COASTAL PLAINS CENTER
for MARINE
DEVELOPMENT
SERVICES

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

DECEMBER 8-9, 1977

WILLIAMSBURG, VIRGINIA

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Sponsored by the

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for Marine Development Services
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COASTAL PLAINS CENTER
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CONTENTS

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 in this Report.

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

January 31, 1978

AN OVERVIEW OF THE COASTAL PLAINS REGIONAL COMMISSION

By CLAUD ANDERSON
Federal Cochairman
Coastal Plains Regional Commission

It is a pleasure for me to join with you here today for the opening of this Conference on Marine Resources of the Coastal Plains States. For on this very important occasion, the Coastal Plains Regional Commission is proud of and takes credit for having given birth to your host, the Center for Marine Development Services. The Center, presently located in Wilmington, North Carolina, is an integral part of our overall Marine Resources Program. It was developed and is supported by the Coastal Plains Regional Commission.

As many of you know, the Coastal Plains Regional Commission is a Federal-State partnership established under the Public Works and Economic Development Act of 1965. The Coastal Plains Regional Commission and its seven sister Commissions located across our Nation are designed to bring the Federal Government into an effective alliance with State and local governments in a full-scale effort to help economically lagging regions move into line with the rest of the Nation. This Federal-State partnership is unique in the sense that, unlike other Federal assistance programs, in the Title V Commissions the State Governments are equal partners with the Federal Government. This arrangement has several principal advantages. Firstly, it provides a new measure of recognition of the States' role in selecting economic development priorities and gives considerable autonomy to the Governors to develop and approve projects commensurate with their needs. Secondly, the Regional approach encourages Governors of contiguous States to regularly meet and make decisions on issues which impact individually and collectively on their States. Regular meetings of this nature promote cooperation among neighboring States and enlarge the framework within which individual State decisions are made. Thirdly, as Federal Cochairman, not only am I a spokesman for the National Administration, but it is my responsibility to act as liaison between the State and Federal executive branches of government while administering the Federal dollars appropriated annually to the Commission. This arrangement removes traditional bureaucratic levels of government and makes it possible for the Governors, as Commissioners, to identify a problem on Monday and have services delivered on Tuesday or Wednesday.

In a world that is increasingly being shrunk by mass communications and transportation, problems are magnified and made common to all. Television and newspapers tell us daily that the problems of Israel and Egypt are our problems. Surely, when international problems can become domestic problems, then the problems of Florida and Georgia are the problems of Virginia.

Regional forms of government are governments of the future. The Regional concept as embodied in the Title V Regional Commissions, in my opinion, and in that of others associated with this program, has the greatest potential for solving problems which do not stop at State boundaries. Our five States are bound together by a commonality of mutual concerns which lend themselves to a joint approach in their solution. Contrary to the past wherein the Commission has primarily focused its policies and projects on traditional problems of income disparity and lack of technical skills to meet the demands of today's industry, tomorrow's focus must be broader, to include such things as the future availability and quality of freshwater resources, the question of urban-rural development and balance, minority business entrepreneurship, and a new "energy-use" life style. The National Administration is particularly concerned with the development of energy sources which will balance needs with environmental concerns, taking into account the onshore impacts of offshore development, as well as protection of the coastal zone.

I certainly hope that in your deliberations here today, you remember what I said earlier, that these problems are not respectors of local or State political boundaries and, therefore, neither should your proposed strategies and solutions be.

The Coastal Plains Marine Center is a fine example of what I am talking about. This Center and this annual conference are valuable components of the Commission's Marine Resources Program, and have taken on a greater significance with each passing year. The reasons for this are two-fold. Firstly, the Commission's active interest in tapping the potential of these vast resources has been intensified because of the addition of the States of Florida and Virginia in the last two years. By expanding our boundaries, the Coastal Plains Regional Commission has taken on substantial new areas for development. Secondly, and perhaps more

importantly, there is an increasing awareness at every level of the need for conservation and management of the Nation's fisheries, marshlands, tidelands, and other marine-related resources.

The Commission and its member States can be credited with great foresight in this regard when a program in marine resources was instituted in 1969 which anticipated these needs in the Region. The original Commission States of North Carolina, South Carolina, and Georgia requested and received funds for the construction of marine science and extension centers which have come to serve as focal points for planning and management of these resources. With the recent completion of the three complexes in North Carolina, the Coastal Plains Region is in an excellent position to meet the challenges presented by the demands of contemporary society on our resources. Through these centers, located along the coast of the Region, valuable data is being accumulated which will be of great assistance to the States and Federal Government in the management of these resources.

This, however, is only a beginning. So I charge you this morning to look into the future and anticipate situations that might become problems. I know that our own Marine Resources Advisory Committee is examining the activities of its first ten years in existence and seeking recommendations for improvements in the program and how influence can be brought to bear on other organizations and agencies, including those of the Federal Government, in anticipation of the problems which lie ahead. This kind of planning is a necessity and is what the Coastal Plains Commission is all about.

With this in mind, what takes place here over the next two days will have an important bearing on the direction of this program. Bringing together a distinguished group of experts in this field can only be beneficial to what we do. So as you seek answers at this conference, let me urge each of you, as you participate in the sessions, to be not only critical, but also creative.

I am confident that you will make a valuable contribution to this undertaking as the Commission goes forward to meet the challenges before it. I know that you will find this conference meaningful and productive.

THE MARINE RESOURCES PROGRAM OF THE COASTAL PLAINS REGIONAL COMMISSION

By STANFORD R. BEEBE
Marine Resources Program Director
Coastal Plains Regional Commission

I am glad to be able to tell you about the Coastal Plains Regional Commission's Marine Resources Program. Many of you have been involved in our meetings and have served on our ad hoc committees. Your involvement demonstrates a technique for moving the decision-making process closer to the States. That is an important point, but let me get back to it in a minute.

To tell you about the Commission's Marine Resources Program, I would like to raise three questions and then answer them.

1. What is the Coastal Plains Regional Commission?
2. How does the Commission's Marine Resources Program work?
3. What are some of the projects of the Marine Resources Program?

In the early 1960's, the Congress began to look at regions of the country where the per capita income was considerably below the National average. Prior to this time there had been programs to promote the economy, but none organized on a regional basis. The thinking at that time was that before the National economy could advance, the lagging regions would have to be brought up to the National average. The result was the 1965 Public Works and Economic Development Act. Title V of this Act provided the authority for States with contiguous boundaries and common economic problems to form commissions and qualify for special Federal assistance. In late 1966, the Governors of North Carolina, South Carolina, and Georgia petitioned the Secretary of Commerce for recognition as the Coastal Plains Regional Commission. That charter was subsequently granted, and the Commission is now ending its tenth year. There are eight such Title V Commissions. They were designed to be a Federal-State partnership, with the Commission members being the Governors and a Federal Cochairman appointed by the President. The Commission's purpose is to attack common economic problems of the Region. By having a coordinated attack, a synergistic effect is achieved that is not produced by one State attacking the same problem.

The regional concept is still new, and many questions are unanswered. A White House Conference on Balanced Economic Growth will take place the last of this month. It will examine the role that the Commissions and other programs play and will attempt to formulate new recommendations for economic development. However, of two things I am sure:

1. The Title V Commissions have moved the decision-making process closer to the States; and
2. They are more sensitive to short-term changes in their region's economy.

The second question is "How does the Commission's Marine Resources Program work?" The Title V legislation provides that citizen groups and special committees will be used extensively. To satisfy this requirement, the Governors of the original three States appointed a Marine Resources Advisory Committee in early 1968 which was composed of three individuals from each State. That Committee was to meet, examine the marine-related economy of the three States, and make recommendations to the Governors.

The original findings of that Committee were sound, and many of the Commission's projects today reflect the thinking of that group. That technique is still used by the Commission today. The Marine Resources Advisory Committee is made up of three members from each of the five States appointed by the Governors and three members from Federal agencies appointed by the Federal Cochairman. This group meets quarterly, and the Commission staff member provides them with reports on Commission projects and data on the marine-related economy. Based on their own expertise, studies funded by the Commission, and discussion at meetings, they recommend projects and policy to the Commission. They act in an advisory capacity only; however, their recommendations historically have been well received.

When this Advisory Committee seeks a detailed analysis of a particular segment of the economy, they recommend that an Ad Hoc Committee of experts be put together to study the problem. The Ad Hoc Committees are very informal, meet regularly, have special expertise in specified areas, and bring in additional outside experts and data for their work. They serve strictly as volunteers, with their expenses paid by the Commission. After studying a problem they will make specific recommendations

to the Marine Resources Advisory Committee. The Marine Resources Advisory Committee will review the recommendations and in turn present them to the Governors and Federal Cochairman at a formal Commission meeting. They may be adopted as policy by the Commission, rejected, or adopted in part. These advisers have an excellent record of pinpointing problems and making sound recommendations.

This system has been remarkable in its ability to come up with very workable solutions to some old problems. In a minute I will talk about some of the projects that have been recommended. Currently, I am working with a Venture Capital Ad Hoc Committee that will recommend methods of facilitating the flow of capital to new and expanding businesses. This Ad Hoc Committee has been active for about six months and will be completing their work in early 1978. I believe it is apparent from a description of this process that in the Coastal Plains Regional Commission, most of the recommendations are made by people from our member States who have both the expertise and the responsibility for handling similar problems within their own States.

The third question which I posed concerned a description of some of the Commission's projects. One of the earliest and most important concepts to come out of the Marine Resources Program was to encourage the construction of modern marine research and development centers in each of the States. Based on a study by the Commission in the late 1960's, it was apparent that the States were not prepared to handle research, development, and management projects related to the coastal areas. Through planning grants and construction funds from the Commission, each of the original three States has completed modern research and development centers. North Carolina has three such centers, located in Dare, Carteret, and New Hanover Counties. South Carolina has a modern, expanding research and development center located at Fort Johnson in Charleston. Georgia has a large research and development complex which was constructed on Skidaway Island near Savannah. All of these centers are now beginning to attract additional Federal dollars in project money and to draw Federal programs to their locations. The framework has been built for research and development centers that will stretch from Virginia to Florida.

Seeking to place emphasis on the development of the Coastal Plains mineral resources, an Ad Hoc Committee was appointed in 1974, composed of the State Geologists. They recommended that the Commission invest in aero-magnetic and aero-radioactivity surveys of the entire Coastal Plains Region. These surveys are flown at one-mile intervals at an elevation of approximately 500 feet, towing instrumentation which measures the magnetic properties of the basement rock and the surface radioactivity. This data is then transferred by computer onto contour maps which provide information on the location of heavy metals and the geologic formation of the basement rock. To date approximately $600,000 has been invested in this project, and in its first year titanium deposits of commercial value were located in Southeastern Georgia, commercial value of which is estimated to exceed 600 million dollars. Just recently additional valuable mineral deposits have been located in the Charleston, South Carolina area, and work is currently underway for further testing. It is probable that in the next few years test oil wells will be drilled because of the information provided by the magnetic data. In addition, the magnetics provide information that can be used to locate faulting and other geologic formations of commercial and scientific interest. This has been a cooperative project between the U.S. Geological Survey and the Commission, and is an outstanding example of how the Federal-State partnership can work.

In 1974 and 1975, the Marine Resources Program worked with an Ad Hoc Committee on the seafood industry. This Committee's major recommendation was that the Commission place emphasis on the planning for construction of at least one seafood industrial park in each of its States. Basically, the seafood industrial park concept involves the construction of a harbor with modern bulkheading, sufficient channel depths, and all facilities required, including water, sewer, electricity, adequate ice, fuel and repair facilities, and a centralized freezer storage system. This concept will change the basic marketing structure within the Coastal Plains Region, providing a more competitive setting for the industry and one that will give more incentives to fishermen and will attract large institutional buyers to these complexes.

This same Ad Hoc Committee also recommended a regional marketing effort for underutilized species. This past year saw the first marketing promotion on a five-State basis. This was a cooperative project between the National Marine Fisheries Service, the Gulf and South Atlantic Fisheries Development Foundation, Inc., the various State marketing offices, and the Coastal Plains Regional Commission. Approximately 18 cities were targeted in the Midwest. The results are in, and they are very impressive. As the seafood industrial parks begin to provide more product at higher quality, the Midwestern market should be well established for the Southeast.

One of the earlier Commission projects

recommended by the Marine Resources Advisory Committee was the establishment of a Center for Marine Development Services. The primary function of the Center was to be the transfer and exchange of information on all types of research and development underway within the Region. This has to be one of the outstanding Commission projects. The meeting you are attending today is one of a series of Annual Conferences on Marine Resources sponsored by the Center. You will find more scientists, researchers, developers, and marine-related personnel at this meeting than at any other marine meeting in the Southeast. The Center also assists in organizing forums and conferences for the Regional transfer of information and expertise. If you have had contact with this Center, you know that their responses to requests for help are immediate, accurate, and willingly provided. If you are planning a conference or forum, they can help you.

I would like to close by mentioning two things. First the Commission is now into its tenth year. The Marine Resources Program will be doing an extensive reveiw of the marine-related economy. As in the past, we will be using Ad Hoc Committees. We will be asking many of you to help us. Second, I would like to thank those here who have served on committees. Your time and advice have been, and will continue to be, appreciated by the Coastal Plains Regional Commission.

INDUSTRIAL DEVELOPMENT IN COASTAL GEORGIA

By VERNON D. MARTIN
Executive Director
Coastal Area Planning and Development Commission

It is a real pleasure for me to be here this morning to inform you about two unique programs that the Coastal Area Planning and Development Commission (APDC) has been working on for quite some time, and is now in the process of implementing. I say "unique" since each of these programs is the first of its kind to be attempted in the United States, and, in my opinion, there is a lot to be learned by other local units of government and regional agencies throughout the United States in these two areas. The two areas I will address involve a Regional Revolving Development Fund and a Regional Tourism Program, both operating entirely within the eight-county region that our agency serves.

Before I begin this discussion, let me explain to you the organization and function of the Coastal Area Planning and Development Commission. The Coastal APDC is one of the 18 similar agencies in the State of Georgia, and similar to some 650 other regional agencies like it in the United States. Our commission encompasses the entire coast of Georgia and serves a population of more than 300,000, including 25 local units of government. It is directed by a 30-member Board of Directors, who are appointed by the county seat governments and county commissions. The Board of Directors is advised by various advisory councils and utilizes a professional staff of more than 30 people to carry out the various plans and projects that are deemed necessary by the local units of government and the Board of Directors. It is an agency whose budget this year exceeded slightly over a million dollars and is supported by State, Federal and local funds. It has been in existence since 1963 and is a public agency created to formulate public plans and policies which deal with such local or areawide issues as community growth, economic development, or wise use of land and water resources. Professional staff members prepare studies and plans in a variety of areas, including housing, transportation, law enforcement, older Americans, health, recreation, tourism, and human resources. In addition to formulating public plans and policies, it provides technical assistance to its member governments to assist local officials in putting these plans into action and, in other ways, as requested by local officials, to help them carry out their duties and responsibilities.

Before I outline to you the Regional Revolving Development Fund, I would like to explain to you the circumstances under which this program came into being.

Due to a change in corporate priorities, W. R. Grace and Company had been following a path of divestment of domestic consumer food business for the past several years. Two were actually divested in 1975. Four serious and extensive negotiations for the sale of the Seapak Division of W. R. Grace were pursued with other major food corporations throughout 1974 and 1975. One reason that those negotiations had failed was due to the depressed economic and market conditions of the frozen seafood industry which prevailed in 1974 and 1975. At that time the three most recent prospective purchasers withdrew from negotiations after receiving information from their legal counsel that anti-trust laws would prevent them from purchasing Seapak, since these companies already had a major share of certain frozen food markets. An additional reason was simply that many firms did not have the 10 million to 15 million dollars in cash with which to purchase the company. However, recovery started during the second half of 1975, but the previous conditions had reduced Seapak's normal earnings temporarily, and that, plus the depressed seafood industry, had made it impossible to attract outside investors for a normal divestment.

Up until the industry fall-out, Seapak's sales and pre-tax earnings enjoyed a healthy growth. In 1975, while not yet back to earlier levels, Seapak continued to show a healthy $1,500,000 recovery from the 1974 loss, which was their first loss in 20 years. Had the divestiture and liquidation of Seapak become a reality, it would have had a major disastrous effect in the region of Brunswick and coastal Georgia, as well as Brownsville, Texas. The losses would have been:

1. An annual payroll of $5,200,000, covering some 1,200 employees who would have been terminated. Most of these employees would have been from minority groups.
2. During the recent three years, Seapak had spent some $8,500,000 on the construction and modernization of plants and offices, primarily at the Brunswick, Georgia location.
3. Loss of local taxes paid by Seapak that had increased from $23,000 annually in 1972 to

$108,000 in 1975, and now approach approximately $135,000 annually.

4. Loss of Seapak expenditures on raw materials, supplies and services, and resulting contributions to the economy that totalled more than $26,000,000 in 1975 alone. In addition, there was approximately $4,000,000 spent annually for freight payments, utilities, telephone service, etc.

So, as you can see, this represents a grand total of some $30,000,000 worth of disbursements made by Seapak into the local and general economy in that one year of 1975. Had the intentions of W. R. Grace proven successful, we would have had a disastrous effect on our economy, due to the liquidation of this very important firm.

When negotiations reached a complete breakdown, I was approached by Mr. Jack Cofer, Chief Executive Officer of Seapak, asking for possible financial assistance for a low-interest loan that would help save one of the world's largest seafood processing plants from being phased out of existence. We had learned of a program in which the Economic Development Administration (EDA) had been involved in South Bend, Indiana, where there had been a similar situation threatening the closure and liquidation of South Bend Lathe Corporation, a corporation that had been in existence for nearly 100 years. In that case, EDA was able to make a Title IX Grant to the City of South Bend. Title IX funds are monies that are legislated specifically for economic adjustment problems, both positive and negative. That grant was then loaned to the employees at an interest rate of 3½% to allow the employees to purchase 100% of the ownership of the South Bend Lathe Corporation through the establishment of an Employee Stock Ownership Plan (ESOP). With the knowledge of that project, I immediately contacted and requested an urgent meeting with the then Assistant Secretary of EDA, Mr. Wilbur Mizell. I explained to Secretary Mizell that the purpose of our project was to avoid liquidation of Seapak operations, and thus maintain the employment of over 1,000 employees in southeast Georgia and Brownsville, Texas, and also provide these employees with the additional opportunity for an ownership position in the new business. A secondary benefit of the proposal would have been to relieve and eliminate the heavy and expensive financial reporting requirement of W. R. Grace headquarters in New York City that presented an opportunity for the new company to greatly reduce administrative expenses and improve profit results. The third and final benefit would be the ability for Seapak to resume its growth plan that, understandably, had been held in restraint for the past two years, due to W. R. Grace and Company's divestment effort. Fortunately, we received the blessings of Mr. Mizell, as well as those of the Director of the Southeastern Regional Office of EDA, Mr. Charles Oxley, and proceeded to develop a grant application to EDA for $5 million. Of course, $5 million was not half the amount of money needed to purchase Seapak, and we were able to make the necessary financial arrangements to receive a $2 million outside equity investment from Rich Frozen Foods, Inc., of Buffalo, New York, one of the Nation's largest and finest frozen food companies, and were able to acquire a loan from W. R. Grace and Company, the former corporate owner of Seapak, in the amount of $4 million. As a result, we were able to consummate the $11 million total package that would give the employees of Seapak, in a period of about 8 years, the opportunity, through the establishment of an ESOP, to purchase 51% of the Seapak Corporation.

During the early phase of our working on this grant, the thought occurred to me again and again that, should EDA allow us to do so, it would be an excellent opportunity to establish a Revolving Development Fund throughout coastal Georgia for the purpose of creating additional economic development opportunities through the availability of low interest funds for various kinds of economic development projects and programs that are allowable under the Title IX guidelines. Fortunately, I was able to convince the Administration that this would, indeed, be a unique and extremely worthwhile program and we were, therefore, allowed to establish a mechanism whereby the interest and principle payment would be returned to our agency for the purposes of establishing and implementing this Revolving Development Fund Program.

In establishing this Development Fund, our Board deemed it necessary to have a smaller group than the 30-member Board of Directors for purposes of operating this in an effective, businesslike manner. They, therefore, have formed a development corporation that consists of the same representation and number of our Executive Committee of the APDC, which totals 11 members, and provides adequate representation from each and every county in our region. Since early 1977 the corporation members, myself, and our legal counsel, have been actively involved in developing the by-laws of the corporation that will govern the operation of the corporation itself and, more importantly, the lending guidelines that will be used for purposes of disbursing these funds to worthy economic development projects within our region. Of course, these guidelines first have to receive approval of the EDA Southeastern Regional Office, in Atlanta, and once this is done we feel we will

have a fair amount of latitude to operate within these guidelines for purposes of developing and funding projects within our region. It is the general intention of the corporation to use these funds for the purposes of stimulating new industrial growth for the area that is compatible and acceptable with the environmental and ecological considerations that are so important throughout coastal Georgia. The funds may be used to save existing industries which may be experiencing difficulties due to short run market or business trends, and to help existing industries possibly expand their plant operations and activities—all of these, of course, with a keen eye on the creation of as many new jobs as possible.

In the process of implementing our economic development policy, the corporation has stressed very strongly its intention and desire to totally coordinate this program with the leading lending institutions throughout coastal Georgia, the industrial development authorities, and others who have a vested interest in the economic development of our portion of the State. As a matter of fact, it is our current feeling that most of our prospects and projects will be brought to us through these various existing institutions and agencies. We, of course, will want to share our financial position as much as possible with the lending institutions within our region and participate with them to the highest extent practical. Where possible, we would expect to require a reasonable amount of individual equity that will have a result of making each and every one of our funded projects a true and solid economic development potential for our region.

Many of you may be wondering about the amount of funds that we will have available. We will receive payments of interest only for the first three years, in the amount of approximately $175,000 per year. In 1981, the corporation will begin to receive annually approximately $345,000, of principal and interest, up through and including December 1999.

We have released some publicity about the corporation and have had a very good response from local individuals interested in participating in the program, and have also been very much encouraged by the enthusiasm shown by various representatives of the lending institutions throughout the region.

That concludes my presentation on the Regional Revolving Development Fund and now I would like to briefly discuss with you the second phase of my topic, the Regional Tourism Program that we have underway.

As I mentioned, the Coastal Area Planning and Development Commission comprises the entire coastal region of Georgia, extending from the South Carolina line, north of Savannah, to the Florida line, north of Jacksonville. Two weeks from today, I-95 will be entirely open through the State of Georgia. When that time comes, a tourist will be able to traverse the 125 miles of I-95 through coastal Georgia in less than two hours without stopping at all.

History has proven that interstates throughout the country have been a disaster to the old highways and to the businesses which had operated successfully for many years along them. Certainly this has been the effect on the businesses that have depended upon the traffic along U.S. 17 for many, many years. The effect of the opening of the various portions of I-95, which began back in 1970, caused some businesses to shut down overnight and others to close in less than two months. Those businesses that remained open experienced an overnight decrease in their revenue by as much as 90%.

We anticipated early that this was going to happen and made a decision to do something to offset the damage not long after the first stretch of I-95 opened in McIntosh County, Georgia in 1970. At that time, the potential disastrous effect on other businesses throughout the coast was acutely expressed by those businessmen who were hit first. The decision of my Board was to create an Advisory Council on Tourism that was to meet and discuss the various problems that would arise as the result of that, and additional, openings of I-95, and to suggest a manner in which this problem could be dealt with. The Advisory Council was made up of a cross-section of individuals representing tourist interests, private businessmen, and those having historical interest, and became increasingly active and concerned in direct proportion to the succession of additional lengths of I-95 being opened to traffic. About two years ago, after the majority of I-95 had been opened, it was recommended by the Advisory Council that our Commission undertake and complete a development plan with the expressed intention and purpose of devising an immediate and successful way to deal with this problem.

Following that recommendation, the Board was able to acquire a $20,000 grant from then Governor Carter, of Georgia, through his Coastal Plains Regional Commission Development Fund, and match those monies with funds available from the Coastal Highway District of Georgia, which for many years built, maintained, and operated the Talmadge Bridge that brought traffic across the Savannah River from South Carolina into Georgia on U.S. 17. We commissioned a consultant and eventually completed the plan that is now being implemented and used as the guiding light in our program. The plan is entitled "A Plan for Coordinating Tourism and Development in Coastal

Georgia." One of the major recommendations of that plan was that our agency create a Tourism Division within our organization that would attempt to bring together all of the individuals and groups in the counties which had an interest in promoting tourism and in offsetting the negative economic impacts as a result of the opening of I-95. I am happy to tell you that our program is underway and making great progress, having begun officially with the hiring of our Director of Tourism on February 1, 1977. The initial operation of our program's $40,000 a year budget was funded in the first year by a $20,000 grant from Governor Busbee's Emergency Fund, and a matching $20,000 from the counties themselves. For this current year and next year, it is proposed that the Coastal Plains Regional Commission grant will be matched by the counties for the operation of our program, and after the fourth year of operation, we feel that the tourist industry itself will support the program financially.

Tourism is important to all of the States represented here, and I would like to review with you what it means to Georgia from my eight-county area.

Tourism set records in Georgia for the first six months of 1977, when the travel industry posted sales of more than two billion dollars, an 11% increase over the same period last year.

The Department of Industry and Trade has pointed out that the four most attractive tourism areas in Georgia are Atlanta, Plains (the home of President Carter), Savannah, and the remainder of coastal Georgia. So, two of the major attractions are in my back yard.

I-95 is now carrying about 22,000 motor vehicles per day. This translates into approximately 75,000 persons each day passing our door, and these figures will gradually rise to 30,000 motor vehicles and 100,000 persons, with the completion of the last section of I-95.

Georgia Governor George Busbee was quoted recently as saying, "The travel industry in Georgia has become so important that it generates 25% of all retail and service sales in the State." The largest gains are reported by the lodging industry, with motels and hotels chalking up gains of 20%.

Former Governor Marvin Griffin of our State was fond of saying that it was easier to pick a tourist that it is to pick cotton. In a year like 1977 we are not going to have much cotton to pick, nor crops to gather—crops are a disaster—but the tourists will be here in increasing numbers.

Our plans are to let them know that they are welcome, and that we are anxious to share with them the many and varied treasures along the coast of Georgia.

Let me briefly review with you some of the things we are attempting to do to lure tourists to coastal Georgia.

A logo with an egret, one of our best known birds, as the central theme, will appear on all highways leading into our areas, and will appear on all brochures, visual communications systems, maps, signs, guidebooks, and displays associated with coastal Georgia. We plan to make it as well known as the seagull, which is, as you know, the emblem for the Ocean Highway.

We have been successful in bringing about an agreement with Georgia's Department of Transportation and the county zoning commissions regarding requirements for outdoor advertising along the interstates. The counties and cities have been advised of what they must do and all of them are now amending their ordinances to bring them into compliance. Some have already been submitted to the Georgia Department of Transportation for approval.

If finally approved, outdoor advertising will be tightly controlled and regulated, and geared to aiding the motorist in finding needed services and points of interest, and not to harassing him with distractions and signs which have little or no value.

Visual communication systems are perhaps the most effective method of acquainting the traveling public with attractions in an area. This being true, we are devoting a great deal of time and funds to the coastal logo signs, displays, maps, guidebooks, and brochures. These will be widely distributed throughout the United States and Canada. In addition, we are considering newspaper advertisements in designated areas of Canada from which we hope to attract additional tourists during the winter months.

We are also developing short-range radio broadcasts along I-95. This device has been used successfully in other areas of the United States. It would mean establishing short-range transmitters at various points along U.S. 17 and I-95 which could broadcast information regarding the local area to automobiles traveling through the corridor. Information could be broadcast about facilities at various interchanges, locations of welcome stations, and other points of interest along the route, and make reference to the directional system.

Working with the University of Georgia, we are now putting together a program for training personnel directly involved in serving the traveling public. These personnel will include hotel, motel, and restaurant employees, service station attendants, welcome center employees, police, other public servants, and others involved with the traveling public. The purpose of this training will be

educating these people about the resources of coastal Georgia, in order that they may be in a better position to pass along information which is helpful and factual. As a rule, they are the first persons to see a tourist when he comes to coastal Georgia and the last to see him on departure. It is important that they make a good impression.

In closing, let me thank you for your proven interest in coastal Georgia. The Coastal Plains Regional Commission Grant came at a critical and opportune time for us. It served a good cause and permitted us to get off to a running start, and will mean much to the area I represent.

We invite you to visit with us in coastal Georgia. There is much to see and do, and it would give us an opportunity to repay you for your generosity and understanding of a problem which has now become an opportunity for a great section of Georgia.

THE CRISIS AT THE WATERFRONT

By GEORGE ROUNDS
Secretary
National Association of Engine & Boat Manufacturers

Boating is big business. There are some 2,000 manufacturers of marine products (excluding miscellaneous accessories); 16,500 retail dealers, distributors, etc.; and over 5,000 private marinas and yards. Boating directly employs 350,000 persons in full time jobs, and approximately 100,000 additional workers on a part-time basis, generating a payroll in excess of $1 billion.

Boating is a big sport. One in four Americans goes boating each year—that is over 50 million people, who use an estimated 10,105,000 boats of all sizes and kinds and spend approximately $5.3 billion dollars yearly on their sport. Curiously enough, there is no state in the Union that does not have a boating populace. The boating fraternity has been growing steadily at a rate of about 5% yearly for the past two decades, but the future of boating is in jeopardy, and the key to its future lies in that thin piece of water and real estate called the coastal zone. This fragile environment serves as a magnet for all peoples, each with a different intended use of the waterfront, and each considering inviolate his or her right to use the waterfront as they see fit.

