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REAUTHORIZATION OF THE NATIONAL SEA GRANT  
COLLEGE PROGRAM

GOVERNMENT

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JOINT HEARING  
BEFORE THE  
SUBCOMMITTEE ON  
EDUCATION, ARTS AND HUMANITIES  
OF THE  
COMMITTEE ON  
LABOR AND HUMAN RESOURCES  
AND THE  
COMMITTEE ON COMMERCE,  
SCIENCE, AND TRANSPORTATION  
UNITED STATES SENATE  
NINETY-SIXTH CONGRESS

SECOND SESSION

ON

S. 2589

TO AMEND THE NATIONAL SEA GRANT COLLEGE PROGRAM  
ACT, AS AMENDED, AND FOR OTHER PURPOSES

AND RELATED BILL

APRIL 25, 1980



Printed for the use of the Committee on Labor and Human Resources  
and the Committee on Commerce, Science, and Transportation

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INFORMATION





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## CHAPTER I

The first chapter of the book is devoted to a general survey of the history of the United States from the time of its discovery by Christopher Columbus in 1492 to the present day. It covers the period of the early colonial settlement, the struggle for independence, the formation of the federal government, and the expansion of the country to the Pacific Ocean. The chapter also discusses the role of the United States in the world during the 19th and 20th centuries.

## CHAPTER II

The second chapter of the book is devoted to a detailed study of the political system of the United States. It begins with a discussion of the Constitution, which is the supreme law of the land. It then goes on to describe the three branches of government: the executive, the legislative, and the judicial. The chapter also discusses the role of the states in the federal system and the process of amending the Constitution.

The third chapter of the book is devoted to a study of the economic system of the United States. It begins with a discussion of the role of the government in the economy, and then goes on to describe the various sectors of the economy, including agriculture, industry, and services. The chapter also discusses the role of the United States in the world economy.



## REAUTHORIZATION OF THE NATIONAL SEA GRANT COLLEGE PROGRAM

FRIDAY, APRIL 25, 1980

U.S. SENATE, SUBCOMMITTEE ON EDUCATION, ARTS AND  
HUMANITIES, COMMITTEE ON LABOR AND HUMAN  
RESOURCES, AND THE COMMITTEE ON COMMERCE,  
SCIENCE, AND TRANSPORTATION,

*Washington, D.C.*

The subcommittee met, pursuant to notice, at 10 a.m., in room 1224, Dirksen Senate Office Building, Senator Claiborne Pell (chairman of the subcommittee) presiding.

Present: Senator Pell.

Senator PELL. The meeting will come to order.

This is a joint hearing of the Subcommittee on Education, Arts and Humanities, of the Committee on Labor and Human Resources, and of the Committee on Commerce, Science, and Transportation, on legislation to amend the National Sea Grant College Program Act, and to authorize additional appropriations for the program.

We will be under some time pressure because I have to leave at 10:20 for a meeting at the White House on the events in Iran. I will ask everybody here to put their statements into the record and be brief in his oral testimony.

With unanimous consent, I will insert my opening statement in full in the record at this time rather than reading it.

I would express my gratitude to Senator Hollings and Senator Magnuson for the joint meeting of the two groups; and I would ask that a statement of Senator Hollings be inserted in full in the record at this point to precede mine as a courtesy to him.

We will also include in the record at this point the texts of S. 2589 and H.R. 6614.

[The opening statements of Senator Hollings and Senator Pell and the bills referred to follow:]

### OPENING STATEMENT OF SENATOR HOLLINGS

Senator HOLLINGS. We are here today to review the national sea grant program. This is a program to accelerate the national development of marine resources, including their conservation, management, and economic utilization. This is being accomplished through projects designed to encompass research into current problems, adequate training and manpower, and transfer of technology and knowledge to the people who need it in a form they can use. Since the inception of the program a highly productive partnership has



evolved of practical research, education, and advisory services. Through the 14 years of its existence the national sea grant program has demonstrated that this partnership between the Federal Government and universities can be an effective way to establish the knowledge and understanding for the wise use of ocean and coastal resources.

At a time when inflation requires cutting back on wasteful Government spending we must recognize those programs that have made contributions. Sea grant should receive continued support as we become more dependent on our vast renewable and nonrenewable ocean and coastal resources. We must develop the means to understand and use the oceans wisely. Yet we must also be aware of the tenor of the times and the need for budget constraints. I am looking forward to hearing the comments and suggestions made by all of you working so closely with these programs. I am quite familiar with the development of the program in South Carolina and am pleased that the director of our new sea grant consortium could be here to testify.

#### OPENING STATEMENT OF SENATOR PELL

Senator PELL. The meeting will come to order. This is a joint hearing by the Subcommittee on Education, Arts, and Humanities of the Committee on Labor and Human Resources, and of the Committee on Commerce, Science, and Transportation, on legislation to amend the National Sea Grant College Program Act and to authorize additional appropriations for the program.

At the outset, I want to express my appreciation and thanks to Senator Cannon, chairman of the Commerce Committee and of the Senate National Ocean Policy Study, and to Senators Magnuson and Hollings, vice chairmen of the National Ocean Policy Study, for their usual cooperation and assistance in the joint consideration of this legislation by the two Senate committees.

The legislation before the committees would authorize appropriations for the national sea grant college program for 3 additional years, through fiscal year 1983. In addition, S. 2589 and H.R. 6614 would make changes in the program authorization of a minor and technical nature.

We have with us today witnesses from the National Oceanic and Atmospheric Administration of the Department of Commerce, from the Sea Grant Association, and from several institutions that participate in and contribute to the work of the program. We look forward to their views, comments, and recommendations.

Before we hear the witnesses, I would like to provide a somewhat personal historical perspective. The sea grant college program, with this legislation, will be entering its 15th year in 1981. Former Representative Paul Rodgers of Florida and I introduced the first legislation proposing an ocean counterpart to our land grant college system in 1965. The first congressional hearing on the proposal was held at the University of Rhode Island in that same year and the authorizing legislation was enacted 1 year later in 1966.

Since that time the sea grant program has been transferred, by Executive reorganization, from the National Science Foundation to the Commerce Department, and has been expanded at what is best



described as a deliberate pace from the first year appropriation of \$1 million to a fiscal year 1980 appropriation of \$38 million.

Over the years since it was established, the program has been periodically reviewed by the Congress, and in each case the Congress has found the objectives and mechanisms of the program to be sound and worthy of continuation and expansion. Some program changes have been made, principally in the addition of separate and specific authorizations for a program designed to meet high priority national needs and a program of international cooperation and assistance.

The legislation before the committees proposes modest increases in the level of authorized appropriations for the sea grant program. These increases are barely sufficient to adjust to projected cost increases due to inflation. In the case of the international and national needs programs, no increases in funding authorization are proposed, not because these programs are considered less valuable, but because the fiscal year 1980 authorization level would allow adequate room for growth from the existing level of appropriation.

My own conviction is that the national sea grant college program is extremely cost-efficient and effective and is responsive to needs that should have a very high priority. I have in fact been disappointed that the program has not been accorded a higher funding priority and a greater emphasis with NOAA, the Department of Commerce, and the administration. Indeed, if inflation during the past 5 years is taken into account, the sea grant program in real, constant dollars, has been on a no-growth diet.

We all know that we are now in a period requiring very stringent budget restraints. It is a period in which even the most worthwhile of programs must be subjected to rigorous review and examination.

Although I am proud to be one of the founding fathers of the sea grant college program, and I am convinced that the program is effective and highly productive, during this hearing I will be asking each of the witnesses to provide the kind of justification that would persuade an individual taxpayer in Rhode Island that his money would be well spent on continuation of this program.

I think the evidence is there, and I think the taxpayers deserve to have it presented.

[The text of S. 2589 and H.R. 6614 follows:]



96TH CONGRESS  
2D SESSION

# S. 2589

To amend the National Sea Grant College Program Act, as amended, and for other purposes.

---

## IN THE SENATE OF THE UNITED STATES

APRIL 21 (legislative day, JANUARY 3), 1980

Mr. PELL (for himself, Mr. HOLLINGS, Mr. CANNON, Mr. MAGNUSON, Mr. PACKWOOD, and Mr. STEVENS) introduced the following bill; which was read twice and referred jointly, by unanimous consent, to the Committees on Commerce, Science, and Transportation and Labor and Human Resources

---

## A BILL

To amend the National Sea Grant College Program Act, as amended, and for other purposes.

- 1       *Be it enacted by the Senate and House of Representa-*  
2       *tives of the United States of America in Congress assembled,*  
3       That the National Sea Grant College Program Act (33  
4       U.S.C. 1121 et seq.), as amended, is further amended—  
5               (1) in section 203(6) by inserting “Great Lakes  
6       and the” immediately before “territorial sea”;  
7               (2) in section 205(d)(2) by inserting “may be ap-  
8       plied to the short-term rental of buildings or facilities



1 for meetings which are in direct support of any sea  
2 grant program or project and" immediately after "con-  
3 tract" the second time it appears therein;

4 (3) in section 206(c) by inserting the following  
5 new paragraph immediately after paragraph (2):

6 "(3) Not to exceed \$7,000,000 for fiscal year  
7 1981, not to exceed \$7,000,000 for fiscal year 1982,  
8 and not to exceed \$7,000,000 for fiscal year 1983.";

9 (4) in section 209(c)(3) by striking the first two  
10 sentences and inserting in lieu thereof the following:

11 "Any individual appointed to a partial or full term may  
12 be reappointed for one additional full term."; and

13 (5) in section 212 by inserting the following new  
14 paragraph immediately after paragraph (2):

15 "(3) Not to exceed \$55,000,000 for fiscal year  
16 1981, not to exceed \$60,000,000 for fiscal year 1982,  
17 and not to exceed \$65,000,000 for fiscal year 1983.".

18 SEC. 2. Section 3(c) of the Sea Grant Program Im-  
19 provement Act of 1976 (33 U.S.C. 1124a(c)) is amended by  
20 inserting the following new paragraph immediately after  
21 paragraph (2):

22 "(3) Not to exceed \$5,000,000 for fiscal year  
23 1981, not to exceed \$5,000,000 for fiscal year 1982,  
24 and not to exceed \$5,000,000 for fiscal year 1983.".



- 1        SEC. 3. The section heading of section 3 of the Sea  
2 Grant Program Improvement Act of 1976 (33 U.S.C. 1124a)  
3 is amended to read as follows:  
4 "SEC. 3. SEA GRANT INTERNATIONAL PROGRAM."

○



96TH CONGRESS  
2D SESSION

# H. R. 6614

---

## IN THE SENATE OF THE UNITED STATES

APRIL 18 (legislative day, JANUARY 3), 1980

Read twice and referred to the Committee on Commerce, Science, and  
Transportation

APRIL 21 (legislative day, JANUARY 3), 1980

Referred jointly to the Committee on Commerce, Science, and Transportation and  
to the Committee on Labor and Human Resources

---

## AN ACT

To authorize appropriations to carry out the national sea grant  
program for fiscal years 1981, 1982, and 1983, and for  
other purposes.

1       *Be it enacted by the Senate and House of Representa-*  
2       *tives of the United States of America in Congress assembled,*  
3       That the first sentence of section 206(c) of the National Sea  
4       Grant College Program Act (33 U.S.C. 1125(c)) is  
5       amended—

6               (1) by adding “out” after “carrying”, and

7               (2) by adding at the end thereof the following:

8               “(3) \$3,500,000 for fiscal year 1981.



1           “(4) \$5,000,000 for fiscal year 1982.

2           “(5) \$6,000,000 for fiscal year 1983.”.

3       SEC. 2. The first sentence of section 212 of the National  
4 Sea Grant College Program Act (33 U.S.C. 1131) is  
5 amended by adding at the end thereof the following:

6           “(3) \$50,000,000 for fiscal year 1981.

7           “(4) \$58,000,000 for fiscal year 1982.

8           “(5) \$65,000,000 for fiscal year 1983.”.

9       SEC. 3. The first sentence of section 3(c) of the Sea  
10 Grant Program Improvement Act of 1976 (33 U.S.C.  
11 1124a(c)) is amended by adding at the end thereof the  
12 following:

13           “(3) \$2,000,000 for fiscal year 1981.

14           “(4) \$3,000,000 for fiscal year 1982.

15           “(5) \$4,000,000 for fiscal year 1983.”.

16       SEC. 4. Section 203(4) of the National Sea Grant Col-  
17 lege Program Act (33 U.S.C. 1122(4)) is amended by insert-  
18 ing “humanities and arts,” after “international affairs,”.

19       SEC. 5. Section 203(6) of the National Sea Grant Col-  
20 lege Program Act (33 U.S.C. 1122(6)) is amended by strik-  
21 ing “territorial sea” and inserting in lieu thereof “Great  
22 Lakes and the territorial sea”.

23       SEC. 6. Section 204(c) of the National Sea Grant Col-  
24 lege Program Act (33 U.S.C. 1123(c)) is amended—



1 (1) by inserting after clause (4) a new clause (5)  
2 to read as follows:

3 “(5) encourage cooperation and coordination with  
4 other Federal programs concerned with ocean and  
5 coastal resource conservation and usage; ”, and

6 (2) by renumbering the existing clauses (5) and (6)  
7 as clauses (6) and (7).

8 SEC. 7. Section 205(d)(2) of the National Sea Grant  
9 College Program Act (33 U.S.C. 1124(d)(2)) is amended by  
10 striking “contract may,” and inserting in lieu thereof “con-  
11 tract may be applied to the short-term rental of rooms or  
12 facilities for meetings which are in direct support of activities  
13 under a sea grant program or project, and may,”.

14 SEC. 8. The section heading of section 3 of the Sea  
15 Grant Program Improvement Act of 1976 (33 U.S.C. 1124a)  
16 is amended to read as follows:

17 “SEC. 3. SEA GRANT INTERNATIONAL PROGRAM.”.

18 SEC. 9. Section 209(c)(3) of the National Sea Grant  
19 College Program Act (33 U.S.C. 1128(c)(3)) is amended—

20 (1) by striking “only” in the first sentence and in-  
21 serting in lieu thereof “to serve”, and

22 (2) by amending the second sentence to read as  
23 follows: “An individual appointed to serve for a full or



1 partial term may be reappointed to serve for no more  
2 than one additional full term.”

Passed the House of Representatives April 17, 1980.

Attest: EDMUND L. HENSHAW, JR.,  
*Clerk.*

By W. RAYMOND COLLEY,  
*Deputy Clerk.*



Senator PELL. I would also ask that a letter from the Division of Marine Resources in Washington, dated April 22, 1980, addressed to Senator Howard W. Cannon, chairman of the Committee on Commerce, Science, and Transportation be inserted in the record at this point.

[The following was received for the record:]





# DIVISION OF MARINE RESOURCES

UNIVERSITY OF WASHINGTON • A SEA GRANT COLLEGE

April 22, 1980

The Hon. Howard W. Cannon  
Chairman of the Committee on Commerce,  
Science and Transportation  
U. S. Senate  
Washington, D.C. 20510

Attn: Sharon Meyer  
Room 126  
Russell Senate Office Building

Dear Senator Cannon:

It is with genuine regret that I am unable to accept your invitation to testify in person before the joint committees on the occasion of your review of the National Sea Grant College Program. My feeling of regret is particularly acute because my 11 years as director of the Sea Grant Program in the State of Washington will soon end. Recently I was appointed Director of the Applied Physics Laboratory at the University of Washington, and I continue in my Sea Grant responsibilities only until a permanent successor can be found. Although it is a poor substitute for a personal appearance before your committees, I request that this letter be included in your record of testimony, if that is possible.

The achievement of Sea Grant has been the development of an active partnership among federal agencies, universities and local citizens with the common purpose of improving our nation's abilities to utilize more effectively its marine resources and to conserve them for the future. The development of this mature partnership has not been a simple task. Misunderstandings have occurred and expectations have sometimes fallen short. Small marine businesses have expected direct funding to relieve their financial pressures. Special interest groups have expected instant advocacy of their causes. Academicians have been disappointed that basic research has not been considered a priority. Program reviewers have been frustrated by a seeming lack of attention and progress in addressing issues they believe are important. That these misunderstandings and unrealizable expectations are now infrequent marks the maturation of the Sea Grant program.

Moreover, relationships with industry have been strengthened. There has been a rapid increase in the numbers of joint research and education projects between Sea Grant and industry that represent genuine partnerships in the planning, execution, and support needed for successful outcome. Opportunities for industrial involvement clearly are increasing, and industry



undoubtedly will play a more significant role in Sea Grant's future. This trend is particularly important, since it offers an ideal blend of those with new knowledge and those with the greatest understanding of the application of that knowledge.

In many ways, Sea Grant's educational projects are an investment in future extended uses of the sea. Training students so that they are qualified to contribute expertise and new approaches to solving problems of the national marine community is an act of faith in the future. Investments in education realize long-term benefits though years may pass before a significant impact is apparent. After 12 years, Sea Grant support for education has very clearly demonstrated this. Graduates of Sea Grant supported programs are now assuming positions of leadership in government and industry.

A pattern parallel to that identified above for education is also apparent in results of Sea Grant's advisory services. Successful dissemination of information is not a passive role. The process requires manpower and resources dedicated to applying research results to those problems. Even with a focused extension effort, it takes time for innovation to become accepted and applied. People without prior access to the research results of the nation's universities and other sources of useful information now have those contacts as a direct result of marine advisory efforts. Many of these people are now leaders in their communities on marine issues and thereby provide the means to transfer new ideas more effectively.

Many examples can be given, have been given, and will be given that illustrate these and similar accomplishments of Sea Grant in meeting the purposes for which Congress created this program. In normal times, therefore, one could predict, with considerable confidence, that support of this program would be maintained and perhaps expanded. But these last few years have not been "normal times". In fact, the program's appropriations probably peaked, in real dollars, about 1975. In terms of effectiveness, however, Sea Grant probably reached its peak much later as a result of some of the factors I have mentioned here. The end result, if the recent funding history prevails, is serious staff reductions in Advisory Services and a noticeably reduced capacity to respond effectively to even the highest priority needs and opportunities of the marine community.

Although the program remains viable at this point, it now faces losses of momentum that will far exceed the small savings that could be realized if the program is not funded at a level that compensates for losses from inflation. This level of investment--small as measured in terms of the total federal budget--could continue its present substantial returns.

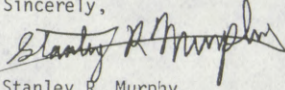
Although I have no specific evidence to support my optimism, I remain confident that Sea Grant not only will survive, but will also continue to serve well its intended constituency. My confidence is based upon these observations: the Sea Grant concept has been proven to be a good idea and



it works. Because of that factor, the program has consistently attracted a cadre of highly respected, innovative, and hard-working people.

Therefore, the continued support of the small, but dedicated, group in Congress will be deeply appreciated by those of us who are involved with Sea Grant and by those who benefit from its programs.

Sincerely,

A handwritten signature in dark ink, appearing to read "Stanley R. Murphy", written in a cursive style.

Stanley R. Murphy  
Director

Senator PELL. I also have a statement by Dr. Robert B. Abel, who is vice president of the New Jersey Marine Sciences Consortium and director of the State's sea grant program, and I ask that that be inserted in the record in full at this point.

[The statement referred to follows:]

TESTIMONY OF DR. ROBERT B. ABEL BEFORE THE SENATE COMMITTEE ON COMMERCE,  
SCIENCE, AND TRANSPORTATION, AND SUBCOMMITTEE ON EDUCATION, ARTS, AND  
HUMANITIES, OF THE SENATE COMMITTEE ON LABOR AND HUMAN RESOURCES

My name is Robert B. Abel. I am Vice President of the New Jersey Marine  
Sciences Consortium, and Director of the State's Sea Grant Program.

Messrs. Chairmen:

In response to your kind invitation of April 8, 1980, I am pleased to offer a few observations on the proposed bill to continue authorization of the National Sea Grant Program. As you know, the vantage point from which these observations are made is unique, owing to my previous position as founding director of the Program.

Thus, I have been afforded the opportunity to view Sea Grant as both a National and Local executive. The practice is to be commended, and I should like to recommend, for the record, that as many Sea Grant Directors, as can be accommodated, join the National office for a year and vice versa. The Intergovernmental Personnel Act can perform a special service for the Sea Grant Program.

It has been gratifying to have lived with and watched the progress of Sea Grant over the past dozen years, from an obscure task with one million internally reprogrammed dollars and an odd name, to the largest marine program in the world. As first expressed by Representative Charles Mosher in previous hearings, Sea Grant has really become a movement.

In retrospect, a principal reason for Sea Grant's success was the original legislation. Artistic in its simplicity, it permitted the Executive Agency wide latitude for imaginative implementation without neglecting necessary safeguards and responsibility to the Congress.



The Pell-Rogers Act has withstood the test of time, surviving even the threat to its effectiveness posed by the so-called "Sea Grant Improvement Act" of 1976. Occasionally, in legislative history, amendments to existing laws, proposed and enacted in good faith as "improvements" or means of "tightening up" the law have had the opposite effect in practice.

I opposed most of the proposed amendments to the National Sea Grant College Program Act in 1976. Had I been gifted with the second sight, I would have been even more adamant in my opposition. I still believe that the best thing the United States Government can do for the Pell-Rogers Act is to leave it alone.

Having enunciated this as a generality, I can, in conscience, admit a few minor technical exceptions, prompted by changes in the Executive environment. No fault, therefore, can be found with any of the changes in the proposed bill at hand:

1) The explicit addition of Great Lakes to the Sea Grant lexicon is harmless. From a legal viewpoint, it may not be necessary, since PL 89-454, to which the Sea Grant Act is Title II, specifies inclusion of the Great Lakes in Section 8.

2) During the early deliberations on construction of the original Sea Grant legislation, Representative H. L. Gross of Iowa, one of the "Budget Watchdogs," stated he would agree to the legislation only if it prohibited the use of Federal funds for "Bricks and Mortar." Although this constituted a degree of impediment to some of the grantees, the marine community has mostly appeared willing to live with it. Lately, this restriction is believed to be possibly hampering the use of rental halls for Sea Grant-sponsored meetings, etc. If this, in fact, is providing a harassment to many of the Sea Grant Directors, some relaxation may be justified. Such relaxation could be abused however; the accompanying (to the legislation) report ought to caution the Sea

Grant office to maintain careful surveillance over this type of use.

- 3) No objection.
- 4) Permission to reappoint its members to second term on the Advisory Committee is badly needed. This is one of the crippling effects of the Sea Grant "Improvement" Act alluded to above. It has been obvious to anyone knowledgeable of Sea Grant that owing to the unusual complexity of the Program, it takes more than the normal indoctrination time to understand the Program well enough to contribute usefully as a committee member. This change is strongly recommended.
- 5) Recommended as being desirable, if optimistic.

The proposed amendments to Section 3, of the Sea Grant Improvement Act, appear justifiable. In this connection, it has been observed that good use seems to be made of the funds allotted to the International Sea Grant Program. While it is undoubtedly too late for inclusion in this legislation, it is suggested that consideration be given to transferring custody of, and responsibility for, the Congressionally inspired "Regional Fund" (see Senate Calendar 772, 5/15/78) to the International Sea Grant Program.

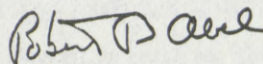
Finally, a word about my own Program and its significance to the national network. I am currently employed by twenty-three colleges and universities which have formed a Consortium, a privately incorporated alliance, the only one of its kind. It is a means of acquiring the aggregate capability in marine technology to which none of the component institutions could individually aspire. Our Consortium is a fascinating experiment in marine technology management; it could have happened nowhere except under Sea Grant, which has encouraged so many innovative organizational departures in its short history.



We are, however, the smallest and newest of the Sea Grant Programs. In this circumstance, I was, naturally, concerned over the recently enunciated Government doctrine of first priority being assigned to "quality," with institution building consigned to lesser consideration. It has always been my view that the last states to enter Sea Grant should not be penalized for lateness alone. In fact, the taxpayer from Connecticut deserves just as much Government assistance, per capita, in protecting and developing his State's contiguous marine resources, as his California counterpart.

It is, therefore, especially encouraging to observe that the National Office appears to continue, and take seriously, its mandate to construct a strong network. They should be commended for this, particularly as they appear willing and able to do so without diluting the Program's quality.

Messrs. Chairmen, thank you very much for having afforded me this opportunity to assess a program I hold so dear.

A handwritten signature in dark ink, appearing to read "Robert B. Abel". The signature is fluid and cursive, with the first name "Robert" and last name "Abel" clearly distinguishable.

ROBERT B. ABEL

Dated: April, 1980.



Senator PELL. Our first witness, Mr. Ferris Webster, Assistant Administrator for Research and Development, NOAA, Department of Commerce, is not yet here.

Dr. Corell is here.

If Dr. Corell could come forward, please, I would appreciate it. How many members of the panel of sea grant directors are here?

Dr. Niels Rorholm, coordinator, sea grant program, University of Rhode Island, from my own State, is here and also Dr. John Armstrong.

Maybe you could all sit up there.

When Mr. Webster comes in, he can join you.

**STATEMENTS OF FERRIS WEBSTER, ASSISTANT ADMINISTRATOR FOR RESEARCH AND DEVELOPMENT, NOAA, DEPARTMENT OF COMMERCE; AND DR. ROBERT CORELL, PRESIDENT, SEA GRANT ASSOCIATION, DIRECTOR, UNIVERSITY OF NEW HAMPSHIRE AND UNIVERSITY OF MAINE SEA GRANT PROGRAM, AND STATEMENTS OF A PANEL OF SEA GRANT DIRECTORS CONSISTING OF DR. NIELS RORHOLM, COORDINATOR, SEA GRANT PROGRAM, UNIVERSITY OF RHODE ISLAND, KINGSTON, R.I.; AND DR. JOHN ARMSTRONG, EXECUTIVE DIRECTOR, SOUTH CAROLINA SEA GRANT CONSORTIUM**

Dr. CORELL. Senator Pell, it is an honor to be here. It is my privilege and pleasure to discuss with you the critical importance of the national sea grant college program to American universities and colleges.

Senator PELL. I am sorry to interrupt you.

Mr. Webster has just come in; and maybe he will come forward.

Because of the events of last night and this morning, Mr. Webster, I have to leave to go to the White House at 10:20, so I am trying to push along as quickly as I can.

Written statements will appear in full in the record.

If anyone feels it is too hasty, we can have another day. If you will agree with this, it will be acceptable to us and to Senator Hollings.

Mr. WEBSTER. Thank you, Senator Pell.

Excuse me for my lateness. I have submitted written testimony, and I would be pleased if it would be inserted in the record.

Senator PELL. It will be made a part of the record.

Mr. WEBSTER. May I make 2 minutes of comments?

Senator PELL. Please do.

Mr. WEBSTER. The highlights of our testimony revolve around new activities that sea grant has been involved in. I am speaking now of international activities, about our studies of fisheries education and about our national projects. Let me say one or two words about each of those. I know you are interested in those.

The national sea grant college program is continuing to work toward the goals set forth in the original legislation and the 1976 Reauthorization Act; that is, to enhance the development and use of the resources of the oceans and Great Lakes through greater involvement of our academic institutions. During the past few months, 2 new sea grant colleges were designated by the Secretary, bringing the total to 15. A formal application has been received



from another institution and we hope that it will receive favorable consideration.

The 1976 act authorized a new international program for sea grant which has now been implemented with 2 years of funding having been provided to 11 U.S. institutions for projects in 19 different foreign nations.

Although it is too early to be able to document the positive results expected from these programs, we can state that it has been identified by our law of the sea negotiators as an indication of the sincere interest on the part of the United States in helping developing nations to upgrade their marine science capabilities.

The sea grant staff has completed the study of educational needs of the commercial fishing industry that was requested by the Senate in 1978.

Although it was difficult to obtain broad agreement on the needs for the future, the study group concluded that a modest improvement in existing educational programs was warranted to enhance the skills of those already in the industry and provide better trained personnel for future positions. Training programs to produce large numbers of new entrants into the industry were not considered necessary.

The last activity that I would like to discuss is the national projects program.

The one study conducted under this section of the 1976 act is a program designed to improve our ability to predict sediment movement along our shorelines which can help us avoid some of the costly coastal erosion problems of the past.

A team of scientists recently completed a month-long experiment at Santa Barbara and are planning another for the east coast.

However, with our desire to fund other projects, we have decided to reduce our funding for this sediment study in fiscal year 1981. In order that the planned study can be completed and on schedule, other sources of Federal funding are being sought. Both the Navy and the Corps of Engineers are now considering the possibility of providing such support.

On a final note, Mr. Chairman, our determination to meet the original goals of the Sea Grant College Act are bearing fruit.

In the past year, two new sea grant institutions joined the network. The first bi-State program in New Hampshire and Maine was inaugurated in January and Georgia joined the sea grant network a month or so ago.

The Alaska program applied for sea grant membership and we believe decisions on that will be made at the end of the years.

We will be glad to respond to any questions.

Senator PELL. I will be submitting questions for the record afterwards. My own support for the program remains as strong as it ever was. If there is one program where the cost-efficiency-benefit ratio to the Government is high, I think it is in this program; and I would like to see it grow and flourish more than it has in the past. I realize that this is a tight budget year but I will be doing my best to see the program prosper.

Dr. Corell?

Dr. CORELL. Mr. Chairman, I would like to enter a few comments in summary of the testimony that has been submitted in writing.



The Sea Grant Association has reviewed the reorganization draft bill and would like to support the recommendations that you and your committee have put forward.

The Sea Grant Association has also identified four major priorities for 1981 and 1982, to be addressed by all of its programs.

If I might, I would like to read those.

First, expand research and related development programs to support the healthy evolution and development of the American fishing industry;

Second, increase applied research, development and educational programs which enhance our Nation's capacity to resolve conflicts in ocean and coastal resource utilization;

Third, expand the transfer of technologies and methodologies from the research and field laboratories of universities to industry, commerce, and all levels of government; and

Fourth, expand the national projects and international cooperative assistance program, established by the last reauthorization legislation of sea grant.

Sea grant has a unique record of accomplishments in applied marine and coastal research, in training young professionals and in helping users to apply new knowledge. This record provides a solid foundation as we address these priorities at the beginning of our second decade.

Sea grant colleges and institutions have demonstrated the value of cooperation in opening ocean opportunities. As Sea grant colleges and institutions, we believe we must do more to meet marine resource responsibility. We are prepared to meet the challenge posed by the national sea grant college enabling legislation. On behalf of the Sea Grant Association and the National Association of State Universities and Land-Grant Colleges, we seek your assistance in reauthorizing this important act.

We are grateful for this opportunity to appear before you.

Senator PELL. Thank you.

Your statements in full will be made a part of the record.

[The prepared statements of Dr. Webster and Dr. Corell follow:]



Statement of  
Dr. Ferris Webster  
Assistant Administrator, Research and Development  
National Oceanic and Atmospheric Administration  
U.S. Department of Commerce

Before the  
Joint Hearing  
of the  
Senate Committee on Commerce, Science, and Transportation  
and the  
Subcommittee on Education, Arts, and the Humanities  
of the  
Senate Committee on Labor and Human Resources

April 25, 1980



Mr. Chairman and Members of the Committee and Subcommittee:

I would like to thank you for the opportunity to discuss the National Sea Grant College Program before these committees. The Sea Grant Program has made considerable progress since your last hearings on this subject. I would like to outline some of our accomplishments, particularly in those areas that are of most concern to the members of these committees.

As you know, under the 1976 legislation known as the Sea Grant Program Improvement Act, Sea Grant's activities were expanded to incorporate a greater identification of national priorities in the marine environment, the development of an international program for assisting developing nations, and an enlargement of our educational program, particularly at the pre-college level. Additionally, the 1976 Act provided for the initiation of a fellowship program to permit greater opportunities for individuals desiring careers in ocean-related professions. Specifically, we have targeted the fellowship program to attract those who by virtue of race, sex, physical handicap, cultural heritage, or poverty have had restricted access to those professions.

We have completed a study into the education and training structure of the U.S. commercial fishing industry requested by the Senate in 1978. The study was based on the Senate's recognition of the need to modernize the skills of U.S. commercial fishermen, as well as its awareness of the competition faced from foreign fishing fleets and of the potential wealth that exists within the U.S. Fishery Conservation Zone. One-fifth of the world's living marine resources are estimated to exist within 200 miles of our coasts.



The educational needs and opportunities of the commercial fishing industry were examined by a panel of experts drawn from all levels of post-secondary education, from all parts of the industry, from the Marine Advisory Services, from the National Marine Fisheries Service, and from the National Sea Grant College Program.

In its report, the study panel emphasized that new and upgraded fishery educational programs needed by the commercial fishing industry are of three kinds:

1. Vocational-technical training programs primarily to improve the practical knowledge and skills of those already in the industry.
2. Associate degree programs to educate and train new entrants into the industry and to give them a background for further education to the bachelor level and beyond, if they desire to move in that direction.
3. Bachelor through doctoral degree programs to produce fishery industry specialists to be the new wave of teachers, researchers, and industry representatives.

An educational infrastructure, the panel reported, needs to be created in the United States to achieve those goals. That infrastructure, according to the study, should include programs at all educational levels and should give first priority to the vocational-technical training of adults already in the industry and to associate and higher-degree programs for new entrants into the industry.



At present, according to the report, there are relatively few associate degree programs closely related to the real needs of commercial fishermen. While there are bachelor and post-bachelor degree programs available in some specialties, such as marine economics, biology, and fisheries, the report continued, both the expansion of current programs and the creation of new programs and facilities "should be considered."

The report indicated that new emphasis on fishery educational programs may not solve all the problems of the industry. However, the panel reported, "without an adequate educational infrastructure as a foundation for vertical integration, the U.S. fishing industry will not be able to employ increasingly sophisticated marketing and equipment in the internationally competitive struggle for the food resources of the sea."

The report indicated that support is needed to:

1. Create or upgrade at least one associate degree program on each of the Nation's three coasts -- Atlantic, Pacific, and Gulf.
2. Create or upgrade at least two departments or schools of commercial fisheries, one on the Atlantic and one on the Pacific Coast, which will offer bachelor and higher degree programs.
3. Provide an integrated, three-tiered educational system (vocational-technical, associate degree, and bachelor or higher degree), which facilitates reentry into the industry at any time.



4. Build a flume for fishing net demonstration and research purposes at one of the advanced-level fisheries departments or schools and establish a fishery electronics research and demonstration facility at another.

We hope that the findings of this study will be helpful in your deliberations.

I would like to emphasize to these committees that while Sea Grant has expanded its scope of activities and has made significant progress in those extended arenas, the program continues to focus on local and regional needs, as envisioned by Senator Pell and others in the original legislation. Sea Grant accomplishments, in other words, have continued in the tradition of the program's past record of success. Moreover, our effort to develop a stronger network of Sea Grant Colleges is materializing according to plan. In January, the joint University of Maine/University of New Hampshire program was designated a Sea Grant College, the first bi-State program to achieve that status. The University of Georgia was elevated to that same status in March, and the University of Alaska has made formal application for designation, based upon sustained excellence for more than three years in the programmatic areas of research, education, and advisory services.

Since its inception, Sea Grant has been regarded as a valuable component of our overall national program for dealing with marine science, technology, and marine resources. The program, we think, contributes materially to the United States' leadership in these fields. According to



UNESCO, four countries have two-thirds of the world's marine scientists, and the U.S. has twice as many as the next largest. For that reason, and because Sea Grant pursues an integrated approach of research, education, and advisory services to develop low-cost projects aimed at prompt and practical results, the Congress--through the 1976 legislation--created an international Sea Grant component. As envisioned, this component was to be a small, university-based pilot effort which could develop a new capacity within U.S. universities to work cooperatively with institutions in developing nations to develop their marine science capability for their own benefit and to create a spirit of goodwill and cooperation that will enhance the access of our research vessels to their waters.

Our small International Cooperation Assistance Program (ICAP) now involves projects at eleven institutions in the U.S. They include the University of California, Florida Sea Grant Program, University of Hawaii, Louisiana State University, Maryland Sea Grant Program, Oregon State University, the University of Rhode Island, the New York Sea Grant Institute, University of Delaware, University of Miami, and the Virginia Institute of Marine Sciences. The project at the University of Hawaii is particularly noteworthy by virtue of the vast geographic area it covers. In cooperation with the University of the South Pacific, the educational needs and marine public service needs are being addressed in eleven Pacific nations: Solomons, Fiji, Tuvalu, Kiribati, New Hebrides, Cook, Nauru, Tokelau, Tonga, and Western Samoa. To date, we are supporting projects in Chile, Colombia, Costa Rica, Egypt, India, Israel, Malaysia, Mexico,



and the South Pacific Nations already mentioned. Thus, we are supporting projects in Latin America and the Caribbean, in the Middle East, in Southern Asia, and in Oceania. Tropical Africa is the only principal area of the developing world in which ICAP is not supporting any projects whatsoever, and we are making an effort to include Africa in the future.

