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**SEA  
GRANT  
WEEK '85**

**A Summary Report**

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Twentieth-Year  
Commemorative Anniversary  
October 20-24, 1985

Editor: Elisabeth Keiffer

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# **Sea Grant Week 1985: A Summary Report**

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**Sea Grant:  
Past, Present, and Future**

Twentieth-Year Commemorative Anniversary  
October 20-24, 1985

Co-Hosted by:  
The Sea Grant Association and  
The University of Rhode Island

Editor: Elisabeth Keiffer  
Published March 1986

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*This report of Sea Grant Week 1985, published by The University of Rhode Island, gives the highlights of a day and a half of commemorative activities. In the interests of economy, the talks are presented in summary, with an attempt by the editor to bring focus to the most important points raised by the speakers in the most succinct manner possible.*

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# 1985 Sea Grant Conference Agenda

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## Session I

**Welcome:** John A. Knauss, Vice President for Marine Programs, University of Rhode Island

### The First 20 Years

**Session Chair:** Francis H. Horn, President Emeritus, University of Rhode Island

#### Sea Grant as Social Invention: The Formative Years

Lauriston King, Assistant Director, Sea Grant Program, Texas A & M University

#### Panel: A Variety of Views

**Administration:** William G. Gordon, Assistant Administrator for Fisheries, National Marine Fisheries Service

**University:** John C. Calhoun, Jr., Deputy Chancellor of Engineering Emeritus, Texas A & M University

**Sea Grant Director:** Robert A. Ragotzkie, Director, Sea Grant Institute, University of Wisconsin-Madison

## New Horizons

**Session Chair:** Athelstan Spilhaus, Father of Sea Grant

### The Exclusive Economic Zone

David A. Ross, Chairman, Department of Geology and Geophysics, Woods Hole Oceanographic Institution

### New Technologies

Robert W. Corell, Director, Marine Programs, University of New Hampshire

## **Session II**

### **Today and Tomorrow**

**Session Chair:** Sanford Atwood, Former Chairperson, Sea Grant Advisory Panel, National Sea Grant College Program

#### **The View as Seen by**

**Universities:** E.A. Trabant, President, University of Delaware

**Congress:** Nancy E. Reichley, Legislative Aide to Senator Lowell Weicker

**Administration:** John McTague, Deputy Director, Office of Science, Technology, and Policy

## **Session III**

### **New Opportunities and Challenges**

**Session Chair:** Robert Abel, President, New Jersey Marine Sciences Consortium

#### **Discussion Panel**

Daniel Aldrich, Former Chancellor, University of California at Irvine

James S. Coles, Chairman, Executive Committee, Research Corporation of New York

Ferris Webster, Chairman, Universities National Oceanographic Laboratory System

#### **Summary: Beginning Our Climb to the Future**

John A. Knauss, Vice President for Marine Programs, University of Rhode Island



## Sea Grant: Past, Present, and Future

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John A. Knauss

Welcome.

Twenty years ago this month, in this very hotel, 224 people representing 30 states came together to discuss the concept of a Sea Grant university. We heard Athelstan Spilhaus elaborate on the Sea Grant ideas he had first publicly proposed two years earlier. We heard Senator Pell describe the legislation he had already introduced to give substance to the Sea Grant concept. We heard the late Wib Chapman's wonderful talk about differences between sea people and land people. Wib's concept of Sea Grant was quite simple—we needed better and more sophisticated training for the sea people.

We heard from Paul Fye and Benny Schaefer, and hearkened to the warnings of Emery Castle and Harold Knoblauch about patterning ourselves too closely on the land-grant model.

We've come a long way in 20 years.

Some time ago, I suggested to the Sea Grant Association that on the 20th anniversary of that first day-and-a-half Sea Grant conference, we hold Sea Grant Week in Newport, Rhode Island, and that we take one and a half days of Sea Grant Week to look back on where we have been, review how well we have done, and, perhaps more importantly, determine where we are going, what the new challenges and opportunities are. This is a meeting I have been looking forward to for some time.

On behalf of President Eddy and the University of Rhode Island, I would like to welcome you to Newport. I trust the entire week will be a success.



## **Sea Grant as Social Invention: The Formative Years**

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Lauriston King

Social inventions, like their counterparts in technology, draw on the past. They borrow, mix, and recombine often familiar ingredients—ideas, practices, relations between groups and individuals—so that something new and different results.

To understand Sea Grant and how it evolved over the past two decades, it is useful to view it as a social invention, an arrangement of parts and practices that contributed something quite new to our ability to deal with the oceans.

Four things made it possible for Sea Grant to happen: the creative gifts of the inventor, a problem inviting an imaginative solution, a receptive political climate, and a textbook case of political action.

Athelstan Spilhaus saw a problem and a way to tackle it by a fairly simple reordering of some institutions. The idea made sense—a logical package and one with a proven track record for agriculture in land-grant universities. The efforts of those promoting it created an enthusiasm and momentum that was hard to resist. Finally, its advocates had the stamina and ability to hang in over the long haul. The story is well told in John Miloy's brief political history, included in your conference materials.

