the management plan for the Castle Hayne aquifer should include:

1. The expansion of the useful life of the aquifer and avoiding its premature deterioration.
2. Minimizing the total long range social costs, taking into account the future value of water, the extra pumping costs imposed on users of the aquifer, and the cost of quality deterioration.
3. Minimize the uncertainty attached to the reliability in regard to the quantity and quality, in time, with the withdrawals.
4. Avoid foreclosure of future alternatives.

Unfortunately, the estimation of benefits and costs of groundwater development is also a problem. In some activities, for example open pit mining for phosphate ore, groundwater is a useless commodity and has negative value. In other uses, groundwater is an economical commodity and has a positive value as an essential ingredient for the production process. Both kinds of uses can co-exist, as is the case of the Texasgulf operations. The desirability of groundwater for any use cannot be determined until it is known what other uses are being sacrificed, or what additional costs are being imposed on other users, present or prospective. We are making some advancement in assigning benefits and costs to the study I am now conducting.

Lets now examine what the ingredients of a groundwater management scheme should be. First of all, any management scheme should take both quality and quantity aspects of groundwater development into account. The Environmental Management Commission has sufficient authority to regulate the use of groundwater depending on the quality and quantity assessment and the dynamic relationship between the quantity control and quality changes should be actually incorporated into the application decisions. The best way to do this in a complex system like the Castle Hayne is

through the use of mathematical models. We have developed, at the University of North Carolina, analog and digital computer models of the Castle Hayne aquifer, which have been verified in reproducing historic behavior of the aquifer. We are fortunate that since 1965 we have been able to study Texasgulf property as a result of the pumping tests. Very few other places are in as fortunate a position. But, predicting water quality is unfortunately very difficult and, at present, the only way we can do it is through methods which often lack sophistication.

The second ingredient in establishing a policy for the development of groundwater aquifer is to have established guidelines. In any policy for long range groundwater development, a decision has to be made of what the maximum economic pumping lift can be. This is the equivalent of specifying that the withdrawal in different sections of the aquifer should not exceed a certain value in a particular period of time. Other ingredients of these guidelines should be that decisions have to be made as to the acceptable variation in water quality in a real extent and time. If such guidelines are not adapted, it is impossible to determine the particular use we find reasonable, or whether the impending changes in water quality are intollerable. The groundwater management policy should contain measures to prevent the deterioration of the resource. We are also trying to use mathematical models to see where it is most beneficial to put recharge areas and where it would be most beneficial to control the drawdown. In arriving at a policy of groundwater management, we cannot depend upon the following:

1. The stabilization of drawdown in water levels because changes in water quality keep on occurring long after the quantitative hydrologist teams visit.
2. Market sources, so there has to be some sort of regulation.
3. The amount of total use of an aquifer because the location of demand in relation to the

geohydrology and quality boundaries are sometimes different. The same quota demands in different spatial configurations would have quite different consequences on water quality and piezometric levels.

Any policy for the management of groundwater must be on a regional basis. The optimum management of groundwater is extremely difficult because extractions from the aquifer system are controlled by a large number of individual decision makers and because of extremes of controlling standards between different users. The pumping by one user affects the availability of the resource to others, and the failure to protect quality in one use adversely affects the value of the resource to other users widely separated in space and time. The best interests of all users, can only be protected through a system of regional groundwater management.

We are fortunate in North Carolina that a few large users control the majority of groundwater withdrawals. Therefore, through such economic measures as charges levied, we might be able to persuade these large users to take into account the cost that they are putting on other users. The planning horizon that one has to adapt for the formulation of groundwater management must be a long one because mechanisms affecting water quality have widely different time scales. The quality changes affecting only a small portion of the aquifer manifest themselves early, but various large scale changes, due to natural movement and leakage from confining beds, are extremely slow. Moreover, in groundwater development, benefits and costs alter as market use declines and are widely separated in space. There is usually a substantial time lag measured between the start of withdrawal and the time the deleterious effects of water quality become evident. In such circumstances, the particular use may appear to be attractive on a short time scale, but the same use when taken on a longer term basis may have social costs, which may far outweigh the benefits.

# GROUNDWATER DEVELOPMENT IN SOUTHERN GEORGIA AND FUTURE NEEDS

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## HISTORY OF DEVELOPMENT

It is difficult to establish exactly when groundwater development actually began in Georgia. The first settlers and Indians obviously relied heavily on springs or other surface water sources; however, since groundwater can be developed easily, particularly in the coastal area, I am sure that many dug wells were also used. For example, we know that occupants of Fort Frederica near Brunswick used shallow dug wells for their water supply in about 1734. These wells were often constructed within the dwellings and utilized 3 or 4 barrels which were stacked on top of each other to keep the well from caving-in.

Citizens of Augusta developed nearby Turpin Spring in 1820, using hollowed-out logs as water mains to supply the city. Some of these interesting old mains were recently uncovered during an excavation.

It was not until the late 1800's that scientists in Georgia began to document our groundwater supply and the various techniques used to develop this resource. Thus, most of our early technical information imparts a growing trend toward construction of deep artesian water wells in the Coastal Plain.

In 1881, Colonel John Porter Fort completed the first flowing well in Georgia at a site near Albany. An amateur geologist, Fort was convinced that previously unsuccessful attempts to build flowing wells was due to improper construction techniques and certainly not a lack of water. He noted that successful flowing wells had been drilled in Charleston, South Carolina, in 1848. Colonel Fort's success obviously had an impact on the groundwater development in southwestern Georgia because a year later, in 1882, the city of Albany drilled a similar well and shortly thereafter became known as the "Artesian City."

Groundwater development expanded rapidly in Georgia's coastal area. Brunswick's first well was drilled in 1884, and in 1887, Savannah shifted from the old surface water supply source to the new groundwater supply which consisted of 14 wells at that time. Savannah was quite a large city in the late 1800's as reflected by their groundwater use of 6 million gallons of water per day in 1887.

A report prepared in 1898 by S. W. McCallie, the State Geologist, contained an interesting section devoted to the health aspects of artesian water use. "It can be affirmed and verified, by numerous examples, that the use of these artesian waters has materially lessened the prevalence of chills and fever in South Georgia." Of course, today, we may find humor in such a quote, but we must realize that McCallie was a trained scientist who was not prone to making trivial statements and that prior to this time most people obtained their water from very shallow dug wells or streams which were nothing more than open sewers. The new water sources were often 150 to 300 meters (500 to 1000 feet) below land surface and thus well protected from contamination.

Although most groundwater in the Coastal Plain was used for domestic purposes, other important users included ice plants, steam boilers, and breweries. Besides supplying pure water, the wells of the coastal area had other important benefits. The energy available from the pressurized aquifers was used to provide flowing water to water fixtures in two story buildings and to operate certain machinery. One example illustrating this use was a rice mill located at Tarboro which used three artesian wells to power a 9 meter (30 foot) water wheel.

## EXISTING SITUATION

Groundwater use in the coastal area has grown such that the total withdrawal in the coastal counties almost equals the amount of groundwater withdrawn in the remainder of the State. Over one billion liters (300 million gallons) of water per day is withdrawn in the coastal area compared to approximately 1.4 billion liters (385 million gallons) per day for the remainder of the State. Most of the water is used for industrial purposes (84 percent). In recent years, a trend toward decreasing groundwater use has been noted. Many industries are recycling more water now than ever before, and more lower quality surface water is being used. An extremely beneficial trend, this recycling saves the higher quality water for those uses which require a good quality water supply.