In the international field, Sea Grant works closely with the Department of State. Copies of all formal proposals, for example, are reviewed by the State Department's Office of Marine Science and Technology. Additionally, some of the proposals for international assistance are reviewed by the Interagency Group on Human Rights and Foreign Assistance, which is chaired by the Deputy Secretary of State and includes representatives of Treasury, Defense, the National Security Council, and the Agency for International Development. Representatives of the Departments of Agriculture and Commerce, and the Export-Import Bank also participate in the group's deliberations.

Even though progress in reaching agreement on a treaty governing the exploration and production of minerals from the deep ocean floor has not progressed as rapidly as many had hoped, there are many reasons to believe that negotiations will be successful ultimately and that within a few years seabed mining will be taking place under an international regime. With the existence of that possibility, Sea Grant might well play a major role in establishing a framework of qualified individuals who could assume positions of responsibility within that authority.



This opportunity has not gone overlooked, and Elliot Richardson, our Ambassador to the Law of the Sea (LOS) Conference, mentioned Sea Grant as a resource to developing nations during remarks he made at the Pacem in Maribus Conference in Cameroon last year. Ambassador Richardson has made numerous references to ICAP throughout recent LOS sessions. I should mention also that the Sea Grant ICAP program is a centerpiece of the U.S. approach to the TEMA Committee meeting of the Intergovernmental Oceanographic Commission now being held in Buenos Aires. TEMA stands for Training, Education, and Mutual Assistance. It is an international working group which has as its purpose an effort to help developing nations participate in international marine scientific investigations.

I would like now to turn to national projects. Sea Grant scientists from California, Delaware, Massachusetts, and Washington recently completed a major field experiment in California which someday could enable more accurate predictions of the effects of proposed alterations of the shoreline environment. The project under which this study was undertaken is known as the Nearshore Sediment Transport Study, or NSTS, and it is the first national project upon which Sea Grant has embarked.

This recent experiment, at Santa Barbara, is the second major field study to be conducted under the program. Previous experiments were conducted during a month-long, intensive investigation of the forces at work in the near shoreline off Torrey Pines Beach, near La Jolla, California. More than 100 electronic instruments were being used to



measure wave height and current speed and direction, as well as sand concentrations in the Santa Barbara study, the largest of its type ever undertaken. These measurements were transmitted simultaneously to onshore equipment for computer processing. Additional measurements were made by surveying crews and by an automatic profiling tractor that "crawls" into the surf zone to record the slope of the ocean bottom. Over the month-long period, more than one-half billion data points were recorded, according to the scientists.

The long-range goal of this series of field experiments is the development of mathematical models to predict sand behavior from knowledge of the local wave climate and thus to provide recommendations for actions to change an undesirable shoreline condition. Another major field test is planned for the East Coast or Gulf of Mexico in about 18 months.

As you know, Mr. Chairman, national projects have been a matter of vital interest to the Congress and to us in Sea Grant. As you also are aware, the program was initiated without specific Congressional guidance. Accordingly, the interpreted intent was to focus effort on a problem of high national importance that was ripe for significant advance in understanding. For a variety of reasons, which have been proven to be true, we selected a five-year program in beach protection. Subsequently, we have received more specific instructions from this Committee that National Project funds should selectively be used on a project-by-project basis to give broad programmatic direction along lines identified in the



Federal Register as being of particularly high national priority. Accordingly, a list of 14 additional problems were published in the Federal Register on August 8, 1978, and other projects are being considered.

With the limited funding available for National Projects, we have to reduce or eliminate the support for the existing project in order to initiate any new ones.

Because it would have been irresponsible management to abort a program of such importance and into which such a major investment had been made, we elected to continue the program while trying to broaden the base of support amongst other Federal agencies. The Corps of Engineers and the Navy are sufficiently impressed with the quality and importance of this major experiment that they are now planning to provide major contributing support to its conclusions. We have executed the largest experiment ever attempted to understand the process of beach erosion while shifting from one management to another.

During the early years, the thrust of the Sea Grant education and training program was toward the development of specialists. The emphasis was on graduate-level professional training, community college technician training, and occasional courses in specialized four-year undergraduate areas. Throughout the Marine Advisory Service, the emphasis was on the translation of research findings to the user community outside school and institutional settings. The target audiences largely were adults involved in marine-related business and industry and in school-age



youngsters in groups such as the 4-H, Boy and Girl Scouts. As Sea Grant matured, greater focus was placed by the Congress on the development of curricula in marine education for elementary and secondary schools. Recognizing the importance of delivery mechanisms for Sea Grant-produced educational material, we moved toward the development of a closer working relationship with offices of education, at the Federal, State, and local levels.

In working toward achieving greater introduction of marine education into the schools of America, we have not limited our attention to marine science alone. Rather, we see marine education as encompassing the full curricula involving the arts, the humanities, social sciences, economics, and other subjects. The reaction to our new thrust in the academic community has been encouraging. Primarily through the efforts of the Sea Grant staff, the Council of Chief State School Officers (CCSSO) instituted a policy statement encouraging the States to engage in and forward marine education. In addition, that organization established a network of marine education coordinators for State education agencies across the Nation. In working closely with the U.S. Office of Education, subsequently the Department of Education, Sea Grant was instrumental in the establishment of a marine education unit in the Office of Education. We feel assured that this initiative will continue within the recently-established cabinet level department.

Additionally, the Federal Interagency Committee on Education, Subcommittee on Environmental Education created a Marine Education Task



Force, which Sea Grant chairs. Within the Sea Grant network itself, our directors and educational specialists have been working in conjunction with the national office, and as a result, there is a much wider recognition of the need for marine education to carry out the goals of the program and an integration of activity throughout the multi-state Sea Grant network. Finally, we have strengthened our Marine Education Materials System (MEMS) at the Virginia Institute of Marine Science which provides pre-college advisory and educational assistance to school systems, science centers, and teacher groups. We look upon these developments as major achievements which will bring about productive results.

Education can be defined in many ways. Some of our advisory service activities readily can be defined as education. One example, our Sea Grant Program at the University of Southern California has developed a course, known as "California and the Ocean," which has proved effective in focusing public attention on the ocean environment. Materials developed for that course have been used in a number of non-traditional classroom situations. Complete programs have been developed for magnet schools, summer camps, Boy Scouts, museums, bilingual programs, visually impaired students, and for international programs. An inner-city program using those materials provided instruction to more than 500 classrooms. The Department of Health, Education, and Welfare has provided funding for the program in marine studies for the visually handicapped. The curriculum materials produced by Sea Grant will be the primary source of information and the USC Sea Grant staff will coordinate the entire program.

A program not as easily identified as education, perhaps, is one in our Florida Sea Grant Program. Five years ago, there was not a single 4-H marine program in that State. Today, because of Sea Grant, enrollment exceeds 8,000--probably the largest program of its type in the Nation.

I already have mentioned the increase in the number of institutions which have achieved Sea Grant College status. I would like to add that the mission of completing the network of Sea Grant Colleges is moving along well. We now are in a position to concentrate our efforts more toward the utilization of this capability than toward developing that capability per se. One of our goals, of course, will continue to be to improve the effectiveness of the program. We will continue to expand the utilization of our capabilities, striving to maintain a fair balance of research for the present against research for the future in such a manner that the investments in Sea Grant prove useful to the public. In other words, economic benefits of our research as they can be applied to assisting the user will remain an important and significant consideration.

To be more responsive both to the heterogeneity of the program and to the needs of the Nation, we have restructured the National Office of Sea Grant along mission lines. This reorganization has permitted us to focus more on functional than on institutional lines and has given us a much better perception of what is taking place throughout the network in areas such as aquaculture, fisheries, coastal protection, and the like.



In another recent operational change of office procedures, we have gone to a two-year cycle of awards to Sea Grant Colleges. Our belief is that these programs have matured to the point where annual reviews, which take time, energy, and expenditure, are no longer necessary -- although we will continue to monitor progress throughout the period. We already have launched this program, and while there still are a few improvements we can make, the innovation has saved both time and money. Most importantly, this new procedure permits the Office of Sea Grant and the State Directors to focus more of their management attention on substance rather than on form.

One of the most significant aspects of the Sea Grant Program is the wide diversification of its activities. This is so, of course, in part, due to the variety of problems and opportunities that exist from region to region and from State to State where our Sea Grant institutions exist. It also is true because of the diversity of problems that still need solutions in our marine and coastal environments. I do not think anyone can look at the wide spectrum of research being carried out by Sea Grant scientists without being impressed. For that reason, allow me, if you will, to tick off a few of the areas of investigation in which Sea Grant is engaged:

Aquaculture--Nearly 100 of our projects in FY 1979 were devoted to plant and animal aquaculture. The studies involve a wide variety of finfish and shellfish, and the investigations center on greater production at lower

costs, reproduction in captivity, the development of salt-tolerant plants, ocean farming, genetic and dietary improvements, and closed-cycle mariculture in which we hope to raise oysters and clams to marketable size in one-third the time they reach that size in nature.

Energy--There were 15 energy-related projects in FY 79 in five categories: two in power conversion, six in environmental research, two in power plant impacts, three in exploration and production, and two in the social sciences. While our activities in this area may be modest, our research in the conversion of saltwater to freshwater through a wave-powered desalination system shows great promise, and our studies on the disposal of thermal effluents are expected to have considerable influence on future design and operation of power plants.

Engineering--We had 106 projects in ocean engineering or engineering at 22 institutions during FY 79. We are encouraged by the studies into biofouling and corrosion on offshore structures, the use of acoustics for fisheries assessment, and developments in remotely-controlled submersibles.

Fisheries--Our fisheries projects embrace the full spectrum of activities important to the industry. They include: economics, engineering, and law, in addition to research into fish life histories, environmental interactions, and fish pathology. Our most significant activities were, in general, fish biology, population dynamics, and environmental interactions. These are the research areas which contribute most to our understanding



of any species, what its potential is for expanded harvest, and what effect the harvest might have on the species and on other species in its food chain.

Medicines from the Sea--We have a number of projects at several institutions which are exploring extraction and assessment of medicines from marine compounds. Our studies show promise in the control of cardiovascular, nervous system, and neoplastic (cancer) diseases.

Environmental Research--Nearly every coastal state program has at least one integrated series of projects studying a bay, estuary, or wetlands system. Areas being studied include Alaska's Bering Sea, Hawaii's Northwest Islands, Washington's Puget Sound, three areas in California, Corpus Christi Bay, Louisiana's Barataria Basin and Atchafalaya River, Mississippi Mouth, Florida's Apalachicola Bay, Georgia's Savannah Harbor, North Carolina's barrier islands, the Chesapeake Bay, salt marshes and ponds in Delaware, Rhode Island, and Massachusetts, and Lake Michigan's Green Bay. In FY 79, we supported 164 separate projects in marine environmental research, of which 70 were ecological in nature, 73 were concerned with pollution, and the others with models and applied oceanography.

Those are some of the primary areas of Sea Grant research. There are many others just as significant and important. For example, we are developing marketable new seafood products. We are studying chitin, a shellfish waste product, and its derivative, chitosan, both of which have important chemical properties in the binding of such commercial products

as paper, paste, and film emulsions. We have many studies looking into the problem of water pollution, one of which is the concentration of PCBs (polychlorinated biphenyls) in the Great Lakes. We are experimenting with frozen fish eggs and frozen fish sperm, an activity which shows promise of bringing to fish breeding what artificial insemination has given to cattle breeding.

We have developed a number of major improvements in diving procedures and developed a greater interest in the exploration of the special problems women face in diving. Our research showing that individuals who "drown" in cold water stand a much better chance of survival than ones who "drown" in warm water has been accepted widely, resulting in the saving of many lives that might otherwise have been lost. In addition, Sea Grant recently sponsored, in cooperation with other agencies, the First International Conference and Workshop on Hypothermia. The conference attracted experts from five nations and brought into focus the problems of severe cold exposure, such as might be experienced by fishermen or sportsmen.

Through its researchers and its marine advisory service agents, Sea Grant has developed a significantly successful relationship with industry. Industry representatives have come to realize that when problems develop, they can turn to Sea Grant for assistance. One example is the matter of seafood processing wastes. Management of these wastes is an international problem. Recognition of that fact stimulated Sea Grant scientists at the University of Southern California to carry out research on the problems



involved. As a result, the Cannery Steam Company estimated that because of these data, which gave water quality officials positive input on wastes, a two-week shutdown of plant operations was avoided. In dollars, this adds up roughly to \$25 million in sales and employment for that two-week period, based on sales of approximately \$2 million a day. Five thousand workers, who would have been out of work during the period, continued in gainful employment. The research also provided testimony by a Sea Grant investigator at a hearing that avoided a permanent shutdown of a Star Kist Tuna plant, which would have put 2,300 employees out of work for an indefinite period and created a huge financial loss for the company.

Another example of Sea Grant-industry cooperation took place at the Massachusetts Institute of Technology. That institution has a strong involvement with industry, primarily because of its engineering capabilities. It also is known for not backing off from high-risk research. That was the case in 1976 when at the request of fishing and fish processing interests, MIT organized a project team to develop new ideas to help those industries. Among the ideas developed was a dogfish shark skinning machine. Dogfish shark represent a major potential fishery resource with an excellent export market. No machine existed that would process dogfish shark to export standards so that all processing was done by high-cost hand labor.

With support from NOAA's National Marine Fisheries Service and Sea Grant, MIT scientists have developed a prototype machine that takes whole dogfish in varying sizes, cuts off the tail and fins, slits the

belly flap, peels off the skin, and drops off the carcass ready for final processing. The machine is designed to handle 6 to 10 fish a minute, and a production model probably could double or even triple this rate. Such a production model should be able to process about 25,000 to 30,000 pounds of fish per 8-hour workshift--the equivalent of about five expert hand skinners. MIT carried out a recent public demonstration at which considerable interest was developed from industry representatives.

As a result of Sea Grant research on the West Coast, Transfresh Corporation of California has put into operation a carbon dioxide atmosphere shipment system to transport fresh fish from Alaska to Seattle. Five million pounds were shipped by this method this past year. The cost of shipment by this method runs about 4 or 5 cents a pound. The cost of air shipment would be 15 to 40 cents a pound.

Another subject of vital interest is energy conservation. Through the use of a NOAA satellite to measure sea temperatures from space and relay that information to earth, tremendous energy savings are being realized by fishing fleets on both the East and West Coasts. Ocean surface temperature patterns are important indicators of commercial quantities of fish. By knowing the location of the proper temperatures, fishermen can save vast amounts of time and fuel which otherwise would have been expended in searching for the fish. Fishermen have credited temperature charts with increased catches of salmon and albacore on the West Coast and of swordfish on the East Coast. The increased profits from



the larger catches combined with fuel savings represent an estimated benefit of more than \$2 million for the vessels on the West Coast alone.

These examples, of course, are indications of our genuine interest in having Sea Grant work more cooperatively and effectively with industry, be it in fishing, processing, or manufacturing. This interfacing is a conscious effort on our part, as exemplified by the Marine Industry Advisory Service (MIDAS) Program at the Massachusetts Institute of Technology. That program, started in 1975, is designed to foster greater involvement in and awareness of marine-related product and business development and opportunities for the Nation's industries. The link between industry and Sea Grant extends far beyond that definition, of course, for we not only have assisted in the development of marine-related industries, but also in helping those industries overcome problems that have been indentified to our researchers. Evidence of the success of this program, which now is being expanded to other institutions in the Sea Grant network, can be found in the fact that participation in the MIT program now includes more than 100 corporations, government agencies, and other organizations.

On March 26, 1979, the Secretary of Commerce transmitted to the Congress draft legislation which reflected the Administration's view that the authorization of appropriations for this law should be extended for two years for such sums as may be necessary. We continue to support this position. In order to continue all the useful programs which I have mentioned today, it is vital that the authority for funds for the

Sea Grant Program be continued. I urge you to enact legislation which would enable us to continue our work.

Again, I want to thank you for the opportunity to appear before you. I will be happy to answer any questions you might have.



TESTIMONY OF

DR. ROBERT W. CORELL

PRESIDENT, SEA GRANT ASSOCIATION

and

DIRECTOR, UNIVERSITY OF NEW HAMPSHIRE/UNIVERSITY OF MAINE SEA GRANT  
COLLEGE PROGRAM

BEFORE THE

JOINT REAUTHORIZATION HEARINGS

OF

THE COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION

and

THE SUBCOMMITTEE ON EDUCATION, ARTS AND HUMANITIES

OF THE

COMMITTEE ON LABOR AND HUMAN RESOURCES

OF THE

UNITED STATES SENATE

April 25, 1980

Senator Pell, Senator Cannon and distinguished members of the United States Senate Committee on Commerce, Science and Transportation, and of the Subcommittee on Education, Arts and Humanities of the Committee on Labor and Human Resources, it is my privilege and pleasure to discuss with you the critical importance of the National Sea Grant College Program to American universities and colleges. On behalf of the Sea Grant Association and in cooperation with the National Association of State Universities and Land-Grant Colleges, we are grateful for your invitation to present our perspectives on the National Sea Grant College Program during these reauthorization hearings.

The Sea Grant Association, representing 45 member institutions of higher education and several industrial member organizations, seeks to advance the Sea Grant concept as a uniquely successful mechanism that can contribute substantially to our nation's goals for the oceans, coastal and Great Lakes regions. It works to promote the development of and excellence in Sea Grant and related marine research, education and advisory service programs.

The National Association of State Universities and Land-Grant Colleges (NASULGC) is a partner in promoting and developing an outstanding National Sea Grant College Program. This Association is the oldest higher education Association in the United States, representing the 142 principal state universities in the nation and the land-grant colleges in the 50 states, the District of Columbia, Guam, Puerto Rico and the Virgin Islands. These institutions enroll more than 3.25 million students (approximately 30% of all students enrolled in the 3,000 United States colleges and universities) and grant 38% of all higher education degrees and 64% of all doctoral degrees. It is from this broad based perspective and interest in the National Sea Grant College Program that I appear before you to present testimony on the importance of the National Sea Grant College Program to our nation and to its institutions of higher education.

These associations submitted to the 96th Congress the following statement about the vital importance of marine resource research and development to our nation:

"Using the oceans and the Great Lakes intelligently is one of the great challenges of this age. Marine food, energy, minerals, transportation and recreation as well as the preservation of the marine environment are increasingly accepted as a necessary part of our future, but we need to educate ourselves if we are to derive maximum benefits of the sea.



"America's universities can accept these challenges through education, research and advisory service programs. In the last half century, major centers of oceanographic excellence have emerged on all ocean coasts and the Great Lakes. Little more than a decade ago, the Sea Grant Act broadened the capabilities of the nation's colleges and universities to develop the ocean's resources by forming a partnership between them, government, industries and the people of America. But opportunities for service and requirements for new knowledge far exceed the financial resources.

"The institutions are expected to provide scientific and professional assistance in the implementation of new and wide-ranging national marine legislation, such as the Coastal Zone Management Act, the Marine Sanctuaries Act, the Aquaculture Act, the Outer Continental Shelf Act, the Ocean Pollution Research Act and the Fisheries Conservation and Management Act.

"Solutions for marine resource problems and exploitation of marine resource opportunities require sustained research efforts at all levels, from the most fundamental research for understanding to innovative application of existing and newly found knowledge.

"Tied as they are to education and broad public service, university research programs have historically produced rich benefits for the nation. There is abundant evidence that this pattern is being and will be repeated in the area of ocean and Great Lakes resources. To achieve these goals we recommend that:

- (1) Sea Grant programs be encouraged to take a leadership role in sustained research efforts directed toward solution of marine resource problems.
- (2) Support for stronger marine programs within the universities be given high priority.
- (3) Support for university education and training in all aspects of marine resources and environment be increased.
- (4) University research vessels be supported and maintained at a level necessary to accomplish their tasks.

"The promise, the mystique and the opportunities in the ocean demand our attention. The people of the United States and, indeed, the world deserve no less."<sup>1</sup>

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<sup>1</sup> Agenda, Recommendations For National Action in Higher Education, The 96th Congress, a Joint Statement of the National Association of State Universities and Land-Grant Colleges, the American Association of State Colleges and Universities, and the Sea Grant Association.



The National Sea Grant Program was founded on the concept that a three-way partnership between universities, the federal government, and regional interests represented by industry and state government, is a most effective mechanism for establishing new knowledge and understanding essential to the development, sagacious use and conservation of our ocean, coastal and Great Lakes resources. For fourteen years this concept has been proven sound.

More and more, United States industry looks to the sea as a source of minerals and petroleum, as a site for profitable technologies, and as a field for innovative business ventures to spur economic growth and development. Government is expanding its commitment to wise management of ocean and coastal resources. Citizens are responding with new awareness to the cultural, recreational and ecological importance of the oceans and coasts. The National Sea Grant College Program provides a mechanism for fostering cooperation between these various interests.

Sea Grant programs in coastal and Great Lakes states apply the resources of major universities to ocean development through programs committed to further the wise use of our nation's marine resources. These carefully designed programs address high priority issues of local, regional, national and international importance.

The Sea Grant Association has identified four major priorities for 1981 and 1982, to be addressed by all of its programs:

- (1) Expand research and related development programs to support the healthy evolution and development of the American fishing industry,
- (2) Increase applied research, development and educational programs which enhance our nation's capacity to resolve conflicts in ocean and coastal resource utilization,
- (3) Expand the transfer of technologies and methodologies from the research and field laboratories of universities to industry, commerce and all levels of government,
- (4) Expand the National Projects and International Cooperative Assistance Program, established by the last reauthorization legislation of Sea Grant.

Sea Grant has a unique record of accomplishments in applied marine and coastal research, in training young professionals and in helping users to apply new knowledge. This record provides a solid foundation as we address these priorities at



the beginning of our second decade.

Sea Grant Programs are building upon the land-grant experience and tradition of research, education and advisory/extension services. Through Sea Grant research, university faculty and research staff apply scientific skills to practical questions in ocean and coastal engineering, aquaculture, commercial and recreational fisheries, marine mineral and chemical resources, and the many other fields represented in the ocean's challenge. Working with faculty investigators on Sea Grant projects, students produce useful results while learning the techniques required for marine research and management, and preparing themselves for professional, ocean-related careers. Sea Grant's efforts in marine education are helping to inform Americans about "the world of water".

Sea Grant Advisory and Extension staff carry the results of research to people in industries and local agencies and to citizens who put this new knowledge to work to meet national economic and social goals. These advisory and extension agents, in turn, inform the university about research needs of industry, local agencies, and the citizens of our country. This two-way communication between society and our universities is building on the proven tradition of the Land-Grant Universities' Cooperative Extension Service.

The National Sea Grant College Program is capable of reaching the goals and purposes of the Act. Reauthorization is essential, along with increases in the budget to enable higher education to contribute adequately to the partnership. The Sea Grant Association, in its recommendations to the Appropriations Committees in Congress, believes President Carter's "no increase" budget for the National Sea Grant College Program in FY81 must be increased in Congress so that Sea Grant colleges and institutions across the United States can continue to produce the benefits I have outlined and so that states and regions not now served by Sea Grant can also benefit through this unique program.

Sea Grant colleges and institutions have demonstrated the value of cooperation in opening ocean opportunities. As Sea Grant colleges and institutions, we believe we must do more to meet marine resource responsibility. We are prepared to meet the challenge posed by the National Sea Grant College enabling legislation. On behalf of the Sea Grant Association and the National Association of State Universities and Land-Grant Colleges, we seek your assistance in reauthorizing this important act.

Thank you.



Dr. RORHOLM. I have submitted my complete statement for the record.

I support the authorization bill wholeheartedly, and I attempt to demonstrate that the sea grant program is a program that pays off. I do this by taking some examples of our work in Rhode Island. For example I quote some work with respect to developing efficient fishing gear where we can demonstrate, with very believable numbers, that the last 10 years of fisheries gear testing and development has paid off nearly 10 times the Government investment even if we just measure the returns from latest technology transfer, two-boat midwater trawls. We hope to continue to investigate and look at efficiencies of commercial fisheries both from the point of savings and from the point of view of harvesting the right species at the right time.

In research I show an example where a considerable savings made possible in another Government activity was caused by sea grant work in our laboratory. I want to emphasize the extreme difficulty of presenting to you correct, accurate numbers as to the impact of research. It happens frequently that the returns do not begin to accrue until 6 or 7 years after the research has been done. Also, university sea grant work ties in with and benefits the educational program.

I show an additional sample where the educational program and improved research has been an important aid to community development planning in the city of Newport, and I demonstrate, without showing actual numbers, values of the sea grant educational program that we have had over the years. I want to emphasize though, as I finish that I have never yet done a study of economic impact, and I have done them over 18 years or so, without coming to the conclusion that the impact that I could not measure was as great as those that I was able to measure.

Senator PELL. I have one or two questions I intend to ask verbally after we hear the next witness.

Your name is?

Dr. ARMSTRONG. John Armstrong, director, South Carolina Sea Grant Consortium.

Senator PELL. Dr. Armstrong, you may proceed.

Dr. ARMSTRONG. Thank you very much. It is a pleasure to be here. I will keep my remarks very short.

Senator PELL. When it is received, it will be inserted in the record in full.

Dr. ARMSTRONG. In South Carolina we have embraced completely the sea grant concept. We have a unique new sea grant consortium made up the seven marine related institutions in the State. It is a new State agency. We have banded together to take on the management of the sea grant program and to coordinate various coastal and ocean research and assistance activities.

As an indication of the State's commitment and dedication to the sea grant approach, our legislature is expected to triple the direct cash support for our sea grant programs. If this occurs, it will almost equal the current level of Federal support.

We are gratified by this action and expect to continue on in our long-term commitment to the sea grant concept. We feel very strongly about the sea grant approach. I won't give the list of



accomplishments that I feel we have obtained. I will put those in the record at an appropriate future date.

I believe equal attention should be given to the sea grant concept or philosophy as well as to the very important specific sea grant accomplishments. We believe in the approach that we have taken in working between local and State governments in sea grant in forming a partnership. We would like to see this extended.

In closing, I would like to say that we in South Carolina view the sea grant program nationally as if we have reached a point where we have developed a "stable" of highly qualified and fine horses. We think we now ought to be able to run now and show our benefit to the Nation.

Thank you.

Senator PELL. Thank you very much.

[The prepared statement of Dr. Rorholm follows:]

TESTIMONY OF

DR. NIELS RORHOLM

UNIVERSITY OF RHODE ISLAND

before

THE COMMITTEE ON COMMERCE, SCIENCE,  
AND TRANSPORTATION

and

THE SUBCOMMITTEE ON EDUCATION, ARTS AND  
HUMANITIES OF THE COMMITTEE ON LABOR  
AND HUMAN RESOURCES

April 25, 1980



Mr. Chairman and members of the two Committees, I am Niels Rorholm, Professor of Resource Economics and in charge of the Sea Grant College Program at the University of Rhode Island. Thank you for giving me an opportunity to discuss Sea Grant--it is my favorite topic.

I speak in support of the three-year reauthorization of the Sea Grant College Program Act, both in concept and in the three annual amounts of \$55, \$60 and \$65 million. I regret, of course, that it has not been possible to fund Sea Grant up to authorized amounts in the past. Perhaps as we learn to better measure the effectiveness of Sea Grant work in education, research, and advisory services, we can demonstrate more clearly that Sea Grant is a good investment for the country and deserves full funding as authorized.

If I may, I would like now to give some examples of Sea Grant benefits. The numbers are not correct in an absolute sense, but when I use numbers, they are the best we could get without expensive studies and without alienating the very people we are supposed to assist. They are numbers I can believe in.

As the first example, let me take the matter of developing more efficient fishing gear. That is an area that we have specialized in to some extent in our Fisheries School and Marine Advisory Service. That sort of specialization and consequent sharing of talent is often found in the Sea Grant network. Every program does not have to do everything. We get "more mileage" that way and it is one of the procedures that makes Sea Grant truly a national program.

During the ten years that we have been involved with the improvement of fishing gear, two people--Mr. Hillier and Mr Taber, one a teacher in our Fisheries School and one a Marine Advisory specialist--have, among other duties, introduced more efficient gear as follows.

The Wing Trawl was imported by URI Sea Grant from Europe in 1969 and tried here with various modifications of deck handling equipment. The purpose was to improve the ability of the net to catch the higher swimming fish. It worked, and was improved in the URI-340 net--a high opening bottom trawl that we developed for the NMFS fishing tests with American and Russian vessels. This net has been extensively copied and occasionally we still modify aspects of it for specific uses. The 340 (sometimes called "high fly") has a higher catch rate especially for fish other than groundfish. The net is particularly good for fluke, whiting, scup, and butterfish which, so far, are not heavily pressed species. This net, or copies of it, are in use now from Maine to North Carolina that we know of. Since we publish instructions on how to make the net, fishermen or net manufacturers can, of course, make it, and it is hard to trace the "family tree" of a given net.

Canadian Pair Seining came next. It was designed for smaller, low-powered boats. Lobster boats have used it in the off season. It did not spread widely, but was soon replaced by the Scottish Seine, a very low energy requirement fishing method which is beginning to be used by several fishermen. I know of two in Maine, four on Cape Cod, and one in Westport, Mass.



The desire to catch part of the adult herring stocks while foreigners were still fishing off New England and, later, the desire to participate in a short-term, sometimes lucrative herring-for-export fishery in late winter or early spring led to our introducing Mid-Water Pair Trawls from Europe. With these, two boats work together. Earlier, our fishermen were limited to getting the herring when it was well inshore on the bottom in early winter. As the winter progressed, the herring moved offshore in midwater and the fish were lost to the foreign fleets. Even before the passage of the Fisheries Conservation and Management Act, this Sea Grant effort had paid for itself many times.

In this season that has just ended, eighteen vessels that we know of located from Maine to Rhode Island were using the gear. Two boats are using the newest single boat midwater trawling which we are just now beginning to adapt and refine.

The cost to the government of this work over ten years totals at most \$300,000. The fishermen and the University have contributed some \$150,000 in vessel and crew time, plus other services, for tests and demonstrations. This does not include their investments in equipment.

Based upon structured conversations with fishermen from Massachusetts and Rhode Island, one can make the following sample calculations that are valid as an average of the past two seasons. The costs and revenues listed refer to differences from what they would have been had the vessels stayed in the traditional, but allegedly hard-pressed, groundfish fishery during the (average) 35 days of fishing on herring with midwater trawls that is possible during the three winter months.

TABLE I

Average Investments, Costs, and Revenues for a 75-Foot  
 Dragger Pair Trawling 35 Days During Three  
 Winter Months <sup>1/</sup>

Investments

|                                    |              |
|------------------------------------|--------------|
| Midwater Trawl (\$10,000) per boat | \$ 5,000     |
| Blocks, etc.                       | 1,000        |
| Three days fishing lost initially  | <u>9,000</u> |
| Total                              | \$15,000     |

Costs<sup>2/</sup>

|                                               |              |
|-----------------------------------------------|--------------|
| Net (Interest \$450,<br>depreciation \$1,000) | 1,450        |
| Blocks (Interest \$90, depreciation \$200)    | 290          |
| Initial conversion (\$9,000 x 18%)            | <u>1,620</u> |
| Total                                         | 3,360        |

Revenues

|                                                                                  |                  |
|----------------------------------------------------------------------------------|------------------|
| Reported Average Gross Stock for 35 days<br>pair trawling -----                  | 124,950          |
| Reported Average Gross Stock for 35 days<br>bottom trawling -----                | 105,000          |
| Increase due to adopting new method -----                                        | 19,950           |
| Savings in trip costs (30% less fuel <sup>3/</sup> , ice,<br>and unloading)----- | <u>7,350</u>     |
| Total net gain in revenue per vessel for<br>winter fishing                       | 27,300           |
| Increase in labor earnings                                                       | (15,015)         |
| Increase in vessel earnings                                                      | <u>(12,285)</u>  |
| Total increase for 18 vessels                                                    | <u>\$491,400</u> |

<sup>1/</sup> The typical vessel dealt with here is 75-ft. long, 400-450 h.p., and is manned by a captain and three crew members.

<sup>2/</sup> Net repair costs may be lower than when dragging once the skippers gain experience with the method.

<sup>3/</sup> Based on not towing doors, but mainly through shorter fishing days--about ten hours for pair trawling compared to an average of fifteen hours for three vessels when dragging.



As shown in the table, the combination of increased landings and of savings caused by this new gear more than pays for all the fishing gear development at URI funded by the government. It is worth noting also that this net catches a high proportion of species that have been thought of as surplus to U.S. needs, and thus provides export earnings. In formal terms:

Costs for 10 years of Gear Development:

|                                                           |                   |
|-----------------------------------------------------------|-------------------|
| U.S. Government                                           | \$ 300,000        |
| University and Fishing Industry                           | <u>150,000</u>    |
| Total                                                     | \$ <u>450,000</u> |
| Benefits to 18 present vessels<br>per year of operation   | \$491,400         |
| Present value of benefits (assuming<br>18% interest rate) | \$2,730,000       |
| Net Benefit                                               | \$2,280,000       |
| B/C ratio                                                 | 1:5.6             |
| B/C ratio for Government investment                       | 1:9.1             |

It should be noted that this is a present ratio, not a hoped-for number. Additional use of the gear by other vessels will increase benefits. I would expect them to at least double before leveling off.

Next, I would like to mention an example of not only the prospects, but also the difficulties of measuring value of research results. The project is one of growing salmonid fish in tanks or silos with recirculating water so very little effluent is discharged, and this is treated first. The method is particularly promising for hatcheries because disease control is made much more nearly possible. This work is directed by Dr. Meade of our faculty.

Dr. Meade reports that this past year the discoveries made at his facility when applied to the Dworshak National Fish Hatchery reduced their smoltification death losses from 30-35,000 per day for about a month, to



less than 300 per day for this critical period. On a total basis, this translates to reducing loss from about one-million fish to 10,000 fish, or a saving of about 990,000 fish. While the costs at the Dworshak Hatchery are not known, a conservative cost of bringing the fish to that stage of life would be \$.25 per fish--an annual saving of \$247,500. The total Sea Grant expenditure at URI for salmonid systems over the nine years we have been working on it has been \$354,000, so less than two years of Dworshak operations has paid the bill.

Nor is this, of course, the primary benefit. Industry is beginning to invest in facilities of that type, and that is the main goal. In addition, benefits are occurring that are uniquely Sea Grant. The University is supporting expansion of facilities and is initiating academic programs for people who wish to learn the science of aquaculture, and the facility serves as a "home" for a State Aquaculture Association. On another front, chemist Dr. Simpson has worked with pigmentation. White salmon does not sell well and not all artificial pigments are stable during cooking. Bolstering the work of both men is Dr. Wolke, a Marine Pathologist who specializes in identification and treatment of diseases in fish. Finally, work done by Mr. Howe of our Advisory Service and Dr. Fisher from Geology in analyzing possible uses of salt water "aquifers" is coming together with the salmonid work to make possible the use of this constant temperature water on a non-shoreline location for controlled aquaculture.

I spoke with a graduate student in Dr. Meade's program last week. He wants to start a business producing steelhead trout in a closed system on an aquifer, pigment them and market them as a slightly lower-priced product competing with the high-priced salmon on the east coast.



I suppose I can best summarize the point I am trying to make with this somewhat involved tale by saying that the sort of research seeding that Sea Grant does falls in very fertile ground at universities. Quite aside from immediate benefits that may (or sometimes may not) occur, interactions with faculty, students, advisory people and users of information nearly always produce benefits over time that amply pay back the initial investments, although frequently they are not measurable.