### **Sea Grant as Social Invention: Its Components**

The pivotal idea was for government to encourage all the skills found in universities to grapple with marine problems, not just those of individual researchers in oceanography. As Spilhaus outlined it, Sea Grant colleges not only would concentrate on applications of science to the sea, but would relate these to the natural sciences which underlie them, to the social sciences as they are affected by and, in turn, affect the occupation of the sea. They would also be associated with the liberal arts which describe man's relation to the sea and enhance his enjoyment of it.

The second idea, of matching funding to ensure that local programs were responsive to state as well as national needs, was hardly new to government grant programs but had not been used before to shape the character of marine research. This rather simple administrative requirement went a long way toward fostering the partnership character of the program, decentralizing its administration and generating support within the universities and states for Sea Grant.

The third idea involved the assumption that research aimed at marine problems was not especially useful unless there was some way to get that knowledge out to the people. Marine advisory services and information programs were built into Sea Grant as part of its working philosophy.

Finally, a good part of the inventive work came after Sea Grant's creation. Robert Abel and his small staff in the National Science Foundation drew freely on its experience and that of the Office of Naval Research to set up procedures for proposal planning, review, and administration—all the components associated with a competitive grants program. It soon became apparent that there was a need to work with a single individual at the universities, and once there were enough of these a council of directors was set up to work out the details of partnership between the national office and the universities—an example of the flexibility and pragmatism that is one of the program's hallmarks.

Each of the parts of Sea Grant I have described was not especially novel in itself. But once combined they resulted in a pattern of government and university relations quite different from those already in place to support marine research. This new arrangement proved to be a very flexible and productive one for pursuing our interests in the oceans.

### **Sea Grant as Social Invention: Consequences**

Sea Grant added a new means of advancing our understanding of the oceans. After nearly 20 years, there is general agreement that it plays a unique and important role in the nation's marine programs. It provides virtually the only research support for marine-related subjects outside the traditional aca-

demic fields and, unlike them, has sought to direct its research investment to areas of more immediate commercial or management interest. Also unlike them, its proposals must withstand not only the critical scrutiny of peer reviewers, but also must persuade prospective users that the research will contribute to the development, use, or management of marine resources.

The key to making the new mechanism work has been the evolution of a formal and informal network, which nothing in the legislation required. Sea Grant colleges make up the formal network. But the real strength comes from semi-formal and informal arrangements, such as joint projects and sharing of specialists, that link the institutions. These links provide ready access to experts of all kinds.

The Sea Grant partnership has proved too that it can promote development of the marine economy. That has been demonstrated in many ways—through the support of state legislatures, the cooperation of industries, the organization of marine trade associations, through savings accomplished as a result of new techniques, through the creation of new industries. Each of our programs has made a contribution.

### **Future of the Invention**

I feel strongly that the key to Sea Grant's continued success is expansion of its research base. It is this part of the program that has suffered most in recent times. For nearly seven years, only about half of federal Sea Grant funds have gone to research, while increases in personnel costs in other parts of the program have cut back even further prospects for additional research support.

Without some realistic expectation of long-term stable support, researchers shy away from Sea Grant, projects are often underfunded, and there is an inclination to support quick payoff projects rather than more broadly defined, innovative efforts. From a management point of view, Sea Grant directors are faced with a chronic dilemma of how to continue to fund productive researchers over the long haul yet still include promising new scientists in the program.

The success of the land-grant and Sea Grant ideas has prompted thought of their applicability to other research areas, other nations, and other sectors of the economy. For example, Texas A & M aspires to be the first land-grant, Sea Grant, and space-grant college. Our neighbors in Canada have asked specific questions about how Sea Grant works.

I would urge those who may seek to use the success of the land-grant and Sea Grant experiences for other innovative ways to link government, industry, and the universities to pay attention not only to the formal structure of these programs but to the informal structures as well. Both resulted in basic social inventions with the capacity to change and improvise as needs and conditions changed, to experiment with new arrangements that were kept if they worked, and abandoned if they didn't.

Sea Grant has been a great invention. I hope there are others who, like Dr. Spilhaus, enjoy tinkering with ideas and who will repeat his success by designing yet another mechanism of discovery to enhance our understanding of the oceans as we enter the 21st century.

## **Panel: A Variety of Views**

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### **Development of Sea Grant from the Perspective of the National Marine Fisheries Service**

William G. Gordon

Our cooperative efforts with Sea Grant have brought about varied and overwhelmingly positive results. I have time for only a few examples.

A joint effort between the National Marine Fisheries Service and the University of Rhode Island developed for fishermen a series of satellite-derived sea-surface temperature charts.

Recently, a 42-minute film on the design and performance of shrimp trawls was jointly produced and marketed.

In Hawaii, one of our most successful cooperative efforts has been the investigation of marine resources of the northwest Hawaiian islands.

A joint study of commercial fishermen's port facility needs led to significant improvements in facilities at Ventura Harbor, California, and was used as a model for similar harbor developments along the West Coast.