Despite this trend, everyone will agree that

groundwater use in the coastal area will most likely increase in the future. Several factors seem to justify this statement:

1. The completion of I-95 will likely increase accessibility and thus increase the number of people visiting the region.
2. There are two active ports which probably could support further activity.
3. Large tracts of developable land exist in the coastal area—some land is owned by the State (eg. Colonels Island) but most is owned by paper companies.
4. There is the obvious potential for both offshore and onshore petroleum production and other economic minerals which would stimulate various types of development.

Most of you are probably aware of what happens in an artesian system shortly after the system begins to be developed—the artesian pressure declines. This decline in pressure generally affects a large area. For example, the cone of depression due to pumpage in the Savannah area affects localities at least 40 kilometers (25 miles) away. Today, the area in which one can obtain a flowing well is very much smaller than the area in the 1800's. This, of course, is not necessarily bad but rather an unavoidable aspect of water use. The potential and existing problems of saltwater or brackish water encroachment related to groundwater development in Georgia's coastal area are widely acknowledged. The need for managing the resource is now one of Georgia's primary concerns.

Unfortunately, we are faced with managing the resource with an imperfect knowledge of the physical characteristics of that resource. Groundwater resource managers are in a situation similar to some economists who must prepare budgets based upon uncertain revenue projections. Hydrologists can quantify cause (ie. pumpage) and effect (ie. water-level decline) relationships in most developed, or problem, areas along the coast, but they have not arrived at a point yet where projections can be made regarding the total quantity of water that can be withdrawn from the whole aquifer without creating problems. For hydrologists, this is the age-old problem of defining "safe yield." This is obviously a problem when we consider first of all, the immediate need for management in critical groundwater use area, secondly, the fact that we are dealing primarily with a very large aquifer which flows beneath approximately one-fourth of Georgia as well as parts of Florida and South Carolina. Finally, we are dealing with a number of managing agencies (ie. Georgia, South Carolina and several districts in Florida) who have not agreed upon their management techniques yet.

## FUTURE NEEDS

What type of work remains to be done? In my opinion we cannot neglect management needs and emphasize data collection, nor can we neglect data collection and emphasize management. Both activities must be equally emphasized. However, past experience has shown that basic data collection is overlooked until the occurrence of a crisis requiring a management solution. This lack of foresight must be avoided.

Since the State Division of Geologic and Water Resources is primarily concerned with resource assessment rather than management, I would like to list some general basic data needs of Georgia. These are:

1. A better definition of the recharge-discharge characteristics for each aquifer unit is needed. Few people recognize the important interrelationship between surface water and groundwater or the hydrologic relationship between adjacent aquifers. This is of concern not only in areas where the relationship is obvious, but also in areas like the estuaries where the relationship is less obvious.
2. The vertical variations in water quality needs to be defined more accurately. The source of the brackish water which intrudes the fresh water aquifer at Brunswick lies far below the aquifer. Insufficient data exists to clearly define the saltwater—freshwater contact throughout most of the Coastal Plain.
3. The water transmitting characteristics of the major aquifer in high-use areas is fairly well known, but similar data needs to be developed in outlying areas to assure optimum well-spacing and safe yields.
4. Aquifers are found above and below the principal artesian aquifer of Georgia yet little information exists regarding the quantity or quality of water in these aquifers. Older and younger aquifers are viable, alternate sources for groundwater supplies in areas where the principal artesian aquifer is being over-pumped.
5. Our existing water-level monitoring network emphasizes the major aquifer. This network needs to be expanded to define natural and man-induced changes in other aquifers. Also, numerous groundwater quality monitoring networks need to be established in aquifers prone to contamination.
6. Only large municipal or industrial groundwater users are required to submit water use data. A program is needed to periodically inventory very accurately all water users. Money managers can sympathize with hydrologists in that the latter are

attempting to manage a checking account without a clear understanding of how many checks are being written or who is writing them—clearly a ridiculous situation.

7. More general geologic information is needed and a wider circulation of existing information would be helpful. For example, it has been hypothesized that the previously mentioned brackish water, which intruded the fresh water zone at Brunswick, actually migrated along a fault. Other similar faults likely exist. The geology of the Coastal Plain needs updating, and these faults need to be defined prior to intensive groundwater development to avoid intrusion problems.

In summary, groundwater is one of the most important resources of southern Georgia. It is a resource that can be used to attract new development, both domestic and industrial. Like any resource, Georgia's groundwater supplies need management and careful monitoring. This necessary monitoring entails very expensive data collection. I would thus, like to stress to those of you who are concerned about resource management, planning or development that you give as much consideration to Georgia's important underground water supply as you give other more obvious resources.

# U.S. GEOLOGICAL SURVEY PROGRAM ACTIVITIES IN COASTAL ZONE AREAS

by N. J. HUTZEL and D. R. NICHOLS\*

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In recent years, the use of land in coastal areas has emerged as a matter of increasing National concern. Concurrent with a growing awareness of the delicate natural balances inherent to the coastal zone, there has developed a greater demand on the plentiful resources of these areas. The great biological diversity of the coastal ecosystem's marshlands, estuaries, and beaches, the conduciveness of this environment to the breeding and growth of many important fish species, and the seashore's superior recreational potential place a high value on maintaining the coastal zone in its natural state.

On the other hand, as the population of the coasts' already massive urban concentrations increases, more land, sometimes in hazardous areas, is being converted to provide for housing and transportation needs as well as related commercial and industrial growth. Furthermore, the need for expanded energy resources has created pressures for additional generating facilities, such as fossil and nuclear fueled powerplants and for the development of new energy sources in state and Federal offshore lands, including the Outer Continental Shelf (OCS). The refineries, pipelines, storage facilities, and other facilities which accompany the development of OCS resources can result in an ever-increasing burden on the coastal environment. Passage of the Coastal Zone Management (CZM) Act in 1972 and the amendments in 1976 are a recognition of the responsibilities at the Federal and state levels in planning for and resolving these conflicting demands on the coastal lands.

The success of the states' efforts to plan for and manage growth of this magnitude and complexity will depend to a great extent on the availability of adequate environmental and earth science information. With regard to the latter, the U.S. Geological Survey (USGS) will play an important role in providing information about energy, mineral, and water resource appraisal; water quality and quantity; assessment of natural hazards, including landslides, subsidence, earthquakes, flooding, and coastal erosion; environmental assessment of proposed developments needed to implement these plans; and base and land-use maps. The Geological Survey recently published Bulletin 1428 (Marcus, 1976) which describes USGS programs in coastal

areas and documents the varied nature of the Survey's contribution to data collection and analysis in the Coastal Zone. The report forms the basis of most of the comments that follow.

## SURVEY PROGRAMS AND PRODUCTS RELATING TO COASTAL ZONE PLANNING

### MINERAL RESOURCE EVALUATION AND DEVELOPMENT

The Conservation Division of the Survey has responsibility for evaluating mineral resources on the OCS and Federal lands in the coastal zone and for providing technical advice to the Federal agencies responsible for leasing mineral rights. Once the lands are leased, the Conservation Division supervises all exploration, development, and production activities associated with mineral extraction.