In actuality, there are distinct activities which are water-dependent, and obviously, boating is one of them. The recreational boating industry has an obvious and direct relationship to the waterfront, wherever that waterfront may be, and whatever its value might be to the boating public.

The value of the waterfront is multiple in that every boat and boater must pass through it to get to the water and enjoy his sport. It also must have certain aesthetic qualities essential to the enjoyment of boating; and, with fishing so much a part of the boating scene, it also must have an ecological integrity. Therein lies one of the problems, one of the elements of the crisis at the waterfront for boating. In order to make boating possible, we must have access to the water and we need facilities at the water's edge to service and accommodate the boats. We must provide the services without destroying the environment on which boating's pleasures depend.

Twenty years ago, the problem was not as acute as it is today, but it was present. Forty years ago the problem did not exist at all because the boating public was relatively small in comparison with the available waters, and the pressures on the coastal and inland waters were light enough that none of us were concerned about the ecological health of those waters. The Sierra Club, Friends of Earth, and the Environmental Protection Agency were little known, or did not exist. Water was abundant. Streams, we were told, clean themselves every 100 feet. There was enough marshland around, so what if we dredged one out for a boat basin? Times have changed.

Today, there are 10 million boats in the United States and 50 million Americans enjoying them during the year. Each year brings more boaters and more boats. But for how long? The time may well be at hand when the boating industry will have to accept the fact that it will not grow, that it has reached its maximum market. Why? Because we have literally run out of room at the waterfront. The supply of slips, moorings, and boat storage facilities has fallen far short of the demand, and the situation is not improving, nor is there much hope of improving the supply in today's economy.

The factors contributing to the boating crisis at the waterfront are, or should be obvious to everyone:

1. The supply of developable waterfront property is virtually depleted, and what is left is so prohibitively expensive that investors who might have been induced into putting their money into boating facilities a few years ago, now recognize the pitiful return on investment that a marina represents.
2. Even if one could find the property and the investment capital, the environmental controls all but prohibit the development of that waterfront.

Many people feel that there is a dire shortage of marina facilities, but until now, no one has sought to quantify that shortage. We at the National Association of Engine and Boat Manufacturers have attempted, in a limited way, to do so. We surveyed marinas in every state, by means of a mailed questionnaire. We received 283 responses. If you accept the estimate that there are some 4500 marinas and yards in the United States, our response represents about one-sixteenth of that marina population. We therefore projected the actual response up by a factor of 16. This gave us a total of 737,840 slips, moorings, and dry-stack berths. We also learned there are 217,792 boatmen waiting for slips, moorings, or dry-stack berths. In

other words, we know that we have another 30% more boatmen waiting for a place to keep their boat than we have places to put them.

We also asked the marina and yard owners how many additional slips they could build on their present property if there were no zoning, environmental, or money restrictions placed on them. The answer was that 422,768 new slips could be available at the present sites were it not for the impediments mentioned. That represents 194% of the present demand!

What then are the prospects for additional waterfront facilities? Are there new techniques and philosophies that must prevail if we are to meet the demonstrated need for additional facilities? Do we have an obligation to meet that need? The answers to these questions are not easy. Nor are there singular answers, since each issue is intertwined, to a certain measure, with the other.

Can we say that if the problem is industry's problem, industry must then resolve it? The old answer of let the demand dictate the supply is no longer possible, for private industry and the individual entrepreneur have lost control of the situation, both from a situs standpoint and from an economic standpoint.

The traditional role of private enterprise as the sole provider of boating facilities is no longer realistic nor possible. The raw capital to finance such ventures is no longer there, and even if it were, the cooperation of government is essential to make the developments possible. Nor, for a number of reasons, can it be the sole role of government. While government may be the primary mover in the future of boating facilities' growth, the private sector, which can provide the expertise and management, must become involved.

Thus, a coalition of organizations bringing private enterprise, the public, governments, and institutional forces to bear is now necessary to the growth of boating facilities for the following reasons:

1. Restrictions of law.
2. Restrictions of property availability.
3. Restrictions of environment.
4. Adverse public opinion.

Let's now view each sector's role in the overall program:

Government. I choose to view government as a potential source of cooperation and funding in facilities development. Cooperation from government is needed to help make the development of facilities possible by including boating in its long range recreational planning. Government must be convinced of the desirability of re-examining current restrictions, both local and National, on development. Government will respond if the other three partners in the coalition apply rational pressures and present a clear statement of the need. Private enterprise can help apply that pressure as an information course and as coordinator.

Institutions. The research and advisory services such as those of Sea Grant and the Marine Advisory Service Programs can provide a wealth of third party data to support the other three members of the team and can help identify the needs and provide the creative solutions through research into new technologies and systems. Again, a solid interface with private enterprise is necessary to define industry's needs.

The Public. A vast source of political strength is presently underutilized in boating, mainly because the "good guys," the boating public, are not organized into a cohesive force. Industry and the institutions might be able to pull some of that force together. At the very least, we can do our utmost to inform that sea of humanity about the problems and the solutions.

Private Enterprise. With perhaps the highest stakes in this game, private enterprise faces the toughest tasks:

1. Overcoming adverse public opinion.
2. Amassing valid supportive data.
3. Seeking creative solutions.
4. Finding the dollars, both in its own pockets and unlocking other resources such as state funds, Bureau of Outdoor Recreation funds, and municipal funds.
5. Simply staying alive in a fickle business by keeping those facilities, that are now open, operational.

I might add, in light of number 5 above, that the marinas which responded to our questionnaire stated that the lack of profits resulting from soaring costs brought the demise of no less than 170 marinas in the past five years, (that is not a projected figure), representing a loss of 13,327 slips. Those facilities were lost to another form of development. While the new use was not specified, one can assume that it was either non-boating commercial, or waterfront residential.

I can't help but wonder what would have happened if the communities in which those 170 marinas used to be had had a strong development plan and policy that provided recreational facilities for their citizens. With such a community commitment to its residents, any waterfront development can include boating facilities.

With one in five Americans looking to boating as a form of recreation they choose to enjoy, I believe that government has an obligation to consider the needs of those people. However, I also believe that the needs of all peoples have to be considered as well. There are some people who have absolutely no

desire to ever set foot in a boat (I am sorry to say). Nonetheless, I will wager that those same zealous landlubbers will, if given the opportunity, sit at dockside, or riverside, or shoreside, and watch the boats, or just the river, go by.

Therefore, I believe that the next major thrust of marina and boating facilities will come in those areas where the most people can be served with the widest variety of waterfront pleasures. It has to come there, for more than just convenience reasons.

I am looking to the city-centers for the future growth of boating facilities. The reasons are clear:

1. That's where the people are.
2. The area usually is already developed and now in the process of decay and there is little of an ecological nature that needs to be preserved. In fact, marinas have been known to improve the aquatic environment.
3. The land areas most often are government owned, already in public hands, and thus available for the town or city to work with.
4. The opportunities to expand boating facilities elsewhere are limited, and at best highly controlled.

Thus, while the crisis is indeed a National one, the solution must, of necessity, be local, or state, in focus. The opposition is local and the benefits to the people are local. So a good measure of our efforts must be toward developing an awareness among local industry and government to become involved in finding solutions to the shortage. We have to retrain the public, to organize the public, and to educate the financial community.

So if you ask me where does industry fit into the coastal region, I must respond from my vested position by saying that we have to fit, if an industry that supports nearly a half-million jobs Nationwide, is to survive. How we fit will depend on how well we can work in concert and harmony with the governments involved, with the private institutions, and with the public. If the coalition works, boating will survive. If it does not, boating will revert back a half a century to the time when it was the sport of a wealthy few.

If we ignore the issues and do not seek to work on the solutions together, then 50 million Americans are going to be extremely unhappy with us, and I do not want 50 million Americans against me.

ANALYSIS OF NATIONAL SHORTAGE OF BOATING FACILITIES

Total Response: 283
Estimate Total Marinas/Yard in US: 4,500
Effective multiplier: 16

PRESENT SUPPLY	Up to 25'	25' - 40'	40' - 65'	65' & Up	Total
Slips	253,216	259,072	76,448	7,952	596,688
Moorings	39,056	26,928	11,360	1,504	78,848
Dry-Stack	58,800	3,504	—	—	62,304
TOTAL AVAILABLE	351,072	289,504	87,808	9,456	737,840
	47.6%	39.2%	11.9%	1.3%	
Additional Needed	125,296	118,688	42,976	6,640	293,600
	42.6%	40.0%	14.6%	2.26%	
Slips Added in Past 5 years	48,112	25,040	10,464	1,312	84,928

Number of Boatmen	Slips:	Moorings	Drystack	Trailer Stored	Total
Waiting for Facilities	168,096	31,984	9,360	8,352	217,792
	77.2%	14.7%	4.3%	3.8%	

Number of Slips
Lost in Past Five Years ..... 13,327 (net)

Potential for Additional
Slips at Present Sites 422,768

Reasons for not expanding (in order):

Environmental opposition: 37.5%
Capital funding lack 36.1%
Zoning restrictions 27.5%
Lack of permits 23.2%
No demand 4.6%
Other: 28.9%
lack of space; cost;
government & local opposition;
lack of profit; high taxes &
insurance; lack of help.

Of Marinas/Yards Closed in Past Five Years,
the Reasons Were: .....

39.4% sold to another form of development
30.9% lack of profits, high costs; & zoning problems

OCEAN POLITICS AND DEEP SEABED MINERAL DEVELOPMENT

By RICHARD J. GREENWALD*
Special Counsel
Deepsea Ventures, Inc.

Ten years ago, the United Nations General Assembly decided to begin discussions, in a specially created Ad Hoc Committee, on what practical means might be devised to promote the peaceful uses of the deep seabeds and their resources for the benefit of the world. Today, of course, we have seen that Committee grow from its birth as a 44-Nation Committee studying issues related to the minerals of the deep seabeds to a full Conference of Plenipotentiaries, the so-called "Third United Nations Conference on the Law of the Sea." This Conference presently involves some 154 nations, the Vatican, and several dozen national liberation fronts. The subject matter has expanded to include not only the deep seabeds, but also a host of other ocean issues including territorial seas, contiguous zones, the continental shelf, 200-mile exclusive economic zones, fisheries, passage through straits, the status of islands, archipelagoes, the high seas, pollution, scientific research, technology transfer, and settlement of disputes. The ostensible objective of this Conference is to reach agreement on a comprehensive treaty which would rewrite the law of the sea, including the law applicable to deep ocean mining.

The latest text produced by the Conference, which is commonly referred to as the "Informal Composite Negotiating Text," (ICNT), is composed of some 303 Articles and seven Annexes, themselves containing 114 more Articles.

There are strong arguments being expressed in the United States that this highly complex draft treaty does not provide for basic protection of the United States interests in the following non-ocean mining areas:

1. Security of investments in continental shelf areas.
2. Military transit of straits, and navigation through archipelagoes.
3. Scientific research on the high seas.
4. Environmental cooperation and standards.

Other speakers will undoubtedly address themselves to these issues. I will confine my remarks to the evolving United Nations regime to control ocean production of minerals and to discourage direct private, or state investment in such activities. Indeed, the trend to prevent such activities has become so pronounced that Ambassador Elliot Richardson, the head of the United States delegation to the Conference, has been forced to notify the other delegations that the current text—that is, the ICNT—is so bad with regard to ocean mining as to make the total treaty package unacceptable even if the United States interests were protected in the remainder.

The ICNT describes the resources of the deep seabed as the "common heritage of mankind" and prescribes that all development shall be carried out by, or on behalf of, an International Seabed Authority. The ICNT would thus displace the freedoms of the high seas doctrine as the basis of the right to mine the deep seabed. The Authority would be composed of all nations who ratify the treaty according to their individual constitutional processes. It would be modeled on the United Nations, and comprised of a legislature of 155 nations, known as the "Assembly"; an executive branch of 36 nations, known as the "Council"; a complex and somewhat emasculated judicial branch, known as the "Tribunal"; and a mining company known as the "Enterprise," which would mine the seabeds for the Authority.

The administrative costs of the latter organ alone have been estimated by the United Nations Secretary General at $6,000,000 per year after its start-up period. As in the case of the United Nations, the United States would be expected to bear the largest part of the financing.

Thus, the Authority would have all attributes of a sovereign state except that of a population. It could, through its Assembly, and on a one-nation/one-vote basis, pass legislation binding on its member nations and their subjects. The United Nations General Assembly cannot do this. The International Seabed Authority's Council could make major fiscal, regulatory, or enforcement decisions which would have an effect on all states, even those which voted against such a measure or chose not to become members of the Authority. The United Nations Security Council cannot do this, and for good reason, as recent events have shown.

Under the terms of the ICNT, the Authority could decide, at a later date, that private enterprise has no place on an ocean floor governed by the power politics of Third World socialism. In this event, by means of a review conference, the Enterprise could be granted an operating monopoly which would,

*Paper Presented by Robert J. Pietrowski

without compensation, appropriate the remaining values in existing mining operations. The United States Constitution itself forbids the exercise of this kind of power to the Federal Government.

The ICNT provides that a state or a private miner must, in order to be granted a contract to mine, offer two mine sites to the Authority, of which the Enterprise will have the right to select the best. Depending on the degree of data collection and evaluation required by the Authority, this could mean up to $100,000,000 in extra costs to the private miner, and a windfall of equal amount to the Enterprise. That adds up to a $200,000,000 competitive disadvantage, all in "front-end money," and all expended by the private miner in the period prior to securing the right to mine.

The ICNT provides that a private miner shall always be under the "full control" of the Authority, which, as we have seen, is also his competitor. Moreover, the Authority also has the power to tax the private miner and to limit his production by reference to world demand and in commodity conferences, wherein the Authority represents the production of both the Enterprise and the private miner. The Enterprise, on the other hand, will not bear these burdens; it will be subject to neither taxation nor production controls.

If the private miner wishes to dispute an action by the Authority, or the effect of its regulations, he will find his opportunities for judicial review and relief quite limited. The Tribunal is denied jurisdiction to decide cases involving the abuse of discretionary power by the Authority; nor may it question whether the Authority has acted in accordance with the provisions of the Treaty. This constitutes a reversal of Thomas Jefferson's legacy of a government of laws and not men.

Nor will the United States mining interests be alone in suffering under these conditions. The natural inclination of such an unfettered bureaucracy is to expand its jurisdiction. Such expansion will only occur at the expense of other freedoms of the seas.

It is hard to imagine that any rational diplomat would take such a system seriously. Nations dependent on foreign sources for copper, nickel, cobalt and manganese are unlikely to ratify such a treaty. The Senate of the United States is unlikely to ratify such a treaty. The latter fact may give a number of nations some pause, particularly in view of the fact that the Third World and the Soviet Union expect the United States to finance a major share of the costs associated with the Authority and its ocean mining organ, the Enterprise.

Representatives of the four United States companies participating in ocean mining consortia have gone on record that, if the United States were to impose such a treaty regime on United States citizens, no further investment would be made in ocean mining. These firms have been working in the field since the early 1960's and the cumulative sums spent are now estimated in excess of $100,000,000. These companies, being cast early in the role of an "endangered species," quickly perceived the strength of leadership and the delaying power of the anti-United States and anti-development forces in the United Nations seabed negotiations. Accordingly, the industry turned, in 1970, to the Congress to find interim or alternative relief.

Since 1971, the Congress has been considering bills which would regulate United States ships and personnel in their exercise of the high seas freedom to mine the oceans. These bills, from their inception, have specifically provided for their replacement by a Law of the Sea treaty ratified by the United States. In these bills, which would be enforceable only on United States ships and personnel, a code of conduct is created with the usual provisions of mining legislation relating to security of tenure, diligence, taxation, and so forth. In addition, the bills contain provisions related to the application of United States environmental standards and prevention of monopoly. The most controversial provision, one which potential ocean miners feel is the core of the legislation, requires the United States to compensate its licensed ocean miners in the event the United States ratifies a treaty which diminishes or terminates the miner's present right to mine the deep ocean floor, and in effect, confiscates investments made in reliance on this right.

Perhaps the most important feature of the proposed legislation, from the broader perspective of United States and world interests, is its reciprocal nature. In an effort to encourage cooperation between nations, the bills provide for recognition of the claims of like-minded nations, on the condition that those nations recognize the claims of United States miners. The customary law of the sea, particularly in its non-military applications, was founded on the principle that maritime cooperation reduces the chances for conflict. These bills retain that principle.

During the first six years in which Congress considered domestic ocean mining legislation, the Administrations ignored the usefulness of such legislation as a means to impart a sense of urgency into the lethargic United Nations negotiating sessions. Each year, Congress could expect testimony from a parade of Administration law of the sea negotiators returning breathlessly from Geneva or Caracas claiming that a disastrous negotiating session really represented progress toward an imminent and advantageous conclusion of a comprehensive treaty. Each year brought pleas

from the Administration that Congress delay domestic action on ocean mining. Each year the Administration's optimism was accompanied by a refusal to consider and comment upon domestic alternatives. Such an attitude led to passage in 1976 of a 200-mile fisheries bill, which is perhaps less effective than it might have been had the Administration cooperated earlier and more fully with Congress. Perhaps because of this lesson, in 1976 Administration attitudes toward ocean mining and related legislation began to shift.

By late 1976, the Administration was moving rapidly toward endorsing the concept of interim ocean mining legislation. This was due, in part, to Third World disdain when Dr. Kissinger, in a burst of terminal generosity, gave away the seabed store. In a series of 1976 initiatives (in which dramatics took the place of preparation) the former Secretary of State proposed many of the most onerous features of the ICNT, namely, production controls on ocean minerals, United States provision of a large part of the Enterprise's funding, a 20-year review conference with provision to exclude private capital, and the requirement that private miners provide a mine site and technology to the Enterprise as a condition of obtaining a contract to mine. He also proposed that the United States miner pay a share of his profits to the Authority with no provision for credit against United States taxes. The Third World greeted these proposals, not as negotiating concessions by the United States, but rather as confirmation of a divine right. It therefore refused to budge in confrontations regarding other ocean law issues in the full expectation that the United States would place further concessions on the table.

Happily, the current head of the United States delegation, Ambassador Elliot Richardson, has recognized domestic legislation as a valuable tool in his negotiations and is now on record in support of such legislation.

There are many ocean mining bills before the current Congress, the most important being Senator Metcalf's S. 2053, Senator Steven's S. 2168, and Congressmen Murphy and Breaux's H.R. 3350. The Metcalf and Murphy-Breaux bills contain provisions suggested by the Administration. It is likely that these bills will reach the floor in both houses of Congress early next year, and that similar legislation will be considered in other ocean mining countries.

One more session of the Conference is tentatively scheduled for Spring 1978. Inter-sessional work in preparation for this session has already begun. Reports indicate that procedural problems have dominated these meetings, as they have stifled the United Nations negotiations for the last decade. No progress can be expected in 1978, nor can the negotiations reach fruition until the Third World gets its house in order by defining both its leadership and its objectives. One cannot negotiate with anarchy and, as ten years have amply proven, a common anti-American bias provides sufficient glue to bind Third World solidarity in repose—but not in movement.

OCEAN TRANSPORTATION AND PORTS—WHAT'S NEXT?

By W. DON WELCH
Executive Director
South Carolina State Ports Authority

Ocean transport technological changes in the past 20 years have revolutionized the shipping industry, particularly in the present decade. Leading the parade of changes was containerized cargo transported on specially-designed containerships. Then came LASH ships, vessels built to carry barges loaded with cargoes, and ro/ro (roll on/roll off) freighters constructed to accommodate wheeled equipment which can be driven on and off the ship rather than being lifted by a crane. Still another development is the heavy-lift, shallow-draft vessel equipped with its own derricks which can operate in small, remote harbors with channel depths of less than 20 feet and with inadequate or no shoreside cranes.

These new modes of transportation have been accompanied and accelerated by a tremendous boom in world trade. Dry cargo alone has risen 350% since World War II. Huge investments have been made and are being made for port facilities, including those in developing countries such as in the Middle East and Africa. Competition between ports within the economically-developed countries has become very keen, and the United States is a classic example. Ports which did not anticipate or looked askance at the predicted dramatic growth of containerized shipping and were late coming on stream with dock, crane, and back-up facilities required for serving the new mode with speed and efficiency have lost cargo to other ports and have been playing a desperate catch-up game since.

Hopefully, these current major investments are based on sound market intelligence. To protect the financial integrity of the port industry, it is imperative to avoid obsolescence in facilities, and not to overspend for one mode of ocean transportation at the expense of another. At the Port of Charleston, we have attempted to strike a reasonable balance, realizing that although 70% or more of general cargo eventually will be carried in containers, break-bulk is here to stay and must be accommodated. Prudence dictates also that we take a long, hard look at the future of LASH and ro/ro modes rather than take a costly plunge on the basis of chance. For example, there are not that many LASH vessels in service—only 16—to warrant large expenditures by all ports for barge mooring and marshaling areas. In the case of ro/ro, ship designs vary from bow to stern to side loading, and all of them may become obsolete in the face of a new concept. The Soviet Union is reported to be constructing such vessels with a quarter ramp on deck which would not require heavy, permanent shoreside investment. Other ships already in use have slewing (swivel) ramps for stern load and discharge.

At Charleston we have not yet decided to provide special facilities for LASH and ro/ro. We have, instead, adopted a wait-and-see policy. We have noted that no additional LASH vessels are reported to be on order or under construction, anywhere. We also believe that the avalanche of ro/ro activity is temporary, likely to flatten out and even begin declining within the next 5 to 10 years.

In general, ports worldwide have made a remarkable achievement in providing the facilities to handle the giant surge in international trade and its new modes of transport. Today, it costs many millions of dollars to construct just one container berth, install one specialized container crane, pave and light adequate open storage areas, and provide mobile container-handlers to move the boxes. The intermodal era has imposed severe financial and social strains on port operations. Many port operators, particularly in developing countries, have not been able to keep pace with the modern technology because of the costs involved. These ports have simply lost out in the competitive situation. This has been true to some extent even in so-called developed countries which could afford bigger and better ports—but have been reluctant, as in Auckland, New Zealand, to "take the plunge" until the situation became critical.

The demand for efficiency and faster turnaround time for today's intermodal carriers places additional pressures on port operations. Many major ports are limited in expanding by land factors. They must resort to higher-density storage for the short term; container maintenance and repair facilities must be relocated well away from the dock areas; and storage charges are increased as an incentive for consignees to move their containers out more rapidly. Some terminals have been—and others will be—rebuilt or relocated in their entirety to serve the new generation of vessels with the modern facilities they require. That is the case in Brisbane, beset with channel problems and lying 22 miles upriver from the sea. There, a $100 million container and ro/ro

terminal with two cranes is being constructed at the mouth of the river.

Port construction and modernization is going on just about everywhere on the globe. LeHavre is building its third container berth, and Cape Town has ordered three container cranes. Long Beach is expanding with new omni-terminals to handle both containers and break-bulk cargo. Charleston will develop a brand-new marginal pier complex with two container berths equipped with four container cranes and two break-bulk cargo berths served by two conventional gantry cranes. But that brings up another port problem of the day which is particularly acute in the United States. The South Carolina State Ports Authority is prepared to build that new terminal but has been waiting more than three years to get a Corps of Engineers permit, thanks to a welter of bureaucratic red tape and mandatory study-after-study and survey-after-survey, coupled with the concentrated opposition of environmental extremists and "no growth" exponents, who neither know nor care anything about the economics of ocean transportation, and even less about port operating requirements. It is a democratic contradiction that in almost every element of our society, a relative handful of vocal dissidents can stifle or delay progress which stands to benefit substantially the vast majority of citizens.

We have discussed briefly some of the technological changes and requirements in the shipping industry on the ocean side—that is, a new breed of ships demanding a new breed of ports. Much more could be said about the sizes and designs of ships today and tomorrow, including tankers and other bulk cargo vessels. One obvious development is that cargo liners are very expensive to build, about three times more than five years ago. For that reason alone, the average life of ships is being prolonged far beyond expectations. The average age of the 132 U.S.-flag containerships, a large number of which are conversions, is 21 years, and 36 of them exceed 32 years in service. And at this moment, only five new ones are on the way, but Sea-Land Service, the world's biggest containership operator, has announced plans for five more large vessels which individually can handle 2,000 containers in 20-foot equivalents. Those figures, however, pale by comparison with the USSR, which almost doubled the number and tonnage of its merchant fleet between 1965 and 1975 and should triple its present 12 pure containerships and 18 ro/ro vessels by 1986. Right now they rank fourth in the world in vessels on order or under construction, well ahead of the U.S. They also have passed this country in oceangoing ship tonnage and steadily are increasing their 2.9% share of U.S. cargoes in 1976 toward a predicted 6.5% in 1985. It is hard to tell what the Soviets might do in their shipbuilding programs of the future, particularly in design. It seems hard to believe, but the Russians built a round ship in the 1870's—who knows, they might try it again some day.

Ocean transportation, of course, must be linked with overland services. In containerized cargo, we have seen the introduction of the rail landbridge, minibridge, and micro-minibridge, terms which still confuse some of us in the shipping industry. All of them involve through ocean rates in joint agreements between steamship lines and rail carriers. The landbridge links Europe and the Far East via railroad between U.S. East and West Coast ports. The minibridge handles shipments with a single tariff and bill of lading which are marshalled by rail at one port, thence transported by a unit train to a port on another U.S. coast for export, and vice versa. The microbridge is a relatively-new concept not yet widely embraced which offers a through ocean rate directly to and from inland points located on waterways. As you probably have read, the water-rail agreements have evoked considerable controversy, especially the minibridge, but they have been approved by the Federal Maritime Commission and upheld in court, meaning that they likely will play a major role in U.S. foreign trade for many years ahead.

The decided trend toward larger, more versatile ships has been an important feature in transportation changes. The average general cargo ship weighed about 10,000 deadweight tons in the early 1960's but is 50% larger today. Of course, there is an optimum size which may already have been reached, roughly 1,000 feet long and 50,000 deadweight tons. The law of diminishing returns comes into play at about that point, as do maximum draft capabilities and berth lengths at most major ports. Vessel configurations also are restricted by interocean canals, such as the Panama Canal, and by narrow harbor entrances in some instances.

In this regard, we are not talking about the giant bulk carriers such as super tankers, the largest of which is 554,662 deadweight tons, with a length of 1,312 feet, a beam—maximum width—of almost 207 feet, and a loaded draft of 92 feet. The subject of ships and their designs is far too broad to cover here, but suffice it to say that many bulk vessels being built today have a lower length-to-breadth ratio to decrease their drafts.

Two other recent developments in shipbuilding are worthy of note. The first commercial oceangoing ship with a catamaran hull will soon enter heavy-lift service, although a major West German shipyard announced in 1974 that plans were being considered to construct a catamaran containership with all cargo and operating functions above the

water line and driven by eight propellers instead of four. It is difficult to predict whether or not this radical departure from conventional ship design will take hold in the years ahead. Another development has been the artubar—articulated tug barge—with its own detachable power plant and wheelhouse. Such units are under construction for both the bulk trade and container transport. The container artubars will be used in U.S. North Atlantic coastwise service and in the Florida-Caribbean trade. Among the self-propelled barge units being built are two 580-foot ro/ro types with three decks which can accommodate 380 forty-foot trailers moving between Jacksonville and Miami to and from Puerto Rico and the Virgin Islands.

Now, "what's next?" What can we foresee in the next 10 years or so? We have already touched on ship design and size and referred to the necessity for a longer life span in view of the vastly-inflated costs of construction. There is currently a serious overtonnage in tankers which is predicted to continue well into the 1980's and perhaps beyond, largely because of production of too many vessels in the 30,000 to 100,000-ton deadweight range.

In my opinion, it is very unlikely that we will witness further major technological changes in shipping modes. There will likely be further refinements in the various components of containerized cargo movement, in both ship and port facilities. One expert has declared that world trade must have a 2.5-fold increase in containership capacity by 1990, which partially explains why the Russians are building vessels at such a furious pace. On the port side, the Federal Maritime Administration estimated three years ago that $400 million must be spent annually throughout the 1970's by the United States for facilities to handle the basic requirements alone.

It would not be wise, however, to forecast and support full-scale containerization for all developing ports in the world because of the tremendous investment involved, inadequate rail and highway interface, insufficient land for back-up areas, and lack of properly-trained operational and administrative personnel. Even in several well-developed, long-established ports, a critical shortage now exists in space for storing containers, leading them to construct very costly, high-by, stacking warehouses, some in silo design. This last-resort option adds substantial cost and inflexibility to a container operation, and is avoided wherever possible.

We should see in the United States during the next 10 years, significant steps taken toward sea traffic controls and automated harbor navigation facilities similar to those which govern the movement of aircraft. Such sophisticated equipment, which could include docking systems, must be preceded, however, by the granting of legal authority to operate it and the support of pilots and masters. It is an exciting prospect which appears feasible, although extremely expensive, and certainly vital as international trade and the number of vessels in service continue their predicted growth.

