the DECADE AHEAD

PROCEEDINGS

9th Annual
Sea Grant Association
Conference

NINTH ANNUAL NATIONAL SEA GRANT ASSOCIATION CONFERENCE

PROCEEDINGS

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Sea Grant Program
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NINTH ANNUAL NATIONAL SEA GRANT

ASSOCIATION CONFERENCE

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THE ASSOCIATION OF SEA GRANT PROGRAM INSTITUTIONS

The Association of Sea Grant Program Institutions was formed on November 19, 1970 in Washington, D.C., as an organization of colleges, universities and other institutions concerned with the broad objectives of the National Sea Grant Program.

The Association's objectives are:

1. To further the optimal development, use and conservation of marine and coastal resources (including those of the Great Lakes), and to encourage increased accomplishment and initiative in related areas.
2. To increase the effectiveness of member institutions in their work on marine and coastal resources (including those of the Great Lakes).
3. To stimulate cooperation and unity of effort among members.

A new decade has opened with debate and enactment of major federal legislation concerned with national ocean policy, the national Fisheries Management Act, and aquaculture development.

Open space is not only the last and greatest resource reserve of our planet; it is absolutely vital to the maintenance of a healthy planet and its life forms, as well as constituting a major medium for international trade and communications among its people.

The question, then, of the challenge facing the Sea Grant Association and its members is not the analysis of what the national Sea Grant Program *HAS BEEN*, but rather *WHAT IT CAN BECOME*.

TABLE OF CONTENTS

Welcoming Addresses

Fujio Matsuda
President
University of Hawaii

Sea Grant enters a new phase at the university, in the state, and in the nation. Nine years of participation have demonstrated the strength and vigor of the concept, have demonstrated that the university can play a vital role in developing new industries, new vocations, and new avocations for society. During this period some problems have developed, and some opportunities have been missed; it is in the resolution of these problems and in the development of the new opportunities that the future strength of Sea Grant lies.

At the University of Hawaii, the greatest successes of Sea Grant have been in the application of scientific knowledge to the development of new industries. Our most mature effort in this regard has been the development of the precious coral industry—

and in particular the development of pink and gold corals. This development is almost a textbook case of the ideal Sea Grant project. Initiated by Sea Grant, the project originally located, identified, and studied beds of precious coral in order to determine not only their economic value but also environmentally effective techniques for harvesting optimum sustainable yields. A technique for harvesting with a submarine and submersible barge was developed, and measurements were made of the growth rates for the various corals. From these studies, sustainable yields were determined, and information was furnished to the regulating agencies to permit them to manage the resource. After several years of support, the Sea Grant funding of this project was phased out and transferred to economic development programs of the state, since projects at this stage of development are not appropriate for Sea Grant funding nor ultimately for local funding when they are fully developed. This has already happened in the precious coral industry. The industry has grown from essentially zero at the start of Sea Grant to a $4.5 million gross in 1974, to an $11 million gross in 1975, and to a projected $18 million in 1976. It is an important industry in Hawaii, one that is labor-intensive, that utilizes a local marine product and requires unique marine skills. The health of the industry is such that major capital investments in underwater devices for improvement of harvest have been undertaken.

It appears that the precious coral story will be duplicated in a number of other areas such as:

"aquaculture of the Malaysian prawn,"

"mining of off-shore sand,"

"shark as a quality food and shark fishing as an industry," and

"semi-submersible hull for an inter-island transportation system."

Although we are proud of these successes of the Sea Grant program, there are a number of concerns. Perhaps the first concern is that there are an equal number of Sea Grant projects which are technologically successful, or which *appear* to be technologically successful and economically viable, for which industry demonstrates only apathy. For example:

A Sea Grant-sponsored study of transparent underwater hulls has produced a breakthrough in the design and construction of these previously expensive and sophisticated structures. These hulls are used for tourist submersibles, for underwater reef

viewing facilities, and for aquaria has both esthetic and commercial potential. Far more expensive and less effective structures have proved to be commercially viable in Japan. Nonetheless it has been difficult, if not impossible, to interest either industry or the people of Hawaii in the development of such projects.

A major and continuing problem of the Hawaii tuna industry has been the preservation of live bait. A technologically and economically feasible live-bait tank was developed under Sea Grant, but the fishing industry has not been interested in outfitting their boats with this important device. Similar reactions have been experienced with the man-in-the-sea program, a number of aquaculture programs, a number of fishing programs, programs for underwater parks and recreation, programs for environmental restructuring of the coral reef, and programs for exploitation of the manganese nodule resources of the Pacific.

Two elements appear to be lacking in the translation of concept to realization. The *first* is an (A) *effective marine advisory program* which is able to communicate with industry. Hard-headed businessmen find it difficult to translate the results of academics into projects which can be sold to financial institutions, to the stockholders, and to the management. I recall that for the semi-submersible ferry, many reports were written pointing out the excellent ride qualities of this new craft. It was not until a demonstration ride was taken by the Governor, the members of the State Legislature and the local press that the concept was sold. The actual experience of riding smoothly and comfortably in the waters of the famed Molokai Channel and watching another ship of the same tonnage pitching, heaving, and rolling in the same waters is far more effective than all of the reports and calculations which can be derived from model tests and theories. Credible proof of economic viability is essential if industry is to use the results of research. We are pleased, but cautious, with respect to the Marine Advisory Program which has been established and is a growing part of our Sea Grant Institutional Program. It fills a vital function; however, one may question whether it can successfully compete for funds in any university faced with severe funding constraints.

The *second element* that seems to me to need strengthening if the Sea Grant Program is to be effective is in (B) education. Unless and until the body politic as a whole understands the

opportunities and the importance of the ocean, resistance and apathy will prevent progress. If we look at the State of Hawaii in the past few years, we discover that ocean education in the elementary school, junior high, high school, and in the undergraduate college curriculum has been minimal. Those courses that did exist were invariably in the biological sciences with occasional courses in the physical sciences. Education in marine-oriented arts and social sciences was virtually non-existent. Marine skills were equally absent. A survey of high school students in the State indicated that nearly three fourths of the students were unable to swim, and of the one-quarter that could only half could swim more than 50 yards.

The University of Hawaii is proud of its Sea Grant-initiated "Keiki to Pau Hana" program, which translated from Hawaiian means "Childhood to Retirement" program of marine education. This program extends into the elementary school with an annual Makahiki Kai or festival of the sea, and continues in the high school with the Blue Water Marine Laboratory and curriculum developments in marine science and social sciences of the sea. It is further continued in the college undergraduate program with the innovative and highly successful Marine Option Program. Thus, a very modest beginning has been made on the generalized marine education of the new generation. This has not been done without a severe strain on the budget. Ten per cent of the Sea Grant Institutional support is now in education. This has had to be spread thin to meet the spectrum needs of marine education. Although they have been successful, some of these fall outside of a university's normal mission. They are competing for funds in a university budget which is already stretched to meet the essential needs of higher education. As Sea Grant looks to the future, it should ask how these needs may be met—and they must be met—without taxing the university structure.

These observations add up to the conclusion that the base of participation in Sea Grant must be broadened beyond the university to include the entire spectrum of education, to include the entire range of state and federal economic and social development agencies. Such broadening should take place with and through the university; for it is the basic thesis of the Sea Grant Program that the university is the fountainhead of the innovations which we require if we are to move our nation back to the sea.

Don Walsh
Director, IMCS
(*Representative for President John Hubbard, University of Southern California*)

I am sorry that President Hubbard could not personally greet you today. Our University is in the middle of trying to raise some $235 million by 1980 and the President's schedule is often very uncertain when he is following up on a likely prospect. So I hope you will take no offense, but these are the "laws" that seem to govern private universities.

So, welcome! We are glad to have you here at USC. I think we will have a very productive meeting; we have good facilities; the weather will be fair; and I hope the output of the meeting is as good as its environment.

I would like to talk briefly about USC and the Sea as background on what we are doing in marine studies.

The ocean work at the University of Southern California actually began some time ago. In 1910 our first marine station was set up

at the old Venice Pier. Consistent with our present day emphasis on the coastal environment, our first study program in 1910 was on the influence of the Santa Monica sewer outfall on the coastal lagoon area. In 1911, the University built its first oceanographic research ship, the *ANTON DOHRN*. Interestingly enough, one of USC's Trustees Emeritus was skipper of that ship as a young graduate student in the 1920's. He remembers those days fondly.

In the early 1930's, Captain G. Allan Hancock, a wealthy supporter of the sort that we all hope to have someday, came onto the scene. He was one of that great tradition of very wealthy men who used their private resources for advancing serious marine research. Captain Hancock, who made most of his fortune through land development in this area, had a 195 foot private yacht, called the *VELERO III*, on which he invited graduate students and research personnel from institutions in this area to take cruises with him. By the mid-1930's, he had acquired so many specimens in bottles, reports and data, that it was clear he needed a shoreside facility to work up the results of his ocean expeditions. In 1939 he agreed to establish the Hancock Foundation here at USC. He gave his ship, the *VELERO III*, to the University and provided funding and guidance for the 100,000-square foot marine research building on the main campus. This was about the biggest, built-for-the-purpose marine science building in the country at that time (1940). It is very well designed, if you have some time during this meeting, walk through it. He spared no cost in getting the very best for the Hancock Foundation.

During the war, the *VELERO III* went into the Navy and after the war, Captain Hancock decided to replace it with a new ship. In 1948, the *VELERO IV*, which we still have today, was launched. From the founding of the Hancock Foundation in 1934 to 1954, Captain Hancock was both Director of the Foundation and Captain of *VELERO IV*. Before he left the University, he was also Chairman of our Board of Trustees.

In 1963, through the convergence of many different elements, local universities, regional institutions, government, and private donors, 50 acres of land were set aside on Catalina Island for construction of a marine science station. The National Science Foundation put up about half the needed resources and in 1967 the laboratory was completed. In 1970 we began formal class work and research at this site.

In 1970 we also began our Sea Grant Institutional Program. Ron

Linsky, who is here at this meeting, was the Program's Director from 1970 until 1975 when he went to Hawaii to direct their Sea Grant Program.

But with all of this progress, it was still clear that USC was not making much of a real impact on the national scene in marine studies. The University established a special task force in 1972 to find out 'why?' This group met for a year and found that the basic institutional structure, and organization within the University for marine studies was inadequate to permit orderly growth. In 1974, the Board of Trustees agreed that an Institute for Marine and Coastal Studies should be formed to bring together, coordinate, manage, and develop all marine studies at the University. In September of 1975, I joined the University as the first Director of the Institute and we began our work.

I have said 'marine studies' because our program is broken into three principal areas: marine sciences (classical oceanography); ocean engineering; and marine policy studies. We have invested our first year and a half in developing the "architecture" of our organization, recruiting the best possible people and trying to get our program well organized within USC before seeking regional, national and international opportunities.

Today our program runs at about $4.5 million in supported research. It consists of the Sea Grant Program, the applied marine research activities that used to be under the Hancock Foundation; and the Hancock publications program. In facilities we have the 110 foot *VELERO IV* and 16 other water craft located on an acre and a half waterfront site in Los Angeles Harbor. At that same site we also have Harbors Research Laboratory in a 26,000 square foot building which was the old Catalina Steamer Terminal. Finally, on Catalina Island, we have the laboratory I mentioned before. There is another 135 acres surrounding that location for future expansion purposes.

In closing, I would like to introduce two of our USC hosts who will be with you the whole three days. Don Keach, who is Deputy Director of the Institute and the Sea Grant Program Director, will be happy to assist you if you wish to visit any of our facilities. And the lady who really put this meeting together from the USC side, Dorothy Bjur. Dottie is the Education Coordinator for the Sea Grant Program as well as the general manager for this meeting. Please feel free to call on either Don or Dottie to answer any questions or to provide assistance.

Keynote Speakers

The Decade Ahead

YVONNE BRATHWAITE BURKE
The Honorable Congresswoman
New 28th District, California

It is a pleasure to be here today and to join Dr. Stanley Murphy (University of Washington), President of the National Sea Grant Association; Dr. Fujio Matsuda, President of the University of Hawaii; and Dr. Don Walsh, representing the University of Southern California.

The question under discussion today is the future of the Sea Grant Program. In my mind, we are far behind in ocean research. We must find ways to bring the attention of the public and legislators to the importance and the urgency of this vital field.

We here all know that the oceans are the last and greatest resource reserve of our planet.

We all know the vital role the ocean plays in maintaining a healthy planet and maintaining the life forms of this planet.

We all know the oceans are a major medium for international trade and communications. We know the importance of research that will be the basis of decisions that may mean the survival of our civilization.

Here in California, we know that the first major marine mining operation may be based along the California coast. We know of the potential for mining manganese, as well as cobalt, nickel and copper.

We know that the southern entry for Alaskan oil will be here. We also know that, to date, oil has had an ecologically devastating effect on the California coastline. Oil spills have created a hostile environment in which the oil companies, the government and the public attempt to balance the interests and needs of each.

Some of us know of the struggle led by Congressman Paul G. Rogers of Florida when the original Sea Grant legislation was enacted in 1966. At that time little work had been done in oceanography. We were aware of the great store house of wealth

and potential in the ocean and the real lack of development of marine science.

It took a real selling job at the time. It wasn't seen as having any priority. Yet many of the forecasts have come true. Developments from offshore minerals to medicine have come true. There is a potential for an anti-toxin for the treatment of cancer; there are developments in fish farming and saltwater deterioration and beach erosion and worm farms.

All these developments are small when we consider the future. Thoughts of cities in the sea, floating airports and aquaculture seem to some to be fantasy—yet we know they are not.

The future holds the major problem of feeding an expanding world population. Fish is the food staple of China and Russia and is of growing importance around the world. Less and less will we be able to reserve the land mass needed to graze cattle. Yet, the United States is neglecting its fishing industry. It is said that every other fish in our frying pans is foreign.

Somehow, we must convey the urgency of our message. Our dreams are a decade old, and we have found few people who have the vision to realize the dream.

My goal, today, is to report to you on the Sea Grant Program and Appropriations Process. The more knowledgeable and skilled you become at representing the importance and urgency of your interest to the right people at the right time, the greater the possibility that the United States will assume the leadership that it should. Influencing national policy is not easy. I know. But the stakes are high. It is worth the effort.

Many people do not understand the legislative process in Congress. Even fewer understand the appropriations process and the differences between the two. Simply, the appropriations process makes available funds for programs previously authorized by an act of Congress. Without appropriated funds, many programs would never be implemented.

As you know, the National Sea Grant Program was authorized by P.L. 89-688, the National Sea Grant College Program Act of 1966. The program's first authorization was $5 million in FY 67. Today, Sea Grant has an authorized funding of $50 million. Yet, since FY 67, appropriations for Sea Grant have never matched its annual authorization. In this fiscal year, FY 77, $50 million is authorized, yet only $27.7 million were appropriated by Congress. Why?

Often times, Congress is criticized for failing to adequately fund certain programs, despite its approval of substantially higher authorizations. However, there are other participants in the process, who play a vital role in Sea Grant's budget. Let's trace this year's Sea Grant Budget request from its inception to the Congressionally approved level of $27.7 million.

Each year in preparation of the departmental budget, Sea Grant Administrators submit to the Department of Commerce (National Oceanic and Atmospheric Administration) its anticipated budget requirements, based on their perspective as program administrators. For this fiscal year the request was $30.5 million. The Department's budget office reduced this initial request to $27 million.

The next step, the Office of Management and Budget (OMB) is perhaps the most critical chain in the process. It is often overlooked, yet it is decisive to Sea Grant's funding. OMB is the President's office to supervise and control the administration of the budget; to bring about a more efficient and economical conduct of the federal bureaucracy.

The Commerce Department's recommendation for $27 million for Sea Grant was forwarded to OMB. OMB reduced this amount to $23.2 million. Unseen by you, $7.3 million had been eliminated prior to submission of the budget to the Congress.

As a member of Congress, I believe in the separation of powers clause in the Constitution. I also strongly believe in economy and sound management in the federal government. I *do not* believe in the dismantling of vital programs by an arm of the executive branch of government. I *do not* believe that political expediency or a basic lack of comprehension by OMB officials are grounds to eliminate Sea Grant or any other program or to render its funding level untenable.

The Department's budget request after being approved by OMB is then forwarded to the Appropriations Committee, of which I am a member. As previously indicated, this year's Sea Grant budget request to the Congress was $23.2 million. In the words of Dr. John W. Townsend, Jr., Associate Administrator of the National Oceanic and Atmospheric Administration, ". . . the program level has been about the same for three years. It has not gone down but it has not gone up. That does not, however, take into account inflation."

Why must we presume that OMB is hostile to Sea Grant?