### TOPOGRAPHIC MAPPING

The Topographic Division is currently accelerating production of 7.5-minute, 1:24,000 scale quadrangle maps in coastal zone areas. These topographic maps, which are designed for general use, indicate contours of the land, drainage patterns, transportation and communication networks, urban developments, and forest coverage. Another 1:24,000 scale product available for many coastal areas and often used for interim mapping and as a companion to the topographic maps, is the orthophotoquad, which is an aerial photograph, prepared in standard quadrangle format from which positional distortions have been removed to provide an accurate, uniform scale. These maps often show subtle vegetative changes that may indicate margins of wetland areas, and thus can be of help in determining certain land uses within a coastal area. The USGS anticipates that within a year, virtually the entire coastal area of the conterminous United States will be covered by up-to-date 1:24,000 scale topographic maps or orthophotoquads. Complete coverage of coastal areas currently is available only in the standard 1:250,000 scale topographic map series.

In cooperation with the National Ocean Survey (NOS) of the National Oceanic and Atmospheric

\*Paper presented at Conference by William Doyel



Administration (NOAA), the USGS is publishing maps which incorporate bathymetric and other hydrologic data into the standard topographic maps, orthophoto maps, and orthophotoquads. These topographic-bathymetric products are designed to assist land-use planners, physical scientists, and others interested in the management of coastal lands. The recently published Wilmington, Delaware, 1:250,000 scale topographic-bathymetric map is an example of this map series, as are the five intermediate-scale 1:100,000, and twenty-nine 1:24,000 scale topographic-bathymetric maps currently in progress along the Georgia coast. A suite of maps of the Fort Pierce area, Florida, are prototypes of the topographic-bathymetric map series. Also in cooperation with NOS, the Topographic Division is publishing a Coastal Mapping Handbook, to be released by the first of April 1977, designed to assist personnel involved in coastal management programs in determining their mapping requirements and in selecting products to fulfill their needs by providing information on data sources, formats, and the availability of technical assistance.

#### LAND-USE/LAND-COVER MAPPING

Another USGS program with considerable application to coastal zone planning data needs is the Geography Program's land-use and land-cover mapping and data analysis program. In this program, land-use and land-cover information and associated data are compiled from high-altitude photography and other available source materials onto standard 1:100,000 and 1:250,000 scale base maps. The resulting information provides fairly detailed information on 37 Level II categories grouped into nine main (Level I) land-use and land-cover categories:

1. Urban or built-up land
2. Agricultural land
3. Range land
4. Forest land
5. Water
6. Wetland
7. Barren land
8. Tundra
9. Perennial snow or ice.

As an example of the detail provided by Level II analysis, streams and canals, bays and estuaries, reservoirs, and lakes, with a minimum area of 10 acres, are delineated as distinct categories under the general Level I category, water. The USGS land-use and land-cover classification system (Anderson and others, 1976) is designed to accommodate third and fourth levels of detail needed at regional,

county, or municipal levels. It is intended that the data for these latter levels, which could be determined from medium and low-level imagery, be developed by the user groups themselves. A key factor in developing Levels III and IV would be the ability to aggregate these more detailed categories into the Level II categories adopted by USGS in order to produce a land-use classification system with Nationwide applicability. The advantages of a uniform, Nationwide land-use classification system are obvious. A number of States, including Florida, Georgia, North Carolina, Alabama, and Louisiana, have entered into cooperative agreements with USGS to undertake Level I and II land-use mapping, and Florida has adopted the USGS system as a basis for its Level III Land-Use and Cover Classification System.

Associated maps are produced for political units, hydrologic units, census county subdivisions, and areas of Federal land ownership. Following graphic compilation, these maps and the land-use and land-cover maps are digitized and the resultant data are stored on magnetic tape to facilitate retrieval, manipulation, and analysis. Other data sets can be related to the land-use and land-cover data by means of the associated maps and their digital counterparts, and either statistical tabulations or computer-plotted maps can be produced.

#### WATER RESOURCE, MARINE, AND ESTUARINE STUDIES

The primary intent of the Geological Survey's water-related projects is to investigate the geologic and hydrologic characteristics of the coastal zone, identify actual or potential problems involving water quantity or quality, and provide data and information essential to efficient coastal zone management. Emphasis in estuarine studies is placed on evaluating the hydraulic, chemical, and biotic framework and the changes induced by human activities.

Specific estuarine studies currently being undertaken include:

1. Estuarine hydrology of Tampa Bay, a study directed at assessing the impact of a proposed channel-dredging project on the hydrology of the bay.
2. Water quality modeling of eight selected Florida estuaries, a project whose object is to develop digital water quality models to evaluate the effect of waste discharge on dissolved oxygen, biochemical oxygen demand and chloride.
3. Reconnaissance investigations of South Carolina estuaries, a project designed to define the movement of saltwater and freshwater in

coastal embayments.

4. Flow modeling of the Chowan River Estuary, North Carolina, a project which entails preparation of a flow model designed to be of assistance in studying nutrient cycling and biological processes within the estuary.

Other studies, being carried out by the Water Resources Division and the Office of Marine Geology, are concerned with circulation patterns, the dispersion of sediments and heat in particular bays or estuaries, groundwater recharge, encroachment of seawater into aquifers, and erosion and sedimentation along coasts.

Many of these aforementioned studies are formulated under the auspices of the Water Resources Division's cooperative program in which the state and USGS contract to study an issue of mutual interest on a 50/50 funding basis. The professional contacts fostered by this long-standing cooperative effort facilitate the dissemination of USGS earth science information to land-use planning and management efforts at the local level. Two other Water Resources Division activities particularly important to dealing with problems in the coastal zone involve the documentation of frequency and magnitude of flooding and the review of environmental impact statements concerned with the effect of energy-related activities on water resources.

#### HAZARD APPRAISALS

Inherent in any thorough study of natural constraints on development in the coastal area is a careful examination of potential geologic hazards, such as faulting, subsidence, landsliding, and coastal erosion.

Fifteen percent of the Nation's population lives in the high-risk, earthquake-prone coastal areas of the New England, Southeastern Atlantic, and Pacific coastal regions. Because these areas have been subjected to strong, damaging earthquakes in the past and are considered to be vulnerable to high seismicity in the future, it is critical that risk levels be assessed. The Geological Survey has a lead role in Federal programs directed towards assessing, predicting, warning of, and mitigating earthquake hazards.

The increasing number of nuclear power facilities being planned in the coastal zone is a further stimulus for a thorough appraisal of geologic hazards in these areas. Geological Survey research and review of applications regarding the siting of nuclear reactors focus on consideration of the hazards posed not only by potential seismic events, but by flooding, landslides, subsidence, and the

continuity of sources of cooling water. One element of the Geologic Division's reactor hazards program includes a cooperative study, with the Nuclear Regulatory Commission (NRC), of the geologic structure and recency of faulting along the Atlantic Coastal Plain. Because of the potential damage from a recurrence of an earthquake with a magnitude comparable to that of the 1886 Charleston earthquake, regional geologic and geophysical studies are being concentrated in South Carolina and Georgia.