Together, the National Marine Fisheries Service and Oregon State University Sea Grant developed the first detailed data on distribution, feeding habits, growth, and migration of juvenile salmon in the ocean off Oregon and Washington.

These examples represent just a fraction of our cooperative efforts with the Sea Grant Program across our country and over the years.

Now I would like to take this opportunity to mention areas in which we at the National Marine Fisheries Service believe our sister programs should be working together.

As NMFS puts more and more effort into estuarine/habitat research in support of NOAA's mission in the estuaries, there will be a need for the expertise of Sea Grant institutions.

We need to jointly organize historical research information and develop computerized estuarine and regional data bases. Sea Grant institutions could also contribute to other advanced

technology activities. For instance, NMFS is developing a satellite data-base program—the coastal habitat assessment research and mensuration program—where changes in the conditions of coastal wetlands from Cape Hatteras to Maine are observed and will be related to the conditions of fish and shellfish stocks. Sea Grant institutions could contribute significantly to many facets of such a program.

In the area of Saltonstall-Kennedy funding and proposal reviews, we are establishing mechanisms to allow Sea Grant representatives to participate more fully in the process. For example, I would like to see more cooperative research like the Mississippi-Alabama consortium project funded by Saltonstall-Kennedy to develop artificial reef-siting plans in the northern Gulf of Mexico.

We also want to solicit Sea Grant participation in our strategic planning and budgetary processes at the earliest possible developmental stages.

Sea Grant participation would be welcomed in our habitat policy implementation. We need your assistance in exploring with the Corps of Engineers opportunities for creating new habitats.

I would also like to encourage Sea Grant to develop closer cooperation with fisheries-oriented foundations and the regional fisheries management councils.

We are considering reinstating NMFS in the Great Lakes. If we do, we will need Sea Grant assistance to carry out our mission there.

We would like to initiate discussions with Sea Grant on the vital topic of fishing vessel insurance.

I project that future mutual interests, respect, and aims will contribute greatly to the forging of even closer ties between our two groups.

## Sea Grant and the Universities

John C. Calhoun, Jr.

The Sea Grant Program represented unfamiliar territory for the universities when it started. They were not as ready for it as one might have expected. Nor was the National Science Foundation. As a result, the nature of the program and its form within the university structure had to be forged by the people responsible for it, most of whom had differing views of what Congress intended, what federal practices permitted, and of how universities operated.

Sea Grant didn't fit the concept of a single function—either teaching or research. It didn't fit an existing academic discipline. It didn't even fit the standard idea of grants within the government system. NSF wasn't able to accommodate these differences. Fortunately, the universities were able to, although they had to make some adjustments.

The first problem they had to deal with was that of creating a university focus for something that had no academic slot. At that time, no university recognized an academic field called "marine resources." Indeed, few do today. If a single word could have been coined—a word like "agriculture," for example—the job would have been easier, but the best rallying point to be found was "sea grant."

A second problem the Sea Grant Program created for universities was that it necessitated a university-level relationship—not a principal investigator relationship—with the federal government because of its broad subject matter, its various functions, and its requirement for matching funds. One could hardly expect the university president to deal with NSF. Who, then, should be in charge? Could a person from one faculty have the necessary breadth of view to formulate a program for all disciplines? Who could best deal with the publics involved?

A third problem was to build a constituency for the program in order to assess priorities for action. There were many local interest groups—fishermen, port authorities, environmentalists, etc.—and these all had to be identified and sometimes brought together for collective action. Each group, of course, felt its

priority to be tops. In addition, some of these groups were already constituencies of an existing academic group; e.g., agriculture, transportation, and so on. Fortunately, the Sea Grant Program was able to act as a catalyst and synthesizer, so that resolving the constituency problem helped somewhat to focus the internal thrust of the university.

A fourth problem arose from the fact that NSF had to depart from its traditional methods of reviewing and approving projects and transfer some of this responsibility to the universities. Nevertheless, NSF wanted to keep project control. This idea of an institution being the local vehicle for the discharge of a national mission was strange for both the NSF and the universities.

A final problem was the number of operational questions that arose. This led universities first to compare notes, then to create forums for considering their common problems, and eventually to establish a formal association.

The universities were given a task they had never been given before and have not been asked to do since. They were asked to apply their capabilities, in whatever way they thought best, to advance the development of marine resources. It was, in my opinion, a challenge to the university systems of our nation, and for the most part they have responded to the challenge well.

## **Sea Grant—the First 20 Years**

Robert A. Ragotzkie

One of the first things we Sea Grant directors learned was that with few exceptions our institutions did not exactly embrace the new program. They liked the money, but the idea of coherent research directed towards marine resources was not always understood or accepted. Changing institutional attitudes presented quite a challenge.

We also had the problem of matching funds. As federal grants became sizable, institutions realized that the matching requirement presented a significant commitment. We learned about state legislatures, program accountability, and constituencies.

We learned too about program reviews and site visits—how



to use them both for making our case to Washington and for educating our faculty.

