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FOURTH ANNUAL REPORT of the MARINE AFFAIRS COORDINATOR to the GOVERNOR and LEGISLATURE STATE of HAWAII

JULY 1975 to DECEMBER 1977

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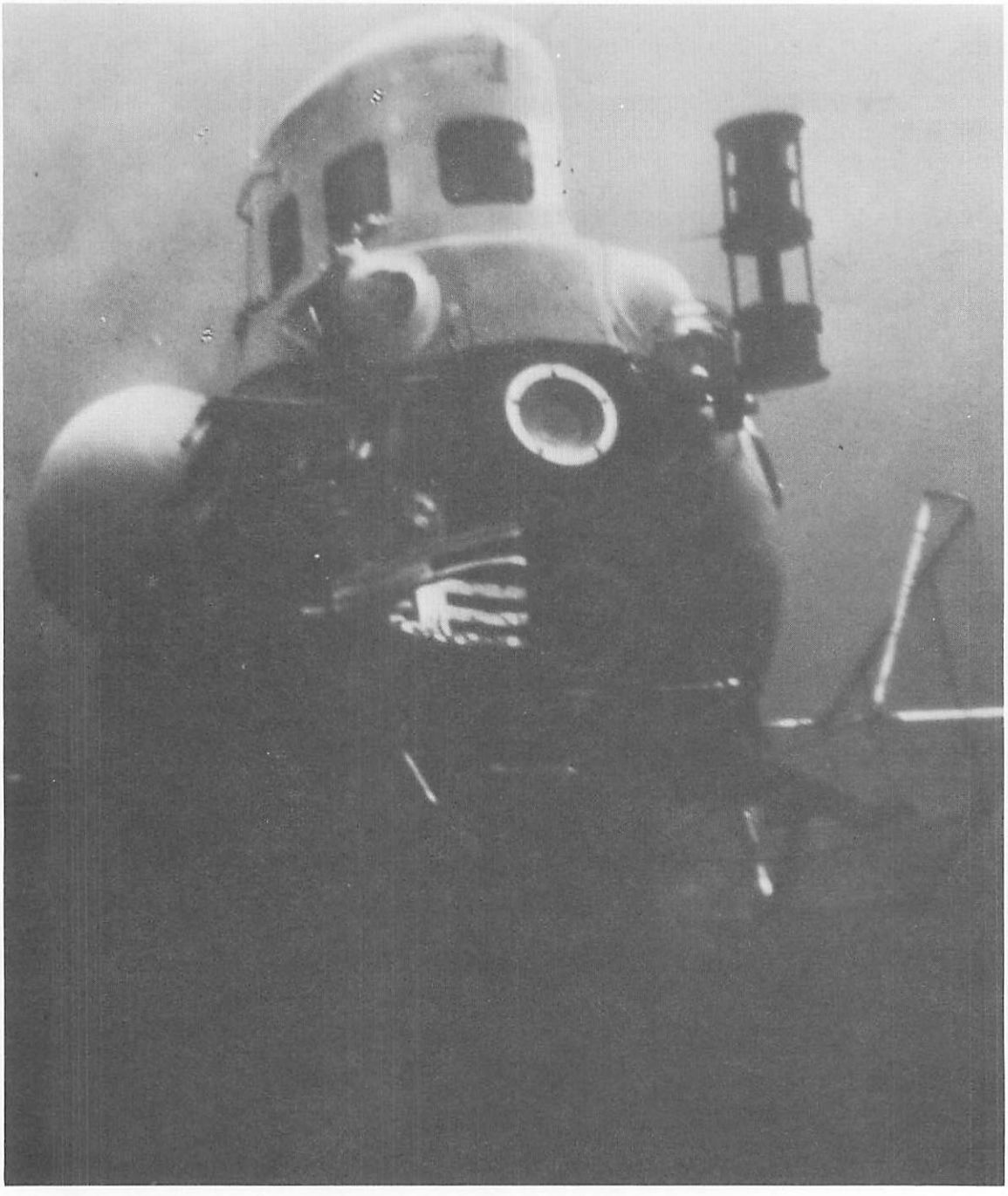
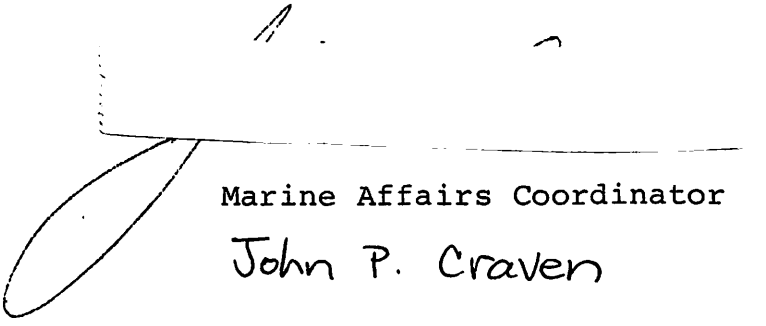