Another hazard-appraisal program currently underway in the Geologic Division involves mapping relative degrees of susceptibility to, and incidence of, landsliding in areas across the Nation. The Survey recently published the "Preliminary Landslide Overview Map of The Conterminous United States" (Radbruch-Hall, and others 1976), as a part of the National Environmental Overview Map series which is directed towards providing geologic, hydrologic, and topographic data supportive of National-scale environmental assessments. In addition to hazard-related studies, the Survey conducts a broad range of basic geologic and resource appraisal studies in coastal areas.

#### PROGRAMS RELATING TO EFFECTS OF OCS DEVELOPMENT ON ONSHORE LAND USE

The USGS has initiated several projects directed largely to assessing the impacts of siting energy-development facilities in coastal zone areas. In 1975 the Resource and Land Investigations (RALI) Program of the USGS undertook, through an agreement with the New England River Basins Commission (NERBC), a project to provide information in support of State and local needs in planning for onshore facilities associated with OCS development. A key component of this study is the development and testing of a methodology for facility siting. Two products of this study have just been completed—Onshore Facilities Related to Offshore Oil and Gas Development: Fact Book and Onshore Facilities Related to Offshore Oil and Gas Development: Estimates for New England. The final product of the study is to be a methodological guidebook with National applications to facility siting. In order to transfer this methodology, plus other applicable methodologies and information to State and local planners and decision makers, two series of workshops will be held. The Survey, with funding from the Environmental Protection Agency, has given a contract to the American Society of Planning Officials (ASPO) to plan, conduct, and evaluate the workshops.

Somewhat removed geographically from the site

of this conference is another project being carried out by the Earth Sciences Applications (ESA) Program in the Puget Sound region of Washington. The focus in this project is on the development of earth science information critical to coastal management decisions in the diversified, sometimes hazard-prone, geologic and hydrologic environment of Puget Sound. This area may well be a key location for the development, transfer, refinement, and storage of Alaskan crude oil. The Sound's productive estuarine system, which supports major recreation and fishery industries, is potentially endangered by well-established timbering, pulp, lumber, aircraft, and aerospace industries. These sometimes conflicting land uses support the largest population and economic center in the Pacific Northwest and establish the Puget Sound area as a particularly fertile ground for the application of earth science information to problems of coastal zones. The products of this study include basic data and interpretive maps, including an explanation of the methodology used, as well as seminars, workshops, and discussions with Federal, State, regional, and local user groups. The data analysis and interpretation techniques developed in this area are being designed for ready application to other coastal states.

We hope that this quick overview of selected Geological Survey programs in the coastal zone has been helpful to you and will stimulate suggestions and ideas for changes or expansion of projects to better serve state needs. For those that wish more information on these and other programs, contacts for specific studies are listed in the back of Bulletin 1428, which is included in the following list of references.

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# **SOUTH CAROLINA'S COMPUTERIZED MAPPING PROGRAM**

**By ALFRED H. VANG, III**

*The Geographer*

*South Carolina Budget and Control Board*

I want to talk basically about three areas:

1. The evolution of a computerized mapping program in South Carolina.
2. The result of the South Carolina program.
3. The outgrowth of a study we are doing with the Coastal Plains Region Commission.

Then we will demonstrate to you some of the things that are possible with the South Carolina system.

When we got into the coastal zone business in South Carolina, we found that we did not have any maps which were worth very much. Some of the maps were done in 1915; some were 1915 U.S. Geological Survey (USGS) 15-minute quadrangle sheets, and so on. We also found that it really was not useful for us to have a hard copy map since the day that a map is printed, it is out of date and the production cost is staggering—\$20,000 upward. So we developed our own system based on low level, color infrared aerial photography and computers.

Most of you are familiar with computerized mapping systems, but our system is a little different from most. We took the USGS quadrangle sheets, updated them ourselves with aerial photography, and fed this information into the computer and our data bases. We then overlaid these bases with 133 data categories. We have the capability of using 999 data categories. We found this method to be the only way we could effectively make a management decision in the coastal areas. I say this because we can now tell what is at a particular site. We also have scale variation so that we can produce a map at whatever scale is necessary. So, the result is a regional approach that is site specific.

We found a problem in the compatibility of data in the coastal zone and that the organizations working with these data were not always sharing their information. With assistance from the Coastal Plains Regional Commission and the Coastal Plains Center for Marine Development Services, we held a conference in Columbia with individuals working with computerized systems in the five Coastal Plains States. The results of the conference indicated that we needed to have a system of compatibility—some way that we could exchange information. One of the best ways to exchange this information is on computer compatible tapes. As an outgrowth of the conference, the State of South Carolina, in cooperation with the Coastal Plains

Regional Commission, is conducting a study of the five Coastal Plains States' data and mapping systems. We plan to use information obtained from a questionnaire to show areas of compatibility between States and how they can share information. We also hope to be able to show where there is a significant lack of information, what this is costing, and how these costs can be reduced. One way in which this could be done is through the development of a State-wide program using USGS orthophotos to build up a tax mapping system. The maps would be shared with other State agencies having the need for such information. This is only an idea and has not happened, but we are trying to get it to take place.

Our study was picked up in turn by the American Congress on Surveying and Mapping (ACSM). ACSM held a conference last summer and recognized the need for the coordination and sharing of mapping information by various user groups. I believe they are going to use our results in South Carolina to show how this could be done on a National level. Basically what is involved is the coordination of local, state, and Federal Governments. Everybody is mapping. Everybody is coming up with new data, but no one knows where it is. The Cartographic Information System deals strictly with maps. Maps are great for use as bases, but you have to have the information to go on them, and no one knows where that information is. At least in South Carolina they do not, and I am sure that is the case in most other states.

We have with us today George Walters from the University of South Carolina, who is working with us in developing our system. We are going to call up our computer in Columbia, South Carolina and give you a demonstration of what the maps look like on the display screen as well as some of the features of the system. One of the advantages of this system is that we can change scale upon demand, while you are looking at the display screen. Based on tax maps, or USGS maps, we can go down to a subdivision and show you what is there. Also, any input of data can be made on line while the operator is sitting at the terminal. If you want to see what relationships exist between natural phenomena or between economic phenomena, the system can provide it to you. We envision that the system will solve a lot of problems in the State of South Carolina.

Many of you may be familiar with a program developed by IBM and used by many states to assist with their legal processes. The system is based on key words and enables the user to determine what laws are applicable to certain cases. We plan to go one step further in South Carolina by also putting into our system all the municipal codes. This information would be useful in coastal areas in helping to determine what the environmental effects of a proposed project would be as well as what ordinances would have to be complied with to conduct the project.

We also believe that our system would be valuable to industry. For example, if a company wants to locate a new facility in the State, we can input certain information about the firm's needs, such as labor forces, transportation requirements, acreage needed, etc., into our computer. The computer will then select the best sites meeting these requirements in the State and show them on a map on the display screen. The system operates over regular telephone lines, so it is possible to set it up anywhere. The South Carolina State Development Board would like for us to install a terminal in their office in Brussels, Belgium, so that they will be able to just place a call and obtain whatever information they want instantaneously.

The meeting which we held in Columbia indicated a number of common problems in the Coastal Plains States. We found that most of the States are getting ready to develop some sort of data or information system based on computers and using computer mapping of some sort. A lot of money is being spent developing such systems and we hope that our study of the existing data and mapping systems will show the individuals in the five States the alternative approaches to developing the best computerized mapping program for their State. We are sending about 300 of our questionnaires out in the mail and will follow some of these

up with site visits to talk with the individuals actually working with some of the programs.