Let me read to you examples of OMB comments concerning Sea Grant:

"The program appears to be merely a series of local programs *without any national focus.*" (Emphasis mine)

"The program is starting to exhibit tendencies toward a *national* focus and is thus in danger of losing its useful local characteristics," (Highlight inconsistency)

"The objectives of the program are unclear, the need for the assistance is uncertain, and the benefit from the assistance not readily apparent."

"Sea Grant has strong support on Capital Hill; therefore, it is necessary to drastically reduce its budget to preclude its unrestrained growth via the appropriations process."

Are these comments by officials concerned with economy and sound management in the Sea Grant Program? Are these statements a reflection to OMB's growing tendency to politicize issues? Are they reflective of officials totally familiar with the program and its purposes?

The findings of the National Advisory Committee on Oceans and Atmosphere are most enlightening. It is possible that some members of that Commission are present today. Let me quote from its 5th Annual Report, dated June 30, 1976:

"Sea Grant is not simply another research program. In intertwining education, research and advisory services, it is in effect a service program . . . it is not a science program: It encompasses the disciplines of business, law, economics, government and management."

With growing national concern over coastal zone management and the assertion of jurisdiction over economic resources within the 200 mile limit and the untapped natural resources which our marine bodies supply, what is OMB's rationale in continuing to recommend reductions in Sea Grant funding? OMB actions to date certainly can not be described as being in the national interest.

Significantly, the Advisory Committee's Report stated, "Sea Grant is presently not receiving sufficient funds to permit it to fulfill its mission adequately." Despite the continuing financial restraints, Sea Grant has successfully engaged in:

Energy research; land mark studies in Outer Continental Shelf development and deep water ports

Coastal zone studies which have formed the basis for many state coastal zone management plans and programs

Research in food production, including successful mariculture programs and advances in seafood technology

Development of useful products from seafood processing wastes

Development and training of a cadre of scientists, engineers and administrators

And countless others.

What is the perspective for the future? What lies in the Decade ahead?

The National Advisory Committee on Oceans and Atmosphere has recommended that Sea Grant funding be increased to a minimum of $40 million annually, in order to allow institutions in the program to build their programs to a point which reflects their capabilities to meet demonstrated needs.

Still others have projected a program with a total size of 24 Sea Grant Colleges, which would require a minimum of $55 million. Also included would be funding for development of programs, national in scope.

From my perspective, as a Member of the Appropriations Subcommittee responsible for Sea Grant appropriations, I believe that expectations of Sea Grant growth and expansion are reasonable. I believe that growth and expansion will be accompanied by the necessary funding. I sense a mood in the Congress that should enable Sea Grant to accomplish its goals. Members of the House and Senate are becoming increasingly aware of the importance of the Sea Grant Program. The link between Sea Grant and the solution to many of our economic, environmental, energy and food problems is readily apparent.

The House and Senate Subcommittees have prevented OMB designs to dismantle Sea Grant and reduce available funding. The Congress has approved authorization in this fiscal year of $50 million and $5 million for development of programs of national significance. An additional $3 million is authorized for development of international programs. Generally, the Appropriations Committee is more conservative and did not provide funding for those additional items. We did, however, secure a funding level of

$27.7 million, which approximates the Department's request prior to OMB reductions.

I think you will see in the next Congress, an acceptance of the Advisory Commission's funding that Sea Grant "encourages local initiative in addressing problems, which, while their specific manifestations may be local or regional in character, are collectively of importance to the Nation as a whole."

It is of more than passing interest that Congressman Bill Alexander of Arkansas, a member of the Appropriations subcommittee, is a deep sea diver and especially interested in a strong program of deep sea technologies.

What would be the strategies to maintain and increase the funding?

Power in the Congress is vested in the Subcommittee Chairman. To insure adequate consideration for budget increases, it is always important to contact the appropriate subcommittee chairman. I would recommend simultaneous contact with both the House and Senate Subcommittee Chairman. Remember too, that the Senate is much more liberal in appropriating funds than is the House.

It is important to brief all Members of the Subcommittee, particularly if their state or district participates in the Sea Grant Program or derives some benefit from it.

It is not enough to simply brief Sea Grant proponents. *Seek to Sway opponents.*

Keep us informed year round on major accomplishments. Too often we only hear from you when you are in trouble—which usually comes prior or during appropriations hearings.

NOAA and Sea Grant Administrators should seek to orient OMB officials to Sea Grant. Try to preclude OMB's aloofness in the future.

Keep the pressure on. Emphasize that you are not seeking the perpetuation of a bloated bureaucracy. Rather, the opportunity to possibly salvage the 21st century at a relatively small cost to the federal government.

In conclusion, be assured of my continued support. Support not only within my subcommittee, but also within the California Congressional delegation, with my alma mater and other Sea Grant institutions, and with you, the individuals directly responsible and involved for the success to date and the future success of Sea Grant.

Sea Grant and the Political Process

JOHN P. CRAVEN
Dean of Marine Programs
University of Hawaii

My talk started out by saying that "It has been said that," but I didn't have a reference for it. But, I will now say that Congresswoman Burke said that "until an idea is introduced into the political process, it's time has not yet come." And if that statement has validity, then the programs of Sea Grant must be introduced into the political process if the goals of Sea Grant are ever to be realized. The overall goals, as most of us understand, are a mobilization of the intellectual resources of the university to concentrate on marine-related problems, and opportunities of the society to introduce the results of the university's study to the society so that the society might thereby be changed and once again utilize the sea for the resolution of its problems, to create new economic opportunities, and just for the simple enjoyment of the ocean.

The dilemma is thus raised, for it is fundamental to our philosophy of government that programs supported by tax dollars be de-politicized, and that individuals supported by tax dollars not be engaged in partisan politics. And now an affirmed line is drawn between propaganda and public information; the one being information that is thrust on the public in order to convince them of a new direction, and the other information which is requested by the public as a public service. We all know of the many excellent movies and television productions of the USA that are unavailable, and quite legitimately, for public viewing. On the other hand, we are all aware that not only our Sea Grant Publication Offices but the Department of Agriculture as well have numerous informational films and materials for every aspect of land and sea utilization.

As we look at Sea Grant we see that it is not an entirely federally funded program. Not all the funds are federal dollars, nor has everyone who works for the Sea Grant Program received full-time support in federal dollars subject to the restrictions of the Hatch Act. First, those private firms and their employees who are not supported by federal funds and who do provide matching funds for Sea Grant projects have no restraints in entering into the political process, and may, subject to their own company or union rules, participate in that process even during working hours. This has been constrained much recently by the Federal Campaign Practices Act which has eliminated corporate spending either

directly or through services in support of the candidates for federal office. But no such restraint has been imposed or can be imposed on individuals of labor and management acting in concert together at their own volitions under a union or corporate body in support of individual candidates. Second, not all states have Hatch Acts, and where Sea Grant projects are matched by state funds or where the participants are paid wholly by state funds, these individuals may also participate fully in the political process, but of course on their own time. Third, of those who are supported fully by federal funds, not all of them are constrained by the Hatch Act. Indeed, and I do not think many university employees are aware of this; *all* university employees are specifically exempted from the provision in the Hatch Act. As a result of these three categories of exemption, nearly all of those who participate in the substantial programs of Sea Grant (I think that would qualify for all the people in this room) may on their own volition participate fully in the political process, and this includes partisan politics.

Of course, the political process is not restricted to partisan participation. We are all aware of the total process of the program. We had an excellent thought from Congresswoman Burke on the political process on the national level. The Sea Grant legislation, whose renewal must be enacted this year, will be structured by elected representatives. Testimony will be heard from governors, state representatives, and even on occasion, Sea Grant Directors, as well as the advisors of the National Advisory Committee on Oceans and Atmosphere, a body appointed by the President and currently composed of individuals predominantly of a certain political fate. Sea Grant is thus involved in the political process and can be more fully involved than it has been in the past. Its program thus have an opportunity to take root. It is therefore legitimate to ask whether the process is effective and whether it can be made more effective.

And as you have all been waiting for in this talk, I am going to tell you of an opportunity to test that effectiveness. It was provided to and by your speaker in the past six months. He was a candidate in the primary elections of a major political party, which I shall not name so I will not be partisan, for a congressional seat from one of our nation's oceanic states. Now the campaign was unequivocally based on the importance of the ocean to that particular state, as evidenced by the title of the campaign organization. The campaign organization was entitled "Citizens for John P. Craven, Hawaii and

the Sea." During that campaign, the candidate met and had a personal interaction with nearly 60,000 people. Included in these interactions were daily breakfast seminars involving more than 1,000 people. The campaign staff of full-time volunteers at any one time numbered between 20 and 30, the weekend and evening volunteers for any weekend or evening ranged from 50 to 150, and volunteers for canvasses and special political events, many of whom are in the audience today, ranged from 1,500-2,500. There was thus an opportunity afforded to obtain a statistically valid estimate of the public perception of the ocean and the public perception of Sea Grant, an estimate of the number of major political supporters for the ocean, and an estimate of the nature and scope of the oceanic constituency, if there was indeed an oceanic constituency.

The most humbling aspect of public perception was the immediate discovery upon launching the campaign that not one in 100 of the body politic had ever heard of the candidate's name or the names of his colleagues; not one in 1,000 had ever heard of Robert Abel; not one in 10,000 had ever heard of Robert White, to say nothing of the Secretary of Commerce, whoever he may be. There were those who thought that Elliot Richardson was the Watergate Prosecutor, and there were many, many more who thought that Fujio Matsuda was the basketball coach of the University of Hawaii. There seemed to be a general knowledge of Sea Grant Hawaii, until one day I was talking to an executive, and he allowed how he liked Seagram's very well, but preferred Calverts. Now despite this initial impression of ignorance, there was however a perception that there was an ocean, that it is surrounding the island state of Hawaii, and that in some way it is important. It was a nearly universal idea that all individuals involved in the ocean were oceanographers, that oceanographers engaged only in studies of what we would call marine biology, that the entire oceanic job market consisted of opportunities in ocean science and that most of these jobs, if not all, required an ocean degree and probably an advanced degree. These initial perceptions were initially discouraging until we learned, as we always learn in the political process, that voter response (and their impression is very superficial) comes bubbling to the surface. And in their subconscious there were many more valid and meaningful perceptions.

The task of the campaign was one to remind the body politic, and to recall to the body politic, these more valid insights about the

ocean. We started by appealing to the perception that somehow the ocean could provide a fourth economic base for Hawaii, and that this economic base was somehow dependent upon action from the federal government. As many of you know, the economic base of Hawaii rests on essentially three major categories—sugar and pine (sugarcane and pineapple agriculture), tourism, and defense spending. They have all been more or less equal in the economy, although they have been changing in recent years, with tourism becoming more important, sugar and pine staying level, and defense spending also staying level. There has been an awareness in the economy that these industries will not grow, except for tourism; an awareness that even though the economy stays healthy, these industries will not provide the kinds of jobs Hawaii will need—jobs which are Hawaiian, jobs which will use the trained minds coming out of the university in very large numbers, and jobs which will preserve the environment and the beauty of the state. Therefore there was somehow a subconscious perception that the ocean could provide that fourth economic base. Now this concept was reinforced by the candidate with the following citation:

Whenever we talk about jobs in the ocean, we talk about the passage of the 200-mile fishing zone legislation that extends U.S. jurisdiction over an area of 2.2 million square miles. This is the largest acquisition of jurisdiction in the history of the United States, twice as large as the Louisiana Purchase. And of this 2.2 million square miles, 600,000 square miles are of the Hawaiian archipelago. The resource assessment alone would involve an extensive research program, and the control and protection of this area will require an increase in the size of our Coast Guard. The resources to be developed in this Hawaiian archipelago include: the precious coral industry which is growing by leaps and bounds and will soon have to move up the leeward chain to find additional resources; the reef fishing industry because there are abundant reef fish and shark in the area; and in the long distance future, the manganese nodule deposits of the Hawaiian archipelago. So in that one piece of legislation alone is the opportunity for jobs. And as we pointed out, the passage of aquaculture legislation pending before the Congress would provide support for the developing field of aquaculture, a movement which has been developing in Hawaii and under Sea Grant Hawaii. And we pointed out that when the Metcalf Bill is passed, U.S. miners will be protected in the procurement of manganese nodules which are potato-sized rocks located just south

of Hawaii. We didn't point out that "just" was 500 miles. We exhorted the body politic to say whose manganese nodules do you think they are, and the response was that they were the property of Hawaiian Dredging. We pointed out that some day ERDA may implement an ocean thermal energy conversion program, establishing not only an energy research and development center but a center for open-sea mariculture as well. And this project too has received its funding not from ERDA, as initial statements from the federal government would indicate, but from Sea Grant, who, unlike the energy agency, is acting instead of thinking. And from time to time we talked about a very esoteric project called Project DUMAND where the astronomers have come up with a means of measuring the outer galaxies by detecting neutrinos at the bottom of the ocean. We discussed the establishment of an inter-island ferry system that President Matsuda mentioned using a semi-submerged platform; the implementation of recommendations of Senator Hollings' National Ocean Policy Study, the ramifications of the study not yet known, but certainly producing commercial ocean development; the building of structures of pre-stressed concrete (Hawaii has a very sophisticated pre-stressed concrete industry); and finally, to mention the Sea Grant Extension Act, expanding the scope and coverage of Sea Grant through our research and development, Advisory Services, and education.

Now these reminders, amplified a little more briefly and with a little more simple language, would trigger the remembrance of a number of issues as they appeared in the press or electronic media. The primary awareness on the part of the body politic was that the reef fishing industry had deteriorated in the past ten years. There was a general hope and feeling that aquaculture could be successful and lower the cost and increase the variety (both incorrect notions). Many were aware of manganese nodules and the possibility of energy from the ocean. The inter-island ferry system was recognized as a perennial issue, but the proposed solutions did not seem credible (to the body politic). But nobody understood Project DUMAND, and Senator Robert Hollings was about as well known as Robert Abel. But Sea Grant Extension sounded like a good idea because it involved federal funds.

All in all, the body politic, when confronted with the evidence for new jobs in the ocean, had enough awareness of the ocean, the nature of new potential, an appreciation of federal spending as it was conducted in the space program, to agree that a fourth

economic base for Hawaii's economy was possible. But instead of rejoicing in this conclusion, the local residents of Hawaii voiced concern. They were concerned that the new ocean industry would open up new jobs for which the citizens of Hawaii were not qualified, and as a result, an in-migration from the mainland would take place, and the local economic picture would remain as bleak as it is today. This was a legitimate concern, if one looks at Scotland, for example, seeing what the North Sea has done to the local coastal fishing towns. Everywhere that oceanic industry has developed, it has developed not with local residents but with an in-migration of people from a foreign land. Now I don't like to say that in Hawaii in-migrants from the mainland are in-migrants from a foreign land, but once you are in Hawaii, you get the attitude of "blow up the bridge, I'm aboard."

Now whenever this issue of in-migration was raised, the candidate was quick to describe the Sea Grant Hawaii-initiated marine education program, the Makahiki-kai (Festival-of-the-Sea), the aquarium elementary education program, the Blue-Water Marine Laboratory, and the high school curriculum development program. The University of Hawaii Marine Option Program (MOP) was cited in detail, and a specific example was used; an example which came to symbolize the campaign. A MOP student named James Kuwabara was a local boy who went to the University of Hawaii interested in the ocean with no hope as an undergraduate of getting an ocean education, but he nevertheless majored in zoology and signed up in the Marine Option Program. James became an apprentice to Mr. Fujimura, who has done the macrobrachium development program at Sand Island. James spent all his living days, other than his school days, learning how to develop prawns. All during this time he was a great student as he graduated with a 4.0 average, and then he went on to Cal Tech, and he is now studying open-sea mariculture with the intention of coming back to Hawaii in order to be a leader in that development. During that time he sent a letter asking how he could support the campaign. He said. "I'm going to do this much. I'm going to send a check for my food money for a week, and I want to let you know how I got my food this week. I got it by diving in the ocean for abalone and fish." And when we told that story, the people of Hawaii understood what ocean eduction would and could mean to the people of Hawaii. A remarkably high percentage of the parents of the elementary school children were aware of the Makahiki-Kai and the aquarium

programs and had very positive feelings about it. Parents who had any association with the Blue-Water Marine Laboratory or the Marine Option Program were enthusiastic about the concepts. Then the candidate found in his description of the programs, and the notion that the candidate was associated with them, were by far the most positive and effective message of the campaign. At no time had anyone asked the embarrassing and legitimate question as to whether this program was adequate in scope or in funding. The answer to that question would have to be a resounding "NO." All of these programs have had to fight and are fighting an annual battle for survival. The Marine Option Program, for example, can barely afford 150 students on a campus of 23,000, and less than 1% of the entire undergraduate student body is receiving any kind of an ocean education in a state having 60,000 square miles of ocean and less than 15,000 square miles of land.