INTRODUCTION

The position of Marine Affairs Coordinator was established within the Office of the Governor by Act 137 of the 1970 Hawaii State Legislature. In declaring its findings and needs, the Legislature identified the marine environment as one of Hawaii's most valuable assets, whose optimal development and utilization would require deep involvement of State government. Further, the Legislature declared the necessity for a planned and concerted development effort, which would require a mechanism that cut across the line duties of various State agencies. This mechanism was the establishement of the Marine Affairs Coordinator, who was mandated, subject to the Governor's approval, to develop long-range plans, formulate specific programs, conduct analyses of existing and proposed marine programs, assist departments involved in marine affairs, coordinate multi-agency marine activities, and promote increased Federal and private involvement in marine programs.

Act 149 of the 1977 Hawaii State Legislature amended the original law by deleting the provision requiring approval of the Governor in the conduct of duties, and established a semi-annual reporting requirement for the benefit of the Governor and Legislature.

Since 1970, the Marine Affairs Coordinator has funded projects with $5,481,431 in State monies and, in so doing, has generated $7,234,858 in Federal and private grants. Activities from Fiscal Years 1970-75 have been reported in the three previous annual reports. This report will summarize projects sponsored in Fiscal Years 1976 and 1977, and identify those activities currently being conducted in Fiscal Year 1978.



Marine Affairs Coordinator

John P. Craven

II. FISCAL YEAR 1977-78, AN OVERVIEW

A. Activities of the Marine Affairs Coordinator (MAC)

The current program of the Marine Affairs Coordinator focuses its attention on planning and coordination, as well as responding to the immediate research and development needs of the marine community.

The advent of the Governor's Interim Marine Affairs Advisory Council has established a forum for long-range planning and policy recommendations from among the State's top marine scientists and industrialists. It is expected that strategies, priorities, and evaluations will emanate from this group, using "Hawaii and the Sea - 1974" as a foundation. The initial topics addressed by the Council have been policy considerations relating to jurisdictional issues resource evaluation, and developmental strategies for the Leeward Hawaiian Islands.

In addition to liaising with numerous agencies and individuals, the Marine Affairs Coordinator has initiated ad hoc committees and meetings dealing with such diverse topics as marine education, fisheries legislation, sand mining, Leeward Islands developmental policy, and diving safety.

The MAC sits on a number of councils, ranging from Water Quality and Coastal Zone Management to Aquaculture Development, and is often called upon to provide input to State and Federal agencies on marine-related matters.

Programmatically, the MAC supports, and in some cases initiates, a wide range of projects which require State funding. In this fiscal year, at least thirty projects will receive support from the MAC, with emphasis on economic development and education activities.

As part of the continuing effort to survey the State's marine resources, the Marine Affairs Coordinator has supported a major State/Federal assessment of the Leeward Hawaiian Islands. Although funding has been minimal this fiscal year, significant funds will be used to support a variety of Leeward Islands projects in FY 1978-79.

Current conservation/preservation projects supported by the MAC include an in-depth study of the effects of cessation of sewage flow into Kaneohe Bay, a test of microbiological indicators to determine fecal contamination of inshore waters, and continuing management studies of Hawaii's green sea turtle and opihi populations.

In the area of economic development, the MAC is supporting projects related to manganese nodules, sand mining,

and skipjack tuna fishing. The manganese nodule project will provide a better understanding of nodule formation and assess several alternatives for off-shore dumping of residue. Such studies are complementary to the nodule program of DPED.

