Introduction:

Sea Grant—A National Investment for the Future

by David A. Ross

The National Sea Grant College Program works on a simple premise: Apply the intellect of U.S. universities and research institutions to the problems and opportunities associated with the use of the oceans, especially our coastal oceans. The program is the principal academic effort in the United States focusing on marine resources. Sea Grant is special in other ways, including its three-part emphasis on research, advisory services, and education, and its encouragement of cooperation between industry, academia, and the government. In addition, the program's impact on the nation's marine economy has been substantial. A 1981 analysis* showed that a fraction of Sea Grant's total project activity had led to $230 million in annual gross revenue or savings, resulting in better utilization and efficiencies in marine and coastal-based industries. This annual dollar amount is close to the *total* federal support Sea Grant received in its first 13 years. The program has never received more than $42 million in funding for any given year.

Much of Sea Grant's strength lies in its grass roots support, which is driven largely by the practicality of its research and advisory efforts. Simply said, Sea Grant research attempts to show us both how best to use the ocean, and how best to preserve it—not an easy task.

Despite the demonstrated need and value of the Sea Grant Program, it has had considerable budgetary problems during this decade. For the last seven years, its budget essentially has been eliminated by the federal Office of Management and Budget (OMB), but fortunately has been restored by Congress each year.

The future of the National Sea Grant College Program is uncertain; the program must be responsive to the needs of coastal states, local constituencies, federal budgets, national problems, and the direction of marine science. One important ray of hope lies in the most recent congressional reauthorization of the program (1987), which introduced a new concept for Sea Grant: Strategic Research Initiatives. This concept, combined with related efforts in other governmental agencies, could result in major changes in the way we view and study the oceans and could lead to very exciting times for Sea Grant.

This article offers some details about the founding and structure of the Sea Grant Program and some speculation on its future. The other articles that comprise this issue describe specific and innovative aspects of various Sea Grant-sponsored activities.

Creating the National Sea Grant Program

The National Sea Grant College Program was established in 1966 to foster understanding, development, utilization, and conservation of marine resources through support of research, education, and advisory services. Now in its third decade, Sea Grant continues to carry out that mission. Since its modest beginning, the program has grown to a base of 29 core institutional programs (Table 1 and Figure 1). In earlier years programs were located at major, marine-oriented universities and institutions. As Sea Grant expanded, it drew in other universities and institutions not part of the traditional marine community, several of which focus on the Great

* Report prepared by the Sea Grant Task Force, Washington, D.C., March 1981, for the Marine Affairs Committee of the National Association of State Universities and Land Grant Colleges.