Other major ocean perceptions of the body politic were derived from visits to the State Fair, where Sea Grant Hawaii had a display, the most popular element of which was a shark swimming in a plastic pool and visitors hoping that someone would fall in. Visitors also came to the State Farm Fair where the candidate had a display of tropical reef fish but most effectively a "touching pool" with starfish and sea urchins, and it seemed that all during the campaign, there were more people who had touched the starfish at the Farm Fair than had shaken hands with the candidate. But it soon became obvious that the biggest and strongest public impression of the ocean came from Jacques Cousteau and television, and in Hawaii from a weekly fishing program on television called the "Bruce Carter Show." This show has the highest ratings of any locally generated show. The equating of ocean industry with fishing and little else must certainly be due to the effectiveness of this fine but limited oceanic presentation to the people of Hawaii.

Now, were the negative perceptions as far as the ocean campaign was concerned? Yes, but not as many as I anticipated. I anticipated a large concern about utilization of the oceans for fear that it could damage the environment. Now I found that this concern was inversely proportional to the distance one got from the campus into the real world, and that the more one got into the real world, there was more of a concern with jobs and ocean utilization than there was for ocean protection. So I did not spend much time debating or discussing that issue.

I very quickly found out that any mention of the Sea Grant

Floating City Project with which I had been associated with was fatal, that this was regarded as unrealistic, visionary, imaginary, and the kind of a project that if any congressman were to sponsor, would certainly be fanciful. But that was true with the English-speaking population. We have a very large Japanese-speaking population in Hawaii, and the candidate had a fortunate opportunity. I never mentioned the floating city in English, but I never mentioned anything *but* the floating city in Japanese. In Japanese, all our TV, all our newspaper coverage, all our commercials concentrated on the joint project between Sea Grant and architect Kikutake of Japan in which they worked with us on the Sea Grant Floating City Project. And when Kikutake went back to Japan, bearing the idea from Sea Grant Hawaii, he persuaded the people of Japan to demonstrate the floating city concept in Aquapolis at the Okinawa Fair. And the Japanese press was generous. Many of you do not realize, if you do not read Japanese, that every time the Japanese described Aquapolis at the Okinawa Fair, they gave credit to the University of Hawaii as being the originator of that concept. And so the people of Japan or those related to Japan were very receptive to the notion that a project of this kind was not fanciful, but was real, and that it could be done, and therefore, every opportunity we could have through the Japanese language press, in reviews of Kikutake's book, reviews of the International Conference on the Ocean and the Sea, or discussions of the project, were taken advantage of.

The total effect of the Hawaii and the Sea campaign was very positive, and the candidate's strength in the polls began to rise markedly. And of course when that happens, there comes a counter to the campaign. The counter to the campaign was that the ocean was a single issue, and the candidate was a single-issue candidate. Of course, every counter has a counter-response. We were fully prepared for that, and we came forward with the counter-response with the theme that is absolutely vital to the public understanding of Sea Grant. That is, that the ocean is a place, not a discipline; that nearly every human activity that takes place on land can take place in the ocean. There is oceanic art, oceanic music, ocean law, ocean resource management, oceanic medicine, ocean recreation, ocean real estate, you name it, and that all of these must be part of the oceanic community, and that it is much more narrow for a representative of an oceanic state to regard the full range of his responsibility from a land orientation than to regard them from a

sea orientation. Now I must tell you that this response was eloquent, and you might have thought it was a good response, but it was ineffective, and the candidate found that this merely boxed him in on the notion of a single issue, such that he was forced late in the campaign to broaden his platform to include issues in such a way that they appeared to be independent of the ocean perspective. It seems to me that the primary misconception of the body politic with regard to the ocean is to regard the ocean as a separate distinct entity and irrelevant to the daily lives of the people of the United States.

To understand this point, it would be instructive to examine the occupations of the candidate's supporters in a major oceanic constituency, and I will not dwell too much on that except to make a few points. The candidate's campaign manager is a practicing country attorney who calls himself a "country attorney," and he practices down on the plains of Wahiawa. He left his practice from time to time to enter the political process first as campaign manager for the late Governor Burns, and more recently for Governor Ariyoshi. Prior to this campaign, he had little or no connection with or concern of the oceans. Yet it was he who chose the name for the citizens committee and he who urged that the ocean be the primary campaign theme. Why? He was a disciple of Governor Burns; he had studied the goals that had been set by the Governor of the State, and he was determined to fulfill those unfinished dreams of what was called "John Burns' Impossible Dream." One of these dreams was a frequently recurring statement in every state-of-the-state message that it was Hawaii's destiny to be the lead of the oceans and that the state should make every effort to preempt the nation, so in Governor Burns' words, "May Hawaii be the world's lead in ocean research and development." And to that end,Governor Burns in 1969 had organized a State Task Force on Oceanography. He instituted in 1970 a study on "Hawaii and the Sea" and sponsored a legislative program to provide institutional support that would strengthen Hawaii's bid for Sea Grant College status. Now in this instance, the campaign manager took his dedication to the ocean purely from the words of a political leader. And all too often many of us feel that words of such leaders are dismissed as campaign rhetoric, because they seem always simplified and general to us who would be in the profession. And yet, we should recognize that every time that we can persuade a political leader or a government leader to come forward with a positive statement in

terms of the ocean that this will have a tremendous and dramatic effect on people who are otherwise uninformed or unconcerned about the ocean.

I want to make one point about the oceanic constituency. There are two congressional districts in Hawaii, and at a political rally the candidate was humorously introduced by a well-known Hawaiian master of ceremonies as the candidate from the third congressional district — the ocean. And this was indeed so, that as one looked out on the ocean, one would see that not many people lived there. But if there is a constituency, it must be those who derive their livelihood from the sea. But the surprising fact is that many who derive their livelihood from the sea are completely unaware of the fact that they derive their livelihood from the sea. One group who understands is the fishing community, and it was evident throughout the campaign that they regarded themselves as part of our oceanic constituency. They furnish financial support; they bring interest, and of more significance the political supplies that are the machinery of every political gathering. We have seen people in Hawaii who do get their living on the sea. So why do they regard themselves as "ocean constituents"? This is evidenced by the endorsements of the maritime unions, masters, masons, pilots, unions of people who are practically on the inter-island ocean. This did not, however, include the ILWU, because the ILWU does not regard itself as part of the ocean constituency. To them, the ships come to the pier, and that is when their business starts. It is a land-oriented operation, basically regarding themselves as a land-oriented group in competition with the Teamsters for jurisdiction. And not only did the candidate not get their endorsement, he did not even get a request to be interviewed from the ILWU. And there are many other cases such as the kamaboko (fish cake) industry. Now they ought to be a sea-oriented constituency. Kamaboko used to be made out of shark until the Food and Drug Administration came along and decided that the ingredients had to be labelled, and with the prejudice against shark, the industry shifted to codfish. And where do they get the codfish? It's all Icelandic cod, arriving on the plane, and carried down to the kamaboko factory. As far as the kamaboko factory is concerned, that's just a product that shows up to be processed through the door. It isn't fish; it's that stuff that comes off the airplane. They do not regard themselves as part of the oceanic constituency.

So there was an education problem; how to educate people that

they were indeed dependent upon the ocean. They are worried about shipping strikes, and as they see it, it is a strike by ships manned by other people, from other nations, and from other communities. They do not see it as an economic opportunity for themselves to participate in the economic process.

Let me now tell you about the outcome of the election. As you already know, the candidate lost. He carried two districts: Manoa, where the University of Hawaii is located, and Kaimuki, where they only speak Japanese. There is a lesson in that. The lesson is that the Sea Grant intellectual process is still localized around the university and has not spread out. Where did the candidate get smashed? The candidate got smashed in a place called Kalihi. This is the place that had the highest amount of unemployment. This is the place where the people who would be the chief beneficiaries of jobs from the sea are located. This is the place where people do not come to coffee hours, do not come to morning breakfast seminars, and spend a fair time watching TV.

What is the final significance to Sea Grant of this experience? If I had to put two things that Sea Grant has to focus on, it is first the educational program *away* from the university at the elementary and the high school levels and at the time when minds are forming impressions of what the ocean is all about; and secondly, the advisory service program.

This morning President Matsuda made some remarks that were probably misunderstood. He made the remark that these two programs (MOP and Marine Advisory Services) could not expect to be supported as a parasitic program on the university, as university funds and mission do not spread to cover these educational and advisory programs.I think many interpreted this as saying that these programs are not important. No. These programs are so important that to expect to support them properly and legitimately as a parasitic tax on the rest of the Sea Grant Program is to fail to hit that program where it must be hit if it's to be effective. In the next ten years we must somehow identify, separate, and independently fund at an adequate level educational program, instructional programs, TV programs, advisory programs, and programs that carry the magnificent results of Sea Grant to people in an incredible way, so that when you ask them about what the opportunities are for Hawaii and the ocean, instead of having to engage in an election yourself, you can sit back and listen to a constituent talk for a change.

The Problems and Opportunities of Deep Sea Mining

JOHN E. FLIPSE
President
Deepsea Ventures, Inc.

It is my pleasure to be with you and to respond to the invitation of the two Don's, Don Keach and Don Walsh, to take part in this Sea Grant Meeting. My discussion this morning will be limited to manganese nodule mining, although I was delighted to hear that Hawaiian offshore sand and gravel are getting some attention. Briefly, let's look at nodule mining and then at its problems and opportunities.

I'm sure you are all familiar with the resource. The form we are interested in are the nodules, *not* the Hawaiian manganese crusts. As stated by John Craven, it will be many years before the crusts can be economically mined. The distribution of nodules in the world's oceans is very wide; but, fortunately for all of us, between the Equator and 30 degrees North latitude and the Hawaiian Islands and the Mexican coast, lie the best deposits of manganese nodules now known.

The typical assay of this material is about 30% manganese, 8 or 9% iron, 1½% nickel, about 1½% copper, and ½% cobalt. That may or may not sound exciting to you. To our Belgian associates it is a real let down from their long experience in the Congo, or Zaire, as it is now called. There they worked ores that ranged from 16% copper and 2% cobalt to the low grade of the present ore, 6% copper and 1% cobalt. I'd like to point out that the last mine that was opened in the United States for copper was at an assay level of one-tenth of one percent copper. So there are some differences in ores! Unfortunately, the nodules in the Atlantic Ocean are about half, or a little less than half, of the metal content of those in the Pacific Ocean. Even so, they might be attractive simply because they are in much shallower water and much nearer to the United States, but unfortunately they are more expensive to process. There is a mirror image of the north Pacific deposit in the south Pacific. We have concentrated on the deposit closest to home.

Now, for the technology. The current exploration techniques are probably capable of doing the job, but not for doing the job *economically*. The use of TV for inspecting the sea floor is an old technique, one we've used since about 1964. TV viewings on a one-mile grid continue as our principal method in confirming the presence of the nodules. Photographs, grab samplers, coring machines, dredges, and so on, are also techniques that are still used. An excellent Sea Grant study was done by Dr. John Noakes of the University of Georgia for the in-situ evaluation of a deposit. A sled, containing an isotope of californium was towed through the deposit to make the nodules radioactive and the backscatter from the various metals contained read on a meter on board your exploration ship. Unfortunately, the machine didn't work on the first trip, but I'm convinced it will be persued by the academic community and/or industrial concerns.

There has been considerable progress over the last few years in the development of techniques for mining manganese nodules with hydraulic dredging as the principal approach. Inducing the flow of water through the pipe line by air lift or in-line pumps has been investigated. Both techniques work! The dredge heads, machines at the end of the pipeline that gather the nodules, separate them from the sediments, and put them into the pipe, are in a state of proprietary art, while the rest of the mining system is pretty well established technology.

In spite of the good work that was done in developing the GLOMAR EXPLORER pipeline, a three-mile long conduit suspended from a moving ship is an expensive and basically difficult technical problem. I hope someday that we can allow Ray Kaufman, our Technical Vice President, to speak in depth on this subject because it is a tremendously interesting technical subject. Right now, this technology is expensive to acquire so Deepsea is not willing to disclose the details.

Another ocean mining system called the Continuous Line Bucket system, which we enjoy calling the "Japanese Rope Trick," involves hanging a large number of small scoops on a continuous polypropolyne line which is looped from the ocean floor to one or two ships on the surface.

The line gets knotted up often enough so that we are not really convinced that the system will be a major producer, but it may be developed for prototype operations.

This week, a 24,000-ton, prototype mining ship will sail from

Galveston, Texas, to the West Coast. It will be outfitted here with a pipe-handling system and a dredge pipe. It will then be sailed to our claimed mine site, 1,000 miles southwest of San Diego, to begin mining in the early months of next year. Although the production rate is not really commercial, the ship will provide sufficient nodules for the scale-up of our pilot processing plant to a demonstration processing plant.

To win the metals from the nodules, it is necessary to put the nodules back into solution. They agglomerate from the sea water over a period of some millions of years, an ion at a time, with the copper, nickel and cobalt ions as substitutes for other metal ions in the iron and manganese minerals. Hence, to get the payoff metals out, you must put them in solution. The separation of the solutions is straightforward enough. The metal-winning is where the innovative technology is required. Manganese nodules have something in their favor as an ore. All of the metals appear in the nodules as oxides. This is great for two reasons: they contain a lot of energy and they contain little, if any, sulphur, one of the problem-makers in processing. Since you must chemically dissolve the nodules, you are going to reprocess your reagents because you cannot afford not to. Therefore, the plants tend to be very clean, a blessing in this day and age. All of our processing work has been done with an acute awareness on our part of environmental concerns. We are not an old smelter with a coke oven that we have to modernize. We're designing a mining and processing system to work with full knowledge of the regulations imposed on other metal processing companies. There is little technical difficulty as long as you know the rules of the game and as long as they don't get more severe as time goes on!

Another important concern is the extent of U.S. dependency on others for essential metals. The domestic sources of the metals contained in manganese nodules do not exist or are rapidly disappearing. We import 98% of our manganese. The other 2% we get from the U.S. Government stockpile. There are no domestic manganese mines. We also import 30% of our nickel, 100% of our cobalt, and 20% of our copper. Let's speculate on the effect and likelihood of cartels. Although the Organization of Petroleum Exporting Countries (OPEC) is our sworn enemy, Norwegian oil is coming on the market at exactly the same price as Middle East oil. In Europe, the Norwegians are known affectionately as "the blue-eyed Arabs." I have no confidence, and I don't think you should

either, that we are going to get better treatment in manganese. You must have 14 pounds of manganese for every ton of steel manufactured, that's the best rate, 20 pounds per ton is average in Europe. There is no way to make steel without manganese. We depend on Africa, and particularly Gabon, which is a good place to depend on today, and Brazil for our supplies.

The free world depends on Zaire for cobalt. It is a by-product of their copper refining operations. It is distributed to Belgium, to Canada, to other places, but when you buy cobalt, it comes from Zaire. They are not particularly adverse to cartelization and would do it if they could afford to!

Let me briefly comment upon the economic problems of ocean mining. Will we have free markets? Or, will we have binding commodity agreements? Mr. Kissinger is bound to have commodity agreements! And, one such agreement brings on two more because the first doesn't work very well without help. If your commodity is covered while others are excepted, we need more commodity agreements, for equalization. Ocean mining probably won't work if there are extensive commodity agreements. Not that the prices will get lower under the commodity agreements, but because competitive markets will no longer exist and an alternate source is then the endangered source. An economic problem of immense proportions are the capital requirements of an ocean mining venture, $500 million to $1 billion. Another problem of an economic nature is the cost of delay. We have been looking at possible sites for a processing plant. We find that the time required from purchase of land to groundbreaking is five years in Virginia to nine years in California. An economically viable operation cannot tolerate delays of that magnitude in establishing a processing plant and getting some return on investment. Another source of delay is U.S. government regulation. I really enjoyed your keynote speaker, Mrs. Burke, this morning describing the turf fight that's now going on between the Commerce and Interior Departments, a jurisdictional fight. We've often said that we can work with anyone, all we had to know was who are we working with! Look at the legislation on ocean mining before the U.S. Senate and House, they name all of the various Executive departments as having responsibility. Let me quote from an editorial in *Barron's*, "The world bank has turned to financing in a big way Africa's most radical social experiments. If they succeed, and it is conceivable, the bank will end by becoming the prime promoter of socialism over capitalism

throughout the third world. For the perpetrator of the Edsel and the TFX, this is a fitting tribute."

Enough about the problems of ocean mining, let's talk about the opportunities. The U.S. does need some of these metals badly and we need an assured future source. If we give up our rights to the seabed nodules, we're idiots because we've then played into the hands of the controlled economy and guarantee our continued dependency. Even if there never is economic commercial ocean mining because of real problems, the *threat* should keep the cartels under control, a very real factor. When I argue with my Brazilian and Chilian friends, they keep saying, "we worry more about the fact that it's there and that it could happen than that it will happen." There is a tremendously large resource on the ocean floor. If it goes through the same sort of development as land resources, the best will be taken first, then the next best, and eventually unlimited deposits at a lower level assay. We have an ore body there that should meet our needs for thousands of years; not hundreds of years, but thousands of years.