In response to the need for sand supplies for beach restoration and construction, the MAC is supporting an ocean-bottom sand sampling program to determine quality and quantity of nearshore sand resources.

In partnership with Maui County, DPED, and the University, the MAC is serving as lead agency in a baitfish culture and field testing project to find a supplemental bait for Hawaii's ailing skipjack tuna fleet. In addition, the MAC is cooperatively supporting a program to determine the feasibility of aerial spotting of tuna schools for the fishing fleet.

The MAC has long advocated a "keiki to pau hana" marine education program stressing environmental awareness, historical perspectives, and vocational training. In conjunction with DOE, the University, and Waikiki Aquarium, the MAC is supporting a variety of educational projects including the "Blue-Water Marine Laboratory" for high school students; the Aquarium Educational Program for schools and public at-large; "Makahiki Kai", the annual festival-of-sea exhibition; a statewide diving safety program, including diving medicine workshops for doctors and paramedics; ship time for Leeward Community College's marine technician program; and operational funds for the University's Sea Grant marine advisory program.

In order to enhance infrastructure for various marine activities, the MAC has provided facilities support in the form of diving decompression chambers at strategic locations, maintenance of Makapuu pier, and temporary storage space for several marine programs.

B. State/Federal Marine-related Expenditures, FY 1977-78

The Marine Affairs Coordinator has initiated a computer data retrieval system which will, for the first time, enable a compilation of essentially all marine programs within the state. The following summary, compiled from the computer system and other sources, includes only State/Federal research and development expenditures. Information on privately-funded activities were not easily obtainable, and environmental impact assessments were omitted.

TABLE I. SUMMARY OF STATE/FEDERAL MARINE-RELATED EXPENDITURES, FY 1977-78

AGENCY	State Funds	Federal Matching	TOTAL
Department of Agriculture (DOA)	250,000*	-0-	250,000*
Department of Defense (DOD)	93,000	93,000	186,000
Department of Education (DOE)	26,750	-0-	26,750
Department of Health (DOH)	465,646	507,111	972,757
Department of Labor & Industrial Relations (DLIR)	18,588	-0-	18,588
Department of Land & Natural Resources (DLNR)	7,527,419	169,147	7,696,566
Marine Affairs Coordinator (MAC)	477,854	488,869	926,723
Department of Planning & Economic Development (DPED)	1,772,323	383,000	2,155,323
Office of Environmental Quality Control (OEQC)	54,500	-0-	54,500
Sub-total	10,686,080	1,601,127	12,287,207
Department of Transportation (DOT) Water Transportation Facilities Division (Operating and CIP Funds)	28,075,576	45,429	28,121,005
University of Hawaii (UH)	(NOT AVAILABLE AT THIS TIME)		
GRAND TOTAL	38,761,656	1,646,556	40,408,212

TABLE II. SUMMARY OF STATE/FEDERAL MARINE-RELATED EXPENDITURES, FY 1977-78

PROGRAM AREA	AGENCY	AMOUNT	FEDERAL MATCH	TOTAL
A. RESOURCE ASSESSMENT				
LNR 805: Fish survey, investigations, enforcement	DLNR	310,160	55,000	365,160
North Kona-South Kohala Carrying Capacity Study	OEQC	47,500	-0-	47,500
GOV-109	MAC	26,260	-0-	26,260
TOTAL		383,920	55,000	438,920
B. MARINE CONSERVATION				
Water Pollution	DOH	358,860	371,200	730,060
Areawide Waste Treatment Management	DOH	50,000	135,917	185,917
LNR 401 Preservation/Protection native fish	DLNR	101,152	14,147	115,299
Ala Wai Canal dredging	DLNR	500,000	-0-	500,000
LNR 805 Oceanfront Parks	DLNR	6,413,775	-0-	6,413,775
Natural Areas Reserve System Commission	DLNR	1,400	-0-	1,400
GOV-109	MAC	65,550	245,270	310,820
PED 103 Land Use, Statewide Planning and Coordination	DPED	75,000	300,000	375,000
TOTAL		7,565,737	1,066,534	8,632,271

TABLE II. (continued)