More important, we learned about program development and management. Despite the attractions of quick-fix research, we found that the real payoffs came most often from the long-term, often high-risk projects. Beyond the research results themselves, these efforts produced highly trained graduates for industry, government agencies, or universities—the real payoff for the Sea Grant investment.

Perhaps the biggest lesson we directors have learned is the benefit of networking. Although we organized and met as a group early on, it has only been in the last five years that we have really used our network. And as the various Sea Grant groups—MAS people, communicators, educators, etc.—became acquainted nationally, many new activities have emerged. Most recently, funding crises required us to take political action to survive. The network enabled us to meet these crises successfully.

Now I would like to suggest some goals for our future.

It seems to me we must do much better in meeting the challenge of outreach. If we are to do all that needs to be done, we must think of expanding the advisory services program by a factor of 10. Three or four thousand Sea Grant agents, or 100 to 150 per coastal state, is hardly too many to do this job.

Secondly, we should consider establishing marine experiment stations. Aquaculture, in particular, suffers from a lack of developmental and demonstration projects. These stations would, of course, be linked with Sea Grant research programs and with the expanded advisory services program. They would stimulate private investment and generate joint ventures. Many of our programs already have facilities or sea access which could be readily converted to marine experiment stations.

The third area we must continue to work on is research. Sea Grant research is a lot better than it was 10 or 15 years ago, but it is nowhere near good enough. We should continue to take the long view in addressing marine resource problems. We also should not shrink from supporting high-risk research. We should identify our best scientists, both natural and social, and back them. If every single Sea Grant project succeeds, then we will not have taken any risks and Sea Grant as a program will have failed.

## The Exclusive Economic Zone

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David A. Ross

I suspect that many in the scientific community have not considered how the Reagan proclamation on the exclusive economic zone can influence their work and lead them to exciting new applications of science and technology.

Ownership of our EEZ means we must conserve and protect, as well as develop, this new environment. In other words, we must continue our long-term monitoring programs in the marine environment.

Where does Sea Grant come into the picture? Certainly the Sea Grant network could do an excellent job in monitoring a storm like Gloria, or putting numerous ships at sea for ground truth for a satellite. Indeed, the Sea Grant network is so established it could provide an excellent set of synoptic observations of the near-shore environment—if someone was clever enough to design the experiment.

But let's assume for a minute that we didn't have a Sea Grant Program. If we didn't, but wanted to create a mechanism for dealing with the EEZ that allowed the academic community to work with government and industry on marine problems spanning both physical and social sciences, our new organization could well look like Sea Grant, which has clearly been very successful in applying all science to the phenomena of the ocean.

I think it would look like Sea Grant, but with four important differences.

First, research would focus on a small number of long-term problems that can capitalize on our ownership of the EEZ. The choice of these problems should have input from the scientific, technical, and, probably, the government community.

Once the topic or topics are chosen, a research strategy and agenda should be developed and evaluated on a regular basis. A mechanism like the ocean drilling program might be appropriate, with thematic and regional committees advising a representative planning committee. A specific university or organization should be in charge of each problem.

The second difference--which I almost hesitate to mention-- is that the new effort would not be tied as closely to states' interests as Sea Grant is. The ocean does not respect states' boundaries, nor federal-state boundaries. I am not implying that states be divorced from the process but rather that problems be considered on a regional basis.

This new effort must have a foreign component, by which I mean long-term commitments to a country or region that is developing its EEZ. The benefits from such foreign commitments would be extensive and useful to all.

Finally, since the EEZ is under national rather than local or state jurisdiction, it is illogical to require non-federal funds for match.

How do we achieve this? Dr. Calio, director of NOAA, has called attention to the "federal team" that is developing the EEZ plan. I suggest this team seriously consider the role the academic community can play and have some of us become part of the continuing planning process for the national EEZ. The opportunities are too large not to use the full talent that the United States has and that Sea Grant can provide.

## Critical Technologies: Key Components in Advancing the Ocean Sciences

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Robert W. Corell

The history of oceanography and the ocean sciences is replete with extraordinarily profitable interactions between science and technology. Recent developments in both suggest that special opportunities exist in the ocean sciences which depend on exploiting new technologies to the fullest. Today I want to focus on the exciting potential of several keystone technologies that hold significant promise for the ocean sciences.

The first is the development of supercomputing capability, only recently available to the ocean science community. Supercomputers will make it possible to model oceanic circulation at a scale and scope we couldn't achieve till now. The harbor and estuarine models of the late 1970s will be crude and inadequate in comparison. Thanks to these supercomputers we will be able to understand long-term climate and short-term weather and comprehend interactions in the coastal zone in ways not possible before. The impact of the systems at the other end of the computing scale—microcomputers—may have an even greater impact.

Second is the dramatic expansion in the past few years of remote-sensing technology, validation, and theoretical underpinnings. Thanks to it, we can monitor such phenomena as global sea-surface temperatures, El Niño, and tuna congregations.