In conclusion, I would like to reiterate my firm conviction that ocean mining will take place. Hopefully, the United States will straighten out its priorities so that we will pursue our national interest and protect our industry and our future. I sincerely hope that ocean mining will be a commercial, rather than government, undertaking with a return on investment commensurate with the considerable financial risks.

There is no question that foreign countries, whose natural resources are considerably more limited than our own, will pursue ocean mining, even if the return on investment is marginal, in order to develop essential metal feed stocks. Deepsea Ventures' contractual obligations provide for this, with American technology, if we do not go ahead here.

Thirty years from now our first generation technology will be laughable. Feasibility studies will be as hard to comprehend as the turn-of-the-century dialogue regarding highways and automobiles. The opportunities for American technical ingenuity are many. I can only encourage and academic institutions to fully utilize Sea Grant sponsorship to continue their high quality programs in the development of our ocean resources. I hope that our political and ideological uncertainties can be handled as expertly as our technical program! Carry on the good work.

Thank you.

Council Speakers

Coastal Zone Management: An International Perspective

JOHN ARMSTRONG
University of Michigan
(*Coastal Research Council/Ocean Policy and Marine Resource Development Council*)

It is certainly a great pleasure to be back with so many of my Sea Grant colleagues. As many of you know, I have taken on the new and challenging task of developing the Coastal Zone Laboratory at our University. In doing so I haven't had as much contact with my many friends in Sea Grant as I would like; so it was with

great pleasure indeed that I accepted the invitation to come and participate with you here this week in your annual meeting. Sea Grant, to me, represents the most important applied marine sciences program this nation has assembled and holds the potential to become even more important in the future. I am honored to be here today with all of you.

I was asked to talk today on the general subject of "coastal zone management in an international setting." That this is a subject discussed before a gathering of Sea Grant participants is indeed appropriate. First, because researchers at Sea Grant institutions have pioneered much of the work in coastal resource analysis and many of the Sea Grant programs are focused extensively on the problem of coastal resource management. Secondly, it is appropriate to discuss the subject of international coastal zone management at a Sea Grant gathering because those of us involved in marine and coastal studies have realized long ago that these problems do not recognize political boundaries nor are they exclusive to any particular political idealism or form of government. Marine and coastal problems transcend the institutions of man as do most of the environmental issues that we find ourselves with today.

In a larger sense we realize that the world is indeed very small. The gasoline that we casually purchase at the local service station comes, in part, from oil pumped from beneath the coastal waters of the Caspian Sea or the Persian-Arabian Gulf, and in the future the coastal waters of Mexico, Nicaragua, and other nations may supply some of our energy needs. (Just how much of our oil is to be supplied this way would be a subject for another day.)

Thus, the complex problems of coastal resource development and use are worldwide, and in many cases highly interactive between nations, at least in a political and economic sense, if not also physical. Coastal resource management as a concept, as an area of research or as a pressing resource management problem, is not unique to the U.S. We often tend to confine our thinking to problems of coastal planning and management in our own state or nation. Coastal resource problems are worldwide and the awareness of this is increasing rapidly. The means by which a country manages and controls its coastal zone may vary widely from country to country, but the impacts of man's use will be the same and the consequences of his misuse will be the same for each country. The questions of critical areas, areas of particular

concern, direct impact, management strategies, and so on are questions being faced by all nations regardless of political ideology or social order. The problem of whether or not an oil refinery on the coast will preclude future recreational or tourism opportunities is the same in Ghana as it is in New Hampshire. The impact of siting nuclear power plants on the coast of Iran does not differ significantly from impacts involved in the siting of such plants in California.

I believe that this internationally common problem of coastal resource management presents a challenge and an opportunity to the Sea Grant Program. The challenge lies with recognizing that the coastal problems that we deal with here are similar, and in some cases, related to coastal problems in many other countries. The opportunity lies in what seems to me to be a chance to both learn from and provide assistance to other nations that are grappling with these same problems. We live in a global world and with well thought-out programs we can participate in this international coastal arena in a way that will enrich our own programs and those of other nations.

I know that some of the Sea Grant Directors and participants may view any potential international Sea Grant participation with less than enthusiastic support. Of course, the main focus of our efforts should be towards solving our own critical coastal and marine problems. In a budgetary situation that is extremely tight, we are not in a position where much needed scarce resources can be used to finance extensive international programs. However, I don't believe that this need necessarily be a critical limiting factor.

I suppose one of the reasons I was asked to speak here today is that I have had a limited opportunity to observe and participate in some of the coastal resource management and planning efforts being carried out in some of the overseas nations.

I would like to share with you briefly some of these observations and to discuss what I believe are some of the major needs of the other nations in the coastal and marine field.

I am not going to describe in detail all of the many coastal resource planning and management efforts underway or anticipated in overseas nations. Rather, I would like to comment on some major international coastal resource efforts, and then to discuss what implications all of this might have with respect to the Sea Grant concept.

The United Nations has recognized the need for further

development of coastal resource management programs and has launched some modest, but very important, efforts in this direction. As part of my reporting to you on the international coastal management issue, I would like to give you some background information on the U.N. activities in the coastal resource management area. You will note that the U.N.'s programs in this area are focused primarily on developing nations, which is consistent under their charter.

In February of 1973 the Economic and Social Council of the United Nations issued a report called "Action Programs in Science and Technologies for Developing Countries; the Sea." In that report there was a strong emphasis on the importance of the coastal zone and the importance of coastal zone management as a part of the overall growth strategies for developing nations.

In August of 1973 the Economic and Social Council passed its basic resolution dealing with this area, Resolution 1802LV. This resolution requested the Secretary General of the U.N. to carry out certain marine-related tasks. I think of interest to us here is the second part of that resolution and let me try to summarize it for you. First, as an aside for a moment, I would like to say that with respect to developing countries, there was seen in the motivation for the U.N. resolution a need to manage the growth of individual sector activities so we could get some optimal mix of economic development and resource management. In this case the U.N. is trying to recognize the age-old problem of trading off economic growth versus the value of environmental resources. The pressures for economic growth in developing nations are as intense, or more intense, than in this country because of their relative economic position in the world order.

Refineries will probably be located primarily on the coasts of developing countries as opposed to the developed nations. Without careful planning this development may not be consistent with the plans of those same countries for other possible coastal uses; for example, tourism development, if they should see that as a dimension of economic growth. So there are many reasons similar to the ones in this country for developing nations to be involved in comprehensive coastal planning, except the time scales are much shorter than ours, much more compressed.

Again the resolution passed by the Economic and Social Council recognized this and called for development plans and programs to ensure proper management and development of coastal areas and

to encourage nations to make that an element of their national planning programs. The resolution obviously emphasized the need for international cooperation and specifically called out that the Secretary General undertake a comprehensive interdisciplinary study of coastal management in the international setting, and that has been essentially carried out. The lead agency in the U.N. is the Ocean Economics and Technology Office of the Department of Economic and Social Affairs. This office has relied on a number of other agencies and various consultants and advisors.

In summary, the resolution called for a comprehensive interdisciplinary study and that was completed in May 1974. I think those of you interested in international coastal development and management may want to get a copy of that study. A draft of this really puts the coastal management problem in perspective from the view primarily of the developing nations, and as such tries to draw together the need to balance growth with the conservation and preservation issue.

As a result of the comprehensive study that was issued by the United Nations, the next step in the U.N.'s entry into this field was a coastal area developing meeting in New York in November 1974 at which a number of coastal zone experts and representatives of developing nations were called together to review the comprehensive plan and to see if they could take the next step in developing some specific proposals for action at the regional level. The strategy in the U.N.'s program was to try and come up with intra-country regional programs, and four areas were selected: Strait of Malacca, Gulf of Guinea, the Persian-Arabian Gulf, and the Southern Caribbean Atlantic region.

These regions were selected as representative types of areas possessing some of the coastal problems that many of the other countries possess, and the objective was to come up with some early action programs for coastal planning and management.

Let me briefly describe the problems of these areas and why they were important. You will recognize that these problems, as I said when I started, are of the same nature that we have in the U.S. The Straits of Malacca was, and is, an important and heavily used international waterway which has served as a center for offshore oil drilling, fishing, and tin extraction. These activities frequently have conflicted in terms of competition for coastal space, and at the same time, other problems such as soil erosion along some parts of the coast, silting of ports, and destruction of

fishing areas have resulted. A major finding of the conference was that there is a need for introduction of effective measures to reduce conflicts in the utilization of these coastal resources and that the opening up of new areas for development could yield a considerable benefit to the area. The concept of multiple use would also find application in the area of, for example, using effluents for industry in mariculture and thus using the coastal areas for economic gain.

In the Persian-Arabian Gulf the problem is a little bit more complex because of the acceleration of petroleum extraction. Here we find the basic conflict between the fisheries that are so important to the small settlements in the Gulf and the exponentially increasing number of oil shipments, tonnage-wise, through the Gulf area from various oil fields both onshore and offshore. The need here was for the eight countries of the Gulf to try and come to some understanding of what impacts will be brought upon the relatively small reservoir of water contained in the Gulf and the type of institutional arrangements that might be derived there, particularly since the offshore oil drilling may be accelerated quite drastically.

Of the ten countries of the Gulf of Guinea, three fell into the category of the least developed countries having an average per capita annual income of less than $190 U.S. So here we have an extreme case of the need for economic growth and improvement combined with the need for wise use of resources for overall benefit of the nations. Also, we have some of the most severe physical conditions in terms of coastal environment—erosion, difficulty of siltation of ports, and some of the more engineering-oriented problems. Here the need was to bring in some expertise that the nations do not yet possess from outside and to help start training programs to enable them to deal with some of the more physically-oriented problems involved in coastal development.

The Southern Caribbean Atlantic region posed yet another contrast in the conflicts between coastal resources and the need for economic development. The tourism sector, of course, in the Caribbean is well-known. Coastal area development here is thus particularly important to the islands. There are not many other options for development besides tourism, although there is some mineral processing extraction. Jamaica is in the process of installing a new bauxite plant on its coastal area, and there the difficulty with the potential impacts—long-term impacts—is yet

to be dealt with. So here we have an area oriented towards tourism as opposed to some of the more heavy mineral extraction or energy-related industries.

The U.N. now is in the process of attempting to develop further each of these four regional plans and to date two developments have occurred since the New York meeting. There has been a survey team sent to the Persian-Arabian Gulf region to visit each of the eight countries. They recently have returned and have put together a comprehensive, final set of action proposals for each of the countries, again in a regional setting. That step has been accomplished and out of that will come proposals for funding both to the individual countries and to the United Nations, UNEP, and UNDP to start with the implementation phase.

The second step that has occurred in the United Nations' program in coastal area development and planning was a major seminar held in June of this year in Berlin. I had an opportunity to attend this seminar. It was called "The Inter-Regional Seminar on Development and Management of Resources in Coastal Areas." It was jointly sponsored by the United Nations and the German Foundation for International Development. The seminar was held for a period of about 14 days in West Berlin at the institute headquarters, and the main objectives were to bring together high-level representatives from the major developing nations with coastal zones—actually there were about 35 in attendance which I thought was rather a significant number—and to discuss some of the findings from the earlier U.N. planning efforts and to see whether or not, from the individual country's standpoint, the action proposals could be reviewed and perhaps even adopted at a much more rapid pace. So what this turned out to be was really an educational program in part and in part a planning session. The proceedings will, I believe, be available within a few months. As I mentioned, there were about 35 countries there. There was wide representation from the Caribbean group, the Central-South American group, the Persian-Arabian Gulf, the Mediterranean, Africa, and Southeast Asia.

The seminar produced discussions of a variety of different problems that each nation felt were, at the present time for themselves, most important—erosion in Togo, Africa was the most urgent problem for them. The extraction of sand and gravel in the Malacca Straits was a problem of interest to those people. But I think what was encouraging and interesting was the clear

need, the consensus that in spite of the fact that each country had a present problem, at the moment that each felt that there was a basic need for a framework in which general coastal zone development could be carried out in a logical, wise way. There were numerous conflicts discussed, examples of the consequences of not trying to look ahead in the planning of some of these coastal countries. These case histories sounded very similar to some of the difficulties we have had in this country—building of refineries in areas where this action would circumvent the future opportunity to develop a highly valuable resort area, or the destruction of a fishery by the lack of proper planning in terms of knowledge of currents and littoral drift and so on.

In conclusion, it was surprising to me to note that there really was almost unanimous agreement on the need for a comprehensive planning framework even though their individual problems were very difficult for them at the present time. They recognized at the end of the seminar the need to do this. One of the things we actually did was to structure some models of coastal planning programs for some of the countries in a workshop session.

The other finding or observation I made was that regardless of the particular process for making decisions in a country—in other words, whether it was a highly democratic country or a highly centralized, less representative type government—the need for the basic structure of planning and management and information gathering was almost identical. I suppose on second thought that is not very surprising because no matter who makes the decision and how, if they make it in a logical way, they need basic sets of information and they need to evaluate the impact of development on existing resources. It was highly encouraging from that standpoint.

Some other examples are of interest: Indonesia has what I feel is quite a sophisticated program in laying the groundwork for a comprehensive coastal zone management activity. They have, I believe, about 26,000 miles of coastline, and their approach there is going to have to be obviously on the regional or sub-regional basis. But they have done some very good work and, I think of all the countries at the Berlin Seminar, they had made the most progress. A country that wasn't there, and I know has engaged in activity at the state level is Australia. Jens Sorenson has spent some time there and, I believe, will be publishing some material on this in the future.

The United Arab Emirates is evolving a program that I am very familiar with in the Persian-Arabian Gulf. They are a country that has gone ahead without waiting for the U.N. regional plan to begin and are in the midst of initiating the generation of a comprehensive coastal area development plan for their entire coast, which is about 400 miles in length. Here again, one of their primary immediate concerns is the subject of increased oil shipping and its affect on their fisheries and potential recreational areas.

Spain has a program that I thought was quite interesting. Their emphasis was on the need to rethink some of the problems associated with the extensive development that has gone on on the Mediterranean coast of Spain. Those of you who have been there, will know what I am talking about. They are the first to admit it. There has been some extensive overbuilding of the tourism industry there.

Ireland is initiating a program that I have been fortunate enough to be involved in. Their coastal management program is going to have to deal with the same type of thing that Scotland has dealt with—the development of oil in the Irish Sea. So their program is going to have to deal carefully with the energy facility siting question and onshore impacts: refineries and the offloading of oil.

As I have pointed out here, there are many nations involved in coastal resource planning and management activities. The developed nations have used their existing technological base and expertise to structure programs at a much faster pace and level of sophistication than the developing nations. However, because of the presence of untapped coastal resources in many of the developing nations and because of their need for a broader economic base, the need for coastal development planning is urgent. This was readily apparent from the interest experienced at the Berlin Conference.

What relationship does all of this have to the Sea Grant Program? Obviously, we can learn from observing what other developed nations are doing in coastal management. They might learn from observing our programs as well. But for the most part the developed nations that are into this subject—France, Sweden, Britain, Norway, and others—already have the technological base to deal with most of these problems.

The developing nations, on the other hand, are by definition interested in development, in economic growth. By and large,

attainment of this growth is linked to the need for technological development, the establishment of a technological base.

Here is where the binding point is. We have a "chicken and egg" problem. How do developing nations evolve a proper technological base? In our case we can ask this question with respect to coastal and marine resource development. In order to build a technological base, one should have a technology assessment capability. But without the technological base, the assessment capacity is very limited.

The development of an assessment or evaluative infrastructure is tied closely with the country's technological base. Such an infrastructure is usually lacking in a developing nation. In the case where technological base building occurs through importation of technology, the assessment infrastructure is of critical importance.

Given the assumption that providing coastal and marine-related assistance is desirable, what then is it that the Sea Grant community can provide?

Let me first note that Sea Grant viewed in an international setting is not a new idea. As you know, the 1973 Sea Grant Amendments (in particular, section 205) called for a study of the means by which results of marine research might be shared with other nations. Such a study was carried out by Professor Kildow and a large group of participants at MIT. I am not up to date on the status of this report, but while it was perhaps a bit academic, it did contain several interesting recommendations. I am also not sure whether or not the international aspect of Sea Grant is still in the legislation, but I do feel this is a subject worth pursuing further.

It seems to me that Sea Grant Programs produce three distinct, but related, "products": research findings, educational and training efforts (and "educated" individuals), and what might be classified as the problem identification and definition process.

Research findings, characterized by theories, information, and something called technology, could possibly be applied or "transferred" to problem situations that exist in other nations. It is my belief that these kinds of products will find little direct application to problems of other nations, particularly developing nations because they are designed for our own particular technological infrastructure. This hypothesis will have to be evaluated in later phases of this study.