PROGRAM AREA	AGENCY	AMOUNT	FEDERAL MATCH	TOTAL
C. ECONOMIC DEVELOPMENT				
Aquaculture Loan Program Appropriated 1971 Available for loan, December 5, 1977	DOA	500,000 250,000*	-0-	250,000*
Shellfish monitoring	DOH	36,786	-0-	36,786
SCET funds for brine shrimp project labor	DLIR	18,588	-0-	18,588
LNR 153 Commercial Fisheries	DLNR	296,004	100,000	396,004
GOV-109	MAC	133,600	10,000	143,600
Water Transportation Facilities	DOT	25,277,514	-0-	25,277,514
PED 102 Commerce & Industry	DPED	1,109,360	83,000	1,192,360
PED 107 Services Development & Marketing	DPED	587,963	-0-	587,963
TOTAL		27,691,227	193,000	27,884,227
*Estimated				
D. MARINE EDUCATION				
Blue-Water Marine Laboratory	DOE	26,750	-0-	26,750
Reef Studies instructional Grant	OEQC	7,000	-0-	7,000
GOV-109	MAC	172,105	193,599	365,704
TOTAL		205,855	193,599	399,454

TABLE II. (continued)

PROGRAM AREA	AGENCY	AMOUNT	FEDERAL MATCH	TOTAL
E. FACILITIES SUPPORT				
Kauai Recompression Chamber Installation	DOH	20,000	-0-	20,000
Tsunami Warning Sirens	DOD	93,000	93,000	186,000
TRN 801 Small Boats (harbors)	DOT	2,798,062	45,429	2,843,491
GOV-109	MAC	55,850	-0-	55,850
TOTAL		2,966,912	138,429	3,105,341

C. Summary of MAC-Funded FY 1977-78 Projects

The FY 1977-78 budget of the Marine Affairs Coordinator, including Part II and Part V appropriations, totaled $688,653, of which $547,880 was actually allocated. Of this amount, $70,615 is budgeted for staff support and office operations. Thus, $477,854 has been allocated for project support. This amount has generated $448,869 in Federal matching funds.

TABLE III. MAC PROJECT EXPENDITURES, FY 1977-78

MAC PROJECT TITLE	MAC FUNDING	FEDERAL MATCHING FUNDS	TOTAL
I. RESOURCE ASSESSMENT			
Coastal Zone Data Bank	25,000	-0-	25,000
Preparation of the Leeward Archipelago Proposal	1,260	-0-	1,260
		TOTAL	26,260
II. MARINE CONSERVATION			
Microbiological Indicators for Ascertaining Fecal Contamination	10,000	19,270 Sea Grant	29,270
EPA/Kaneohe Bay Sewage Relaxation Study	32,000	206,000 EPA	238,000
Green Sea Turtle Management Study	21,550	20,000 Sea Grant	41,550
Opihi Management Study	2,000	8,400 DPED	10,400
TOTAL	65,550	253,670	319,220

Table III (continued)

MAC PROJECT TITLE	MAC FUNDING	FEDERAL MATCHING FUNDS	TOTAL
III. ECONOMIC DEVELOPMENT			
Ocean Metals (Manganese Nodules)	60,000	-0-	60,000
Tuna Baitfish Project	33,000	-0-	33,000
Catfish Project	10,000	-0-	10,000
Aquaculture Pond Management Project	5,600	-0-	5,600
Sand Sampling Project	15,000	-0-	15,000
Hawaii Skipjack Aerial Spotting Program	10,000	10,000	20,000
TOTAL	133,600	10,000	143,600
IV. MARINE EDUCATION			
Voyages Into Ocean Space Lecture Series	3,850	-0-	3,850
Aquarium Education Program	26,500	-0-	26,500
Makahiki Kai '78	12,000	24,000 Sea Grant	36,000
Blue-Water Marine Laboratory	30,000	-0-	30,000
MAC Student Internship Program	6,000		6,000
Statewide Diving Safety Program	15,000	-0-	15,000
World Mariculture Conference	1,000	-0-	1,000
Sea Grant Publications	7,511	104,000 Sea Grant	111,511
High Visibility Undersea Observation Structure	9,644	26,099 Sea Grant	35,743
LCC Marine Technology Program Ship Time	17,500	-0-	17,500

Table III (continued)