The explosive development of complex microcomputer and microelectronic systems is just beginning to impact the ocean sciences and deep-sea research. They make it possible to conduct research heretofore difficult or impossible. Acoustic tomography, sophisticated navigation systems, new underwater imaging systems and underwater vehicles as well as "smart" instrument systems are examples of the technological impact on ocean science. The full potential of these hasn't yet been exploited, primarily because applications have been largely in pre-

programmed systems with little capacity to adapt to changing conditions and environments.

A new concept, that of knowledge-based systems (KBS), does adapt to and accommodate such changing conditions and environments, however. KBS computer systems solve difficult problems by using strategies and protocols which model human expertise and insight, and eliminate the need for massive search techniques. This development provides the framework for attacking real-time systems. Real-time KBS is projected as the keystone concept for oceanographic applications.

Here are some of the marine applications of knowledge-based systems: robotic free-swimming vehicles, autonomous surface and subsurface platforms, "smart" instrument systems, signal processing, surveying aids, ocean program management aids, military and national security applications.

All of these call for continued effort in the Sea Grant community. Among the possible new initiatives, those I see with national priorities, are the following: marine biotechnology, fisheries oceanography, estuarine habitats, fisheries development and trade, water quality, seafood technology and quality, aquaculture, the EEZ, and coastal carrying capacity.

## Today and Tomorrow

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### As Seen by the Universities

E.A. Trabant

In summarizing Sea Grant's progress to date, I would say first that academia has played a central role in the development of our nation's marine resources; secondly, that universities are better prepared than ever before to play a dynamic role in research and development in partnership with government and industry.

Now, let's look at the future. It is obvious we have the capability to continue making significant advances in marine research. Biotechnology and genetic engineering will help us find stronger, disease-resistant fish strains both for aquaculture and for restocking the oceans. The applications of satellite technology are just beginning. Computers will make both research and management more effective. Robotics and offshore and underwater systems are central to a growing use of the oceans.

But if we are to fully exploit the potential of the Sea Grant concept, we must have increased and consistent financial support. Why does our nation continue to undervalue its marine resources and fail to increase its investment in marine research?

I suspect one answer is that marine resources are not perceived to be critical to our daily existence. We hear more about the curiosities of the oceans than their commodities. Coastal areas are valued for their recreation rather than their production potential. The casual treatment of the issue of marine resource use and management is reflected in the organizational structure of both the federal government and our institutions of higher learning. In too many universities, marine interests are scattered through too many units, with no coalescing force. In the federal government, ocean programs are administered in 10 departments, 8 independent agencies, and 38 agencies and sub-agencies.

Some of us think it is no longer permissible to dream of a single, central ocean agency with responsibility for the nation's

total civilian and federal ocean effort. Many believe our ocean affairs embrace too many constituencies to be housed in a single agency. Yet land resources and space exploitation have each fitted under a single governmental umbrella. In my opinion, optimal use and management of marine resources require an equivalent single federal agency.

Almost 20 years ago, we found the will to establish Sea Grant. In the next 20 months it is imperative that we find the will and the way to complete our organizational task: to create a single federal group or agency to represent and to work for and with our national marine community.

## **As Seen in Congress**

Nancy E. Reichley

Sea Grant is one of the most cost-effective and productive programs in the federal government, and each year it proves its worth in economic benefits and service to industry and government alike.

Yet each year the Administration proposes to eliminate Sea Grant. And each year Congress restores its funding. It is frustrating to have to continually battle for a program that should need no defense.

The projects speak for themselves. In 1981, annual sales from 19 projects, many of them not typically attempted by industry or the federal government, may have resulted in commercial development of almost 62 million dollars.

Part of the solution to Sea Grant's problem lies in increasing its political base. Stronger efforts must be geared towards getting the word out—on state, regional, and federal levels. More members of Congress can be brought around if we persist in our efforts to put the oceans and coasts at the top of the environmental agenda.

As to the future, several directions are possible and not all are new. One possibility is the re-establishment of international programs. The Sea Grant International Program, begun in 1976, was phased out in 1982, even though it had demonstrated that

such projects were scientifically and diplomatically useful. It could easily be made a permanent part of the federal-university-private sector partnership. It could also work closely with other agencies inside NOAA. Let me propose, for example, a stronger relationship within NOAA between the Sea Grant and Undersea Research offices. If their past collaborative efforts were expanded on an international scale, it could lead to all sorts of innovative programs. The Caribbean would be an excellent place to start.

There are other directions in which Sea Grant can and should expand. One of them is the development of its biotechnology program. In 1983, 55 million dollars was spent on agricultural biotechnology. In that same year, only eight million dollars was spent on its marine counterpart by Sea Grant.

With many of our fisheries declining, we need to develop aquacultural technologies that will allow us to replace or re-establish old fisheries. Both industry and the government have shied away from aquaculture because it can be a high-risk venture. It also has the potential for a high-value, long-term payoff. We need to move on it soon.

There are certainly other directions Sea Grant can pursue. With our increased responsibility in the EEZ, Sea Grant has a multitude of opportunities to use its research, education, and extension expertise. Scientific and economic projects are already underway at Woods Hole Oceanographic Institution and several universities.