The world ship orderbook presently is the lowest since 1968 and last year dropped to only 38% of the 1974 high. New shipbuildings on order or under construction represent just one-fourth of today's world capacity, and 86% of those vessels are scheduled for delivery by the end of next year. But as mentioned earlier, it appears certain that containership fleets will be greatly expanded in the years to come. There may be a continued trend toward combination carriers which will be equipped to carry a blend of cargoes, including containerized, unitized and palletized, ro/ro, heavy-lift, and liquid bulks. These self-sustaining "combo" vessels are valuable in serving remote areas with a profile of low or slow economic development, a limited volume of trade and inadequate dockside cargo-handling equipment. LASH operations in the long term will continue to have their place in the shipping world. In the Middle East, for example, they will continue to be valuable until the congestion of ports in that area is relieved by new and expanded terminals and equipment, inasmuch as LASH ships discharge and load their barges while at anchor, well-removed from docks. This mode of shipping, however, has an inherent limitation in that the barge cargoes must rely on water transit via navigable rivers and man-made canals to effect overall transportation savings.

Prospects are good that severe port congestion will no longer plague the shipping world after this decade. In fact, the Arab zest for the world's goods may lead those oil-rich countries to an excess of berth capacity, particularly for ro/ro and break-bulk cargoes. And finally, a solid breakthrough in solving problems related to dredging may become a reality, including a doubled life expectancy for existing spoil disposal areas.

Being an optimist, I see far more bright than foreboding prospects ahead for U.S. and for world ocean shipping—but we face tremendous challenges in building up the U.S. merchant marine, stabilizing rates, and keeping the Russians at bay. These problems can be licked, and they will be if we band together in massive, cooperative efforts. In the critical area of our seacoast, it is absolutely essential that reasonable balance be established between port development on the one hand, and environmental protection on the other. The National interest is not well served when internal battles tear us apart, and either prevent or delay the construc-

tion of much-needed facilities. I submit that we are playing directly into the hands of our friends the Russians when we do this, and this does not bode well for the ongoing competitive battle between our two systems.

TRENDS IN MARINE TRANSPORTATION

By RALPH W. HOOPER
President
Interstate and Ocean Transport Company

As an operator of oceangoing and coastal vessels and barges and a representative of The American Waterways Operators, Inc., the National trade association for the barge, towing and shipyard industries, I am grateful to share with this distinguished group some of our experience and concepts of marine transportation.

Those of us in the marine transportation business have a lively appreciation of the importance of protecting our marine resources while at the same time being aware of the healthy competition surrounding our industry.

This Conference demonstrates the keen interest displayed by Virginia, North Carolina, South Carolina, Georgia, and Florida in protecting our beautiful estuarine environment while endorsing economic growth for the region. We in the private sector hope we can continue our joint endeavors with you in the contribution to responsible, orderly utilization and protection of coastal and inland waters.

One such resource which happens to be shared by the five participating States is the Atlantic Intracoastal Waterway. From Norfolk to Miami, this canal accounts for 4.5 million tons of commerce annually, consisting primarily of iron ore and concentrates, fertilizers, paper and pulp, residual and other fuel oils. In addition, internal movements in the major harbors from Norfolk north to Maine, along the Atlantic Coast, account for another 44 million tons of commerce. This transportation service depends heavily on our mutual interests in developing and protecting such a natural blessing.

The Gulf Intracoastal Waterway carries 96.9 million tons of commerce by barge, consisting of crude petroleum, marine shells, coal and lignite, fuel oils, and basic chemicals. To provide the complete picture, the major harbors along the Pacific Coast account for some 28 million tons of internal commerce each year.

Most of our great centers of population, of industrial production and commercial distribution, and our centers of culture owe their origins and initial growth to commerce on our rivers and in our coastal waters. At one time, the city of Oxford, Maryland, only 90 miles across the Bay from here, was the largest port on this continent.

It is no accident that of the 150 cities in the United States with a population of 100,000 or more, 131, or 87%, are on navigable waterways. Roughly one-fifth of the counties in the United States are waterfront counties and these account for 58% of all the Nation's productivity, 55% of all manufacturing jobs, and 51% of all new manufacturing facilities. Since 1952 more than 10,000 industrial plants have been located or expanded along the navigable waterways of the United States, creating thousands of permanent jobs and representing a capital investment in excess of $175 billion.

Transportation on our inland and coastal waterways today is geared to flexible, low-cost delivery of large volumes of basic raw materials, fuels, chemicals, grains, and other bulk commodities. This alert bulk transport segment is the only portion of our transportation network not rate-regulated by the Government. Another segment of the industry hauling non-bulk and "packaged" products, though rate-regulated, serves the waterway system carrying steel and machinery in a most efficient manner.

The barge and towing industry has continued to grow, developing several trends along the way. I would like to touch briefly on these and give you some idea of where the industry is going in the future.

In terms of ton-miles generated, the growth has been spectacular. In 1940, a total of 22.4 billion ton-miles were produced by the barge and towing industry, compared to 267.2 billion in 1976, an eleven-fold increase.

Today's traffic consists of petroleum and coal products, which account for 60% of all barge traffic, and grains, chemicals, and sand and gravel account for another 23%. All told, the barge and towing industry accounts for about 65% of total domestic waterborne transportation.

The barge and towing industry moves an ever-increasing share of the Nation's total transportation. According to the Transportation Association of America, inland river traffic accounted for 5.2% of total transportation in 1947, 8.1% in 1960, and 9.3% in 1970. In 1976, the industry reached an all-time high of 11.4%. This figure excludes barge traffic which moves on the coasts and the Great Lakes, but is an excellent indication of the industry's increasing share of total transportation. Total barge traffic, including coastal and Great Lakes, accounts for 12.3% of all transportation, which incidentally is

moved at 2% of the Nation's freight transportation bill, representing an annual savings to shippers and consumers of approximately $13 billion.

It takes an ever-growing fleet of boats to provide the power and barges to provide the cargo capacity to move the large volumes of traffic handled today. Presently, the fleet consists of 4,240 towboats and tugboats with a combined horsepower in excess of 5.5 million and a fleet of 26,787 dry and liquid barges with a cargo-carrying capacity of 35.6 million net tons. The inventory of towboats since 1960 has increased by only about 5%, but the total horsepower has more than doubled. The average horsepower per vessel has been increased from 628 in 1960 to 1,317 in 1976.

Both the number and combined cargo capacity of dry and liquid barges have risen substantially. The fleet has increased by 62% and the capacity has grown by 118%. Average capacity per barge has grown from 990 tons in 1960 to over 1,330 tons in 1976.

Technological innovations have allowed for the design and efficient use of more powerful towboats able to move upwards of 40 barges in some cases. The future will bring more of the same.

The barge and towing industry today constitutes the most energy-efficient method of freight distribution in the United States, consuming only 500 BTU's per ton-mile. This compares with 750 BTU's per ton-mile for railroads, a full 50% more. In addition, the industry enjoys the position of being the most inexpensive and safest mode of transportation.

Put another way, a gallon of fuel will move one ton of freight about 300 miles by barge. That same gallon will move that same ton less than 200 miles by rail.

Barge rates are approximately four or five mills per ton-mile. Rail rates, according to the ICC, average 18.5 mills per ton-mile. Even rail unit trains cannot compete with barge rates. Other modes have even higher rates, with the exception of pipeline transportation.

In the area of safety, an Arthur D. Little, Inc. study in 1974 analyzed typical movements of ten hazardous commodities by barge, rail and truck. The results show that, in almost every instance, barge transportation provides the cheapest movement, the least urban exposure, the least short-term environmental impact due to a spill, the least relative human exposure, the lowest expected value of property loss and the longest interval between spills. The study concludes:

> "The barge mode of transport is apparently better inspected and regulated from a safety point of view than either truck or rail.
>
> "In the event that water transport of hazardous substances were to cease, present capacity of the overland modes of transport would not be sufficient to handle the overload. It would take a minimum of two and a half years, and probably much longer, to develop additional haulage capacity in the overland modes to accommodate the hazardous substances currently shipped by barge."

In addition, our industry can boast several other economic advantages. For instance, for regulated commodities, rail has an empty factor of 45%, compared to only 12% for barge. Rail requires the labor of approximately 240 men to move 100,000 tons of freight. That same movement by barge would require only 96 men.

Rail transportation requires between 84 and 168 horsepower per 100 tons of freight compared to only 23.3 horsepower for barge transport. Barge equipment costs about $60 per ton of capacity compared to $156 for rail. And for rail equipment, it requires 500 pounds of structural steel to produce one ton of capacity while barge equipment requires only 375 pounds of steel to produce the same ton of capacity.

What will the future hold for barge transportation? According to all predictions, increased traffic of almost every commodity, especially fuels. And this increased traffic will not be at the expense of other modes of transportation, which are also projected to haul additional tonnages in the future.

According to the Federal Energy Administration's Project Independence Report, the waterways may be required to carry 63 million tons of coal annually above present volumes by 1985, a 50% increase. Barge transport of coal from Hampton Roads is already significant and the report states that the barge industry, based on past performance and future indications, will be able to meet this demand.

All told, the increase in number of barges from 1975 to 1990 will be about 41%, while capacity will increase by about 46%. The total traffic on the inland waterways is expected to be 774 million tons in 1990, compared to 563 million tons in 1975, a 38% increase.

At the outset of these remarks I mentioned that those of us in the marine transportation business have a lively appreciation of the importance of protecting our marine resources. Safety is a matter of continuing and vital concern to our industry—concern for the general public in the areas where transportation is performed, concern for the safety of the cargoes carried, and concern for the quality of the rivers and shipping lanes used for navigation.

Our industry is guided and governed by some of the most highly developed regulatory controls in

existence to safeguard the movements of oil and the so-called dangerous cargoes. The industry has supported legislation to license those in charge of operating towing vessels, which eventually became law. The industry then worked closely with the Coast Guard to implement the massive licensing program and further supported legislation to require bridge-to-bridge radio-telephones on towing vessels, which also became law.

We, as concerned citizens and members of the transportation industry, endorse and will fully support Federal programs that enhance safety, but always cautioning that the economic and operating impacts are within reasonable bounds. The Coast Guard, through enforcement of its own regulations and those of the Environmental Protection Agency, already has an ongoing comprehensive program for vessel safety and protection of the marine environment, and they are now aggressively pursuing a program to prohibit substandard vessels from operating in the navigable waters of the United States.

Let us isolate, then, some of the facets of the industry besides its economic contribution and talk about some of the trends which may interest you.

As mentioned before, the bulk segment of the barge industry is unregulated and has free entry for competition. This happy circumstance leads to rapid technologic development to improve performance. On the western rivers system unique hydrodynamic achievements have been made to incorporate very high horsepowers into shallow-draft hulls using efficient propeller designs normally shrouded in Kort nozzles which significantly increase the thrust of the propeller. In order to accommodate maneuverability of these vast tows, multiple rudders—in fact as many as 10 per towboat—are used to twist and position the tows into locks or battle currents. This propulsive and maneuvering combination tends to alleviate damages in normal dockings. The industry has led in communications systems, using VHF, UHF and single side-band radio from their very inceptions. Depth finders and multiple radars are common.

In the coastal segment, the significant trends are toward super barges, vessels of over 30,000 deadweight tons, which are pushed or towed by large seagoing tugs. Several unique and patented devices have created breakthroughs enabling these units to move faster and be more safely maneuvered in and out of harbor and when docking. One concept developed by our company, called the "Stinger System," has also been patented. This device enables a protrusion from the tug's bow to fit a concave receptacle in the barge's notch, permitting the two units to remain together in significant waves encountered in coastal waters.

In this presentation, I have endeavored to cover some of the trends reflected by the barge and towing industry over the recent years as well as what can be expected in the future. Our industry performs a vital transportation function, and in our current energy situation, a mode of transportation which can move goods cheaply, safely, and with a minimum of energy expended while at the same time moving large volumes of energy products. As time goes on these benefits will be even more important to the economy of our Nation, the protection of our marine resources, and the well-being of our people.

DEVELOPMENT OF CONTAINERIZATION IN INTERNATIONAL TRADE

By ROGER H. SKOVE
Vice President
Seatrain Lines, Inc.

It is indeed a privilege to come here and have the opportunity to address this very distinguished group. Also, it is nice not to have to face any shippers this morning, and believe me, with the rate increases and the competitiveness that was mentioned earlier, after coming off of 59 days of hard and sometimes dubious contact with the various unions, I feel almost as though I am on vacation.

I assume that most of you are involved with some facet of the industry that is ecology-minded, or some other less tangible aspect than that in which I am involved on a day-to-day basis. It is very rare that I have an opportunity to talk to a group where I do not have competitors sitting in the audience, questioning everything I say and taking exception to my sources. I prefer them not to be here, so that I can be as broad as possible in talking about the marine transportation industry and its development of containerization. I will also, at the conclusion of my remarks, tell you something about Seatrain, and perhaps why we are where we are and some of the things we are doing in related fields, such as energy and some other areas.

Containerization is a wonderful way to move products from one point to another. Whereas our systems here in the United States are absolutely fantastic, I have found very few areas elsewhere in the world that have the capacity we have in the utilization of lakes, rivers, and other points up and down the coast. However, in my own field, with containerization and the tremendous capital investment that is necessary to operate a viable and profitable business for the stockholders and to keep everything in perspective, we have had to expand to become more a worldwide than a domestic operation. Containerization, as we know it today, is the prime way of moving valuable cargo, normally finished goods rather than raw material, into an overseas port.

The initial thrust of this business began in 1954. Mr. McLean started a company by the name of Sealand (not my company) and came up with the excellent idea that if you were going to transport cargoes from one point to the other, and then down to the sea and then to some point overseas, it seemed rather inconsistent with good judgment to have to bring that cargo down to the piers, take it off the conveying trucks, lay it down, set it out in the weather, subject it to pilferage and all the other things that happen to cargo exposed in that manner, then re-lift it onto a vessel, take it to another point somewhere and again put it on some sort of conveyance, whether it be a truck, railroad, or even in some cases the horse and buggy. So, he decided to put a container on a truck, move the truck right onto shipboard, take it to its final destination and, where possible, run it on into the interior.

The first place where we started this type of operation was an extension of our existing domestic services to Puerto Rico. In 1954 and 1955, Sealand began several very small operations which carried on into the 1960's. Other steamship lines soon saw that this was a trend that was being readily accepted by the shipping public, and that if they did not move in the same direction, they would be left behind in advancements as far as the industry was concerned. By 1965 several lines were into this with existing vessels and very little expertise. At that point, railroad and trucking people were the source of much of what was known at that time because they were the ones who were bringing the cargo down to the piers. At the very outset, the knowledge of this group of people was all in a very few minds.

The next step involved a lot of investment. Then a great deal of time evolved, but by the early 1970's the system became much more sophisticated, and containerization really began to catch on. In fact, in the early stages, not more than 3 or 4% of the cargo moved in containers. Today, in general, depending upon the port you are looking at, 40-50% of the tonnage that moves into or out of the United States is now in some containerized form.

Several factors helped this type of transportation considerably. When moving cargo in a container, the container becomes the packaging box, and the cost of preparing a shipment for rehandling two, three, four, or five times is greatly reduced. Secondly, one of the major problems in moving cargo was the factor of loss brought about by theft, damage, or mysterious disappearance. At one time it was said, and I would not want to be quoted, but I think it was pretty close, part of a seaman's income, probably as much as 20%, was supplied by that cargo which he could find other means of disposing of instead of putting it on the vessel he was

supposed to be working. So, when this area of loss was taken away, part of the insurance costs were vastly reduced and, generally speaking, it became less expensive to move cargoes from one point to the other. More sophisticated means also resulted in the streamlining of documentation, which is a big problem in our industry. With the speeding up of vessels and the decreased time it now takes to go from the U.S. East Coast to overseas points, the paper work that is necessary to move cargo through customs, etc. was now finding itself to be far behind the cargo. Before, the paper work was getting to the destination weeks ahead of time. So that was another system that had to be speeded up, and that has been done and has worked out very well. Now we had customers who liked the method, and we had receivers on the other end who thought the method was an excellent way to handle cargo. We also had port people who moved into the forefront of this particular type of transportation and built good ports throughout the world, and things began to work, except that we lacked markets.

Puerto Rico obviously was not large enough to sustain the type of investment that the companies were making. The next market was Europe. This market has grown considerably and has provided excellent economic advantages for this Country, both through exports and imports. Markets in the Far East, including those in Japan, Taiwan, Hong Kong, Thailand, and the Singapore area, have also grown, and Australia and New Zealand are coming along very rapidly now. The latest exposure is in the Middle East where much money has been brought forward and there are many buyers in the market, but it is not a very sophisticated market yet. It is mostly a market for finished materials, and not much of a raw material market, but that will come. All of this has allowed industries such as our own, with the tremendous capital investments that we have, to take advantage of the new technical aspects of the business, and whether they be in utilization, safety features, data processing, or communications, to help the industry as a whole.

We did run into a problem in 1974-75 when the world economic situation brought a halt to some of the expansion programs that we all had in mind. But the economy is now beginning to pick up a little bit again. We see inventories at a more manageable level. We see the money market presently operating at 6½ to 9%, which is a healthy area in which businesses can borrow and carry over to accounts receivable. We see the stockpiling that was tremendous in Japan and throughout the world in 1974 reduced pretty much to manageable levels. The economy in the industrial nations is strengthened, and the underdeveloped countries are beginning to buy some hard goods. In our industry, that all means a positive factor. The technology and the quality of the products that we are making in America are going to continue to be in demand. We as a company, and as an industry, are going to continue to respond to these demands. We think that the next 12 to 18 months are going to be strong for us. The economy in this Country is holding. I do not want to go into that too deeply, for I am not an economist, but we do see trends. We see trends in the changing of the dollar, and we see trends in that the dollar is buying more in overseas markets than it has for a while, and our exports are beginning to pick up. We went through a period in which imports were heavy and exports were down. We reversed that in the last 3 or 4 months, and our current projections for 1978 are more in this direction.

My own company, Seatrain Lines, started out in 1929, but it was not until 1965 that we began to get into some broader markets. We have expanded from a small operation of 5 vessels to 27 vessels presently operating in all sectors of the industrial world. We built 4 turbo-jet engine, very large container ships, each holding 943 40-foot containers. This was the first innovation of that type of propulsion that we had in our industry, and we did this in concert with the United States Government. We opened up the Brooklyn Navy Yard, which had been closed for many years, and have just completed a third supertanker and have a fourth one on the way and soon to be finished. The old Manhattan was used in the experiments going up into the Northwest Passage to see if it was feasible to bring oil out that way when the Alaskan oil find was brought to a refinery. We have worked with the United States Government in building some special crane-operated ships. We have built some special tankers, and we have 17 ships of that nature, five of which are on some type of lease to the Navy for bunker purposes. We joined with the Tobago Government to open a refinery down there and helped in moving cargoes to and from those islands and eventually back up into the States. We joined forces with 6 Eskimo tribes to arrange proper handling of oil coming out of Alaska, in both the holding station up there as well as moving it down to the West Coast, and eventually all the way down to the Panama Canal. These examples will give you an idea of what a company like ours can do. It takes good management. It also takes a lot of cooperation from all agencies, including government agencies, private agencies, port agencies, and just people who are generally interested in keeping the steamship business a viable and contributing segment of our economy.

ECONOMIC DATA REQUIREMENTS FOR THE EVALUATION OF ENERGY CONSTRAINTS TO MARINE AND COASTAL DEVELOPMENT

By CATHERINE E. MELEKY*
Office of Policy Development
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National Marine Fisheries Service

The supply of commercial fishery products has increased from 4,366 million pounds in 1966 to 5,350 million pounds in 1976, a 23% increase. A primary reason for this increase has been the development of the U.S. fishing industry through capital investment and technical innovation. Capital investment and technical innovation have been facilitated by the availability of relatively inexpensive energy inputs needed to power the machinery and equipment used in the catching, processing, and distribution of fish products.

In the first half of the century, a dramatic change occurred concerning the acquisition of energy resources. The limitation of supply by major oil-producing countries in 1973, and the subsequent quadrupling of price in imported crude petroleum, meant a major increase in costs to the U.S. fishing industry. Since future supplies and prices of energy resources are uncertain, information concerning the energy dependence of the fishing industry is essential for public and private energy programs.

The major objective of this study was to determine the current status of energy consumption data for the fishing industry and to identify those areas where information is not available or is inconsistent. An attempt was made to define the fishing industry and its components and to define data needs in each. Research was then done to determine the kind and extent of data available as well as its reliability. This data will then be used to determine future economic data requirements for the evaluation of energy constraints to marine and coastal development.

*Paper co-authored by Brian J. Rothschild

FUTURE ENERGY COSTS TO THE FISHING INDUSTRY

For most forecasts of future energy costs, two major assumptions are usually made. First, it is assumed that large arbitrary price increases, such as occurred in 1973 and 1974, will not be repeated. Second, the assumption is made that prices will increase at an average rate of inflation in the industrial countries. The upper limit for energy prices will reflect the costs of alternative energy sources and the revenue requirements of the OPEC nations, while the lower limit will reflect the costs of production.[1]

In a study prepared by the White House for the Joint Committee on Taxation, prices for U.S. "newly discovered" crude petroleum production would be $16.78 per barrel in 1980 and $21.90 per barrel in 1985, as shown in Table 1.[2] In a study done by the United States International Trade Commission, the OPEC state's sales price for "marker" crude petroleum (the price to which all other OPEC crude petroleums are indexed) as of July 1, 1977 was $12.70 per barrel. At an inflation rate used in the National Energy Plan of 5.5% per year, the OPEC "marker" price, f.o.b. Saudi Arabia would be $14.91 per barrel in 1980 and $19.49 per barrel in 1985. The U.S. price would be equal to the above prices plus transportation and applicable duties and would be close to the predicted U.S. crude petroleum price.[3]

Based on these and other predictions of energy resource prices, the Department of Energy has forecast increases in the prices of jet fuel (primarily diesel fuel and kerosene), gasoline, and electricity at

[1]As the price of imported crude petroleum increases, energy production using domestic secondary sources is possible. In Estimates of the Economic Cost of Producing Crude Oil by the United States Senate Committee on Interior and Insular Affairs, recent estimates indicate that, in the United States, at crude petroleum prices of $12 to $15 per barrel, production from large frontier deposits of crude petroleum becomes economically feasible. The production of synthetic fuels from coal and other sources is possible at a price of $15.00 per barrel. The Energy Research and Development Administration indicates in its market oriented program that roughly 3 to 4 times the current proven U.S. reserves of crude petroleum are obtainable at a price of $15 per barrel. At $20 per barrel, up to 5 times the current proven reserves are available. For further information see footnote 3.

[2]Platt's Oilgram News Service, June 13, 1977, p. 3

[3]Factors Affecting World Petroleum Prices to 1985, United States International Trade Commission, USITC Publication 832, Washington, D.C., September 1977, pp. 7-10.

a similar rate. The price of jet fuel is expected to increase from $4.20 per million BTU's in 1975 to $4.40 and $4.60 per million BTU's in 1980 and 1985, respectively. Gasoline prices are expected to increase at an average annual rate of 5.5% to 6% from 1975 to 1980. Electricity for industrial use is predicted to cost $7.70 per million BTU's in 1980 and $8.50 per million BTU's in 1985, almost double the 1975 price of $5.60 per million BTU's.[4]

Table 1—United States Projected Crude Petroleum Domestic Wellhead Prices: 1980 and 1985

(In current dollars per barrel)

Category	1980	1985
Newly discovered	16.78	21.90
New	14.18	18.54
Lower tier	6.35	8.29
Tertiary	16.79	21.90
Stripper	16.66	21.74
North Slope	10.30	15.34
N.P. Reserves	16.79	21.90

Sources: The White House analysis of price trends for the Joint Committee on Taxation as given in Platt's Oilgram News Service, June 13, 1977.

Price increases in energy requirements of the fishing industry will effect its producing capability. The extent of such an effect on each sector of the industry must be determined. The following section contains a determination of the data requirements useful as decision-making inputs.

THE FISHING INDUSTRY

For purposes of this study, the fishing industry will be divided into two sectors, the harvesting sector, and the processing sector. The harvesting sector will consist of those activities associated with the catching of fish and shellfish and their transportation to shore, or some other place of sale. The processing sector encompasses those activities which take place from dockside to the ultimate consumer.

The Harvesting Sector. Data requirements for the harvesting sector include fuel requirements of current fishing vessels according to their characteristics and number, a breakdown of costs associated with fishing effort, and future energy-saving technology.

The determination of fuel requirements for the current U.S. fishing fleet depends on the size and characteristics of each vessel, its engine size and type, its netting and gear, its construction materials, and its age. Each of these factors can effect fuel efficiency and requirements. In addition, tonnage, hull construction, and hold capacity information would help to clarify the relationship between fuel requirements and vessel characteristics.

Data on costs of fishing effort will provide the basis for the determination of relation between total cost and energy costs. Data requirements associated with variable costs, fixed costs, and opportunity costs are also necessary. Variable costs include: the cost of goods and services, such as ice, food, nets, ropes, etc.; crew costs and payroll taxes; and, operating capital. Fixed costs consist of the cost of: insurance premiums; miscellaneous expenditures such as office, telephone, travel, bookkeeping, etc.; and depreciation allowances. Opportunity costs reflect foregone opportunities by the owner, either by working as a crew member on his vessel, or managing his own business. These costs include costs of management and cost of operator's labor.

Finally, data on fishing effort is needed to determine a measure of fuel efficiency. Data to be collected include the number of hauls and the time spent fishing by fishery and class of vessel.

The Processing Sector. The processing sector includes all of the activities associated with the conversion of fish and shellfish into a saleable form by various processes, and its marketing and distribution. The major areas of inquiry in this sector include: shipments and end-of-period freezer holdings or inventories by major species, product type, and form (canned, frozen, etc.); costs of production by major species; costs of cold storage by form, area, and type of cold storage medium; and, transportation costs.

Costs of production include employment costs, the cost of fish or shellfish, capital expenditures, and other variable and fixed costs. Costs of cold storage will vary according to the form of the product (blocks, boxes, etc.), the fish species, the type of freezer, the freezing medium, and construction materials, the geographical area, usage frequency, and the length of time the product is in the freezer. Data required for the estimation of transportation costs include knowledge of marketing and costs associated with the various forms of transportation, such as truck, plane, and train. Required knowledge of marketing routes includes point of origin, the number of markets in which the product is bought and sold, the manner in which the product is transformed or further processed between the time it leaves one market and enters another, and the final consumer. The quantity of processed fish transported through the marketing system should also be determined.

In the preceeding paragraphs, data requirements

[4]Department of Energy, unpublished statistics.

for the estimation of energy usage in the fishing industry have been enumerated. In the following section, current major research efforts to supply energy data for the fishing industry are presented and evaluated to obtain an estimate of energy costs. Data concerning energy usage in fisheries are available in various forms; that is, variations occur in the extent of detail, the order of accuracy, the extent of coverage, and reliability of the source. This research effort concentrated on the acquisition of the most current studies available on the total energy expenditure by the fishing industry.

ESTIMATES OF ENERGY REQUIREMENTS IN THE FISHING INDUSTRY

The following studies represent the current attempts to estimate total energy requirements in the harvesting and processing sectors. Studies dealing with only a few species of fish or one geographical area were considered to be limited in scope and application and, therefore, not included.

The Harvesting Sector. In June, 1975, a review of the current literature was done by Booz, Allen and Hamilton, Inc., management consultants under contract to the Federal Energy Administration, to obtain estimates of energy usage in the fishing industry. Efforts were made to obtain energy estimates for total energy use in direct use, producing production inputs, capital inputs, the wholesale sector, producing production inputs for the wholesale sector, the retail sector, producing capital inputs for the retail sector, and transportation in wholesale and retail sectors.

The only information obtained was an estimate for energy usage by commercial fishing vessels, as follows:

Source: Energy and Food: Energy Used in Production, Processing, Delivery, and Marketing of Selected Food Items.
Energy Estimate: 43,300 BTU's per pound of fish product
125.8 trillion BTU (1973)
Standard Units: *same as above*

Energy estimates contained in this report are given in BTU's per pound of fish product consumed for 1973, up to, but not including, the point of processing; principally, therefore, for the fueling of trawlers and fishing boats. The estimate of energy usage was obtained by applying a BTU-per-pound ratio to total pounds of canned, frozen and fresh fish produced. The source of the BTU-per-pound ratio was not documented. The data sources were the 1972 Census of Manufacturers, and Agricultural Statistics, 1974.[5]

Source: National Marine Fisheries Service, unpublished estimates
Energy Estimate: 1330.2 million gallons (1974)
Standard Units: 166.4 trillion BTU's

Estimated Fuel Consumption by the U.S. Fishing Fleet, 1970 and 1972 - 1974.

Type of Fuel	million gallons 1970	1972	1973	1974
Gasoline				
Commercial Fishing	68.4	68.4	61.0	58.0
Inboard Rec. Vessels	121.8	129.2	151.0	160.0
Outboard Rec. Vessels	407.9	432.4	469.0	486.0
Diesel fuel	—	—	—	626.2

The above estimates for gasoline and diesel fuel consumption were derived from surveys of the National Marine Fisheries Service. The estimate for gasoline consumption resulted from a survey of sales at large marine terminals and was adjusted to account for smaller dealers. The estimate was designed to be an indication of fuel consumption and may be subject to an error of over 100%. The estimate for diesel fuel consumption was derived from estimates of regional diesel fuel consumption.[6]

Source: Energy Consumption By Transportation Mode and Oil Embargo Scenarios - Economic Adjustment and Impacts
Energy Estimate: 114 thousand barrels per day (1974)
Standard Units: 163.9 trillion BTU's

End Use Energy Demand By Marine Vessels

Type of Fuel	Thousands of Barrels Per Day 1972	1973	1974
Motor Gasoline	41	44	46
Distillate Oils	56	66	68
(Commercial Fisheries only)	9	8	7.5

End use demand forecasts for certain types of fuel were made for marine vessels. Marine vessels included in the study were pleasure boats and

[5]Albert J. Fritsch, Linda W. Dujack and Douglas R. Jamerson, Energy and Food: Energy Used in Production, Processing, Delivery and Marketing of Selected Food Items. CSPI Energy Series VI, Center for Science in the Public Interest, June 1975 in Energy Use in the Food System prepared for the Federal Energy Administration, Washington, D.C., 1976. pp. IV-8 & IV-9.