We have been fortunate in setting up our system in that by working with the University of South Carolina we have been able to develop a system at a greatly reduced cost. We were able to set the whole thing up for about \$200,000. We also found that by working with USGS under their cooperative program, we can produce tax maps at a cost of about \$4.00 per square mile as compared to the \$30.00 per square mile that it costs a local government to produce a tax map. Also, we can fly our own aerial photography. We use two cameras, one for infrared, to obtain natural resources information, and the other for black and white for use in the tax mapping system and industrial development. The total cost savings for the State and local governments is astronomical and I think that if you look at the situation for your particular State, you will find the same thing to be true.

I have been asked to explain a little more about the local and municipal programs available through our system. We can take a zoning map and input it into the computer. Each time the local government body meets they can refer to this input in making decisions. As changes take place in zoning or other local regulations, the map can be immediately updated in the computer. In other words, all of the necessary information could be made available to local governing bodies when they need it.

In terms of a representative from industry wanting to know more about a local area for a possible plant location, the system would be of immense value. One of the thrusts in South Carolina has been that we want to grow with industry. We do not want to stifle its growth. In some cases, trade-offs must be made and that has been our philosophy. This system is a tool we have developed for use in determining such trade-offs.

# MERRMS—A COASTAL RESOURCES INFORMATION SYSTEM FOR VIRGINIA

By J. CLAIBORNE JONES

*Assistant Marine Scientist  
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One of the most pressing problems facing coastal resource managers at all levels of government is a lack of adequate informational support. Information on a variety of subjects is required for sound decision-making in the development of an effective coastal zone management program. Scientific research, of course, continues to provide a tremendous amount of data on the coastal zone and contiguous ocean waters. It is essential not only that this information be made available, but also that it be made available in a form which can be readily used and understood by managers and planners who, in many instances, are not particularly scientifically-oriented. Far too often, scientists and managers seem to operate in mutually exclusive vacuums.

In view of the foregoing, the need to provide an interpretive interface between scientists, the developers of basic information, and managers, the users of this information, becomes obvious. Furthermore, today's information explosion puts a great burden on scientists who would remain current even in their own discipline. Since many problems are now being attacked by multidisciplinary teams, some basic knowledge of other fields becomes imperative. Today I would like to describe to you a system which we have developed at the Virginia Institute of Marine Science (VIMS) to cope with these problems. The system is known as MERRMS, an acronym for the Marine Environment and Resources Research and Management System.

In order to understand the system, however, it is important to first understand something of the structure and function of the Institute.

VIMS is the State's oceanographic agency, a legislatively-mandated State agency like the Department of Health or Agriculture. The Institute, however, is strictly an advisory agency with no managerial responsibilities. We are also an educational institution, serving as the School of Marine Science of the College of William and Mary and the Department of Marine Science of the University of Virginia. Professionals on the VIMS staff hold faculty positions in both institutions simultaneously. Thirdly, we do basic research in all facets of marine science and, finally, we accept grants and contracts for work in marine science

from foundations, industry (when in the public interest) and the Federal Government.

In our role as an advisory agency, we are called upon to make comments on every project which affects the tidal waters of the State. In the past, we have found that sometimes we did not have all the information which we required to make a really thorough comment, or that information which we did have was not being utilized simply because it was so dispersed throughout the Institute that we couldn't pull it all together in time. MERRMS was established in 1971 to serve as a sort of point source of information to aid in such situations. Our goals were, first, to establish a broad-based, easily-accessible information system and, secondly, to design the system so that this information could be presented in a variety of ways to suit the needs of the individual user.

Our first task was to gather all of the aerial photographs of Virginia which individual researchers had acquired over the years. To these we added topographic maps for Tidewater Virginia and later supplemented them with those from North Carolina, Maryland and Delaware. We also collected highway maps for all Tidewater counties and added navigational charts of all Virginia waters and other major waterways of the East Coast. Access to this information, as well as retrieval, display and interpretation is achieved through the use of indexing, roll files, and wing panels. Thus, without a great deal of work, we had managed to complete a useful and fairly comprehensive cartographic data base.

The next phase of development was the establishment of a small, heavily indexed, special purpose library to assist managers, advisors, and researchers. We made the decision at that time—a decision which we have never regretted—to use microfiche as a medium of storage for this library. Entries are selected for relevance to the coastal zone, with a natural emphasis upon the waters of the Chesapeake Bay and its tributaries. Our holdings currently include more than five thousand references ranging from copies of hardcover books and technical publications to such "gray literature" entries as letters, informal reports, and newspaper clippings. Document files continue to grow at the rate of approximately one hundred acquisitions per

month.

All publications are filmed and unitized into microfiche for convenient storage. Access to publications may be gained through either author or subject, with most references cross-filed under several subject categories. To further facilitate rapid access, all publications are computer-retrievable via the Institute's IBM 370/115 coupled with an IBM 370/145 at the William and Mary Regional Computer Center. As publications are received in MERRMS, they are read, and as many as ten descriptors are assigned to each publication, based upon its content. The descriptor list was chosen primarily from the Water Resources Thesaurus drafted by the Department of the Interior. Some descriptors, which we found inapplicable, were deleted from the basic list; others which we found necessary, such as local place names, were added. There are approximately two thousand descriptors available. These descriptors, in addition to standard bibliographic information, are entered onto magnetic tape. Through this means, it is possible to search for information by author or subject as well as by the descriptor. The computer may print out all titles to which any of several descriptors have been assigned, or, alternatively, only those titles to which all of the chosen descriptors have been assigned.

In addition to the obvious advantages of microfiche in terms of ready storage, microfiche can be duplicated rapidly and inexpensively in MERRMS. Distribution therefore becomes a simple matter of a request, followed by the forwarding of the document by return mail in a standard envelope. MERRMS has several portable microfiche readers which are utilized when a researcher wishes to take a publication with him for further study. A microfiche copy is made and the researcher takes the portable reader and his throw-away copy with him. This system ensures that our permanent files will always be one hundred percent complete. We also have a reader-printer which enables researchers to reproduce a paper copy from any article available on microfiche. As part of the Institute's continuing coastal zone management effort, MERRMS provides local Planning District Commissions in the Tidewater region with monthly lists of acquisitions, and pertinent publications are provided to local planners free of charge.

The third major component of MERRMS is a multi-projector visual display system composed of five 35 mm slide projectors and a six feet square rear projection screen. The viewing room contains a

console which gives the operator random access to the slide file. The rear projection screen is divided into quadrants, each covered by a projector with an 80 slide capacity. Any or all of the projectors may be used simultaneously so that, by apportioning slides covering a particular area among the four projectors, as many as four factors affecting that area may be shown at one time. Thus, any one of 320 slides can be presented almost instantaneously. Since carousel reels are easily changed, the presentation is essentially limitless within the four-projector format. With the VIMS Art Department and Photo Lab at our disposal, we are able to obtain series of slides covering virtually any subject of interest to us.