NOAA plays a key role in developing policies affecting ocean and coastal activities. Within NOAA, Sea Grant remains essential, maintaining a strong liaison with educational institutions, industry, and government. I urge each of you to continue this important work.

## **As Seen by the Administration**

John McTague

Sea Grant has aspects that are extremely controversial, especially with this Administration. To explain where the controversy does and doesn't lie, I should talk about the Administration's



science policy as a whole and whether our approach to Sea Grant is consistent with that policy or whether we're "picking" on it.

Since the beginning of the Reagan Administration, there have been two countervailing trends in the government with respect to research and development. The first—and you might call it negative—is to get the government out of commercial activities, except in cases where regulation is so severe no private developer could guess what the government is going to do or make a rational plan. Nuclear power is an example. Or in areas with broadly distributed public good—food and drugs, for example. In the first years of this Administration, non-defense development funds were cut about in half. In the same period, the countervailing trend was a very substantial increase in support of basic research. That went up 56 percent in the last four years, across the board.

One of the strongest recommendations of the President's Commission on Industrial Competitiveness was to increase support of basic research, especially at universities. Another was to stimulate cooperative research between government, industry, and the universities. A third stressed the importance of interdisciplinary research.

The Administration is strongly in favor of many of the activities of Sea Grant. Peer review serves us all well. Having the federal government doing long-term, highly distributed basic research is a good thing. Marine technology, biochemical and satellite technology and engineering are appropriate areas for the federal government to be involved in. Another positive aspect of Sea Grant is that it focuses on universities, where we get the highest leverage for our tax dollar. If we could isolate these areas they would be well supported.

What's bad about Sea Grant? Many of its activities are regional. Why should the federal government underwrite them? Some work is clearly commercial development. How does supporting that become a federal role? How do we get a surgical balance on what we support and what we oppose? Congress is not the place to set research priorities.

How should you handle activities spread across many agencies? Ocean and marine activities are not the only ones. Another

recommendation of the President's Commission on Industrial Competitiveness was to establish a department of science and technology so that these priorities could be made. That has not been supported by universities because they fear the loss of "flexibility of funding." I don't think that would ever happen.

So, these are the problems. I don't know if we will ever solve them, but I think the discussion to date has been unfortunate. Everyone here has said things I agree with, but no one has gotten to the heart of the matter. How do we get to discuss the things we disagree on and try to find a method to either compromise on them while we build up the areas we do agree on or cut them out? We have to find a new method.

# New Opportunities and Challenges: Discussion

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## From Land-Grant Perspective

Daniel Aldrich

As one who has been involved with land-grant programs for 50 years, I have been asked to comment on what Sea Grant might learn from those programs' successes and failures.

While economic, social, and political forces will affect the emphasis, time, and resources allocated individually to education, research, and service, understanding of the indivisible nature of this triumvirate is paramount to the present and future of Sea Grant. It has been my experience in land-grant programs that when the quality of any one of the elements of this triumvirate deteriorates, the whole program falters.

Its 20-year history gives Sea Grant a unique perspective on current and future national needs in marine resource development. In the light of my land-grant experience, I should like to comment on some of the challenges and opportunities confronting Sea Grant.

The editor of *Aquaculture Magazine* has attributed recent U.S. growth in aquaculture to the types of technological progress being supported by Sea Grant, citing specifically the work of a research team at the University of California, Santa Barbara. Procedures developed there are said to increase one hundredfold the chances for financial success of companies engaged in shellfish culture.

Marine biotechnology is in its infancy compared to its terrestrial counterpart. It holds promise for solving the problems of dispersal of wastes in the marine environment. Genetically engineering marine organisms so they can detoxify wastes or produce useful compounds from them is a particularly promising opportunity. Marine biotechnology offers the United States the opportunity for international leadership in marine resource development. Adequately funded, it is an opportunity that can be readily seized.

How might Sea Grant acquire the necessary funds? I believe the same basic principles used to bring the United States to its present level of agricultural development would similarly lead the nation to world leadership in marine resource development.

As the proportion of the population in agriculture has dwindled to a very small minority, so has public understanding of agriculture and the factors that made possible its productive vitality and competitive position in world trade. To address this problem of public ignorance, the partners in agriculture, universities, government, and industry have embarked on an education program to improve public understanding of how a healthy, productive agriculture is maintained.

Partners in Sea Grant have no less a challenge in public education if they expect to obtain the financial support, public and private, that will enable them to position the United States as a world leader in marine resource development.

## **University-Industry Symbiosis in Academic Research: The Constructive Role of Research and Development Organizations**

James S. Coles

As government support of basic research in academic institutions leveled off and even declined in the 1970s, universities turned to new sources of support. One has been American industry and, more recently, foreign-based corporations.

While past industrial support of university research has not been large relative to government support, it has been significant. In 1979, in the top 100 universities, it ranged from less than \$15 million to almost \$150 million. Meanwhile, faculty and administrators have courted industry as never before, and industry has been flattered by the attention.