[6]National Marine Fisheries Service, Department of Commerce, unpublished estimates, March 1975.

commercial fishing boats. Demand is defined as primary stock disappearance, that is, stock moved into secondary storage, consumed or exported. Forecast calculations and procedures documentation is not described in the report.[7]

Source: Energy and Environmental Analysis, Inc.
Energy Estimate: 15,444 thousand barrels (1974)
Standard Units: 60.8 trillion BTU's

Fuel Consumption By Commercial Fishing, 1967, 1971 and 1974

	Thousands of Barrels		
Type of Fuel	1967	1971	1974
Motor Gasoline	1,342	1,680	1,384
Distillate and Fuel Oil (Diesel Fuel)	13,206	16,534	13,611
Lubricants	434	547	449

The above fishing industry data includes gasoline and diesel consumption for commercial fishing only and does not include energy used by fish hatcheries and fish and game preserves. The data is based on a survey by the National Marine Fisheries Service of the largest marine fuel distributors (reviewed earlier). According to this study, data was not available on electricity use or other fuels outside of gasoline and diesel oil.

Gasoline energy consumption was estimated on a state-by-state basis using National E/O coefficients and state data on commercial landings. For 1974, the coefficient for gasoline was calculated directly from 1974 U.S. gasoline consumption estimated by the survey and 1974 commercial landings published by NOAA. The E/O coefficient for 1971 was calculated by combining 1970 and 1972 energy and output data. The E/O coefficient for 1967 was estimated from data for the closest available year, 1970.

Since diesel fuel consumption data were only available for 1973, the 1973 ratio of U.S. diesel fuel consumption to gasoline consumption was assumed to hold for every state, for each year 1967, 1971, and 1974.

The overall data quality, as evaluated by the reporting company, is unknown due to their inability to assess the accuracy of the National Marine Fishery Service survey, evaluate state-by-state variation in E/O coefficients, account for possible gasoline to diesel fuel shifts and to assess the error introduced by using one year's E/O coefficient for another year.[8]

Source: National Energy Accounts: Energy Flow in the U.S. 1947-1972.
Energy Estimate: 85.7 Trillion BTU's (1971)
Standard Units: Same as above

In this study, data (Tables 2-4) were collected on gasoline, diesel fuel, motor oil, and grease consumption from 1947-1972 for fisheries. Gasoline consumption figures represent commercial fishery use only (fuel for fishery vessels), and were derived from a study by the National Marine Fisheries Service, mentioned earlier in this report. Figures were estimated by finding a 1974 coefficient in gallons per ton of gross weight in the commercial fishing fleet and multiplying that coefficient by the total gross weight in tons for each year 1947-1972. The tonnage statistics are from annual volumes of Fishery Statistics of the United States, "Summary of Operating Units."

Estimates of consumption figures for diesel fuel are classified as waterborne vehicle use by commercial fisheries. Estimates for motor oil consumption are classified as function uses in marine transportation for the fishery sector. All fishery data was assigned the lowest quality rating by this firm.[9]

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[7]Energy Consumption By Transportation Mode and Oil Embargo Scenarios - Economic Adjustment and Impacts, Jack Faucett Associates, Washington, D.C., May 1973 and January 1974.

[8]Energy Consumption Data Base, Volume III, Chapter 1, The Agricultural Sector, Final Report, Energy and Environmental Analysis, Inc. prepared for the Federal Energy Administration, Washington, D.C., March 1977, pp. 443-447, G-1, G-39, G-77, G-115, G-153.

[9]National Energy Accounts: Energy Flow in the U.S. 1947-1972, Volume I and II, Jack Faucett Associates, submitted to the Federal Energy Administration, Washington, D.C., November 1975.

Table 2
Energy Usage, By Type of Fuel
1954, 1958, 1962, 1967, and 1971.

Energy Product	Trillion BTU's 1954	1958	1962	1967	1971
Light Hydrocarbon gases except propyl and butanes	.004	.012	.012	.020	.048
Gasoline	7.410	7.830	7.200	8.407	10.622
Motor	7.132	7.499	6.901	8.061	10.260
Aviation	.278	.331	.299	.346	.362
Diesel Fuel	45.412	49.268	49.641	61.564	74.129
Lubricants and greases	1.080	1.022	.880	.658	.598
Petroleum Products (Jet fuel)	—	—	.039	.133	.301
TOTAL	53.906	58.132	57.771	70.782	85.699

Source: National Energy Accounts, Jack Faucett Associates, 1975.

Table 3
Energy Consumption, By Function
1954, 1958, 1962, 1967, and 1971

Functional Use	Trillion BTU's 1954	1958	1962	1967	1971
Fuel and Power Use	53.906	58.132	57.771	70.780	85.699
Transportation Fuel	53.906	58.132	57.771	70.780	85.699
Personnel Passenger Highway Vehicles	2.739	2.579	1.875	1.647	2.105
Trucks	.560	.854	1.041	1.935	3.352
Aircraft	.282	.335	.342	.484	.669
Waterborne Vehicles	50.325	54.364	54.513	66.714	79.574

Source: National Energy Accounts, Jack Faucett Associates, 1975.

Table 4
Transportation Fuel Use By Energy Product
1954, 1958, 1962, 1967, and 1971

	Trillion BTU's				
	1954	1958	1962	1967	1971
Personnel Passenger					
Motor Gasoline	2.676	2.530	1.842	1.622	2.078
Lubricating oil	.057	.045	.031	.024	.025
Greases	.006	.004	.002	.001	.001
Trucks					
Light Hydrocarbon Gases except Propyl and Butyl	.004	.012	.012	.020	.048
Motor gasoline	.462	.646	.708	1.086	1.721
Diesel Fuel	.082	.181	.303	.804	1.549
Lubricating oil	.011	.015	.016	.033	.031
Greases	.001	.001	.001	.001	.002
Aircraft					
Aviation gasoline	.278	.331	.299	.346	.362
Lubricating oil	.004	.004	.004	.005	.005
Petroleum Products (Jet fuel)	—	—	.039	.133	.301
Waterborne Vehicles					
Motor gasoline	3.994	4.324	4.351	5.353	6.480
Diesel Fuel	43.330	49.087	49.338	60.761	72.580
Lubricating oil	.910	.867	.764	.564	.503
Greases	.091	.085	.061	.036	.030

Source: National Energy Accounts, Jack Faucett Associates, 1975.

Source: National Energy Accounts: Energy Flows in the U.S. 1947-1972, Bureau of Mines Survey
Energy Estimate: 602.3 million gallons (1972)
Standard Units: 75.3 trillion BTU's

The figures in Table 5 are adjusted Bureau of Mines data for gasoline and diesel fuel usage in commercial fishing. The original Bureau of Mines figures appeared in an accounting of all marine transportation fuels. Data for distillate oil which includes diesel fuel and gasoline originally came from Mineral Industry Surveys "Sales of Fuel Oil and Kerosene" (Annuals), Bureau of Mines. The figures were designed to be rough order of magnitude estimates.[10]

The Processing Sector. Estimates for fuel usage in the processing sector are made according to Standard Industrial Classification (SIC) numbers. For the fishing industry, SIC numbers 2091, Canned and Cured Fish and Seafoods; and 2092, Fresh or Frozen Packaged Fish apply.

SIC number 2091 and 2092 are found under Division D, manufacturing, of the SIC schedule. The manufacturing division includes establishments engaged in the mechanical or chemical transformation of materials or substances into new products... The product of a manufacturing establishment may be "finished" in the sense that it is ready for utilization or consumption, or it may be "semi-finished" to become a raw material for an establishment engaged in further manufacturing . . . "

[10]Ibid., p. 131-134

Table 5
Gasoline and Distillate Oil Usage
in Commercial Fishing,
1960-1972
Millions of gallons

Year	Gasoline Usage	Distillate Oil Usage
1960	35.4	362.2
1961	35.3	361.0
1962	34.8	355.8
1963	36.0	368.1
1964	36.6	374.0
1965	38.0	388.5
1966	40.2	411.2
1967	42.9	438.1
1968	46.1	471.2
1969	47.1	481.4
1970	48.9	500.0
1971	51.7	523.3
1972	54.6	547.7

Source: National Energy Accounts: Energy Flows in the U.S. 1947-1972, Bureau of Mines Survey, 1975

Section 2091—Canned and Cured Fish and Seafoods.

Establishments primarily engaged in cooking and canning fish, shrimp, oysters, crabs, and other seafood, including soups; and otherwise curing fish for trade . . .

Section 2092—Fresh or Frozen Packaged Fish and Seafood.

Establishments primarily engaged in preparing fresh and raw or cooked frozen packaged fish and other seafood, including soup. This industry also includes establishments primarily engaged in the shucking and packing of fresh oysters in nonsealed containers.[11]

Source: Fuels and Electric Energy Consumed
Energy Estimate: SIC 2091 - 1.3 billion kilowatt-hour equivalents (1974)
SIC 2092 - 1.1 billion kilowatt-hour equivalents (1974)
Standard Units: SIC 2091 - 4.4 trillion BTU's
SIC 2092 - 3.8 trillion BTU's

The following table (Table 6) contains estimates of fuel consumption for SIC categories 2091 and 2092.[12]

Table 6
Purchased Fuel and Electricity Consumption and Costs for Canned and Cured Fish and Seafood Industry (SIC 2091) and Fresh or Frozen Packaged Fish and Seafood Industry (SIC 2092), 1974

Canned and Cured Fish and Seafood Industry

Purchased fuels and electric energy
Kilowatt-hour equivalent (billions) 1.3
Total Cost (million dollars) 8.2

Purchased fuels
Kilowatt-hour equivalent (billions) 1.2
Cost (million dollars) 5.4

Purchased electric energy
Kilowatt-hour equivalent (millions) 143.8
Cost (million dollars) 2.8

Fresh or Frozen Packaged Fish and Seafood

Purchased fuels and electric energy
Kilowatt-hour equivalent (billions) 1.1
Total Cost (million dollars) 11.0

Purchased fuels
Kilowatt-hour equivalent (billions) 0.8
Cost (million dollars) 4.0

Purchased electric energy
Kilowatt-hour equivalent (millions) 331.0
Cost (million dollars) 7.0

Source: Fuels and Electricity Consumed, Census of Manufactures, 1974

Source: Energy Efficiency Improvement Targets
Energy Estimate: SIC 2091 - 4.8 trillion BTU'S (1974)*
SIC 2092 - 4.1 trillion BTU's (1974)*
SIC 2091 6.2 trillion BTU's (1972)
SIC 2092 3.7 trillion BTU's (1972)
Standard Units: Same as above

Four main types of analyses were done for each industry defined as being within the food and kindred products industry. Among these were Canned and Cured Fish and Seafood (SIC 2091) and Fresh or Frozen Packaged Fish and Seafood (SIC 2092). Of the four types of analyses, this paper will consider two: the industry composite energy type

*Estimated

[11]Standard Industrial Classification Manual, Office of the President, Washington, D.C., 1972, p. 68.

[12]Fuels and Electric Energy Consumed, Census of Manufactures, Bureau of Census, Department of Commerce, Washington, D.C., 1974, p. 142.

(ICET) profile established for the 1972 base year, and the industry composite energy use (ICEU) profile. The ICET profile identified the amount of energy consumed and the distribution of energy by fuel type. The ICEU profile determined energy use on two levels: intermediate uses, including the percentage distribution of energy for direct use, boiler use, and electrical use; and end uses, including all major final uses of energy, each as a percentage of intermediate use.

In 1972, 6.2 trillion BTU's were used to can and cure 1,618.6 million pounds of fish and seafood, (SIC 2091) that is, 3,827.4 BTU's per pound of fish and seafood. Intermediate energy usage was divided as follows: boiler use (79%), direct use (14%), and purchased electricity (7%). Energy end use for boiler usage can be divided into receiving (1%), warehousing (1%), and miscellaneous use (5%). Energy used in direct usage was primarily for the fueling of plant vehicles. End use for purchased electricity was characterized as: receiving (5%), preparation (3%), processing (28%), warehousing (25%) and miscellaneous uses (11%). The following table presents the above breakdown in terms of actual fuel usage (Table 7).

In 1972, 3.7 trillion BTU's were used to package 1,233 million pounds of fresh or frozen fish and shellfish (SIC 2092), that is, 2,996 BTU's per pound.

Boiler use accounted for 72% of total energy usage, while direct use and purchased electricity accounted for 5% and 23%, respectively. Boiler usage may be divided into various end uses as follows: receiving (1%), preparation (90%), processing (3%), warehousing (1%) and miscellaneous use (1%). Energy in direct uses was expended for the fueling of plant vehicles. Purchased electricity was used in the following activities: receiving (27%), preparation (29%), processing (9%), warehousing (30%), and miscellaneous uses (5%). The following table presents the above breakdown in terms of actual fuel usage (Table 8).

Table 7
Energy Usage By Activity
for Canned and Cured Fish and Seafood Industry (SIC 2091), 1972

Trillion BTU

Total Use	Intermediate Use		End Use	
			Receiving	0.049
			Preparation	2.204
	Boiler Use	4.898	Processing	2.351
			Warehousing	0.049
			Miscellaneous	0.245
6.200	Direct Use	0.868	Plant Vehicles	0.868
			Receiving	0.022
			Preparation	0.135
	Purchased Electricity	0.434	Processing	0.122
			Warehousing	0.109
			Miscellaneous	0.048

Source: Energy Efficiency Improvement Targets, 1976

A broad variety of data sources were utilized in generating the intermediate and end-use distributions for each industry. Trade associations and industry representatives provided energy use data in many cases. Published sources dealing with energy use by process were also consulted.[13]

Energy usage by type of fuel for the Canned and Cured Fish and Seafood Industry (SIC 2091) and the Fresh and Frozen Fish and Seafood Industry (SIC 2092) is shown in tables 9 and 10. In the Canned and Cured Fish and Seafood Industry, fuel oil usage increased from 1.8 trillion BTU's in 1962 to 2.3 trillion BTU's in 1972, then decreased to 1.2 trillion BTU's. Consumption of natural gas increased rapidly from .45 trillion BTU's in 1962 to 2.9 trillion BTU's in 1972, then decreased slightly in 1974 to 2.2 trillion BTU's. Net electricity use increased from .28 trillion BTU's in 1962 to .53 trillion BTU's in 1974.

[13]Energy Efficiency Improvement Targets, Food and Kindred Products Industry, Development Planning and Research Associates, Inc. Prepared for Federal Energy Administration, June 1976, pp. 5-7, 25-26, 156-161 and 42-1 to 44-13.

Table 8
Energy Usage By Activity
for Fresh and Frozen Packaged Fish and Seafood Industry (SIC 2092), 1972

Trillion BTU

Total Use	Intermediate Use		End Use	
			Receiving	0.027
			Preparation	2.398
	Boiler Use	2.664	Processing	0.080
			Warehousing	0.027
			Miscellaneous	0.133
3.700	Direct Use	0.185	Plant Vehicles	0.185
			Receiving	0.230
			Preparation	0.247
	Purchased Electricity	0.851	Processing	0.077
			Warehousing	0.255
			Miscellaneous	0.043

Source: Energy Efficiency Improvements Targets, 1976

Table 9
Energy Usage By Type of Fuel,
Canned and Cured Fish and Seafood Industry
(SIC 2091), 1964, 1972, 1974

Trillion BTU

Fuel Type	1962	1972	1974*
Distillate Oil	0.874	1.796	0.717
Residual Oil	0.975	0.477	0.521
Total Fuel Oil	1.849	2.273	1.238
Coal	0.104	0.118	—
Natural Gas	0.452	2.899	2.184
Other Fuels	0.663	0.453	0.817
Total Purchased Fuels	3.068	5.742	4.239
Net Electricity	0.281	0.452	0.539
Total Purchased Fuels and Net Electricity	3.349	6.195	4.778

*Estimated

Source: Energy Efficiency Improvement Targets, 1976

Table 10
Energy Usage By Type of Fuel,
Fresh or Frozen Packaged
Fish and Seafoods Industry
(SIC 2092), 1962, 1972, 1974

Trillion BTU

Fuel Type	1962	1972	1974
Distillate Oil	0.304	1.186	1.044
Residual Oil	0.196	0.343	0.553
Total Fuel Oil	0.500	1.529	1.527
Coal	—	0.597	—
Natural Gas	1.786	0.365	0.835
Other Fuels	0.272	0.339	0.586
Total Purchased Fuels	2.558	2.830	3.018
Net Electricity	0.313	0.864	1.077
Total Purchased Fuels and Net Electricity	2.871	3.694	4.095

*Estimated

Source: Energy Efficiency Improvement Targets, 1976

In the Fresh or Frozen Packaged Fish and Seafood Industry, total fuel oil usage tripled from .50 trillion BTU's in 1962 to 1.5 trillion BTU's in 1972, then increased slightly to 1.6 trillion BTU's in 1974. Natural gas usage decreased from 1.8 trillion BTU's in 1962 to .37 trillion BTU's in 1972, then increased slightly in 1974 to .84 trillion BTU's. Net electrical usage increased from .31 trillion BTU's in 1962 to 1.07 trillion BTU's in 1974.[14]

[14]Ibid, pp 42-6 and 44-5.

CONCLUSIONS

The following conclusions may be deduced from the various discussions presented in the paper:

1. Energy use estimates for the harvesting sector vary widely.
2. Energy use estimates for the processing sector also vary.
3. The estimates on energy use in the harvesting sector, done by National Marine Fisheries Service personnel, were to be considered "ball-park" estimates due to weaknesses in methodology. Since estimates by the NMFS were the basis for all other studies made of the harvesting sector, excluding one, these estimates are subject to the same weaknesses.
4. The studies concerned with estimating energy usage by the processing sector had inconsistent results and were limited, due to the almost exclusive use of Census of Manufacturers data which is confined to SIC industry designations.
5. Many of the estimates on fuel usage are currently inadequate because they were based on pre-embargo data and, thus, fail to consider post-embargo shifts in energy use due to price changes and conservation measures.
6. A comprehensive analysis of the energy utilization in the fishing sector cannot be completed until the transport sector is included. Data on transporting fish and seafood products are relatively unavailable.
7. Detailed analysis of energy consumption is restricted by the fact that most estimates of energy use are based on simple trend extrapolations.

Since most of the studies fail to provide adequate decision making and analytical information on energy use in the U.S. fishing sector, more detailed studies on energy use are needed. These studies should be species specific and focus on obtaining energy use from the ex-vessel level to the final demand level. Only by understanding the entire flow of energy within the fishing sector and related components can bottlenecks be identified, and policies to alleviate these bottlenecks be developed.

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ENERGY: THE CRITICAL CHOICES

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In 1973, before the Arab embargo, the United States imported 35% of the oil it used—concern was so great that "Project Independence" was proclaimed, but to no avail. Imports are now providing 48% of the oil used in this Country.

In 1971, that imported oil cost the United States $3.7 billion. Last year, the figure increased ten-fold to $36 billion and is expected to be $45 billion in 1977. This strains our balance-of-payments, and concern about that burden has been a major cause of the dollar's current troubles in foreign exchange markets. The oil remaining in this Country is now more difficult and costly to find. Though high prices would encourage some additional production, the fact remains that the United States is running out of oil. It is estimated that we have only 8% of the world's remaining recoverable oil, whereas the Middle East possesses 62%. Surprisingly, for the first time in history, the Soviet Union is the world's leading oil producer, not the United States.

Though gasoline prices rose following the oil embargo, they remain far below those of most countries. Europeans, who have little domestic oil, pay, on the average, almost $2.00/gallon. A confused American public asks why prices aren't higher here, if there really is a growing shortage of oil.

The price of gasoline has been kept low in the United States because most of our domestic production comes from already existing wells, which were constructed when oil was easier to find. Additionally, our political and economic influence in the Middle East, along with other factors, has successfully delayed major price increases by the OPEC nations. Pressure is building against this dampening effect, and prices will have to increase significantly in the near future.

Though prices to the consumer have been kept low, we pay the heavy costs of economic and military instability. Imagine the effects of another oil embargo which could cut our oil supply by one-half! As though that wasn't enough of a problem, our second most widely used fuel is natural gas, which is even in shorter supply. In many areas, no new natural gas customers are being accepted, and last winter's shortage proved how critical the situation has become.

The Administration is counting on coal, our third most widely used fuel, to substitute in some cases for oil and gas consumption.

Coal is abundant and would allow the oil and gas saved to be used in applications for which there are no substitutes, such as transportation. New methods of using coal, including gasification or fluidized-bed combustion, can improve its efficiency. Coal will be more important in our near future, but its long-term use is limited by the inherent social costs, including air pollution from sulfur emissions and the effects of strip mining.

Nuclear power was planned to fill a larger role in electrical power generation. But uranium and construction costs have both soared, and plant construction has slowed. There are also many lingering concerns about the dangers of nuclear power, and some countries, such as Sweden, have placed a moratorium on further development.

A great deal of research money is being spent to see if hydrogen fusion, the force which powers the sun, can be obtained in a reactor here. Fusion reactions do not involve the radioactive emissions inherent in the common fission reactors, but the technology has not yet been proven. But any attempts to further centralize our energy sources does not give credit to the potential of more efficient sources.

The best central generating facilities still waste about 70% of the energy they consume. They also require tremendous capital investments that now run to almost a billion dollars per unit in the case of nuclear plants. That is a major reason for the increasing price of electricity.

But our need for energy has not diminished. This is especially true in coastal areas, which are centers for distribution, fishing, manufacturing, and tourism. Increases in the costs of fuels can have damaging effects on profitability. Since food and housing require fixed expenditures for any household, any increase in energy cost will curtail travel and leisure activities first. Impacts will first be felt on tourism, and thus the economy of coastal regions.

Manufacturing, agriculture, and all other sectors have also been affected, and will suffer from future shortages and price escalations. Industries interested in locating in a particular state once asked the question: "What environmental regulations will we face?" Now another question is posed: "What energy sources are available and what will it cost?"

With most of our Country's population growth occurring in coastal regions, energy questions loom

ever-larger. Such questions are not only about supply, but also about the energy facilities which are moving to coastal areas. The increase in offshore drilling, new coal and nuclear power plants, oil and gas transport, and pipelines involve some of the most significant impacts coastal areas in all countries must consider.

Thus, we see that an energy supply future which follows past practices is fraught with hard decisions. Let us now look to the demand for energy and how it might be adjusted to improve this bleak outlook.

It has long been assumed by many people that our economic growth is dependent upon growth in our energy supply, but we are finding the opposite to be true. Our extremely high rate of consumption has created economic and political instability, and is cause for much concern about our ability to continue the independence which we have enjoyed for so long.

It has been clearly demonstrated that we have the capability to drastically reduce our energy appetite. West Germany, among other nations, has the same gross national product per capita as we, but uses only one-half as much energy to produce it. They manage their energy better, and utilize readily available conservation methods. For example, cogeneration, the use of waste heat to produce electricity, provides only 4% of our needs, as compared to 12% of the electrical demand in West Germany.

We need only look to our glass skyscrapers to see how energy inefficient our buildings have become. A study by the American Institute of Architects concludes that improvements in buildings could reduce our total energy consumption 33% by 1990. The Massachusetts Institute of Technology is constructing a building which will obtain 85% of its energy from passive solar design. This means that the building is oriented to absorb and store the sun's energy in the winter, and to shed that warmth in the summer. It is "passive" because there are no pumps or mechanical motion involved, just good design. For the average home-owner, even simple measures on existing buildings, such as insulation and weatherstripping, can save 15-20% in home energy bills.

Automobiles in America have become more widely used and, paradoxically, less efficient over the years. Government regulation finally reversed that trend, and the 1976 cars were 27% more efficient than those produced in 1974. As older cars are replaced by increasingly efficient newer models, the figures will continue to improve. Significantly, the automobile industry has not suffered as a result of the change. Time and again, it is being shown that energy conservation is good for everyone.

As with other nations, we must build or restore systems for mass transportation. Improvements in our rail system and development of local transit systems could especially benefit coastal areas. Along with walkways and bikeways, such systems could reduce the impact of higher energy costs on tourism and also normal manufacturing and sales operations. Most industrial nations do in fact have mass transit systems far superior to ours. The trend toward more and more traffic and congestion could be reversed by turning capital investments away from new roads and toward systems that would reduce the need for highway expansion. This would not only save energy, but would lessen two main problems in metropolitan areas, congestion and air pollution.

Economics will, in part, dampen the demand for energy. As gasoline prices increase, people will drive fewer miles. When that time comes, however, if we don't act now, there may be no good alternatives to the use of petroleum products, and the impacts could be harsh.

We also know that energy conservation can greatly aid the industrial sector. Our office has been working with Georgia Tech to provide energy management assistance to industry. They have already shown tremendous success, with energy savings of 15% or more on many occasions with small capital investments. With significant capital investment, savings of 30-40% have been realized.

As a result of the era of very cheap power, we have come to accept inefficient buildings, cars, appliances, lights, heaters, and electric toothbrushes. It is often surprising for people to find what little energy a well-designed car or house actually needs. The current shortage of insulation attests to the fact that people are willing to take steps once the effect on their pocketbook is clear. Last winter's cold weather had one positive side-effect—it was an education for us all in energy conservation.

Our first step, then, must be to wring every bit of use we can from each unit of energy. Almost every type of energy use can be improved, and the cost is usually a good investment that will pay for itself many times in both energy and dollar savings. Also, the economic value of energy conservation investments will increase as the cost of energy rises. And, if the direct economic benefits are good, the social advantages are tremendous. A move toward energy self-sufficiency and greater frugality with our resources can only improve our international posture and image.

As conservation takes effect through the replacement of inefficient cars, buildings, and machines, we can develop alternative energy sources to replace those now being depleted. The most rapidly

growing resource available to us is solar energy. The technology is proven and the economics are constantly improving. Solar water heaters were in widespread use in Florida during the 1950's, until the price of electricity went so low as to make them non-competitive. The sun powers all of our natural systems, including the wind, rain, and photosynthesis, and now promises to energize our built environment as well. The most common applications for solar energy use are hot water and space heating, which are currently economical in most areas of the country. Such systems usually have sufficient storage capacity for several days use without sun, and have conventional back-up systems for longer, cloudy periods. On balance, they usually supply 50-70% of a home's heating and hot water needs.

Solar-powered air-conditioning is also available, but now requires a longer period to pay for itself. Most states have enacted tax incentives for solar energy equipment, and the Federal Government is about to pass a tax credit which should spur the growing industry even more. The most significant problem now facing the development of solar energy is the unfamiliarity of the public, builders, contractors, and architects with this new technology. As solar systems become more commonplace, and as the equipment becomes more standardized, solar energy is expected to meet more and more of our energy needs.

It is also possible to make electricity directly from the sun with solar (or photovoltaic) cells. They are usually made from silicon, which is abundant, and are very durable. They are still very expensive, but with new developments and mass production, the price is expected to decrease in a manner similar to electronic calculators.

Solar power has also been adopted for many agricultural uses, including heating, crop drying, and irrigation.

In the Coastal Plains Region, there is great potential for the better use of wood as an energy source. We are all familiar with wood burned in a stove or fireplace. Now that equipment is being designed to distribute heat more efficiently, and other uses of wood as an energy source are being developed. Wood gasification is one means of providing energy for industrial applications. Pelletization of wood gives it a BTU content per unit almost equal to coal, but without the dangerous sulfur dioxide. There is much low-grade wood that is suitable as an energy source that constitutes simple waste at this time. More complete use of the wood already being harvested is one way to provide large additional amounts of energy.

Another age-old source of power is that of the wind. In 1900, a $4 million windmill industry existed in the United States. By the 1920's, wind power had become a major source of electrical power on farms and homesteads across the country. The establishment of the REA in 1930 made federally subsidized centrally-generated electrical power available to farms, and thus signaled a temporary end to wind power. Rapidly increasing prices of electricity and oil and gas have rekindled interest in wind energy and the industry is expanding. Coastal regions provide good conditions for this energy source; the largest windmill in the world will soon be constructed in North Carolina by the Federal Department of Energy. The most promising future, however, is with the small windmills for local applications, which are becoming more efficient and less costly.

Wood, the sun, and the wind can provide efficient, free, and locally owned and controlled energy on-site. They can also provide a mechanism for beating inflation in one important aspect of our economy.

In the long-range, we may find that our energy needs are best met by conservation and low technology energy sources. The expense of many large-scale technologies, both in dollars and social costs, are proving higher than we planned, and new sources such as solar promise infinite and non-polluting energy supplied by an industry that is labor-intensive and community oriented.

But what about transportation? Though still virtually untapped, fuels such as hydrogen and methane may someday replace our now-vital gasoline and diesel fuel. Hydrogen can be produced from water by electrolysis, and the electricity needed could be provided by solar, wind power, or other sources.