The fifth projector, also of the random access type, is operated by itself and covers nearly the entire screen. It is used for large-scale displays of problem areas and for special, single-projector presentations. This adds flexibility to the system and has been particularly useful for seminars and briefings. As an example of how the entire visual display system functions, let us suppose that our problem concerned the construction of a nuclear power plant in Hampton Roads. The center slide could show the Hampton Roads area with the location of the proposed power plant. The quadrants might be used to show locations of oyster beds, clams, currents, salinities, bottom profiles, locations of other industrial wastes in the area or any one of many other factors with which the project manager must concern himself. By displaying several factors on the same screen, physical relationships among various aspects of the problem can be quickly and correctly assessed.

In closing, I would like to reiterate that MERRMS is an acronym for the Marine Environment and Resources Research and Management System. Our purpose is to collect, collate, display and disseminate information on the resources, inhabitants and phenomena of the coastal zone. We feel that we have, in MERRMS, a rather unique informational system designed to aid in effective coastal resource management decision-making. By providing scientists, as well as managers and planners, with interpreted scientific data in a form appropriate to their individual needs, we enable these vital decisions to be made from a much broader perspective. As our capabilities and data base increase, we hope to be able to provide a valuable service to scientists and managers throughout the entire Coastal Plains Region.

# THE FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976 AND THE STATE DEPARTMENT ROLE IN ITS IMPLEMENTATION

By DOUGLAS G. MARSHALL

*Director*

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## THE LAW

On April 13, 1976, President Ford signed into law The Fishery Conservation and Management Act of 1976 (P.L. 94-265), popularly called the 200 Mile Fishery Bill. The Act was passed after many months of debate and in response to ever rising concern over the state of fisheries resources off the coasts of the United States. It is a major and a far-reaching piece of legislation. It is consistent with the direction in which fishery resource management is moving worldwide and it takes into account possible future ratification by the United States of a Law of the Sea Treaty.

The Act begins with a statement of findings, purposes, policies, and definitions of the terms used in the law. The remainder of the Act is divided into four titles. Title I establishes the 200 Mile Fishery Conservation Zone and exclusive U.S. management authority over all fish within the zone, all continental shelf fishery resources beyond the zone, and all anadromous species throughout their migratory range beyond the zone except in waters which we recognize as pertaining to another country. The zone becomes effective March 1, 1977.

Title II of the Act deals with foreign fishing pursuant to international fishery agreements. Basically the law provides that, beginning March 1, 1977, foreign fishing within the United States Fishery Conservation Zone for anadromous species, or continental shelf fishery resources beyond the fishery conservation zone, is prohibited unless it is conducted in accordance with the provisions of the Act and authorized pursuant to existing International Fishery Agreements or Governing International Fishery Agreements negotiated pursuant to the new law. The Governing International Fishery Agreements are designed to establish the basic conditions under which foreign countries may fish in the zone. These agreements do not grant any right to fish, but rather provide that if a surplus of fish is found to be available, the foreign country would adhere to the principles set forth in the agreement in any fishery in which it might be allowed to fish. The Governing International Fishery Agreements described in the new law are

subject to review by the Congress after signature. If the Congress does not object to the agreement within sixty continuous days of Congressional session after it has been transmitted to Congress by the President, the agreement then becomes effective.

After a Governing International Fishery Agreement has been concluded, there is a procedure for the application by foreign countries for fishing permits and for the issuance of such permits by the United States. There is also a separate procedure for the issuance of registration permits to foreign fishing vessels which wish to fish under the terms of International Fishery Agreements which were in effect at the time of the enactment of the law and which continue to be in effect, with regard to the United States, on March 1, 1977.

Title III of the Act sets National standards for fishery conservation and management and describes in detail the fishery management program to be established under the new law. A major element of that program is the Regional Fishery Management Council system. Each of the eight councils established will have representatives of the state and Federal Governments and of the public, including conservation and environmental interests. The Department of State, the Coast Guard, the Fish and Wildlife Service, and the Marine Fisheries Commissions each have a non-voting member on the Councils.

Each council must prepare managements plans for the fisheries in its area of jurisdiction and appropriate regulations to carry out those plans. Each plan must contain a description of the fishery, including number of vessels involved, type of gear used, species of fish involved, estimated management costs, and potential revenues. The plan must determine the U.S. harvesting capacity, total allowable catch, and any surplus remaining for foreign fishing. Plans are reviewed by the Secretary of Commerce who may approve, disapprove, or partially disapprove. The Department of State and the Coast Guard are consulted in such reviews by Commerce.



If a council does not prepare a plan within a reasonable time or if the Secretary of Commerce has disapproved a council's plan and it has not been corrected by the council, the Secretary of Commerce may himself prepare a management plan in consultation with the Department of State and the Coast Guard. His plan must then be submitted to the council concerned.

Title III also describes acts which are unlawful and the related civil and criminal penalties.

Title IV of the Act amends certain other United States laws to make them conform to the provisions of the new Act.

### IMPLEMENTATION

Since the passage of the law, the Department of Commerce, the Department of State, and the Coast Guard have made a concerted effort to prepare for the implementation of the new law when the exclusive fishery management authority of the United States, as set forth in the Act, becomes effective on March 1, 1977. The Regional Fishery Management Councils have been established and have begun meetings to prepare for carrying out their responsibilities under the new law.

The Department of State has signed agreements with Poland, the Republic of China, East Germany, Romania, and the Soviet Union. We have ongoing negotiations with Spain, the European Economic Community (EC) on behalf of Italy, France, and West Germany, with the Republic of Korea, Bulgaria, and with Japan.

The law provides that, if a foreign country submits an application for a permit to fish for a stock of fish for which the Secretary of Commerce determines no management plan will be prepared by the appropriate regional council and implemented before March 1, 1977, the Secretary of Commerce may prepare a preliminary fishery management plan for the stock involved. Such a preliminary fishery management plan will remain in effect, with respect to foreign fishing for which permits have been issued, until such time as a management plan is prepared by the appropriate council and approved by the Secretary of Commerce. If the regional councils have prepared plans and those plans have been implemented by that date, they will, of course, be the plans utilized with regard to all fishing covered by the Act, including foreign fishing.

Application forms and permit forms have been printed and distributed to those nations with which we have signed agreements. A schedule of fees for permits for foreign fishing is being prepared.

In our negotiations with foreign countries, we cannot guarantee specific quotas or catch levels nor access to a particular stock. Surpluses of each stock are determined on an annual basis by the regional councils. Stock conditions change and American harvesting capacity hopefully will increase. Foreign fishing is clearly within the intent and the provisions of the law but it probably will decline from past levels, particularly in certain stocks.

Once surpluses have been identified by the management plans, the responsibility for allocating the surplus among foreign fishermen belongs to the Secretary of State in consultation with Commerce. Criteria for allocation are: traditional fishing activity, past cooperation with the United States in fishery research, cooperation in enforcement with respect to conservation and management, and finally, other appropriate considerations.

At the time the Act was passed the United States was party to a dozen bilateral fishery agreements and multilateral arrangements. Virtually all of them will have to be replaced by new agreements consistent with our new law. We are making good progress toward full implementation of the Act.

In addition to the agreements I have mentioned so far, we have another group in which the shoe is on the other foot, where we wish to fish in the zones of other countries. We have an agreement with Brazil which allows our distant water fleet to shrimp off the Brazilian coast. We have recently concluded an agreement with Mexico which allows several categories of American fishermen, including sports fishermen, to fish in the Mexican 200-mile zone. We are engaged in a very complex and difficult series of fishery negotiations with Canada. Canada and the United States each fish in the other's waters. Similar agreements may later be necessary with other countries.