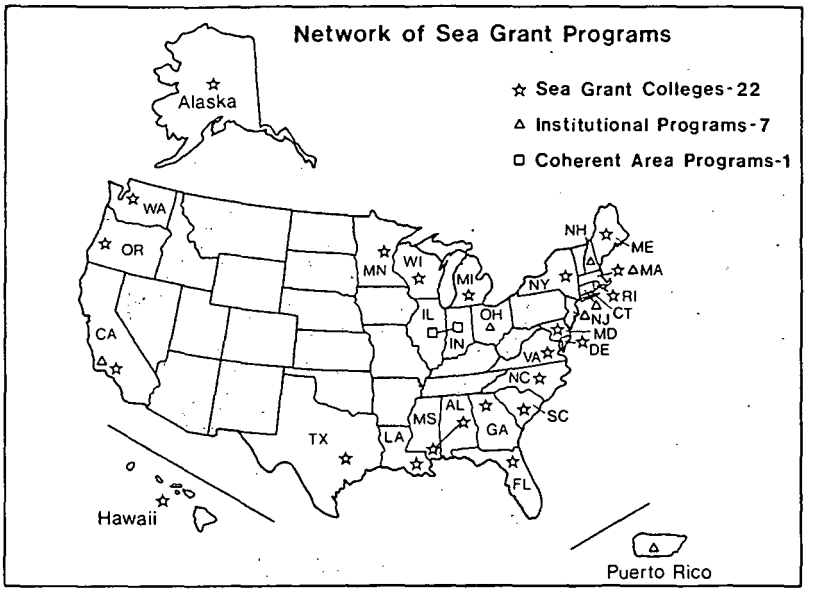

Figure 1. The three legs of the Sea Grant Network—research, education and training, and advisory/extension services—comprise more than 300 individual participating academic and marine research institutions. More than 3,000 scientists, engineers, educators, advisory/extension service agents, and students work in Sea Grant.

Lakes. Now, the Sea Grant network encompasses more than 300 universities and affiliated institutions involved in Sea Grant projects, generally working within the 29 core programs.

The term "Sea Grant" needs some clarification. First, there is a National Sea Grant Office in Rockville, Maryland, whose principal charge is to provide national direction, leadership, and coordination for the individual programs (Table 1). The present director of the national office is Ned A. Ostenso who, following a distinguished career at the Office of Naval Research, joined Sea Grant in 1977. He succeeded the first director of the national program, Robert B. Abel, who is now president of the New Jersey Marine Sciences Consortium. Then there are the 29 individual Sea Grant programs. Each individual program also has a director or coordinator who is charged with administering and leading his or her respective program as well as cooperating with other programs and sharing results across the entire suite of programs.

The origin of Sea Grant is attributed to a well-known marine innovator, Athelstan Spilhaus (see *Oceanus*, Vol. 30, No. 4, pp. 99–104). In a 1963 address on the state of the U.S. fishing industry, he asked:

> *Why, to promote the relationship between academic, state, federal, and industrial institutions in fisheries, do we not do what wise men had done for the better cultivation of the land a century ago. Why not have 'Sea Grant colleges?'**

Spilhaus, in his inimitable manner, continued to pursue the Sea Grant idea on many fronts. The concept also was advanced by John Knauss (see profile, page 75) at the University of Rhode Island, who organized a symposium on the subject in October 1965. The concept became a reality with the strong and inspired leadership of Senator Claiborne Pell of Rhode Island, who introduced Senate Bill 2439 to create Sea Grant Colleges, and Congressman Paul Rogers, who introduced the companion House Bill 16559. In October 1966, President Johnson signed a revised bill creating the National Sea Grant College and Program Act (Figure 2). The events leading up to the creation of Sea Grant are well chronicled in an account by John Miloy.*

After an initial four-year period within the National Science Foundation, in 1970 the Sea Grant Program moved to the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce. Presently, Sea Grant resides in NOAA's Office of Oceanic and Atmospheric Research, along with other extramural programs. Because of its different formula, and hence, different mindset from other federal programs, Sea Grant has sometimes appeared, in an administrative sense, to be an unwanted orphan in Washington. This has always intrigued, and occasionally disturbed me because the Sea Grant concept is basically sound, has very strong congressional support and endorsement, and has proven its effectiveness during more than 20 years.

The Three Parts of Sea Grant

The strengths of the National Sea Grant College Program lie in its conceptual underpinnings, as formalized in the Sea Grant Act. It combines

* A. Spilhaus, 1972, *Land is Just an Island*, EOS, Vol. 53, No. 5, p. 572.

* J. Miloy, 1983, *Creating the College of the Sea*, Texas A&M Sea Grant Program, 64 pp.

Table 1. Sea Grant programs. The National Office of the National Sea Grant College Program is located at 6010 Executive Boulevard, Rockville, MD 20852.