An example of one that cannot be measured directly is the following:

The Waterfront Commission of the City of Newport requested assistance in coming to grips with the question of what policies Newport should have with respect to its harbor. This led to Dr. Hammerschlag's taking on the problem as a second-year graduate studio project, thus "letting loose" on the question a class of 18 students from the Graduate Community Planning School. The results were a valuable educational experience including initial meetings with officials and citizens' groups, giving preliminary presentations to those groups after the fieldwork was done and, for four of the students, preparing the final report which we printed. So far, nearly 250 copies have been requested and the concepts developed appear to be actively discussed by the Newport decision makers. The cost was \$5,000. The value? It is not sufficient to say that such a study would have cost the City of Newport \$60-70,000, for chances are they could not really buy that kind of study. So, while we know the students involved are now better able to deal with urban coastal problems than they would have been without this experience, we will not know for some time--if ever--what specific role the work played in helping Newport to solve its problems.

Manpower training is an important part of the Congressional charge to Sea Grant. While it is easy, by using average relationships between years of education and lifetime earnings, to show a high benefit to cost ratio of our Sea Grant educational programs, this somehow misses the point. Of more importance is that the demand for the programs in Fisheries, Marine Affairs, and Marine Resource Economics are high and that the graduates have good placement records. These educational programs are either mostly or exclusively funded by University funds, but Sea Grant is always ready to entertain innovative proposals for improving needed marine-related education, for that is one way we meet the mandate of developing manpower to help the nation solve coastal and ocean problems.

The examples of benefits developed above are few. I consider them a beginning, and we will try to add to these analyses in the future. Before ending with a list of additional recent accomplishments of the URI Sea Grant College program, let me reiterate that whereas I speak only of Rhode Island's work, the true national impact of Sea Grant lies in the fact that coastal and Great Lakes states all have Sea Grant programs in various stages of development. We both compete and cooperate. Sea Grant is paying off and it is prepared to generate further benefits with the increased funding we so sorely need.



SOME RECENT BENEFITS RESULTING FROM  
THE URI SEA GRANT COLLEGE PROGRAM

April 1980

1. Water reuse systems developed with Sea Grant support are continuing to gain acceptance in State and Federal hatchery operations. Private investments are also being made, both in this country and in Sweden and West Germany. With the recent recognition of the usefulness of salt water aquifers, additional facilities are being planned for Southern New England. The first of these is under construction in Old Lyme, Connecticut.
2. URI investigators and advisory personnel working with industry did the initial research and development which has led to wide-spread use across the nation of low-cost floating breakwaters made of used tires. At an average cost of \$5,000-\$8,000, these devices protect structures and boats worth millions without costly stone construction.
3. URI researchers did the first work which led to the development of the deep sea red crab fishery along the U.S. East Coast, contributed heavily to the data base on the economics of various-sized fishing vessels (now an important management need), and brought about test marketing of U.S. dog fish on German markets.
4. Analysis by URI economists of the Massachusetts inshore lobster fishing was an important part of formulating that state's lobster management measures.
5. Marine hydrocarbon research has established sources of hydrocarbon pollution in Rhode Island, documented the damage, estimated the quantities discharged, and proposed solutions (waste-oil recycling) and permissible discharge levels.
6. The first comprehensive bio-economic study of recreational fishing on the East Coast is just being completed in cooperation with NMFS. Lessons learned in methodology are forming bases for studies in other parts of the country.



7. URI's fisheries education program has educated several hundred young people to become fishing mates and skippers.
8. In a follow-on (typically Sea Grant) on University of Michigan's basic work on hypothermia, URI has conducted a training program for instructors and has more recently, with an international conference, significantly decreased the time required for the American Red Cross to promulgate standards and incorporate hypothermia prevention and treatment in their educational material. Estimates of time gain vary from one to three years.
9. Significant progress has been made in getting better science into natural resource decisions. Specific examples include knowledge of sources and pathways for toxic materials, effects of sewage seepage on macro algae affecting circulation, in turn affecting sedimentation, knowledge of circulation patterns for sewage outlet location and oil-spill clean up, economic data for public fisheries management and for individual fisherman decisions.
10. In a joint activity between Sea Grant and the City of Providence, a "Narragansett Bay Room" was added to the Roger Williams Park Museum. The exhibits are aimed at giving the viewer an appreciation for the cultural and natural history of the Bay, its present uses and its ecosystem. Approximately 120,000 school children will visit this annually. With the YMCA, a marine-education center is being established where primary and secondary school teachers can bring classes for various science work under the guidance of Sea Grant personnel.

If the average American understood his coasts and waters half as well as he understands his automobile, better decisions would be made on the use of our coasts. One has to begin that effort with the very young.



Senator PELL. Thank you very much.

I would like to impose on both Mr. Webster, Assistant Administrator for Research and Development of NOAA and Dr. Corell, president of Sea Grant Association and ask if they would be willing to answer for the record these rather detailed questions that we have prepared?

Mr. WEBSTER. Yes.

Dr. CORELL. Yes.

Senator PELL. In addition to that, would you submit for the record, and this I guess would be more directed to Dr. Corell or Dr. Rorholm or Dr. Armstrong, a few examples of projects with favorable ratios.

If any of the others of you can give us some succinct examples, I would appreciate it. I was particularly struck by Dr. Corell's statement that when you take the Consumer Price Index, the budget for 1980 is just about where we were in 1973. It is level funding in real dollars. While this is not the year to take a giant step forward, I would like to see us think in terms of the next time around of laying the groundwork for really giving the program a jump forward.

I would also request Mr. Webster, in connection with the questions we have asked about international participation, to add into the record any further thoughts he has in this regard and also examples of international sea grant action that we have taken.

The hour when I must depart for the White House having come, I would thank you very much. I would ask you to excuse this rather hasty treatment, but I assure you that your testimony and your questions and answers will be reviewed in full. I assure you also that the testimony will appear in printed form so we can use it for distribution to the Sea Grant College Association and to give us the ammunition we might have not just for this year but to lay the groundwork for the next round that we have.

I would also ask unanimous consent that the Fisheries Education Training Report be inserted in full in the record. I believe that is the report, Dr. Rorholm, that we talked about in Point Judith just a few weeks ago.

Dr. RORHOLM. Yes.

Senator PELL. I have read that and I was struck by it. It is an excellent document. That will be inserted in the record in full.

[The following was received for the record:]

EDUCATIONAL NEEDS OF THE U.S. COMMERCIAL FISHING INDUSTRY

A REPORT TO THE UNITED STATES SENATE

BY THE NATIONAL SEA GRANT COLLEGE PROGRAM, NOAA

BY

WARREN E. YASSO, Ph.D.

SPECIAL ASSISTANT TO THE DIRECTOR

NATIONAL SEA GRANT COLLEGE PROGRAM

February 1980



## NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

National Sea Grant College Program

MAR 24 1980

Honorable Ted Stevens  
United States Senate  
Washington, D.C. 20510

Honorable Claiborne Pell  
United States Senate  
Washington, D.C. 20510

Dear Senators Stevens and Pell:

I am herewith submitting the National Sea Grant College Program report on Educational Needs of the U.S. Commercial Fishing Industry requested during the Sea Grant Authorization Hearings held by the U.S. Senate in 1978. The report is based on the views of those interested in the educational needs of the commercial fishing industry, including college and extension educators, commercial fishermen, industry managers, and representatives of the National Marine Fisheries Service and the National Sea Grant College Program. Such views have been supplemented and documented by reference to both published and unpublished literature. This is a staff report prepared by the Office of Sea Grant and, as such, its contents should not be construed as representing Departmental or Administration positions.

In conducting the research and personal surveys for this study, we found, on the one hand, a paucity of factual data and documentation and, in the other hand, a disparity of opinion as to what the commercial fishing industry educational needs are. Accordingly, this report cannot be considered a consensus but, rather, an attempt to reflect reasonable interpretations of available data and experiences, and the middle ground of expert opinion. This dearth of data, and strongly held but divergent views, has dictated that the study proceed with caution and thoroughness. As a result, this report has taken much longer to complete than we anticipated.

I hope and trust that this report will serve as a solid foundation for building needed educational infrastructure in support of a newly vitalized U.S. commercial fishing industry.

Respectfully,

(s) Ned A. Ostenso

Ned A. Ostenso  
Director

Enclosure

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## EXECUTIVE SUMMARY

Recent legislation has provided the U.S. commercial fishing industry with a unique opportunity to capture a larger part of the sustainable wealth of living resources within our Fishery Conservation Zone. Reduced imports and increased exports of fish and fish products is an attainable national goal.

During the study the educational needs and opportunities of the commercial fishing industry, at this time of expanding activity, were examined. The results indicate that a modest expansion of existing educational programs is warranted.

New or upgraded fishery educational programs needed by the U.S. commercial fishing industry to meet this opportunity are of three kinds:

- Vocational-technical programs primarily to improve the practical knowledge and skills of those already in the industry.
- Associate degree programs to educate and train new entrants into the industry and give them a background for further education to the bachelor level and beyond, if they desire it in the future.
- Bachelor through doctoral degree programs to produce fishery industry specialists to be the new wave of teachers, researchers and industry representatives.

An educational infrastructure needs to be created in the United States to achieve these goals. The infrastructure should include programs at all educational levels and should give first priority to the vocational-technical training of adults already in the industry and to associate and higher degree programs for new entrants into the industry.

At present there are a relatively few associate degree programs closely related to the real needs of commercial fishermen. Bachelor and post-bachelor programs do exist in some of the specializations such as marine economics, law fisheries biology, aquaculture and seafood technology. Both the strengthening of and creation of new programs and facilities should be considered.

A new emphasis on fishery educational programs will not solve all of the multifaceted problems of the industry. However, without an adequate educational infrastructure the U.S. fishing industry will not be able to employ increasingly sophisticated ships and equipment in the internationally competitive struggle for the food resources of the seas. Most importantly, we believe



that such an educational infrastructure will help promote badly needed vertical integration in education and training programs for the industry.

Therefore, in addition to educating the public about the industry and its products, and an expanded emphasis on vocational-technical programs for adults already in the industry, additional funding must be provided:

- to create or upgrade at least one associate degree program on each of the three coasts -- Atlantic, Pacific and Gulf.
- to create or upgrade at least two departments or schools of commercial fisheries, one on the Atlantic and one on the Pacific coast, which will offer bachelor and higher degree programs.
- to provide an integrated, three-tiered educational system (vocational-technical, associate degree and bachelor or higher degree) which facilitate re-entry at any time.
- to build a flume for fishing-net demonstration and research purposes at one of the advanced-level fisheries departments or schools and to establish a fishery electronics research and demonstration facility at the other.

Sea Grant alone can not attempt to answer all of the questions listed in the U.S. Senate request for the study. For example, if a decision is made to assist in creating or upgrading the program and facilities of only one associate degree institution on each of the three coasts then the choice of institutions should not be made by Federal fiat. The public, state legislatures, faculty members and fishery interests should be represented in an intense discussion and competition for designation of any of the associate degree institutions to be upgraded. Such discussions and competition should result in programs with a better benefit-cost ratio than if only the Federal Government undertook the task.

However, it is clear that the educational efforts called for in this report are beyond the interest and funding capability of a single state. This is due in part to the fact that a high percentage of the students enrolled in these programs will come from states other than the one in which the institution is located. Federal funds will be needed on a continuing basis to provide a significant base for new or upgraded programs.

The Senate request also raised the issue of a suggested curriculum for each educational program determined to be necessary. General curriculum recommendations are discussed in the report. However, specific curriculum elements for each type



of program are not specified. These decisions have been made traditionally by local faculty: such a faculty planning function is recommended for new or upgraded fishery educational programs. Ideally, the resulting programs should allow students to reenter as their need for additional formal education develops and provide a good working relationship between the vocational-technical or associate degree programs and the higher degree programs.

We recommend that only state and private institutions be considered as the location for new or upgraded fishery education programs. Federal institutions and Federal faculty were considered unnecessary and undesirable.

The attached report is presented in six chapters plus appendixes. Chapter One discusses the current status of the U.S. commercial fishing industry in terms of numbers of fishermen, craft and vessels, import/export ratios and published comments on educational needs of the industry. Educational efforts of some of the successful foreign fishing nations are discussed in Chapter Two. Chapter Three provides a description of existing associate degree programs, their strengths and limitations, as a basis for discussion of the higher education programs needed to ensure the long-term health of the industry. Chapter Four contains a discussion of educational programs as they relate to projections for technological innovation and employment potential of a strengthened commercial fishing industry. Specific recommendations for instituting or upgrading associate and higher degree programs are made in Chapter Five. A summary of the report and its conclusions are found in Chapter Six.



## PREFACE

In recent years the United States commercial fishing industry has undergone dramatic change both in technological sophistication and in its political, economic and regulatory environment. Accordingly, there has been increasing concern about the adequacy of the essentially laissez-faire education and training structure of the industry. The need for a more coherent and substantive national approach to fishing industry education and training has been addressed in proposed Federal legislation and by the U.S. Senate request for a study of the needs for new programs to educate and train domestic commercial fishermen.

In response to this request from the Senate, the Office of Sea Grant formed a study group to consider the educational needs of the U.S. commercial fishing industry. Members of the Study Group and Conferees, listed in Appendix A, were drawn from all levels of post-secondary education, all parts of the industry, Marine Advisory Services and national offices of the National Marine Fisheries Service and the National Sea Grant College Program.

The charge for the study Group was explicitly expressed in the conference report of the National Sea Grant Authorization Hearing, 1978:

"Fishery Revitalization Study

During the course of the hearing, discussion was held on which topics should be studied under Sea Grant's national projects research program. One issue received particular attention: the need to modernize the skills of U.S. commercial fishermen. The committees made the point that as commercial fishing technology becomes more sophisticated, U.S. fishermen need advanced training similar to that provided to the fishermen of other nations.

As a result, the committees wish the National Sea Grant Office to conduct a comprehensive study of the need for and options regarding new programs to train domestic commercial fishermen. The study is to be submitted to the Committees by January 1, 1979. The study is to analyze and make recommendations regarding all aspects of this issue, including but not limited to the following:

National, regional, and state costs and benefits that accrue as a result of establishing programs and centers responsive to this need;

The substantive content and curriculum for such programs;

Alternative institutional arrangements at Federal, State, and local levels to administer such programs and centers; and

The most desirable geographic distribution of such programs and centers throughout the United States.

The committees believe that this effort is important and that the Sea Grant program is uniquely qualified to undertake a study of this kind."

Because of the magnitude of this assignment and the timetable for reporting, the Study Group concentrated on the broad spectrum of undergraduate and graduate educational needs of the U.S. commercial fishing industry. In addition, there was some discussion of how a new or improved educational structure to serve the needs of entrants into the industry might also benefit those already working in the industry. Group members were well aware that fishermen represent only one segment of a complex and important industry which has diverse educational needs at many levels and were acutely sensitive to the sad fact that few solid data exist upon which to build a quantitative foundation for this study. Accordingly, extrapolation had to be made for limited data, anecdotal reports and foreign examples. Validity of the study is most related to the massive accumulated experience and diverse background of the many people who generously volunteered their time to its development.



## ACKNOWLEDGEMENTS

The National Sea Grant College Program appreciates the cooperation of those who accepted the invitation to participate in the meetings of the Study Group or in subsequent discussions with the author of this report. These individuals gave freely of their time and effort in the hope of benefitting the U.S. commercial fishing industry.

In addition, Dr. Roland Smith and Mr. William Hannum, National Marine Fisheries Service (NMFS) and Dr. Virgil Norton, University of Maryland, discussed the nature of the study with National Sea Grant College Program representatives. During the Study Group's second meeting, Captain Roger Motte, Head of Ocean Science, Plymouth Polytechnic, Plymouth, England, and Captain David B. Thomson, Senior Fisheries Extension and Training Officer, U.N. Food and Agriculture Organization (South China Sea Program), presented information on overseas fishery education programs and also participated in some of the subsequent discussion. Svernir Cunnnlaugsson, Counselor, Embassy of Iceland translated printed materials and discussed Icelandic fishery education programs with the author.

This report of the Study Group, supplemented by references to the published literature and solicited personal communications, was written by Dr. Warren E. Yasso on special assignment to the National Sea Grant College Program from Teachers College, Columbia University. A few paragraphs of the text were edited from contributions of Study Group members. Other contributions are included in the appendixes.

The cooperation of those who read and commented on this report is also hereby acknowledged with gratitude. Such comments have led, through a series of revisions, to an improvement in the final text. However, the author has mainly attempted to reflect attitudes and opinions of a majority of members of the Study Group and the conferees listed in Appendix A. Many knowledgeable persons from outside the Study Group, who read a late draft of this report, have expressed opinions ranging from substantial agreement to substantial disagreement with the conclusions and recommendations of the Study Group. It is not surprising that there should be diversity of opinion on an issue as complex as the educational needs of the U.S. commercial fishing industry, especially in view of the dearth of solid supporting data. Therefore, it was gratifying to find wide, albeit non-universal, support for conclusions contained herein.



## Chapter I

## INTRODUCTION

In 1975 there were 260,323 persons employed domestically as fishermen, processors or wholesalers. In the same year, 103,194 craft and vessels were used in the domestic commercial fishing industry of which only 16,211 were vessels over five net tons (National Marine Fisheries Service, 1979). Processing and wholesaling were carried out at 3,606 shore establishments, three-fourths of which were in Atlantic Coast and Gulf states.

Between 1968 and 1978 exports of domestic edible fishery products increased to reach a record weight of 203,778 metric tons (448 million pounds) and a record value of \$831.7 million in 1978. When nonedible fishery products are added, the total export value increases to \$905.5 million also representing a record. Over 35 percent, or 71,947 metric tons (158 million pounds), of the record export of edible fishery products is accounted for by various forms of salmon. These represent about 39 percent of the export dollar value of edible fishery products.

United States imports of edible fishery products in 1978 totaled 1,100,348 metric tons (2,421 million pounds). This was a record import weight of such products and its \$2.275 billion value also set a record. Adding import of nonedible fishery products also establishes a record total value of \$3.099 billion. Tuna represent the largest weight of any single fish product import amounting to almost 36 percent, 390,919 metric tons (860 million pounds), of the edible import total. However, shrimp represent the largest value of any single fish product import amounting to 18.5 percent, \$421.7 million, of the edible import total.

Commercial landings by U.S. fishermen amounted to about 2.74 million metric tons (6.1 billion pounds) live weight in 1977. Landing weights are roughly equally distributed among the Atlantic, Gulf and Pacific Ocean regions. Great Lakes and other inland landings total only about 7 percent of the average for the larger regions. However, the foreign catch within the U.S. Fishery Conservation Zone (F.C.Z.) amounts to an additional 1.754 million metric tons.

It is generally assumed that 9 to 18 million metric tons (20-40 billion pounds) of fish are available, on a sustained basis, from the U.S. F.C.Z. (U.S. Department of Commerce, 1976). The U.S. F.C.Z. is the largest of any nation. Within it are an estimated one-fifth of the world's living marine resources (U.S. Department of Commerce, 1976). Thus, improvement of the U.S. capability in commercial fishing is needed not only to reverse



the trend of U.S. fish product imports but also to tap the potential wealth within the U.S. F.C.Z. The situation is in the U.S. Department of Commerce report cited above:

"The U.S. commercial fishing industry has before it opportunities to reach new levels of production and to expand further its already significant contributions to the Nation's food supplies and economy. For the nation as well as for the industry, the prospects deserve urgent attention."

Many reports have dealt with the complex scientific, political, economic and sociological interaction needed to improve the U.S. commercial fishing industry. A report to the Congress by the Comptroller General of the United States (1976) suggests four basic actions to strengthen the industry:

- "a. Restoring fish stocks through effective management and improvement of the environment;
- b. Developing underutilized species;
- c. Displacing foreign fishing in the U.S. F.C.Z.;
- d. Increasing the efficiency of harvesting operations and overcoming barriers to processing, marketing and distribution."

In addition, the Atlantic States, Gulf States and Pacific Marine Fisheries Commissions (1977) recommended an improvement in information quality and flow to industry, and public and education programs. The first four educational needs identified were:

- "a. preparing retailers and merchandisers to properly handle and display products;
- b. consumer education programs to promote use of all types of seafood;
- c. education of commercial fishermen about finance, taxes, loans and establishment of cooperatives;
- d. on-the-job training programs for entrants into commercial fishing, in supporting fields such as: welding, refrigeration, navigation and hydraulics."

The importance of these suggestions is illustrated by the following excerpt from a U.S. Department of Commerce report (1976):

"Food products must be wholesome, safe for consumption, and



of a quality that encourages consumer interest and confidence. Because fresh fish spoil more rapidly than most other foods, the quality of fisheries products, and consequently their acceptance in the market place, is often highly variable and should be improved. The growing variety of species available and of processes for converting them to products for retail consumption, calls for improved labelling to better inform consumers."

While not denying the need for the educational efforts listed above, the Study Group recognized the need for fishery education programs at all academic levels. Included in such programs would be public education about fish, fishing, seafood processing, marketing, seafood nutrition and preparation of meals containing seafood products, as well as vocational-technical and workshop training for those already in the industry. For the long-range health of the U.S. fishing industry, the educational system should provide more extensive formal training for fishermen and seafood processors and also should produce a new breed of commercial fishery specialist. A consensus of the Study Group was that the U.S. system of higher education is not now capable of turning out such a coherent spectrum of talent. The new term, "commercial fishery specialist," is an umbrella designation covering many fields of expertise within the commercial fishing industry: education, management, technology, law and so forth. These specialists would be most useful to an industry which is increasingly becoming more vertically integrated. The Study Group does not denigrate existing undergraduate and graduate programs in such fields as ocean law, economics and fishery biology. Rather, the desire is to state that considerable innovation in staffing, structuring or restructuring of degree programs and building of new facilities is needed before the U.S. commercial fishing enterprise can be best served by an integrated educational system that addresses commercial fishing in its entirety as a complex industry.



## Chapter II

INTERNATIONAL PERSPECTIVE ON FISHERIES SCHOOLS  
AND PROGRAMS

This section contains a brief survey of the literature on foreign schools and programs. The appendixes contain more detailed reports on foreign programs prepared by, or at the urging of, members of the Study Group.

The basic question is whether foreign nations, with demonstrable success in fishing, have developed unique programs that might serve as models for adaptation to the U.S. system of education. From the information in reports discussed in this section and in associated appendixes it appears that the foreign programs rely on the type of formal educational system familiar to all Americans. However, the age at which students are sensitized to the fishery industry, types of training programs by student age and degree/certificate expectation and upward mobility through schooling are all related to the obvious political, social and economic environment of each nation.

U.S.S.R.

An overview of the Soviet fishing industry is provided by Kravanja (1976). From a dominantly coastal marine fishery prior to the early 1950's, the Soviet Union now has the world's largest distant-water fishing fleet. From 1950 to 1975 the total catch increased from 1.7 million to 10.3 million metric tons. During that time the estimated number of Soviet fishermen has remained constant at about 250,000 as the fishing industry shifted from a labor-intensive to capital-intensive development. Capital investment grew from a yearly average of \$2.9 million in 1940 to \$1 billion in 1975.

Expansion of Soviet fishing has required a highly skilled labor force provided through government recognition of fisheries workers as professionals and development of an effective system of fishery secondary schools and universities specializing in fisheries education and training. Sensitization to fisheries development and occupations begins in primary schools where some field trips and other programs emphasize the fishing industry and fisheries biology. In addition Soviet fishermen are relatively well paid, enjoy long vacations, live a comfortable life aboard ship and enjoy other special privileges such as foreign travel.

There are basically four types of fishery schools which provide education and training:

1. Fishery Trade School (non-diploma) - seven schools accept eighth grade graduates who become skilled, low-paid workers after one, two or three years of training.



2. Specialized Secondary Schools - called the mainstay of Soviet fisheries education, 25 schools train captains, navigators and other officers for either high seas or coastal and inland fleets.
3. Higher technical and engineering institutes - equivalent to U.S. colleges, these six institutions accept a relatively few secondary school graduates to become top-level economists, gear designers, planners, managers or engineers.
4. Schools for improving the qualifications of fisheries personnel - these are actually education programs, to upgrade and update skills of medium to upper echelon personnel, given in enterprise training centers for the secondary and higher-level institutions.

Approximately 61,000 were enrolled in 31 Soviet secondary and higher level fisheries schools in 1975. About half of these were enrolled in correspondence courses while working full time in the fishing industry. About 10,000 students graduate from the system each year. All but three of the schools are located in proximity to lake or ocean waters.

An estimated 2,500 to 3,000 full time faculty members serve the needs of students. Therefore, student/faculty ratio appears to be about 20 or 25 to 1 on an overall basis. However, if only full time students are considered then the ratio drops to a number more in line with that discussed later in this report. Average annual per capita student cost to the Soviet government is \$1,050.

#### JAPAN

Japan is considered one of the countries where "institutionalized vocational training has reached the highest level of development" (Cole and Hall, 1973). Colleges for fishermen have existed in Japan since the 1890s. The Japanese system is used as a model for nations desiring to make fishing of major economic importance. Educational alternatives are available at all levels of instruction but early specialization is required of students.

Senior fishery high schools accept students at about age 15 for courses lasting about three years. Seven specializations are offered:

Fishing operations

General fisheries



Fisheries management

Fish processing

Fish culture

Marine engineering

Radio and electronics

Those completing such basic specialization enter the industry at the deck-hand level or equivalent. However, the schools also offer postgraduate work of professional level which involves students in an additional academic year of classroom instruction followed by one year on a training vessel and six months on a commercial vessel. Those who complete the postgraduate course qualify as first-class second navigator or engineer.

There are 60 senior fishery high schools in Japan, ten of which offer evening classes. In the early 1970s, total student enrollment was 60,000 of which about 750 were postgraduate trainees. Most of the schools operate their own training vessels.

At the next higher educational level are the two fishery colleges which continue a tradition begun in 1890s. About 1,500 students are enrolled in all programs which are dominantly of a practical nature: one-third of the courses are general; the remaining two-thirds are specialized. A one-year postgraduate course leads to a Certificate of Competency in seamanship. A two-year course in advanced fisheries subjects leads to an M.S. degree. Fish culture training stations, field biology laboratories and training vessels are operated by the colleges.

Those who wish to pursue a career in fisheries research complete an academic training available at about 16 other universities. A more detailed account of Japanese fisheries high schools and the two universities of fisheries is given in a report by J. Doyle (Appendix C).

In addition to research facilities at the academic institutions, there are "Nine national fisheries research laboratories and a network of 80 prefectural experimental and branch research stations (which) conduct extensive research programs on fishing, marine biology and other oceanography areas" (Comptroller General, 1976).

In recent years the Japanese fishing industry has declined in importance. In 1971 Japan became a new importer of fish products. Because of an absolute decrease in its productivity growth rate and decrease relative to other industrial sectors, the gross value of fishing industry output represented only about



one percent of Japan's 1973 gross domestic output. However, the fishing industry remains a major economic factor in that it provided about 50 percent of the animal protein consumed in Japan in 1973 (Comptroller General, 1976). In contrast, fish products account for only about 5 percent of animal protein consumption in many western nations.

Support for the Japanese fishing industry comes from its government through the Fisheries Agency of the Ministry of Agriculture, Forestry and Fisheries. In 1976 the Fisheries Agency had an operating budget of \$472 million with an additional \$637 million earmarked for insurance programs, loans, and investments (Comptroller General, 1976).

Among the recent programs designed to aid the fishing industry are long-term, low-interest loans to:

- reduce debt of fishing companies
- reduce overcapacity of the tuna fleet
- help with higher fuel costs

A similar loan program to stabilize domestic fish prices began in 1976.

#### GREAT BRITAIN

Prior to 1973 no bachelor's degree program for fishery science existed in Great Britain. However, in that year the Council for National Academic Awards approved a four-year course at Plymouth Polytechnic, Department of Maritime studies, leading to a B.S. in Fishery Science. Entrants must have high academic qualifications and extensive maritime experience as evidenced by a Certificate of Competency as Master, Skipper, or Mate.

The curriculum at Plymouth Polytechnic is a three-part academic program interrupted by two 26-week (average) work experiences in the fishing industry. Main objective of the program is to turn out graduates who can assume duties such as:

- development officers with research teams
- operations managers of fishing fleets
- command of trawlers
- management of posts in trawler companies
- advisors to operations and design criteria
- management posts in fish farming



- advisors to overseas governments, particularly those with development programs
- processing, marketing and distribution
- research and development posts

A full time equivalent faculty of eight professors service the program which has about 150 students.

In 1971 the Grimsby College of Technology instituted a diploma course in Fisheries Management within its Department of Maritime Studies and Fisheries. The program was built around head-of-department and six subject tutors. It is designed to train well-qualified entrants for posts as senior administrative and management officers of a fishery.

A recent innovation which combines research capability and fisherman training is the flume tank at the Fisheries Training Center at Hull, England. The Center was constructed with funds from the White Fish Authority, a government agency smaller than, but somewhat like, the U.S. National Marine Fisheries Service.

Cost of the Training Center and flume was about \$700,000, not including the land, which was donated. It should be noted that most of the classroom instruction takes place nearby at the Nautical College in Hull where the Fisheries Training Center offers a range of short, practical, but highly specialized courses for fishermen. Two courses, each of five days duration, make use of the flume tank which is the largest of its kind in the world. The flume is a reinforced concrete tank 31 meters long, 5 meters wide and 5 meters deep with a water recirculating system that can simulate trawling at speeds up to 2.25 meters per second (4.5 knots). In it, scale models of trawls and other fishing gear are demonstrated. The courses are free to British fishermen but also available to foreign nationals on a fee basis. One American skipper-owner who took the five-day course, titled "Fishing Gear Technology for Distant Water Fishermen," was reported to have said "...I think I have learned more here in five days than in 20 years at sea." (Wray, 1978)

#### NORWAY

From an emphasis on vocational schools closely oriented to preparing students for specific fisheries occupations the focus is now toward an open ended system that allows progress toward a university degree.

In mid-1978 a fifth government-supported training school for fishermen was opened. The school, located south of Bergen, has a faculty of eight and a maximum student enrollment of 70. Any



Norwegian who has completed the nine-year primary education program is eligible to apply for the two-year training program to receive a fishermen's ticket. While at school the candidates receive free board and lodging as well as travel expense for holiday trips back home (Fishing News International, 1978a).

The first year of the program centers on such courses as basic science, fishing gear, nautical subjects and fish finding equipment, catch techniques and fish handling. A candidate spends the second year aboard a fishing boat doing supervised work. As an alternative to the two-year formal training program a fisherman's ticket is available to those who have successfully completed three years as a working fisherman.

Those desiring a fishing boat skipper's certificate must pass an examination after completing a second year of supervised practice and an additional year of course work.

A more detailed overview of Norwegian fishing education programs in primary and secondary schools, special vocational schools, universities, technical schools and adult education programs, prepared for this study by P. Heggelund, can be found in Appendix D.

#### TAIWAN

Taiwan has one university and two colleges that offer four-year education programs in commercial fisheries. Such programs graduate about 120 student annually. There are four commercial fisheries programs at the junior-college level which graduate about 500 students annually. An additional 500 students graduate annually from the five vocational schools which offer pre-college training for commercial fisheries. Most schools at all levels offer separate programs for fisheries technology, marine engineering, aquaculture and seafood technology. Schools at the pre-college and junior-college level also train skippers for inshore work boats whereas schools at university and college levels also train merchant marine officers.

Costs of the educational programs are difficult to assess because of government subsidization and relatively low wages of faculty (approximately \$100 to \$200 a month). Taiwanese students for associate and bachelors' degrees pay tuition of about \$1,000 a year; vocational school students pay tuition of about \$30 a year (David Kan, personal communication).

In addition to the formal education programs, there is also an upgrading program for fishery workers. A pre-college graduate can reach the same level of accomplishment as a two-year or four-year college graduate by credited work experience on fishing vessels and by taking correspondence courses or by passing examinations. The National Oceanic University has five research



centers, four colleges and fifteen departments in fisheries and related maritime sciences. New fishing technology is introduced to the fleet through the fisheries services and research centers.

For captains of fishing vessels under 30 meters (100 feet) licenses are not required; most of the captains are fishermen without formal training. The fisheries program in Taiwan is strong because most of the schools offer several choices of major study thereby allowing more efficient use of faculty members. The success of the programs also benefits from easy access to employment for pre-college and junior college graduates.

Experience with fisheries training in Taiwan indicates that the grass roots of commercial fisheries training is at the pre-college and junior college levels. The four-year college program graduates tend to take shore jobs or merchant marine jobs rather than employment on fishing vessels.

#### ICELAND

Fishing and fish processing combine to form Iceland's major industry. In recent years there has been an increase in the stern trawler fleet. The new, European built ships are more efficient than the side trawlers they replaced. They can be worked by crews of 16 rather than the 25 or 30 needed previously. Boatbuilders have also developed combination trawler/purse seiners and trawler/long liners that are of interest to Icelandic fishermen (Fishing News International, 1978b). Three 45 meter (225 ft.) trawler/purse seiners were added to the Icelandic fleet in late 1977. They have the most modern electronic and hydraulic equipment including bow and stern thrusters of 400 horsepower each (Fishing News International, 1978c).

Because it is so widespread and vital there is a pervasive national interest in all aspects of the industry. A majority of Icelanders have friends or relatives whose incomes derive from the industry. Therefore, Icelandic youth have a continually reinforced sensitization to the industry. Fish processing plants offer summer employment to school and college youth. Girls somewhat under 16 years of age can work in the processing plants. They are restricted, however, to jobs that do not require the high productivity for which older workers are paid bonuses (Glen, 1975).

Iceland has compulsory education for youths age seven to 16. During the past few years significant changes have occurred in educational options open to graduates of the compulsory program. Many of these options are innovative and experimental. Students wishin an academic training attend four years of junior college until age 20. They may then continue four years of either university or teaching training. If,



instead, they leave junior college after two years they can choose from a wide variety of two or three year vocational-technical programs in physical education, nursery school teaching or nursing and technician level preparation for the health care professions.

Students who complete the compulsory program also have the option of transferring into business and technical programs. Most of the fishery-related specializations are found in such programs which are of three to seven and one-half years duration. Specializations include four year programs in fish processing plant inspection, marine engineering and navigation. Navigation school requires one year of work training prior to admission.

The Iceland Technical School offers training for managers of fishing fleets and fish processing plants. This program yields the equivalent of a bachelor degree. Graduates of the compulsory program are required to have two year of work training prior to admission. On entering they take one year of preparatory courses, a year of basic sciences and then three and one-half years of specialized courses. A graduate of junior college may enter to take only the three and one-half year specialization.



## PRODUCTIVITY OF FISHING FLEETS AND EDUCATIONAL IMPLICATIONS

Having examined the fishery education system in selected countries, it is necessary to ask whether or not there is detectable correlation between a nation's educational effort and its productivity.

### Quantitative Measure of Productivity

Only one attempt at quantitative ranking of the productivity of major fishing nations was found in the recent literature. This ranking system, based on gross register tonnage of a fishing fleet and the live weight of its yearly catch, is discussed in Appendix E. But, there are no comparative data available by which one can relate a nation's fishery education effort and either the short-term or long-term productivity of its fishing fleet. However, there seems little question that adding an appropriate level of education and training can improve the productivity of individual fishermen and fishing boats. Experiences that support this assertion are reported in the next section and in Chapter Four of this report. The most important aspect of these educational programs is, unfortunately, also the most intangible to assess. That is, in addition to improving the technical skills of participants in the individual facets (catching, ship handling, processing, etc.) of commercial fishing, the degree to which these facets are integrated to provide individuals with an educational background in all phases of the industry's operations is vital.

### Qualitative Measure of Productivity

Professor A. Holmsen, University of Rhode Island, (personal communication) talked with two crews whose vessels, with similar diesel power plants, became disabled at sea. One crew was able to disassemble the engine, diagnose the problem, and communicate with shore about specific replacement parts that were needed. This vessel lost only one day of fishing time whereas the other vessel, whose crew lacked requisite training in diesel engine repair, lost three days of fishing time. Thus, a course in diesel engine maintenance might have made the second crew more efficient and productive.

Beyond the skill level discussed above, Holmsen also cites examples of vessel skippers whose knowledge of fish behavior, technological aids, and market conditions results in higher return on capital investment than that for less well educated skippers.

Although no unique definition of productivity is offered here, the concepts of productivity and efficiency can be combined to suggest that a crew which is able to harvest more fish of a



given species in a given time using the same type of equipment as another crew is the more productive. From an economic standpoint the productive crew would know which species to fish for at a given time and with what equipment in order to maximize the return on investment.