As countries around the world extend their fisheries jurisdictions, confused, and at times, conflicting claims arise. The new law recognizes the need for boundary negotiations to settle such issues and we expect to engage in a series of these negotiations with adjacent or opposite foreign nations over the coming months.

## RECENT ACTIVITIES OF THE REGIONAL FISHERY MANAGEMENT COUNCILS

By EDWIN A. JOYCE, JR.

*Director*

*Division of Marine Resources*

*Florida Department of Natural Resources*

I appreciate the opportunity to speak here, and I want to thank Bev Snow and all his staff for allowing us the chance to talk about what we are doing, why we are doing it, and how the Regional Fishery Management Councils are starting to function.

As Bruce Lentz mentioned briefly, Harmon Shields is the person in charge of marine resources for the State of Florida and is the Governor's designee on the South Atlantic Regional Fishery Management Council and on the Gulf of Mexico Regional Fishery Management Council. We are involved in both these Councils and, in addition, are very strongly interested in the Caribbean Council and its activities because of the fact that spiny lobsters and many other animals which are very important to Florida's fisheries probably originate in the Caribbean area and are brought up through the various currents to become a part of Florida's fisheries.

As a member of two Councils as well as being in charge of an over 1200-person Department, you can understand that Mr. Shields has very little spare time. Since there are an estimated 50 man-days of involvement per year per Council, you can also understand why this is a very serious problem for many of the states. The top marine resources official is called on to put roughly one-fifth of his working days into Council activities as an almost totally new requirement and, yet, still must carry out all his prior activities as well.

Mr. Marshall has already discussed the details of Public Law 94-265 and mentioned how it created the Management Councils, so I would like to go into some of the "nuts and bolts" of what has occurred in the way of Council activities since their formation. The first meeting of all the Councils was a joint one and occurred during the week of September 13 in Arlington, Virginia. This was a very interesting meeting and, I think, indicated the trends of thinking. It also showed, even though we were members of eight different Councils from widely separated regions, that we all were optimistic about what the Councils can do and what our activities will mean to the fishermen of the United States.

Since that first meeting, the South Atlantic

Council has held further meetings in Jacksonville, Florida; Savannah, Georgia; Charleston, South Carolina; and Morehead City, North Carolina, where our most recent meeting was held last Sunday, Monday, and Tuesday. So, the meetings are coming fast and furiously, and major duties up to this point have really been organizational. One of the first things we did was to elect a Chairman. We also decided on a location for the Council offices very carefully to assure that we picked an area with easy access for all the Council members and one that had some governmental and state agency facilities. These would be helpful to the Council Staff in their work. We selected Charleston, South Carolina.

We are now in the process of hiring a Council staff, and it appears that there will be some five to seven positions with an Executive Director who can be hired at a top level of a GS-15. For those of you who might like to apply for the Executive Director's job, it can pay as much as \$39,600 per year. It is not a bad job, but it will be a rough one, so we are going to be very careful to select an able, qualified Executive Director. Each of the Councils is facing this same problem and, since there are five Councils from Maine through Texas, including the Caribbean Council, we are, in some cases, interviewing the same people for the same level job.

In consideration of the budgets for the Councils, we were informed at the Arlington meeting that we would have to have total budget requirements for the Councils set up by mid-December of 1976, and that this should include not only the rest of this fiscal year, but also for 1977-1978 and 1978-1979 as well. This requirement has been met.

Approximately 22 million dollars was provided for operations of all the programs called for under PL 94-265. Of that 22 million dollars, only 3 million sifted out to be used by the Regional Councils themselves. When we began to figure the costs of preparing management plans and the numbers of persons needed to contribute to these, it became obvious that in many areas there is very little completed research that will be useful in determining whether we have an excess of resources that could be made available to foreign fishermen. We

are looking at some contractual funds for additional research in these areas, but it is a very expensive operation.

Most of the Councils, in carefully evaluating their budgets, have indicated that they are in the neighborhood of from one-half to one-third of what they will actually require for operating funds. We all, of course, have cast an eye towards the additional 19 million dollars made available for other facets of the Act. I do not want to suggest that these other facets are not important for the total operation of the Councils or the Act itself, because they are. We did, however, look back over the total budget and carefully reviewed priorities to determine where the additional funds needed for the individual Councils could best be obtained. As brought out during the Arlington meeting, one area we all felt could be reassessed was the approximately 11 million dollars allocated for vessel construction and operation for the National Marine Fisheries Service. Of this, 7.5 million dollars was for the construction of two new vessels. In view of past experience with Federal vessels and the fact that these cost from \$2,500 to \$4,000 a day to operate, we suggested that this might be an area from which the needed additional funds for the Councils could be provided. In essence, we felt that, rather than build vessels which might later be simply tied at the docks because of funding restrictions, some of this money could be used for the Councils and the remainder could be used to lease existing vessels for necessary field work. All of these things elicited a very wide response over the several meetings we have had, especially from the National Marine Fisheries Service.

All Councils have been evaluating species which they feel should be considered for management. Among the South Atlantic and Gulf Councils, there is a strong feeling that the by-catch of billfish from the foreign tuna longline operations is a very critical problem. Tunas were specifically excluded from PL 94-265, but the billfish by-catch in this operation is certainly within the jurisdiction of the Councils according to our legal authorities. As Chairman Bruce Lentz mentioned, whenever we have a question we must first ask our legal advisors if we

can even ask that question and then proceed from that point. In cases such as this, where several Councils are concerned with a particular fishery, the Secretary of Commerce can designate a lead Council or one or more Councils to handle the formation of a management plan. The South Atlantic Council was informed just prior to its last meeting that it has been designated the lead Council for the billfish by-catch problem, and this will be one of our first involvements.

I want to mention a couple of other things which I think you might find interesting. Most of you know that there are other cooperative Federal and State groups which have interests and responsibilities with respect to the fishery resources of these coastal areas. Examples are the Gulf States Marine Fisheries Commission and the Atlantic States Marine Fisheries Commission. Under the auspices of other Federal funding, the State-Federal Fisheries Management Boards have been formed for various areas, including the South Atlantic and Gulf.

The question has been raised as to whether all of these three different groups—the Regional Councils, the Commissions, and the State-Federal Boards—are really needed. The discussions have indicated that most of us feel that they are all needed because they actually bear slightly different responsibilities in different areas. The Councils, for example, are primarily concerned with the area from three miles out to two-hundred miles. The State-Federal Boards deal primarily with problems that occur within the territorial seas; that is, they deal with species which are primarily fished within three miles of land but which cross state boundaries. The Commissions are compacts of states and provide a forum for discussion of state problems over a broader range and for consideration of state problems as a whole. The Commissions may then take a consensus stand to Washington for Federal consideration. Consequently, most of us feel that all three of these groups should be left to function separately as they now do, at least for the present time. As the authorities and functioning of the Regional Councils becomes more clearly established, I am certain the roles of these groups will be under continuous review.

# THE FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976: A MIXED BLESSING

By WILLIAM N. UTZ

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National Shrimp Congress

I appreciate the invitation and opportunity to participate in this program, a program which on the whole provides a medium through which Federal, State, and local government administrators, scientific researchers and representatives of private industry, such as I can communicate our views and exchange thoughts concerning various conditions and situations which face the Nation and industry, in particular the fishing industry, today.