The educational product, as practiced in Sea Grant Programs at present, has some relationship to problems of foreign nations, but not a very substantial one. Certainly the individuals educated by Sea Grant related education activities can go to foreign nations and solve problems, but the number of such individuals is small.

The third "product," and one which is felt to be the most significant, is the Sea Grant *approach* to problem identification and definition as practiced at least to some degree by most U.S. Sea Grant Programs.

Consider the advisory service approach of an extension agent, aided by "resource specialists" working at the local or regional level in identifying marine resource problems, defining the problems and then working with research personnel to obtain results (e.g., technology assessment?). Note that this process need not imply only short-term problems or "non-academic" research (whatever that is), but spans the whole range of research activities to match the problem needs of a region or resource system.

In many cases it is felt that this process of problem identification and definition could be one of the most valuable products to be transferred to or developed in another nation. The awareness and approach to this phase of problem solving is usually the most important one. It involves creativity and it involves a methodological approach. It is this concept that Sea Grant has in part developed in the U.S. that will be of value. It is the approach to problems that needs to be developed in other nations (if they want it). This is not to say that the research products discussed above are not important, but they will be of little value until the problem identification and definition process is carried out in a meaningful way.

With respect to the basic approach to working with other nations, there seems to be three basic elements of the resource development problem, e.g., questions that in-country managers must ask themselves:

1. What do we want to produce to meet growth objectives?
2. How can resources be allocated to meet production?
3. How do we evaluate the degree of goal attainment achieved by the production?

The contributions to be made by external sources of assistance such as Sea Grant relates to all three of these questions.

One potential model might be the establishment of a Sea Grant

Advisory Services Program to work in various countries. However, it would seem important in this case that parallel Sea Grant type programs be established within and by the particular country so that the problem-solving team is made up primarily of nationals from that country and that the end result is to build up their own capability. In this case resource specialists would exist both at U.S. Sea Grant Programs as well as within the country. Technological and research assistance would eventually flow from both sources. Educational activities would be structured to build, where necessary, the resource specialist base within the country.

In the U.S. the Sea Grant concept, carried out by universities, has had some success in providing assistance to various segments of the marine community. In particular, Sea Grant Programs have been involved with local and state governments. In the U.S. university faculty and programs have had considerable influence with government development and related research programs. This may not always be the case in other nations where, while universities may be highly respected, they have not been traditionally looked to by government for assistance in problem solving.

Entry into this arena should be on a modest, carefully designed basis. One or two specific countries could be identified in which specific coastal or marine resource problem can be addressed, while at the same time pursuing the establishment of the problem definition/technology assessment capability.

These early experiments would serve to test the workability and desirability of Sea Grant international activities. There are many possible alternatives for continuing beyond this point.

In closing, I can only say that there are some extremely interesting problems of coastal resource development emerging throughout the world. It is my belief that the Sea Grant Program could enrich itself considerably by "testing" the water and seeing whether or not what we are doing, (the way we approach problems, and the way in which we say we can get information to people) has any value to countries that have just started to become aware of these very crucial, very important problems.

Perhaps we can realize even higher levels of accomplishment in situations where resources are just beginning to be thought of as resources, and where the development of meaningful research and management concepts may truly be of benefit to society.

Thank you.

Sea Grant/Industry: A Symbiotic Relationship

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INTRODUCTION

I am happy to have the opportunity to address the leaders of the Sea Grant Program—perhaps I should say the Sea Grant Movement—because I believe that Sea Grant is much more than just another federal ocean grant program. On the announcement for the meeting, I believe I was listed as the keynote speaker for the Communications and Advisory Councils, and on the subject of Sea Grant/Industry, a symbiotic relationship. I am going to take the author's privilege and talk to you on the much broader issues of Sea Grant Communications.

Many of the things I am going to say may be controversial, but I want to get you thinking about them. It is my contention that the basic mission of the Sea Grant Program—and not just the Advisory Services—is communications, and that Sea Grant's communication efforts as such should be looked at carefully and improved. For background, I would like to mention that as a member of the National Advisory Committee on Oceans and Atmosphere, I spent one year on a panel reviewing the Sea Grant Program. Our report has just gone to press, and will be available

shortly. Many of the report's conclusions have been disclosed in Congressional testimony by NACOA's Chairman, Bill Hargis and by Sea Grant's Panel Chairman, Bill Ackerman. In addition, the fifth annual report of NACOA has a chapter on the findings of the committee which Congresswoman Burke referred to. Many of my general statements regarding the mission and the operations of Sea Grant will be as a result of this study. This afternoon, however, I will try to identify a few of the communication requirements which I observed during the study.

A MATCHING FUND PROGRAM, ITS REGIONAL AND LOCAL CHARACTER:

We all know that Sea Grant was a program created in 1966 by Public Law #86688, which authorized the establishment and operation of Sea Grant Colleges together with a program of education, training, research, and advisory services related to the development of marine resources; and that the new 1976 Sea Grant Improvement Act has appended the words "To increase the understanding, assessment, development, utilization and conservation of the nation's ocean and coastal resources." This wording, I believe, better expresses the broader character of Sea Grant.

An important aspect of this program was that it was a "matching funds program." It is my belief that those three words, "matching funds program" constitute one of the most important differences between Sea Grant and other federal ocean programs and thus making it unique. It also adds new dimensions to the communication requirements. Let us examine some of the effects of this premise. First, it requires a partnership approach between an academic researcher and the customer for research. The customer must pay one-third of the cost, and this cannot be federal funds which means that state, county, city or private industry will be the customer. It is important to note that because of this arrangement, the problems tackled will probably be of local or regional significance. This does not imply that the problems will not be of national interest or on national issues, but it does mean that they will be looked at from the local or regional viewpoint. This is an extremely important characteristic of the Sea Grant Program which has many times been overlooked—or worse yet, criticized. The majority of federal agencies and programs have missions spelled out for specific resources and problems on a

national basis. In other words, a top-down approach. I would like to make a comment here regarding the change made by the 1976 Act which allows Sea Grant to work on problems of national or international importance without the required cost sharing. I worry about this, even though Congress in the new Act has set an amount of $5 million and a statement that in any fiscal year it should not exceed an amount of 10 percent of total funds for the rest of the program. This concept changes the basic character of Sea Grant as an agency with local and regional responsibilities to one which could, in the future, be overshadowed and even consumed by complex national and international issues. We need Sea Grant to deal with local and regional problems, and not further confuse the responsibility between Sea Grant and other federal agencies. I agree with President Ford's statement when he signed the Sea Grant Improvement Act of 1976 that the proposed national project and international assistance program could be more appropriately carried out by other agencies with the responsibility for addressing national and international marine-related needs.

One of the dangers of working on local and regional problems is that one must be sure that they are just that, and that one knows what the difference in their character is from region to region, and on a national scale. For this reason, Sea Grant must have an adequate communication system so that it cannot be criticized for working on problems already solved in some other region. Furthermore, these problems and the answers must be communicated to other federal agencies so that they may be understood and considered at the national level. I do not believe that this communication channel has been adequately developed by Sea Grant. The new Act has recognized Sea Grant's responsibility to coordinate marine information functions under Section 210 of the Act, and Congress is certainly going to check how well this is being accomplished.

MULTI-DISCIPLINARY CHARACTERISTIC:

Another important factor to be appreciated concerning Sea Grant is its multi-disciplinary characteristic. The majority of federal agencies have specific resources or single purposes; responsibilities such as coastal management, fisheries, offshore oil and gas, etc. In contrast, Sea Grant was designed to be particularly responsive to the immediate practical needs of

industry and government in a host of subjects, and I was pleased to see that this was recognized in the new Act with the following statement: "The term 'field,' related to coastal and ocean resources means any discipline or field, [including marine science and the physical, natural and biological sciences, (and engineering including therein), marine technology, education, economics, sociology, communications, planning, law, international affairs and public administration] which is concerned with, or is likely to improve the understanding, development, utilization, or conservation of ocean and coastal resources."

State, county and city governments do not have available in-house these broad, multi-disciplinary characteristics and are loud in their praise and support of Sea Grant assistance in solving many of their coastal zone and marine problems. The small business section of industry has also benefitted greatly and is vocal in their support of Sea Grant assistance.

Large industry on the other hand has not been heavily involved with Sea Grant. It is my opinion that this is not due to a lack of interest or a communication problem. I believe it involves a fundamentally different approach; something like the difference between the federal agencies' charge and Sea Grant's charge with regards to its sector of influence in marine effort. Large industry has resources and multidisciplinary staffs necessary to carry out their requirements in the fields of scientific research, engineering, business, law, planning and it can do this on a proprietary basis. On the other hand, I do believe that large industry does recognize the extremely important task that Sea Grant accomplishes in educating the public and government officials on marine resource issues. It should be further recognized that large industry has experienced some public distrust with industry funding of research by the universities. There is often the feeling that the results may be biased and not acceptable. I do not agree with this, but I do believe that it is a fact of life that must be recognized. Therefore, it may be unwise for large industry to place funds in Sea Grant program activities and inadvertently jeopardize the esteem Sea Grant enjoys with the public.

I am certain that with this group I do not need to go into the difficulties of communicating and translating information concerned with such a broad reservoir of knowledge, with the number of disciplines involved, and making it available in a form that is readily understandable by the wide range of customers. I believe

that the Advisory Services have been doing an excellent job in this respect. I am concerned, however, with Sea Grant researchers who publish only for their professional stature and not their cost sharing customers.

A SERVICE PROGRAM:

It is obvious that Sea Grant is not just another federal research program. It is a service program enabling the university and research institutes to offer their capabilities relating to ocean and coastal resources to the local and regional customers who are willing to share the cost of the program. I believe that one of Sea Grant's difficulties in being able to obtain adequate federal funding has been the fact that this service characteristic of the program has not been adequately communicated to the government, OMB in particular. After all, it is entitled a grant program and is with the academic community, and OMB's bias against institutional granting is well-known.

Further evidence of the need for upward communication shows in Congressman John Murphy's opening statements at the Sea Grant's over-sight hearing held this spring when he asked a series of questions:

What degree of coordination is there between Sea Grant programs and other federal efforts in this area?

How effective is the Sea Grant organization on the various campuses?

How are the users of Sea Grant products brought into the system, and how can we gauge the effectiveness of Marine Advisory Service activities?

How might we better enable the Sea Grant program to address itself to pressing national ocean policy issues?

How are priorities established in the program between research, advisory services, and training activities, and on what basis are the research activities chosen?

What is the proper balance between the institutional Sea Grant operations and the individual research projects?

How adept has Sea Grant been in adapting to the shifting public priorities in ocean matters during the past ten years?

It is interesting that nearly every one of those questions could

be answered by communicating the goals, policies and statistics of the operations of the Sea Grant.

A further indication of this need for upward communication was the fact that at least four of NACOA's eleven recommendations were concerned with this subject; i.e., clarification of the subjects of goals, roles and policies of Sea Grant. I believe that the new Sea Grant Act includes a new vehicle which can accomplish this upward communication. The Act calls for an annual report that the Secretary shall submit to the Congress and the President no later than February 15 of each year—a report on the activities and the outlook for the Sea Grant Program, with an evaluation by the Director of the Office of Management & Budget and by the Director of the Office of Science and Technology.

It is obvious that there has been considerable confusion in both the minds of Congress and the administration as to the roles of, and the goals of the Sea Grant Program. Sea Grant has had ten years in which to develop its true character. Now is the time for the Program to issue a meaningful report that communicates its purposes and accomplishments with adequate data on a yearly basis that will allow Congress and the administration to judge its success or failure. I am certain that Sea Grant management is not going to take the preparation of this report lightly. It is not going to be easy and it will place demands upon all of you from the individual institutions as well as the national staff.

IN SUMMARY:

I believe that Sea Grant has evolved an excellent communication with regional and local customers as attested by its matching funds programs. In my opinion, there is need for a better informational exchange system between the various federal agencies and Sea Grant at the national level, as well as between the various Sea Grant institutions on a regional and national basis. There is evidence that there is considerable coordintion at the local level between representatives of the agencies and Sea Grant. Finally, there is need for an improved upwards communication, and it is hoped that the Annual Report called for by the new Sea Grant Act will be a meaningful report which really communicates the true character and performance of the Sea Grant Program.

In conclusion, let us not hide Sea Grant's light under a lobster pot, but help make it visable to all; not just to those of us who are willing to look through the slats.

Imagination and Education

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I have been trying to get an adequate marine education for over 30 years now but that goal has become more elusive than ever. The problem is that the horizon of knowledge retreats before me, expanding upward and outward in all directions because of all the new things going on. Since my pathway is only linear, the part that remains to be known increases as the cube of what I have already learned. Thus my percentage of total knowledge becomes ever smaller. It is a paradox: the more you know the less you know.

I never liked school or formal courses very well and spent most

of the time I was required to put in, daydreaming of the outside world. I was a teen-age Walter Mitty, doing all manner of adventurous things, travelling to far away places and leading very heroic expeditions. All in my head. I expended a great deal of imagination in school to keep myself away from the dull reality of book learning. Except that I would sneak into the library to read Mark Twain, and Rafael Sabatini, and Rudyard Kipling.

My first college dean once said, "You should never allow college courses to interfere with your education." I didn't. They rarely saw me in class after that. I went to work underground in various mines and tunnels and these eventually led to the Colorado School of Mines—from which I probably would have graduated—except for a disagreement with its president.

Since leaving school I have had not only a wonderful and adventurous life covering a lot of the world, but I have become something of a scholar. I know now what I missed and I have tried to analize why the educational process seemed so dreary.

There were two prime reasons: 1) I never really had a great professor to whom I could really look up to because he seemed to know nearly everything. There are such men; intellectual demi-gods who think about new subjects in new ways; who can unfold the ocean world and reveal the fun inside. And 2) I was never properly introduced to the intellectual excitement of great, fascinating ideas; nor did I sufficiently question what I was told or ask really penetrating questions.

Disappointing as this was, I did learn something. I found that it is virtually impossible to force-feed an education—to teach someone who doesn't really want to know. Education begins when a student (or congressman) seriously asks a question and sincerely wants an answer. From then on learning is easy. So, the first step is to pique the curiosity enough so the questions are asked.

That requires one to stimulate the student with ideas that are so strange or curious that he must ask questions to satisfy his curiosity. Thinking of the ideas and properly presenting them requires imagination.

Now there's no point in my simply saying to you, "use your imagination to present some exciting new ideas." But I can give you a demonstration of what I mean. You are all teachers, but my students now, and I will try to get you so excited on some ideas that you can hardly wait to learn more about them.

The following are examples of intellectually exciting ideas that

relate to the understanding of the ocean and its history. All are true. The object of stating them is to stimulate your imagination and stir your interest. They are part of the Bascom imagination-motivation test. I will give you a few seconds to think about each one.

- A white line, painted by nature on the floor of the Pacific Ocean, precisely marks 4000 miles of the earth's equator.
- Some shrimp are all males for the first 2-3 years of life; then all become females. Some fish (including the local sheepshead) are all female for the first 2-3 years of life; then they all become males. In one species of deep sea fish the male melts into the female on mating and they become a single fish.
- Ancient mariners crossed both Atlantic and Pacific Oceans many times over 2000 years ago. The smallest known boat to cross the Atlantic (in recent years) was less than 6 feet long.
- There are mineable quantities of gem diamonds on the ocean bottom. And tin. And Titanium.
- There are an estimated 2 million species of animals in the ocean. Of these only about one quarter have been scientifically described.
- The amount of metals dissolved in the ocean range from ten's of millions of tons for scarce metals (such as lead and cadmium) to billions of tons of copper, zinc, and nickel. The maximum possible amount of any metal added by man in all history is about 100,000 tons of copper. This is about 1/100 of one per cent of the amount naturally present.
- Ships over 2000 years old still exist virtually complete on the deep sea floor in certain special (reducing) environments. They and their cargos can be found and recovered.
- The marine animals of the California coast are most abundant near waste water discharges and under oil platforms.
- Particles of brass (a wholly man-made material) are found in very large quantities throughout the deep waters of the central Atlantic Ocean.
- One marine animal has its own m'aidez (May Day) alarm. When attacked by hermit crab, the brittle star rapidly flashes a bioluminescent light. The flashing light attracts kelp bass which eat the crab.
- The tonnage lost each year of modern steel, propeller-driven ships equipped with the best safety and navigational devices is

greater than the annual loss of wooden sailing ships 100 years ago.

- No serious attempt has ever been made to find and salvage the most valuable shipwreck known. (a galleon with $40 million in gold and silver aboard.)
- The energy released when a fresh water stream empties into the ocean (called salinity energy) is equal to that released when the same volume of water flows over a waterfall 700 feet high.
- The occurrence of a major rain storm in southern California in September (such as we had this year) pressages a series of major flooding storms the following year.