ALASKA

Alaska Sea Grant College Program
138 Irving II
Fairbanks, AK 99775

CALIFORNIA

California Sea Grant College Program
University of California
La Jolla, CA 92093

USC Sea Grant Program
Institute for Marine and
Coastal Studies
University of Southern California
University Park
Los Angeles, CA 90089–0341

CONNECTICUT

Connecticut Sea Grant Program
Marine Sciences Institute
University of Connecticut
Avery Point
Groton, CT 06340

DELAWARE

University of Delaware
Sea Grant College Program
Robinson Hall
University of Delaware
Newark, DE 19716

FLORIDA

Florida Sea Grant College Program
Building 803
University of Florida
Gainesville, FL 32611

GEORGIA

Georgia Sea Grant College Program
University of Georgia
Ecology Building
Athens, GA 30602

HAWAII

Sea Grant College Program
University of Hawaii
Marine Science Building
Room 102, 1000 Pope Road
Honolulu, HI 96822

ILLINOIS/INDIANA

Illinois/Indiana Sea Grant
Program
Purdue University
Department of Forestry
and Natural Resources
W. Lafayette, IN 47907

LOUISIANA

Louisiana Sea Grant College
Program
Center for Wetland Resources
Louisiana State University
Baton Rouge, LA 70803

MAINE

UME Sea Grant College Program
University of Maine
14 Coburn Hall
Orono, ME 04469

MARYLAND

University of Maryland
Sea Grant College Program
H. J. Patterson Hall
College Park, MD 20742

MASSACHUSETTS

Sea Grant College Program
Massachusetts Institute
of Technology
Building E38–330
292 Main Street
Cambridge, MA 02139

Sea Grant Program
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

MICHIGAN

Michigan Sea Grant College Program
University of Michigan
2200 Bonisteel Boulevard
Ann Arbor, MI 48109

MINNESOTA

Minnesota Sea Grant College Program
University of Minnesota
116 Classroom-Office Building
1994 Buford Avenue
St. Paul, MN 55108

MISSISSIPPI/ALABAMA

Mississippi-Alabama Sea Grant Consortium
703 East Beach
P.O. Box 7000
Ocean Springs, MS 39564–7000

NEW HAMPSHIRE

UNH Marine & Sea Grant Programs
Marine Program Building
University of New Hampshire
Durham, NH 03824

NEW JERSEY

New Jersey Sea Grant Program
New Jersey Marine Sciences Consortium
Building 22
Fort Hancock, NJ 07732

NEW YORK

New York Sea Grant Institute
State University of New York
Stony Brook, NY 11794–5000

NORTH CAROLINA

UNC Sea Grant College
Program
Box 8605
North Carolina State University
Raleigh, NC 27695–8605

OHIO

Ohio Sea Grant Program
The Ohio State University
1314 Kinnear Road
Columbus, OH
43212–1292

OREGON

Sea Grant College Program
Ads 320
Oregon State University
Corvallis, OR 97331

PUERTO RICO

Sea Grant Program
Department of Marine Sciences
University of Puerto Rico
Mayaguez, PR 00708

RHODE ISLAND

URI Sea Grant College Program
University of Rhode Island
Narragansett, RI 02882

SOUTH CAROLINA

South Carolina Sea Grant
Consortium
287 Meeting Street
Charleston, SC 29401

TEXAS

Sea Grant College Program
Texas A&M University
College Station, TX 77843

VIRGINIA

Virginia Sea Grant College
Program
Madison House
170 Rugby Road
University of Virginia
Charlottesville, VA 22903

WASHINGTON

Sea Grant Program
College of Ocean and Fishery
Sciences
University of Washington
Seattle, WA 98195

WISCONSIN

Sea Grant Institute
University of Wisconsin
1800 University Avenue
Madison, WI 53705

research, education, and advisory service components, and represents a partnership of government, universities, and industry. The 29 individual programs also work together, forming a network that shares expertise on regional and national levels and that responds as a cohesive unit to emerging issues. As I shall discuss later, this structure is both an opportunity and a problem.