Our office is working with Georgia Tech and the Georgia Department of Natural Resources on a proposal to make newly acquired Ossabaw Island energy self-sufficient. The Island is currently powered by a diesel generator, the fuel being brought over by boat. This involves great expense for an island with a small population. Several alternative ideas are under consideration, including a combination of hydrogen/solar system which would meet all of the Island's energy needs. Solar energy could provide heating, hot water, air conditioning, and the electricity to make hydrogen. A windmill could be used to pump water and make additional electricity for hydrogen production. The hydrogen could be used for cooking and to power the vehicles on the Island, a transition that is not difficult for the internal combustion engine.

Projects such as this one will continue to be developed and offer the hope of clean, new ways of meeting our energy needs. The challenge we face is not so complex as we sometimes believe, and the answers may in fact come from the simple

questions we need to ask ourselves. Those questions involve every aspect of our energy use and how we can squeeze more social benefit out of every available BTU or kilowatt-hour of energy.

To continue our past practices of waste locks us into a difficult, if not disastrous, path. We can, however, choose to change our energy consumption and make the slow transition from an exhaustive fossil fuel economy to one based on conservation and renewable resources. No more important step could be taken toward securing the American future.

ENERGY CONSERVATION IN SEAFOOD PROCESSING

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Make no mistake about the present energy situation. The shortage is real and all industries, businesses, and individuals must learn to accept the fact and cope. There is no need, however, to develop negative attitudes since a concerted drive to eliminate energy waste can return many benefits.

Before discussing the seafood utilization industry, let's first consider the broad aspects of energy requirements for food in the United States during the past decade.

A recent study sponsored by the National Science Foundation and conducted by the Oak Ridge National Laboratory, discloses that about 12% of the total National energy budget is consumed by the food cycle. The distribution is as follows:

Food Processing	33%
Agriculture	18%
Households	30%
Wholesale & Retail Trade	16%
Transportation	3%

The total energy consumed in food production during 1963 was 6,100 trillion BTU's. As shown in the above list, an astonishing 30% of the energy used in food utilization is expended in the process of preparing the food in the consumer's home.

The study also showed the various allocations of energy according to food commodities:

Dairy	16%
Fruits & Vegetables	18%
Flour & Cereal Products	13%
Sugar & Sweets	10%
Alcoholic Beverages	10%
Meat, Poultry, and Fish	27%
Other Foods	6%

In a study by the University of Connecticut, it was shown that the energy used to produce a gram of seafood protein, when compared to other types of protein, is usually less; however, there were three exceptions: king salmon, shrimp, and lobsters. The following table lists the breakdown of various types of seafood and non-seafood products and the energy required to produce the product:

Food	Energy (KCAL Input/Gram Protein)
Herring [a]	6.58
Wheat	13.7
Ocean Perch [a]	17.3
Blue Crabs [b]	27.5
Pink Salmon [c]	30.4
Rice	40.0
Cod [a]	78.5
Tuna	81.3
Haddock [a]	92.0
Halibut [c]	93.2
Flounder [a]	95.2
Eggs	132
Catfish [d]	139
Boilers	149
King Salmon	159
Pork	186
Milk	263
Shrimp [e]	598
Range Beef	685
Lobster [f]	769
Feed Beef	800
Range Lamb	818

a = Atlantic
b = Chesapeake
c = Pacific
d = Aquaculture
e = Gulf
f = Maine

The next table indicates the energy used in seafood production. The total energy given, expressed in kilocalories of energy per kilogram of food output, includes harvesting and processing sectors of the distribution chain, and also includes those costs allocated to fuel, electricity use, depreciation of equipment, maintenance, and utilization of raw ingredients and packaging materials. Also included is an estimate based on storage for 90 days, from the time of processing to the time of purchase by a consumer from a retail outlet.

*Paper Co-authored by Donn Ward and Frank Huang

ENERGY USE IN SEAFOOD PRODUCTION
KCAL/KG

Food	Harvesting*	Processing+	Processed Seafood**	Wholesale‡	Retail	Total
Perch (Frozen Filet)	1,330	4,640	8,470	352	70	8,890
Sardines (Canned)	580	12,200	13,800			13,800
Salmon (Canned)	4,560	11,500	19,000			19,000
Cod (Fresh Filet)	4,280	5,260	18,500	6.1	110	18,600
Flounder (Fresh Filet)	5,250	5,130	20,300	6.1	130	20,400
Halibut (Frozen Steaks)	11,500	5,280	25,800	352	170	26,300
Haddock (Fresh Filet)	8,070	5,830	28,200	6.1	110	28,300
Salmon (Fresh)	19,800	6,030	33,500	6.1	70	33,500
Lobster (Live)	33,700				160	33,900
Tuna (Canned)	16,100	8,360	41,500			41,500
Scallops (Frozen)			49,800	352	150	50,300
Shrimp (Fresh)	74,800	10,000	134,000	6.1	110	133,800
Blue Crab (Steamed)	2,290	21,500	138,000	6.1	210	137,800

* Includes boats, gear, and repair
\+ Includes paper, ingredients, machinery
** Includes + plus harvesting
‡ Includes storage for 90 days

It has been noted that the increased amount of energy utilized in fishing over the past few years has not yielded a proportional quantity in fish landed. In contrast, the overfishing that has been practiced by various nations has resulted in an increased use of energy per unit volume of catch. Studies by the Food and Agriculture Organization (FAO) of the United Nations have shown that the energy cost of fishing for the last few percent of the fish in a school is much greater than that spent for the majority of the school. It has been estimated that the cost per ton used in taking the last 2% would be about 10 times that for the first 98%. However, it must be remembered that it is usually advantageous for a vessel to take the maximum catch since the cost of the fuel is low and offset by the cost of the raw product, especially if a highly desirable species is being sought.

It must be remembered that, even if more energy is devoted to fishing, additional species would not be landed in a greater amount. Many of the desirable species have been overfished and it is doubtful that extensive fishing efforts would be able to obtain significantly increased yields. What is becoming more popular are the under-utilized species and a reallocation of our current marine food products. At the present time, only one-third to one-half of the fish caught is now used for human consumption. The remainder is used for industrial fishery products which eventually are incorporated into poultry and other animal feed rations.

In harvesting seafood it should be noted that there is a wide variation in energy used to produce a kilogram of protein. For example, harvesting energy consumption relative to protein output a ratio of 117 to 1 exists for lobsters relative to sardines. It should also be noted that the value of 769 kilocalories per gram of protein for lobsters, the most energy intensive seafood, compares with 800 kilocalories per gram for feed lot beef. It is interesting, however, that Atlantic herring require surprisingly little energy in harvesting, only 6.58 kilocalories per gram of protein. This is less than what is needed to grow a gram of incomplete protein from corn, wheat, or oats. Also of interest is the fact that tuna, the only example of fish caught by large modern ships traveling to foreign waters, does not consume as much energy as might be expected. When fishing in the same area, large ships, although they catch more, require more energy than older, smaller ships per pound of seafood caught.

One of the reasons why the total energy required for shrimp and blue crabs is high (when compared to that of perch, salmon, and cod) is that shellfish have significantly lower product yields. It is not uncommon for a blue crab to yield less than 10% from the harvest weight. Values as low as this are not obtained in the fin fish industry. Usually, yields of one-third for fish filets to 75% for steaks are sometimes achieved. On an average, approximately 50% yield of a fish is usually obtained after processing.

This comparison of unprocessed seafoods with other protein food sources indicates that fish utilization is less energy intensive than many farm animals and some field crops.

Two related 1980 energy efficiency improvement goals have been established for the seafood industry:

1. Gross Goal—12%
2. Net Goal—10%

The gross goal represents the projected improvement from 1972 to 1980 in energy efficiency per unit of output, which is deemed both technologically feasible and economically practical based on analysis. The net goal reflects an overall adjustment of the gross goal for exogenous factors. For example, the Environmental Protection Agency (EPA), Occupational Safety and Health Act (OSHA), and Food and Drug Administration (FDA) regulations are projected to increase energy requirements of the industry over the period by at least 2%.

Seafood products can be divided into two general classes:

1. Products produced for human consumption.
2. Products produced for animal food and bait.

While the two classes use an almost identical process for the same raw material and, perhaps, are produced in the same establishment, it is important to segment their energy cost into different categories. If this were not done, 100% of the energy used by the seafood industry would invariably wind up being assigned to 60% of the industrial product. This problem would arise because energy utilization is reported in terms of the Standard Industrial Classification (SIC), which does not take into consideration the classification of the ultimate consumer. As a word of caution, when reviewing any energy allocated by a food industry, it must be remembered that the Standard Industrial Classification only considers the type of product being processed and not the audience for whom the product was intended.

The canned and cured seafood industry is relatively product extensive. The important species are tuna, salmon, clams, shrimp, and sardines but these constitute only the largest in volume. It should be remembered that the product varies by grade, packing medium, can size, and many other factors. The canned and cured seafood industry had energy consumption characteristics as listed:

SIC 2091 ENERGY CONSUMPTION

1. 2091 used 0.5% of total SIC group 20 during 1974.
2. 2091 ranked 39 among 47 SIC 20.
3. Canned fish required: 4,000 BTU/lb. in 1971; 3,000 BTU/lb. in 1974.

In 1972, the seafood industry composite energy profile was as follows:

COMPOSITE ENERGY PROFILE

Fuel Type	1962	1971	1972	1974
			%	
Distillate Oil	26	29	29	15
Residual Oil	29	8	8	11
Total Oil	55	37	37	26
Coal	3	2	2	—
Natural Gas	14	47	47	46
Other Fuels	20	7	7	17
Total Fuel	92	93	93	89
Electricity	8	7	7	11

It must be remembered that energy conservation at this point in time may be less important to the seafood industry than several other issues. To many observers it appears the industry may be fighting for survival. There are many areas that are of vital concern to the industry, such as EPA guidelines, foreign fishing, Regional Management Councils, FDA regulations, minimum wages, and OSHA regulations, which may produce inefficiencies in the utilization of seafood.

There is also a growing consumer resistance to seafood products due to increasing retail costs. Because of the importance of these issues, it is not surprising that energy utilization has been given a somewhat lower priority.

Factors affecting energy conservation goals are:

1. Energy Prices
2. Energy Conservation Equipment Investment Costs
3. Investment Capital Availability

Let us now consider the composite seafood industry energy use profile. This profile is divided into two categories:

1. Intermediate Use Energy Distribution, and
2. Use Energy Distribution

The intermediate use energy distribution is broken down among fuel inputs and purchase of electricity. The fuel input is broken down into direct use and boiler use. In 1972, the seafood industry consumed 14% of all energy purchased in direct uses. Seventy-nine percent went to boiler operations for steam generation, with the remaining (7%) being purchased for electricity. The direct use of fuel input was accounted for by plant vehicles used to transport raw and processed product at the receiving and warehousing stages. The fuel used in processing plants is primarily allocated to preparation (45%), processing (48%), and miscellaneous (7%) which includes receiving, warehousing, and boiler losses. It is estimated that 33% of the overall boiler output is lost through the stack, through blow-down, steam traps, poor steamline insulation, and general heat

losses in converting fuel input to boiler output. As expected, the majority of heat is used in preparation, precooking, and processing (retorting) with the remainder being used for other items such as space heating. The retort is one of the greatest users of energy in the blue crab and canning industries. The stationary retort is not very efficient and a typical thermal energy balance is as follows:

THERMAL ENERGY BALANCE
STATIONARY RETORT

Operation	Energy Used	Energy Lost
	----------%----------	
Heating (of product)	16.7	—
Venting	—	36.4
Crate & Retort Heating ...	—	16.4
Condensate Heating	—	11.2
Radiation	—	19.3

Electricity is used primarily for lighting, running belts and motors, and for refrigeration.

Let us consider the above problems in more detail and discuss the technologically feasible and economically practical measures that can be used to reduce energy use.

1. Direct Use
   It is technically feasible to conserve approximately 10% of the energy going to plant vehicles by improving vehicle maintenance and driving practices. This savings will be maintained by using better-tuned vehicles, careful routing, and minimizing vehicle use. Other changes that can be brought about are: making maximum use of common-carrier fleets and railroads, conversion of large trucks to diesel engines, and replacing large size company cars with compacts or subcompacts, enforcement of the 55 mile-an-hour speed limit, use of radial tires over the conventional tires, having drivers avoid prolonged engine idling, devices mounted atop tractor cabs and on trailer noses that reduce air drag, installation of automatic speed control devices, and utilization of full primary loads in backhauling. These improvements are largely costless and are technologically and economically achievable. The end-use efficiency in the direct use, resulting primarily from management, is forecast at 10%.
2. Boiler Use
   Improved boiler or steam use offers the most improved efficiency in energy use through reduction of boiler losses, a curtailment of hot steam used to heat boiler feed water, and more efficient use of hot water. The conversion of fuel energy to usable steam energy results in the loss of energy, since the BTU input is greater than the BTU output as final steam. This loss is commonly referred to as boiler efficiency or fuel to steam efficiency. Energy is also lost in the form of hot air going up the stack, the incomplete burning of boiler fuel, radiation and convection losses, and other miscellaneous losses. It is possible that some losses can technologically be reduced by 14% by 1980. Much of this improvement will be in the operation and maintenance controls, better combustion controls, a minimization of blowdown procedures, repair of line and valve leaks, use of insulation, and sizing of boiler to requirements. Also important is the elimination of hot water leaks from equipment or hoses and the use of automatic shutoff nozzles on clean up hoses. Other measures could include proper clean up water temperatures and types of detergents with energy savings in mind. It is important to note that steam clean up uses considerably more energy than does hot water clean up. The second major conservation measure through reduced boiler use involves heat recovery from preparation steam in processing cooling water. It is technically feasible to reduce steam use by 5% in both precooking and retorting by exchanging heat from the two processes. One simple technique that could be adopted in seafood processing plants is the use of heat from refrigeration compressors being used to preheat water for hot water systems. The third boiler use conservation measure is to lower thermostats to reduce space heat. The temperature could be reduced to 50° during nonwork periods and 65° during work periods. This method would involve housekeeping and perhaps some capital investment.
3. Purchased Electricity
   Purchased electrical energy conservation techniques involve changing lighting practices and using electrically driven belts and motors more efficiently. Conservation of lighting energy is derived mainly by turning out lights and making more use of natural lighting by maintaining and cleaning windows and skylights. Capital investments in photocells, monitor switches, and fluorescent lights is technologically feasible. A second major conservation measure to reduce purchased electrical energy use requires sizing electrical motors to fit load requirements. It is estimated that a 3% gain of energy efficiency could be achieved if the above practices are implemented.

4. Other Considerations

Other considerations will actually increase the overall energy use by the processing industry. As human labor costs increase, technological innovations will be introduced to replace the high cost manual labor. It is anticipated that the increased use of mechanization will result in a 1% greater energy use by 1980. It is also estimated that enforcement of new regulations, as previously mentioned, (EPA, FDA, etc.) will also have or require an overall energy efficiency impact of approximately 1%. Consequently, during the next four years energy use will increase by 2%. The overall energy use efficiency goal is composed of three elements—gross goal, adjustments for other considerations, and net goals. The fish industry (SIC 2091) is estimated to be able to meet a gross goal of 12% in energy efficiency improvement by 1980. Adjustments for other considerations in complying with federal statutes reduce this goal by 2%, to yield a net goal for the industry of 10%. This goal is for the composite industry and it meets the criteria of technological feasibility and economic practicality. Energy used by seafood plants is important, but what should also be considered are the implications from suppliers. While the seafood industry may be a low energy user, what if their suppliers are not? Moral: Each processing company should obtain information on the vulnerability of their suppliers. One example of this is the energy used in container production.

ENERGY USED IN CONTAINER PRODUCTION

Container	Energy (TOE)
Tinplate	1.2
Aluminum	6.3
Plastics	2.9
Paper	1.6
Glass	0.4

TOE = Tonne Oil Equivalent

As seen in the above information, the type of containers that would be available to the seafood industry could change significantly should energy restrictions be imposed at the federal level. At the present time, aluminum cans are being used to package various fresh seafood products. While the company may have the processing line geared to the production of products in aluminum cans, energy curtailments may necessitate that a substitute product be obtained. It is quite possible that a substitute product will require the allocation of increased capital investment and require a time interval between the planning and implementation stages. Consequently, a food processing company may be forced to suspend processing operations for a considerable period of time.

Materials are purchased from a supplier. What happens if the supplier is forced to curb production? Moral: Get assurances from the supplier or look for another source. In analyzing supply information, the following should be considered:

1. Estimate the severity of shortages.
2. Project the time profile of shortages.
3. Decide whether the shortage is absolute or relative.
4. Anticipate the range of prices and supplies.
5. Estimate the timing of price changes.

There are several general considerations that seafood processors should consider and remember with respect to energy restrictions. A list containing the major aspects is as follows:

1. Unattractive products can become attractive.
2. Company should develop product rationing.
   - Rely on price.
   - Reduced allocations with penalty extra purchase.
   - Strict rationing.
3. Company should know consumer buying patterns with respect to supply and demand.

Seafood processors should set up contingency plans that can become quickly operational should a crisis develop. If a company anticipates substantial curtailment, it might want to activate a cost reduction program to protect profit margins. A similar program might be triggered by sharp increases in the cost of supplies. The final task is one of devising specific steps to be taken now, and possible steps to be taken if specified events occur in the future. A good procedure is to establish an action plan for immediate implementation and then formulate a series of contingency plans with trigger mechanisms.

A crucial element for the success of this whole exercise is to establish ways to measure the effect of the action and ways to follow events which are basic to contingency plans. Plans too often have been implemented without appropriate monitoring and control so that, if not disastrous, the results were less than desired. Implicit in the control process are steps aimed at evaluating the effects of a given plan on operations and profits. The company should go about an energy audit systematically, identifying and evaluating all relevant elements, and will surely come through the energy crisis in better shape than the one that doesn't. This should be the aim of management. Anything less would surely place a company in a situation that may have disastrous effects on its financial structure. Energy audits are perhaps one of the most useful devices a plant can have to inventory their energy use and

cost. The information to be obtained from an energy audit is as follows:

1. Historical and present energy usage and an assessment of energy sources having the greatest impact.
2. A compilation of specific current problems.
3. Industry profile of minimum energy requirements to maintain production at different levels.
4. A list of actions taken to conserve energy with expected savings and a list of alternatives.

The energy crisis was quite obvious in Virginia last year. As we look to the future it may be necessary to develop new institutional structures in order to meet expected energy problems within the future. Some of the changes to be made may not be desirable to management of current seafood operations. However, the alternative to accepting and adopting the changes may be to face uncertainty. One of the problems that affected the seafood industry last year was the curtailment on the use of natural gas. Perhaps in the future the seafood industry may wish to seriously consider the establishment of an industrial park which could utilize coal in a central type of boiler which would provide the necessary steam for space heating and product utilization. Also, if gasoline is restricted in the future, employees may not be able to drive to work and perhaps an industrial park would facilitate more effective carpooling and mass transportation.

In summary, the seafood industry should find it technically feasible to conserve 17% energy and economically practical to conserve 12% energy (9% from improved operating procedures). However, replacement of labor by machines and new regulations imply a 2% energy use increase. This should result in a net energy conservation goal of 10%.

FISHERIES DEVELOPMENT IN THE SOUTHEAST

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INTRODUCTION

Since 1960, the world catch of seafood has nearly doubled, while domestic production has remained essentially static. Though American fishery production has been constant, the Nation's appetite for seafood has sharply expanded. Through home and institutional routes, consumers purchased more than five million metric tons of seafood last year, with a retail value near nine billion dollars. The inability of domestic firms to meet this demand has lead to increased importation of fishery products, resulting in a balance of trade deficit approaching two billion dollars. At present, domestic production represents 37% of the edible seafood market, as compared to a 59% market-share in 1960.

NATIONAL OVERVIEW

With the passage of the Fishery Conservation and Management Act, the domestic industry has shown great interest in re-asserting itself. Numerous and formidable economic barriers must, however, be overcome. Specifically, the industry must address the following:

1. The industry base is fragmented, i.e. the seafood industry is composed almost entirely of small businesses. The majority of these enterprises are unable to acquire the financial, technical or managerial support needed for major expansion.
2. Over half of domestic processing plants employ fewer than 20 people, with annual sales of less than $350,000. By comparison, the average for other food-related industries approaches 56 employees, with nearly four million dollars in annual sales.
3. American vessels have limited harvesting capacities, with the average vessel employing three crewmen, or less, with annual gross earnings of less than $100,000.
4. Industry-wide capital requirements are substantial. To replace foreign participation, and achieve additional growth over the next 10 years, an investment of five billion dollars is needed to modernize and construct needed vessels and processing facilities. At present, the domestic fleet is capable of harvesting only one-fifth of the available finfish resources.
5. Domestic fleets and processing facilities are tradition-bound. For example, harvesting and production are concentrated on a limited number of species, with five edible species accounting for 60% of volume and 70% of value. Additionally, 80% of the industry fish catch is concentrated on a single species, i.e. menhaden. Expansion will require considerable product diversification with significant market development, both here and abroad.
6. Seafood transportation and marketing networks are poorly established. Most processing, storage, and transportation facilities, as well as marketing support services, are undeveloped. Considerable modernization and technical input, reflecting the experiences of other food-related industries, are required.

SOUTHEASTERN FISHERIES

The shrimp industry, the most important fishery in the Gulf and South Atlantic, has been beset by a series of problems over the past several years. Shrimpers have been faced with increased competition from imported product, resulting in a decline of dockside prices. Concurrent with this has been the escalation in operating costs, primarily due to increased fuel prices. Uncertain market conditions, combined with higher operating costs, have continued to squeeze vessel profitability, escalating costs in an already inflated marketplace. While fishing effort has continued to increase, both through a greater number of boats and more efficient gear, catch per unit of effort continues to decline. Treaties with foreign governments continue to phase out American shrimping in distant waters. Displaced vessels will return to territorial waters, thus increasing effort on domestic stocks.

To respond to these spiraling pressures, both industry and government have sought to focus attention on new fisheries. As described in a draft copy of Fisheries Development in the United States, a 1977 publication of the National Marine Fisheries

Service, significant new fishery potential may include:

Fishery	Potential Production (million pounds)
Trawl Bottomfish	3,400
Coastal Pelagics	5,800
Mullet	150
Squid	20
Spanish Mackerel	75
Inshore Sharks	50
Bonita/Little Tuna	10
Dolphin/Amberjacks	5
Slope Invertebrates	3
TOTAL	9,513

GULF AND SOUTH ATLANTIC FISHERIES DEVELOPMENT FOUNDATION, INC.

To address these new potentials, the industry trade associations of the Southeast, working through the cooperation of the National Marine Fisheries Service, formed the Gulf and South Atlantic Fisheries Development Foundation, Inc. While the Foundation is a new concept, its mandate for wise and careful fisheries development is clear. With direction from industry, and ongoing input from government, the Foundation has set out to serve as:

1. A means through which the commercial fishing industry can determine its research and development needs, then implement projects and programs to meet them.
2. A mechanism through which fishery-related funds can be channelled to meet mutually desired objectives.
3. A conduit through which public sector organizations can effectively coordinate their efforts via a single organization, representing both the Gulf of Mexico and South Atlantic.
4. A potential advisory body to the Gulf of Mexico and South Atlantic Fishery Management Councils.

The Foundation is directed by a Board of Trustees composed of one or two representatives from the coastal States stretching from Texas to Virginia. The Trustees represent Statewide organizations or, in the absence of such organizations, fishery cooperatives and/or individuals closely identified with a wide spectrum of Statewide fishing activities. To date, 15 Trustees represent the region.

Current support for the Foundations's activities comes primarily from the Coastal Plains Regional Commission and Economic Development Administration. In addition, member organizations contribute time and support, as do cooperating agencies and institutions. The Foundation aims to cooperatively establish research and development plans for those fishery resources that the Board believes have commercial potential. Thus, while the Foundation is a private, non-profit corporation, it works closely with state, Federal and other organizations that share similar goals and objectives. This working relationship includes the identification of problems that require limited commercial development; the development of problems and projects that attempt to solve these problems; and the responsibilities of each organization's role in such efforts. As a result, the Foundation seeks out the research and development expertise existing in the National Marine Fisheries Service, Sea Grant, state agencies and other institutions and agencies, endeavoring to communicate industry's concerns and interests. As appropriate, industry assistance and contracts are awarded to qualified individuals and organizations.

The Foundation, per se, does not intend to compete with state and academic institutions for existing monies, nor does it conduct research itself. Rather, the Foundation cooperatively administers development programs through the commitment of its Trustees, Executive Committee, and Executive Director. The Executive Director handles day-to-day activities including contract administration, information dissemination, and general staff support. He, in turn, relies on an Executive Committee composed of the President, Robert P. Jones (Southeastern Fisheries Association), Vice President, Robert G. Mauermann (Texas Shrimp Association), and Secretary-Treasurer, Norman P. Angel (North Carolina Fisheries Association), for ongoing guidance. Additionally, the Board meets quarterly, as well as being regularly apprised of important business and activity, particularly that which is within immediate purview of respective Trustees.

Central to the Foundation's goals and objectives is an effort to assist the States in developing more fisheries interest and support. Where endeavors are not currently available, the Foundation endeavors to bring resources forward. With the expertise already available, the Foundation endeavors to enhance both the conservation and better use of the marine stocks in the Gulf and South Atlantic.

FUTURE DEVELOPMENT

On a National scale, it has been estimated that for each one million dollars in additional fleet landings, 113 jobs, 33 directly in fishing and 80 in support industries, can be established. Consequently, if American production could offset one-half of the two billion dollar trade deficit in fisheries, well over 50,000 new jobs could be created. While this is not expected as an overnight turn-about, the potential

unquestionably exists. Research, development, and additional legislation are needed to stimulate this situation.

Through joint action of industry and government, fisheries development can thus mean the establishment of:

1. Solid economic bases for analyzing growth opportunities.
2. Basic information and training for industry diversification and growth.
3. Financial incentives, i.e. loans, loan guarantees, and tax incentives, to reduce risk and encourage expansion.
4. Mechanisms whereby industry can act collectively to solve its own problems.

Though little industry expansion has been noted in recent years, the future of fisheries development to the Nation offers:

1. Potential for greater cash flow and capital accumulation.
2. Increased interest by the investment community.
3. Greater opportunity for export market development.
4. Improved quality control and consumer protection.
5. Greater availability and variety of product selection.

While this development poses major challenges to industry and government, the opportunities and rewards are great, offering both public and private benefits. With the renewed interest in this Nation's fishing heritage and potential, the challenge will not go unnoticed.

FISHING FOR FUN & PROFIT

By DALE S. BEAUMARIAGE
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Reliable access to food resources has guided our human destiny for centuries. Transition from a nomadic life, wandering after roving animal populations, or following seasonal fruiting of wild crops, to the settlement of villages where agricultural practices provided man time to occupy himself with other pursuits, is generally acknowledged as the behavioral birth of civilization.

As these civilizations flourished, exploration of new parts of this planet became a pursuit of the bold and led to the birth of many nations, ours being one of the finest in history. Here, in Williamsburg, we are constantly reminded that considerable attention was given by the colonists to the importance of self-sufficiency in providing food for the people. Today's gathering is undoubtedly aware that initial settlement in a coastal area was no accident, for readily available seafood resources have facilitated the dispersal of human populations throughout the world.

As we think of the intervening time since our Nation was born here in Virginia, we recognize that our free enterprise system and democratic principles of government have allowed unprecedented growth. We have explored the interior of this vast country, tapped its great mineral and forest resources, and developed an agricultural capacity of substantial scope—so substantial that the value of our fishery resources are rudimentary in comparison to those of agriculture. However, it is not our standards which count anymore.

The value of fish as a primary renewable natural resource is today being examined by many nations and many groups of people within those nations. Perhaps this attention will establish the true value of fish to people more clearly than ever before. Historically, fish have been considered valuable either as food or for entertainment. Fishermen have been categorized as commercial fishermen, or sports fishermen, according to a variety of strongly held notions as to who were the better (or worse) of the lot. Government scientists and law enforcement officers charged with fishery management are, incidentally, held at various levels of esteem by both groups and widely manipulated by each according to the issue at hand.

George Kent, a political scientist at the University of Hawaii, recently stated in an article in Oceans magazine that "Traditionally, all oceanic resources have been understood as either res nullius or res communis." He further expressed the opinion that res nullius resources are "no one's and subject to appropriation, whereas res communis resources are anyone's, and not subject to appropriation." It is important that we correctly define these terms, particularly with regard to appropriation, since the essence of Kent's article on fishery management equity is fundamental to what I want to discuss. Black's Law Dictionary (Revised 4th Edition) states that res nullius means property of nobody. However, it occupies this status because it has never been appropriated by any person and because (in the Roman Law) it is not susceptible to private ownership. Res communis does indeed mean things common to all, and although capable of being used and enjoyed by everyone, even in single parts, can never be exclusively acquired as a whole.