You have heard 14 imagination-motivating test statements. Now, here's how to grade the test. Begin by eliminating from consideration any of those statements that you already knew, or believed in, or completely understand. Of the remainder you should have been surprised or astonished by at least half of them and asked yourself: "How can that be?" "What natural process or circumstance could produce that curious result?"

If such questions did *not* rise at once to your mind, you are already eliminated. You are not likely to stimulate intellectual excitement in someone else.

However, if it seemed to you that some of those statements were fantastic or offered a great opportunity for science, or exploration, or energy, or wealth, you probably asked yourself: "What is the supporting evidence?" and thought, "Where can I find out more?" Those are the questions I wanted you to ask and the ones you should want your students to ask.

The final grade on this test cannot be assigned for about a month. It depends on whether by that time you have actually gone to some reference source (either a library or a guru) to learn more about some of those statements. If you do, then *I* pass this test—my grade being proportional to the amount of investigation that you do. Even better, my score doubles when you ask yourself, "How can I present similar stimulating ideas to my students that will make them want to ask questions and read books on marine science subjects." When you do, and when they do, then we are both successful as marine educators. The criterion is that you furnish the stimulation that gets the pupils imagining the possibilities and studying on their own because they want to learn.

From that point on a teacher is useful, not essential. That constitutes success in education.

Special Awards

National Sea Grant Association Award Presentation:

B.J. COPLAND
Director
North Carolina Sea Grant Program

Mr. Paul Atkinson, President of the Sun Shipbuilding and Dry Dock Company, is the recipient of this year's Sea Grant Association award. Mr. Atkinson is uniquely qualified for this award because he exemplifies the Sea Grant concept in action—that is, the use of new technology in the commercial development of the oceans with full regard for environmental protection. In keeping with this philosophy, Mr. Atkinson is responsible for:

- creation of commerce on the ocean
- stimulation of trade between nations through excellence in ship design, construction and operation
- innovation and creativity in design and fabrication of ocean test and exploration equipment
- stimulation and support of marine education and research through industrial cooperation.

Some specific examples of Mr. Atkinson's leadership at Sun Shipbuilding and Dry Dock Company are particularly appropriate for this award.

1. *Ecological Tanker*—The *Prince William Sound* is the first of this type and is now in service. Two others of similar design are under construction. These vessels feature a complete double hull for protection against grounding and collision, enhancing the principle of segregated clean ballast. Other vessel design features include oily water separators, waste products combustion and full inert gas systems (including the ballast tanks)—all developed at Sun.

2. *Roll-on/Roll-off Designs*—Sun Ship Co. vessels of this type are the largest and fastest in service and now operate worldwide. These innovations have provided mechanisms for more efficient and more economic ship service.

3. *Anchorage—Seattle Steamship Service*—Twice-weekly steamship service is providing superior connection between the growing Alaskan economy and other U.S. ports. A Sun subsidiary, TOTE, is operating two roll-on/roll-off vessels in this service, translating technical superiority into economic excellence.

4. *Advanced Ship Design*—New technology has been successfully applied in advanced ship design and operation. These advances are exemplified by the gas turbine propelled *Admiral Wm. M. Callaghan,* the icebreaker *Manhattan,* and the well-known *Hughes Glomar Explorer.*

5. *Special Ocean Structures*—Advanced technology has been successfully applied in the fabrication of special structures. Notable among these are the Navy Marine Engineering Laboratory, which is a 27' x 10'2" 12,000 psi test chamber of HY 100 steel, and the two HY 140 pressure hulls for the Deep Submergence Rescue Vessel (DSRV).

6. *Marine Education*—Mr. Atkinson contributes significantly to marine education by serving as a Trustee of the Webb Institute of Naval Architecture and Marine Engineering. He is heavily involved in a Sea Grant College Program as a member of the Advisory Board of the University of Delaware College of Marine Studies.

It is my great pleasure to present this Sea Grant Association check for $500 to Mr. Paul Atkinson as recipient of this year's award. As an example of transfer from a Sea Grant-nurtured industry to a representative of a more traditional one, I will also present this beautiful precious coral statuette provided by the Hawaiian precious coral industry.

National Sea Grant Association Award Acceptance:

PAUL E. ATKINSON
President
Sun Shipbuilding & Dry Dock Company

At left receiving award is Mr. Paul E. Atkinson from Dr. Stanley Murphy, 1975-76 National Sea Grant Association President.

Gentlemen:

I am honored to receive your award, and particularly pleased to be the first industry recipient. I consider it to be a tribute to the efforts of people at Sun Ship.

I would like to speak to you about marine matters as we at Sun Ship see them and indicate to you how so many marine disciplines become of concern to us and why we are taking an increasingly active role in those disciplines.

We are an old line, major shipbuilder in the United States. We are different in many respects from our competitors; one way is in our concentration in the area of commercial transportation. Recently, in addition to designing and building large commercial ships, we have also begun to operate them. Our viewpoint of operation is that it is a part of a larger transportation system and that successful operation can only result from a larger and more complete understanding of all forces at work on the system.

Hence you find among our people, some concerned with marine affairs, politics, population trends and needs, and commodity knowledge. Knowledge not bounded just by the sea, but rather, knowledge intended to put the sea to use for those ashore.

And what about our knowledge of the sea? We are able to and have achieved remarkable feats in engineering and construction for the sea. We are proud of our engineering achievements. Among many others, there have been the pioneering ice breaker *Manhattan*, high speed trailerships, and our recent ecology class tankers. But we see in every area that our knowledge is far from perfect. I will examine some of these shortcomings with you, but first I'd like to comment upon three dominant, recent changes and continuing changes impacting upon us.

The capital cost of commercial ships has escalated enormously, despite increased shipbuilding productivity. Predominantly, technical complexity drives this change. Liquefied natural gas carriers are one easy example. In addition, ships have become larger and the demand for speed has brought a need for increased power, in many ways not dissimilar to the reasoning for Concorde. We have experienced a four to five fold increase in power requirements for some of our ships in just the last few years. As a consequence, capital costs per ship of $150 MM are no longer rare. With daily costs of $50,000 to $100,000 there is no tolerance for design inexactitude.

Coupled with a demand for higher speed which means increased fuel consumption, we have been faced with the sudden changes in the world's energy picture. Since the oil embargo of 1973, fuel prices have soared more than three times. Couple that with the power increase and you have a 15 to 20 fold increase in the influence of fuel costs on ship operation. Suddenly it is imperative that we improve upon power plants and "seaman's eye" and shaft alley navigation.

Thirdly, the delicate balance of our ecosphere is coming into sharp focus—and probably none too soon. In every area of our operations we share this concern, whether it be in the Arctic, in our trailership operations between Seattle and Anchorage, or routine operations elsewhere on the high seas. Indeed it has become a constant concern and consideration in manufacturing operations on the Delaware River.

These three changes, taken in toto, have made our business a completely different one in less than 5 years.

Let me return now to some of the shortcomings we perceive.

1. Fuel economy demands optimum hull conditions. Hull fouling and its control, consistent with environmental considerations, must be better understood. We recently were surprised to find with underwater TV, abundant grass growth on a high speed vessel in Alaska service. Conventional wisdom would have said in that service and at that speed, we should not have experienced this situation.
2. We find it imperative that vessel performance be accurately known—and yet methods of measuring speed through the water and horsepower aboard today's ships are too crude for accurate diagnostics. Progress is being made by us and others. Accurate thrust measurement is a rarity on ocean vessels today.
3. Propeller design with its complicated interaction with flow from the hull continues to make success largely dependent upon art and luck rather than science. This situation is intolerable. We currently have two sisterships in service with strikingly different cavitation damage on the two identical propellers.
4. Communications are currently undergoing a revolution. Considering the economics of the investment, it is amazing that vessels may be out of touch with their managers for days regarding important technical, economic and human factors.
5. Corrosion problems in the marine environment are not new problems, but they are taking on greater urgency. With vessel costs mounting, the economic loss from out-of-service repairs to vessel internals becomes staggering. A better understanding of fundamentals and their application is necessary. We are asking ourselves if the ballast water on our tankers should be treated.
6. Corrosion, like fouling, can take its toll in the vessel fuel bill. Like others, we have recognized that copper/nickel clad hulls might offer relief from both fouling and corrosion. We find that for today's requirements, we are in a very different ballpark than our ancestors who copper clad hulls. Successful application becomes a very complicated, multidisciplinary matter.
7. The successful design and construction of ship structure is advancing, but we find many areas calling for more atten-

tion. Ocean engineering is only beginning to quantify the service loads. Analytical techniques such as finite element analysis and photoelastic techniques are receiving increased attention as is fracture mechanics. But it is still a common experience to suffer structural damage and even vessel losses.

8. Weather prediction has made great strides but our own assessment indicates great room for improvement. In particular, wind force and direction becomes extremely important as ship speed increases. The effect of the wind on the sea is obviously of extreme import. In addition, we preceive a great need for better understanding of the effect of weather upon vessel performance. Much theoretical work has been done but practical and reliable application is in its infancy.
9. With vessel size growth have come new and different mooring and port problems. One has only to contemplate the concerns attendant to an Arctic terminal and the enormity of conceivable ice forces to realize the many disciplines which require marshalling to succeed in operations in harsh climates.

I could continue with a long list of current problems. There are future ones as well and in almost all cases the current problem blends with the future with just greater urgency.

In our quest for answers, we have turned to many sources, but high on the list are the universities. It is only natural that there we have interfaced with the Sea Grant Program, I believe, both as a contributor and I hope as a beneficiary.

The sea is complex. It is difficult to isolate one element from the whole. Each problem that we tackle turns out to be multifaceted—and the problems are burgeoning.

The requirement for multidisciplinary solutions to these problems has become the norm, not the unusual.

The Sea Grant Program has brought the tremendous strength of the academic community to bear on these problems. That community is in place.

The principal ingredient for successful implementation of the Sea Grant Program over the next few years will be the continued application of interdisciplinary capability to real time problems. The measure of success with which Sea Grant will be identified will depend on the timeliness and pertinence of its efforts aimed at the solution of people-oriented ocean problems.

Graduate Student Research Awards

In recognition of the outstanding contributions made by graduate students in furtherance of the National Sea Grant concept of applied research in the realm of marine resources development, the 9th annual meeting of the Sea Grant Association inaugurated the Graduate Student Research Awards.

Awards of $100 each were presented to the authors of three selected papers at the banquet on Tuesday evening, November 9. The awards were sponsored by the National Ocean Industries Association (NOIA), Charles Matthews, President. Representing Mr. Matthews was Mr. Bernard Frankel of Los Angeles who presented the students with their checks.

The following three students were selected on the basis of abstracts submitted to their local Sea Grant Directors for preliminary screening. Final decisions were made by the selection committee, chaired by the Association President, Dr. Stanley Murphy.

Ms. Deborah A. Barsotti
Dept. of Pathology
University of Wisconsin
"Biological Response of Nonhuman Primate to Low Level Polychlorinated Biphenyl Exposure"

Mr. R.J. Carrick
Dept. of Environmental
Science & Engineering
University of North Carolina
"Improved Methods for Detecting Enteric Viruses in Oysters"

Mr. Guy D. Marchesseault
Graduate School of Oceanography
University of Rhode Island
The Application of Delayed Recruitment Models to Two Commercial Fisheries"

Biological Response of Nonhuman Primate to Low Level Polychlorinated Biphenyl Exposure

DEBORAH A. BARSOTTI
Department of Pathology
University of Wisconsin

In slightly more than five decades man has seen the finale to the much too often told story of progress: the production of a product, its broadened application, global distribution and the resulting hazard to fish (1), birds (2), animals (3) and man (4). Polychlorinated biphenyls (PCBs) were first manufactured in the United States in 1929 for use as a dielectric fluid for capacitors and resistors. The uses expanded to such things as plasticizers, fireproofing and carbonless duplicating paper. PCBs are suited for these uses because of their stability, fire resistance, high dielectric strength and conductivity. These same properties that make PCBs valuable to industry also cause them to be of grave concern to the environment. In 1966, PCBs were discovered to be worldwide environmental contaminants and identified as the culprit in the poor reproductive capacities and death in many species of fish eating birds in Sweden (5). Since that time the presence of PCBs has been demonstrated in almost every environmental media and many of the organisms.

The United States' sole manufacturer restricted sale of PCBs to closed systems in 1972 and three years later the levels in many foods had declined, but the spread throughout the environment is much greater and at higher levels than believed before. It is estimated by the EPA that 10 million pounds a year is lost to the environment. Most of this loss is in industrial disposal in dumps or direct drainage into our inland and coastal waters. Consequences

of this pollution is seen in its high levels in the waters serving industrial areas and the life they contain such as the Hudson River, the Great Lakes and the Gulf of Mexico.

The bioaccumulation in the food chain is evident with man being at the top. A survey of randomly selected human adipose tissue in 1973 and 1974 showed that 35.1 and 40.4% respectively contain more than 1 ppm (6) This fact has brought attention to the need for additional information on the potential injurious effects of PCBs at chronic low levels of exposure. To aid in the clarification of these effects, the rhesus monkey (*Macaca mulatta*) was chosen for its similar response to PCBs when compared to those of the Japanese patients that were exposed to PCBs through the ingestion of industrially contaminated rice oil. These included chloracne, alopecia and periorbital edema (4). In the following paragraphs a summary of the biologic response of the nonhuman primate and its offspring to levels of PCBs that are allowed in some foods destined for human consumption is presented.

Eighteen female and four male adult rhesus monkeys were fed diets containing 2.5 and 5.0 ppm PCB (Aroclor 1248) for up to 16 months. These levels are ½ and equal to that FDA allows in the edible portion of fish. Within 2 months, lesions characteristic of PCB intoxication such as alopecia, acne and edema of the eyelids could be detected in some of the females. During the experiment, all animals exhibited these lesions to some degree. Alteration in serum lipids and liver function tests were detected(7).In addition, these animals experienced menstrual irrigularities and increased excretion of urinary total ketosteroids (8) . Radioimmunologic studies of the circulating levels of progesterone and estrogen is being determined and preliminary observations indicate alterations in the hormonal patterns most likely due to the increase in function of the liver enzymes. The ability to maintain pregnancy was affected as exemplified by the frequent resorptions and abortions(7).Even more dramatic was the effect on the offspring of these experimental animals. It has been reported that these compounds cross the placental border in man(4)and the rhesus monkey(9)The birth weights of the infants born to these females were one to two standard deviations from the controls and hyperpigmentation was observed. Skin biopsies at birth showed detectable levels of PCBs and this level increased with time through exposure to PCBs in the mothers' milk. Within 2 months the infants also exhibited lesions characteristic of PCB intoxi-

cation. There was a 50% mortality in this group within 8 months. This indicates that the accumulation of transplacental and mammary movement was sufficient to cause morbility and mortality in infant nonhuman primate (10). The remaining infants were removed from their mothers at 4 months and placed on a synthetic milk replacer. These animals subsequently are recovering and the only sign of PCB exposure visible is the pigmentation pattern indicating the importance of the removal from the source of exposure.

Males exposed to 5 ppm exhibited more tolerance to the compound. Only one male exhibited periorbital edema and erythema after similar time of exposure. In spite of a high body burden of PCBs their breeding capacities did not vary from the controls (7).

Presently all animals have been removed from the diet. The rate and extent of recovery is being evaluated through physical and clinical methods. The second breeding trials were more successful. These animals still have detectable levels in their tissues and the capability of transmitting the PCBs to their offspring.

It is evident from the preceeding report that levels of 2.5 and 5.0 ppm in the diet causes adverse biologic effects on nonhuman primates and their offspring. At this time there is no definite answer to the question of man's involvement but indications are that these levels may cause similar effects.

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Improved Methods for Detecting Enteric Viruses in Oysters

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INTRODUCTION

The concept of the indicator organism is basic to many areas of public health; the shellfish sanitation program is no exception. The total coliform standard implemented 50 years ago by the National Shellfish Sanitation Program is used today in determining the microbial quality of shellfish and shellfish growing waters with respect to fecal contamination (1). This standard, however, has been challenged for its inability to distinguish between bacteria of fecal origin and bacteria from other sources (2) There is incentive, therefore, to develop a more specific test for fecal contamination in shellfish.

As desirable as indicator bacteria standards may be, a bacterial standard which does not reflect the enteric viruses as potential human pathogens in shellfish cannot be endorsed. Research in this are by Fugate *et al.* (3) and Gerba and Schaiberger (4) indicates that bacterial and viral fates in coastal waters are poorly related. Furthermore, epidemiological evidence indicates that oysters may act as vehicles in enteric virus disease transmission. Outbreaks of hepatitis A (HA) and gastroenteritis have been attributed to consumption of raw and steamed shellfish (2),(5-7). Koff, *et al.*, has also shown that shellfish may be a significant cause of HA during non-epidemic periods (8).