A key Sea Grant role is to attract scientific expertise to address pressing marine and Great Lakes resource questions by providing funds for research support. Sea Grant research often focuses on fundamental questions in marine science, technology, and marine affairs, but frequently with an emphasis on the application of that science to a specific marine resource problem. Resource problems can be in areas as diverse as aquaculture, biotechnology, pollution, marine minerals, or shoreline erosion, but the

Figure 2. Four "Fathers of Sea Grant" and a former National Sea Grant College Program Director. From left to right: Robert Abel, John Knauss, Sen. Claiborne Pell, Rep. Paul Rogers, and Athelstan Spilhaus. Dr. Abel served as National Sea Grant Director from 1967–76. Dr. Ned Ostenso (see photo page 5) has been the Director since 1977.

focus often is perceived to be on a local level rather than on a national level. This perception frequently is wrong, as the various individual parts can constitute a national effort, but unfortunately there is generally little emphasis or visibility for this important point.

The second component of the National Program is marine education. Marine education covers a variety of activities, ranging from marine science curriculum development, dissemination of workshop and conference proceedings, public information communiqués, to funding graduate student support. This educational component is vital to developing a knowledgeable citizenry, which, of course, is a prerequisite to the wise use of the oceans and Great Lakes and their resources. Sea Grant, especially its larger programs, plays a leading role in marine education development in the United States.

The third component of the Sea Grant concept is its advisory and extension services. Through the efforts of marine advisory and communications personnel, current information, recent research results, and advice are provided on a local and regional level to a broad community of marine resource users, including commercial or recreational fishermen, boat owners, port and harbor managers, coastal property owners, or coastal town officials. Sea Grant marine advisory agents keep in touch with current coastal issues and organize initiatives such as workshops, project demonstrations, seminars, and information campaigns to address these issues. The output of individual programs is shared throughout the national Sea Grant community.

Networking

Sea Grant operates on a national level as a broad and effective network of individual programs. Through networking (something that has been made easier with the advent of computers and electronic mail), each individual program can access the information and expertise from all the other Sea Grant programs. The best example of this type of beneficial networking is found in Sea Grant information transfer. All Sea Grant products (books, reprints, videos, and so on) are available from the programs, and on-line computer searches can be made, covering all Sea Grant material available via the National Sea Grant Depository (at the University of Rhode Island's Pell Library). *Sea Grant Abstracts*, produced quarterly, provides a national listing of current Sea Grant publications. Sea Grant directors, educators, communicators, and advisory personnel are all a part of this network.

There are also five regional Sea Grant associations (Northeast states, Mid-Atlantic states, Southeast states, Great Lakes states, and Pacific region) and one national association. The directors of the individual programs meet within their respective regional associations, and at the national association, to discuss various problems and opportunities.

Some Financial Aspects

Twenty-two years after its inception, Sea Grant remains a model program because of the interaction between government, universities, and industry. This linkage and cooperation are ensured in the Sea Grant Act by the stipulation that a third of total program funding must come from nonfederal sources. This means that for each $2 in federal support, $1 must be contributed from a nonfederal source. In this manner, Sea Grant projects can tie into or be joint efforts with business, or local or state governments. Sea Grant can provide a mechanism to catalyze the entire process of developing new marine enterprises, from supporting fundamental research in the

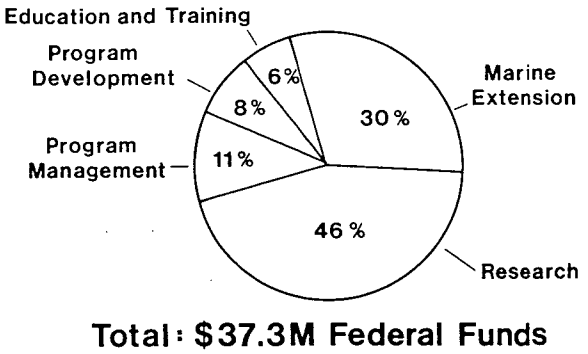

Figure 3. Sea Grant funding by program area, FY 87.