Much of the recent industry support has come from individual companies, whose interest was sparked by a variety of biotechnology research. Many larger companies established their own programs in this research or invested in the many new

small companies springing up to gain ingress to this promising new industrial area. This was duly noticed by universities, several of which sought to establish an equity position in the results of *their research*.

This happy circumstance of industrial support for university research in time of need is not without problems. The first objective of the university should be the teaching of students, and research should be undertaken to further that education. Among the problems presented by university-industry symbiosis are: secrecy, conflict of interest, impairment of education, deterioration of the traditional impartial positioning of the university relative to outside problems or events, the erosion of freedom of choice in research topics, and the diversion of faculty energy and interest.

There is, I believe, a constructive role for research and development organizations (RDOs) at the university-industry interface. Certainly there is a need for a neutral party to play a role with respect to the exploitation of university patents. An RDO can take an objective position in evaluating invention disclosures from faculty in patent application and in licensing.

University and other non-profit laboratories are facing rapidly escalating costs for instrumentation, supplies, technicians, and libraries. Today, industry is willing to provide funds for research with varying degrees of quid pro quo commitment from the university and the investigator. The possible positive and negative impacts of this partnership of conveniences, as well as benefit, is yet to be fully experienced.

Research and development organizations can help ensure the independence and integrity of the university and professor-scientist, at the same time providing for the efficient transfer of technology from the university laboratory into commercial production for public use and benefit. The experience of RDOs and their third-party neutrality and independence enhance their unique role in avoiding potential conflicts and problems and optimizing the benefits to all concerned—inventor, university, industry, and the public.

## Collaborative Research

Ferris Webster

Over the next two decades there will be new opportunities for Sea Grant to carry out collaborative research on a national scale.

What I propose is that at least a part of the Sea Grant research program could consist of large-scale collaborative marine research that might emulate the procedures used in large-scale collaborative oceanography. The National Sea Grant College Program already provides a mechanism for a kind of marine research that can complement but need not copy oceanographic research. I am not recommending that Sea Grant embark on that.

I am struck by the differences between the procedures used in large-scale programs during the International Decade of Ocean Exploration (IDEO) and those used by Sea Grant programs. IDEO programs were characterized by bottom-up planning. The scientists who implemented the program designed the program. NSF simply provided an opportunity.

Sea Grant programs are characterized by fragmented planning. The long-term research lead comes from Washington.

We in the Sea Grant institutions, not the Sea Grant Office, must take the initiative to develop large-scale research programs. We must define some long-range goals, coordinate to achieve them, and make some hard decisions. That will surely raise all the painful problems of coordination that oceanographers have experienced. Nevertheless, that is the challenge that must be met.

What are the new research opportunities? Let me mention a couple that would benefit from a united approach.

The diverse research on estuaries supported by the Office of Sea Grant is today the major estuarine research element in NOAA. Similarly, NOAA's aquaculture research is being done through Sea Grant.

In neither case is there an image of a coordinated national program. The total is less than the sum of the parts. If we could only get together, today's diverse elements of estuarine and aquaculture research supported by Sea Grant could be the foundation for principal national programs in the future.

The question is: do these projects warrant a national approach? I believe Sea Grant research would benefit from cooperation and a bottom-up approach to program initiation. We should, for instance, be pressing the point that there is a commonality in estuarine problems.

Then, too, for both estuarine research and aquaculture, there is great potential for interaction with other components of NOAA. However, it must be based on community-wide involvement and commitment by Sea Grant institutions. Ideas driven by the program directors in Washington do not have the same clout.

There are new opportunities for research, but they will never be realized if we wait for the Office of Sea Grant to take the lead. That lead must come from the grass roots. The reward can be a new level of maturity for marine research. This, in turn, will generate fallout benefits for the education and advisory service components of the program and will stimulate new enthusiasm within NOAA.

## Conference Summary: Beginning Our Climb to the Future

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John A. Knauss

Those of you who have recently read the proceedings of the first Sea Grant conference 20 years ago would agree, I think, that it set the stage for much that has happened in Sea Grant since. On the other hand, we were not very good forecasters in several areas. Much of the discussion then concerned how the combination of engineering and science would bring us into the brave new world. I think all of us would agree that, with a few exceptions, there has been little creative engineering in the program.

We were also wide of the mark concerning fisheries. There was no mention of fisheries management as such, and the whole concept of environmental quality was missed. So, if anyone looks back on this conference 20 years from now, we'll be lucky if they say at least we got the broad concepts right. So much for forecasting.

What is clear, though, is that Sea Grant came at exactly the right time, a time of new legislation, new ideas, rapidly expanding ocean interests.

What we have learned about Sea Grant and the universities over the past 20 years is that it was just as well we never tried to put it in a single college, as was done with land grant. Marine activities have been growing too rapidly and in too many directions. A real strength of Sea Grant has been its role in expanding those activities throughout the entire university.

Many of you mentioned networking. Networking amongst Sea Grant institutions is excellent. I wonder if it is as good within universities? And should we do more? Perhaps Sea Grant might attempt an additional mission—to network the entire marine community within each of its universities.