The area of interest which I am to address is the recently extended fisheries jurisdiction surrounding the United States and extending outward 200 miles from the base line of our coast. I don't pretend to recognize all of the advantages nor to see all the pitfalls of the 200 mile limit. I would, however, like to share with you some of the thoughts that have come to mind, some of which have been expressed at length, and some which I have been thinking about privately. In some instances, I am not positive that I have reached any finite conclusions of my own.

First, for those of you who possibly may not be aware of it, the question whether to extend our jurisdiction outward to 200 miles or retain our existing boundaries until international agreement could be negotiated, was not a one-sided discussion. It was hotly contested from both viewpoints and, although the final votes in Congress would indicate a substantial majority in favor of the unilateral extension which has been undertaken, it was indeed a long time coming, a battle which was debated at length, and one which was won inch by inch. Many of the positions which the proponents advocated during this controversy still are not subject to final proof. Only time and world events will prove which side, if either, was more correct.

The American shrimp industry, which I am proud to represent, furnishes an excellent example of how the unilateral extension of our economic zone can be a mixed blessing. While first impressions would indicate that our coastal shrimp fleets, who are the envy of the world, are now afforded great protection from having their fishing grounds overworked by foreign fleets coming close to the United States' shores in search of shrimp resources, such is not truly representative of the ultimate result. One must also look to the other side of this legislative blessing. The jurisdictional claim

put forward by the United States furnishes all foreign countries precedent for taking similar steps to force foreign fishing vessels away from their fishing areas. Such similar steps, therefore, would necessitate United States distant water shrimp fleets operating off other countries' coastlines to either subject themselves to that country's domination and control, which may call for heavy duties, licenses, regulations, and other restrictive measures, and in some instances, being forced out of those fishing areas totally, or, returning to United States' fishing areas. Whether driven out by legislative mandate or by economic prohibition, the result will ultimately be the same. The distant water United States shrimp fleets must look for other resource areas. Where will they turn as an alternative? The only resource area they can be assured of is that within 200 miles of the United States. When those fleets, some of the most sophisticated and productive in the world, return to exert their fishing efforts in United States shrimp grounds, the impact upon those fleets presently operating in these areas could be substantial. Since the impact of such additional effort tends to be relative, in inverse proportion, a small one-boat operator tends to be the foremost victim. Thus, we may witness a strange turn of events—the small American fisherman, who is the intended beneficiary of extended jurisdiction, could well become the primary victim.

I recognize that only time and events will determine whether that scenario will come to pass. I hope, however, we will all acknowledge that it is, in fact, a possibility that could well occur. Should there be doubters, I point to one precedent which may justify believing that it is more a probability than a possibility. I refer to the United States unilateral declaration that the North American lobster (*Homarus americanus*) is a creature of the continental shelf. Representatives of the spiny lobster industry which operates in the South Atlantic issued strong protest to this unilateral action, pointing out that first, a substantial amount of the damages complained of were in fact caused by foreign incidental catch, thus, such unilateral action would not produce any significant impact or advantage for the lobstermen whom they sought to protect from foreign fishing, and secondly, in their

judgment, it would adversely affect the spiny lobster fishery. The spiny lobster industry stressed that this unilateral act by the United States would most certainly have a devastating impact upon their industry inasmuch as a substantial portion of their production was taken off the continental shelf of the Bahamas and surely the moment unilateral action was taken by the United States, making the North American lobster a creature of the continental shelf, it would establish adequate precedent for the Bahamian Government to take similar action respecting the spiny rock lobster (*Panulirus argus*). In spite of these protests, the United States did, in fact, declare the North American lobster a creature of the continental shelf and the Bahamian Government almost immediately declared the spiny lobster a creature of their continental shelf. The net result we see today is that American spiny lobster fishermen have been severely damaged in their capability to produce this resource and, regarding the benefit reaching the New England lobster industry, to date there appears to be little if any significant change in conditions resulting from that legislation.

I state this to provide some background and some reflective and sobering thoughts for all of us, both in industry, who are to be regulated, and you in government and on the Regional Fishery Management Councils, who are charged with the responsibility for establishing, interpreting, and administering the economic zone regulations. I do this so that we might all reflect and acknowledge that extended jurisdiction, while well intentioned and possibly beneficial to the industry overall, has placed a large segment of the seafood producing industry in jeopardy. Recognized and accepted, that it is probably impossible to pass a law that benefits all and injures none, it is likewise probably impossible to administer a law that is fair, equitable, and beneficial to all without injury to anyone. However, just as certain, it is possible to have well intentioned laws passed and, if they are ineffectively administered, they will produce inequities to many and benefits to few.

We have a great potential before us through this 200 mile legislation. We presently have encompassed a larger body of resources than any other country in the world can claim by extending its economic zone to 200 mile. These are wealthy resource areas. They justify protection. They justify careful management and conservation. We have been furnished an opportunity by this extended jurisdiction to manage resources in such a fashion that they can be more productive, more profitable, more enduring, and more bountiful than we could ever have hoped had they been neglected in the face

of all the global changes occurring both ashore and at sea.

This potential is there. This opportunity has been furnished to us. But, recognize that this opportunity has been furnished by placing segments of the fishing industry in jeopardy. Therefore, I think that each and every one of us, whether as private citizens, as a member of the fishing industry, as members of the Management Councils, as members of government agencies charged with regulations, or as members of the legislature charged with overview of these laws and the passage of new laws to augment or correct omissions or errors, must acknowledge and accept that we are all charged with a grave responsibility. Yes indeed, a responsibility to ourselves, to the industry, and to the Nation as a whole. A responsibility to see that the hard battle fought over the question of extended jurisdiction was not a wasted effort by the proponents, and that the overall benefits attained justify the jeopardy faced and the sacrifices to be endured by some segments of the industry.

In other words, now that we have accomplished this legislative step—the preliminary step—let's not waste it away by trading away negotiations, by weak enforcement, or by management schemes and systems that do not achieve the purposes sought, those being:

1. The American citizen having more and better seafood upon his table.
2. The American commercial fisherman having a better opportunity to be productive and secure greater earnings for his productivity.
3. The American sportsman having a better opportunity to pursue his pastime.
4. That lovers of nature and the preservers of our environment can, within reason, attain and maintain a balance of ecology.

Yes, we are indeed at the point of stepping off into a totally new era of dealing with our ocean resources, not only within our own economic zone, but throughout the world. There are many in industry who have had misgivings about the steps we have taken which have brought us to this point, but we are focusing on the positive aspects and want to expand and develop the potential available to us. It is a challenge. It is an adventure into an uncharted arena providing a challenge for the strong at heart, for the dynamic, for the pioneer. If that sounds like I have just described the American fisherman I think the description is appropriate. It is that hardy soul who lays it on the line every day. I think, however, he is saying something to us. He is saying, "Come toe the line with me. You shaped the dream of a protective economic zone in which I can ply my

trade. You had me pursue that dream until it was shaped into legislation and passed into law. Do not dissipate my dream at the conference table, and do not turn my dream against me in the Management

Councils for, if you do, the 200 mile economic zone as a benefit for America's fishermen was but an illusory legislative promise—it was in fact but a dream."

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