MAC PROJECT TITLE	MAC FUNDING	FEDERAL MATCHING FUNDS	TOTAL
IV. MARINE EDUCATION (cont.)			
Marine Advisory Program	41,000	35,000 Sea Grant	76,000
Marine Affairs Symposium	2,100	4,500 Sea Grant	6,600
TOTAL	172,105	193,599	365,704
V. FACILITIES SUPPORT			
Refurbishing Hyperbaric Chambers	32,000	-0-	32,000
AEGIR Prospectus	4,200	-0-	4,200
Wave Attenuation Project	12,150	Sea Grant in-kind	12,150
Marine Marshalling Facility	2,500	-0-	2,500
Makapuu Pier	5,000	-0-	5,000
TOTAL	55,850	-0-	55,850

The following narratives summarize each of the current projects supported by the Marine Affairs Coordinator.

1. RESOURCE INVENTORY AND ASSESSMENT

COASTAL ZONE DATA BANK

Task Order: Not Yet Written

Proposed MAC Investment: $25,000

MATCHING FUNDS: Not Yet Determined

A firm program for reorganizing and operating the Hawaii Coastal Zone Data Bank is now being formulated. MAC investment is anticipated at $25,000. For information on past operation of the data bank, see the FY 1975-77 section of this report.

PREPARATION OF LEEWARD ARCHIPELAGO PROPOSAL

Task Order #153

MAC Investment: $1,260

NO MATCHING FUNDS

The "Tripartite Cooperative Agreement" between the State of Hawaii and two agencies of the Federal Government calls for a joint five-year study of the Northwestern Hawaiian Islands and their nearby waters. The study will look at the feasibility of balanced utilization of the areas fishery resources in light of the need to maintain adequate feeding stocks for the protected species of the Hawaiian Islands National Wildlife Refuge. (For more information, see "State-Federal Fisheries Survey of Northwestern Hawaiian Islands" in the FY 1975-77 section of this report.) The Sea Grant Program of the University of Hawaii is, at this writing, preparing a proposal to the National Sea Grant Office for a large-scale multidisciplinary research project to gather information relevant to developing and managing fisheries in the leeward section of the Hawaiian archipelago, which includes the Northwestern Hawaiian Islands. Funding from this task order is assisting UH Sea Grant in preparation of that major proposal which, if supported by the National Sea Grant Office, will prove of considerable benefit to the marine economy of Hawaii. Main thrust of the MAC-supported work is to investigate all logistic requirements for the proposed major multidisciplinary study. A secondary effort is to develop a sub-proposal to investigate the ecology of the community of reef-building corals in that area, including a comprehensive review of published scientific papers on reef ecologies of such areas.

2. MARINE CONSERVATION

MICROBIOLOGICAL INDICATORS FOR ASCERTAINING FECAL CONTAMINATION

Task Order #142 (FY 1977-78)

MAC Investment: $10,000

MATCHING FUNDS:
Sea Grant: $19,270;
City/County of Honolulu: $ 8,663

The Water Resources Research Center of the University of Hawaii is seeking, via this project, a more accurate means of identifying the presence of disease-carrying human fecal material in ocean waters. For approximately 60 years the presence of coliform bacteria has been the accepted indicator of fecal pollution; the "coliform count" has been the standard by which the potential for the transmission of human disease in water has been judged. This method of total coliform analysis, however, does not diffrentiate between human fecal material and animal wastes, although human disease transmission is directly related to human fecal material, and not to animal wastes. The researchers are investigating a means of identifying human fecal material in ocean water that has already been demonstrated to be valid in fresh water. This method compares the ratio of fecal coliform to fecal streptococci; in human fecal material the ratio is always greater than four, while in animals the ratio does not exceed 0.7. If a means for accurately distinguishing between dangerous human fecal material and far-less-dangerous animal wastes can be established, it will be much easier to determine when a truly dangerous case of water pollution exists in public swimming and surfing areas.

OPIHI MANAGEMENT STUDY

Task Order: Not Yet Written

Proposed MAC Investment: $2,000

NO MATCHING FUNDS

This project will be a management study of opihi populations in Hawaii County. Its purpose is to determine the effects of harvesting in an area of high-level harvesting activity as compared to a control area with only limited harvesting effort. Information developed by the project should be useful in establishing regulations for opihi management.