Kent describes how, within the recent decade, the principle of common heritage has been adopted by the United Nations General Assembly. This common heritage principle is being interpreted by the Law of the Sea Conference participants as applying only to resources of the sea floor beyond national jurisdictions. Since it could, however, conceivably be applied to fisheries, we should be aware of four major points guiding its application. Kent listed these principles:

1. Peacefulness—The resources should be used only for peaceful purposes.
2. Equity—The benefits derived from the use of the resource should be distributed equitably. This in turn means that . . .
   a. As a common heritage, everyone is entitled to share in some measure in the benefits from the use of the resource. This necessarily implies non-appropriability, such that no individual, corporation, or government has the right to claim the resource for its own exclusive benefit.
   b. A greater share of the benefits should go to the poor.
3. Environmental Integrity—As the heritage of the future, as well as the present, users of the resources should show respect for the environment, limiting both depletion and pollu-

tion.

4. Common Management—To give effect to these principles, a governing agency responsible for their implementation must be established. That agency, acting in behalf of all mankind, should provide for participation by all affected parties in the making of its decisions.

Adopting these common heritage principles for management of international fisheries would also bear directly upon domestic fisheries, thus locking government squarely into a principal role in dividing up the pie due into its role as manager or trustee for all the people.

Division of the interests in fish stocks among government managers, recreational and commercial harvesters has permitted those stocks to be managed either for fun or profit, which have been considered mutually exclusive goals. Each civilian segment has used its influence to competitively gain advantage over the other via government's regulatory role so that archaic, subsistence-level exploitation or unreasonable access restrictions limit full utilization of many available fish stocks. Recognizing that fish stocks are limited, more often by habitat than reproductive potential, we have rightfully assigned government the task of assuring a renewable supply of these stocks through habitat protection plans, or by regulating fishing mortality through a variety of conservation laws. Unfortunately, the public share of the cost of assuring such a renewable supply may become disproportionate to the public value of the resource. This happens because economic principles which outline the most efficient allocation of resources cannot be applied where common property resources are involved. This is the basic flaw in attempting to have government equitably allocate scarce resources according to the principles of common heritage.

With no measure of resource value, the concept of a competitive market, efficiently allocating the resources needed for production, is inoperable. Resources under a competitive situation are allocated by an equilibrium of supply and derived demand for the resource which determines price and quantity traded. Supply depends upon both production costs and the availability of raw material, while derived demand for the resource is established by the marginal productivity of the resource and the final finished product price. Since a common property resource has no "true value" this allocation system cannot operate.

Although a great deal of effort is being expended to establish the recreational value of fish, there is no adequately definable market from which a price may be derived because of the high level of substitution of alternative recreational experiences and the inability to "measure" the value of the recreational experience. Similarly enigmatic is the measure of risk taken by commercial fishermen in employing capital and labor to catch fish as a profession. A value established for that risk would, however, more likely yield reliability from a market viewpoint, since economists can equate opportunity costs with excess profits earned by fishermen in a variety of fisheries and thereby demonstrate how much a man is willing to relinquish to remain a professional fisherman. (Excess profits exist after fishermen pay themselves a return for labor, management, and investment.) It is necessary to determine how much a sports fisherman will sacrifice to participate in taking similar risks to reveal a commonality of human desires which should reduce the schism between ardent members of each group.

The majority of the human problems encountered in fishery management are not caused by true fishermen, but by those people peripherally engaged in commercial or recreational fishing. They are first to champion unlimited and easy access as an inalienable right, they steadfastly refuse to acknowledge (and usually perpetuate) inequities in government fishery management programs, and they are the people to whom government is incredibly most responsive. True fishermen are risk takers. True fishermen pit their experience, time, and ingenuity against nature to succeed in catching fish. Their success resides in their ability to reduce the probability of failure. Dilettante fishermen want a guarantee of success for their investment of time or money. This difference is crucial in determining how fisheries will be managed.

Fishing must remain a primary food producing enterprise for its ultimate protection. This can and should be accomplished where fun and profit will complement each other and still permit our domestic fishing capacity to grow to the point where we may compete in the worldwide seafood market. If this Nation is to enter that market, I believe it is essential that we establish a precedent for considering U.S. fishery resources res nullius or res communis omnium rather than as belonging to the common heritage of mankind or res communis humanitatis.

I feel this distinction is subtle but vital to the free enterprise system. Legal scholar, Stephen Gorove, examining this common heritage concept in an article published in the San Diego Law Review recognized that the governmental machinery required to properly represent "mankind" would be necessary if the authority to delegate disposal of the interests in its property rights were to legally evolve in a substantive manner.

Fish should rightfully not be subject to government allocation while alive and free to move about. They should be equally accessible to all while in this state, with ownership conveyed to individuals only after the fish have been captured. The relative proclivity of individuals to excel in successful fishing would therefore guide the equitability of resource distribution.

Only with these criteria can government objectively protect the renewability and achieve the optimal sustained yield of fish resources. Otherwise, government is charged with the impossible task of equitably allocating resources with highly variable spatial and temporal distribution patterns and generally unpredictable annual abundance fluctuations.

Transferring the responsibility for developing techniques to predict such distribution and abundance patterns to the private sector via considering such resources res communis omnium will not only speed up the development of such capabilities, but should also instill an investment in those resources which will best protect their renewability.

Protection of resource renewability and full utilization of the food producing capabilities of our coastal zone (10 times more efficient in converting solar energy into protein than the richest terrestrial fields) is of utmost importance in a world where food is fast becoming the limiting resource for survival. It is shamefully naive and criminally indulgent to assume that we can appropriate common heritage resources for the entertainment of our privileged few in the face of critical needs and superior harvesting and processing technologies of other nations.

The issues involved in negotiating allocations for foreign fishing of surpluses within the new Fishery Conservation Zone come right up to the shoreline and into our bays and estuaries. The U.S. domestic fishing capabilities are miserably ineffective because fisheries in this Country have not played a significant role in its economy. We can change that, if not in domestic consumption, certainly in the world market. But first we have to put our inshore fisheries in order. We can no longer afford to have our house divided, sports interests pitted against commercial interests, fishermen against processors, government against all of the above.

Fishing for fun and profit will allow us to establish an economic climate in which the degredation of coastal water quality will not only be halted, but reversed. Fishing for fun and profit will encourage investment in risk taking, rekindle the indominatable American ingenuity which enabled us to tap other great wealths. Fishing for fun and profit can be accomplished in a free enterprise system where entry is limited by sound economics, not bureaucracy. However, it will take sacrifice, hard work, true sportsmanship and respect for nature.

The primary use of our fishery resources as food should be acknowledged by all concerned. This is a principal mandate of the Eastland Fisheries Survey and is totally compatible with the concept of optimal sustained yield. In fact, estimates ranging from 25 to 50% of the per capita consumption of seafood in this Country has been attributed to recreational catch, the size of which is yet to be adequately determined. There is clearly nothing to prevent us from viewing the food producing capabilities of our recreational fishermen as a latent labor force of commercial fishermen whose derivation of satisfaction from angling for their supper is supplemented by sale of part of the catch to defray trip expenses. Such fishermen should be accommodated by government but we should at all costs avoid the myopic view of accommodating them to the exclusion of other fishermen who capture fish with nets.

Remember, fishing is risk taking with no guaranteed satisfaction or success. It is also time; the probability of success increasing proportional to the time engaged in fishing. Not only is there room for both anglers and netters, but the processor, faced with trying to assure markets of dependable production from fickle Mother Nature, requires both groups working together to supply him with fish. Biologically, the distribution and abundance of fish is controlled primarily by habitat. This limiting factor must be recognized by all three user groups and they must stand together against those alternative uses of such habitat proposed by segments of our society unconcerned about food production and distribution. Although commercial and recreational fishermen have stood together in the past to stave off pollution and indiscriminate marsh dredging, they have now drifted apart and are quibbling over the remaining accessible fish resources in undegraded portions of our coastline.

Government can play a significant role in bridging the widening rift between user groups by providing a mechanism to facilitate deriving the fullest possible benefits to society from recreational and commercial exploitation of the stocks under its care. It can use the previously mentioned measure of opportunity costs, representing the sacrifice which true fishermen make to participate in taking risks on being successful in capturing (owning) fish, as an entry fee to obtain the privilege of having access to res communis omnium. This, combined with the institution of fishing guilds where professional fishermen display progressive levels of competency and responsibility to compete for better opportunities to acquire more of such common

property, should foster U.S. advancement in equitably allocating access to finite fishery resources.

Such a mechanism would permit a value to be assigned to common property resources and facilitate both exclusion of inefficient fishermen as well as reward most efficient fishermen according to the open market system. Individual owner-operators would proliferate within the commercial fishing industry because their level of economic profit would be lower than that required by large corporations, allowing owner-operators more incentive to fish. Devotion of more time to fishing would also create an incentive to reduce the risk involved, encouraging investment in new equipment that would improve domestic fishing capacity and modernize the industry. Corporations would be encouraged to vertically integrate exploration, harvesting, processing and distribution to attempt to derive the greatest overall benefit from every infrequent experience they have in simultaneously predicting market acceptance and resource availability. Acquiring the capital for such vertical integration would depend upon public investment, thus attaching a more tangible value to the renewable fishery resources. Each of these avenues is likely to be followed by businessmen operating under less government control in fisheries than is now being forecast.

Some species would likely be harvested only by recreational fishermen (depending upon the region), especially if they were encouraged to introduce some of their catch into acknowledged market channels. We would find that the enjoyment they received from the experience and the additional costs which they were willing to incur in capturing those fish would out compete some commercial fishermen in satisfying market demand. Some species would still require production efforts by both sports and commercial fishermen to satisfy market demand, but this competition would be in an open, free enterprise system, not behind the closed doors of some bureaucratic system where merit rarely has anything to do with decisions. Thus, the recreational harvest would be fully utilized, a true value would be established for fish products emphasizing their utility as food (a scarce resource, internationally), and all participants would be encouraged to fish according to government's recommendations of how best to perpetuate continued use of renewable, primary, unappropriable resources.

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NEED AND USE OF LOW TECHNOLOGY AQUACULTURE

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The harvest of traditional marine resources, once thought to be unlimited, has leveled off to between 100-150 million metric tons/year. This is probably close to the maximum sustainable level of harvest for these resources. We can speculate that using new techniques or exploiting new species may add another 25% to the harvestable fishery sometime in the future. The United Nations Food and Agriculture Organization (FAO) reported that, assuming continuous population increases, a world shortage of fishery products could be expected within 10 years (FAO, 1974). The report suggested several means of avoiding this shortage and one was to increase fishery production by aquaculture. NOAA reported that from 1970-1975 the world wide output from aquaculture had increased by about 50% to approximately 6 million metric tons (NOAA, 1975), giving support to the United Nations suggestion. However, because of the costs involved, it is doubtful that aquaculture will be a means of providing a source of inexpensive protein.

In the United States aquaculture has shown a dynamic growth over the last decade and one can cite the exemplary advances in salmon, trout, and catfish culture. The reasons for these advances are complicated, but technology, favorable economics, nutritional information for all life stages, and relative ease of isolating the growing areas are certainly among the more important aspects of the growth of freshwater and anadromous fish culture. One should remember that this was not an instantaneous industry. Much of the early work on these species was done in Federal and state hatcheries. In these hatcheries the basic techniques were developed, not with a profitable culture system in mind, but to restock streams which had been overfished. The culture of these species is now at a point where major advances are being made by genetic research.

The culture of marine species has lagged far behind. The reasons are many, but the lack of specific nutritional information, the competition with natural harvests, the inability of the mariculturist to conveniently separate his culture system from the marine system, and the difficulties imposed by multiple use and abuse of productive near-shore areas are among the more serious problems. From the standpoint of food production, particularly if multiple uses are to be made of the marine waters, it would appear that, generally, bottom dwelling species would be the most amenable to field culture in the United States. Of the benthic species, the bivalve mollusks have the greatest number of attributes that one would look for in a culturable species. The life histories of clams, scallops, mussels, and oysters have been known for years. A large number of species can be cultured and some tolerate a wide range of environmental conditions. The sessile nature of the organisms makes containing them in a relatively small area economically attractive. These species are herbivores, obtaining food by filtering the phytoplankton from the water and converting this directly into a protein source that is large enough and nutritious enough to be harvestable and usable by man. In addition, most species have an established market demand.

The interest in culturing these species in the United States is intense and in the last ten years there have been well over 100 private companies formed to culture one or more species of marine bivalves. Some of these ventures have been rather modest, consisting of a trailer or small greenhouse and grow-out areas, while others have been large, highly technical, and very costly systems. Some of these larger facilities attempt to avoid the problems of multiple use of grow-out areas by sophisticated, complicated, and costly engineering systems designed to complete the cycle from egg to market under controlled conditions. Unfortunately, the more technical, the more sophisticated, and the higher the energy demand, the greater the capital investment and the operational costs. Often, as a reflection of these costs, the unit cost of producing a shellfish is high when compared to simple field grow-out systems, or the price of the wild harvested product. Thus, for these complicated systems in today's market, the profit per unit of product is often quite low.

Although the trend in bivalve culture has been toward these more technical and more sophisticated methods, perhaps a critical evaluation of this trend is necessary at the present time. The cost of fossil fuels has greatly increased in the last few years and will probably continue to do so in the foreseeable future. These increased costs mean that energy saving procedures often make the difference in profit and loss in any type of production, not to mention those which have small profit margins to begin with. Another difficulty

with these large technical systems is that the capital investment is high for both starting and year-to-year operation. Relatively long periods (at least three to seven years) are usually necessary before any income is realized from such an endeavor; and even longer periods may be necessary before a profit can be shown. The current high interest rates make borrowing such large sums of money difficult, if not unattractive, to potential investors. The low profit margin, the high capital cost, and the high risk of failure in any new scheme makes the investment even more unattractive. Unfortunately, many research plans are satisfied if the end result shows a modest profit. In the financial community anyone who is going to invest in a high risk business expects high returns. These expected returns would have to be on the order of 20-40% in order to attract a major investor who has the capital to maintain the system for the three to seven years start up period. These arguments do not suggest these large technical schemes have no place in the culture scene, but do suggest that they still have to undergo further development before we are going to see their widespread acceptance by the financial community. This also suggests that anything that can be done to lower the capital investment may make the potential culturist more willing to risk the hardship of beginning a business.

To understand where we can save on this capital investment, we can look at a culture system and see which sections are most amenable to reducing the system's effectiveness. A bivalve culture system usually consists of the following:

1. A conditioning or holding unit for ripening or holding spawning stocks. The conditioning unit can be eliminated. Instead, the spawning season is increased by utilizing spawning stock from other areas as natural gonadal development occurs. It is cheaper to ship animals than to maintain them in a warm or cool system.
2. A spawning unit. Instead of using expensive heat exchangers, spawning can be accomplished using a simple water bath to heat spawning stocks in small containers of sea water. Alternatively, spawners can be placed in a trough where small volumes of running filtered sea water can be introduced through a coil of plastic tubing immersed in a container of heated water.
3. A larval culture unit. Larval culture uses filtered centrifuged sea water warmed in a solarium or greenhouse. Temperature is controlled by use of fans to exhaust heated air.
4. A plantigrade culture unit (post larval stage). Plantigrade culture can be carried out utilizing ambient sea water with only a minimum of filtering and no food added. Temperature control is not needed.
5. A juvenile grow out or nursery unit. Juvenile grow out can be carried out in the field where protection can be provided or in small, controlled, benthic nursery areas.
6. A finishing grow out or final grow out unit. Finishing or final grow out may require thinning of the nursery areas or planting of the rafted individuals in benthic beds. Some individuals may be harvested at this time.
7. An algal culture or food production unit. The area of greatest initial savings is in the algal culture unit. Instead of using unicellular algal culture with its attendant high labor costs, the Wells-Glancy method can be used. This consists of either selectively filtering or centrifuging sea water and storing it in gently aerated tanks in a solarium. The small phytoplankton that passed the filter or centrifuge bloom in the tanks that are warmed and lighted by the sun. After 24 to 72 hours the filtered seawater, with its bloom of phytoplankton, can be used as growing media for the larvae. This has the advantage of having a natural mixture of species and there are no major costs of labor or energy to maintain the system. In addition, the use of natural water for feeding the plantigrade and field grow out eliminates the need for culturing large volumes of phytoplankton to support growth of the species. These factors also eliminate the need for large troughs or for pumping large volumes of water.

The above method has been in development at the Virginia Institute of Marine Science Eastern Shore Laboratory for a number of years and the use of these simple techniques has been shown to be practical. Several groups are utilizing the system in commercial ventures.

Thus, until major advances are made in the highly technical systems, a less captial-intensive means of culture can be utilized. The system is flexible so that it can be used on a variety of species; and portions of the more technical systems can be incorporated as they become economically attractive.

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A PRELIMINARY ASSESSMENT OF THE SUPPLY AND DEMAND FOR MARINE SCIENTISTS AND ENGINEERS

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INTRODUCTION

The assumption that one can predict the future about anything with any degree of confidence is dangerous. Furthermore, to assume that one can predict manpower needs, particularly for an extremely small segment of the National manpower needs, is doubtful. Nevertheless, I will attempt to briefly look at the supply and demand factors that are available and offer, at least, a qualitative assessment of the employment opportunities that are likely to be available for marine science graduates.

The task of a meaningful manpower assessment is further complicated because the assessment of manpower needs should be on an individual discipline basis such as physical oceanography, rather than on a general basis. Unfortunately, National statistics are often not kept to this degree of specificity. In addition, in attempting to use past and current data from which to extrapolate future data rules out the event of a major perturbation to the system. For example, the recent move of a portion of the Office of Naval Research from the Washington, D.C. area to Bay St. Louis, Mississippi lead to a rather substantial demand for physical oceanographers because a number of oceanographers who were employed in the Washington area did not wish to make the move to Bay St. Louis.

By the way of one further disclaimer it should be noted that the Social Science Data Center at the University of Connecticut is presently conducting a major study of the present Federal support for the marine sciences and the effect that current trends might have on the future of marine sciences. As part of this study, some evaluation of manpower requirements will be made. Also, the National Academy of Science is initiating a study on marine scientist requirements. When these two studies are completed, I would hope that much more definitive statements regarding the opportunities for marine scientists can be made.

SUPPLY SIDE

Before discussing the supply side of the marine science equation, it might be worthwhile to look at supply and demands for scientists and engineers as a whole. The most recent data are presented in Figure 1 from a report of the National Science Foundation (1). It may be seen that in the five major categories, the 1972 supply slightly exceeds the demand and in 1985, this increase in supply over demand will increase. This is particularly true in engineering and social studies. This leads to the situation shown in Figure 2 (1) where it is predicted that there will be about a 15% increase in non-science and/or engineering activities by those holding doctorates in 1985. This increase in non-science and engineering employment is brought about because of the competition for jobs within ones primary discipline. Therefore, it should be expected that competition in the science and engineering area for people involved in education and research and development will be quite keen.

Turning to the supply of marine scientists, Table 1 (2) indicates the number of marine scientists and engineers who are listed as receiving degrees for the years 1972-73, 1973-74 and 1974-75.

Table I - Degrees Conferred by Degrees and Years.

	1972-73			1973-74			1974-75		
Discipline	B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
Oceanography	292	154	89	237	199	70	253	169	95
Marine Biology	96	19	14	163	99	25	273	87	15
Ocean Engineering	88	112	10	136	80	36	210	99	28
	476	285	113	536	378	131	736	355	138
General Biology.....	31,571	2,983	627	36,630	3,210	657	39,153	3,139	637

from Reference 2

The source of these data does not present any information for chemical oceanographers or geological oceanographers. However, the "oceanographer" category is listed under the heading of physical scientists and may include these two disciplines. The "marine biology" description probably does not include biologists that are aquatic oriented and who would, in fact, seek employment as marine biologists. The bottom row of figures indicates the number of "General Biology" degrees conferred during the same time period. It can be seen if only 10% of these graduates are in a marine related area that it will have the effect of causing about a 50% increase in the total number of doctoral graduates available in the marine sciences. Essentially the same situation applies in the categories of General Zoology, Physiology, Biochemistry, and the various engineering disciplines. Therefore, even through National statistics on degrees conferred are gathered and documented, it is still virtually impossible to accurately assess the present new supply of manpower available for careers in marine scientist.

It can be assumed; however, from Table 1 that there is a gradual but increasing trend in the number of degrees awarded in the marine sciences. Therefore, the new entries into this job market appear to be slightly increasing.

DEMAND

In attempting to estimate the demand for marine scientists, two approaches were taken. The first was an attempt to get direct estimates of jobs available. The second was an attempt to determine a trend in Federal research funding which, one could argue, is indicative of the manpower requirements.

The attempt to obtain a direct estimate of manpower requirements was pursued by communicating with a representative number of industrial employers of marine scientists, major academic institutions in the marine sciences, the Bureau of Labor Statistics, the National Science Foundation, and the Scientific Manpower Commission.

The rather limited survey of prospective industrial employees indicates that none of these firms was actively seeking marine scientists and only one indicated that they expected to seek any in the near future. Because of the small size sample, it should not be concluded that there are no openings for marine scientists in the industrial sector. However, the results of the survey do indicate that the industrial sector is probably not a fruitful area for those seeking employment in marine sciences. One exception to this picture could be in the consulting field in areas of environmental impact assessment. This type of activity is being performed by a large number of small to medium sized firms.

The major academic institutions in the marine sciences were surveyed because they are supplies of employees and, therefore, it was expected that they would have knowledge of employment opportunities. In addition, they themselves are one of the major employees of Ph.D. degree holding marine scientists. The result of this small survey that was conducted through the various university placement centers yielded little information on employment prospects. It is clear that at the advanced degree levels, employment is sought directly within the individual discipline. Job opportunities come to the attention of the faculty and are passed along to the graduate students on essentially an individual basis.

In terms of universities as employees it appears that there has been an increasing number of schools that have recently begun new marine science programs, or which have enlarged ongoing programs. This expansion of university activities has obviously had an effect on both the supply and demand. On the supply side, the increasing number of universities offering degrees will obviously lead to an increasing number of people in the job market. On the demand side, the growth of these programs has lead to the need to employee faculty to operate the programs. It appears that in the early 1970's the balance may have favored the demand side, but recently the balance favor the supply side.

The Bureau of Labor Statistics in the Department of Commerce has compiled some statistics on the anticipated need for oceanographers. This category "oceanography" is one of 800 categories used by Bureau of Labor Statistics and it is impossible to know exactly who is included in this designation. Their estimate of employed oceanographers in 1976 is 2700. Their estimate of demand in 1985 ranges from 3100 to 3400. They also estimate that 100 to 125 openings per year will be available to meet this expansion and to replace normal attrition.

In attempting to assess the growth of oceanography through Federal support, the most useful documents come from the annual study by the National Science Foundation (3). Figure 3 indicates the level of support from 1967 through 1978 for basic and applied research. With the exception of the period from 1972 to 1973, there has been a steady growth in the funding of oceanographic research by the Federal Government. The average increase for combined basic and applied research has been increasing about 20 million dollars per year for the past several years. Based on the 1977 budget of 184 million dollars, this is an increase of about 10%. While this may appear

to be a rather substantial increase, in the light of present inflation the real program increase is probably less than 4%. The other information shown on this Figure is the percentage of research funds that are allocated by the Federal Government as a percentage of their total ocean program. It may be seen that for the last 3 years, this percentage is reasonably small, and about the same, which indicates that there is little or no emphasis on increasing Federal funding for oceanographic research. This rather nominal increase in past and present Federal funding is consistent with the nominal increases in the employment patterns that have been predicted directly. It is, of course, recognized that direct employment assessment use Federal funding levels as an input to the estimate.

COMPARISON OF SUPPLY AND DEMAND

The important factor in assessing manpower requirements is the relative value of supply and demand. It appears that the total supply of oceanographers or marine scientists/engineers is sufficient to meet the demand based on the estimates of National Center for Education Statistics in the disciplines of oceanography, marine biology, and ocean engineering. If the assumption that a small percentage of general biology graduates will also compete in the marine sciences job market then it is apparent that the supply greatly exceeds the expected demand.

The still unanswered question that is of paramount importance to prospective graduate students and university programs is: within the marine science field, are there disciplines where the supply exceeds the demand and other disciplines where demand exceeds supply? If one attempts to advise prospective graduate students or develop or strengthen programs, this must be done on a discipline basis such as physical oceanography or biological oceanography. To the writer's knowledge there are few definitive statistics that can be applied to answer this question. The one piece of information that may provide some insight is a breakdown of funding by description of the Navy's Ocean Science Program (4). Table II shows the funding from 1972 to 1976.

Table II - Funding for Naval Oceanographic Program

	Fiscal Year (In Millions)				
	1972	1973	1974	1975	1976*
Underwater Acoustics	$26.7	$24.3	$25.3	$25.5	$28.0
Physical Oceanography	20.7	19.0	19.3	19.3	21.4
Geology and Geophysics	9.3	8.5	8.6	8.6	9.8
Chemical Oceanography	2.2	2.0	2.0	2.0	2.2
Biological Oceanography	3.7	3.4	3.4	3.4	3.7
Engineering Research	3.1	2.8	2.7	2.9	3.2
Other	2.5	1.1	0	0	0
Total	$68.2	$61.1	$61.3	$61.7	$68.3

*Estimated figures only

from Reference 4

Two factors are obvious from this table. One is that engineering, including acoustics, and physical oceanography are the predominant areas of activity in the Navy's program. The second is that there has been little change in funding over these years. Of course the Navy's program represents a rather specialized need for marine science information. In addition the entire Department of Defense's ocean program only represents about 30% of the Federal Ocean Science efforts (5). Obviously, agencies such as the Environmental Protection Agency and the Bureau of Land Management have very different research needs, and as a result are funding in quite different areas.

Because such limited data on demand of marine scientists by discipline is available, perhaps the best approach is to make subjective judgements based on informed opinion. The writer attempted to draw on the opinions of those in the academic community, Federal agencies, and private industry. Unsubstantiated opinions seem to be that there presently exists, and will continue to exist, an excess of biological oceanographers, or marine biologists. Chemical oceanography, and to a limited extent, geological and physical oceanography are rather small disciplines in terms of numbers of people employed. Because of the small size of the work force, rather subtle changes can produce

rather important changes in the supply/demand ratio. For example, the initiation of an ocean mining effort by firms in this Country could provide sufficient demands for marine geologists to completely change the employment potential for marine geologists. For this reason it is difficult to make definitive statements about future supply and demand balances in these disciplines. The ocean engineering discipline is also rather small and highly varied. Although the concensus of opinion is that ocean engineers will be in demand, it is important to note the lateral mobility of engineers from traditional land based employment to marine based jobs. This lateral mobility probably would come into play in the event of a major new demand for certain types of ocean engineers.

I confess that this presentation has probably shed little light on the assessment of employment potential for marine scientists and engineers. However, the presentation may have served its purpose if it raises a warning flag that jobs may not be abundant for recent and future graduate degree holders in marine sciences.