The knowledge necessary to achieve such productivity can be obtained through the generalization of practical experience and through appropriate research and training efforts. Certainly such knowledge can be transmitted, aboard ship, on a one-to-one basis from the possessor to the apprentice. But, when those possessing relevant knowledge, or the ability to acquire it, are relatively few and those desiring it are many then our society has found it best to institutionalize the transmission of the knowledge. The hazards and complexity of commercial fishing operations also weigh against the use of untrained personnel aboard ship. For example, Captain Richard Champlin believes (personal communication) that because of the intense operating conditions aboard Rhode Island commercial fishing boats it is unrealistic for him to hire raw apprentices for on-the-job training. In contrast, he welcomes graduates of recognized commercial fishery education programs as fully functioning and fully paid members of his crew. In a similar vein Charles McLeod comments (personal communication) that equipment aboard a modern fishing vessel and fishing technology is too advanced for use of apprentices as on-the-job trainees. He believes that an associate degree in commercial fishing is a reasonable prerequisite for the new generation of career fishermen. He predicts that future New England fishermen will be heading further offshore in larger and more sophisticated boats. This will require people with appropriate knowledge and skills.

Assuming that a more modern and efficient U.S. commercial fishing fleet would increase productivity over the present, what are the educational consequences of creating such a fleet? As will be discussed in Chapter IV of this report, the creation of such a fleet implies the availability of well-trained personnel to operate the vessels and gear. Therefore, the need for more and better formal education programs for fishermen and women is a natural consequence of the desire to increase productivity and safe operation of the U.S. fishing fleet.



## Chapter III

SURVEY OF FISHERY EDUCATION IN THE U.S.  
AND ITS POSSIBLE FUTURE DIRECTIONSSecondary School Feeder Program

When considering initiation of new fields of study in college or universities, or even expansion of existing studies, the question of supply of students must be addressed. Fisheries sciences and seafood processing technology are relatively new fields of study in U.S. college curriculum. Applicants to associate degree programs are usually interested in career opportunities. Applicants to four-year colleges are usually interested in major and minor fields of study. Those who have no firm feelings about their major/minor fields of study can, theoretically, make such decisions in their sophomore year. However, in most cases, the reality is that those who early identify major/minor fields of study tend to get better advisement and make more rapid progress toward a degree. It is assumed that such ability to specify major/minor is related to a complex set of variables among which are life goals, parental desires, available curriculum and sensitization to fields of study through courses taken in secondary schools.

Therefore, exposure to such high school courses as oceanography, marine biology, fisheries, ocean resources and ocean environment might sensitize students to college studies of fisheries and seafood processing. In Great Britain, for example, a special effort was made by the Hull Fishing Vessel Owners' Association to inform every secondary school student in the North of England about careers in the trawler industry (Fishing News, 1974).

It is assumed that large-scale exposure of secondary school students to such courses might, because of student interest and job potential, create pressure for expansion of existing programs at colleges having the capability to offer fisheries/seafood processing major/minor coursework. Does the secondary school curriculum across the nation currently offer the hope of sensitizing students to such college-level programs?

To answer this question a brief survey was undertaken by the National Sea Grant College Program. Data gathering procedures, raw data and data analysis are presented in Appendix F. In the eight states listed there were 1.47 times as many students enrolled in secondary-level oceanography courses in the 1977-78 school year as compared to the 1972-73 school year. Projected to the entire nation this suggests a total of about 68,000 students enrolled in such courses during 1977-78.



Therefore, many more students than in the past are being sensitized to marine-related topics including fish behavior and fishery resources. Those who are sensitized to fishing industry careers, through secondary-school coursework, but who have little immediate access to entry-level positions in the industry, might be motivated to pursue associate and higher-level college programs as preparation for future employment. Even specialized high schools should not be considered as an alternative to higher degree programs for training entry-level personnel. This general opinion among commercial fishermen is typified by the remarks of Captain Milford Johnson (personal communication) who believes that a career in commercial fishing requires post high-school preparation.

#### Associate Degree Program

A relatively few associate degree programs are available in the United States for the training of fishermen. One of these programs is offered by the Department of Fisheries and Marine Technology at the University of Rhode Island (U.R.I.). Prior to the beginning of the U.R.I. Program it was recognized that the only established school educating technical personnel and fishermen in North America was the College of Fisheries, St. John's, Newfoundland, Canada. The U.R.I. program is strongly related to the actual needs of deepwater fishermen. Its current curriculum is given in Table 1.

TABLE 1

#### ASSOCIATE DEGREE PROGRAM OF THE DEPARTMENT OF FISHERIES AND MARINE TECHNOLOGY, UNIVERSITY OF RHODE ISLAND

| <u>First Semester</u>  |                              | <u>Credit Hours</u> |
|------------------------|------------------------------|---------------------|
| ENG 113                | Composition                  | 3                   |
| FMT 013                | Shipboard Work I             | 2                   |
| FMT 101                | Shipboard Safety             | 3                   |
| FMT 118                | Intro. to Comm. Fisheries    | 3                   |
| MTH 109a               | Algebra and Trigonometry     | 3                   |
| REN 135                | Fisheries Economics          | 5                   |
| <u>Second Semester</u> |                              |                     |
| FMT 014                | Shipboard Work II            | 1                   |
| FMT 110                | Marine Technology            | 4                   |
| FMT 121                | Fishing Gear I               | 3                   |
| FMT 131                | Seamanship                   | 3                   |
| SPE 101                | Fund. of Oral Communications | 3                   |
| - -                    | General Education Elective   | 3                   |



Third Semester

|         |                               |   |
|---------|-------------------------------|---|
| FMT 235 | Fisheries Meteorology         | 2 |
| FMT 241 | Diesel Engineering Tech.      | 4 |
| FMT 261 | Marine Electronics            | 4 |
| FMT 281 | Navigation I                  | 4 |
| FMT 293 | Fishing Operationsl Practicum | 1 |
| FMT 351 | Fish Preservation             | 3 |

Fourth Semester

|         |                        |   |
|---------|------------------------|---|
| FMT 222 | Fishing Gear II        | 3 |
| FMT 242 | Fluid Power Technology | 4 |
| FMT 371 | Ship Technology        | 4 |
| FMT 382 | Navigation II          | 4 |
| FMT 393 | Fishing Operations     | 3 |

The U.R.I. Program may be used as a model for emerging programs as might other schools, such as Clatsop Community College, Astoria, Oregon which have also achieved success in fisheries training (National Fisherman, 1976).

The associate degree program began at the University of Rhode Island's Department of Fisheries and Marine Technology in 1967. There were 108 graduates of the program through the class year 1976. Motte and Merdinyan (1977) estimate that 96 percent of the graduates experienced continuous maritime employment subsequent to graduation. Table 2 lists data on employment category for the 71 graduates actually interviewed.

TABLE 2EMPLOYMENT CATEGORY OF UNIVERSITY OF RHODE ISLAND ASSOCIATE

DEGREE GRADUATES, 1969-1976, (DATA FROM MOTTE  
AND MERDINYAN, 1977)

| <u>Employment category</u> | <u>Number of<br/>Respondents</u> | <u>Percentage of<br/>Respondents</u> |
|----------------------------|----------------------------------|--------------------------------------|
| Captain/Owner              | 11                               | 15                                   |
| Captain/Non-Owner          | 7                                | 10                                   |
| First Mate                 | 17                               | 24                                   |
| Engineer/Cook/Deck Captain | 20                               | 28                                   |
| Ordinary Deck Hand         | 16                               | 23                                   |
| TOTALS                     | 71                               | 100                                  |

A mean position somewhere between engineer and first mate is considered by Motte and Merdinyan as the expected level of employment after a mean of 2.33 years actual on-the-job



experience after graduation. Additional years of employment should raise the level of accomplishment.

The University of Rhode Island program was credited by respondents with providing the major portion of fishing knowledge in contrast with only small contributions from father/relatives or practical experience. The average respondent also felt that formal training had provided a three- to five-year lead over someone seeking to become a fisherman through practical experience alone. Additional coursework had been taken by 46 percent of graduates of the associate degree program. Captain James McCauley believes (personal communication) that the associate degree programs serve a dual function. They permit young people to enter the industry even if there is no family tradition of commercial fishing. And, they allow much more rapid progress to the rank of captain.

#### Bachelor's Degree Programs

In the U.S. undergraduate curricula leading to a baccalaureate degree in fisheries have evolved from the traditionally scholastic disciplines of zoology and biology, from the more vocationally oriented programs of wildlife biology and conservation and from the land-grant schools of agriculture and mechanics. These three different beginnings produced programs characteristic of their origins, but in time, each has been modified so that currently there are more similarities than differences.

A panel convened at the University of Washington (1968) to study the programs identified a poor fit between educational needs of fishermen and existing offerings. It suggested that the following segments be explored to service the needs of the entire fishing industry:

1. technical training related to the catching process,
2. technical and managerial training related to the processing phase,
3. management and administration of the resource,
4. research by private, federal, state and university organizations,
5. research and training about fishery education."

In spite of the earlier efforts of a few to encourage initiation of baccalaureate offerings, no four-year programs leading specifically to a bachelor's degree in commercial fishing exist in the United States. Therefore, a whole range of more advanced courses is being denied to those, like graduates of the



University of Rhode Island Associate Degree program, who desire increased formal training in the industry. The captain/owner needs extensive knowledge in many disciplines. Leonard Stasiukiewicz, a Certified Public Accountant and manager of the Point Judith Fisherman's Cooperative, states (personal communication) that the captain/owner should have college level knowledge of personnel and group psychology and business economics. This is especially true for captains/owners who are members of fishery cooperatives where complex business decisions are made by and for the group. Lewis Roberts suggests (personal communication) that a common pattern is for bachelor-level programs to provide theoretical courses to round out the applied coursework given in associate degree programs.

An outline of general subject categories, relevant to a four-year program, compiled by J. Doyle (personal communication), is given in Table 3.

TABLE 3

OUTLINE OF A BACHELOR'S DEGREE PROGRAM IN  
COMMERCIAL FISHING

General Subject Categories:

- I Humanities
- II Social Sciences
- III Basic Science
- IV Technology

Examples of Courses Within Categories:

- I Humanities
  - Communication
- II Social Sciences
  - Maritime and Fisheries Law
  - Business Management
  - Food Marketing and World Market Structure
  - Accounting and Tax Law
  - Economics
- III Basic Science
  - Algebra and Trigonometry
  - Analytic Geometry
  - Calculus
  - Statistics
  - Chemistry (including organic and quantitative analysis)
  - Physics
  - Zoology
  - Oceanography



## IV Fishing Technology

- Fisheries Navigation
- Fish Behavior
- Fisheries Oceanography
- Fishing Grounds
- Fisheries Engineering (including hydraulics,  
diesel mechanics, electronics and refrigeration)
- Processing Technology
- Fisheries Biology
- Fish Stock Management

Graduate Degree Programs

Graduate training can provide fishery specialists, including teaching faculty and researchers and top-level administrators within the industry or in governmental agencies. Whether justified or not, one of the frequent complaints by fishermen is that fishery researchers and governmental administrators have little knowledge of the overall industry and especially of the needs of fishermen. Therefore, fishery specialist graduates of the new programs would fill a clear need.

One example of program needs is given by Professor William Swensen (personal communication) who believes there is a present and future need for extension agents who have graduate training in population ecology combined with practical experience in commercial fisheries. Some of the Conferees, with whom contents of the report were discussed, believe that future managers of fish processing and distribution operations will come from innovative graduate programs in such areas as environmental law, environmental engineering, marketing and marine economics.

Advanced Specialized Programs

An advanced-level training program for fisheries biologists is offered by the U.S. Department of the Interior, Fish and Wildlife Service. The program is given at the Fisheries Academy, National Fisheries Center - Leetown, Kearneysville, West Virginia. The program "...was established to provide advanced or state of the art training to practicing fisheries biologists. Programs selected for development by the Academy are those which are ordinarily unavailable from other sources" (Rober E. Putz, personal communication).

Courses relating to commercial marine fishing problems are not now being offered or even considered by Academy planners. However, the Academy might be able to offer short courses, on a fee basis, in such subjects as estuarine ecology and environmental problems related to anadromous fish. Implementing



such courses would depend on specialized needs of university-based graduate programs in commercial fisheries that might develop in the future.

#### Staff Requirements

Cole and Hall (1973) found that for all existing fishery education programs in the world, the overall ratio of staff to trainees was between one to seven (1:7) and one to ten (1:10). These ratios were fairly uniform across countries and across levels of instruction. They recommend a ratio of 1:10 for practical courses and 1:20 for theory courses. They recommend a general maximum of 25 hours instruction per week by each faculty member (Cole and Hall, 1973).

Even where short courses are given involving basic training for fishermen in the use of simple equipment, the instructor should have some amount of specialization. Cole and Hall (1973) state the obvious rule derived from all educational experience: "As a general rule, the higher the level of training the more highly specialized the staff should be." Therefore, efficient high-level instruction usually requires a highly specialized staff based in a relatively large institution. One of the problems in securing an improved educational program in the fishing industry is the availability of well-qualified faculty for associate and higher degree programs. Until graduate programs are in operation and turning out the next generation of faculty members there may be a shortage of qualified faculty--unless foreign nationals are brought in to staff the programs. Therefore, staffing requirements must be given serious consideration when new programs are being discussed.



## Chapter IV

## EDUCATIONAL INITIATIVES AND EMPLOYMENT POTENTIAL

The offshore fisherman pursues his craft away from the public view in what most land-bound people would consider an hostile environment. His tools for finding and capturing a source of food that swims in a dark, saltwater medium have no common analogs on land. Therefore, most land-dwellers have little idea about fishing and especially about fishing technology. This is well described by Sainsbury (1971):

"To many eyes the methods and equipment used by fishermen appear crude and unsophisticated; in fact, so far as modern commercial fishing is concerned, the opposite is true in most of the world's important fisheries. Technology, sophistication, complexity and investment in vessels and equipment, together with techniques of finding and bringing fish to port, are showing rapid growth. Increasing investment in research and development is continually improving the efficiency of operation and conditions under which fishermen work."

The need for improved and available fisheries education must be based, firstly, on a belief that this education would produce a more efficient and safer harvester and processor. It should be based, secondly, on the reasonable hypothesis that it is more efficient to train such personnel in a formal education setting rather than on the job. It is recognized that, because of the complexity of modern fisheries practice, the "complete fisher" cannot be produced in the classroom. However, certain technologies and knowledge can be better imparted in a formal educational setting to workers entering fisheries as a profession. And, thirdly, new initiatives in fisheries education should be based on the realistic assumption that research and development efforts will grow around a new cadre of faculty employed in graduate fisheries education. Their presence in a research and teaching environment will foster the potential for U.S. creation of new technological devices for the fishing industry just as faculty research has led to technological breakthroughs in other disciplines. The beliefs and assumptions listed above are discussed in the remainder of this chapter.

Technological Innovation and Transfer

Technology has made an impact on the navigation and fish finding apparatus found on U.S. commercial fishing vessels. However, a U.S. Department of Commerce report (1976) puts such innovation in perspective:

"With a few notable exceptions the fishing industry has not responded to the remarkable advances in technology which



have occurred in the last 30 years. For example, blue crabs are still largely picked by hand; little mechanical handling is used on U.S. vessels. Opportunities exist to apply techniques established in other areas to sophisticated fishing strategies, to the speedier location and harvesting of fish, their mechanical handling on board and their processing into a wide variety of new and diverse products to supplement and expand the sale of traditional lines. Well designed technological improvements can not only increase productivity but increase the share in existing markets, while opening new ones to U.S. fishermen.

As new species are developed, modification and testing of new fishing gear will be needed. Shipboard handling and storage methods to maintain top quality must be determined for species which have not traditionally been taken. Freezing characteristics and new packaging requirements must be studied if quality is to be maintained throughout the marketing chain."

Many specific examples of need for technological innovation can be found in the published literature and in personal communications listed below. Charles McLeod (personal communication) describes a recent trip to Peterhead, Scotland during which he learned that Scottish fishing vessels equipped with bow thrusters are able to do purse seining in winds up to 88 km/hr (55 mph). In contrast United States purse seiners are limited to working in wind conditions less than 24 km/hr (15 mph). Further, he reports that Scottish fishery leaders feel that U.S. fishermen are 15 to 20 years behind their European counterparts.

Approximately 100 West Coast fishermen were asked about the adequacy of their gear (Office of Technology Assessment, 1977). The groundfish/bottomfish, gillnetters and trawl operators were the groups least satisfied with their gear. In addition to better gill and groundfish nets there is a need for development of a small-scale, multi-purpose, mid-water trawl and better equipment to freeze, handle and store fish aboard ship.

The electronic navigational and fish finding equipment found on modern fishing vessels costs more and is more complex than an entire fitted fishing vessel of a generation ago. Many present-day captains are not using their electronic equipment to its full capacity. It has been stated that in New England the electronic devices used to find schools of fish are generally not in operating conditions and, if operable, are often not used (A. Clifton, personal communication).

The captain or vessel owner generally receives minimal training in the use of a piece of equipment at the time of purchase. Additional training for captains and crews may



sometimes be found at workshops conducted by manufactureres, the Marine Advisory Service, fisherman's associations and others.

Captains of active commercial fishing vessels generally express little interest in extension-type workshops. They claim that they do not have time for such activities and that workshops are often scheduled at inconvenient times for potential participants. Therefore, a key to upgrading the knowledge and skills of practicing fishermen may be a combination of extension agents performing shipboard instruction and availability of properly scheduled, land-based workshops. Some of the knowledge and skills to be imparted may seem surprisingly basic to those outside the industry; yet the needs seem to be present in all geographic areas. For example, almost all of the commercial fishermen interviewed by the author believe that net mending and rigging instruction are badly needed. Captain Thomas Norris stated (personal communication) that only about one-half of the offshore trawler crews of his acquaintance were experienced enough to mend and adjust their nets.

One example of technological innovation is the recent adaptation of the twin trawl system for use in the Georgia coastal shrimp fishery. Such a system was pioneered by Gulf Coast shrimpers in the 1950's. They found many advantages in towing four small nets rather than two large ones. Benefits include less drag, larger net area and easier handling and repair of the smaller nets. However, the twin trawl system had to be adapted for use in shallow waters off the Georgia coast where the shrimp resource is located.

Redesign and testing of nets, trawl doors and rigging were performed by University of Georgia Sea Grant extension personnel with the cooperation of local commercial shrimp boat operators. Captain Ellis Phillips (F/V Miss Tonya) began using the system. Because of the his increased catch twenty other boat owners converted to the twin trawl system during the next several fishing seasons. Their catch increases of 30 to 100 percent have allowed rapid repayment of the conversion cost.

Difficulty in adapting and improving the twin trawl sytem for use in Georgia waters (Harrington, 1975; Rivers, 1976) suggests that scale model studies in a flume tank might have sped progress toward a final design. Part of the relatively expensive, diver assisted tests of comparative net performance also might have been conducted more expeditiously if a research flume were available in the United States.

In addition to the White Fish Authority Training Center and flume, previously discussed, the technological training of fishermen in Great Britain has been addressed through two innovative programs (Fishing News International, 1974). In 1973 the White Fish Authority began operating in mcble training unit



that consists of a trailer-borne mockup of a modern trawler wheelhouse including all the requisite fish-finding electronic gear. The electronic equipment is operated by playback of tapes of fish and bottom echoes recorded on commercial vessels that use the same equipment. The trailer and associate mobile classroom are driven wherever interested fishermen are found.

The next step up from the passive training available on the mobile training unit is the world's first digital navigation and fishing simulator. It began operation at the Hull College of Higher Education in 1974. Specific fishing areas are simulated in the fish finding and navigation equipment through computer programs that are controllable by the instructor. Each skipper responds to the programmed changes in fishing conditions in order to assess his competence in "netting" fish under the simulated conditions. Such technological innovation is considered essential for U.S. fishing education programs.

There have been significant increases in the amount and kinds of environmental data available to fishermen during the 1970s. Although much of this information is valuable in locating and effectively harvesting fish it is rare to find a fisherman with sufficient background to apply these tools. Temperature and salinity data are commonly used by Soviet and Japanese fleets in locating fish and planning fishing strategy. Satellite imagery could be widely used for locating pelagic fishes.

A knowledge of the physical environmental factors and their relation to distribution of fish could greatly increase the efficiency of some fishing fleets. The study of the relationship between the environment and its effects on fish (commonly called fisheries oceanography) is not being pursued with the same vigor in the U.S. as it is in Japan and the U.S.S.R. Fishermen from the latter two countries depend heavily on temperature, salinity, bottom type, currents and other physical factors to guide their fishing efforts. Unfortunately, few U.S. fishermen have the knowledge necessary to apply such aids to their fishing.

A partial solution to such problems lies in students trained in new educational programs that stress the technology of the fishing industry. They would be:

- a. trained in design, use and repair of new basic equipment and high technology devices;
- b. able to communicate the need and advantage of such innovations to their employers;
- c. better able than most personnel to carry information on need for additional innovations back to research faculty with whom they can communicate and aid in planning and implementation.



### Technology and the Future of Fishing

Alverson (1975) has commented on the status and future of fishing technology:

"Existing fish detection and extraction systems are adequate for expanded operations and for harvesting any unexploited concentrated of demersal or pelagic fishes. Technology does provide the basis for increasing the harvest of conventional forms. However, the capacity of existing technology to accomplish this is limited by the fact that most large demersal and pelagic fish stocks are already highly exploited. Furthermore, although many stocks collectively may comprise large resources, they are sparsely distributed per unit volume of water and their effective use necessitates development of more efficient extraction systems.

Moiseev has noted that any further substantial increase in total catch will depend on man's ability to concentrate fish artificially, to improve the efficiency to fishing gear, and to learn to control the behavior of fish."

Non-traditional (underutilized or unconventional) species offer a second area for technological innovation. A species is underutilized because of problems in harvesting, processing or marketing. Each species of fish has its own unique chemical and physical properties. While certain fish, such as cod, halibut and salmon, are relatively easy to maintain in good quality many of the abundant species such as Alaska pollock and hake are not. To further develop the U.S. fisheries it will be necessary for fishermen and processors to learn to handle properly species of fish that they are now accustomed to handling.

New and more complex equipment may be necessary to handle many of the species of fish not currently harvested by U.S. fisherman to achieve a competitive position in the world fish market. This equipment will range from filleting machines to new or more sophisticated freezing machinery. Specialized training will be needed to provide people capable of operating and maintaining this equipment.

A third area for marine fish resource utilization is described by Alverson:

"In addition to increased catches which may come from geographical expansion of fisheries operations and exploitation of unconventional species, gains can be achieved through elimination of waste from species now harvested and through transfer of fish used for industrial purposes to products used for direct human consumption. For



example, by 1985 the equivalent of two million extra tons of fish could be made available as a result of technological changes and utilization patterns of this type, and this value could be increased to approximately 15 million tons by the year 2000."

Through a combination of new technology and new patterns of utilization, Alverson (1975) predicts a substantial increase in fish and shellfish production as shown in Table 4. He comments that, "the natural order of the oceans--the basic biology--provides humanity with the opportunity for substantial increases in fish and shellfish production. Man's social order and his technological development will determine whether the opportunity is seized or lost."

TABLE 4  
OPPORTUNITIES FOR INCREASED FISH AND SHELLFISH  
PRODUCTION, 1985 AND 2000

| <u>Resource Category</u>                         | <u>Potential Increases (Kilotons)</u> |               |
|--------------------------------------------------|---------------------------------------|---------------|
|                                                  | <u>1985</u>                           | <u>2000</u>   |
| Traditional species (Conventional species)       | 8,000                                 | 14,000        |
| Non-traditional species (Unconventional species) | 5,000                                 | 35,000        |
| Waste elimination (equivalents)                  | <u>2,000</u>                          | <u>15,000</u> |
| TOTALS                                           | 15,000                                | 64,000        |

Status of Seafood Technology Programs

There are few undergraduate and graduate programs in food technology around the nation that provide managerial and other higher-level personnel to the seafood processing industry. For example, the University of Washington offers undergraduate electives in fishery technology and graduate specializations within the Department of Food Science and Technology of the College of Fisheries. However, only about five (5) undergraduate students per year (30 percent of the undergraduate majors) take the electives in fishery technology.

Because of limited facilities the department is allowed a maximum total registration of only 25 graduate students; the number of graduates with fishery technology specializations is proportionally small.



Most of the undergraduates from the University of Washington program have employment commitments prior to graduation. Graduate students tend to enter academic institutions, become employees of larger research laboratories or federal employees. However, Professor John Liston and Professor George Pigott, University of Washington (personal communication), report that many graduates of the M.S. program are now entering smaller commercial seafood processing operations and that many of the major seafood processing plants in the northwestern U.S. and Alaska employ graduates of the Department of Food Science and Technology in management capacities. They also report an increased interest in such students among employers. Therefore, an expansion of the University of Washington and similar programs or initiation of new programs could serve the future needs of the seafood processing industry.

#### Industry Attitudes Toward Educational Initiatives

It is an understatement to say that the commercial fisheries industry is a varied enterprise. It is varied in terms of the size of individual productive units in the industry, type of fishery being tapped, educational attainment among members of a fishery and a host of other factors. Therefore, industry reaction to graduates of any new educational program will vary according to the complex of factors operative in a local milieu at that time.

Members of the Study Group who represent the fishery industry or who undertook informal surveys subsequent to the meetings report no industry opposition but little industry support for new educational initiatives (H. Nickerson and J. DeWitt, personal communications). However, this reaction must be balanced against the success of graduates from existing associate degree programs. G. Motte reports (personal communication) that a lack of enthusiasm for the U.R.I. associate degree program prevailed among local captains until graduates of the program were able to prove themselves aboard ship. Now, qualified applicants must be turned away for lack of space in the U.R.I. program and prospective employers desire more graduates than can be produced. Tipman Marine reports (personal communication) a continuing need for well trained fishing boat captains in the New England area. A general salary level of \$30 to \$50 thousand is not competitive with offers from the offshore oil and other marine industries.

Some fishermen do express enthusiasm for upgrading their own knowledge and that of the next generation. For example, Elliott (1977) cites a statement made by a Marine Advisory Service Agent working in the Great Lakes region:

"The fishermen have indicated they want to be more professional in their approach. They want to be better able



to ask more intelligent questions about some of the decisions being made that might or that do have a great impact on their lives and on their investments. More importantly they want to be able to make better assessments of the decisions being made by others."

From literature citations and personal communications it seems that the commercial fishing industry recognizes the need for a variety of education and training programs. Which programs to support will be a decision by men and women of foresight at all levels of government. Vindication of their vision will come as graduates of well designed and managed programs take their place in a revitalized commercial fishing industry. The difficulty in communication between fishery scientists and fishermen cited by Townes (1978) may be ameliorated as more fishery school graduates enter the industry.

#### Employment and its Relevance to Educational Initiatives

In a country with a well-established industry fewer trained personnel are needed than in a country experiencing rapid expansion of the industry. In the case of a country with an established industry, where increased automation and improvement in technology lead to projection of reduced employment, Cole and Hall (1973) state that it is possible to base future training needs on the assumption that everyone entering the industry will require institutional training and that working life expectancy is 30 years. Further, they assume that if there is uniform flow of personnel entering and retiring from the industry then a ratio of 30:1 should exist between those in the industry and those completing training to enter the industry each year. In a survey of nine countries with established fishing industries, Cole and Hall (1973) found the ratio ranged between 23:1 to 1,000:1. The high ratios might reflect such realities as improvement, through further training, of job position within a given segment of the industry to another. Cole and Hall caution that "estimates of working lives must, therefore, be made separately for each occupation or group of occupations within a particular industry and allowances must be made for "wastage" both during training and in service."

Rather than looking at the United States as a nation with a stable industry, it is more relevant, for the purposes of this report, to project employment resulting from capital investment to exploit non-traditional species in the newly created U.S. Fishery Conservation Zone. It is assumed that, initially, the resulting product primarily would be for the export market. A 1978 unpublished estimate by the National Marine Fisheries Service, NOAA, suggests that a total investment of between \$3,790 to \$4,029 million will result in an annual increase of \$3,650 to \$3,888 million to fishery business and a consequent increase of 75,038 to 81,016 in number of jobs within the industry and in



allied supporting industries. The yearly economic benefit of the total investment would not continue indefinitely. Additional funds would have to be allocated for replacement of vessels, docks, plants and equipment as they aged. Details of the NMFS estimates are presented in Table 5.



Table 5  
(UNPUBLISHED) NATIONAL MARINE FISHERIES SERVICE ESTIMATES OF THE IMPACT OF DEVELOPMENT OF NON-TRADITIONAL SPECIES IN  
U.S. FISHERIES CONSERVATION ZONE AND THE WESTERN PACIFIC  
Investment (Millions of 1978 Dollars)

| Species                           | Vessels             | Plants and<br>Equipment | Docks | Total               | Jobs<br>Created   | Business Created<br>(Millions of 1978 \$/year) |
|-----------------------------------|---------------------|-------------------------|-------|---------------------|-------------------|------------------------------------------------|
| New England Whiting               | 29.8                | 46.0                    | 10.0  | 85.8                | 1,672             | 66.7                                           |
| New England Squid                 | 29.8                | 52.0                    | 10.0  | 91.8                | 5,752             | 229.2                                          |
| Pacific Skipjack<br>and Yellowfin | 125.0               | -                       | -     | 125.0               | 20,306            | 1,257.9                                        |
| Pacific Hake                      | 48.0                | 66.0                    | 6.0   | 120.0               | 1,945             | 77.4                                           |
| Pacific Anchovy                   | 102.5               | 30.0                    | -     | 132.5               | 4,362             | 57.9                                           |
| Alaska Groundfish                 | 551.3               | 1,518.0                 | 300.0 | 2,269.3             | 23,000            | 1,464.2                                        |
| Gulf of Mexico<br>Bottomfish      | 81.8-<br>136.5      | 280.0-<br>465.0         | 50.0  | 411.8-<br>651.5     | 8,972-<br>14,950  | 357.2-<br>595.3                                |
| Gulf of Mexico<br>Pelagics        | 263.5               | 90.0                    | 100.0 | 453.5               | 9,029             | 189.8                                          |
| TOTALS                            | 1,231.7-<br>1,286.4 | 2,087.0-<br>2,267.0     | 476.0 | 3,789.7-<br>4,029.4 | 75,038-<br>81,016 | 3,650.3-<br>3,888.4                            |



Another way of looking at personnel needs of the U.S. commercial fishing industry is to project employment that would result from U.S. fishermen providing more than the current one-third of edible fish products to the domestic market. If, for example, U.S. fishermen could supply two-thirds of our domestic needs, while also building export markets, then an NMFS (1978) estimate states, "this could add \$8 to \$10 million to the U.S. economy and create 200,000 to 300,000 new jobs in commercial fishing, food processing and industries that support fishing."

In summary, whether personnel needs are looked at in terms of replacement of current workers, capital investment, or increased catch to meet export and domestic consumption requirements, there is potential for many new workers to enter all levels of the U.S. commercial fishing industry. All of them will require some training. A majority of them would benefit from some type of formal education and training programs offered in post-secondary institutions. A significant percentage of them will desire and benefit from education and training programs that lead to advanced degrees.

#### Fishing Industry Recruitment

Employment opportunities will generate interest in the fishing industry. However, to assure that successful high school students and others receive up-to-date information about the industry and its educational requirements may mandate a special effort. For example, the U.S. Department of Labor, Bureau of Statistics, in its Occupational Outlook Handbook (1978) fails to give any specific information on employment projections for the fishing/seafood processing sector of the economy. Similarly, the Encyclopedia of Careers and Vocational Guidance (Hopke, 1977) devotes only seventeen lines to what is identified as "...this vast new field." The remainder of their discussion is directed to requirements and rewards of the fish culturist. Obviously, the fishing industry has a serious recognition problem that must be overcome.



## Chapter V

## UPGRADING OR ESTABLISHING NEW FISHERY EDUCATION PROGRAMS

It was generally agreed that the U.S. commercial fishing industry would benefit from an increase in number, quality and academic range of educational programs available to those already in the industry and those seeking entry. Recommendations, given, below, are basically concerned with post-secondary educational programs and facilities. However, the Study Group recognized that such a complex problem as fishery education must be a continuing topic of discussion among a broad spectrum of U.S. citizens and their representatives.

Actions to consider while building post-secondary commercial fishery education programs include:

1. Improving the image of fishing and seafood processing as acceptable career choices.
2. Sensitizing the kindergarten through twelfth grade (K-12) school population to fish and the fishing industry.
3. Encouraging use of a wide variety of seafood products among the U.S. population.
4. Developing an understanding among the present generation of fishermen and seafood processors of the needs and benefits of the programs.
5. Developing and/or recruiting, from foreign nations, sufficient faculty to staff new college/university programs.
6. Achieving consensus on curriculum for the new education and training efforts.

Short-Term Efforts

Increased upgrading of U.S. fishermen in technology, through National Marine Fisheries Service programs, Sea Grant Marine Advisory Service, college courses and short-courses sponsored by regional councils or others would have a beneficial impact. An implication of funding for such efforts would be the availability of experienced representatives of the industry who would bear the greatest share of actual teaching responsibility. Hugh O'Rourke cautions (personal communication) that many educational programs for present-day commercial fishermen fail because the fishermen do not have enough influence on program planning. He urges that future programs be built around the perceived needs of commercial fishermen. A categorization of vocational skills needed by present-day commercial fisheries personnel is presented in



Appendix B. Such listings should be used in formulating new programs. Expansion of the existing Marine Advisory Service to meet the demands for adult vocational training would require 50 additional agents and specialists at an estimated cost of \$2,250,000.

### Long-Term Efforts

Study Group members identified merit in planning for upgrading existing formal advanced educational programs, perhaps along the lines of the University of Rhode Island or Clatsop Community College models, where a majority of the graduates hold responsible positions on fishery vessels. A minimum of one associate degree program on each coast -- Atlantic, Gulf and Pacific -- needs to be created or upgraded.

No consensus was achieved as to the total desirable number of nor siting of such associate degree programs because local acceptance and support is such a dominating, yet unknown, factor. Further, the availability, in existing schools, of faculty to teach ancillary courses for the fishery program would bear on the total cost of the program as would the availability of existing classrooms and other facilities.

Stanley Sivertson (personal communication) favors availability of courses and workshops for those already in the industry as well as programs to properly prepare new entrants. However, he cautions that long-term programs should be sited in areas where there is both the potential for expanded commercial fisheries growth as well as availability of youth who desire training. For example, he feels that the present regulatory environment in the Great Lakes region favors sports fishermen. Therefore, long-term stock enhancement and other positive actions may be needed to improve the long-term outlook for commercial fisheries in some areas before educational programs can reach their full potential. Charles Burrows reports (personal communication) that many improvements are already being made in Great Lakes fish stocks and that a commercial potential does exist in some of the larger inland lakes. The closure or potential closure of certain Great Lakes fisheries due to pesticide or chemical contamination is a serious problem in the expansion of commercial fisheries which must be considered.

In addition to the educational efforts discussed earlier there also appears to be justification for the better training of fishermen through four-year under-graduate programs as well as the education of fishery specialists through new graduate programs. A minimum of two such schools or departments offering bachelor and post-graduate degrees should be established or upgraded: one on the Atlantic coast and one on the Pacific coast. As before, siting the advanced programs at existing universities would have the advantage of providing existing



faculty and facilities as support to the fishery effort. Hugh O'Rourke suggests (personal communication) that new programs should be sited in state institutions of higher education and their importance highlighted by offering state scholarships to a majority of the entering students.

It is envisioned that advanced programs will provide the underpinning for vertically integrated nationwide educational effort that also includes public awareness, vocational technical training and K-12 teacher training relating to the commercial fishing industry. The advanced degree schools could fill a leadership role in the evolutionary change of the commercial fishing industry.

As in the case of associate degree programs the total number of advanced degree programs desirable, or sustainable, depends largely on local initiatives which cannot now be predicted.

The Study Group recognized that a successful fishery education system should be flexible enough to provide access to education and training for those who wish to enter or reenter the system after periods of commercial activity.

#### Cost of Upgrading Associate Degree Programs

Facility and personnel costs for upgrading existing associate degree programs will be quite variable depending on many factors including the nature of existing facilities and construction costs at individual educational institutions. The University of Rhode Island A.A. program can be used as one example of the costs of upgrading. The U.R.I. program is now run in rented facilities and uses an average sized vessel. At present the programs serves 40 freshmen and 22 sophomores with a staff of 8. Projections of cost for an 80 percent increase in enrollment (to 110 students) have recently been made (G. Motte, personal communication).