EPA/HIMB KANEOHE BAY SEWAGE RELAXATION STUDY
Task Order #145 (FY 1977-78)

MAC Investment: $32,000

MATCHING FUNDS:
Federal EPA: $180,000

By the beginning of 1978, when the new Mokapu sewage outfall system goes into operation, the volume of sewage being discharged into Kaneohe Bay will be reduced by 94%. This diversion of sewage, from inside the Bay to the ocean, will greatly reduce the stress that the sewage has been placing on the Bay's environment and ecosystems. It is generally believed that this major relaxation of sewage stress on the Bay will prove to be highly beneficial--and only beneficial. But will it? While sewage is generally regarded as a pollutant, it can also be an important nutrient for many living things. Could there be a severe drop in the population of the baitfish "nehu", so important to Hawaii's pole-and-line skipjack tuna industry? There proved to be little scientific data available that applied to the Kaneohe situation. Recognizing the need for a scientific study of the Bay that would allow accurate comparisons of the "before" and "after" situation, the Federal Environmental Protection Agency (EPA) began funding the Hawaii Institute of Marine Biology (HIMB) for a three year study of the effects of this sewage stress relaxation on Kaneohe Bay. This study has received MAC support from the beginning (see FY 1975-77 section of this report). Its findings could have significant impact on the continuing controversy with the Federal Government as to whether or not Hawaii must install expensive (and highly energy consumptive) secondary sewage treatment facilities for advanced-primary treated sewage dispersed into the open ocean via deep outfalls. (Most marine scientists regard such sewage dispersed into Hawaii's open ocean waters as a helpful nutrient, rather than as a harmful pollutant.) In a move of cooperation with this project, and with the approval of the State Department of Health, the City-County engineers in charge of the new outfall system will do some back-and-forth diversion before permanently diverting sewage outside the Bay. First, sewage will be diverted out to test the system. Then it will be diverted back into the Bay for two weeks, outside for two weeks, and back into the Bay for another two weeks. Then it will be diverted outside permanently. This will allow the researchers to study the rapidly changing components of the ecosystem, such as plankton and algae, to see how rapidly they reverse under changing conditions. Because weather conditions and other problems caused completion of the outfall to be considerably delayed from the earlier target dates, and because time remaining in the three years may not allow proper assessment of slowing changing factors, the project may require a fourth year, at a considerably reduced level of both State and Federal funding.

GREEN SEA TURTLE MANAGEMENT STUDY
Task Order #151 (FY 77-78)

MAC Investment: $21,500

MATCHING FUNDS:
Sea Grant: $20,000

This Task Order represents both a continuation and expansion of the Green Sea Turtle Management Study that originated in FY 1976-77. (See FY 1975-77 section of this report.) The expansion is made possible by Sea Grant support being added to the original MAC support which was provided by a special appropriation of the 1976 Legislature. The research is now being conducted on a full-time basis, and covers the major Hawaiian Islands as well as the Northwestern Hawaiian Islands. This expansion of the research is important, as work conducted thus far by the principal investigator suggests that recruitment to the major breeding grounds at French Frigate Shoals takes place from feeding areas around the major islands as well as from the Northwestern Hawaiian Islands. Thus, for a true picture, populations in all areas should be studied. It is the objective of this three-year project to provide biological information that will enable the State to manage the green sea turtle populations on a renewable-resource basis.

3. ECONOMIC DEVELOPMENT

TUNA BAITFISH PROJECT
Task Order: Pending

MAC Investment: $33,000

MATCHING FUNDS:
In-kind $80,000
Maui County

This is a cooperative project involving the County of Maui, the State Aquaculture Development Program, Hawaii Institute of Marine Biology, Sea Grant, and the Marine Affairs Coordinator. Its purpose is to build a pilot bait culture facility which will provide enough cultured live bait for definitive skipjack tuna fishing trials and analysis of cost effectiveness. The baitfish to be tested is the topminnow, also known as mollies, or tabai. Most knowledgeable observers believe that the baitfish problem is the major reason for the long decline of the Hawaiian skipjack tuna fishery. The traditional bait is "nehu", which is often in limited supply, and generally does not survive aboard a fishing vessel for more than three days. This sharply limits the range of Hawaiian tuna boats, while the time needed to catch nehu (now 30% to 50% of total working time) severely limits the time spent fishing. A readily available, more hardy baitfish could greatly increase the economic opportunities of the Hawaiian tuna fleet and could well reverse its long-term decline. Topminnows may be that bait. The techniques of rearing them via aquaculture have basically been developed. (For information on such aquaculture, and related baitfish projects, see FY 1975-77 section of this report.) The project will build a rearing facility based on research at HIMB, and will raise fifteen thousand pounds of baitfish, enough for fifty commercial fishing trials. Two vessels based on Maui will be used for these trials. Because both have approximately the same fishing power, and the same owner, a direct economic analysis will be possible. The vessels will alternate their use of traditional nehu and the cultured topminnows as bait.