The role of oysters and other shellfish as vehicles for enteric virus transmission must be established. In order to do this, adequate methods must be developed to quantatively detect enteric viruses in oysters and other shellfish. This paper describes the development of an improved method for the detection of enteric viruses in oysters.

MATERIALS AND METHODS

Cell cultures, viruses, and virus assay. Poliovirus type I, strain LSc was used as a representative enterovirus, Reovirus type 3 as a representative reovirus and Simian Adenovirus, SV11 as a representative adenovirus. All samples were assayed in VERO cells using the Plaque technique. *Oysters.* Oysters (*Crassostrea virginica*) were obtained from the North Carolina coast. They were shucked and stored at -75°C until used. The oysters were homogenized in a Waring Blender.

RESULTS

The method developed is based on an earlier method described by Sobsey, *et al.* (9). In this earlier method, enteroviruses are effectively absorbed to oyster solids at pH 5.5 and low conductivity. After low speed centrifugation, the supernatant is discarded and the virus-associated oyster solids pellet is washed by resuspending in pH 5.5 glycine at low salt concentration and then centrifuged at low speed. The supernatant is discarded and the viruses are eluted from the oyster solids by resuspending in pH 3.5 glycine-buffered saline at high conductivity. This suspension is centrifuged at low speed and the virus-containing supernatant is adjusted to pH 7.5 and filtered through a 2 um and 0.2 um Cox fiberglass filter series. The filtrate is concentrated to a volume of a few ml by ultrafiltration. The concentrate is assayed for viruses directly in cell culture. It was decided that methodology should be developed for the efficient recovery of *all* enteric viruses including enteroviruses, reoviruses and adenoviruses and that preferably, virus elution should be conducted at near-neutral pH levels to avoid a troublesome precipitate which formed upon adjustment from pH 3.5 to 7.5 and to avoid possible virus inactivation at low pH.

Initial experiments concerned the filterability of the eluate supernatant from the adsorption-elution process in samples

prepared with and without the washing procedure. Because it was found that the washing procedure had a marginal effect on the quality of the eluate supernatant, the washing procedure was eliminated.

Upon investigation of the adsorption process, it was determined that a conductivity of 1500 ppm NaCl and a pH between 5.0 and 5.5 gave excellent adsorption of poliovirus, reovirus, and adenovirus. These pH and conductivity conditions were adopted for virus adsorption in all further experiments.

In experiments on the elution procedure it was found that poliovirus, reovirus and adenovirus could be adequately eluted from the pelleted, homogenized oyster solids by resuspension at pH 7.5 in glycine-buffered saline having a conductivity of between 7500 and 9000 ppm NaCl.

Experiments were conducted with all three viruses to determine the filterability of the virus-containing eluate supernatant. A filter series consisting of a Millipore AP25 fiberglass prefilter and a Cox 0.45 um fiberglass filter gave excellent results. The ultrafiltration procedure remained essentially unchanged from the original procedure described by Sobsey *et al.* (9)

Based upon these experiments a new procedure for the detection of enteric viruses in oysters was developed. In this procedure oyster meat is homogenized in sterile distilled water and adjusted to a pH between 5.0 and 5.5 and a conductivity of a 1500 ppm NaCl for virus adsorption. The homogenate is centrifuged at low speed for 20 minutes and the virus-free supernatant is discarded. The homogenate pellet is resuspended at an oyster solids to eluent ratio of 1/7 in 0.05 glycine-buffered saline at pH 7.5 and a conductivity of 8000 ppm NaCl. This resuspended homogenate is centrifuged at low speed and the virus-containing supernatant is filtered through a Millipore AP 25 and Cox 0.45 um fiberglass filter series. The filtrate is concentrated by ultrafiltration using an Amicon type PM 30 membrane in a stirred ultrafiltration cell.

To test the effectiveness of the new procedure 22-33 gm aliquots of oysters were experimentally contaminated with small amounts of polioviruses reoviruses, and adenoviruses at virus concentrations of 44 to 472 plaque forming units per aliquot. The recovery efficiency for poliovirus, reovirus and adenovirus averaged 62%, 50% and 62% respectively. The virus recovery efficiency for all viruses averaged 58%.

DISCUSSION

These results indicate that a new method capable of detecting small quantities of enteric viruses present in oyster tissue is now available. The method does not involve the use of sophisticated laboratory equipment and is simple enough in operation to be of practical use in a typical shellfish microbiology laboratory.

This new method is now being tested with oysters that have been experimentally contaminated with viruses in their surrounding water environment. It will also be determined if this method can be used for the detection of enteric viruses in clams.

We plan to use this new method to investigate the occurrence of enteric viruses in shellfish and to assess the adequacy of present bacterial standards for shellfish and their growing waters.

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The Application of Delayed Recruitment Models to Two Commercial Fisheries

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INTRODUCTION AND THEORY

One of the basic shortcomings inherent in the Schaefer (1954, 1957) approach to fishery management modeling is that logistic growth fails to distinguish the contributory effects of recruitment on the population dynamics. A delayed recruitment model intended for use in developing dynamic strategies for fisheries management, while maintaining the basic data requirements of only catch and effort statistics is given by the expression,

$$\frac{dP}{dt} = bP(t) - a_1P(t)^2 + a_2P(t\text{-}w) - qf(t)P(t) \qquad (1)$$

The model is similar in form but differs conceptually from a delayed recruitment formulation recently suggested by Walter (1973). The structure of the proposed delay model (1) states that the rate of change of the population is a function of the current population level, P(t), and fishing effort, f(t), as well as recruitment from some past spawning population, P(t-w). It is suggested that due to the difficulty in quantifying the functional relationships between stock and recruitment, it may be sufficient, as well as biologically reasonable, to present the rate of recruitment (a2) as being dependent only on the spawning population level.

Abstracted from a detailed paper presented at the 9th Annual Sea Grant Association Meeting, Los Angeles, California, November 1976.

The proposed delay model can be used in an analysis of maximum equilibrium yield and optimum levels of applied fishing effort. From the Schaefer model,

$$\frac{dP}{dt} = bP = aP^2 - qfP \tag{2}$$

equilibrium analysis results in the derivation of an expression for the optimum equilibrium population level,

$$P_0^* = \frac{b}{2a} \tag{3}$$

Similarly the optimum equilibrium fishing effort corresponding to Po* is

$$f_0^* = \frac{b}{2q}, \tag{4}$$

which leads to an expression for maximum equilibrium yield:

$$Y_0. = qf_0^* P_0^* = \frac{b^2}{4a} \tag{5}$$

A similar analysis for the delayed recruitment model results in the following expressions for optimum equilibrium population level, optimum equilibrium fishing effort and macimum equilibrium yield:

$$\text{i} \quad P_0^* = (b+a_2)/2a_1$$

$$\text{ii} \quad f_0^* = (b+a_2)/2q$$

$$\text{iii} \quad Y_0^* = (b+a_2)^2/4a_1 \tag{6}$$

When catch-per-unit-effort (CPUE) data is used in lieu of population biomass data (as is the case with most Schaefer model applications), the optimum equilibrium population level and maximum equilibrium yield can be rewritten for the delayed recruitment model as,

$$\text{i} \quad P_0^* = (b+a_2)/2a_1q$$

$$\text{ii} \quad Y_0^* = (b+a_2)^2/4a_1q \tag{7}$$

and the expression for optimum equilibrium fishing effort remains unchanged.

THE RHODE ISLAND INSHORE LOBSTER FISHERY

The application of a management model which considers recruitment as a fundamental contributor to population growth and dynamics is of particular interest with respect to the lobster, *Homarus americanus*. Examination of the relationship between lobster stock and recruitment for the Rhode Island inshore fishery reveals that under present conditions of heavy exploitation, annual recruitment contributes substantially to the size of the fishery. The delay model of equation (1) was fitted to catch and effort data for the Rhode Island inshore lobster fishery. A delay of $W = 5$ provided the best fit for the lag between spawning and recruitment.

Management indices generated for the proposed delay and Schaefer models are shown in Table 1. The Schaefer model predicts that over 27% of the calculated equilibrium population can be cropped annually, which contrasts with the 17% predicted by the proposed model. The conservative nature of the yield (Po*) prediction of the proposed model leads to a similar management strategy in which it is suggested that yields in excess of the predicted optimum may result in a condition of overfishing. Additionally, while the yield prediction of the delay model is 14.5% lower than that predicted by the Schaefer model, the prediction of optimum equilibrium effort for the delay model is 25% less, resulting in the prediction of an overall higher catch for

each unit of applied effort by the proposed model. The relationship between yield and applied effort, based upon the derived coefficients of the instantaneous and proposed delay models,

$$Y_0 = \frac{f_0}{a_1} (b + a_2 - qf_0), \tag{8}$$

is illustrated in Figure 1. Although the optimum equilibrium effort and yield predictions of the proposed model depend heavily upon the level of the spawning population some years earlier and tend to be insensitive to specific environmental variations prior to recruitment, it is believed that the fishery manager is supplied with a reasonable set of indices which will permit the implementation of an adequate management strategy.

The delayed recruitment and Schaefer models lend themselves to a simulation analysis of fishery dynamics under conditions of stress and perturbation. Assuming that the lobster stock is initially in equilibrium, it is possible to simulate the effects of altering the applied fishing pressure. The relative sensitivity of the stock to overfishing (Fig. 2) is explored through simulating a 50% increase in applied effort. At the end of five years of simulation the delay model predicts that the stock has dropped about 15%, whereas the instantaneous model predicts a 35% decay. The dependence of the proposed model upon delayed recruitment has acted to diminish the predicted consequences of overfishing. A management strategy formulated with respect to the delay model's predictions would necessarily involve a much more moderate regulation of the applied effort required to restore the stock to its equilibrium level.

Simulations involving conditions of overfishing and underfishing with the delay model demonstrate that the stock is not critically sensitive to these factors. Overfishing the catchable stock by some finite level does not diminish the potential of the pre-recruit populations for augmenting subsequent annual yields. Although the catchable stock will decay, the rate will be less drastic than that predicted by the instantaneous model.

Possibly the most important factor illustrated by the delay model for management decision-making is the amount of time available for analyzing the impact of applied strategies and

making appropriate adjustments. The use of the Schaefer model as a management tool would require that strategies be implemented which were inappropriate to the actual condition of the stock. Additionally, any decision would have to be made within a shorter time frame, allowing for the possibility of increased error. Simulations of the type mentioned here use equilibrium values as initial conditions such that the dynamic predictions of the model are in response to the stress being tested without the additional influence of an already non-equilibrium stock level. Further details regarding both the analytical properties and the application of the proposed delayed recruitment model are given by Marchesseault *et al.* (1976).

FIGURE 1.

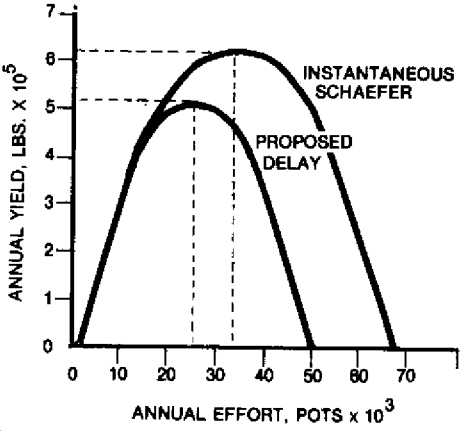
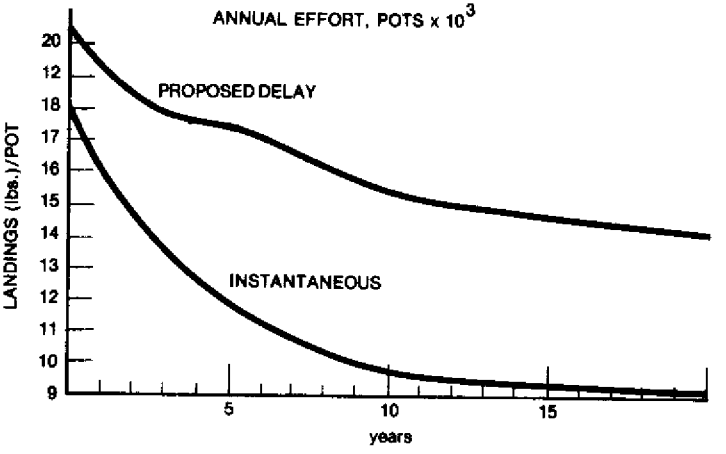


FIGURE 2



Predicted values of optimum equilibrium population, optimum equilibrium applied effort, maximum equilibrium yield and optimum equilibrium CPUE for the Rhode Island inshore lobster fishery.

TABLE 1.

Model	P_0^* (Klbs.)	f_0^* (Kpots)	Y_0^* (Klbs.)	N_0^* (Pounds landed per pot)
Instantaneous (Schaefer)	2226.8	34.01	610.9	17.97
Proposed delay	3007.3	25.47	522.0	20.51

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Marchesseault, G.D., S.B. Saila, and W.J. Palm. 1976. Delayed recruitment models and their application to the American lobster (*Homarus americanus*) fishery. J. Fish. Res. Board Can. 33(8): 1779-1787.

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Sea Grant Association Business Meeting

Report of
D.F. McGillicuddy

INTRODUCTION

The calendar year 1976 has been most unusual for the Sea Grant Association. Our program was exposed to oversight and authorization hearings before the appropriate subcommittees of the House and Senate. The Sea Grant Program was a small part of the overall congressional budget process. The conference committee increased the Sea Grant appropriation. The fiscal year commenced in October rather than July. All these factors contributed to a busy legislative year and are the basis of this report. The unusual legislative activity imposed a heavy schedule on the Washington representative. Direct congressional liaison with the staffs throughout the legislative year was necessary. Suggested names of witnesses had to be compiled and presented to the staffs. Drafts of proposed legislative bills had to be disseminated. Meetings with the Senate NOPS staff had to be arranged. As the compressed legislative calendar became evident omissions in the legislative process were highlighted by the Washington representative. *Examples:* Sea Grant had to be included in the congressional budget act. The appropriation staff had to be reminded that the authorization proposal was much higher. NACOA meetings had to be covered. It was an unusual and progressive year. The Washington representative was pleased to be a participant.

BACKGROUND

Since its inception the Sea Grant Program has operated under a three year authorization. On this basis, during the second and third years the only concern of Sea Grant participants was to observe the appropriation process and trust that there was level funding and hopefully some increase. This year was different and possibly is an indicator of the prospects for 77-78.

THE HOUSE APPROPRIATIONS COMMITTEE HEARINGS

In 1976, the fiscal year for the Federal government started on October 1. Also, it was in this fiscal year that the new Congressional Budget Act was to become effective. The budget act requires that by May 15 of each year, the first concurrent

estimate of budget activity, budget appropriations and a floor for revenues as well as the level of the deficit and the level of the public debt be prepared. With this as background, it is understandable that the Appropriation Subcommittee commenced hearings on February 9, 1976—three weeks after the 2nd session of the 94th Congress commenced. It was a single day's hearing. In response to questions, the Administrator of NOAA testified that because there had been recessions and deferrals in previous years, the $23.3M request from the Executive Branch was a plus factor for Sea Grant. The answer was readily accepted and it appeared the Sea Grant Program would be guaranteed this amount as a minimum.

THE HOUSE SUBCOMMITTEE ON OCEANOGRAPHY

On March 1, 2, and 3, the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries conducted their oversight and authorization hearings. The witnesses included:

March 1, 1976—Dr. Robert White, Dr. Robert Abel, Dr. Sanford Atwood, Dr. Hugh Popenoe, and Dr. Bruce Wilkins.

March 2, 1976—Dr. John Calhoun, Jr., Dr. Paul Fye, Dr. John Donaldson, Dr. John Armstrong, Dr. William McElroy, Dr. Henry Williams, Jr.

March 3, 1976—Dr. Richard Grigg, Dr. William J. Hargis, Jr., Dr. William Ackermann, Dr. Stan Murphy, and Ms. Mary Johrde.

The testimony of all witnesses by and large was positive and supportive of the Sea Grant Program. The hearings at this time evolved around a three year authorization program. As it developed later in the year, a single years authorization was passed by the U.S. House of Representatives for a number of reported reasons. One of the principal reasons was because Congressman John Murphy (NY) relinquished the role of Chairman to Congressman John Breaux (LA). The new chairman desired field hearings before approving an extended authorization bill. Reportedly, some misunderstanding of the Sea Grant Program continued among members of the Subcommittee. Problem areas raised then and which continue are included in the March 1976 letter of Chairman John Murphy:

The Subcommittee is interested in learning:

1. How does the Sea Grant Program relate to and coordinate with other elements of the federal government involved in marine research, such as the National Science Foundation?
2. How effective are the Sea Grant organizations on the respective campuses?
3. How are state and local government, industry and other consumers of Sea Grant products and services integrated into the program?