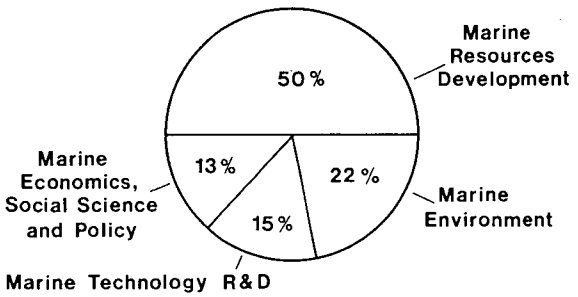

Figure 4. Sea Grant research funding by subject, FY 87.

laboratory, to implementing pilot projects in the field.

Despite the innovation and soundness of the Sea Grant concept, Sea Grant has never been a financial "fat cat." In fact, since 1981 Sea Grant has been level-funded each year at about $39 million. The budget for FY 87 was $37.3 million spent on research, marine extension, education and training, program development, and program management (Figures 3 and 4). This level-funding has not come easily, and has followed the same path each year: OMB first eliminates or zeroes out the proposed Sea Grant budget, and Congress then restores the budget. There have been interesting variations year to year, but the result has been generally the same. In the face of inflation, it has become progressively more difficult to maintain program cohesiveness and productivity from year to year with a constrained budget.

The vexing aspect is that this squeeze comes at a time when renewed affirmation of the Sea Grant concept would make obvious sense and is clearly in the nation's best interest. "Economic competitiveness" is the current shibboleth in Washington, and deservedly so. In fact, this is where Sea Grant could shine, and where Sea Grant could make its major impact. Yet the funding is not there. This is especially ironic in view of the move other countries are now making toward developing programs modelled after Sea Grant, for the same sound reasons proposed by Spilhaus in 1963.

The Future

The budget deficits of recent years are forcing our government to establish priorities concerning federal spending. This will certainly impact scientific research and the marine community. In early 1988, Frank Press, President of the U.S. National Academy of Sciences, urged the scientific community to assist the government in establishing such priorities among the various scientific fields. He proposed that the highest funding priority go to three areas: 1) training and research grants reaching the largest number of scientists, engineers, and clinical researchers; 2) responding to national crises, such as AIDS research and restoring the nation's space launch capacity; and 3) extraordinary scientific breakthroughs, such as high-temperature superconductivity.* Although Press did not say it, I submit that the quality and use of our coastal oceans are approaching a national crisis, and that the condition of this part of the ocean needs to be recognized as a national priority.

Sea Grant is in a very dynamic situation since it functions at both the national and local levels. On the national level, the Sea Grant structure, with its broad marine constituency, could develop planning and operations among multiple institutions, joining universities with government and industry. It really is, however, at the local or state level where Sea Grant mainly operates, and where its presence is so effective. To maintain the local or state constituency requires considerable cost and effort. There are expenses for the management of the institutional program, for the advisory program, and for local research projects. The latter are especially necessary since many programs receive matching funds from their states, thus requiring a focus on state marine problems. I do not mean to imply that this is an incorrect approach, but rather that this approach can result in more attention to local/state issues than to those of a more national nature. The impact and necessity of local projects has increased in recent years because of federal budget cuts to the Sea Grant Program by OMB, and the necessity of congressional action to counter them. Certainly, one of the reasons that Sea Grant has been strongly supported by Congress, and thus has survived as a program, is the value to congressional constituencies of projects that contributed to the solution of local problems. As I previously said, sometimes a collection of local Sea Grant projects can contribute to a national research program, but this point is not generally very obvious.

From a national program view, however, pressures for a local focus clearly present a dilemma. How can a sound national program be developed within a fixed (and often eroding)

* National Research Council, *News Report*, May 1988, Vol. 38, No. 5, p. 13.

budget without some local aspects being reduced? A potential answer is contained in the Sea Grant reauthorization legislation, the "National Sea Grant College Program Authorization Act of 1987," which reaffirmed the basic Sea Grant concept and the Sea Grant International Program, and added several new aspects, such as a Strategic Marine Research Program, and a Marine Affairs and Resource Management Improvement Grant.