##### Capital Costs

|                                                                                                            |                |
|------------------------------------------------------------------------------------------------------------|----------------|
| Replacement of existing training vessel with a completely outfitted 58-to-60 ft. multipurpose vessel ..... | \$ 700,000     |
| Classroom and research building fully equipped, 24,000 square feet floor space .....                       | 1,800,000      |
| Land cost for a five-acre site having 400 ft. shore frontage .....                                         | 1,000,000      |
| Dock of sufficient design .....                                                                            | <u>100,000</u> |
| Subtotal                                                                                                   | \$3,600,000    |



Annual Operating Costs

|                                                                                             |                |
|---------------------------------------------------------------------------------------------|----------------|
| Vessel maintenance, insurance, fuel .....                                                   | \$ 25,000      |
| Expendable supplies and equipment for classroom instruction .....                           | 100,000        |
| Salary for three faculty and two research associates 5 people at average \$20,000/year .... | 100,000        |
| Overhead on salary (55 percent including fringe benefits) .....                             | 55,000         |
| Student aid (fellowships, assistantships, stipends), 20 people at an average \$5,000/year . | <u>100,000</u> |
| Subtotal                                                                                    | \$380,000      |

Clatsop Community College, Astoria, Oregon, provides a West Coast comparison of capital and operating costs needed to expand associate degree programs. At present the commercial fishing option at the school enrolls a total of 24 students. Of these, 20 are freshmen and four are sophomores. The disparity between number of students in the first and second year of the program is primarily the result of students dropping out to enter full-time employment in the commercial fishing industry. This is a similar, but more extreme, example of the phenomenon of first to second year dropout rate seen in the University of Rhode Island program.

At present the Clatsop Community College employs three instructors and one boat operator to serve the needs of both the 24 students in the Commercial Fishing option as well as the 24 students in the Marine Technology option. For a 70 percent increase, to 40 students, in the Commercial Fishing option the following capital and operating expenses are anticipated (D. Phillips, personal communication):

Capital Costs

|                                                                                                             |                            |
|-------------------------------------------------------------------------------------------------------------|----------------------------|
| Replacement of existing training vessel with a completely outfitted 70- to 75-ft. multipurpose vessel ..... | \$ 750,000<br>to 1,000,000 |
| Classroom and research building, fully equipped, 12,000 square feet floor space .....                       | 600,000                    |
| Land and dock .....                                                                                         | <u>- 0 -</u>               |
| Subtotal \$1,350,000 to                                                                                     | \$1,600,000                |



Annual Operating Costs

|                                                                                                                                                        |               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Vessel maintenance, insurance, fuel .....                                                                                                              | \$15,000      |
| Expendable supplies and equipment for classroom institution (Supplemented by industry contribution of new or repairable nets and other equipment ..... | 10,000        |
| Salary for one additional faculty member .....                                                                                                         | 20,000        |
| Overhead on salary (50 percent including fringe benefits) .....                                                                                        | 10,000        |
| Student aid (fellowships, assistantships, stipends) for 10 people at an average \$4,000/student .....                                                  | <u>40,000</u> |
| Subtotal                                                                                                                                               | \$95,000      |

For initiating or upgrading three associate degree programs in schools like the University of Rhode Island, or Clatsop Community College, one on each coast, the total expenditure projects to approximately \$8,000,000 capital costs and approximately \$700,000 annual operating costs. Naturally, such programs sited in existing facilities would require significantly less capital expenditure. This might mean as little as \$3,000,000 total capital expenditure if such existing facilities were found. However, operating expenses would still be as projected for the University of Rhode Island and Clatsop Community College examples. Nothing in the foregoing discussion should be construed as an endorsement of funding for either of the institutions mentioned.

Cost of Instituting Bachelor and Post-Bachelor Programs

Because no bachelor or post-bachelor programs in commercial fisheries (of the type discussed in this report) exist in the United States it is difficult to project costs. In fact, adequate associate degree programs might provide most of the facilities and faculty needed for higher degree programs. This would be practical only where both the associate and higher degree programs are part of the same institution such as the University of Rhode Island which is somewhat unique in this report. But, the collaboration might be possible where an associate degree institution is in proximity to a major university which has an interest in fishery education.

For example, at the University of Rhode Island, approximately 40 baccalaureate students could be accommodated with an increase in essentially only the operating costs.



However, it is considered highly desirable to construct a research and training flume, at one of the bachelor's and higher level institutions similar to that built by the White Fish Authority in Great Britain. Its costs are approximately:

Capital costs

|                                            |                  |
|--------------------------------------------|------------------|
| Land Acquisition (minimum 1.5 acres) ..... | \$ 100,000       |
| Building and Equipment .....               | <u>3,000,000</u> |
| Subtotal                                   | \$3,100,000      |

Operating Costs

|                                                                                |                 |
|--------------------------------------------------------------------------------|-----------------|
| Flume operation and maintenance including technician salary and overhead ..... | <u>\$25,000</u> |
| Subtotal                                                                       | \$25,000        |

Also needed in the United States is a fishery electronics research and demonstration facility which might be located at the second institution of higher education. The cost should be roughly equal to the total for the research and training flume.

Funding Sources

Because relatively few associate and baccalaureate degree programs will serve the needs of large regions, a host state might be reluctant to invest in creating or upgrading such a program. For instance, if the associate degree program at the University of Rhode Island were upgraded to serve a larger constituency (regional or entire East Coast) it seems highly unlikely that any of the capital cost or much of the operating cost would be absorbed by the State of Rhode Island. (G. Motte, personal communication). Federal funds would be the dominant initial stimulant.



## Chapter VI

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In 1977 U.S. fishery product exports reached a record value of \$520.5 million. At the same time, however, imports of fish products also reached a record value of \$2.621 billion. Such a balance-of-trade deficit reflects a long-standing trend that may continue in spite of opportunities for increased harvest by U.S. commercial fishermen in the recently designated fishery conservation zone.

Would increased emphasis on U.S. fishery educational programs facilitate increased productivity of the U.S. fishing industry? What types of programs are needed and what should be their geographic location? What are the anticipated costs of the programs? To answer such questions the National Sea Grant College Program initiated a study in mid-1978. Representatives of the commercial fishing industry, educational institutions and the Federal government met on several occasions to pool their expertise on the educational needs of the U.S. fishermen - the first such national study of the educational needs of commercial fishermen and fishery specialists. Recent studies, related to implications of the establishment of a U.S. Fishery Conservation Zone, focused on alternative issues such as stock replenishment, non-traditional (underutilized) species, increased catch efficiency and consumer education.

The U.S. is a relatively late entrant into the effort to train commercial fishermen. Therefore, a brief survey of foreign educational programs was undertaken to identify their strengths and weaknesses. Personal knowledge possessed by Study Group members and reference materials yielded information on programs in the Soviet Union, Japan, Great Britain, Norway, Taiwan and Iceland. In at least two of those countries there is some effort to introduce information about fishing and fishing industry careers into the pre-college educational system.

Secondary-school programs provide a basic vocational training for youths who enter commercial fishing in such successful fishing nations as the Soviet Union and Japan. In the early to mid-1970s each of those nations had about 60,000 students in secondary-school fishery programs. In spite of their political and ideological differences, those nations share a desire to use fish products as a substitute for beef and other animal protein.

In general, foreign nations with successful fishery industries also have schools which offer the equivalent of associate, bachelor, master and doctoral programs to train higher level workers and researchers. Extension-type programs and



correspondence courses are common in foreign programs to train or retrain fisheries industry personnel.

Foreign nations have not discovered any unique pedagogical approaches to the education of fishermen or seafood processors. However, availability of technology training aids, modernity of fishing-school vessels and equipment and high admission standards for many of the programs are elements that might well be envied by U.S. fishery educators.

Is the efficacy of the foreign training programs measurable in terms of productivity? One of the few available measures of productivity is controversial. It relates weight of a nation's total catch to the "gross register tonnage" of its fishing vessels. By this measure both the Soviet Union and Japan are less productive than the U.S. and significantly less productive than Norway. However, this analysis compares two "distant waters" fishing nations (including catching and processing vessels) with two "close to home" fishing nations. Obviously, then, the fishery education system, highly structured in the Soviet Union, Japan, and Norway, cannot be evaluated by such a measure of fishing productivity. In the future any measure of the effectiveness of an improved U.S. fishery education effort might be designed to take productivity into account as well as all of the values ascribed to education in a democracy.

The total U.S. effort directed toward a broad spectrum of fishery problems is relatively nascent. More secondary-school students in the U.S. are being exposed to oceanography coursework. Such coursework, and related programs in earlier years, could provide a sensitization to fish and employment prospects in the fishing industry.

Existing extension-type workshops conducted by the Sea Grant Advisory Service, equipment manufacturers, fishing organizations and others provide opportunities to some in the industry to learn about new technology, regulations, etc. However, much improvement can be made in this area through revised scheduling procedures and expansion of these programs. This would require the addition of 50 advisory service agents and specialists at an annual cost of \$2,250,000.

Well-recognized associate degree programs to help train fishermen exist at several U.S. institutions. The need for trained fishermen might be assessed by the fact that 50 percent or more of the students find employment before graduation from associate degree programs. However, the ultimate success of such programs is revealed by the fact that 49 percent of graduates from the University of Rhode Island program had become first mate, captain or captain/owner of a fishing vessel after a mean of only two and one-third years on the job.



Study Group members consider an expansion and upgrading of associate degree programs to be a necessity. Because the programs generally operate in rented or inadequate facilities, with less than optimal number and kind of technological devices and with marginal training vessels, the initial capital cost of expansion and upgrading is high. The ultimate number of sustainable associate degree programs must be determined by the marketplace, state and regional commitment to programs and the body of operational knowledge that accumulates from the programs. Nevertheless, an initial effort to provide for at least one new or upgraded associate degree program on each of the three coasts is considered desirable. Based on an average cost, drawn from the University of Rhode Island and Clatsop Community College programs such an initiative at three schools suggests a one-time expenditure of \$8 million and associated annual operating expenses of \$0.7 million to provide full-time associate degree training for about an additional 50 students each year.

Realistically, it could not be expected that state funds would be available for programs that serve needs of fishermen and trainees from a broad geographic region. Federal funds will be needed to stimulate and support these educational programs. Many foreign nations might be inclined to send their students to new or upgraded U.S. fishery education programs. Such students would bring foreign exchange credits that could reduce the cost of the programs.

At present, with the exception of a relatively small effort in seafood technology, there are no bachelor or more advanced fishing industry education programs in operation in the United States of the type described in this report. The Study Group expressed enthusiasm for initiation of such programs to train management personnel, produce Ph.D. level fishing industry researchers and develop sorely needed knowledgeable national representatives of the industry.

Because of differences in the available catch and fishing conditions at least two advanced-level institutions are considered necessary: one on the Atlantic Ocean Coast and one on the Pacific Ocean Coast.

Cost of the advanced programs would be minimal if the programs were operated at, or in proximity to, institutions of higher education that housed the newly conceived associate degree programs. A flume for net demonstration and research purposes should be constructed at one of the higher-level institutions. The flume design would be an updated version of that in operation by the White Fish Authority at Hull, England. The second higher-level institution should have a research and demonstration facility for fishing industry electronics.

Optimally these formal educational programs would be flexible enough and integrated in such a way that an individual



could progress through the various levels with little administrative difficulty. This could occur directly or through reentry after periods of commercial activity.

In the opinion of the Study Group, the enlightened self-interest of the United States government suggests both an opportunity and an obligation to improve the state of educational programs for commercial fishermen, fishery researchers and industry representatives.



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APPENDIX A  
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APPENDIX B

VOCATIONAL SKILLS NEEDED BY COMMERCIAL FISHERY PERSONNEL

BY

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NARRATIVE

## I. Current Needs

The American fisherman is involved in a complex, somewhat unique industry. Formal education and training to prepare individuals for the harvesting and processing aspects of the industry are limited. Historically, training has been on-the-job on a family boat. In changing times, however, sons are no longer staying with the family boat and outsiders are seeking entrance into the industry.

The commercial fisherman needs specific skill training in five major areas:

1. Fishing gear methods to include design, construction, maintenance, repair, and application to the various fisheries.
2. Marine engineering to include diesel engines, marine electrical systems, marine electronic instruments, marine refrigeration and hydraulics.
3. Navigation and seamanship to include marlin spike seamanship, boat handling, Rules of the Road, piloting, celestial navigation and electronic navigational instruments.
4. Related skills to include fisheries oceanography, commercial fishing business management and economic skills and food preparation and storage aboard commercial boats.
5. Upgrade training and continuing education for those already in the industry.

There are perhaps three major areas where the commercial fishermen needs intellectual training:

1. Oral and Written communications
2. Basic Mathematics, including algebra and applied trigonometry
3. Social skills to include an understanding of humanities, social sciences and behavioral sciences

## II. Future Needs

In the future commercial fishermen and processors will need to develop higher levels of sophistication with respect to technology and dealing with the general public. Educational



programs will need to focus not only on specific practical skills, but such things as management, marketing, administration and applied research. The modern fisherman will also need the skills to diversify into any and all related industries. This will require a new comprehensive approach to educating fishermen.

### OUTLINE

#### I. Current Needs

##### A. Sources of Trained Fishermen

1. Family Fishing Enterprise - O.J.T. (on-the-job training)
2. Self-taught fishermen and those receiving primary formal knowledge through Sea Grant Marine Advisory Program-type activities
3. High school programs
4. Post-secondary programs, such as U.R.I., Clatsop Community College, etc.
5. Unspecified sources

##### B. Methodology for Identifying Intellectual and Practical Skill Needs

1. Competency-based task analysis
2. Surveys and inventories
3. Time-motion studies
4. Request for assistance as initiated by the commercial fishing industry
5. Request for assistance by fisheries, educators

##### C. Practical Skills

1. Fishing gear methodology
  - a. Net construction, maintenance and repair, including gillnet, otter trawl and shrimp
  - b. Proper techniques of employing nets, including mid-water trawls
  - c. Construction, repair and maintenance of crab pots



- d. Proper techniques of employing pots
  - e. Construction, maintenance, repair and proper techniques of employing troll gear (both salmon and tuna)
  - f. Construction, maintenance, repair and proper techniques of employing long line gear
2. Marine Engineering
- a. Diesel and gasoline (limited) engine operation and maintenance. Sufficient knowledge for troubleshooting and emergency repair
  - b. Marine Electricity - Basic AC and DC theory, including application to starting motors, generators, alternators, regulators, VOM, electrolysis
  - c. Marine Electronics - Basics of electronic aids such as Loran, X-Y plotter, ADF, Sonar, depth finders, VHF radio, AM radio and radar, including use in locating and harvesting fish as well as emergency repairs at sea to electronic equipment
  - d. Marine Refrigeration Systems - icing, chillers, brine and spray and sharp freezing. Analysis of systems with basic skills in maintaining and troubleshooting mechanical systems
  - e. Hydraulics - basic theory, operation and maintenance of hydraulic systems as found on commercial fishing boats
3. Mariner Skills
- a. Navigation to include basic fundamentals of celestial navigation, operation of fathometers, Loran, radios, radar, direction finders and Sonar
  - b. Basic boat handling, knotting, splicing, rigging, safety and water survival
  - c. Application and intention of U.S. Coast Guard Rules-of-the-Road
  - d. Boat maintenance and repair to include oxy-acetylene and electric arc welding



proficiency. Almost equal emphasis to repair and maintenance of wood, steel and fiberglass vessels

#### 4. Other Related Skills

- a. Commercial Fishing oceanography to include study of water temperatures, currents, salinity and food sources in relation to fish migration and habits. Also fish identification and life cycles
- b. Commercial Fishing Business Management to include a review of current and proposed laws and regulations regarding the industry; organization, operation, importance and interrelationships of fisherman's unions, cooperatives, associations, etc.; Basic economics including how prices are established, record keeping, settlements, cost and profit analysis, insurance and taxes
- c. Marine Food Preparation and Storage - selection of basic four nutrients for well balanced diets that can be prepared economically and efficiently at sea. Basic techniques of preparing palatable meals (ed. note: a very critical knowledge and skill level for the entry level deck hand in our area)

#### D. Intellectual Skill Needs as Identified in N.W. Oregon and S.W. Washington

1. Communications to include basic fundamentals of written and oral communications
2. Mathematics to include basic intermediate college algebra, applied geometry and trigonometry
3. Social skills to include basic psychology, humans relations in business and sociology
4. Other skills such as Advanced First Aid with CPR and job preparation and search techniques

#### II. Future Needs

- A. Practical Skill Needs - The basic "current" methods will continue to provide the foundation at least in the Pacific Northwest. Education will, as a minimum, coincide with technological development



- B. Intellectual Skills - The fisherman will become a more sophisticated businessman. Hence, he/she will need additional training in small business management, administration and marketing techniques. This training can be provided within existing institutions.



APPENDIX C  
FISHERY EDUCATION IN JAPAN

BY

John P. Doyle

Marine Advisory Program

University of Alaska

October, 1978 (Revision)



In 1964 George Borgstrom wrote "the enormous Japanese expansion in fisheries could not have been launched without a broad educational program on all levels." This statement remained true until 1976 when the Japanese world expansion of fishing effort was blocked by the "200-mile limit shock." During the period of 1964-1974 formal and informal educational programs played an ever increasing role in all of Japan's fisheries. The fisheries educational system has impinged on all segments of the fishing industry, from the management of the largest fishing companies to the master of a catcher processing ship or the fisherman operating a 20-foot dory with a 10 hp outboard motor.

In Japan fishery education can start as early as middle school (junior high) with elective courses, and continue through a Doctorate in Fishing Science. Education is considered to be a lifelong process. There are two programs that fulfill that need: (i.e., fishermen's training facilities) the propaganda (extension) section of the Japan fisheries agencies and the propaganda section of each prefectural fisheries department.

The universities provide the central basis for fisheries education and development in Japan. They provide the technical and professional personnel that do the research; manage the resources; train people; and operate the larger fishing vessels. Without the fisheries faculties the fisheries would not operate at any competitive level of efficiency. There are 16 universities in Japan that have fisheries faculties (colleges) or fisheries departments within faculties of agriculture or oceans. Four of these are private universities the remainder are national universities under the Ministry of Education. In addition there are two universities of fisheries: Tokyo University of Fisheries under the Ministry of Education; and College of Fisheries of the Ministry of Agriculture and Forestry. These schools accept a maximum of 1705 students per year. A list of Japanese universities offering fisheries courses, including major subjects, is given in an attachment to this Appendix.

The organization of the Japanese national universities is similar to that found in Europe. The central element is the Chair. Each Chair is composed of a professor, an associate professor, and one or two research associates which are the equivalent of assistant professors or instructors in the American system.

The Chairs are loosely organized into Departments, which are a part of the Faculty or College, under a dean elected by the professors in the Faculty. Each Chair is a fiefdom unto itself and has its own laboratory. After completing the first two years of a basic course, common to all students in the university, a student joins a Laboratory. Although the student takes classes from other professors, most of his guidance and training comes



from within his chosen laboratory. In graduate school the student is even more closely tied to this laboratory and will take only a few lectures or seminars outside of his laboratory. This system produces excellent, highly trained scientists.

I think it is necessary to discuss two university programs in some depth. These are the University of Hokkaido Faculty of Fisheries and the University of Tokyo Department of Fisheries, Faculty of Agriculture. The program descriptions are attached to this Appendix. The objectives of the Faculty of Fisheries, University of Hokkaido, are to produce leaders for the fishing and fish processing industry, government fisheries management agencies, fish and food processing corporations, fisheries research scientists and educators. The Fisheries Department, Tokyo University states, "this Department lays greater stress on the fundamental sciences than on the technical aspects of the subject."

The University of Hokkaido Faculty of Fisheries has a teaching and research faculty of 114 members. This includes 30 professors, 30 assistant professors and 65 research technicians. Two hundred and fifteen undergraduate students are accepted each year and from 5 to 20 graduate students may be accepted. The Department of Fishing Science accepts 80 students per year. These students can enter either the course Science of Fishing Grounds or a course of Fishing Technology. There are 11 chairs in this department which, in effect, means there are 11 separate subject laboratories or 11 different courses of study. When a student enters a laboratory most of his elective subjects will be taken from the professor in that laboratory. Students taking the fishing course must spend a 5th year on board one of the training vessels. The primary objectives of the T/V Oshoro Maru is training cadets; however, there is a scientist on each cruise. The captain on each of the training ships holds a professorship and normally has a doctor's degree in Fishing Science or Fisheries Oceanography. During the 1978 Bering Sea cruise of the T/V Oshoro Maru there were 15 cadets, two scientists and a student.

Although Japan is anticipating a significant cutback in their high seas operation within the 200 mile foreign fishing limits, the University of Hokkaido is of the opinion that there will be a need for the Fishing Science course to continue for a number of years. (Personal comment, Capt. T. Fujii, T/V Oshoro Maru, 1978).

The faculty members of the University of Hokkaido do anticipate an increased emphasis in the area of fish culture to further the development of the nearshore fisheries. This will necessitate an increase in the number of chairs in the Department of Biology and Aquaculture. At present there are 7 chairs within this Department. Students in the Laboratories of Marine Botany,



Freshwater Fish Culture, and Marine Fish Culture would normally enter an applied field industry or fisheries experiment station. Students from the other laboratories would be more likely to enter a more basic research facility or management agency. At present this Department enrolls 40 students per year and attracts about 40 percent of the graduate students of the entire faculty of fisheries.

In the area of food technology, the faculty has two departments: the Department of Food Science and Technology, and the Department of Fisheries Chemistry. Both have five chairs. With the exception of Marine Chemistry and Analytical Chemistry, both departments are food industry oriented. These latter two should be considered as chairs of chemical oceanography.

The University of Hokkaido Faculty of Fisheries has a broad range of programs that have assisted Japan's fishing industry in all facets of its development. This assistance has been recognized by the fishing industry in a tangible way. The industry has provided funds for the establishment of the Institute of North Pacific Fisheries Research and the Hokkaido Federation of Fisheries Cooperatives provides two manned research vessels on a permanent basis for use by the Institute.

Training vessels are common to all universities with a major fisheries program. Institutions such as the University of Hokkaido, Tokyo University of Fisheries, Kagoshima University and Tokai University have several vessels with at least one vessel over 1000 gross tons. The primary function of these vessels is to train sea-going fishermen. Research is a secondary objective.

The stress on understanding the fishing industry pervades all fisheries programs regardless of their stated goals. The curriculum of the Department of Fisheries of Tokyo University is a case in point. As mentioned above, this department "lays greater emphasis on the fundamental sciences." A quick glance at the curriculum (Attachment) shows fishing methods and gear and technology of marine products are required subjects of all students. Elective subjects include navigation and seamanship, fishing boats, fishing mechanics, seafood production, etc.

At present few fisheries students studying for a Bachelor's Degree in the United States study any of the following: fishing gear, seamanship, navigation, fisheries oceanography, fishing grounds, behavior of fish schools, or naval architecture of fishing boats. Yet in Japan it is possible to major or even receive a Doctor's Degree in any one of those subjects so necessary to a successful fishing industry.

Research is an important function of all fisheries departments be it fishing gear or oceanography. All students must complete a graduation thesis based on their own research



findings. This is considered important if the department is to be on the leading edge of change. It is also important that the student be trained in the scientific method regardless if he is to be a fishing captain or a university professor. This must be considered in any fisheries training program.

#### FISHERIES HIGH SCHOOLS

In many countries fisheries high schools are depended upon to provide the trained personnel and to provide leadership in developing the fishing industry. Japan has an extensive fisheries high school system. In Japan, only nine years of school is compulsory. High school is defined as grades 10 through 12 and is entered by competitive examination. In 1973, Japan had 37 fisheries high schools and 15 high schools with a course in fisheries. These schools are all under the education department of the prefecture. Course content is defined by the prefectures under legal and administrative guidelines set by the Minister of Education of Japan.

All 54 high schools have a fishing course; 49 have a course in fish processing; 33 a course in engineering, 26 in radio communication, 12 in aquaculture and 2 in fisheries management. In 1974 there were 19,172 students enrolled in fisheries high schools. In the same year 6,132 graduated. Of the graduates, 4,783 were employed in the fishing or allied industry, 900 continued on to higher education, 449 went to other industries. Graduates of fisheries high schools are expected to be leaders in the field (Tezuka, 1975). A fisheries high school course is expected to be a terminal degree but, due to a steady increase in academic standards, there is an increased number of students continuing on to the university.

Each high school has its own training vessel. The largest vessel is 550 tons, the average is 320 tons and the smallest is 11 tons. Those schools emphasizing aquaculture would have one or two training vessels in the 15 to 20 ton class. It is evident that each of the high schools that specialize in fishing technology has ocean going vessels larger than 299 tons, which would exceed the size of 99% of the U.S. fishing fleet. During fishing classes training on board is the most important part of the course. Without having this practice students cannot obtain a technical marine license and cannot become the executive of the fishing crew, i.e. bosun. These vessels all fish on a commercial basis. For example, the Hakodate Fisheries High School has a training vessel of 500 tons. This vessel makes training cruises to the Bering Sea and Gulf of Alaska every year, fishing crab, salmon and herring and trawling for bottomfish. This vessel normally returns about 90% of its operating expenses, including licensed crew and two instructors. The primary reason for fishing on a commercial basis is not to recover costs but to provide realistic training and to develop the "competitive



nature' of the student which is so necessary for successful fishing (Tezuka, 1975). This is an important point to be considered for any U.S. Fisheries training program.

Fisheries high schools, or any schools for that matter, are not allowed to happen on a haphazard basis but are the product of recognized local, regional and prefectural need. The Oshima District in Southern Hokkaido is a good example. Prior to 1970 this district had 3 fisheries high schools. The Hakodate school trained people for the highsea fishing fleet and in their fish processing factory for the fish processing industry.

The school on the eastern side of the district specialized in fish culture and the production of seed. Their primary production is in Laminaria, Undaria, Porphyra, sea urchin and scallop. These are the primary fisheries in that part of the district. The school in the western district bordered on the Japan Sea where oceanographic conditions are not conducive to aquaculture but there is an active inshore fishery (i.e., out to 200 miles). Naturally, this school's major course is Fishing Technology.

An area in the southeast part of the district had a specific problem. It was directly in the normal typhoon path on an open coast. The sea state was further confused by an opposing current. Also the beaches that existed in the area were composed of shifting sand and did not provide a suitable substrate for bottom organisms or kelp. The biological productivity of the area was very high and a highly productive aquaculture industry existed on each side of the area. The communities of the area prevailed upon the prefectural government to approve a fishery high school for the area. The goal of the school was to develop the technology for aquaculture in that area and train fisherman to practice that technology. By 1973 the technology for culture of Laminaria had been developed and 110 students were enrolled. By 1976 the technology for culture of sea urchin seed and Undaria had been developed and a factory for processing Laminaria into Konbu in operation. In 1977 the products of the school's aquaculture paid for the entire operation of the school and returned \$60,000 to the prefecture. The developers of a fisheries educational systems must define the problems to be solved and set the goals of the institution to solve the problem.

#### CONCLUSION

I can think of no more suitable conclusion than the words of Mr. Takio Tezuka, Chief of the Research Division of the National Federation of Fisheries Cooperative of Japan: "Excellent technique cannot be effectively worked without capable users."



ATTACHMENT  
PUBLIC AND PRIVATE UNIVERSITIES IN JAPAN  
OFFERING FISHERIES PROGRAMS

| <u>National (Public) Universities</u>                          | <u>Fisheries Program Areas</u>                         |
|----------------------------------------------------------------|--------------------------------------------------------|
| Hiroshima                                                      | general                                                |
| Hokkaido                                                       | foods, culture, chemistry,<br>teaching                 |
| Kagawa                                                         | foods                                                  |
| Kagoshima                                                      | general                                                |
| Kochi                                                          | aquaculture                                            |
| Kyoto                                                          | general                                                |
| Kyushu                                                         | general                                                |
| Mie                                                            | general                                                |
| Ministry of Agriculture and<br>Forestry - College of Fisheries | general                                                |
| Miyazaki                                                       | culture                                                |
| Nagasaki                                                       | general                                                |
| Tohoku                                                         | general                                                |
| Tokyo                                                          | general                                                |
| Tokyo University of Fisheries                                  | foods, culture, teaching,<br>oceanographic environment |
| <u>Private Universities</u>                                    |                                                        |
| Kinki                                                          | general                                                |
| Kitazato                                                       | foods, culture                                         |
| Nippon                                                         | general                                                |
| Tokai                                                          | general                                                |



## ATTACHMENT

## FISHERIES PROGRAMS, HOKKAIDO UNIVERSITY, SAPPORO JAPAN

## Faculty of Fisheries

"The faculty of Fisheries is a successor to the School of Fishery established in Sapporo in February 1907 as an attached school to the Sapporo Agricultural College. In 1935 the school moved to Hakodate and became an independent school under the name of Hakodate College of Fisheries. In 1949 Hakodate College of Fisheries and the Department of Fisheries in the Faculty of Agriculture, Hokkaido University in Sapporo, were combined to establish the Faculty of Fisheries, Hokkaido University, in Hakodate. The Faculty is now composed of four departments with 28 chairs. The Research Institute of North Pacific Fisheries, two training ships, three field stations, and a practice factory on campus belong to the Faculty."

Department of Fishing Science and Technology

## Chairs

Applied Ecology for Fishing Ground

Biology of Fish Population

Oceanography and Meteorology

Fishing Navigation

Operation Technology of Fishing

Fishing Gear Engineering

Mechanical Engineering for Fishing

Instrument Engineering for Fishing

Engineering of Fishing Boat

Fishing Boat Seamanship

Fisheries Business Economics



Department of Food Science and Technology

## Chairs

Food Chemistry

Biochemistry

Microbiology

Marine Food Technology

Department of Fisheries Chemistry

## Chairs

Polymer Chemistry of Marine Products

Chemistry of Fish Oil

Marine Chemistry

Analytical Chemistry

Chemical Engineering



## ATTACHMENT

FISHERIES PROGRAMS OF THE FACULTY OF AGRICULTURE,  
THE UNIVERSITY OF TOKYO

## Department of Fisheries

The chief characteristic of this department is that while other departments of the Faculty of Agriculture have as their object the production of plants and animals on land, this department is concerned with their production in the seas and inland waters, i.e., the hydrosphere.

The educational system of this department lays greater stress on the fundamental sciences than on the technical aspects of the subject. In the third year, students receive instruction in a broad range of general and basic fisheries sciences. Then in the fourth year, under the guidance of a professor, they begin research on a subject in order to write a graduation thesis. During this period they receive instruction in a specialized field. In these two years, during the summer, winter, and spring vacations, they also carry out various field works for a total period of one month at both the marine biological station in Kanagawa Prefecture, an attached facility of the Faculty of Science and the fisheries laboratory in Aichi Prefecture, an attached facility of the Faculty of Agriculture.

Furthermore, those students who so desire can make use of their summer vacations to undergo practical fisheries training in companies, factories, fisheries research institutes, and on research vessels. Every autumn a week's educational tour is also arranged.

This department has six laboratories, which are specialized respectively in fisheries biology, aquaculture, technology of marine products, fish physiology, fisheries oceanography and marine biochemistry. The teaching staff consists of six professors and six associate professors."

## Required Courses:

Physics I

Organic Chemistry I

Biological Chemistry I

Outline of Fisheries

Aquatic Invertebrates



Aquatic Vertebrates  
 Anatomy of Aquatic Animals  
 Physiology of Aquatic Animals  
 Aquatic Botany  
 Fisheries Microbiology  
 General Biology of Fisheries  
 Oceanography  
 Water Quality  
 Fish Population and Conservation  
 Fishing Methods and Gear  
 Aquiculture  
 Biochemistry of Aquatic Organisms  
 Technology of Marine Products  
 Laws of Fisheries  
 Experiments in Fisheries Zoology I  
 Experiments in Fisheries Zoology II  
 Experiments in Fisheries Zoology III  
 Experiments in Aquatic Botany  
 Experiments in Fisheries Microbiology  
 Experiments in Fisheries Oceanography  
 Experiments in Fisheries Chemistry I  
 Field Works in Fisheries Sciences  
 Graduation Thesis



APPENDIX D  
FISHERY EDUCATION IN NORWAY

BY

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Marine Advisory Program  
University of Alaska  
July 13, 1978



Fishery education in Norway has experienced a great deal of change over the last few years. Originally the emphasis was on vocational schools specifically designed for the fishing industry. The vocational schools have now been partly replaced by an integrated fishery program in the regular secondary school system. Moreover, the national educational policy is now geared towards providing the students with a practical background applicable to the fishing industry and at the same time provide an adequate scholastic background to enter universities.

Norwegian fishery education can be categorized as follows:

1. Fishery education in primary and secondary schools
2. Special vocational schools
3. Universities and technical schools
4. Continuous (adult) educational programs

#### Primary and Secondary Schools

On the primary level, fishery and marine subjects are part of the elective courses the students may choose. On the secondary level, the students may elect two separate majors in fishery education: Fishing Technology and Seafood Processing.

#### Vocational Schools

##### a) Fishing Technology

This is a one-year course based on nine years of primary and secondary schooling and prepares the students for the "Second Class Coast Shipper" exams. If the students (17-18 years old) pass the exams, the certificate is not written out until the students have 26 months of vessel experience and have passed the age of 21. This particular course is now given at four schools in Norway. It was first given in 1973-74 and has been well received.

If the students want to further pursue their education in fishing technology the traditional course for fishing skippers at the fishery vocational school is still available. This one-year course prepares the students for "First Class Fishing Skipper" certificates. At present there are five vocational schools with this curriculum in Norway. The course itself may be used as a prerequisite for students who will pursue a general maritime education.

In addition to the one-year course in fishing technology, these vocational schools also offer courses in engineering (engine) and galley cooking.



### b) Seafood Processing

Education in this area is also offered at two schools as a 10th year in addition to the compulsory primary and secondary education. An attempt is presently being made to solicit support from the processing industry in providing the students with employment seniority based on their education.

In addition to this one year, vocational training and additional courses are offered at the seafood processing school in Vard. There is only one of these processing schools in Norway.

Other vocational schools for the fishing industry train students at the Norwegian Cannery School, and the Federal School for Food Science.

### Universities and Technical Schools

The Norwegian Fishery University was established in 1972 as an umbrella institution for fishery education at the Universities of Tromsø, Bergen, Oslo, and Trondheim. The University of Tromsø has a broad spectrum of fishery related studies, including: fishery biology, fishery economics, seafood technology and political organization. The graduates receive the title of Fishery Candidates.

The Universities of Bergen and Oslo, Norwegian Technical University (at Trondheim) and the Norwegian School of Business Administration (at Bergen) provide graduate programs for their students in fishery biology and nutrition, seafood processing and fishery economy.

Bergen's Technical College provides, according to student demand, a one-year course in seafood processing. At present (1977) this course is not being taught due to lack of student interest.

With an education from the Norwegian Fishery University the student may obtain employment in educational and research institutions, private and public sector, extension service and numerous political and cooperative fishery organizations.

Norland Community College at Bodo offers the following courses related to fisheries:

1. The 2 1/2-year program emphasizes fishery economy, marine biology and seafood processing. Upon graduation, the students qualify for employment in the private and public sector of the fishing industry, fishery-cooperatives, political organizations and extension service.



2. The 1-year programs emphasizes fishery resource biology and the utilization of these resources.
3. Two courses of 1/2-year each emphasize fishery biology and marine resources and are offered for teachers in secondary schools.

The commonality of the fishery program at Nordland Community College is its vocational emphasis directed toward educational institutions and the fishing industry in general.

#### Continuing (Adult) Education

Continuing education is offered by the Directorate of Fishery in fishing gear, electronics, and navigation. Universities and other educational institutions are now also beginning to offer similar short courses, particularly within the framework of the secondary school system. This redirection, which has occurred over the last 4-5 years, will elevate the educational standard of the employees in the fishing industry.

#### ACKNOWLEDGEMENT

This paper was based on a recent white paper on Norwegian fisheries by B. Myklebust, Norwegian Department of Fisheries.



APPENDIX E

QUANTITATIVE MEASURE OF FISHING  
FLEET PRODUCTIVITY OF THE MAJOR FISHING NATIONS



There is no agreement on how to measure the productivity of a nation's fishing fleet because similar data bases are not available for each of the major fishing nations. Such a comparison was attempted by Kravanja (1976) who presents available data on productivity of the largest high seas fishing fleets for the year 1973. Part of these data are listed in accompanying table. Catch for the U.S.S.R and Japan do not include marine mammals, such as whales and seals, for which data are not available. Only vessels over 100 gross register tons are included in the compilations. Gross register tons is a standard volume measure, not vessel weight or displacement.