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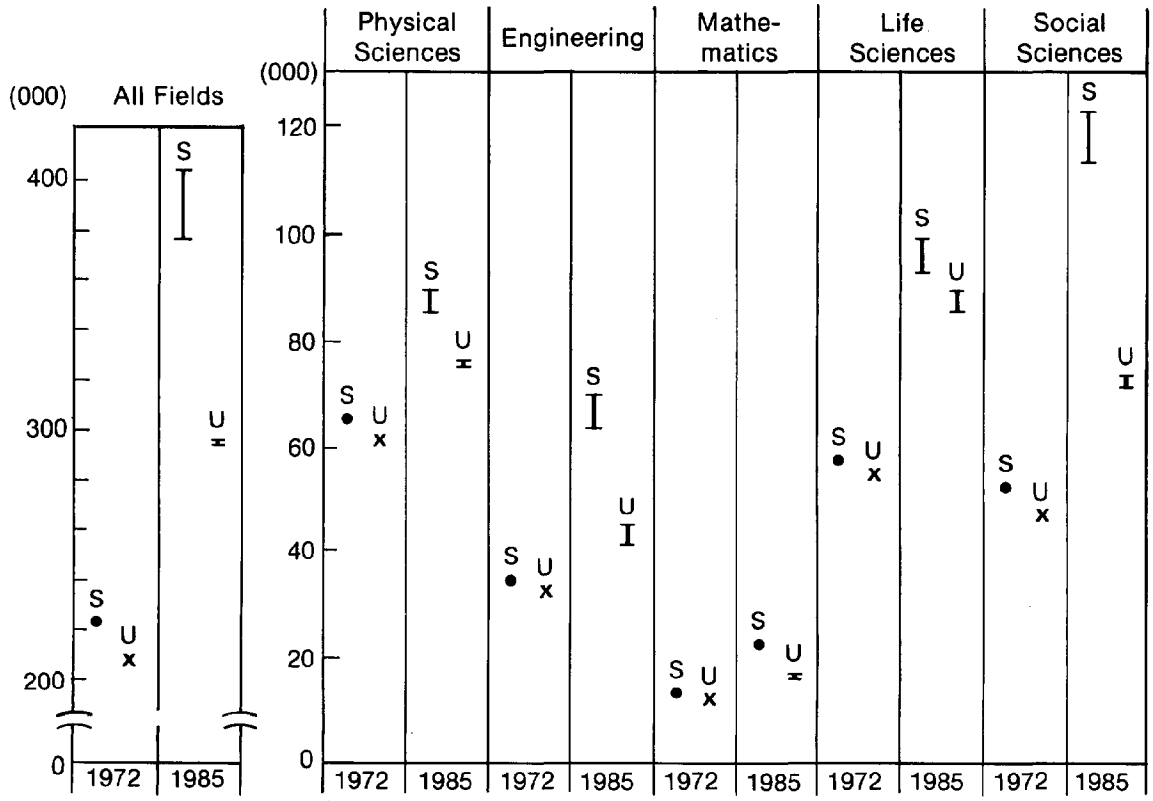
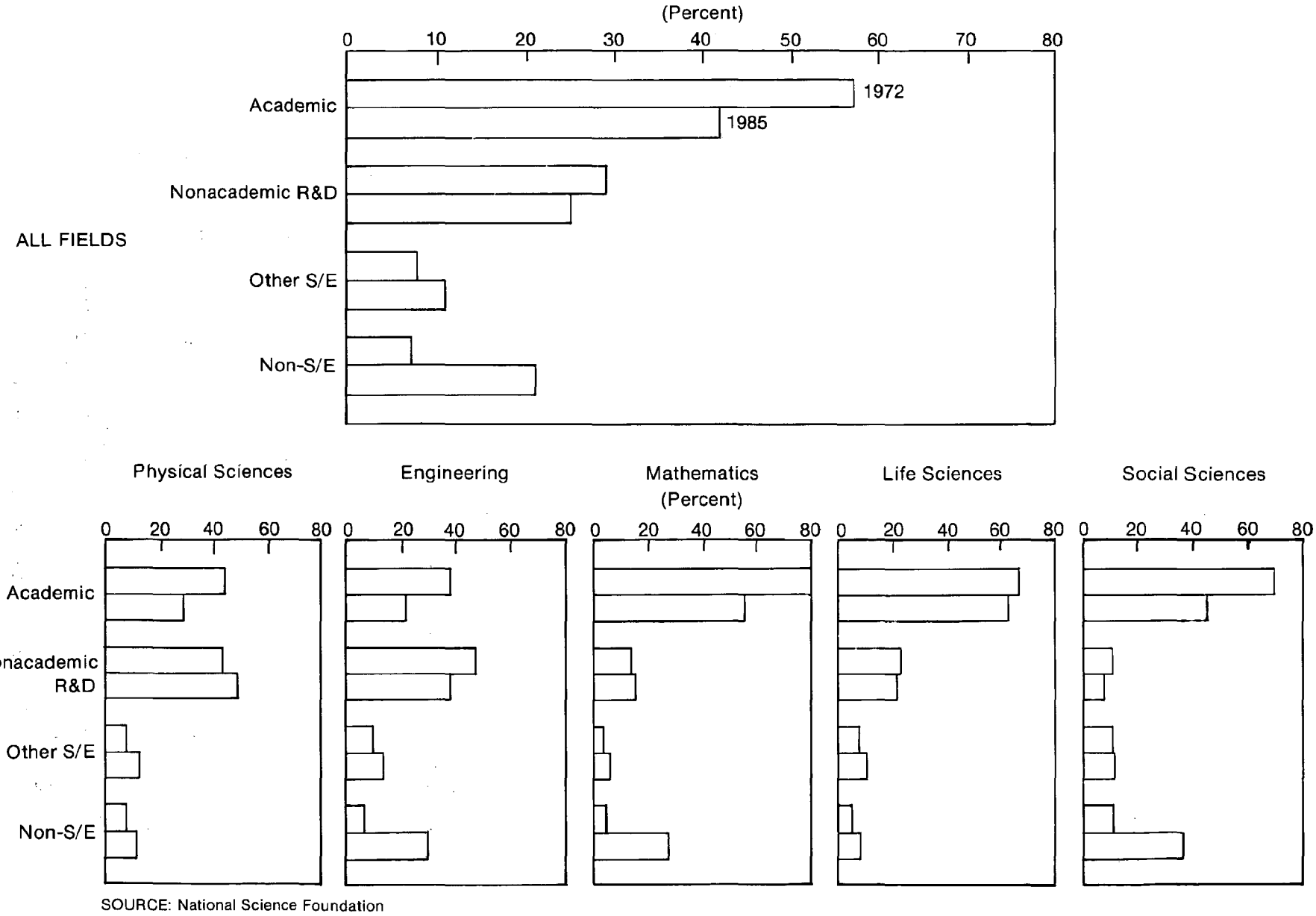


NOTE: Vertical bars indicate range between Probable and Static Model values of supply and utilization.
SOURCE: National Science Foundation

Figure 1. Supply and Utilization Ranges of Science/Engineering Doctorates, 1972 and 1985.



SOURCE: National Science Foundation

Figure 2. Utilization of Science/Engineering Doctorates, 1972 and 1985 (Probable Model)

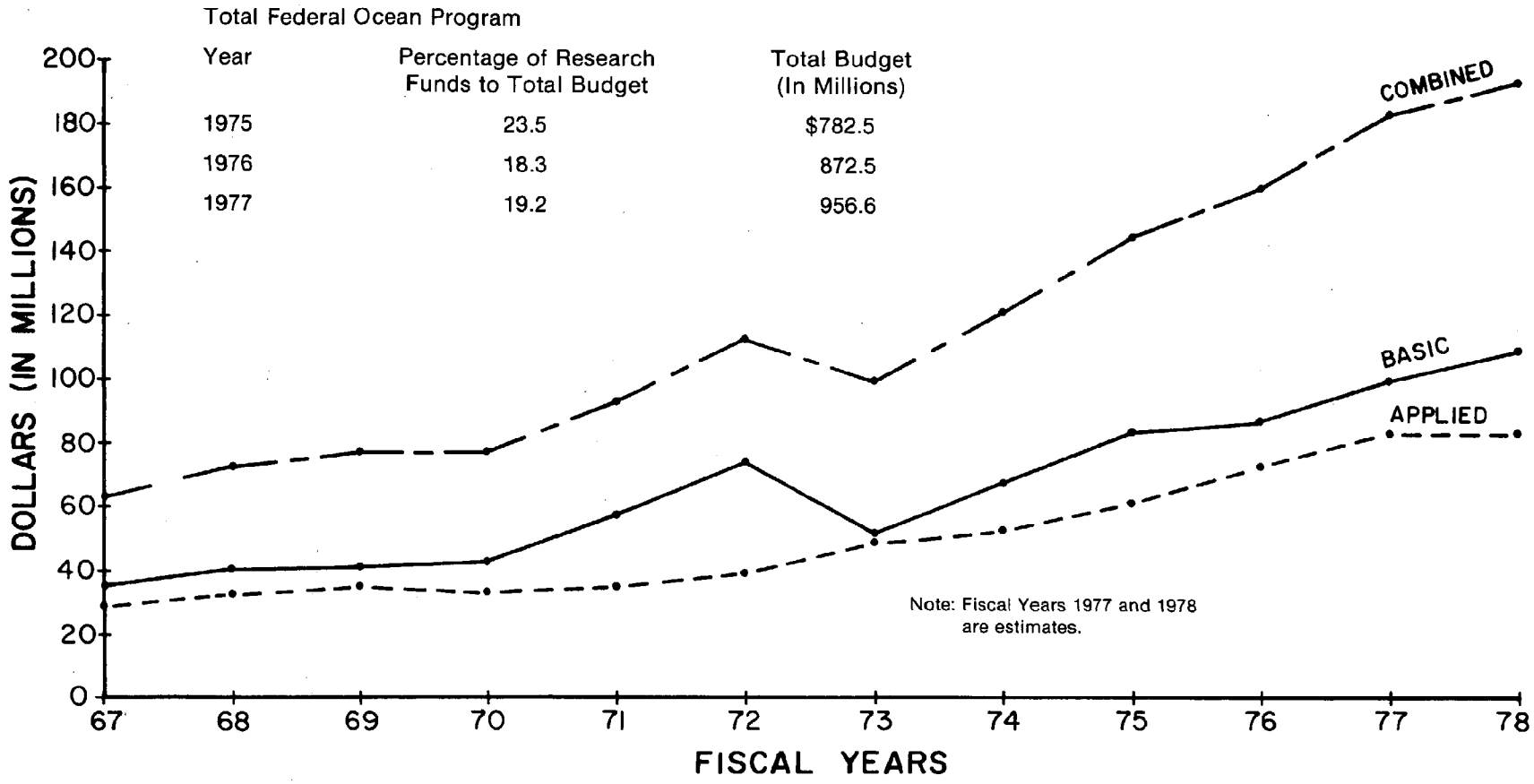


Figure 3. Federal Funds for Basic and Applied Research In Oceanography.

MARINE EMPLOYMENT OPPORTUNITIES IN THE SOUTHEAST

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Marine employment is concerned with the production of goods and services used on, or in, the water, or in the development of resources from the sea. Employment in the marine sector of the United States is comparable to agriculture. While farm labor is in contraction, marine employment will expand well into the 1980's. This study is limited to only five industries that are part of the marine sector. They are shipbuilding and repair, boatbuilding and repair, commercial fishing, water transportation, and those establishments that directly service and supply the other four employment settings. This last group includes marine electronics firms, marine engine, electrical, welding and repair shops, chandlers, line and net shops, and similar firms specializing in providing goods and services to the marine market.

The part of the marine sector not examined in this study is too large to identify here in any detail because it would have to include the manufacturers of sporting goods for use on or in the water, bait shops, marinas and yacht basins, aquariums, numerous marine science and high technology-based marine establishments, the U.S. Army Corps of Engineers, the numerous marine education programs at the secondary and university level, the U.S. Coast Guard, and many similar marine-oriented Federal agencies. All of these examples are part of 19 distinct employment settings that can be identified in the Standard Industrial Classification Manual.

The geographical focus of this study includes the northern parts of Florida extending from a point slightly below St. Augustine, and crossing the State on an imaginary line to include Panama City and Pensacola and all of the labor market above this line. While the major port cities of Brunswick and Savannah, Georgia, and Charleston, Georgetown, and Beaufort, South Carolina represent the centers of marine activity of those States, the entire labor markets of the two States were used for purposes of data collection, reduction, and final analysis. Therefore, all employment figures reported here reflect the major marine sector of South Carolina and Georgia and slightly more than one third of Florida.

PURPOSE OF THE STUDY

Employers in the study region have, for several years, encountered difficulty recruiting and holding technical and skilled workers in certain marine crafts. While a number of reasons can be cited to explain why this difficulty has persisted, only one explanation applies to all five employment settings. This is the lack of a supply of trained personnel adequate to the growth in demand of those industries in the region that compete for skilled workers. There are few training programs for new workers and wage rates in similar industries drawing on this labor pool are often more attractive. The purpose of this study is to document the current and near-future manpower requirements of the region's marine sector. The results of this study demonstrate that the five employment settings that make up the marine sector are undergoing rapid expansion and the need for certain technical and skilled workers is substantial in 1977 and will continue through 1980. The data used to make these manpower determinations were collected over a four month period, March through June 1977, and were assembled through the joint cooperation of individuals in private industry, Federal and State Government agencies, and public education at the State and local level.

THE STUDY DESIGN

The differences in occupational structure and employment settings in the marine sector preclude the use of a single methodology for determining manpower requirements. A separate set of procedures was designed to measure employment levels, growth, and total demand for each of the five industries. In the case of the shipbuilding and repair industry, different operations had to be tailored for each of the three States. For example, in South Carolina, shipbuilding employment is primarily made up of civil service workers in the Charleston Navy Yard where job turnover is very low. This is in sharp contrast to the situation in Florida, where all shipbuilding and repair is almost exclusively concentrated in the private sector making it particularly sensitive to a different range of market influences.

Consequently, the methodology used in conducting this investigation consisted of three independent operations. First, all available State and Federal labor market reporting systems were used to establish an accurate base for determining 1977

and 1980 employment levels in the five marine industries. As part of this first operation, the author followed the research procedures recommended by the U.S. Department of Labor's Bureau of Labor Statistics (BLS). The author also had access to the BLS data in the Labor Department's Regional Office in Atlanta. The second operation included the design of a special mail survey instrument that was sent to 1,000 selected marine employers in the study area. The results of the survey provided an accurate measure of 1977 employment in five technical and twenty-four craft occupations. The third operation consisted of interviewing forty persons from each of the five employment settings, government officials, and other persons familiar with local labor market conditions. Each person interviewed was asked to assess the survey results for their particular industry and market area. Both the interviews and survey results provided a means for estimating the growth in employment between 1977 and 1980 as well as pinpointing specific manpower problems critical to the industry.

OVERVIEW

Employment in the region's five marine industries for 1977 is 57,562 and is projected to increase by 13,654 new workers to 71,216 in 1980. This represents an annual rate of growth in marine employment of 7.9% which is slightly more rapid than the 6.4% of the region's non-agricultural employment. Ship and boat building and repair, water transportation, and all of the marine service and supply firms that support these industries should all participate in this expansion, while commercial fishing will maintain a much lower increase in employment over the three-year period. Specific industry employment levels can be compared in the table below.

Total Marine Employment
In The Study Region

Industry	1977	1980	Average Annual Rate of Growth
Shipbuilding and Repair	13,876	15,980	5.1
Boatbuilding and Repair	8,945	11,334	8.9
Water Transportation	12,238	14,319	5.7
Commercial Fishing	14,322	15,009	1.6
Marine Services and Support	8,182	14,574	6.6*
Total	57,563	71,216	7.9%

*This rate does not reflect the addition of new firms, only the expansion of established firms in the marine service and support industry.

Marine employment in 1977 represented 1.25% of the study region's total non-agricultural employment of 4.583 million. This total non-farm employment for the region is made up of 1.169 million for South Carolina, 2.061 million for Georgia, and 1.353 million for Northern Florida. Total employment for 1977 is an estimate representing a simple extrapolation of historical trends between 1970 and 1975, whereas marine employment in this report is a measured figure based on the manpower survey and follow up interviews with employers.

Table 1, at the end of this paper, is a composite of total demand and the number of average annual job openings for the region's marine sector by selected occupations for the period 1977-1980. Total demand for all five employment settings is projected to be 39,719 by 1980 while total demand for the 29 selected marine occupations will be 26,459 constituting 66.6% of the larger figure. The number of job openings in the 29 selected marine occupations is projected to be 8,823 each year between 1977 and 1980.

SHIP BUILDING AND REPAIR

The region's ship building and repair industry is made up of 23 firms with the largest, the Naval Shipyard in Charleston, employing 7,200 workers. Within the three States of the study region are shipyards ranging in size from 200 to 2,000 employees. While most firms have the capacity to undertake new construction, current employment is primarily concentrated in ship maintenance, modification, and repair. Total employment in this industry is 13,876 in 1977 with a projected expansion to 15,980 in 1980. The shipbuilding industry is often compared with the construction industry because of its cyclical nature and dependence on skilled craftsmen who move from firm to firm, frequently changing their place of residence. This industry has slowly regained its economic strength after a long period of stagnation. While Navy yard employment is not expected to undergo a significant growth, shipbuilding and repair in the private sector is anticipated to expand in the region by 15% between 1977 and 1980 with Florida increasing employment at a rate of 9.3% per year. Projected employment increases in Georgia, on the other hand, will reflect the traditional historical trend of only 2.1% annually with South Carolina increasing at a slightly higher annual rate of 2.3%. While it is unlikely that these anticipated growth rates will decrease before 1980, any new major shipbuilding program of the magnitude of the Merchant Marine Act of 1970 will greatly increase future expansion. For example, in 1973, under the Federal Government's Construction Differential

Subsidy Program, 1.3 billion dollars of contracts were let, with the region's shipyards receiving their share. Without government subsidy programs, the private sector yards have been in a position to successfully compete in the international market for foreign ship conversions and repair contracts. An equally important area that will influence future shipyard employment is the emergence of the offshore industry. Semi-submersible drilling rigs, jack-ups, and drill ships are all fabricated in regular shipyards. Should current exploration activity in the Atlantic prove that large deposits of oil exist, a new and sustained demand will be exerted on the established industry. However, there is already a major concern on the part of many industry leaders over the entry of new types of establishments into the region, firms which may require large numbers of technical and skilled workers presently employed in the industry. All of this exerts a build-up of pressure on the existing pool of labor, thus forecasting the need to train new workers and to upgrade a large number of the established work force. Table 2 shows that for each year between 1977 and 1980, there will be 2,751 new job openings in the 29 selected marine occupations that were measured in this study. Of this number, 460 will be the result of expansion and 2,291 will be required to meet average annual job turnover due to voluntary separations, deaths, and retirements.

BOAT BUILDING AND REPAIR

In terms of diversity, the boat building and repair industry is unique within the region's marine sector. Firms range in size from small two or three employee operations producing a few boats per year, to internationally famous builders who frequently employ more than 400 workers and construct upwards of one hundred large commercial fishing trawlers annually. The technology utilized in the modern boating industry includes the working of various types of woods, metals, and synthetic materials such as fiberglass and ferro cement. Vessel technology includes special propulsion units, steering gear, deck machinery, and auxiliary equipment utilizing every form of modern mechanical and electrical energy. This includes electronics, refrigeration, hydraulics, pneumatics, and even small steam generating systems for distilling sea water. By considering the technology in use, the size of the work force, capital requirements, and markets served, the boating industry begins to compare with ship building in its importance to the region's economy, particularly in its demand for well trained manpower.

New boat construction is only one segment of this industry, and for Florida, its only State rival is California. When the total number of establishments in Florida, as a whole, are joined with Georgia and South Carolina, the overall region in 1976 accounted for 10.6% of the entire U.S. boating industry.

The following table has been prepared to illustrate the size of the region's boat building segment relative to the other types of establishments that make up the overall boating industry for 1976.

THE REGION'S BOATING INDUSTRY

Major Groups	National Total	FLA.	GA.	S.C.	Three-State Totals
Marine Dealers	11,314	838	206	160	1204
		7.4%	1.8%	1.4%	10.6%
Marinas & Yacht Harbors	2,441	208	15	31	254
		8.5%	.6%	1.3%	10.4%
Marine Retailers	17,997	1378	294	284	1956
		7.7%	1.6%	1.6%	10.8%
Average:		7.9%	1.3%	1.4%	10.6%
Specific Types of Firms					
Wholesalers, Distributors, or Jobbers	2,041	161	27	29	
Boat Builders	2,089	165	27	29	
Sailboat Builders	288	23	4	4	
Access. & Equip. Mfrs.	2,441	193	32	34	
Mfr's Representatives	1,006	79	13	14	
Mass Merchandisers	1,163	92	15	16	
Electronics Dealers	3,092	244	40	43	
Yacht Brokers & Consultants	260	21	3	4	
Outboard Motor Dealers	10,108	799	131	142	
Outboard Boat Dealers	9,723	768	126	136	
Inboard Boat Dealers	5,843	462	76	82	
Houseboat Dealers	2,324	184	30	33	
Inboard/Outboard Boat Dealers	7,774	614	101	109	
Sailboat Dealers	5,764	455	75	81	
Aux. Powered Sailboat Dealers	2,177	172	28	30	
Pontoon Boat Dealers	3,449	272	45	48	
Hdwe. & Access. Dealers	12,395	979	161	174	
Boat Trailer Dealers	10,188	805	132	143	
Inboard Engine Dealers	3,626	286	47	51	
Safety Equipment Dealers	10,500	830	137	147	
Boat Materials (Repair) Dealers	6,923	547	90	97	
Paint Dealers	9,891	781	129	138	
Rope & Cable Dealers	11,063	874	144	155	

The principle source of the statistical information used to construct the table is the National Boating Industry Association, but this source represents only a part of this employment setting. Since membership in the trade association is voluntary, not all employers are included in the data displayed in the table. Inasmuch as the focus of the manpower study is to measure employment among employers only in the study region, a more comprehensive and precise listing of boat building and repair firms had to be developed. To prepare this list, a computer printout maintained by the U.S. Coast Guard of more than 5,000 boating manufacturers was used. This more extensive source reports the name of the firm and its address as well as indicating the type of boats manufactured. The list also records additional information required by the National Boating and Safety Act of 1974. Using this source, the study team identified 452 boat building and repair firms in the region. This number is considerably greater than the 252 boat building firms that are members of the National Boating Industry Association and reflected in the above table. Perhaps a number of the 734 Boat Materials (Repair) Dealers reflected in the table are included as part of the U.S. Coast Guard computer listing. This would begin to explain the large difference between the two sources. Unfortunately, the study staff had no way of making this determination. Therefore, the U.S. Coast Guard Boating Safety listing was used in the mail survey.

Employers who were interviewed point out the

impact which fiberglass has had on the boat repair business, suggesting that this factor be considered when planning new training programs. Fishermen, as well as sportsmen, are currently replacing traditional wood vessels with fiberglass hulls. In at least one marina the repair service has declined by a factor of seven because of the change to the large use of fiberglass. The following tables of commercial boat registration in Florida between the years of 1973 and 1976 are an illustration of this dramatic change. The total commercial registrations have increased by 4.1%. The largest increases have been in fiberglass (33.8) and aluminum (14) boats. There are large increases in fiberglass boats in the 16-26, 26-40 and 40-65-foot classes. Boat builders and commercial fishermen in Florida are now demonstrating that these boats are versatile craft that can change gear quickly and fish for different species depending on the season, supply, or market price.

Florida Commercial Boat Registrations for 1972-73 and 1975-76[a]

	Under 16 feet			16 feet to under 26 feet		
Type of hull	72-73	75-76	Percent change	72-73	75-76	Percent change
Wood	5,547	3,583	-35.4	4,600	4,605	+ .1
Aluminum	1,499	1,569	+ 4.7	211	419	+98.6
Steel	58	53	- 8.6	57	65	+14.0
Fiberglass	4,932	5,406	+ 9.6	2,343	4,023	+71.7
Other	168	159	- 5.4	43	47	+ 9.3
Total	12,204	10,770	-11.8	7,254	9,159	+26.3

	26 feet to under 40 feet			40 feet thru 65 feet		
Type of hull	72-73	75-76	Percent change	72-73	75-76	Percent change
Wood	1,873	1,815	- 3.1	1,113	1,082	- 2.8
Aluminum	103	74	- 28.2	21	25	+ 19.0
Steel	122	106	- 13.1	114	129	+ 13.2
Fiberglass	486	886	+ 82.3	104	210	+101.9
Other	9	19	+111.1	4	5	+ 25.0
Total	2,593	2,900	+ 11.8	1,356	1,451	+ 7.0

	Over 65 feet			Total		
Type of hull	72-73	75-76	Percent change	72-73	75-76	Percent change
Wood	304	383	+ 30.0	13,437	11,468	- 14.7
Aluminum	7	12	+ 71.4	1,841	2,099	+ 14.0
Steel	113	124	+ 9.7	464	477	+ 2.8
Fiberglass	8	10	+ 25.0	7,873	10,535	+ 33.8
Other	1	2	+100.0	225	232	+ 3.1
Total	433	531	+ 22.6	23,840	24,811	+ 4.1

[a]Includes fishing, shrimp, oyster, sponge, charter, spring lobster, live bait, mackerel, and for hire.

This should point out the apparent trend in the type of marine repair people needed. Fiberglass is the boat of the future in the Southeast in both commercial and sport fishing. Trained repairmen and builders will be needed. Some employers who were interviewed pointed out needs in the small boat repair and building area, such as training in the use of resin and cloth repair and in mold building. These areas might be successfully included as part of a program at the junior college level.

Personal interviews concerning expansion in marinas and boat building and repair firms suggested strong growth in employment well into 1980. Florida boat building firms in particular are

operating at full capacity in 1977. Continued expansion in the number of pleasure boats and private sport fishing boats is expected to add to the demand for additional new and used boats. Also associated with this expansion is a need for additional marina facilities. Two marina operators interviewed expressed plans for expansion, but dredging permits and other environmental regulations, they said, are slowing growth in this industry.

Employment in 1977 in the boat building and repair industry for the region is 8,945 with a projected expansion to 11,334 in 1980. The greatest rate of growth will take place in Georgia with 13.5% growth per year followed by South Carolina at 12.3% per year. This very high rate is explained because of the small base figures for Georgia and South Carolina. Georgia employed 396 workers in 1977 and will expand employment by 183 persons to a total of 579 by 1980. South Carolina has a slightly larger level of employment, 801 in 1977, and it will increase by 333 new workers to a total of 1,134 by 1980. Boat building and repair industry employment in the study region of Florida will increase from 7,745 in 1977 to 9,621 or 7.5% per year, or by 1,876 new workers by 1980. In overall terms, the region's boat building and repair industry will create 600 new jobs per year between 1977 and 1980 if the projected 8.2% rate of growth can be maintained.

Based on the survey results, the ten most important occupations in the boat building and repair industry can be compared in the table below.

Ten Occupations in Greatest Demand

Occupation	Total Demand	Annual Job Openings
Boatbuilder	563	188
Laminator	1301	434
Carpenter	1055	352
Electrician	316	105
Mechanic	309	103
Painter	187	62
Cabinetmaker	216	72
Engr/Sci Technician	131	44
Welder	92	31
Mech/Engr Technician	39	13

The mechanics employed in the industry include both diesel and heavy equipment specialists as well as small engine repairmen. It was not possible to separate the exact numbers.

For more detailed occupational information on the region and in each individual State, see Table 3.

WATER TRANSPORTATION

This industry includes establishments engaged in freight and passenger transportation on the open seas or inland waters, and establishments furnishing such regular services as lighterage, towing, and canal operation. Also included are excursion boats, sightseeing boats, water taxis, and cargo handling operations from the time cargo, for or from a vessel, arrives at shipside, dock, pier, terminal, staging area, or intransit areas until cargo loading or unloading operations are completed. This industry also includes the operation and maintenance of piers, docks, and related buildings and facilities.

Employment in water transportation for the study region will increase from 12,238 in 1977 to 14,319 by 1980. This represents an increase of 17% or an average annual growth rate of 5.7%. Also, employers interviewed indicated they found difficulty in recruiting licensed personnel such as tug operators, particularly mates and captains. Industry sources also indicated that new plant locations on the region's inland waters will add to current employment. While there was no way for the study staff to assess this impact, the U.S. Army Corps of Engineers oversees a permit system governing onshore, near shore, or near offshore use of the Nation's navigable waters. Interviews with the Corps staff indicated that further research would be needed to determine the size of any recent or planned waterside facility.

While all major harbors and ports in the study region project a steady increase in shipping activity, increased mechanization of cargo handling will tend to limit growth in longshore employment. Labor turnover in this industry is not as high as in ship or boat building and repair. While significant numbers of technical level personnel and skilled craftsmen are employed in this industry, longshoremen represent the single largest occupational group (2,791) in 1977. The strong unionization of this segment of the work force may tend to mitigate against the growth in employment projected for 1980. However, the International Longshoremens Association, AFL-CIO is strongly committed to the health and welfare of its members, and for this reason, the union and management may view favorably any new training program that will enhance the occupational safety and health of the worker in this industry.

The ten occupations in the water transportation industry that indicate the greatest demand can be compared in the table on the next page:

Ten Occupations in Greatest Demand

Occupation	Total Demand	Average Annual Job Openings
Longshore	1,301	434
Mates	739	246
Marine engineer	116	39
Deckhand	853	284
Carpenter	109	36
Rigger	52	17
Diesel mechanic	170	57
Machinist, outside	78	26
Electrician, inside	45	15
Painter	58	19

More detailed employment information on this industry, for the region and each of the three States, can be found in Table 4.

COMMERCIAL FISHING AND SEAFOOD PROCESSING

This industry includes fishing, processing, packaging, and wholesaling of food from the sea. Fishing includes the catching of finfish, shrimping, crabbing, lobstering, clamming, oystering, and the gathering of sponges. Processing includes the cooking, canning, freezing, or other means of preparing seafood for markets at the wholesale level.

FISHING

The total number of commercial fishermen in the three-State region has been virtually constant in recent years. Some growth of this industry should occur in terms of developing under-utilized fisheries. It is projected that any development of under-utilized fisheries will cause existing fishermen to shift from overcapitalized fisheries, such as shrimp, rather than increase the total number of fishermen in the industry. The increase in the number of commercially registered fiberglass boats sees a movement to larger, more versatile craft capable of net fishing, modified trawling, or trap fishing. This foretells a more versatile commercial fisherman, who will be able to operate in several fisheries. The same number of pounds, or more fish, may be caught with fewer labor inputs.

Possibilities for training or retraining exist for new fishermen as they come into the industry to replace those lost due to separations (12.5% per year). If training is to be offered, most industry people believe it should occur at the vocational school level in such areas as navigation, electronics, and diesel engine repair.

There is a good argument for upgrading persons now in the industry. Approximately 75% of all air/sea search and rescue operations conducted between September and June each year are carried out in behalf of commercial fishermen in U.S. waters. The single most common causal factor of accidents, according to Coast Guard investigations, is the failure of commercial fishermen to demonstrate an adequate knowledge of the weather or the International Rules of the Road. Another problem noted by industry representatives is that of crews going offshore who have few capabilities for "on-the-spot" repairs. The results are costly returns to port or shortened trips with no catch, when minor repairs would have prevented losses. Most employers did not feel that any program at the junior college level to train commercial fishermen would meet with much success. Most employers indicated that any formal education program would have to be accompanied by on-the-job training at sea.

The industry shows a relatively high average age of its employees, 48 years of age in Florida, for example, and a low level of entry for young fishermen. Most commercial fishermen are not high school graduates, and less than half earn their entire income from fishing. Only 48% of Florida fishermen who register commercial boats are full-time fishermen. A full 30% of all commercial boat registrants earn over 50% of their income from sources other than fishing. A similar situation prevails in Georgia and South Carolina. Therefore, few of these fishermen would take advantage of training programs.