Nobody suggested changing the program structure of education, research, and advisory services, and I don't expect such a change for the indefinite future. There were varying opinions on the role of advisory services. But there seemed no great en-



thusiasm for major expansion of them at this time. Clearly, in view of our budget, we will have to decide soon what constitutes the proper funding balance for advisory services and research.

We heard very little about developing new areas of education, despite the fact that over the past 20 years Sea Grant has played an important role in developing new marine-related educational disciplines. Perhaps that role is completed; I am not sure.

A continuing concern about any applied research program was mentioned by several of you—that we must not back too much short-term, quick-fix research. However, there seemed to be a general feeling that the level of Sea Grant science is much higher now than it was in the first ten years.

So, what I have heard at this conference is that Sea Grant has been a success. We have had an important impact on marine efforts; we have demonstrated an important economic impact; our university graduates have had an impact on a variety of programs in the public and private sectors. The structure of almost every university with a significant Sea Grant program has been impacted one way or another.

As far as research, Sea Grant has certainly played an important role, particularly in the social sciences and other areas not supported by the National Science Foundation and the Office of Naval Research.

The consensus seems to be that we might need to fine tune the program a bit. No major changes are suggested for the next 20 years. Is that just because we are tired? After all, we have been fighting for survival for the past five years. Or is fine tuning all that's really needed?

As to the future . . . You can start with the set of initiatives listed in the last pages of the commemorative booklets you received. Then there was Bob Ragotzkie's suggestion that now that we have a viable aquaculture program, it's time to have marine experiment stations to go with it. It is an interesting idea and one the Sea Grant community should look at hard.

Dave Ross discussed the systematic mapping of the EEZ. This is clearly going to be done, but is there any role in it for Sea Grant?

Bob Corell talked about real-time monitoring of the marine environment. Perhaps we're finally ready for that. I certainly believe the new techniques and instruments he referred to are going to play an ever more important role in Sea Grant and give us all the more reason to get the best scientists we can involved, people who understand these new technologies.

A number of you mentioned international Sea Grant. I concur with what Senator Pell and the rest of you said; I think we should try to revive that program. Certainly we have the expertise to design it. But that doesn't mean it must remain a Sea Grant program. If it is a coherent program that meets national needs, presumably a way can be found to get it supported elsewhere. I believe that at a time when we are having trouble surviving, we should think in terms of designing programs rather than administering them.

Finally, a point Ferris Webster made and one I hear made by others is that we need a significant estuarine study, that we need to get out of the crisis mode of saving a new bay every year. Assuming that's so, let's design a study independent of Sea Grant at this point. Let's see what is needed for a total program and then figure out what agency should administer it. I think that is the way we should handle other important national issues, and, frankly, I think it is the only way we are going to see any possibility of significant funding increases, at least over the next few years. In most fields of science, I believe, federal support comes in a mixture of quantum jumps followed by slow increases. I believe this is how we are going to get additional support for Sea Grant in the future. So I suggest we design the programs Sea Grant needs, make them coherent, and not worry about who will support them.

## **Address by Senator Claiborne Pell (D-RI) at the 20th-Anniversary Commemorative Banquet**

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As we observe this 20th-anniversary commemoration of Sea Grant, I would like to share some thoughts about the future—not just of the program, but of our entire national and international effort in the marine sciences and engineering.

The United States has much to gain by a more intensive use of our marine science capabilities internationally and on a cooperative basis.

One compelling argument is the dramatic change in national jurisdiction over areas of the oceans. More than 60 nations, including ours, have established exclusive economic zones extending 200 miles from their shores, and this appears destined to become the international standard.

As a result, about one-third of the ocean areas of the world—the areas of greatest interest to marine science and development—will be subject to extensive national control. Future ocean research and development of resources will require cooperation with other nations.

In these circumstances, the United States should have a coherent policy and a coordinated program that makes the most of our national strengths in marine science, engineering, and technology. Economically, politically, and scientifically, we would benefit from such a program.

I suggest we draw on the proven strengths of the Sea Grant College Program. As in Sea Grant, sharing of the costs of projects by United States and foreign sponsors would help assure the degree of commitment and interest required. Also, as in Sea Grant, proposals should be initiated and developed by those who would carry them out—U.S. institutions and their foreign partners—subject to review, modification, and approval. Finally, there must be a mechanism for full sharing among institutions and agencies of information about projects underway, proposed, or completed.

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Twenty years ago when we gathered here to discuss the Sea Grant College concept, there were many unanswered questions. Today, as I suggest a strengthened international marine science and technology program, I look again for your guidance and suggestions. For example, how can we ensure that an enhanced international program will not divert resources from the current high-priority work of the Sea Grant College Program?

I have already had the benefit of suggestions from some of you who I know share the conviction that an improved international program is both justified and in our national interest. And I look forward to further comments, suggestions, and advice from all of you. I hope that 20 years from now we will all be here again, celebrating the wisdom of our deliberations in 1985.

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