Attention is directed to the last column of the table which gives a measure of fishing fleet productivity for each country derived from dividing the live weight of its catch by the total gross register tons of its high seas fleet. By this measure, the Russian fleet is the least productive of the major fleets. Kravanja (1976) explains part of this relatively low productivity as attributable to the fact that more than half of the Russian fishery fleet tonnage is represented by support vessels.

Japan has a high seas fishing fleet of which 14 percent of its tonnage is in support vessels. Nevertheless, all other things being equal, the Japanese fleet is much more productive than the Russian fleet. Kravanja (1976) suggests that this difference in productivity is related primarily to the political systems of the two countries. That is, the central government role in setting quotas for Soviet fishermen may be contrasted with the profit motive of Japanese fishing corporations.

The table also reveals that, contrary to popular opinion, the United States fishing fleet appears to be very productive. The productivity listed for the U.S. fleet is larger than that for the Japanese fleet. However, because there are relatively few support vessels in the U.S. fleet, an adjustment for this factor would reverse the position of the two nations.

Highest in productivity is the Norwegian fishing fleet which operates in similar fashion in the U.S. fleet. Kravanja (1976) suggests that such productivity is most related to the modern and efficient vessels and gear used by Norwegian fishermen.

An obvious failing of the productivity measure used is its focus on catch rather than on some fish product. For example, some support vessels for the Soviet high seas fleet are factory ships that process most of the catch into items that can be taken from the dock directly to the marketplace. In contrast, much of the Japanese catch and essentially all of the U.S. and Norwegian catches are processed at shore facilities.

Another controversial measure incorporated into the data is reliance on vessels larger than 100 gross register tons to



defined size of the fishing fleet. The U.S. has relatively few vessels of that size and, therefore, a small offshore fishery fleet. However, the U.S. has an extensive coastal fishery fleet consisting of vessels under 100 gross register tons. Because the catch of such small vessels is accumulated in the total catch, given in table, the measure of U.S. productivity is highly skewed. It gives a falsely high rating of U.S. fishing productivity. Were it possible to measure total gross register tonnage of the entire U.S. fishing fleet its productivity would be significantly lower.

Size and Relative Productivity of Some of the World's  
Largest High Seas Fishery Fleets, 1973 (after Kravanja, 1976)

| <u>Country</u> | <u>Number<br/>of<br/>Vessels</u> | <u>Gross<br/>Register<br/>Tonnage<br/>(Millions)</u> | <u>Live Weight<br/>of Fisheries<br/>Catch-(Millions<br/>of Metric Tons)</u> | <u>Productivity*</u> |
|----------------|----------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------|----------------------|
| U.S.S.R        | 4,700                            | 6.50                                                 | 8.6                                                                         | 1.3                  |
| Japan          | 3,099                            | 1.51                                                 | 10.7                                                                        | 7.1                  |
| U.S.           | 1,577                            | 0.36                                                 | 2.7                                                                         | 7.6                  |
| Norway         | 604                              | 0.20                                                 | 3.0                                                                         | 14.8                 |

\* Productivity =  $\frac{\text{catch (millions of metric tons)}}{\text{gross register tonnage (millions)}}$



APPENDIX F  
SECONDARY SCHOOL, OCEANOGRAPHY COURSE  
ENROLLMENT IN THE UNITED STATES



A brief survey of oceanography course enrollment in the secondary schools of eight states was undertaken as part of the present study. As a first step, inquiries were sent to the selected members of the Council of State Science Supervisors, Inc. (CSSS). The CSSS members were asked to supply information, for their states, about the kinds and amount of marine-related coursework given in high schools during the 1977-78 academic year. The responses are listed in the accompanying table where these data are compared with similar data obtained from a nationwide survey of public secondary school curriculum, for the 1972-73 school year, conducted by the Department of Health, Education and Welfare (DHEW). The DHEW data are based on teacher responses within the oceanography category of secondary school, natural science course offerings (Ostendorf and Horn, 1977). No other categories, relevant to this study, were surveyed by DHEW.

Most states do not have a mechanism for collecting and reporting detailed course and enrollment data on a continuing basis. Therefore, in any future survey it will be necessary to obtain information from local superintendents of schools, science coordinators, science chairpersons or other knowledgeable persons. However, if the present comparison data are representative of the nation then there were 1.47 times as many students enrolled in oceanography courses in 1977-78 than in 1972-73. Ostendorf (1976) reports that total U.S. oceanography enrollment in public secondary schools was 46,077 for the 1972-73 school year. Therefore, 1.47 times the 46,077 enrollment in 1972-73 suggests that total U.S. oceanography course enrollment has risen to 67,733 in 1977-78.

But the enrollment project may be too low. Knowledgeable professionals in the commercial publishing industry have suggested that oceanography and marine biology enrollment in all secondary schools in the nation for 1977-78 may actually total 150,000.

Regardless of questions that can be raised about the accuracy of enrollment data discussed above. There is no question that oceanography and marine biology are increasingly present as secondary school courses or as parts of other courses such as earth science.



Comparison of Department of Health, Education and Welfare (DHEW)  
 Survey of Secondary School Oceanography Courses for the  
 1972-73 School Year and the National Sea Grant College Program  
 Survey for the 1977-78 School Year

| <u>State</u>   | <u>Agency</u> | <u>Number of<br/>Schools</u> | <u>Number of<br/>Students</u> |
|----------------|---------------|------------------------------|-------------------------------|
| Delaware       | DHEW          | 3                            | 160                           |
|                | OSG           | 48                           | 995                           |
| Florida        | DHEW          | 30                           | 2,670                         |
|                | OSG           | 129                          | 12,385                        |
| Hawaii         | DHEW          | 2                            | 51                            |
|                | OSG           | 80                           | 2,096                         |
| Virginia       | DHEW          | 2                            | 178                           |
|                | OSG           | 18                           | 852                           |
| California     | DHEW          | *                            | 13,937                        |
|                | OSG           | *                            | 8,968                         |
| Iowa           | DHEW          | *                            | 165                           |
|                | OSG           | *                            | 45                            |
| North Carolina | DHEW          | *                            | 393                           |
|                | OSG           | *                            | 676                           |
| Rhode Island   | DHEW          | 2                            | 175                           |
|                | OSG           | 40-50                        | approx. 700                   |
| Total          |               |                              |                               |
|                | DHEW          |                              | 17,729                        |
|                | OSG           |                              | 26,017                        |

\* signifies that data are not available



Senator PELL. The record will be kept open for at least a couple of weeks so that any other members of the committee can submit questions, and I would like you to get your replies back to us within 2 weeks. It will be interesting to have both the administration's reply and the Sea Grant Association's reply.

[The following was received for the record:]



RESPONSE TO WRITTEN QUESTIONS ASKED BY  
THE COMMITTEE AT  
THE  
APRIL 25, 1980  
JOINT REAUTHORIZATION HEARINGS  
OF  
THE COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION  
AND  
THE SUBCOMMITTEE ON EDUCATION, ARTS AND HUMANITIES  
OF THE  
COMMITTEE ON LABOR AND HUMAN RESOURCES  
OF THE  
UNITED STATES SENATE

Prepared by:  
DR. ROBERT W. CORELL  
PRESIDENT, SEA GRANT ASSOCIATION



### I. Question on Matching Funds

With the exception of the National Needs and the International program, Sea Grant is a matching fund program, requiring sponsors to match each federal dollar with 50 cents of non-federal money. What are the most recent statistics on provision of matching funds by project and program sponsors?

Response:

Data collected from a cross-section of Sea Grant Programs throughout the United States indicates that non-federal matching funds provided by the programs always exceeds the one third matching requirement of the Sea Grant Act (\$0.50 non-federal support for each \$1.00 of federal funds). In conducting marine resources research, education, and advisory service programs, the nationwide average for non-federal match provided is consistently well above 38% (\$0.61 non-federal support for each \$1.00 of federal funds). Programs often report that "our match now exceeds the federal grant at a ratio of 1.1/1.0. Our legislature appropriates 50% of federal grant each year and our university provides about 60% of "in-kind" support and overhead contribution." The pattern appears to be one in which the documented non-federal match plus the "in-kind" support provided by Universities is approximately equal to the federal contribution. A detailed survey is being conducted by the Sea Grant Association for the years 1972-79, a preliminary report of which is being provided under separate cover.

### II. Question on Adequacy of Funding

Throughout the history of the Sea Grant Program, increases in both authorizations and appropriations for the Program have come at the initiative of the Congress. The Congress has never either authorized or appropriated less than requested by an Administration, and has on numerous occasions provided more money than requested. Even with this strong Congressional support, however, the funds for the program have barely kept pace with cost inflation. When inflation is taken into account, the Program has been essentially level-funded, in real dollars, since 1973--eight years.

What has been the impact on the program of this stringent funding? What has been the effect on the institutions participating in it?

Response:

The National Sea Grant College Program, after fourteen years of existence, is now a composite of established Sea Grant Colleges, relatively mature Institutional programs, and programs that are in earlier stages of development. The impact of an "essentially level-funded" program for the past six to eight years has been to place severe constraints on all aspects of the program and its development, which has these kinds of effects:

- a) The most serious consequence of the restrictive budgetary appropriations has been the erosion of the Sea Grant research component. The percentage of research within Sea Grant Programs has been consistently dropping throughout the network during the past six to eight years. In a two year period (1976-78), the percentage of federal funding to research in Sea Grant Programs has dropped by 11%, which when combined with the rate of inflation, results in a serious reduction in research efforts. Sea Grant Programs cannot effectively function without dynamic and creative research efforts.



A high priority within all programs is to bring into appropriate balance research programs and the other Sea Grant components. Because the costs of these components (education, advisory services, and management) are essentially fixed and inflation sensitive, research has absorbed the brunt of inflation and level funding realities, resulting in a reduction of research.

- b) Funding restrictions on the more mature programs has almost always limited funding to well below inflation and real costs. Therefore, the established programs with the capability of meeting the objectives set forth by Congress in the National Sea Grant College Program Act, are being seriously constrained and increasingly limited by what amounts to reduced "real" dollars for programs. As one Sea Grant Director states it, "impact on the program has been to severely curtail the development of the program to its full potential strength of 25 Sea Grant Colleges thus holding back the important contributions the system can make to the development and wise use of an important part of this nation's resources. The effect on the institutions participating in Sea Grant has been to severely restrict the growth which is so important in formative stages of new programs. In some cases, the funding limitations in the National Sea Grant Program have, in the face of relentless inflationary pressures, resulted in decreased levels of effort at some of the pioneering Sea Grant Institutions."
- c) The fact that Sea Grant appropriations have not followed growth needs and inflation pressures has had a profound impact on "developing" programs. The Director of the Minnesota Sea Grant Program summarizes the problem well. "Effective level funding is severely limiting for emerging programs like Minnesota. A 10% increase will neither beat inflationary costs nor fund a single viable research project. Thus, developing programs such as Ohio's and Minnesota's require two to three years of large increases (50 to 100%) to become viable. Limiting budgets restricts quality research, necessitates a minimal management team, and restricts the efforts of the extension program. Next year we propose increases in our state match by 100%; with level funding this effort to gain additional funds from our legislature would be futile."



### 3. Question on Sea Grant, Innovation and Technology Transfer

President Carter, in messages to the Congress, has placed a major emphasis on innovation and increased application of new technology as a way to increase productivity. It would seem to me that Sea Grant is an ideal tool to reach those objectives in ocean and marine-affairs areas. For some reason, however, the Sea Grant program, judging from budget proposals, has not been assigned a major role in increasing productivity in the marine field.

Why is this?

Response:

There are, undoubtedly, a number of reasons and views on this subject. Clearly, Sea Grant Programs are committed to those objectives through the entire range of their research, education and advisory service programs. We offer the following thoughts:

- a) It is our judgment that the Executive Branch, as expressed by the President's Budget proposals, does not understand the full capability of the resources and competencies within the Sea Grant network and within the faculty, professional staff and students of American universities. Increased productivity in marine fields is clearly in the national interest, and we believe Sea Grant has a substantial role to play.
- b) The U.S. Government patent, copyright and proprietary information policy, at least as it impacts Sea Grant, is not conducive to close partnerships between Sea Grant institutions and industry. Increased productivity in the economic sector of Marine businesses and industries can be substantially effected by increased collaborations between the academic community and industry. There are, however, major restraints on this cooperation imposed by U.S. Government policy. Dean Horn, Director of the MIT Sea Grant College Program, offered these suggestions on this topic at a recent U.S. House of Representatives hearing (February 21, 1980):

"Innovation and invention have been two of the economic strengths of the United States. It has been traditional that those who are willing to take the risks should share in the rewards. However, major obstacles to effective university-industry linkages and interaction include the issues of proprietary data and patent rights. Very properly, I believe, industry wants to protect its interests and investments, just as the federal government does so by the regulation requiring "royalty free use." However, because the patent assignment decision is not made until after the work is completed and there can be no preagreement or assurance of initial licensing priority or preference, industry will often not release valuable proprietary data or enter into a project with high market potential.



In such cases everyone loses - industry, university, government, and probably most of all, the economy."

"In an effort to attract more industry participation in Sea Grant and to promote the earliest utilization of project results, I strongly recommend that the Sea Grant College Program Act be amended to stipulate that all patents developed with Sea Grant support are to be assigned to the cognizant university grantee subject only to unlimited and royalty-free use by the U.S. government. In addition, any royalties resulting from commercial licensing agreements should be reapplied by the university Sea Grant Program to the direct support of Sea Grant project activities after the direct costs of patent processing have been recovered."

"The principal advantages of such a patent provision would be first, to foster closer university-industry interaction and matching support because agreements to license any resulting patents could be established at the project's beginning. Second, a clear patent policy would facilitate marketing and utilizing the research results at the earliest practicable time. Third, financial benefits from patents would be directed toward furthering the goals and objectives of Sea Grant while protecting the government's interests in the future as well as today. Fourth and most importantly, this action is in keeping with several other similar efforts and proposed or recommended legislation to liberalize federal control of patents to encourage better development and utilization of government sponsored research. The National Sea Grant College Program Act would once again demonstrate its foresight and leadership."

- c) Sea Grant Programs throughout the country are replete with examples of Sea Grant funded activities leading to increased projectivity. The report entitled The First Ten Years, published by the National Sea Grant Office in March 1979, outlines a number of examples of increased projectivity due to Sea Grant research and advisory service activities. Further, an analysis of issues related to innovation and technology transfer are discussed in:
  - 1) An Analysis of the Potential Commercial and Foreign Trade Impacts of the Sea Grant Program, by J. Herbert Hollomon, et al, Center for Policy Alternatives, MIT, Report No. CPA77-2, March 1977.
  - 2) Program Development Procedures and Transfer Mechanisms in the National Sea Grant Program, by J. Herbert Hollomon, et al, Center for Policy Alternatives, MIT, Report No. CPA77-10, November 1977.
- d) The examples listed under item 10 provide additional insight into ways Sea Grant is contributing to increased productivity in the marine section of the U.S. economy.



#### 4. Question about Priorities Between New Programs and Strengthening Existing Programs

Dr. Robert B. Abel, a Rhode Islander who was the first director of the National Sea Grant College Program, and who did an excellent job in guiding its growth through its first ten years, has submitted a statement for the Record of this hearing. In that statement, he expresses concern over a policy of giving priority to "quality" of programs over the objective of "institution building". Dr. Abel notes that this is a government-wide priority, and commends the Sea Grant program for its continued effort to establish a network of institutions. There is nevertheless a note of concern in Dr. Abel's statement, would you comment please on this question of priorities?

#### Response:

The Sea Grant community, including existing programs and the national office, is committed to and supportive of the development of a nation-wide network of Sea Grant Colleges. "Institution building" is essential to the establishment of such a network. There is, however, an apparent discrepancy between "institution building" and "quality", which is both real and imaginary. It is real because to develop a mature and experienced Sea Grant Program, investments must be made in the programs that have long-term (five to ten years) pay-offs, hence those investments are viewed as "institution building." The discrepancy is imaginary because the establishment of all Sea Grant programs requires that each step in the development process must be based upon "quality" effort. The expectations for research, education, and advisory service programs for an established program differ from those in a "developing" program only in that it takes time to develop mature programs. In short, it is only the time scale that differs between the established program (which are evaluated mainly on the quality of effort) and developing programs, (which are perceived to be evaluated both on "institutional building" criteria and on the quality of effort).

The National Sea Grant College programs must continue to support and demand high quality activities while also continuing to develop a full network of Sea Grant Colleges so that the nation's marine resources are wisely developed, conserved, and effectively managed.

#### 5. Question on Fisheries Education

In the course of the authorization hearings by these Committees in 1978, the Committees asked the Sea Grant program to conduct a study of fishery education and training in the United States, and to present a report on what could and should be done to improve fishery education. Senator Stevens of Alaska was particularly concerned about this effort.

That report has now been submitted to these Committees, and unless there is objection it will be included in the record of this hearing as an appendix.

I recognize that this report does not constitute a formal recommendation for action by the Administration, but is in the nature of a staff study. I am nevertheless impressed by the report. I think it demonstrates a need for additional assistance to improve fisheries education and training at all levels.



5. (cont.) Do you have any plans to follow up on this report through new priorities and efforts through the Sea Grant Program or through other NOAA programs?

How much flexibility do you have within the existing budget situation to allocate additional resources to fisheries education and training along the lines suggested in the report?

Response:

The Sea Grant Program is devoted to current and timely problem-oriented research and educational efforts arising from state, regional, and national marine resource problems and opportunities. The Sea Grant Association has identified as a primary emphasis for increased effort in FY81 and FY82, three major areas of effort, the first, to "expand research and related development programs to support the healthy evolution and development of the American fishing industry". The fisheries education and training report prepared by the Office of Sea Grant identifies important priorities essential to a viable American fishing industry. There are substantial interests in "fisheries education" within some sections of the Sea Grant network, but there is little flexibility within the current appropriations to implement new programs. The Sea Grant budget is simply too tight to include a program of the magnitude outlined in the Report. Existing education programs, carefully developed over the past three to five years, are devoted to several needful constituencies (e.g. K through 12 programs in public schools, continuing adult and professional education for clearly identified audiences, etc.). With these commitments and with current funding levels, it is not possible to focus new educational efforts on fishermen alone. The fishing community has legitimate needs for good educational programs, but their establishment will require new initiative funding. Further, any new programs in "fisheries education", will require deliberate and careful planning, because there are distinct differences in the needs of the industry, both geographically and within the infrastructure of the industry itself.

In FY79, the Office of Sea Grant (OSG) in its annual review of its activities, concluded, "the program in fisheries education, though limited, is providing two-year training options at two institutions on the East and West coasts, a specialized program to train veterinarians in Aquatic animal disease problems, and other special curricula for fisheries professionals". For FY79, OSG lists seven (7) fisheries education projects totaling \$224,000 in Sea Grant and \$291,000 in matching funds. The total of all other Sea Grant Projects in Education and Training for FY79 is reported by OSG to be \$2,884,917. Therefore, fisheries education efforts are a small component (7.8%) of our programs at this time.

In spite of these restrictive budgetary constraints, there are important new developments and plans for fisheries education, including a sophisticated training program for training professional fishermen (Captains) in European trawl technology, a plan to train undergraduate American Indian students in fisheries, and education programs to train fishermen in specialized new technologies such as "two-boat trawling" and Scottish seine fishing.



#### 6. Question on International Program

The Sea Grant Act requires close consultation on international projects with the State Department. How well has this consultation process worked?

The International Program during its first two years has been funded at a level of slightly less than \$1 million a year. In your view is this international effort sustainable and viable over a longer period of time at this level of funding, or is a greater priority required to provide a program with meaningful results?

Recognizing that there may not be immediate results from some of these international projects, how would you justify these expenditures to a taxpayer in Rhode Island, South Carolina or California?

#### Response:

The question regarding State Department consultation can best be answered by OSG.

The importance of this program to the U.S. is outlined in testimony before the Congress by the last two Deputy Assistant Secretaries of State for Oceans and Fisheries Affairs. Ambassador John D. Negroponte stated before the Senate Committee on Commerce, Science, and Transportation on April 7, 1978, "At the present time, some \$40 million of U.S. government-funded academic oceanographic research is conducted within 200 miles of foreign countries. I feel we need the good will which could be generated by the International Sea Grant Program. If the Program did not already exist, we would now have to establish one, as the U.S. must increasingly turn its attention to the problems of technical cooperation with the developing world."

The second question concerning funding level and viability is best answered in a report to the Sea Grant Association (SGA) by Dr. Nelson Marshall, of URI, Chairman of the SGA International Programs Committee, in which he states, "The international program is now minimal, i.e. about \$900,000 per year. Even so the few existing programs are an impressive mix demonstrating how the Sea Grant concept can be used in befriending leadership in other maritime nations. Because of my involvement, I can illustrate this best with the University of Rhode Island Program in Malaysia. With faculty members of the Malaysia universities there are now three fisheries studies and two mangrove ecology (in support of coastal fisheries) projects underway. Malaysia universities fully contribute their faculty participation and the University of Rhode Island contributes more than half of our participation, thus our modest ICAP grant of \$95,000 annually is multiplied appreciably. By the time you get this letter we will have five faculty members from the Malaysian universities in residence for long and short term study arrangements, three funded under ICAP and two from Malaysia sources. The latter, with more to come, again shows the multiplier effect."

"This example of the impact of modest funding on a key maritime nation of the world, bordered on one side by the Malacca Straits, which is one of the world's busiest and ecologically most endangered sea lanes, and bordered on the other side by the oil and fisheries rich-but politically stressed South China Sea, suggests how Sea Grant can make friends for the United States where they are undoubtedly needed. One could expand on this with examples of the Sea Grant impact in the Caribbean (University of Miami in Columbia, University of Delaware in Costa Rica, Louisiana State in Mexico), and the Near East and Mediterranean (Virginia Institute of Marine Science in Israel and Maryland Sea Grant in Egypt). The overall list of eleven programs would lengthen the examples but there are big gaps and all have minimal funds."



## 6. (cont.)

"My impression is that before too long ICAP funding must expand three to five-fold to realize the overseas Sea Grant mission and provide for broader participation even at an introductory level."

The last question is important to answer, and Ambassador Negroponte, in the quote above, speaks to the issue from a national interest viewpoint. From the perspective of our State and Institutional interest and constituencies, ICAP is justifiable, we believe, because it provides:

- a) another avenue for sharing and transferring Sea Grant developed technology and methods to individuals who can benefit economically and socially;
- b) a vehicle for improving and expanding the insights, capabilities, and enthusiasm of Sea Grant faculty, professional staff, and students, not only so they can serve international activities more effectively, but so that they can better serve their state and regional constituencies, a benefit only recently recognized and demonstrated through ICAP participation;
- c) a framework for collaboration with colleagues in other countries which expands the intellectual and cultural horizons of our academic community and provides a richness to our programs. In addition to the value of the research and technical assistance itself, the opportunities for collaboration with foreign scientists provide the kinds of personal contact so important for future scientific exchanges and joint marine research projects. These contacts, developed through efforts like Sea Grant's International Programs, promise to become especially important with the growing restrictions on access by marine scientists to the waters of many Coastal States. Indeed, this aspect of the Sea Grant Program anticipates in many respects the obligations almost certain to be imposed on researchers as a consequence of the Law of the Sea negotiations.

7. Question on Humanities

The bill passed by the House of Representatives includes a provision specifically listing "arts and humanities" as related to marine affairs as an authorized activity.

Is it your view that the language of the existing act is sufficiently broad to permit incidental project activity in the arts and humanities? Or is more specific authority considered either desirable or necessary?



## 7. (cont.)

Response:

The general consensus within the network is that the existing legislation is broad enough to permit project activities in the arts and humanities. As one director stated it, "we have always been able to initiate projects in this area when they have been relevant and good."

8. Question on Industry Participation

Would you give the Committee your assessment of the extent of industry participation in the program? Are opportunities for cooperative industry-Sea Grant projects being fully utilized? Are there any unnecessary legislative or administrative provisions that tend to discourage industry participation?

Response:

The extent of industry participation in the Sea Grant Program has not been well documented, but ranges from substantial at programs such as MIT and Delaware to minimal in some other programs, but with most programs it is somewhere in between. The development of a broader based cooperative industry Sea Grant effort, though desirable and important to the Sea Grant concept, is inhibited by two major factors. The first is discussed in the response to question three above and has to do with serious problems with U.S. Governmental policy regarding patents and proprietary information. The second is more subtle. Universities, industry, and government have disparate goals and objectives, which must be addressed realistically in any cooperative program if we are to realize effective and expanded industry-university Sea Grant efforts. Dr. Alfred A.H. Keil, in an address at the SGA Annual Conference in October 1978, summarized the issues well. "Industry, in a free enterprise system, must be oriented toward serving markets and generating profit. Industrial companies face a strongly competitive environment, nationally as well as internationally, and must for economic advantage, protect their proprietary information and patents. Universities with their primary thrust in education and extension of knowledge must protect their freedom of inquiry and teaching while depending primarily on externally furnished support for their operations and the research done by faculty and students. Government, acting as a surrogate for the people of the U.S., has a responsibility to prevent favoritism, to exert certain controls and to assure free competition, but it also has an obligation to create a climate in which U.S. industrial enterprises can prosper and thus strengthen the U.S. economy." While the issues described by Dr. Keil are clear, there will need to be changes in Governmental policy (both legislative and administrative) if there is to be an expansion in Sea Grant industry-university programs. The suggestions regarding patent policy is probably the most important first step in this regard.

9. Question on Women in the Sea Grant Program

As you know there is a concerted effort to assure that women have equal access to careers generally, including those in the marine sciences. Has any progress been made in increasing the participation in the Sea Grant Program by women in both scientific and administrative capacities? How many women are on the staff on the National Sea Grant program in professional positions? Do you have statistics on the percentage on number of women in Sea Grant institutions participating in Sea Grant activities in professional positions?



9. (cont.)

Response:

There has not been a comprehensive study of the involvement of women in the Sea Grant Program. The questions raised may be answered by the Office of Sea Grant, for they may have some of the statistics you request. The Sea Grant Programs have made substantial efforts to increase the numbers of women in responsible roles, in the research, education, advisory and management areas. Even with commitment to expand opportunities for women, progress is slower than anticipated. Dr. Feenan D. Jennings, Director of the Texas A & M University Sea Grant Program summarized both the progress and some of the remaining problems. "Women continue to be under-represented in the marine sciences, as they are in all the physical and natural sciences. In the Texas A & M Sea Grant Program, for example, only one of some 35 projects is headed by a woman scientist. There is only one woman in the 17 member Marine Advisory Service. Women do, however, play a significant role in program administration where two of the six professional management positions are held by women. In addition, the Texas A & M Sea Grant Fellows Program, competitive award based solely on academic performance and promise of future contribution to marine fields, has provided prominent recognition to young women scientists at the University. For example, in 1979-80 four of five Fellows (four State, one Federally supported) selected were women." Dr. B.J. Copeland, Director of the UNC Sea Grant College Program provides a similar perspective. "We have one woman (of 3) on our administrative staff (Assistant Director for Communications) and one woman (of 5) in our advisory services specialist positions. Of the 24 research and education projects, one project PI is a woman. These ratios are at or above the ratio within our institutions." While a careful assessment of the participation of women in Sea Grant would be helpful, it is estimated that the patterns described by Drs. Jennings and Copeland typify Sea Grant programs elsewhere.

10. Request for Examples of Sea Grant Benefits

Please provide the Committee and Subcommittee with examples of efforts and activities where investment of Sea Grant Funding has provided an economic benefit to the region. (This question was raised by Senator Pell in the hearing and he invited an answer as an addition to the nine written questions above).

Response:

The Sea Grant Programs throughout the country have a substantial number of projects and activities which demonstrate the economic benefit to the region. What follows is not an exhaustive listing, but simple typical and current examples.

- 1) The testimony of Dr. Neils Rorholm in his testimony at the subject hearings on April 25, 1980, provided a number of examples.
- 2) The UNC Sea Grant College Program established a \$100,000 Sea Grant (federal + match) research project to develop alternative septic waste disposal systems for coastal soils which resulted in \$3,000,000 of development in the first year that would have been turned down without our results being implemented. They also provided \$25,000 in Sea Grant funds for development of an eel fishery which directly resulted in a current eel industry which brings in \$1,200,000 per year to the region.



## 10. (cont.)

- 3) The UNH/UMO Sea Grant College Program conducted a economic assessment (costing less than \$2,000) of the benefits to the region and to the shippers of having imported containerized cargo enter Northeastern U.S. markets via the Port of Portsmouth rather than trucking over land from Halifax. The decision to ship via Portsmouth (based largely on the study) by the shippers and the State of New Hampshire has resulted in an annual benefit to the New Hampshire economy of \$7.5 million, in addition to the savings to the shippers and customers of imported goods.
- 4) The economic benefit of the cold water near drowning research and education program of the Michigan Sea Grant Program is substantial though not measureable in dollars. The techniques to resuscitate victims of cold water near drownings are being adopted nation-wide, through the Coast Guard, other Sea Grant Programs, and through State and regional agencies. The results are impressive, we believe:
  - a) The U.S. Coast Guard reports decreased cold water fatalities. U.S. Coast Guard and Marines have now adopted the developed techniques.
  - b) Hospitals in the United States have developed cold water drowning teams.
  - c) Legal precedent for resuscitation of cold water drownings has now been established (Federal Court, Denver).
  - d) National awareness led to a minimum of 17 completely recovered drowning victims.
  - e) New policies regarding resuscitation are now being considered on an international level.
- 5) The Oregon Sea Grant College Program reports a number of projects that have resulted in major benefits to that region including:
  - a) Aided in the establishment of commercial oyster hatcheries in Oregon and Washington.
  - b) Trained hundreds of commercial fishermen in modern business management techniques which have resulted in savings to the industry.
  - c) Developed commercial vaccines for fish diseases which are pivotally important to commercial aquaculture industries in the U.S.
  - d) Trained most personnel of twenty small port districts in Oregon which lead to important savings in port operations.
  - e) Developed new commercial wood preservation techniques for docks and wharves.



## 10. (cont.)

- f) Developed and made commercially viable refrigerated sea water techniques for fish preservation.
  - g) Refined fish food formulation which is now a commercial standard for aquaculture industry.
  - h) Instituted a marine safety program which has already saved one life.
- 6) The MIT Sea Grant program provides another example, which involves their work with all steel, streamlined trawl doors that were developed from a Naval Architecture and Marine Engineering Master's Degree thesis. This door is now commercially available from Boston's Wharf Forging and Welding Co. who provided matching support to MIT's Sea Grant Project. The trawl door is the device that spreads the net, holds it open, while it is being towed. The streamlined door greatly reduces the drag, the resistance of the net system, while providing the same opening force as the conventional flat doors. This means reductions in fuel consumption while towing, a direct benefit to the fisherman.

MIT Sea Grant also has developed a unique Marine Industry Advisory Service (MIDAS) as a linkage to marine industries. Through MIDAS we have transmitted research results that are being applied to offshore structures to reduce vibrational or fatigue stress and to make structures both safer and longer lived. Last November the MIDAS Collegium workshop on unmanned, underwater vehicles focused on systems to reduce the hazard of deep undersea work operations. This meeting attracted 75 experts representing 23 industrial concerns, the U.S. Geological Survey, the U.S. Coast Guard, five Navy laboratories, and university researchers from the University of New Hampshire, Scripps Oceanographic Institution, Louisiana State University, Woods Hole Oceanographic Institution, as well as MIT. From another MIDAS Opportunity Brief, MIT Sea Grant's wave energy project results are being used right now by the Sea Energy Corporation in their R & D efforts to economically harness wave energy.

- 7) The most comprehensive study of the potential commercial Sea Grant projects is the 1977 MIT study, referenced above. Because of its importance, we quote from that report: "The specific aims of the study were to establish the extent and conditions under which Sea Grant-supported research projects showed commercial potential and foreign trade impact. Recognition of the circumstances under which these conditions occurred or failed to occur would be useful in the on-going management of the Sea Grant program.

"In order to achieve these objectives, a structured sample of 77 R & D projects funded by Sea Grant at 26 university locations was examined and over 50 industrial firms engaged in related commercial activities were visited.



## 10. (cont.)

"The analysis and interpretation of this primary information has been developed in the preceding chapters against a background of published information on the status of technology in the impacted industrial sectors and extensive experience with the innovation process. Numerous observations and conclusions were included within the context of the preceding chapters. The more significant ones are brought together here for convenience and form the basis for some additional second-order conclusions."

- ....."Comparative estimates of potential economic impact are fraught with conceptual and analytical problems but a method of expressing anticipated sales in 1980 proved reasonable."
- ....."Sea Grant-supported projects have produced significant commercial potential but with the bulk concentrated in a few projects."
- ....."One half of the projects analyzed did have sales potential estimated in total to be about \$122 million annually by 1980."
- ....."Potential trade impact estimates are more complex and tenuous than sales estimates."
- ....."About one third of the projects had either import substitution or export potential for a total value of \$93 million per year by 1980."
- ....."To our knowledge, a similar analysis has not been attempted for other research support programs making comparisons difficult, but it is highly likely that Sea Grant support leads to more rapid and extensive commercial application of research results than most other programs."

The OSG report, entitled "The First Ten Years, contains numerous examples of major economic benefits. A copy of the summary from pages 66 thru 71 is attached.