AEGIR PROSPECTUS
Task Order #150 (FY 1977-78)

MAC Investment: $4,200 NO MATCHING FUNDS

The undersea habitat AEGIR has been given to the University of Hawaii. The Manned Undersea Science and Technology (MUST) Office of the National Oceanic and Atmospheric Administration (NOAA) has requested a plan for using AEGIR, and other oceanic facilities in Hawaii, in undersea research to be sponsored by MUST/NOAA. This Task Order helped fund preparation of a comprehensive prospectus which has been submitted to MUST/NOAA. It emphasizes the advantages, opportunities and interest in an extensive national and State man-in-sea program for the Pacific region centered in Hawaii and capitalizing on existing Hawaiian facilities and programs. To document specific requirements and potentials for manned undersea projects in Hawaii, efforts were made to contact not only the scientific community, but also private industry, State, and City and County personnel whose interests or responsibilities lie in the ocean environment. Fifty three programs were proposed; together they would require over 700 project days in the habitat AEGIR, and more than 340 project days in deep submersibles. Even if only one-third of the project research using AEGIR is funded, it would represent a three-year program for this unique oceanic facility. Research subjects include anthropology, aquaculture, manganese resources, volcanic activity, marine mammals, physiology, biology, and botany. The prospectus was prepared by Makai Ocean Engineering, Incorporated.

WORLD MARICULTURE CONFERENCE
Task Order #148 (FY 1977-78)

MAC Investment: $1,050 NO MATCHING FUNDS

At the invitation of Governor George R. Ariyoshi, the World Mariculture Society (WMS) has agreed to holds its 10th Annual Meeting in Hawaii, during January, 1979. This five-day meeting is expected to attract 300 to 500 participants from a broad cross-section of scientists, technologists, businessmen and practicing aquaculturists. Hawaii's aquaculture community should benefit significantly from the opportunity that the conference will present for a direct exhange of information and experiences. This Task Order therefore provides funds needed for initial planning and preparation for the 1979 meeting of the WMS in Hawaii.

OCEAN METALS (Manganese Nodules)
Task Order #149

MAC Investment: $60,000 NO DIRECT MATCHING FUNDS

For the current fiscal year, this continuing project has directed much of its efforts toward the waters of the channels between the major Hawaii Islands. It is working in close connection with the efforts of the State Department of Planning and Economic Development (DPED), which is currently evaluating Hawaii's role in the manganese nodule industry and making an assessment of the environmental and economic impacts that such an industry might have for Hawaii. The researchers are continuing micorprobe studies of manganese-enriched crustal material recovered from the Northwestern Hawaiian Islands during a November, 1976, survey cruise. (See FY 1975-77 section of this report for details.) They are also making a comprehensive investigation of existing bathymetric and current data concerning the main channel waters; this investigation was requested by the DPED manganese nodule group. It has already been determined that data concerning many areas that would be of importance to any manganese nodule industry is nowhere near adequate for the purpose and in some cases is almost totally lacking. Once the data study is completed, a cruise to obtain missing data is planned; it will be aboard a University of Hawaii research ship in the late spring or early summer of 1978. On that same cruise, certain areas of channel bottoms will be surveyed for manganese deposits and other submerged State resources; special attention will be paid to the undersea slopes east of Maui and Molokai, and to the slope northwest of Hawaii Island.