The international program recognizes that much of the Sea Grant activity supported in the United States is transferable, and many times is essentially what foreign countries wish to learn about their own coastal environment. This part of the Sea Grant legislation unfortunately has not received financial appropriation during the last few years, but some institutions, such as the Woods Hole Oceanographic Institution and Oregon State University, are still pursuing modest international efforts.

The Strategic Marine Research Program is an excellent opportunity for Sea Grant to respond to emerging national issues and priorities. The new legislation requires that a three-year plan be developed to "1) identify and describe a limited number of priority areas for strategic research in fields associated with ocean, coastal, and Great Lakes resources, and 2) indicate the goals and timetables for the research in those fields." This Strategic Marine Research Program presents a definite challenge in that, as of the writing of this article, no specific funds have been appropriated for it. Nevertheless, it is a challenge that must be taken, and some priority areas are now being targeted. The program should not be a repackaging of present Sea Grant research, and it must focus on national needs.

One clear target area for a strategic research initiative under this program has emerged—the coastal ocean. It is an obvious choice since a major portion of the U.S. population lives within an hour's drive of the ocean or one of the Great Lakes, and because it is this coastal region that is most subject to environmental impact. Ironically, it also is this area, comprising our Exclusive Economic Zone (EEZ), that holds considerable economic potential—for fish, minerals, recreation and tourism, even for some safe forms of waste disposal. Remember, it is the challenge to both use this environment (with recreation and tourism among our largest growing industries) and protect it, that is inherent in the principles of the original Sea Grant legislation.

Two strategies are developing to meet the challenge of the Strategic Marine Research Program. The first is a broad-based approach, documented in a recent white paper on the U.S. coastal ocean, produced by Sea Grant directors. This document proposes five areas that the various Sea Grant institutions collectively have the capability to pursue:

- Sediment and shoreline stability;
- Coastal ocean mineral resources;
- Fisheries recruitment prediction;
- Impact of water quality on coastal ocean resources; and
- Marine biotechnology.

Sea Grant already has a foothold in these areas, however, and although the subjects are not a coherent package, they represent areas of critical concern for a large portion of the U.S. population.

The second approach is to pick a single issue with focused goals. One example proposes to look at a particular resource—placers or heavy mineral deposits—and to define what is necessary for an environmentally safe exploration and exploitation program of these minerals. Several offshore areas of the United States have such potential deposits (see article by Peterson and others, page 21). At present the United States is dependent on imports for several critical placer minerals that could be recovered from our EEZ. These include cobalt (86 percent presently imported), platinum metals (88 percent), and chromium (75 percent). If some of these minerals can be recovered in an environmentally safe manner from our EEZ, the need for imports would be reduced and a reliable supply would be assured.

This concentration on a single subject might be more appropriate for a strategic research initiative, but its flaw is that it should be part of a total national plan on how to use the oceans. Until a national plan is developed for ocean use and conservation, and defines the role of the federal government, academia, and industry, our realistic use and conservation of the ocean will continue to be piecemeal in approach.

In conclusion, Sea Grant is a dynamic organization with the national program coordinating individual Sea Grant programs, each of which is trying to meet local needs, earn state support, participate in national efforts, and maintain congressional support. The future that lies ahead for Sea Grant turns on whether there is a national plan for the oceans. A national ocean policy is needed that will unite the varied objectives of federal agencies, academia, and industry into a coherent and cohesive whole. Sea Grant's creation 22 years ago was considered revolutionary. Its performance and accomplishments over the years have proven that Sea Grant is an important national investment in the future of the seas.

David A. Ross is Chairman of the Department of Geology and Geophysics and Sea Grant Coordinator at the Woods Hole Oceanographic Institution. He also is on the Editorial Advisory Board of Oceanus *magazine.*

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