Sea Grant Table XX  
Examples of Specific Benefits

### GEORGIA

|             |                                                                                                                                     |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Cut 10 percent product loss from sawing frozen fish blocks into smaller pieces for breeding—some 400 pounds a day in a small plant. |
| Solution    | Collect, reconstitute and bread fish sawdust.                                                                                       |
| Benefit     | Once-wasted product sells for 50¢ a pound.                                                                                          |
| Investment* | \$93,900.                                                                                                                           |

### GEORGIA

|             |                                                                                                                                                   |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Improve economic efficiency of Georgia shrimp fishermen.                                                                                          |
| Solution    | Debug and adapt Gulf of Mexico twin trawl (two small, side-by-side nets replace one larger one) with fishermen's cooperation, demonstrate method. |
| Benefit     | Increase trawling efficiency by 60 percent. Technique is adopted by others.                                                                       |
| Investment* | \$290,500.                                                                                                                                        |

### HAWAII

|             |                                                                                                                                                                                                                                                |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Expand domestic sources of precious coral. Increase harvest efficiency. Develop sound resource management program.                                                                                                                             |
| Solution    | Use modern Scuba gear and submersibles (STAR-II) to discover and survey resources. Employ same gear for selective harvesting to 1,200-foot depth.                                                                                              |
| Benefit     | Import dependence reduced from virtually 100 percent to less than 25 percent. Retail sales increased from \$2.6 million to \$11.4 million a year. Employment up from 100 to 500 people. Federal and State tax revenues up by \$500,000 a year. |
| Investment* | \$148,522 over a 4-year period; matched by \$294,277 State and industry funds.                                                                                                                                                                 |

### HAWAII

|             |                                                                            |
|-------------|----------------------------------------------------------------------------|
| Challenge   | Find offshore sand deposits for restoring and maintaining beaches.         |
| Solution    | Conduct survey and assessment.                                             |
| Benefit     | Location of six recoverable deposits of 20 to 70 million cubic yards each. |
| Investment* | \$290,500.                                                                 |

### LOUISIANA

|             |                                                                                                                                                         |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Find way to reverse U.S. Food and Drug Administration (FDA) ban on interstate shipment of baby green turtles because of danger of salmonella infection. |
| Solution    | Dip eggs in terramycin before incubation.                                                                                                               |
| Benefit     | Will restore \$2.5-million market for 150 growers—if FDA can be convinced of the safety of the process.                                                 |
| Investment* | \$30,600.                                                                                                                                               |

### MASSACHUSETTS

|             |                                                                                                                                                                                                             |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Reduce bacterial and viral load in sewage discharged into coastal waters.                                                                                                                                   |
| Solution    | Develop and test high-energy electron irradiation purification technique.                                                                                                                                   |
| Benefit     | Sea Grant-supported work led to a \$113,000 National Science Foundation grant and a subsequent grant of \$198,000 to build full-scale pilot plant in cooperation with the Metropolitan District Commission. |
| Investment* | \$19,300.                                                                                                                                                                                                   |



**NEW YORK**

|             |                                                                         |
|-------------|-------------------------------------------------------------------------|
| Challenge   | Find new sources of construction aggregate for concrete.                |
| Solution    | Survey the underwater resources of Lake Ontario.                        |
| Benefit     | Pound several sand deposits, including one worth \$90 to \$150 million. |
| Investment* | \$115,766.                                                              |

**NEW YORK**

|             |                                                                                                                                                             |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Find way to recover and market some of the 8,000,000 pounds a year of fish filleting wastes produced in New York City alone.                                |
| Solution    | Use poultry deboning machines to recover 60 percent in form of white meat left on racks (what's left after fillets are removed); reconstitute and bread it. |
| Benefit     | Marketable at 50¢ a pound compared to 3¢ a pound as mink food.                                                                                              |
| Investment* | \$26,200.                                                                                                                                                   |

**NEW YORK**

|             |                                                                                                  |
|-------------|--------------------------------------------------------------------------------------------------|
| Challenge   | Enable marinas forced to close when rising Lake Erie water level covered breakwaters to reopen.  |
| Solution    | Install a 900-foot floating breakwater using Rhode Island Sea Grant developed "old-tire" design. |
| Benefit     | Marine revenues of \$75,000 a year restored.                                                     |
| Investment* | \$5,000.                                                                                         |

**NORTH CAROLINA**

|             |                                                                                |
|-------------|--------------------------------------------------------------------------------|
| Challenge   | Improve fishermen's ice-holding and fish-keeping capabilities.                 |
| Solution    | Sprayed-in-place polyurethane insulation of fish holds.                        |
| Benefit     | \$100,000 saving in first year for six vessels and two ice-holding facilities. |
| Investment* | \$6,500.                                                                       |

**NORTH CAROLINA**

|             |                                                             |
|-------------|-------------------------------------------------------------|
| Challenge   | Increase earning opportunities for commercial fishermen.    |
| Solution    | Help develop local fishery and export market for eels.      |
| Benefit     | In first year 29 fishermen earned \$75,000 harvesting eels. |
| Investment* | \$10,000.                                                   |

**OREGON**

|             |                                                                                     |
|-------------|-------------------------------------------------------------------------------------|
| Challenge   | Improve fishing efficiency                                                          |
| Solution    | Modify Atlantic Western trawl to increase catching efficiency.                      |
| Benefit     | Catch efficiency up 30 to 100 percent; local catch up by over \$2.5 million a year. |
| Investment* | \$14,000.                                                                           |

**OREGON**

|             |                                                                                 |
|-------------|---------------------------------------------------------------------------------|
| Challenge   | Improve landed quality of fish.                                                 |
| Solution    | Develop superior fish hold liners; also less expensive than old method.         |
| Benefit     | Higher quality landed product and \$290,000 direct cost saving for 129 vessels. |
| Investment* | \$5,000.                                                                        |



**OREGON**

|             |                                                                                                                                                                                                                                                                                                                                                                         |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Restore chum salmon fishery depleted by urbanization and other changes.                                                                                                                                                                                                                                                                                                 |
| Solution    | Raise salmon in hatcheries; release them to sea; and harvest them when they return as adults—called ranch farming.                                                                                                                                                                                                                                                      |
| Benefit     | Investment by private industry. Four private hatcheries in operation; 15 additional license applications in. Anticipate 2 to 3 million-pound harvest in 1980 with \$3 to \$5 million to farmers, with additional take by offshore commercial and sport fishers of 3.5-5.5 million pounds, and State and Federal tax revenues increased by more than \$1 million a year. |
| Investment* | \$93,500.                                                                                                                                                                                                                                                                                                                                                               |

**RHODE ISLAND**

|             |                                                                                                                                               |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Improve fishing efficiency.                                                                                                                   |
| Solution    | Bring Irish fisherman over to explain European pelagic pair trawling.                                                                         |
| Benefit     | Increased local catch by 6,000,000 pounds in first three months of its adoption and trial. Practice now spreading up and down Atlantic coast. |
| Investment* | \$2,400.                                                                                                                                      |

**RHODE ISLAND**

|             |                                                                                                                                                                                                              |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Develop an effective breakwater that is inexpensive and easily installed and removed.                                                                                                                        |
| Solution    | Design, produce and proof-test floating breakwater made of old car tires.                                                                                                                                    |
| Benefit     | A breakwater that can be built and put in place for less than \$6 a foot, and which is enjoying wider and wider use—e.g., Rhode Island, New York, and Washington. Also helps with the tire disposal problem. |
| Investment* | \$54,000.                                                                                                                                                                                                    |

**VIRGINIA**

|             |                                                                      |
|-------------|----------------------------------------------------------------------|
| Challenge   | Outbreak of "pink oysters" and customer refusal to accept shipments. |
| Solution    | Demonstrate safety, nutrition, and that cooking eliminates color.    |
| Benefit     | \$500,000 shipment accepted.                                         |
| Investment* | \$2,820.                                                             |

**VIRGINIA**

|             |                                                                             |
|-------------|-----------------------------------------------------------------------------|
| Challenge   | Improve methods and reduce cost of pasteurizing crabmeat.                   |
| Solution    | Develop flexible film containers to replace cans.                           |
| Benefit     | First firm to adopt process saved \$51,000 on 300,000 pounds in first year. |
| Investment* | \$3,350.                                                                    |

**WASHINGTON**

|             |                                                                                                                                                                                                                                     |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Challenge   | Demonstrate commercial feasibility of NMFS (National Marine Fisheries Service, a NOAA agency)-developed technology for pen-rearing of pan-size salmon.                                                                              |
| Solution    | Join with Domsea Farms, Inc., to conduct full-scale experiments.                                                                                                                                                                    |
| Benefit     | Production of pen-reared salmon brought from nothing in 1970 to some 1,700,000 pounds in 1975 at a market price of \$1.50 a pound; attracted private investment and increased tax revenue potentials by more than \$700,000 a year. |
| Investment* | \$100,000.                                                                                                                                                                                                                          |

\* Investment represents the total of NOAA Sea Grant funds committed to the project. It does not include matching funds or private investment.



## Examples of Immeasurable Benefits

### Primary Beneficiary

#### How Sea Grant Benefits the University

- Augments roles, missions, and stature of the university in the community it serves.
- Encourages mission-oriented, interdisciplinary programs of higher education which are responsive and adaptable to the changing needs of society.
- Fosters the evolution of dynamic, interdisciplinary team approaches to the fulfillment of a broad range of community needs and aspirations.
- Capabilities thus produced attract demands for services and grant and contract funds from sources other than Sea Grant—i.e., Federal and State agencies, industry.
- Opportunity for college-based researchers to work on marine-oriented problems with a practical short-term payoff convinces many, who at first opposed Sea Grant, that good research can be done within the boundary conditions of applied goals.
- Starts university faculty and administrators alike thinking in terms of overall marine objectives and of the value of being *the* State marine university.
- This marine commitment attracts capable faculty and motivated students.
- Interdepartmental and interinstitutional cooperation favors development of complementary, rather than competitive, courses, services, and capabilities.
- Continuous feedback loop between faculty and Marine Advisory Service personnel keeps the faculty and the university administration in touch with the changing needs of society.
- Sea Grant fosters interinstitutional transfer of information and services.
- Provides the university with research opportunities which, without Sea Grant, would not have been possible.





Matching fund requirement fosters beneficial citizen and State involvement in the university function, and vice-versa.

- Gives the university, the public, and the State new perspectives on the marine environment which otherwise would not have been possible.
- Permits presentation of marine accomplishments as selling points for the university before the State legislature.

### **How Sea Grant Helps the Student**

- Presents the students with an exciting diversity of courses and degree programs which previously did not exist.

Encourages competence among the students and enables them to realize diversity in their academic experience which greatly enhances their subsequent value to society, including prospective employers.

Gives students the opportunity to participate in projects and to travel to places which otherwise would not have been possible.

Gives students early exposure to the practical aspects of their academic learning through problem-oriented research, work-study, and internships with both government and industry.

Helps interest students, faculty, and community in applied marine work.

- Provides the financial incentive to university administrations to try totally new courses, degree programs, and other innovations in contemporary education.
- Allows and encourages the university educational process to grow, adjust, and adapt to changing technologic, economic, and societal needs—thus assuring continued educational relevance and more and better job opportunities for the institution's graduates.

### **Sea Grant's Role in the Community**

Enables the comprehensive and diversified resources of universities to be marshalled into a variable-response capability to serve vital community needs and opportunities.

Opens effective avenues of communications between the university and both the community

it serves and agencies concerned with the marine environment.

Catalyzes beneficial, cooperative, and working contact among the institution, State and Federal agencies, industry, and other groups.

Provides specialized assistance in advance planning for the management of coastal and marine resources and for the implementation of those plans.

Provides the governor, legislature, agencies, and others with a quick-response, specialized source of expertise for dealing with critical or unusual problems.

Offers an independent, objective source of advice and counsel which is outside of both the State and Federal government systems.

Primes the pump for a greater concentration of State funds in the area of coastal and marine research and education.

Contributes, through its knowledge of and close association with the marine community, to greater efficiency in the execution of other Federal programs.

Demonstrates how Federal-local partnerships can be made to function effectively.

Shows how a minimum Federal input can produce maximum local benefits.

By virtue of its chain store characteristic, provides one-stop shopping center for displaying a broad inventory of talents and capabilities.

Matches local involvement to local responsibility—a major benefit of the matching fund requirement.

Predicates activities on the genuine needs of the States.

Fulfills critical and emerging needs for special professional and technical skills through adaptive curriculum development.

Promotes manpower sharing for greater productivity and lower costs.

Contributes to sound economic growth and expansion of the tax base.

Provides its benefits at a minimum net added cost to the taxpayer because it largely utilizes existing personnel and facilities.





### **Sea Grant Benefits Extend to Business and Industry**

- [-] Upgrades efficiency in existing marine industries through positive contributions in technology, methods, resource management, marketing, and bookkeeping.
- [-] Expedites technology transfer within marine industries, from one industry to another, from one part of the country to another, and from abroad.
- [-] Identifies, evaluates, and, if appropriate, determines maximum sustainable yield of previously unknown or underutilized resources and provides basic guidance for their exploitation and marketing.
- [-] Generates and stimulates new marine industries as new resources are discovered and as new technologies and markets are developed.
- [-] Discourages new marine industries where, even though the potentials exist, the technologies and basic marketing infrastructure do not.
- [-] Encourages the development of new domestic and export markets for marine products and services.
- [-] Fosters the creation of new marine job opportunities.
- [-] Helps to assure an adequate and timely supply of trained professionals and technicians.
- [-] Assists in power plant and other industrial siting so as to minimize adverse environmental, economic, and other impacts.
- [-] Contributes to improve management of wastes from marine industries, including conversion of wastes into secondary sources of income.
- [-] Serves as a reactive communications link between the marine constituency and those State and Federal agencies and others which regulate or otherwise may impact upon it.



RESPONSES TO QUESTIONS RAISED  
DURING SENATE HEARING ON  
NOAA's SEA GRANT PROGRAM

1. Adequacy of Funding

Question: What has been the impact on the program, especially on the institutions participating in it, of stringent funding limitations, coupled with the rising costs of inflation?

Answer: There is no doubt that inflation has had a real impact on the level of effort and the productivity of the Sea Grant Program. As can be noted in the attached Table, the Sea Grant budget increased by 82% (\$17.3 million) between fiscal years 1973 and 1980. However, when adjusted by any of three indexes, two of which pertain specifically to university costs, Sea Grant's growth was less than 9% over that seven year span. During that time, Sea Grant was directed by the Congress to expand its marine education and marine advisory service programs by approximately \$2 million, to initiate and fund new National Projects. International Cooperation Assistance and Fellowship programs at a \$2 million level and was requested by the Senate to conduct a study of the educational and training needs of the U.S. commercial fishing industry. All of the above has made expansion and development of the basic Sea Grant Program difficult. However, 9 new Sea Grant Colleges have been designated since 1973, 5 other programs were elevated to Institutional status and 3 new Coherent Area programs were initiated. This has been possible only by limiting the growth of the more mature programs to less than cost-of-living increases, thus reducing the level of effort. For example, the first six Sea Grant Colleges would require a total increase of about \$3.5 million to bring them up to the level of effort at which they were operating in 1972.

A second and related effect of these budgetary limitations has been an increasing shift in funding for advisory service at the expense of research programs. This is partially the result of the mandate from the Congress, but it is mostly the result of the fact that,



unlike research projects which have a finite lifetime, advisory services continue indefinitely. To continue to provide these services at even a constant level of effort requires budget increases because of salary increases to the agents and specialists alone. A decision has been made to restrict the growth of the very visible and valuable component of Sea Grant to prevent the exacerbation of this problem as well as to provide more funds for research.

Question: How will the President's budget cuts affect the Sea Grant Program?

Answer: As of this date, no decreases have been proposed for the Sea Grant Program in the FY 1980 or FY 1981 budgets.

## 2. Matching Funds

Question: What are the most recent statistics on matching funds by project and program sponsor?

Answer: For FY 1979, the participating programs formally identified a total of \$21,445,994 in matching contributions. This represents 38.6% of the total Sea Grant Program which included \$34,068,676 in Federal funding. It should be noted that there are additional matching contributions which are not included in the statistics because they are not reported by the participating institutions at the time the grants are awarded.

## 3. Program Coordination and Integration

Question: In what ways does Sea Grant integrate with other NOAA programs such as pollution studies, etc.

Answer: The Office of Sea Grant is now organized along subject area lines with one professional staff member cognizant of and responsible for each field in which Sea Grant funds activities. These specialists work with their counterparts in other NOAA components and in other agencies involving various coordinating mechanisms, including planning, budgeting, reviewing, etc. This is a routine and continuing effort in all fields.

Question: To what degree does Sea Grant coordinate on education at the undergraduate level.

Answer: Very little of Sea Grant's present education and training program is directed toward undergraduate needs. Most of this work is devoted to technician-type training programs where there are few other programs with which to coordinate. Our coordination in this field, as in other areas, is through reviews and planning sessions with other agencies.



#### 4. Innovation and Technology Transfer

Question: Why has the Sea Grant Program not been assigned a major role in increasing productivity in the marine field?

Answer: A greater role for Sea Grant in the development of new marine technology and in stimulating innovation as ways of increasing productivity has been the subject of discussion within NOAA. We hope to expand this effort in future years, but this will have to be a limited expansion due to our effort to hold budget increases to as low a level as practical.

#### 5. Priorities Between New and Existing Programs

Question: Would you comment please on Dr. Robert Abel's concern over a policy of giving priority to "quality" programs over the objective of "institution building?"

Answer: We have not seen Dr. Abel's statement as yet and are not sure of the context of his concern. However, based on the background provided with the question, we believe his concern is that a greater percentage of Sea Grant's funding may go to the more established programs than to newly developing ones. Since Dr. Abel is now the Director of one of the less mature programs, we can understand his interest in our giving priority to such programs. As indicated in the answer to the first question, we have in the past few years done just that, with the result that the more mature programs have suffered as a result of inflationary cost increases. We now are moving toward a more balanced funding pattern that will not benefit one category of program so dramatically at the expense of another. Obviously, this will reduce the possibility that most new programs will realize large increases in FY 1980 and FY 1981. However, we will still be providing the greatest increases to those programs of highest quality as we have in the past, regardless of their status.

#### 6. Fisheries Education

Questions: Do you (NOAA) have any plans to follow-up on the study report through new priorities and efforts through the Sea Grant Program or through other NOAA programs? How much flexibility do you have within the existing budget to allocate additional resources to fisheries education and training along the lines suggested in the report?

Answer: Sea Grant plans to review its existing programs in this field to determine if improvements can be made at no or low cost. However, there are no plans at present to initiate the larger new or expand programs identified in the report. There are several facilities recommended that must be built or leased, neither of which can be done by Sea Grant. All of these larger initiatives would require budgetary increases that would be nearly impossible to obtain in today's economic situation. Therefore, rather than jeopardize what



large program in this area, but do believe that it should be somewhat larger than it is now to benefit those not able to enjoy the oceans and Great Lakes in person, as well as serving as another mechanism to educate the public on the various values of our marine resources.

#### 9. Industry Participation

Questions: Would you give the Committee your assessment of the extent of industry participation in the program? Are opportunities for cooperative industry-Sea Grant projects being fully utilized? Are there any unnecessary legislative or administrative provisions that tend to discourage industry participation?

Answer: We believe that the Sea Grant Program has been one of the leaders in the area of university/industry cooperation, with a record of extensive industry participation for years. Regardless, we are not satisfied with the present level of activity and are moving to expand the element of the Program. As part of the recent Office of Sea Grant reorganization, a Division of Technology and Commercial Development was created with the specific purpose of improving Sea Grant activities in this field. The only legislative or administrative provisions that we feel are inhibiting industrial participation are those concerning patent provisions in our grants. Some companies will not participate or will participate reluctantly in programs involving patentable products or techniques in which their rights are to be determined later or in which the government retains all rights.

#### 10. Women

Questions: Has any progress been made in increasing the participation in the Sea Grant Program by women in both scientific and administrative capacities? How many women are on the staff of the National Sea Grant Program in professional positions? Do you have any statistics on the percentage or number of women in Sea Grant institutions participating in Sea Grant activities in professional positions?

Answer: We have not developed statistics on the number or percentage of female professionals involved in Sea Grant activities in the institutions participating in the Program. However, we know that in certain types of activities, such as in communications (public information) and social sciences, women constitute a higher percentage than in the physical sciences. Also, many of the professionals in administrative positions in the university programs are women. At the present time, the Director of the Maryland Sea Grant Program is a woman as is the Executive Director of the Delaware Sea Grant College Program.



appears to be needed activities by proposing them now, we believe that consideration of these recommendations should be deferred to a time when they would have a better chance at being approved. Even then, we are not sure that Sea Grant or any other NOAA program is the proper sponsor of these initiatives.

#### 7. International Program

Question: How well has the consultation process with the State Department worked?

Answer: Quite well. Representatives of the State Department and other agencies involved in international marine programs have assisted us as reviewers and advisors on all of the proposals we have received thus far for this program. They have been helpful and cooperative.

Question: In your view, is this international effort sustainable and viable over a longer period of time at this level of funding or is a greater priority required to provide a program with meaningful results?

Answer: We believe that this program is not viable in the long term at its present funding level. It is not possible to have a sufficient impact in a realistic time frame throughout the developing world at \$1 million a year. While the program has had some benefit by its mere existence, it can lead to unrequited expectations which can then result in negative feelings toward the U.S.

Question: How would you justify these expenditures to a taxpayer in Rhode Island, South Carolina, or California?

Answer: Stabilizing the developing nations politically and economically is a worthy goal in our opinion, and programs such as this one which attempt to produce better informed scientists and marine resource managers will help in that regard. Since some of these countries are or will be in a position to influence or control resources of interest to the U.S., we believe the taxpayer should favor this type of International program. Also, the fact that nearly all of the money obligated in this program is spent in the U.S. should help avoid its being labelled as another giveaway.

#### 8. Arts and Humanities

Question: Is it your view that the language of the existing act is sufficiently broad to permit incidental project activity in the arts and humanities, or is more specific authority considered either desirable or necessary?

Answer: Although the language in the existing act can be interpreted as including the arts and humanities, the fact that these fields are not specified results in a very limited number of proposals. We do not anticipate a



#### 11. Examples of Economic Benefits

Question: Please provide us with examples of efforts/activities where investment of Sea Grant funding has provided an economic benefit to the region.

Answer: Several such examples were included in the written testimony by Dr. Webster and are described in recent publications, such as The First Ten Years and the first two annual reports for the periods July 1, 1975 to September 30, 1976, and October 1, 1976 to September 30, 1977. Many other examples are being submitted by the Sea Grant Association.

#### 12. Participants and Funding Levels

Question: Would you provide a listing of the Sea Grant Colleges and other institutions participating in the Program and the dollar amount of their current programs?

Answer: This information is contained in the attached awards listing for Sea Grant for FY 1979.

#### 13. International Cooperative Assistance Program - Projects

Question: Would you provide, for the record, the details of the projects in the International Cooperative Assistance Program?

Answer: These details are contained in the attached copy of a brief report prepared for a staff review of the Program, dated December, 1979.

#### 14. Funding by State

Question: Please provide a breakdown of current Sea Grant funding by states.

Answer: This listing is attached for FY 1979.

#### 15. National Projects

Question: Will you provide a list of the projects funded in the National Projects program?

Answer: The list of current projects in this program (National Sediment Transport Study - NSTS) is attached.

Attachments



IMPACT OF INFLATION ON SEA GRANT FUNDING

| <u>Fiscal Year</u> | <u>Approved Budget</u> | <u>Adjusted<br/>with HEPI</u> | <u>Adjusted<br/>with R&amp;D PI</u> |
|--------------------|------------------------|-------------------------------|-------------------------------------|
| 1973               | 21.2                   | 21.2                          | 21.2                                |
| 1974               | 19.8                   | 18.5                          | 18.6                                |
| 1975               | 23.3 <sup>1</sup>      | 20.1                          | 20.0                                |
| 1976               | 23.1                   | 18.6                          | 18.5                                |
| 1977               | 27.7 <sup>2</sup>      | 21.0                          | 20.9                                |
| 1978               | 31.7 <sup>3</sup>      | 22.5                          | 22.5                                |
| 1979               | 35.2 <sup>4</sup>      | 23.2                          | 23.2                                |
| 1980*              | 38.5                   | 23.1                          | 23.0                                |

1. One million dollars deferred by the President.
2. Increase accompanied by a directive that a major portion of the increase be used for marine education and the marine advisory services.
3. Increase accompanied by a directive that \$2 million of the increase be used for the newly authorized National Projects, International Cooperative Assistance, and Fellowship programs.
4. Reauthorization Bill requested a study of the educational needs of the commercial fishing industry with no funding provided.

\* Projected for 1980 on basis of 10% inflationary rate.

HEPI is the Higher Education Price Index

R&D PI is the Research and Development Price Index.



## GRANT STATUS--INSTITUTIONAL

| GRANTEE<br>-----                         | GRANT<br>ACTIONS<br>----- | NO. OF<br>PROJ'S<br>----- | SG<br>FUNDS<br>----- | MATCHING<br>FUNDS<br>----- |
|------------------------------------------|---------------------------|---------------------------|----------------------|----------------------------|
| UNIVERSITY OF GEORGIA                    | 2                         | 17                        | \$790,500            | \$774,700                  |
| MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM | 1                         | 21                        | \$785,000            | \$429,404                  |
| VIRGINIA INSTITUTE OF MARINE SCIENCE     | 1                         | 19                        | \$695,400            | \$434,562                  |
| UNIVERSITY OF MARYLAND                   | 2                         | 26                        | \$734,700            | \$537,050                  |
| UNIV. OF MAINE/UNIV. OF NEW HAMPSHIRE    | 2                         | 32                        | \$1,378,900          | \$699,519                  |
| UNIVERSITY OF MICHIGAN                   | 1                         | 31                        | \$953,300            | \$487,240                  |
| UNIVERSITY OF SOUTHERN CALIFORNIA        | 1                         | 14                        | \$575,000            | \$533,195                  |
| UNIVERSITY OF ALASKA                     | 2                         | 26                        | \$1,208,500          | \$834,852                  |
| -----                                    | ---                       | ---                       | -----                | -----                      |
| TOTALS                                   | 12                        | 186                       | \$7,121,300          | \$4,730,522                |

## GRANT STATUS--COHERENT

| GRANTEE<br>-----                       | GRANT<br>ACTIONS<br>----- | NO. OF<br>PROJ'S<br>----- | SG<br>FUNDS<br>----- | MATCHING<br>FUNDS<br>----- |
|----------------------------------------|---------------------------|---------------------------|----------------------|----------------------------|
| WOODS HOLE OCEANOGRAPHIC INSTITUTION   | 4                         | 25                        | \$811,700            | \$490,796                  |
| NEW JERSEY MARINE SCIENCES CONSORTIUM  | 2                         | 17                        | \$435,000            | \$287,000                  |
| SOUTH CAROLINA MARINE RESOURCES CENTER | 1                         | 1                         | \$5,000              |                            |
| UNIVERSITY OF MINNESOTA                | 3                         | 24                        | \$635,000            | \$525,548                  |
| OHIO STATE UNIVERSITY                  | 1                         | 7                         | \$180,000            | \$101,400                  |



## SEA GRANT AWARDS FY 1979

## GRANTEES

## GRANT STATUS--COLLEGE

| GRANTEE<br>-----                      | GRANT<br>ACTIONS<br>----- | NO. OF<br>PROJ'S<br>----- | SG<br>FUNDS<br>----- | MATCHING<br>FUNDS<br>----- |
|---------------------------------------|---------------------------|---------------------------|----------------------|----------------------------|
| UNIVERSITY OF WASHINGTON              | 5                         | 55                        | \$1,991,226          | \$1,134,706                |
| TEXAS A&M UNIVERSITY                  | 4                         | 33                        | \$1,640,600          | \$1,293,912                |
| OREGON STATE UNIVERSITY               | 3                         | 44                        | \$2,150,000          | \$1,658,800                |
| UNIVERSITY OF NORTH CAROLINA          | 2                         | 29                        | \$965,000            | \$502,000                  |
| STATE UNIVERSITY OF NEW YORK, CORNELL | 2                         | 39                        | \$1,656,700          | \$865,223                  |
| MASSACHUSETTS INSTITUTE OF TECHNOLOGY | 2                         | 36                        | \$1,486,700          | \$1,281,452                |
| UNIVERSITY OF DELAWARE                | 3                         | 27                        | \$993,900            | \$768,507                  |
| UNIVERSITY OF RHODE ISLAND            | 2                         | 31                        | \$1,386,900          | \$757,900                  |
| STATE UNIVERSITY SYSTEM OF FLORIDA    | 2                         | 24                        | \$1,471,000          | \$1,133,200                |
| UNIVERSITY OF HAWAII                  | 1                         | 31                        | \$1,598,000          | \$1,031,119                |
| UNIVERSITY OF WISCONSIN               | 1                         | 56                        | \$1,700,000          | \$950,000                  |
| LOUISIANA STATE UNIVERSITY            | 1                         | 28                        | \$1,147,500          | \$715,392                  |
| UNIVERSITY OF CALIFORNIA              | 1                         | 50                        | \$2,840,000          | \$1,847,685                |
| -----                                 | ---                       | ---                       | -----                | -----                      |
| TOTALS                                | 29                        | 483                       | \$21,027,526         | \$13,939,896               |



## GRANT STATUS--COHERENT (CONTINUED)

| GRANTEE<br>-----                    | GRANT<br>ACTIONS<br>----- | NO. OF<br>PROJ'S<br>----- | SG<br>FUNDS<br>----- | MATCHING<br>FUNDS<br>----- |
|-------------------------------------|---------------------------|---------------------------|----------------------|----------------------------|
| SOUTH CAROLINA SEA GRANT CONSORTIUM | 1                         | 15                        | \$385,000            | \$406,700                  |
| -----                               | ---                       | ---                       | -----                | -----                      |
| TOTALS                              | 12                        | 89                        | \$2,451,700          | \$1,811,444                |

## GRANT STATUS--PROJECT

| GRANTEE<br>-----                      | GRANT<br>ACTIONS<br>----- | NO. OF<br>PROJ'S<br>----- | SG<br>FUNDS<br>----- | MATCHING<br>FUNDS<br>----- |
|---------------------------------------|---------------------------|---------------------------|----------------------|----------------------------|
| AMER. CANCER RES. CTR. AND HOSP., CO. | 1                         | 1                         | \$26,000             | \$44,000                   |
| UNIVERSITY OF TEXAS AT AUSTIN         | 3                         | 3                         | \$147,200            | \$73,614                   |
| UNIVERSITY OF CALIFORNIA              | 3                         | 10                        | \$814,800            |                            |
| OCEANIC INSTITUTE, HAWAII             | 1                         | 1                         | \$65,000             | \$32,500                   |
| HAWAII DEPT. OF LAND AND NATURAL RES. | 1                         | 1                         | \$100,000            | \$100,000                  |
| UNIVERSITY OF ARIZONA                 | 1                         | 1                         | \$33,500             | \$27,784                   |
| UNIVERSITY OF IDAHO                   | 1                         | 1                         | \$36,500             | \$28,416                   |
| UNIVERSITY OF RHODE ISLAND            | 2                         | 2                         | \$290,000            |                            |
| UNIVERSITY OF WASHINGTON              | 1                         | 1                         | \$127,800            | \$1,370                    |
| UNIVERSITY OF DELAWARE                | 2                         | 2                         | \$131,400            |                            |
| MASSACHUSETTS INSTITUTE OF TECHNOLOGY | 1                         | 1                         | \$30,700             |                            |
| OHIO STATE UNIV. RESEARCH FOUNDATION  | 1                         | 1                         | \$17,500             | \$9,359                    |



## GRANT STATUS--PROJECT (CONTINUED)

| GRANTEE<br>-----                     | GRANT<br>ACTIONS<br>----- | NO. OF<br>PROJ'S<br>----- | SG<br>FUNDS<br>----- | MATCHING<br>FUNDS<br>----- |
|--------------------------------------|---------------------------|---------------------------|----------------------|----------------------------|
| UNIVERSITY OF MICHIGAN               | 1                         | 1                         | \$67,300             | \$33,652                   |
| SOC. OF NAVAL ARCH. AND MARINE ENG.  | 1                         | 1                         | \$24,000             | \$42,000                   |
| VIRGINIA POLYTECHNIC INSTITUTE       | 4                         | 4                         | \$191,850            | \$86,500                   |
| GORDON RESEARCH CONFERENCE, U.R.I.   | 1                         | 1                         | \$3,200              | \$5,500                    |
| NORTH CAROLINA STATE DEPT. OF ADMIN. | 1                         | 1                         | \$5,500              | \$3,864                    |
| UNIVERSITY OF CONNECTICUT            | 1                         | 1                         | \$93,900             | \$47,300                   |
| TEXAS A&M UNIVERSITY                 | 1                         | 1                         | \$137,500            | \$70,591                   |
| UNIVERSITY OF PUERTO RICO            | 2                         | 2                         | \$109,100            | \$70,540                   |
| UNIVERSITY OF NEW HAMPSHIRE          | 3                         | 3                         | \$148,100            | \$86,023                   |
| UNIVERSITY OF HAWAII                 | 1                         | 1                         | \$92,800             | \$4,059                    |
| LOUISIANA STATE UNIVERSITY           | 1                         | 1                         | \$46,800             |                            |
| UNIVERSITY OF OKLAHOMA               | 1                         | 1                         | \$136,000            | \$68,000                   |
| YALE UNIVERSITY                      | 1                         | 1                         | \$35,300             | \$18,724                   |
| OREGON STATE UNIVERSITY              | 1                         | 1                         | \$190,000            |                            |
| STATE UNIVERSITY SYSTEM OF FLORIDA   | 1                         | 1                         | \$18,000             | \$1,300                    |
| FAIRLEIGH DICKINSON UNIVERSITY       | 2                         | 2                         | \$121,200            | \$58,585                   |
| HARVARD UNIVERSITY                   | 1                         | 1                         | \$64,200             | \$20,391                   |
| AMERICAN GEOPHYSICAL UNION           | 1                         | 1                         | \$4,000              | \$2,000                    |
| UNIVERSITY OF MARYLAND               | 1                         | 1                         | \$134,400            | \$13,960                   |
| RUTGERS UNIVERSITY                   | 1                         | 1                         | \$24,600             | \$14,100                   |
| -----                                | -----                     | -----                     | -----                | -----                      |
| TOTALS                               | 45                        | 52                        | \$3,468,150          | \$964,132                  |



## INTERNATIONAL COOPERATION ASSISTANCE PROGRAM

## THE SECOND YEAR

by

Thomas E. Murray

Office of Sea Grant

(Prepared for an Office of Sea Grant Retreat,  
December 5-7, 1979, Belmont Conference Center)

INTRODUCTION

Section 3 of P.L. 94-461, signed by the President on October 8, 1976, established the International Cooperation Assistance Program (ICAP) within the Sea Grant College Program. Its goals are (1) to enhance the research and development capabilities of developing foreign nations with respect to ocean and coastal resources, and (2) to promote the international exchange of information and data with respect to the assessment, development, use, and conservation of such resources. The Congress envisioned that grants made under this new legislation would promote cooperation between U.S. academic institutions and their counterparts in developing countries. Grants were to be made only to U.S. institutions, and consultation with the Secretary of State was required before grants were made.

The legislation which established the International Cooperation Assistance Program is given in Appendix A to this report.

Guidelines for ICAP were published in the Federal Register on April 11, 1978. They were quite brief, largely repeating the authorizing legislation. The guidelines did specify that ICAP proposals would be expected to address:

- (1) The nature and scope of the proposed project;
- (2) The utilization of institutional and other appropriate resources in the implementation of the project;
- (3) A clear indication of the foreign participant's commitment to the project;
- (4) Identification of accomplishments expected from a single granting interval;



- (5) Implicit or explicit out-year commitment of resources; and
- (6) The impact of the proposed project on the institution receiving funding.

The guidelines made it clear that ICAP projects should involve genuine cooperation between the grantee institution and the institution(s) in the developing country, and that any project submitted by a Sea Grant institution should take advantage of the marine capability already in existence at that institution.

The guidelines for ICAP are given in Appendix B to this report.

Subsequently, in P.L. 95-428, the second stated goal of ICAP was altered to read:

"(2) promote the exchange among the United States and foreign nations (including, but not limited to, developing foreign nations) of information and data with respect to the assessment, development, utilization, and conservation of such resources."

The reason behind this change is perhaps best expressed in House Report No. 95-1011 from the Committee on Merchant Marine and Fisheries:

"Specific inclusion of 'developed' nations in sea grant's information and data exchange programs will allow marine scientists working under the auspices of the international cooperative assistance program to make use of structures already existing for purposes of multinational marine research efforts . . . . That such structures happen to include developed nations as well (such as South Pacific Fisheries Commission, which includes Australia and New Zealand) should not preclude participation within these structures by marine scientists receiving sea grant funding. The Director stated during hearings that the principal thrust and focus of the program would still be toward the lesser developed nations."

#### GOALS OF ICAP

The goals of ICAP were more fully described in last year's report entitled "International Cooperation Assistance Program: The First Year." Consequently, they will only be summarized here.



The primary goals of ICAP are those stated in the authorizing legislation:

"To (1) enhance the research and development capability of developing foreign nations with respect to ocean and coastal resources, as such term is defined in section 203 of the National Sea Grant Program Act; and (2) promote the exchange among the United States and foreign nations (including, but not limited to, developing foreign nations) of information and data with respect to the assessment, development, utilization, and conservation of such resources." (Section 3, P.L. 94-461, amended by P.L. 95-428)

A significant but implicit goal of ICAP is to help create an atmosphere which is conducive to cooperation between U.S. scientists and those in developing countries.

In establishing ICAP as part of the Sea Grant College Program, the Congress evidently wished that it produce results qualitatively similar to those produced by Sea Grant in this country, i.e. the building of scientific and technological capacity to identify marine resource problems and to solve them.

Another goal of ICAP is to make a contribution to the economic and social development of the developing world. ICAP should foster the development process by strengthening indigenous scientific and technological institutions and by supporting education and training programs.

Finally, it is desirable that technology transfer be a mutual sharing rather than simply a one-way transfer.

#### GRANTS MANAGEMENT GOALS

In addition to the above goals which one might wish to find exemplified in the various international projects, there are other program-wide goals which managers in the Office of Sea Grant should strive to accomplish.

Continuity of Effort. Cooperative international projects, especially in developing countries, generally have to run for several years in order to produce any significant results. So it is advisable that each project be supported for a sufficient duration to have a real impact, even if this means fewer projects are supported than might otherwise be possible.

New Projects. Since both scientific and political elements in oceanic affairs are changing rapidly, it is desirable that ICAP be in a position



to begin some new projects each year in response to these changes. This means that--the above continuity of effort notwithstanding--program managers should not allow a situation to arise in which all resources are pre-committed and no new projects can be started.

Geographic Distribution. If the Law of the Sea Conference has done nothing else, it has awakened developing coastal nations to the economic potential of their oceanic resources and to the need to possess indigenous marine research and development capabilities. Since ICAP manifestly lacks the resources to support cooperative projects with each and every one of these nations, a reasonable goal is to distribute projects broadly among the developing nations and to have at least one project in each of the principal developing regions of the globe.