Murphy's letter to proposed witnesses continued:

> I am interested in hearing your recommendations concerning any changes in the Sea Grant Program which should be made to improve its performance, bring it up-to-date or to otherwise enhance its ability to meet national needs in the marine field.
>
> Some of the issues to which you should address your testimony include: how attuned to national priorities are the Sea Grant Program's priorities (among aquaculture, fisheries, engineering, coastal zone management, socio-economic and legal issues, to cite some examples); what is the proper balance between local and nationally oriented projects; what is the proper balance between research, education and advisory service activities; how effective has the program been in making services and products known to potential users; what is the right balance between individual projects and institutional support; and your recommendation of the proper funding level for the program.

THE COMBINED SENATE SUBCOMMITTEE HEARINGS

The Sea Grant Authorization bill in the U.S. Senate was such that it required consideration by the Subcommittee on Ocean and Atmosphere of the Committee on Commerce (Senator Fritz Hollings, Chairman) and the Subcommittee on Education of the Committee on Labor and Public Welfare (Senator Claiborne Pell, Chairman). Two days of joint hearings were held on March 22 and 23. The Senate legislative bill proposed establishing the Sea Grant Program for three years. A companion Senate bill would establish a National Council on Marine Science Engineering and Research Development. There was a danger that the Advisory Services would be separated from the Sea Grant Program. So much

depended on what the Committee recommended to the Senate. It was evident early in the year that the House and Senate would be at variance in their authorization proposals and that a conference would be necessary.

THE MONTH OF MAY WAS A CRUCIAL PERIOD

On May 3, the U.S. House of Representatives passed the Sea Grant Authorization bill providing for:

1. A one year extension of Sea Grant with an authorization level of $50 M.
2. It is proposed to remove the prohibition against expenditures for ship support.
3. The bill would authorize grants for national projects, and allocate $5 M for this program.
4. An International Cooperative Program is provided for in the amount of $3M.

It was on this date also that the House Appropriations Subcommittee approved the $23.3M requested by the Administration for Sea Grant. The Senate Appropriations Subcommittee was now ready to consider the appropriations for State, Justice, Commerce and the Judiciary.

On May 4, the U.S. Senate Committee on Commerce adopted a three year Sea Grant Authorization bill. The Senate Committee on Labor and Public Welfare approved the bill on May 12. The Joint Senate Committee bill was an indicator of what was to come later in the conference bill. Because the basic authorization bill provides for an annual expenditure of $50M with an additional $5M for National Projects and $3M for an International Cooperative Program, these features had to be included in the First Concurrent Resolution (May 15) of the Congressional Budget Act. It was at this time the Sea Grant Washington Representative learned that the amount budgeted for Sea Grant was in excess of the $23.3M requested by the Administration.

SECOND ROUND OF HEARINGS
HOUSE SUBCOMMITTEE ON OCEANOGRAPHY

In June, Congressman John Breaux, Chairman of the Oceanography Subcommittee held hearings "to view the program in further detail and determine what the *future long-range* scope of

the Sea Grant Program should be—it is better to have these additional hearings aimed at determining the direction in which we should be going with Sea Grant before attempting to completely restructure a program of such magnitude." Dr. William J. Hargis, Jr., the Chairman of NACOA and Dr. William C. Ackermann of the NACOA Sea Grant Panel were asked to discuss the findings and recommendations of NACOA's assessment of the National Sea Grant Program. Sea Grant was represented by:

Dr. Ira Dyer (MIT)
Dr. Walter Gray (RI)
Dr. William Gaither (DEL)
Dr. L. Eugene Cronin (MD)
Dr. Norbert P. Psuty (Rutgers)

This hearing is also a sign of Congressional action to come.

THE APPROPRIATION PROCESS IN COMPLETED

During the weeks of June 14, all appropriation bills in the House of Representatives were scheduled for floor actions. During the week of June 21, the Senate Appropriations Committee considered all bills recommended by subcommittees. Sea Grant was included at $23.3M. Because the conference committee would meet later in the session, a number of letters from Sea Grant members were addressed to Congressional Conferees urging an increase in the appropriation because of the favorable recommendations of the Authorization Committees. The effect was successful. The Sea Grant appropriation was increased to $27.2M.

THE FINAL AUTHORIZATION BILL

On September 15, 1976, the Conferees of both Houses agreed on the Sea Grant Program Improvement Act of 1976. The report was inserted in the Congressional Record and copies were sent to each member institution by the Washington Representative. Significant, are the remarks of Senator Fritz Hollings:

> I am frankly disappointed that the House conferees insisted on a 1-year authorization of appropriation for the program, instead of agreeing to the 3-year authorization proposed by the Senate. However, I understand the desire of the House committee members for an opportunity to study and become more familiar with

the program before approving a more extended authorization, and I look forward to working with the House Members next year in their efforts to further improve and strengthen the Sea Grant program.

I am particularly happy that the conference was able to agree on new provisions in the Sea Grant legislation authorizing a new program of national projects, and a new program of international cooperation, while making it clear that these new and important activities should not be funded at the expense of the basic and existing Sea Grant College program activities in ocean and coastal research, education, and advisory services.

Mr. President, although this legislation is an entire rewriting of the authorization for the National Sea Grant College Program, it maintains intact the principal goals and framework of the program. The legislation represents, indeed, an endorsement of the basic concepts and direction of the program established by the original 1966 Pell-Rogers Sea Grant Act.

SUMMARY

Because Sea Grant was extended for only one year, it is anticipated that there will be extensive hearings next year before the House and Senate Authorization Subcommittees. Some of the areas to be covered and questions raised are set forth in this report. The Washington Representative concludes that there still remains an extensive public relations program to be accomplished in Washington as it concerns the Sea Grant program.

This past year, the Sea Grant program experienced an increase in its appropriation because of the work of each individual member of the association. This action needs to be continued and reemphasized. Statements from association members need to be filed with the Appropriation Subcommittees without fail. Also, we should have a spokesman appearing before the Appropriation Subcommittees of each House urging an increase in our appropriation.

Finally, the Association should concentrate their efforts in presenting our message to the Members of Congress who voted against Sea Grant.

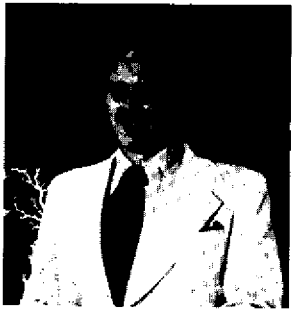
This annual Report is respectfully submitted by:

D.F. McGillicuddy

Minutes

SEA GRANT ASSOCIATION
BUSINESS MEETING

November 10, 1976
University Hilton Hotel
Los Angeles, California



Dr. Stanley R. Murphy
President 1975-76

Dr. Hugh L. Popenoe
President 1976-77

President Stanley R. Murphy called the meeting to order at approximately 8:45 A.M. Roll call determined a quorum present.

The minutes of the 1975 meeting were approved as read.

The treasurer's report was presented and approved.

President Murphy presented his report on 1975-1976 Sea Grant Association activities. His presentation included the following main points:

A. Association membership report.

B. The National Advisory Committee on Oceans and Atmosphere's Sea Grant Panel has been studying the Sea Grant Program. On December 16, 1975, the Executive Committee met with the Panel in Washington, D.C., to contribute to the Panel's study. The Panel's deliberations will soon be released in a report.

C. The Sea Grant Association's recommendations on Sea Grant authorization were distributed to congressional leaders.

D. In February, 1976, a meeting was held to draft written recommendations to the congressional staffs working on Sea Grant authorization.

E. Testimony was presented before the House and Senate subcommittees on Sea Grant.

F. The By-Laws of the Association were modified as instructed by the Delegates at the last Business Meeting.

H. The revision of the Articles of Organization has not yet been completed, but it is expected that this work will be finalized during the coming year.

President Murphy then called upon Mrs.Leatha F. Miloy (Texas A&M University) to report on the activities of the Joint Committee on Marine Resources (Sea Grant Association/National Association of State Universities and Land Grant Colleges). Mrs. Miloy presented background information on the Committee's establishment and past activities, as reported at the last Business Meeting and in the Association's Newsletter, then brought the Delegates up to date on recent activities concerned with familiarization with the federal budget process.

Dr. Murphy expressed his appreciation for Mrs. Miloy's efforts on behalf of the Association.

Dr. Murphy next called upon Mr. Daniel F. McGillicuddy, Washington Representative for the Sea Grant Association, who reported on his activities for the past year.

The Chair then invited the Marine Councils to present their reports.

Marine Education Council—Dr. Gerald S. Posner (City University of New York)

1. Endorsed the draft documents, "Perspective on Sea Grant Marine Education" and "An Introduction to Marine Education," by Harold L. Goodwin.
2. Moved to develop strategies for achieving nationwide marine literacy and to make appropriate recommendations to the Executive Committee for action by the Sea Grant Association.
3. Called upon the Association to recognize the National Marine Education Association and support its objectives as appropriate in furthering all aspects of education relating to the marine environment.
4. Moved that a vote of thanks be made to the Communicators

and to Ms. Dorothy M. Bjur (University of Southern California) for arranging a stimulating and enjoyable conference.

Marine Advisory Council—Dr. James Cato (University of Florida)

1. Had a joint session with the Communications Council and four Sea Grant Directors on how the joint efforts of the Communicators and the Marine Advisory Programs could be carried out.
2. Discussed career ladders in the Marine Advisory Service.
3. Examined the role of Marine Advisory Services in coastal zone management.
4. Will make recommendations to the President of the Association regarding Council Chairman for next year.
5. Revised the general statement from last year's meeting.

Communications Council—Ms. Patricia Peyton (University of Washington)

1. Endorsed the concept of Association councils and urged their continuance and refinement.
2. Called on each delegate to ensure that his/her institution is represented on each Association council and further that these representatives receive institutional recognition and support necessary for their council activities and responsibilities.
3. Invited other councils to call on the professional capabilities that members of the Communications Council can provide in support of Association activities.

Coastal Resources Council—Dr. William W. Schroeder (University of Alabama)

1. Changed the council's name to "Research Council."
2. Resolved to resubmit and reaffirm the Council's Biloxi statement.
3. Drafted two statements concerning
   a. Working with the Office of Sea Grant to identify areas of interest.
   b. Data management and dissemination.
4. Recommended active participation by member institutions. Council representatives should be appointed solely to one council and be familiar with their institution's viewpoints. The councils should be encouraged to formulate research policy.

Ocean Policy and Marine Resource Development—Dr. John Miloy (Texas A&M University)

The Council recommended that the Sea Grant Association create a committee for the purpose of acquiring and developing information on international marine programs. The Committee should seek to achieve the following four objectives:

1. Identification of the kinds of international programs currently in existence.
2. Identification of existing models of international programs that could serve to aid in the development of pilot programs for Sea Grant investigators.
3. Preparation of specific guidelines clarifying the organizational and management roles of Sea Grant institutions entering into international marine programs.
4. Undertake consideration of significant changes needed to modify future international legislation.

The Executive Committee next presented its recommendation that annual dues be increased to $500 for those institutions classed as Regular Members as defined in the Articles of Organization, Articles III, Section A, 1, a, which reads:

1. *Regular Members.* The following shall be eligible for Regular Membership:
   a. Organizations receiving Sea Grant institutional or coherent project support . . .

Before voting on this recommendation the Delegates called for President-Elect Hugh Popenoe's forecast budget summary in order to determine the financial requirements the Association may expect.

The dues recommendation was then approved with the following amendment:

. . . that it is the intent of the members of the Association when they vote on this that only the institutions receiving the institutional or coherent area grant be taxed at the higher dues rate. Election of officers was the next order of business. William Q. Wick (Oregon State University) was chosen as President-Elect for 1976-1977. His election created an additional vacancy on the Executive Committee bringing the number of positions to be filled to four. Elected to the Executive Committee were Robert Corell

(University of New Hampshire), Dean Horn (Massachusetts Institute of Technology), Neils Rorholm (University of Rhode Island), and Donald Rosenberg (University of Alaska).

Three amendments were then considered. Amendment 76-01 concerning the admission of industrial members to the Association was tabled. However, a motion was approved that the President appoint a committee to examine the goals and objectives of the Association with specific instructions to examine how the admission of industrial members would alter the present goals and purpose of the Association.

Amendments 76-02 and 76-03 amending the Articles of Organization and the By-Laws to the effect that the immediate past president of the Association shall serve in an advisory, non-voting capacity on the Executive Committee were unanimously adopted by the Delegates.

Resolutions were then presented, discussed and acted upon. It was resolved:

. . . that the Sea Grant Association encourage President-Elect Jimmy Carter to recognize the special contributions that the nation's Sea Grant Colleges and Institutions make toward the effective use of our marine and coastal resources, and that these considerations be recognized in planning his administration.

. . . that President-Elect Hugh Popenoe (University of Florida) be instructed to write to Congresswoman Yvonne Burke expressing the appreciation of the members of the Sea Grant Association for her vigorous and effective support of the Sea Grant Program during this past year.

. . . that the Sea Grant Association express its commendation and thanks to President Stanley R. Murphy for his leadership during the past year.

President Murphy then turned the meeting over to incoming President Popenoe. President Popenoe announced his committee appointments for the coming year.

Standing Committees

Nominating Committee	—Stanley R. Murphy (University of Washington)
Awards Committee	—Roy W. Hann (Texas A&M University)

Program Committee	—Representatives will be selected from the University of Hawaii, University of Southern California, Louisiana State University, and the Executive Committee.
Publications Committee	—Tom Leahy (University of Florida), Chairman Patricia Peyton (University of Washington)

Special Committees

Finance Committee	—John H. Judd (State University of New York), Chairman Donald Squires (State University of New York
Secretariat Committee	—William Seaman (University of Florida), Chairman Marlena Drew (University of Washington)
Association's Goals and Industry's Participation	—Dean Horn (Massachusetts Institute of Technology), Chairman William Gaither (University of Delaware) Robert Ragotzkie (University of Wisconsin) Neils Rorholm (University of Rhode Island)

Joint Committees

SGA/NASULGC Joint Committee on Marine Marine Resources	—Leatha Miloy (Texas A&M University) One year Robert Ragotzkie (University of Wisconsin) Two years One additional member to be appointed Executive Committee.

The meeting was adjourned at approximately 11:30 A.M.

Respectfully submitted,
Marlena M. Drew
Secretariat Committee

PROPOSED AMENDMENT TO THE SEA GRANT ASSOCIATION "ARTICLES OF ORGANIZATION" & "BY-LAWS"

In accordance with the provisions for amending subject "Articles of Organization" and "By-Laws" the following amendment is proposd to Article III, Membership, and Article I, Section 1.a, respectively:

1. Add a new sub-paragraph, III, A, 1, c, in the Articles of Organization and I, 1, a, 3, in the By-Laws:

   c/3. Corporations, business, institutions and other organizations that directly support or participate in the Sea Grant institutional programs or coherent area projects. Such eligibility, once established, will be extended for renewal of a continuing membership in the Association.

Proponent:_____
Dean A. Horn, M.I.T.

NOTICE OF PROPOSED CHANGE IN ARTICLES OF ORGANIZATION SEA GRANT ASSOCIATION

Pursuant to the provisions of Article X of the Articles of Organization of the Sea Grant Association (Revised October 1974), the following change in the Executive Committee as described in Article VI is proposed:

Article VI, Subsection A, (proposed changes noted in italics)

A. Executive Committee
   1. Composition. The Executive Committee of the Association shall consist of:
      a. The President of the Association, who shall be chairperson of the Executive Committee;
      b. The President-Elect of the Association who shall be vice-chairperson of the Executive Committee;
      c. *The immediate Past President of the Association, who shall serve in an advisory, non-voting capacity; and*
      d. Five additional members, at least three (3) of whom must be delegates from organizations receiving Sea Grant institutional support, to be elected at the Annual Meeting.

Proponent:_____

Leatha F. Miloy
Texas A&M University

NOTICE OF PROPOSED AMENDMENT
TO
THE BY-LAWS
SEA GRANT ASSOCIATION

Pursuant to the requirements of the By-Laws of the Sea Grant Association as approved in October 1975, the following amendment to Section IV (Executive Committee), Subsection 1 is proposed:

section IV, Executive Committee [*proposed change in italics*[

1. The Executive Committee of the Association shall consist of:
   a. The President of the Association, who shall be chairperson of the Executive Committee;
   b. The President-Elect of the Association who shall be vice-chairperson of the Executive Committee:
   c. *The immediate Past President of the Association, who shall serve in an advisory, non-voting capacity; and*
   d. Five additional members, at least three (3) of whom must be delegates from organizations receiving Sea Grant institutional support, to be elected at the Annual Meeting.

Proponent:_____
Leatha F. Miloy
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