Age Distribution of Florida Commercial Fishing Boat Owners, 1974 and All Males Employed in Florida, 1970

Florida Commercial Fishing Boatowners 1974	All Males Employed in Florida 1970	Year of Age
Percent		
4	12	Under 21
11	29	21-30
42	32	31-50
24	17	51-60
19	11	over 60

Total employment in this industry is 14,322 in 1977 with a projected expansion to 15,009 in 1980. This represents a 1.6% annual rate of growth, the smallest in the region's marine sector. The 1977-1980 employment projection is corroborated by industry representatives, including employers and reporting agents of the National Marine Fisheries Service.

PROCESSING AND WHOLESALING

While entry into fishing will be primarily limited to replacement, most expansion in the overall industry will take place in processing and wholesaling. Increases in the processing of imported seafoods will most likely account for this expansion. In spite of the available data, some owners of seafood wholesaling and processing firms are optimistic about the number of employees they will require by 1980, in part because of the recently passed Fishery Conservation and Management Act which may increase the supply of the catch available to the domestic seafood processing segment. However, this expansion, should it occur, will be mainly associated with capital intensive measures rather than labor saving equipment. Declines in the number of small fish houses and associated employment are expected to continue offsetting increased employment in large processing firms. This decline in the number of establishments has continued since 1971. Increased mechanization and volume of processed products per larger firm may require additional skill and training on the part of plant workers. Some technical skill problem areas pointed out in the interviews were heading and wrapping machine operators and general plant mechanics with electrical and mechanical skill. Refrigeration mechanics were also pinpointed as a problem area. Some seafood processors thought that, with the exception of a few specialized skills, college trained people might be overtrained for their industry. Junior college retraining might provide programs to give middle management and first line supervisory personnel basic skills in managing people.

Educational institutions are either lacking, or unknown, to employers in local areas. Most employers have special manpower problems, with specific educational needs in the fields of skilled mechanics, fish butchers, better fishing methods, and training in boat operations.

The ten occupations in the commercial fishing industry that indicate the greatest demand can be compared in the table below:

Ten Occupations in Greatest Demand

Occupation	Total Demand	Average Annual Job Openings
Electronics mechanic	29	10
Deckhand	595	198
Fisherman	2551	850*
Mechanical tech.	222	74
Marine engineer	29	10
Diesel mechanic	131	44
Mates	299	100
Boatbuilder	29	10
Painter	37	12
Carpenter	37	12

*This large number will come about primarily because of the replacement of older fishermen who will leave the industry.

More detailed employment information on this industry, for the region and each of the three States, can be found in Table 5.

MARINE SERVICE AND OFFSHORE SUPPORT

This employment setting is a composite of four types of marine industries which, grouped together, constitute a significant share of the marine sector: electrical, electronic, metal fabrication, and machine shops that directly service the ship and boat building and repair industry; marine suppliers including ship chandlers, wholesalers, bunkering and fuel operations, and marine specialty firms primarily in business to service and supply builders of marine products and marine retailers; marine construction including dredging, pile drivers, diving, and salvage; and marine engineering survey and consulting firms. In addition, are new marine employers of sufficient size to seriously affect manpower needs in the region's near future.

Originally, it was thought that current and projected employment in the emerging "offshore industry" would require that this setting receive special attention. However, the study team did not identify sufficient economic activity that could be isolated and referenced as offshore employment. A careful review of the development of offshore industry in parts of the Gulf and North Sea indicated that the established marine sector is the foundation for any new offshore enterprise. These findings were confirmed by interviews with authorities in the offshore field. The platforms used to drill and later pump oil are usually fabricated in regular shipyards. The loading and movement of equipment and supplies to and from offshore operations are carried out by the established water transportation industry. All of this new activity stimulates an increase in demand for additional labor in the established firms, and often new firms are established which in turn hire new personnel. The study staff made a special effort to identify any new firms in the region and to determine the impact the new operations will have on the existing labor markets. All employers who participated in the survey were assured that the information they provided would be held in confidence. New employers in particular were reassured of this

procedure so as to guarantee that their projected manpower estimates could be incorporated in the report.

A total of 502 marine service and support industries were identified in the study region employing an average of 16.3 workers per firm or a total workforce of 8,182 in 1977. Determining the average annual growth rate for this segment of the marine sector posed a unique problem because the new firms could not be included in the base year. Projected employment for 1980, however, includes the future estimate of established employers who participated in the survey, as well as the 1980 employment forecast made by the new firms who expect to be in full operation in the target year, 1980. It should be noted that of the 502 established firms, 120 are in South Carolina, 112 are in Georgia, and 270 are located in that part of Florida completing the study region.

The ten occupations in the marine service and offshore support industry that indicate the greatest demand can be compared in the table below:

Ten Occupations in Greatest Demand

Occupation	Total Demand	Average Annual Job Openings
Elec/Electronic Tech.	685	228
Shipfitter	322	107
Machinist, inside.....	167	56
Pipefitter	368	123
Welder	917	306
Painter	476	159
Sheetmetal worker	175	58
Diesel and Heavy Equip. mech.....	623	208
Rigger	307	102
Carpenter	202	67

More detailed employment information on this industry can be found in Table 6 for the region and each of the three States.

The methodological procedures used to determine current and near future employment levels in the period 1977-1980, as well as occupational structure and job turnover, are included in the publication, South Atlantic and Gulf Marine Manpower Project, which was published by Florida Junior College, Jacksonville, Florida. An example of the mail survey instrument and the statistical analysis used to reduce the data collected from the survey is also included in the publication. Other technical information to be found in the publication includes explanatory statements concerning the National/State Industry Occupation Matrix System and the Standard Industrial Classification System.

Table 1

TOTAL AND AVERAGE ANNUAL DEMAND FOR THE STUDY REGION'S FIVE MARINE EMPLOYMENT SETTINGS
1977-1980

	Ship Building and Repair		Boat Building and Repair		Water Transportation		Commercial Fishing		Marine Service and Support		Total All Industries	
	Total Demand	Average Annual Job Openings	Total Demand	Average Annual Job Openings	Total Demand	Average Annual Job Openings	Total Demand	Average Annual Job Openings	Total Demand	Average Annual Job Openings	Total Demand	Average Annual Job Openings
Total for The Industry	13,271	4,424	6,211	2,070	5,865	1,955	5,867	1,956	8,505	2,835	39,719	13,240
Total for Selected Occupations	8,252	2,754	4,662	1,554	3,930	1,310	4,072	1,357	5,543	1,848	26,459	8,823
I Technical Levels												
Eng'r/Sci tech.	26	9	131	44	44	15	0	0	229	76	430	144
Mechanical tech.	54	18	81	27	25	8	222	74	130	43	512	170
Elec/Electronic tech.	26	9	39	13	16	5	14	5	685	228	780	260
Draftsman	79	26	23	8	15	5	0	0	62	21	179	60
Loftsman	14	5	9	3	0	0	0	0	0	0	23	8
II Metal Trades and Related												
Boilermaker	285	95	0	0	0	0	0	0	16	5	301	100
Shipfitter	711	237	18	6	14	5	0	0	322	107	1,065	355
Machinist, inside	501	167	63	21	60	20	0	0	167	56	791	264
Machinist, outside	422	141	0	0	78	26	14	5	98	33	612	205
Pipefitter	669	223	0	0	12	4	0	0	368	123	1,049	350
Welder	1,530	510	92	31	38	13	29	10	917	306	2,606	870
Painter	926	309	187	62	58	19	37	12	476	159	1,684	561
Sheetmetal worker	203	67	46	15	15	5	0	0	175	58	439	145
III Electrical Trades												
Electrician, inside	414	138	316	105	45	15	14	5	24	8	813	271
Electrician, outside	192	64	30	10	23	8	0	0	12	4	257	86
Electronics mechanic	181	61	18	6	25	8	29	10	49	16	302	101
IV Mechanics												
Diesel mechanic	191	66	63	21	170	57	131	44	623	208	1,830	613
Heavy Equip. mechanic	261	87	309	103	82	27	0	0				
V Maritime and Related												
Mates	34	11	18	6	739	246	299	100	71	24	1,161	387
Marine engineer	66	22	18	6	116	39	29	10	43	14	272	91
Deckhand	66	22	30	10	853	284	595	198	145	48	1,689	562
Fisherman	0	0	0	0	0	0	2,551	850	0	0	2,551	850
Rigger	423	141	18	6	52	17	14	5	307	102	814	271
Crane, derrick, and hoist operators	300	100	18	6	25	8	0	0	105	35	448	149
Longshore	133	45	0	0	1,301	434	0	0	0	0	1,434	479
VI Boatbuilding and Related												
Boatbuilder	0	0	563	188	0	0	29	10	150	50	742	248
Laminator (boat-bld'g)	133	45	1,301	434	0	0	14	5	149	50	1,597	534
Carpenter	317	106	1,055	352	109	36	37	12	202	67	1,720	573
Cabinetmaker	89	29	216	72	15	5	14	5	18	6	352	117

Table 2

TOTAL REGIONAL EMPLOYMENT IN SHIPBUILDING AND REPAIR

In Selected Occupations 1977 to 1980

	Employment 1977	Employment 1980	Demand in Selected Occupations 1977-1980: Total Demand	Due to Growth	Due to Separations	Average Annual Job Openings
Total Employment for The Industry	13,876	15,980				
Total Employment for Selected Occupations	8,990	10,370	8,252	1,380	6,872	2,751
I Technical Levels						
Eng'r/Sci tech.	69	80	26	11	15	9
Mechanical tech.	139	161	54	22	32	18
Elec/Electronic tech.	69	80	26	11	15	9
Draftsman	208	240	79	32	47	26
Loftsman	27	33	14	6	8	5
II Metal Trades and Related						
Boilermaker	199	231	285	32	253	95
Shipfitter	702	832	711	130	581	237
Machinist, inside	715	813	501	98	403	167
Machinist, outside	773	860	422	87	335	141
Pipefitter	959	1,081	669	122	547	223
Welder	881	1,057	1,530	176	1,354	510
Painter	625	760	926	135	791	309
Sheetmetal worker	254	289	203	35	168	67
III Electrical Trades						
Electrician, inside	619	696	414	77	337	138
Electrician, outside	119	150	192	31	161	64
Electronics mechanic	412	452	181	40	141	61
IV Mechanics						
Diesel mechanic	208	240	197	32	165	66
Heavy Equip mechanic	278	319	261	41	220	87
V Maritime and Related						
Mates	35	41	34	6	28	11
Marine engineer	69	80	66	11	55	22
Deckhand	69	80	66	11	55	22
Fisherman	0	0	0	0	0	0
Rigger	485	560	423	75	348	141
Crane, derrick, and hoist operators	439	491	300	52	248	100
Longshore	139	161	133	22	111	45
VI Boatbuilding and Related						
Boatbuilder	0	0	0	0	0	0
Laminator (boat-bld'g)	139	161	133	22	111	45
Carpenter	303	352	317	49	268	106
Cabinetmaker	56	70	89	14	75	29

State figures for annual job openings have been rounded.

Table 3

TOTAL REGIONAL EMPLOYMENT IN BOAT BUILDING AND REPAIRS

In Selected Occupations 1977 to 1980

	Employment 1977	Employment 1980	Demand in Selected Occupations 1977-1980 Total Demand	Due to Growth	Due to Separations	Average Annual Job Openings
Total Employment for The Industry	8,945	11,334				
Total Employment for Selected Occupations	6,697	8,498	4,662	1,801	2,861	1,554
I Technical Levels						
Eng'r/Sci tech.	188	238	131	50	81	44
Mechanical tech.	116	148	81	32	49	27
Elec/Electronic tech.	59	74	39	15	24	13
Draftsman	34	43	23	9	14	8
Loftsman	10	14	9	4	5	3
II Metal Trades and Related						
Boilermaker	0	0	0	0	0	0
Shipfitter	25	32	18	7	11	6
Machinist, inside	89	113	63	24	39	21
Machinist, outside	0	0	0	0	0	0
Pipefitter	0	0	0	0	0	0
Welder	134	170	92	36	56	31
Painter	268	340	187	72	115	62
Sheetmetal worker	67	85	46	18	28	15
III Electrical Trades						
Electrician, inside	456	579	316	123	193	105
Electrician, outside	45	57	30	12	18	10
Electronics mechanic	22	29	18	7	11	6
IV Mechanics						
Diesel mechanic	89	113	63	24	39	21
Heavy Equip mechanic	447	567	309	120	189	103
V Maritime and Related						
Mates	22	29	18	7	11	6
Marine engineer	22	29	18	7	11	6
Deckhand	45	57	30	12	18	10
Fisherman	0	0	0	0	0	0
Rigger	22	29	18	7	11	6
Crane, derrick, and hoist operators	22	29	18	7	11	6
Longshore	0	0	0	0	0	0
VI Boatbuilding and Related						
Boatbuilder	805	1,020	563	215	348	188
Laminator (boat-bld'g)	1,877	2,380	1,301	503	798	434
Carpenter	1,520	1,927	1,055	407	648	352
Cabinetmaker	313	396	216	83	133	72

Table 4

TOTAL REGIONAL EMPLOYMENT IN WATER TRANSPORTATION

In Selected Occupations 1977 to 1980

	Employment 1977	Employment 1980	Demand in Selected Occupations 1977-1980 Total Demand	Due to Growth	Due to Separations	Average Annual Job Openings
Total Employment for The Industry	12,238	14,319				
Total Employment for Selected Occupations	8,187	9,583	3,930	1,396	2,534	1,310
I Technical Levels						
Eng'r/Sci tech.	98	115	44	17	27	15
Mechanical tech.	61	71	25	10	15	8
Elec/Electronic tech.	37	43	16	6	10	5
Draftsman	31	37	15	6	9	5
Loftsman	0	0	0	0	0	0
II Metal Trades and Related						
Boilermaker	0	0	0	0	0	0
Shipfitter	31	37	14	6	8	5
Machinist, inside	122	143	60	21	39	20
Machinist, outside	184	215	78	31	47	26
Pipefitter	31	37	12	6	6	4
Welder	92	108	38	16	22	13
Painter	122	143	58	21	37	19
Sheetmetal worker	31	37	15	6	9	5
III Electrical Trades						
Electrician, inside	122	143	45	21	24	15
Electrician, outside	61	71	23	10	13	8
Electronics mechanic	61	71	25	10	15	8
IV Mechanics						
Diesel mechanic	429	501	170	72	98	57
Heavy Equip mechanic	208	243	82	35	47	27
V Maritime and Related						
Mates	1,566	1,833	739	267	472	246
Marine engineer	422	286	116	42	74	39
Deckhand	1,407	1,647	853	240	613	284
Fisherman	0	0	0	0	0	0
Rigger	122	143	52	21	31	17
Crane, derrick, and hoist operators	61	71	25	10	15	8
Longshore	2,791	3,265	1,301	474	827	434
VI Boatbuilding and Related						
Boatbuilder	0	0	0	0	0	0
Laminator (boat-bld'g)	0	0	0	0	0	0
Carpenter	244	286	109	42	67	36
Cabinetmaker	31	37	15	6	9	5

Table 5

TOTAL REGIONAL EMPLOYMENT IN COMMERCIAL FISHING
SEAFOOD PROCESSING AND WHOLESALE ESTABLISHMENTS

In Selected Occupations 1977 to 1980

			Demand in Selected Occupations 1977-1980			
	Employment 1977	Employment 1980	Total Demand	Due to Growth	Due to Separations	Average Annual Job Openings
Total Employment for The Industry	14,322	15,009				
Total Employment for Selected Occupations	10,113	10,398	4,072	285	3,787	1,357
I Technical Levels						
Eng'r/Sci tech.	0	0	0	0	0	0
Mechanical tech.	467	509	222	42	180	74
Elec/Electronic tech.	30	33	14	3	11	5
Draftsman	0	0	0	0	0	0
Loftsman	0	0	0	0	0	0
II Metal Trades and Related						
Boilermaker	0	0	0	0	0	0
Shipfitter	0	0	0	0	0	0
Machinist, inside	0	0	0	0	0	0
Machinist, outside	30	33	14	3	11	5
Pipefitter	0	0	0	0	0	0
Welder	61	65	29	4	25	10
Painter	81	87	37	6	31	12
Sheetmetal worker	0	0	0	0	0	0
III Electrical Trades						
Electrician, inside	30	33	14	3	11	5
Electrician, outside	0	0	0	0	0	0
Electronics mechanic	61	65	29	4	25	10
IV Mechanics						
Diesel mechanic	282	306	131	24	107	44
Heavy Equip mechanic	0	0	0	0	0	0
V Maritime and Related						
Mates	622	679	299	57	242	100
Marine engineer	61	65	29	4	25	10
Deckhand	1,243	1,359	595	116	479	198
Fisherman	6,913	6,913	2,551	0	2,551	850
Rigger	30	33	14	3	11	5
Crane, derrick, and hoist operators	0	0	0	0	0	0
Longshore	0	0	0	0	0	0
VI Boatbuilding and Related						
Boatbuilder	61	65	29	4	25	10
Laminator (boat-bld'g)	30	33	14	3	11	5
Carpenter	81	87	37	6	31	12
Cabinetmaker	30	33	14	3	11	5

Table 6

TOTAL REGIONAL EMPLOYMENT IN MARINE SERVICE AND OFFSHORE SUPPORT

In Selected Occupations 1977 to 1980

			Demand in Selected Occupations 1977-1980			
	Employment 1977	Employment 1980	Total Demand	Due to Growth	Due to Separations	Average Annual Job Openings
Total Employment for The Industry	8,182	14,574				
Total Employment for Selected Occupations	5,611	9,347	5,543	3,627	1,916	1,848
I Technical Levels						
Eng'r/Sci tech.	376	451	229	75	154	76
Mechanical tech.	278	334	130	56	74	43
Elec/Electronic tech.	302	843	685	541	144	228
Draftsman	139	167	62	28	34	21
Loftsman	0	0	0	0	0	0
II Metal Trades and Related						
Boilermaker	33	39	16	6	10	5
Shipfitter	57	329	322	272	50	107
Machinist, inside	294	363	167	69	98	56
Machinist, outside	93	162	98	69	29	33
Pipefitter	57	384	368	326	42	123
Welder	1,047	1,666	917	610	307	306
Painter	237	599	476	362	114	159
Sheetmetal worker	90	228	175	138	37	58
III Electrical Trades						
Electrician, inside	57	69	24	12	12	8
Electrician, outside	33	39	12	6	6	4
Electronics mechanic	105	127	49	22	27	16
IV Mechanics						
Diesel and Heavy Equip mechanic	908	1,299	623	391	232	208
V Maritime and Related						
Mates	139	167	71	28	43	24
Marine engineer	82	98	43	16	27	14
Deckhand	228	275	145	47	98	48
Fisherman	0	0	0	0	0	0
Rigger	147	392	307	245	62	102
Crane, derrick, and hoist operators	229	275	105	46	59	35
Longshore	0	0	0	0	0	0
VI Boatbuilding and Related						
Boatbuilder	245	294	150	49	101	50
Laminator (boat-bld'g)	105	197	149	92	57	50
Carpenter	294	408	202	114	88	67
Cabinetmaker	35	42	18	7	11	6

MARINE EMPLOYMENT OPPORTUNITIES AND NEEDS

By CHARLES D. MATTHEWS
President
National Ocean Industries Association

My first reaction when I was asked to participate in this panel discussion was: "Why me? I'm not an educator or a trainer." But, on reflection, I realized it is appropriate for me to be here because the member companies of the National Ocean Industries Association (NOIA) are, in a way, the end reason for our discussion because that is where the jobs are—in the ocean industries. So, I appreciate being here to share some of my impressions with you although you might not like or agree with what I have to say.

First, let me get something off my chest which has been bugging me for some time, and which I have expressed to other groups and educators. If the purpose of marine education is, indeed, to prepare one for getting a job and going to work in the ocean environment, then we are all going about it in the wrong way. This view is reinforced almost every day from my vantage point in the National Ocean Industries Association when I receive a serious letter requesting employment in the oceans. Most of them go something like this:

"Dear Mr. Matthews:

In May I will be graduating from Hometown U. with a degree in marine biology or oceanography. Upon graduation, my main employment interest is to do research or to work in ocean activities. Will you please send me a list of companies requiring such people or other information where I can get a job in my chosen field?"

I am saddened, because I think the colleges and universities along with such a large segment of our current society have made such a fetish of the need for having a college education as a prerequisite of being successful. Coupled with this attitude, Jacques Cousteau has made the oceans so glamorous that the higher educational system is graduating thousands of B.A., M.A., and Ph.D. marine biologists and oceanographers who cannot find the jobs. The current system is simply overloaded. Those of us who are concerned for these young people should start concentrating more on the practical, "hand-on" jobs in the oceans because these jobs provide good money and benefits to men—and let me add—women, but also they may serve as a springboard to other related types of work. We need boll weevils rather than biologists. The industries need roughnecks, roustabouts, tool pushers, swabbers, oilers, and so forth. Many of you may never have heard of a "mud man," but direct jobs like this on the ocean are now going begging, as well as many other ones too. The education and training system should start concentrating more on the practical aspects of vocational training in practical, useful jobs where the workers get their hands dirty, because believe me, working in the oceans' environment is pretty dirty work.

This point was well made by Roger Anderson and Ed Mackin in their paper presented last May to the 1977 Offshore Technology Conference in Houston on the projected marine employment in 1980 by industry and occupationsl subdivisions. Those data indicated that nearly 2,360,000 persons would be employed in marine activities in 1980 with only some 30,950 or about 1 1/4%, engaged in scientific pursuits and 52,860, or a little less than 2 1/4%, in engineering pursuits. Some 1,317,000 will be employed as fitters, craftsmen, mechanics, seamen, longshoremen, fishermen, laborers, and other support personnel.

Don't misunderstand the point I am trying to make. We will continue to need scientists, and indeed, cannot get along without them. But, I am saying we don't need them in the near future in such inflated numbers.

Trying to get a firm grip on this whole problem of marine manpower and education is about as easy as trying to tack Jello to the wall. Everyone has a different idea about how to go about it and none is really successful. Perhaps one of the serious short comings contributing to this dilemma is that we do not have a National marine education policy enunciated by the Federal Government at an appropriately high level of the Executive Branch since the Government's activities do impact on the situation.

Over a decade ago, the Presidential Commission on Marine Science, Engineering and Resources, which became known as the Stratton Commission, recommended that the Federal Government expand its support for ocean engineering and marine technician training at all levels. Some of the Stratton Commission's specific recommendations have been followed, but not the one on manpower. The Commission recommended that NOAA be assigned the responsibility "to help assure that the Nation's marine manpower needs are satisfied and to help devise uniform standards for the

nomenclature of marine occupations." The responsibility for carrying out this assignment was given to the Sea Grant Program which was moved to NOAA from the National Science Foundation. However, at no time has adequate funding been provided for this program to carry out its mission. Nevertheless, in spite of the money problems and lack of guidance from NOAA, Sea Grant did fund programs to produce marine technicians of several kinds, supported graduate programs in ocean engineering, and programs in law and economics. Most of the programs started with Sea Grant money have continued with funds from their own institutions and have become a regular part of the curriculum.

The Sea Grant Program Improvement Act of 1976 placed a somewhat broader education mission on the Sea Grant Program by stating as an objective for Sea Grant: "Providing assistance to promote a strong education base." The appropriations act for fiscal 1977 which followed made it even sharper by specifically appropriating funds to be used for education over and above what NOAA had requested.

Basically then, we have a few pieces of a legislative program reflecting to some degree a legislative understanding of the problem, but we still have no over-all policy. We have the skeleton, but have yet to "flesh it out." All the recent Presidential Administrations have shared in this blame for this situation.

The companies of the ocean industries have grown tired of the false starts, the lack of direction and dedication from Washington, and have begun to wash their hands of the whole thing so far as Federally-funded vocational training and education is concerned. Being fundamentally committed to self-help, risk taking enterprise, the companies have approached the problem of an inadequate supply of capable marine employees by starting their own training schools. For example, the International Association of Drilling Contractors has set up an extensive program of manpower training and career improvement through a network of colleges and universities. Individual company training centers are springing up all over the country.

Special self-help approaches now make it possible for the companies to concentrate on improving their manning requirements by more effective recruitment through existing channels. However, there is a continuing present and future need for dependable, adaptable, and dedicated personnel for the offshore industry. An on-going search is needed. Factors contributing to program efficiency are identification of potential career personnel, vigorous recruitment, careful screening, orientation, training, and appropriate placement. It is recognized that all the ocean industries must do a good job of recruiting and an even better job of retaining qualified personnel. One of the problems which has been developing from this increase in company training programs is that good employees are being lured away from the original employer after he has paid for the employee's training. The offshore trainee retention rate is about 20% for long-term. While this is substantially better than for the hiring of "walk-ons," the rate can be increased thus saving expense to the companies and uncertainty to the employees.

Many NOIA members also tell me the ocean industries are something of an ocean-based foreign legion where a person can spend several years seeing the world before settling down to his life's vocation. The most serious problems with recruitment have been selecting suitable candidates and trying to decide between a candidate's general enthusiasm for a career or one for world travel.

There are entry level job positions which are not dead-end jobs. This is a well-founded fact, but not a well known one. It is necessary for industry to do a better job in the area of informing prospective employees, but also the education institutions as well. The message that must be communicated is that there are opportunities for long-term growth for those willing to make a commitment to learn, work, and grow. Work on the oceans is hard, but it is satisfying also.

Coupled with recruitment is training and safety. Once the personnel are on-board it is in everyone's best interest that they know how to do their job safely. Naturally, this is a function of recruitment (i.e., finding the right person for the right job, etc.) But the majority of training and safety are learned as an employee. A company's training program should be designed not to lose employees either to accident, another company, or another industry.

Training programs are as unique as each individual company, but the main purposes usually serve three objectives:

1. To orient new men to the company and its safety program and to prepare them for their job assignments.
2. To integrate experienced men into the company through advanced technical training.
3. To upgrade and provide employees on new equipment and procedures.

Typically, training for a service boat company will include both practical and theoretical aspects of the business with an overview of the general industry as well. Throughout training programs a balanced mix of practical "on-the-job" training and textbook methods are employed. In addition, many companies now employ counselors to follow an employee's progress and develop a training and

advancement pattern integrated with a life-long career pattern. Promotion, pay, and security factors are vital to this system. Throughout all programs, there must be a balance among safety, indoctrination, training, and career advancement.

The last point I want to make regarding marine employment relates to government policy but not the education shortcomings mentioned earlier. It's no secret that the Federal Government is playing a bigger and bigger role in not only our personal but professional lives as well. To a large extent the number of jobs are directly affected by government policies and actions.

For example, let me mention for a moment a particular piece of legislation, now pending before the Congress, which will prove my point. H.R. 1614—the Amendments to the Outer Continental Shelf (OCS) Lands Act—has been studied by both the University of Rhode Island and Tulane University and they have come to the conclusion that its enactment will delay offshore energy development for a minimum of three years and maybe as much as six years. Tulane's study concerned itself primarily with the impact on the State of Louisiana of enacting H.R. 1614. Let me quote a couple of sentences from the summary of the Tulane Study:

"Absent enactment of the OCS Bill, Louisiana companies and others in the Gulf region between now and 1984 would normally be expected to invest over $2.5 billion in offshore activities. This level of capital investment would not only preserve existing jobs for tens of thousands of workers associated with the offshore industry but would create nearly a quarter of a million new jobs. But if the OCS bill becomes law this increase in investment which would create the new jobs will not be made for as long as possibly six years."

In estimating the possible impact of a three-year delay in exploration and development of the Gulf OCS, Dr. John Moroney of Tulane concluded that "the range of employment postponed is estimated between 40,503 and 67,757 man-years."

He goes on to point out that using an estimated six-year delay, and investment requirements estimated according to the current lease sale schedule total employment postponed in the Gulf region could be as high as 181,000 man-years, or possible jobs.

Perhaps there are some in this audience who will disagree with me about the merits or demerits of enacting H.R. 1614, but I am not here to argue that point. We can discuss that issue later. But, I do not believe there is anyone here who can, or will, dispute the statement that if offshore development does not proceed with dispatch and vigor, there will be thousands of jobs lost in the oceans. And, that is what we are discussing here today. This gets us back to my point that actions by the Federal Government can and do affect the marine employment opportunities and needs.

In closing, let me say one more thing. Last May, at the Offshore Technology Conference mentioned earlier, I moderated a similar panel to this one on Marine Manpower. One of the papers there was given by Harold Goodwin, who was for many years a leader of the Sea Grant Program and, in my opinion, is still one of the great advocates of improved marine manpower education and training. Hal concluded his presentation by quoting from a report concerning the goals for a National Marine Education Policy he was helping to prepare for the University of Delaware entitled, "An Introduction to Marine Science." I would like to quote those same goals and say amen.

"Let it be clear from the beginning that those who advocate marine education do not call for revolution, disruption, or substantial alteration in the present system of education, but only for content balance that will result in successful pursuit of the following goals:

1. A marine-literate society, aware of the importance of the oceans and marine environment and the reasons for that importance; a society able to understand and participate in public and personal decisions affecting or affected by America's needs in the seas and inland waters.
2. A corps of marine-competent professionals, technicians, and workers; America's sea people, educated and trained to carry out the Nation's marine missions whatever those missions may be.
3. In the coastal zones, and near the great inland waters, a public better equipped to use the aquatic environment for recreational renewal, with greater understanding, safety, and enjoyment.
4. A new breed of public managers, whether elected, appointed, or career-professional, able to make decisions that recognize and ensure proper balance among America's needs and interests in the coastal zones and the world of water."

And to that, I say
Amen!

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