#### ADMINISTERING THE PROGRAM

As in the previous fiscal year, the Office of Sea Grant continued during FY79 to encourage universities to submit brief preliminary proposals before development of formal proposals. This procedure was designed to prevent the full-blown development of projects which stood little chance of being supported. It was also done to avoid causing unrealistic expectations in the cooperating foreign countries. Informal advice from a Sea Grant program manager that a proposal is inappropriate for further development does not prevent a proposer from filing a formal proposal if he chooses to do so, and an informal proposal is not a strict requirement.

Generally speaking, there was no change in direction for the program; i.e.

- Emphasis was to be on projects in education and training;
- Projects should, to the extent possible, build upon existing relationships with institutions in developing countries;
- Projects should not raise unfounded expectations in developing countries; and
- Projects should be genuinely cooperative, with some real evidence that the foreign partner is committed to the work.

Fourteen formal proposals were received by the Office of Sea Grant in the course of FY79. These proposals asked for an aggregate of approximately \$2.0 million. As in FY78, the majority of the projects were in Latin America and the Caribbean. Three of the proposals asked for continued support for work which was started under ICAP auspices in FY78.



These fourteen formal proposals were reviewed by people who are knowledgeable in marine education, training, research, advisory service, and international relations. They were also discussed in an interagency meeting held in the Office of Sea Grant. Some of the issues taken into consideration included technical excellence, evidence of genuine cooperation with developing countries in the formulation of projects, evidence of commitment on the part of the developing countries, geographic balance, and subject matter balance.

Final funding decisions were made by the middle of August 1979. Four projects were given support for two-year periods; three projects were given support for one year; six projects were either declined by the Office of Sea Grant or withdrawn by the proposing institutions; and one project was left for final disposition in FY80.

Interaction with the Department of State is discussed later in this report.

#### FUNDED PROJECTS

Table I below gives the grantee institution, participating developing country, duration, and size of grant for each project which was supported out of FY79 funds.

TABLE I

#### ICAP Projects Supported with FY79 Funds

| <u>Grantee Institution</u> | <u>Developing Country</u> | <u>Duration</u> | <u>Grant</u> |
|----------------------------|---------------------------|-----------------|--------------|
| University of Hawaii       | South Pacific Nations     | 1 year          | \$ 92,800    |
| Oregon State University    | Chile and Mexico          | 2 years         | 190,000      |
| University of California   | Mexico                    | 2 years         | 240,000      |
| Florida Sea Grant Program  | India                     | 1 year          | 18,000       |
| Louisiana State University | Mexico                    | 1 year          | 46,800       |
| Maryland Sea Grant Program | Egypt                     | 2 years         | 134,400      |
| University of Rhode Island | Malaysia                  | 2 years         | 185,000      |
| TOTAL                      |                           |                 | \$907,000    |



Details on these projects supported out of FY79 funds are given in Appendix C to this report.

It should be noted that three of these projects (Louisiana State, University of Rhode Island, and Oregon State) are continuations of projects begun last year with support from FY78 funds.

The international project at the University of Hawaii is being carried out in cooperation with the University of South Pacific. This university serves the educational needs of eleven Pacific nations: Solomons, Fiji, Tuvalu, Kiribati, New Hebrides, Cook, Nauru, Tokelau, Tonga, and Western Samoa.

For ease of reference, Table II shows the projects which were supported out of FY78 funds.

TABLE II

## ICAP Projects Supported with FY78 Funds

| <u>Grantee Institution</u>              | <u>Developing Country</u> | <u>Duration</u> | <u>Grant</u> |
|-----------------------------------------|---------------------------|-----------------|--------------|
| New York Sea Grant Inst.                | Chile                     | 2 years         | \$ 72,000    |
| University of Delaware                  | Costa Rica                | 2 years         | 303,500      |
| University of Rhode Island              | Malaysia                  | 1 year          | 95,000       |
| Louisiana State University              | Mexico                    | 1 year          | 21,600       |
| Oregon State University                 | Chile et al.              | 1 year          | 90,000       |
| Virginia Institute of<br>Marine Science | Israel                    | 2 years         | 131,400      |
| University of Miami                     | Colombia                  | 2 years         | 199,900      |
|                                         |                           | TOTAL           | \$913,400    |

Adding the two preceding tables together, we see that ICAP is now supporting a total of eleven education and training projects in most parts of the developing world. There are as yet no projects in tropical Africa.



Since every project supported out of FY78 funds was either supported for a two-year period or received a continuation grant in FY79, no project has yet come to a conclusion.

Table III shows all the projects supported by ICAP to date, with cumulative durations and cumulative funding totals.

TABLE III  
ICAP Projects Supported to Date

| <u>Grantee Institution</u>           | <u>Developing Country</u> | <u>Cumulative Duration</u> | <u>Cumulative Funding</u> |
|--------------------------------------|---------------------------|----------------------------|---------------------------|
| University of Hawaii                 | South Pacific Nations     | 1 year                     | \$ 92,800                 |
| Oregon State University              | Chile and Mexico          | 3 years                    | 280,000                   |
| University of California             | Mexico                    | 2 years                    | 240,000                   |
| Florida Sea Grant Program            | India                     | 1 year                     | 18,000                    |
| Louisiana State University           | Mexico                    | 2 years                    | 68,400                    |
| Maryland Sea Grant Program           | Egypt                     | 2 years                    | 134,400                   |
| University of Rhode Island           | Malaysia                  | 3 years                    | 280,000                   |
| New York Sea Grant Inst.             | Chile                     | 2 years                    | 72,000                    |
| University of Delaware               | Costa Rica                | 2 years                    | 303,500                   |
| Virginia Institute of Marine Science | Israel                    | 2 years                    | 131,400                   |
| University of Miami                  | Colombia                  | 2 years                    | 199,900                   |
| TOTAL                                |                           |                            | \$1,820,400               |

#### THE DEPARTMENT OF STATE

With respect to the International Cooperation Assistance Program, Section 3 of the Sea Grant act states:



"Each grant or contract under this section shall be made pursuant to such requirements as the Secretary (of Commerce) shall, after consultation with the Secretary of State, by regulation prescribe."

And later in the same section:

"Before approving any application for a grant or contract under this section, the Secretary (of Commerce) shall consult with the Secretary of State."

These words clearly give the Department of State a consultative role both in the formulation of regulations for ICAP and in the approval of individual grants.

Within the Department of State, the consultations required by the act were delegated to the Bureau of Oceans and International Environmental and Scientific Affairs (OES) and in particular to the Office of Marine Science and Technology. Within the Department of Commerce, authority was delegated to the National Oceanic and Atmospheric Administration (NOAA) and in particular to the Office of Sea Grant.

Even before the passage of the 1976 Sea Grant legislation, there was close agreement between personnel in the Department of State and in the Office of Sea Grant on the role that an international Sea Grant program could play and how it might operate.

Once ICAP was established and responsible operating agencies were designated, there was collaboration in the development of the regulations which appeared in the Federal Register. This same spirit of cooperation has continued.

Evidence of State Department support for ICAP is found in testimony given by the last two Deputy Assistant Secretaries of State for Oceans and Fisheries Affairs. To quote briefly from the testimony of Ambassador John D. Negroponte before the Senate Committee on Commerce, Science, and Transportation on April 7, 1978,

"At the present time, some \$40 million of U.S. government-funded academic oceanographic research is conducted within 200 miles of foreign countries. I feel we need the good will which could be generated by the International Sea Grant Program. If the Program did not already exist, we would now have to establish one, as the U.S. must increasingly turn its attention to the problems of technical cooperation with the developing world."



On an operational level, copies of all formal proposals are sent from the Office of Sea Grant to the State Department's Office of Marine Science and Technology. There is frequent informal contact between personnel in the two offices as the proposals are subjected to review from technical as well as international affairs perspectives. Then representatives of the State Department participate in interagency meetings at which all proposals are discussed. As a final step in this interactive process, the Department of State is formally notified of the final funding decisions made in the Office of Sea Grant. The consultative steps described here are, of course, subject to change as ICAP continues to develop.

#### HUMAN RIGHTS

Some ICAP proposals must be reviewed by the Interagency Group on Human Rights and Foreign Assistance before grants can be concurred in by the Department of State. The Interagency Group was created in answer to a National Security Council directive dated April 1, 1977. It was directed to provide guidance on bilateral and multilateral foreign assistance and to coordinate the Administration's position in this area. The Interagency Group, which is chaired by the Deputy Secretary of State, includes representatives of Treasury, Defense, the National Security Council, and the Agency for International Development. Representatives of Agriculture, Commerce, and the Export-Import Bank also participate in the group's deliberations. In reaching its decisions, the Interagency Group considers not only human rights conditions but also other fundamental U.S. interests and objectives concerning the countries proposed as recipients.

In both FY78 and FY79, proposals for cooperative projects in Chile were examined by the Interagency Group. Since the projects involved university-to-university cooperation and would have negligible impacts on the government of Chile, all of the projects were approved.

#### PROGRESS REPORT

While no project supported under ICAP has yet come to a conclusion, each of the projects which received funds in FY78 has been able to report progress toward achievement of its objectives. Brief summaries of these reports follow.

##### New York Sea Grant Institute - University of Concepcion, Chile

This project, entitled "Strengthening Marine Sciences Capabilities and Programs at the University of Concepcion, Chile," involves personnel



from the Marine Sciences Research Center at Stony Brook and the Department of Marine Biology and Oceanography at the University of Concepcion. Co-principal investigators are Lisandro A. Chuecas, Chairman of the Department of Marine Biology and Oceanography at the University of Concepcion, and Iver W. Duedall, Associate Professor of Chemical Oceanography at the Marine Sciences Research Center.

The overall objectives is to train Chilean university personnel so they can carry out research which contributes to coastal management in Chile. Specific objectives are (1) to train faculty members in research methods which are used in coastal research, and (2) to supplement the teaching and research program at the University of Concepcion.

The project has received funding from three principal sources: ICAP, the University of Concepcion, and the Organization of American States.

Several faculty members from the University of Concepcion spent short periods of time at the Marine Sciences Research Center taking courses, attending seminars, and planning cooperative research endeavors. Faculty members from the Marine Sciences Research Center are now in Chile teaching short courses, improving the use of laboratory instrumentation, gathering data for a marine resources inventory, and planning a study of pollution processes in the Bay of Concepcion. Chilean research capabilities have been strengthened, not only in technical matters but also in the planning and management of research.

#### University of Delaware - University of Costa Rica

This project, entitled "Joint University of Costa Rica/University of Delaware Marine Studies Program: Manpower Training and Pollution Assessment," involves personnel from the Delaware Sea Grant College Program and several departments at the University of Costa Rica. It aims to build the necessary research and institutional base so Costa Ricans can preserve and develop their marine resources in an orderly manner. Specific objectives are (1) to work with Costa Rican trainees in carrying out a preliminary ecological assessment of marine resources in the Gulf of Nicoya, (2) to study the effects of current circulation on pollutant dispersion in the Gulf of Nicoya, (3) to provide a well-equipped modern and economical research vessel for training and research, and (4) to continue an on-going exchange of personnel between the two universities for training of graduate students and technicians.

As steps toward accomplishment of these objectives, the research vessel Skimmer was transported to Costa Rica where a ship's crew and oceanographic technicians were trained, students and faculty carried out water quality and biological surveys in the Gulf of Nicoya during both wet and dry seasons, and there was an initial remote sensing study of currents in the gulf.



Two Costa Rican students completed master's degree studies at the University of Delaware's College of Marine Studies. Training of the Costa Rican crew for R/V Skimmer progressed to the point where the vessel can be turned over to them for water quality work and light gear sampling as soon as an exchange agreement is ratified by the University of Costa Rica. Lectures and a workshop were conducted at the University of Costa Rica on the topics of remote sensing, coastal vegetation, and fisheries resources.

#### University of Rhode Island - Malaysian Universities

This project, entitled "Cooperative Development of University Marine Resource Capability in Malaysia," involves personnel from the University of Rhode Island, Universiti Malaya, and Universiti Pertanian Malaysia. The principal investigators are Nelson Marshall and Harlan Lampe from the University of Rhode Island.

The overall objective was to enhance the ability of the Malaysian institutions to contribute to the development and management of their country's marine resources. Specific objectives were (1) to develop academic programs in fisheries management, coastal zone management and related fields, (2) to begin appropriate courses and curricula, (3) to work out research projects for local funding, and (4) to outline the structure of a local marine extension service. In the course of the past year it was found that extension work was being adequately handled by the responsible government ministry, so this objective was eliminated. The other objectives boiled down more simply to fisheries economics, fish population dynamics, and ecological studies of factors which affect the food chain.

With respect to fisheries economics, Professor Lampe worked with the Faculty of Economics and Agribusiness at Universiti Pertanian Malaysia. Some of his work was not supported by Sea Grant, since the university asked him to stay additional time at their expense.

Professors Marshall and Saila spent several months at both Malaysian universities helping with curriculum development and research planning in the field of fish population dynamics. Three fishery research projects were starting under local funding.

With regard to coastal ecology, stream mixing diagrams were made for two estuaries, sampling and analysis was carried out jointly by Rhode Island and Malaysian investigators, and one Malaysian faculty member began to study the mangrove-dependent food chain.

#### Oregon State University - Chilean Universities

This project, entitled "An International Cooperative Assistance Program for Latin America, with Emphasis on Chile," involves participants from Oregon State, the Catholic University of Valparaiso, and other Chilean universities.



Objectives were (1) to assist Latin American nations in building their competence in marine resource conservation and development, (2) to continue cooperative training programs, (3) to increase the exchange of marine information and data, and (4) to help Latin Americans purchase, maintain, and use oceanographic equipment.

Some specific tasks were a seminar on the results of recent research in Latin American waters, a workshop to train technicians in marine instrumentation and data collection, supervised on-the-job experience for selected technicians, continuation of an oyster culture program in Chile, distribution of the Newsletter Exposure which describes advances in instrumentation, and initial distribution of a basic oceanography text written in Spanish. Some of these tasks were modified in the course of the past year to reflect changed perceptions of need.

A major effort was the "Inter-American Conference on Marine Science and Technology" at the Catholic University of Valparaíso. Over a hundred scientists participated. While most of the attendees were from Chile, some also came from Costa Rica, Ecuador, Norway, and the U.S. Topics included marine biology, marine chemistry, geology and geophysics, marine fisheries, instrumentation, and research vessel operation. The presentation related primarily to research done off the west coast of South America, but extending as far south as Antarctica.

Virginia Institute of Marine Sciences (VIMS) - Israel National Oceanographic Institute (INOI)

This project, entitled "Improvement and Application of Ocean and Wave Data Acquisition and Modeling Techniques for the Facilitation of Coastal Management Decisions in Israel and in the U.S.," is led by Victor Goldsmith from VIMS and Abraham Goïk from INOI.

The project aimed to strengthen the capabilities of both Israeli and U.S. scientists in the field of wave information and coastal zone planning. Specific objectives were (1) to train Israeli personnel in wave measurement and modeling techniques used at VIMS, (2) to exchange and compare wave data obtained in the same way, and (3) to improve Israeli advisory service activity in the field of wave information and coastal zone planning.

During the past year, Israeli and U.S. scientists worked at each others institutions, new information was gathered, and old data was analyzed. Since several of the Israeli investigators had previously worked in other fields this was a training experience for them. A wave gauge was installed at Dado Beach south of Haifa as part of a cooperative project among INOI, the Shore Processes Laboratory at Scripps, and VIMS. The results of this work are applicable to the planning and development of a proposed coal unloading facility at Hadera, a proposed Haifa marine and recreation complex, and an extension to Haifa harbor.



Louisiana State University - Universidad Nacional Autonoma de Mexico (UNAM)

This project, entitled "An Ecological Program for the Languna de Terminos (Campeche, Mexico) with Special Reference to Fishery Resources and the Potential Impacts of Man," involved personnel from LSU's Center for Wetland Resources and UNAM's Center for Marine Sciences and Limnology. The principal investigator was Dr. John Day of LSU.

The overall objective was to improve Mexican capabilities for ecosystem analysis and coastal management. Specific objectives were (1) to identify and quantify the ecological connections between Terminos Lagoon and commercial fisheries, (2) to develop a hydrodynamic-ecological model of the lagoon, (3) to analyze ecological and economic interrelationships in the region, and (4) to prepare a coastal planning manual. Dr. Day was appointed a visiting professor at UNAM's Center for Marine Sciences and Limnology so he could act as a thesis advisor for students.

The investigators studied phytoplankton and mangrove productivity, paying special attention to the effects of river discharge. Coupled with this effort was a study of fishery dynamics. In order to better understand the drainage basin of the lagoon, a hydrodynamic model was created.

The model will be used to gain a better understanding of the lagoon circulation and to plan further research, as well as allowing for the study of pollutant dispersion, fate of spilled oil, and the movement of larvae. Finally all the information was packaged in a booklet on coastal planning.

During the past year Dr. Day advised a number of students on thesis topics such as the distribution of oyster larvae in Laguna de Terminos, microbial damage on decaying mangroves, ecological and physical parameters in Estero Pargo, the ecology of blue crabs, and community dynamics of benthos associated with *Thalassia* beds. Students from the Universidad Autonoma Metropolitana in Mexico City came to the marine station for classes and extended field trips.

Campeche is the site of the Ixtoc I oil spill.



University of Miami - Colombian Universities and Organizations

This project, entitled "Marine Resources and Environmental Sciences Training and Information Exchange Program for Colombia," involved personnel from the University of Miami and the Colombian Oceanographic Commission which acts as lead agency for the participating Colombian universities and other organizations. The principal investigator was Dr. Francis Williams, Professor in the Division of Biology and Living Resources at the Rosenstiel School of the University of Miami.

The overall objective was to enhance the capability of Colombian scientists and technicians to deal with the resources and environmental problems of their coastal zone. Specific objectives were (1) to provide a short series of lectures and seminars on the principles of multidisciplinary research and the application of these principles to tropical coastal areas such as Cartagena Bay and (2) to provide on-the-job experience in the design, planning, execution, and coordination of field and laboratory programs to provide the data needed for development of plans to manage coastal resources, through an integrated study of Cartagena Bay.

The initial training course was held April 17-27, 1979 at the Colombian Navy's Center for Oceanographic and Hydrographic Research in Cartagena. Thirty-five students and 10 professors from seven universities and one research group attended the seminars. Lectures were given in the language of the instructor, with translation from English to Spanish when required. COLCIENCIAS (equivalent to the U.S. National Science Foundation) supported travel and per diem for students who were not within commuting distance of Cartagena. Formal presentations and less formal discussion groups were held each day; and they covered topics as diverse as estuarine hydrodynamics, marine geology, and public health.

The broad scale integrated study of Cartagena Bay began in June 1979. Students from Colombian universities, especially the two located in Cartagena, are associated with all aspects of the work.



APPENDIX A

P.L. 94-461, October 8, 1976  
 Establishing the  
 International Cooperation Assistance Program

**SEC. 3. INTERNATIONAL COOPERATION ASSISTANCE.**

33 USC 1124a.

(a) **IN GENERAL.**—The Secretary of Commerce (hereafter in this section referred to as the “Secretary”) may enter into contracts and make grants under this section to—

(1) enhance the research and development capability of developing foreign nations with respect to ocean and coastal resources, as such term is defined in section 203 of the National Sea Grant Program Act; and

(2) promote the international exchange of information and data with respect to the assessment, development, utilization, and conservation of such resources.

(b) **ELIGIBILITY AND PROCEDURE.**—Any sea grant college and sea grant regional consortium (as defined in section 203 of the National Sea Grant Program Act) and any institution of higher education, laboratory, or institute (if such institution, laboratory, or institute is located within any State (as defined in such section 203)) may apply for and receive financial assistance under this section. Each grant or contract under this section shall be made pursuant to such requirements as the Secretary shall, after consultation with the Secretary of State, by regulation prescribe. Application shall be made in such form, and with such content and other submissions, as may be so required. Before approving any application for a grant or contract under this section, the Secretary shall consult with the Secretary of State. Any grant made, or contract entered into, under this section shall be subject to the limitations and provisions set forth in section 205(d) (2) and (4) of the National Sea Grant Program Act and to such other terms, conditions, and requirements as the Secretary deems necessary or appropriate.

Regulation.

Consultation.

(c) **AUTHORIZATION FOR APPROPRIATIONS.**—There is authorized to be appropriated for purposes of carrying out this section not to exceed \$3,000,000 for the fiscal year ending September 30, 1977. Such sums as may be appropriated under this section shall remain available until expended.



APPENDIX B

Guidelines for the International Cooperation Assistance Program  
Federal Register for April 11, 1978, page 15309

**Subpart D—International Cooperation Assistance**

**§ 917.30 General.**

(a) 33 U.S.C. 1124a sets up a program of International Cooperation Assistance in marine research, marine education and training, and marine advisory services designed to enhance the research and technical capability of developing foreign nations with respect to ocean and coastal resources and to promote the international exchange of information and data with respect to the assessment, development, utilization, and conservation of such resources. Any Sea Grant College or Sea Grant Regional Consortium or any institution of higher education, laboratory, or institute (if such institution, laboratory or institute is located within any state) may apply for and receive International Cooperation Assistance funding.

(b) International Cooperation Assistance funding proposals will be expected to address: (1) the nature and focus of the proposed project, (2) the utilization of institutional and other appropriate resources in the implementation of the project, (3) a clear indication of the foreign participant's (individual or institution) commitment to the project, (4) identification of accomplishments expected from a single granting interval, (5) implicit or explicit out-year commitment of resources, and (6)

the impact of the proposed project on the institution receiving funding.

(c) The projects supported by International Cooperation Assistance funding are intended to be genuinely cooperative. Innovation and uniqueness will be significant factors in the determination of proposals to be funded. In the case of a proposed international project that is submitted from an institution where a Sea Grant program is in existence, the extent to which the proposed project takes advantage of the Sea Grant institutional capability existing at that institution and thereby strengthening it, as opposed to being a mere appendage to the ongoing Sea Grant program, will also be an important evaluation factor. The U.S. Department of State will be given the opportunity to review all International Cooperation Assistance projects and none will be funded without this consultation. Because the United Nations Educational, Scientific, and Cultural Organization (UNESCO) also funds international projects of the kind that can be funded under the Sea Grant International Cooperation Assistance program, and, to effect coordination in this area between Sea Grant and UNESCO, the Division of Marine Sciences (UNESCO) will be informed of all International Cooperation Assistance projects funded.



APPENDIX C

Summaries of projects supported with FY79 funds under the International Cooperation Assistance Program.

(The author of this report wrote the project summaries that follow. He alone is responsible for any difference between these summaries and the proposals submitted by the investigators.)



TITLE OF PROJECT: University of the South Pacific/University of Hawaii  
Sea Grant International Cooperative Program

GRANTEE INSTITUTION: University of Hawaii

DEVELOPING COUNTRY: Pacific Islands (Solomons, Fiji, Tuvalu, Kiribati, New Hebrides, Cook, Nauru, Niue, Tokelau, Tonga, and Western Samoa)

DEVELOPING COUNTRY INSTITUTION: University of the South Pacific

SIZE AND DURATION OF GRANT: \$92,800 for one year

PRINCIPAL INVESTIGATORS: Philip Helfrich and Jack Davidson, University of Hawaii

DEVELOPING COUNTRY LIAISON: Dr. U. Raj, Director, Institute of Marine Resources, Hawaii

OVERALL OBJECTIVES: To assist the University of South Pacific's Institute of Marine Resources (USP-IMR) develop an advisory network. Exchange talent, information, and ideas between the University of Hawaii and USP using faculty exchanges, the PEACESAT, and other means.

SPECIFIC OBJECTIVES:

- (1) To conduct a joint faculty exchange program between USP and UH designed to achieve improved tropical marine science course offerings and overall professional improvement;
- (2) To establish a functional marine extension service with offices at USP-IMR and one other USP center--
  - (a) to train two local people to serve as marine advisory agents,
  - (b) to conduct a pilot technology transfer project using a multidisciplinary team of UH and USP personnel after the extension agents have identified a high priority solvable problem,
  - (c) to develop specialized expertise within the USP-IMR marine extension agents through the technology transfer project and through exposure to the UH Marine Advisory Program which will retrieve and disseminate information to the agents.
- (3) To evaluate the program and develop a follow-up plan to complete the advisory network and professional improvement programs.



TITLE OF PROJECT: An International Cooperative Assistance Program for Latin American Countries (with emphasis in Chile and Mexico)

GRANTEE INSTITUTION: Oregon State University

DEVELOPING COUNTRIES: Chile and Mexico

DEVELOPING COUNTRY INSTITUTIONS: Universidad Catolica de Valparaiso, Chile and Centro de Investigaciones Biologicas La Paz, Mexico

SIZE AND DURATION OF GRANT: \$190,000 for two years

PRINCIPAL INVESTIGATORS: Victor Neal and William Q. Wick

DEVELOPING COUNTRY LIAISON: Faculty members at the Chilean and Mexican Institutions

OVERALL OBJECTIVES: To assist Latin American nations develop competence in marine resources conservation and development; to continue the development of cooperative marine programs between Oregon State University and Latin American institutions; and to advise Latin Americans on how to purchase, maintain, and use oceanographic equipment.

SPECIFIC OBJECTIVES:

- (1) To determine suitable opportunities for marine advisory service activities in Latin America;
- (2) To transfer knowledge of coastal processes and the techniques of study to Chilean scientists by means of an academic course, a sampling program, and technician training;
- (3) To apply remote sensing capabilities of NIMBUS-7 satellite to study the physical, chemical, and biological nature of the waters off Chile;
- (4) To conduct two workshops on modeling approaches and fisheries technology with Latin American personnel;
- (5) To train Mexican students and scientists in marine mammal research and management;
- (6) To continue support for distribution of the newsletter "Exposure".

ADDITIONAL: This is a continuation of a project begun under ICAP auspices in FY78.



|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TITLE OF PROJECT:                | Informational and Educational Assistance to Marine Science Institutions in Mexico                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| GRANTEE INSTITUTION:             | University of California                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| DEVELOPING COUNTRY:              | Mexico                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| DEVELOPING COUNTRY INSTITUTIONS: | Instituto Nacional de Pesca; Escuela Superior de Ciencias Marinas, Ensenada; Universidad Autonoma de Baja California; Centro de Investigaciones y de Educacion Superior de Ensenada; Centro de Investigaciones Biologicas, La Paz; and Universidad Autonoma de Baja California Sur, La Paz.                                                                                                                                                                                                                                                                                          |
| SIZE AND DURATION:               | \$240,000 for two years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| PRINCIPAL INVESTIGATOR:          | Richard A. Schwartzlose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DEVELOPING COUNTRY LIAISON:      | Faculty in the Mexican institutions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| OVERALL OBJECTIVE:               | Cooperation between Mexican and University of California institutions to improve Mexican research and education in the marine sciences.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| SPECIFIC OBJECTIVES:             | <p>(1) To train a self-supporting, self-perpetuating cadre of marine research technicians for the Mexican marine science community;</p> <p>(2) To acquire reprints, volumes, and hard copies of documents and journals for the Mexican institutions;</p> <p>(3) To provide requested short-term courses to faculty and staff members of the Mexican institutions to upgrade and expand their teaching capacity;</p> <p>(4) To provide upon request access to short-term, intensive training through attendance at summer courses by faculty members of the Mexican institutions.</p> |



TITLE OF PROJECT: A Short Course on Small Harbor Engineering in India

GRANTEE INSTITUTION: University of Florida

DEVELOPING COUNTRY: India

DEVELOPING COUNTRY INSTITUTION: Indian Institute of Technology

SIZE AND DURATION OF GRANT: \$18,000 for one year

PRINCIPAL INVESTIGATOR: A. J. Mehta, University of Florida

DEVELOPING COUNTRY LIAISON: S. Narashimhan, Indian Institute of Technology

OVERALL OBJECTIVE; To enhance the capability of Indian engineers to develop small and intermediate-sized fishing harbors.

SPECIFIC OBJECTIVES: (1) To provide a summary of the latest technology available in coastal/harbor engineering design practice;

(2) To provide a forum for exchange of scientific know-how among Indian and non-Indian experts in the field;

(3) To initiate such a forum for the first time, thus giving impetus to future forums of a similar nature.



TITLE OF PROJECT: An Ecological Program for the Laguna de Terminos (Campeche, Mexico) with Special Reference to Fishery Resources and the Potential Impacts of Man

GRANTEE INSTITUTION: Louisiana State University

DEVELOPING COUNTRY: Mexico

DEVELOPING COUNTRY INSTITUTION: Universidad Nacional Autonoma de Mexico (UNAM)

SIZE AND DURATION OF GRANT: \$46,800 for one year

PRINCIPAL INVESTIGATOR: John W. Day, Jr., Center for Wetland Resources, Louisiana State University

DEVELOPING COUNTRY LIAISON: Dr. Alfredo Laguarda, Director of the Center for Marine Sciences and Limnology, UNAM

OVERALL OBJECTIVE: Improve Mexican capabilities for ecosystem analysis and coastal management.

SPECIFIC OBJECTIVES:

- (1) To continue a cooperative study with Mexican scientists of management topics associated with the shrimp fishery of Laguana de Terminos;
- (2) To transfer the programs and data of the hydro-dynamic model developed during this past year's work to Mexican counterparts, implement it on their computer, and train individuals in its use;
- (3) To continue to train students in field studies necessary to complete an ecosystem analysis.

ADDITIONAL: This is a continuation of a project begun under ICAP auspices in FY78.



TITLE OF PROJECT: Strengthening Environmental Microbiology and Pollution Monitoring Capabilities at the High Institute of Public Health, Alexandria, Egypt

GRANTEE INSTITUTION: Maryland Sea Grant Program

DEVELOPING COUNTRY: Egypt

DEVELOPING COUNTRY INSTITUTION: High Institute of Public Health Alexandria, Egypt

SIZE AND DURATION OF GRANT: \$134,000 for two years

PRINCIPAL INVESTIGATORS: Kazuyoshi Kawata, Acting Director, Division of Environmental Health Engineering, and Vincent P. Olivieri, Assistant Professor of Environmental Health Engineering, The Johns Hopkins University

DEVELOPING COUNTRY LIAISON: Abdel Hadi El Molla, Professor and Head, Department of Microbiology, High Institute of Public Health, Alexandria, Egypt

OVERALL OBJECTIVES: To enhance the capabilities of the Egyptian microbiologist in environmental microbiology in marine environments.

SPECIFIC OBJECTIVES:

- (1) To hold workshops on recent environmental microbiological techniques;
- (2) To train microbiology students in the tracer virus techniques in field research and monitoring;
- (3) To hold a seminar each year on environmental microbiological studies in tropical waters.

ADDITIONAL: Links between High Institute of Public Health and The Johns Hopkins University have been frequent in past years. Many members of the High Institute faculty have been students at The Johns Hopkins University, and exchange visits have been constant.



|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TITLE OF PROJECT:                | Cooperative Development of Marine Resources Capability in Malaysia                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| GRANTEE INSTITUTION:             | University of Rhode Island                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| DEVELOPING COUNTRY:              | Malaysia                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| DEVELOPING COUNTRY INSTITUTIONS: | Universiti Malaya, Universiti Pertanian Malaysia, and Universiti Sains Malaysia                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| SIZE AND DURATION OF GRANT:      | \$185,000 for two years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| PRINCIPAL INVESTIGATORS:         | Harlan C. Lampe and Nelson Marshall                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| DEVELOPING COUNTRY LIAISON:      | Faculty at the Malaysian Universities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| OVERALL OBJECTIVE:               | To cooperate with peers at the three Malaysian universities in strengthening their capabilities in marine resources activities and augmenting URI capabilities in addressing the marine resource problems of the area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| SPECIFIC OBJECTIVES:             | <p>(1) To retrain at least two professionally qualified Malaysian economists in fisheries economics methods;</p> <p>(2) To improve the teaching of fisheries economics in the Malaysian universities;</p> <p>(3) To assess current economic conditions in the fisheries sector of the east coast of Peninsular Malaysia;</p> <p>(4) To strengthen university staff capability to handle responsibilities for instruction and research in fish population dynamics and introduce the kind of research basic to population management;</p> <p>(5) To work with Malaysian faculty members to develop research projects that will permit the role of mangroves to be determined and factored into the making of coastal management decisions.</p> |
| ADDITIONAL:                      | This is a continuation of work begun in fishery management, coastal zone management and related fields last year under an ICAP grant.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |



## SEA GRANT AWARDS FY 1979

## STATE DISTRIBUTION

| <u>STATE</u>         | <u>SG FUNDS</u> | <u>MATCHING FUNDS</u> |
|----------------------|-----------------|-----------------------|
| Alaska               | \$1,208,500     | \$ 834,852            |
| Arizona              | 33,500          | 27,784                |
| California           | 4,229,800       | 2,380,880             |
| Colorado             | 26,000          | 44,000                |
| Connecticut          | 129,200         | 66,024                |
| Delaware             | 1,125,300       | 768,507               |
| District of Columbia | 4,000           | 2,000                 |
| Florida              | 1,489,000       | 1,134,500             |
| Georgia              | 790,500         | 774,700               |
| Hawaii               | 1,855,800       | 1,167,678             |
| Idaho                | 36,500          | 28,416                |
| Louisiana            | 1,194,300       | 715,392               |
| Maryland             | 869,100         | 551,010               |
| Massachusetts        | 2,393,300       | 1,792,639             |
| Michigan             | 1,020,600       | 520,892               |
| Minnesota            | 635,000         | 525,548               |
| Mississippi          | 785,000         | 429,404               |
| New Hampshire        | 1,527,000       | 785,542               |
| New Jersey           | 580,800         | 359,685               |
| New York             | 1,680,700       | 907,223               |
| North Carolina       | 970,500         | 505,864               |
| Ohio                 | 197,500         | 110,759               |
| Oklahoma             | 136,000         | 68,000                |
| Oregon               | 2,340,000       | 1,658,800             |
| Rhode Island         | 1,680,100       | 763,400               |
| South Carolina       | 390,000         | 406,700               |
| Texas                | 1,925,300       | 1,438,117             |
| Virginia             | 887,250         | 521,062               |
| Washington           | 2,119,026       | 1,136,076             |
| Wisconsin            | 1,700,000       | 950,000               |
| Puerto Rico          | 109,100         | 70,540                |



FUNDED IN FY 1980LIST OF PROJECTS FOR NSTS GRANTSUniversity of California, San Diego

\$707,600

1. R/CZ-N-5A (Sullivan) Program Direction: NSTS
2. R/CZ-N-43 (Inman) NSTS: Sediment Transport Studies in the Nearshore Environment (Task 4B)
3. R/CZ-N-4D (Guza) Field Measurements of Surf Zone Enegetics (Task 4D)  
(Thornton)\*
4. R/CZ-N-4F (Seymour)\*\* Field Investigation of Beach Profile Changes NSTS (Task 4E)
5. R/CZ-N-4F (Seymour) Characterization of Offshore Wave Climate: NSTS (Task 4F)
6. R/CZ-N-4G (Seymour) Field Experiment: NSTS (Task 4G)

University of Delaware

\$165,600

1. (Dean) Measurement and Characterization of the Net Accumulation of Sediment in a Trap During the First Major Field Experiment, Santa Barbara Harbor, California (Task 4A)

University of Washington

\$ 99,400

1. (Sternberg) Investigation of Sediment Transport in the Nearshore Environment (Task 4B)

Woods Hole Oceanographic Institution

\$ 39,300

1. R/B-19 (Aubrey) Field Investigations of Beach Profile Changes Nearshore Sediment Transport Study (Task 4E)

Continuing from FY 1979

University of Delaware: Field Measurement of Rip Currents  
(Dalrymple) (Task 1B)

Massachusetts Institute of Technology: Engineering Model of Forcing  
Function (Madsen) (Task 1F)

\*U.S. Naval Post Graduate School, Monterey

\*\*California Department of Boating and Waterways



Senator PELL. This concludes this hearing on the sea grant authorization. It is a joint hearing. We should note for the record what a good idea it is to have joint hearings because of the time saved. I do it with the House Committee on Arts and Education. Here we have a joint hearing with another committee in the Senate. I hope it will serve as an example to some of my colleagues.

Thank you very much.

This hearing is adjourned.

[Whereupon, at 10:23 a.m., a recess was taken subject to the call of the Chair.]

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