SAND SAMPLING PROJECT
Task Order: Not Yet Written

Proposed MAC Investment $15,000 NO MATCHING FUNDS

The most critical need for natural sand in Hawaii at this time is for sand of the proper quality for beach replenishment. That was the concensus decision of a meeting of industry, scientific and government people concerned with sand supplies and usage the meeting was called by MAC in the fall of 1977. As a result, it is planned that the next phase of the offshore sand sampling project supported by MAC will concentrate on seeking sand of beach replenishment quality. For information on earlier activities in this regard, see the reports on "Offshore Sand Mining Development" in the FY 1975-77 section of this report.

4. MARINE EDUCATION

SEA GRANT PUBLICATIONS
Task Order #152 (FY 1977-78)

MAC Investment: $7,511

MATCHING FUNDS:
Sea Grant: $104,000

Making information about marine matters available to both the general public and the marine professional, via well-edited publications of both a technical and non-technical nature, is one of the prime responsibilities of an institution that bears the special designation of "Sea Grant College". Only about a dozen institutions have that designation; the University of Hawaii is one. The need for new publications is increasing, as is the demand for copies of existing publications. Because it is in the best interest of the State of Hawaii that the needs of its citizens for marine information be met as adequately as possible, this Task Order in support of the UH Sea Grant Publications Program was issued.

MAC INTERNSHIP PROGRAM
Task Order #146 (FY 1977-78)

MAC Investment: $6,000

MATCHING FUNDS:
Sea Grant, via UH
Marine Option Program

This new program provides opportunities for undergraduate Marine Option Program students at the University of Hawaii who wish on-the-job training in the expanding field of governmental involvement in marine affairs. Under the agreement, the UH Marine Option Program (MOP) will select intern candidates and fund the initial three-month period of internship in the Marine Affairs Coordinator (MAC) Office. Interns who satisfy MAC requirements and are interested in continuing the internship program will be funded from MAC monies assigned to this project, once the initial three-month period is over. Over the past few years, MOP interns, funded solely by the MOP Program and Sea Grant, have provided valuable assistance to the MAC Office.

"VOYAGES INTO OCEAN SPACE" LECTURE SERIES
Task Order #139 (FY 1977-78)

MAC Investment: $3,850

MATCHING FUNDS:
Nat. Sci. Found: $175,000
National Endowment for the Humanities: 14,802
Private donations : 3,958

"Voyages Into Ocean Space" was a series of nine weekly, free, public lectures presented in nine cities: Honolulu, Hilo, Kailua-Kona, Seattle, Portland, San Francisco, San Jose, Los Angeles and San Diego. Purpose of the series was to enhance and expand the public's understanding of marine-related issues and research. The National Science Foundation's support of $175,000 was for all nine cities; the other matching funds shown above were for the three cities in Hawaii receiving the program. A total of 6,670 people attended the series in Honolulu; approximately 2,000 in Hilo, and approximately 1800 in Kailua-Kona. A requirement laid down by the National Science Foundation was that cities receiving the series support it with related activities. Five such events were presented in Hawaii: (1) Community seminars funded by the Hawaii Committee for the Humanities; (2) decision-makers seminars funded by business and industry; (3) a series of ocean recreation programs co-sponsored by the City-County of Honolulu; (4) an Ocean Exposition at the Ala Moana Center; (5) preparation and publication of an Ocean Resource Directory. MAC funding was used for printing of flyers, posters, programs, lecture summaries and for the Ocean Resource Directory.

POND MANAGEMENT STUDENT PROJECT
Task Order Pending

MAC Investment: $5,000

NO MATCHING FUNDS

The field laboratory of the UH's College of Tropical Agriculture course AG 200/201 (Agriculture Practice) provides an excellent opportunity to teach how to run a prawn-rearing pond located between the normal water source and a field where vegetables or fruit/crops are raised. During the 1977 Fall term, without MAC support, the students enrolled in this course set up the pond, cleared weeds, completed a pipeline system, flooded the pond, stocked it with Malaysian prawn juveniles, and started construction of an overflow pond. All this was accomplished by October, 1977. MAC support will provide for a half-time teaching assistant for the Spring 1978 course who will manage the pond and give instruction in its operation. The Aquaculture Development Program regards this as an educational, rather than an aquaculture activity, and considers MAC a more appropriate source for such support than the ADP.

MAKAHIKI KAI 1978
Task Order #141 (FY 1977-78)

MAC Investment: $12,000

MATCHING FUNDS:
Sea Grant: $24,000

The Makahiki Kai (festival of the sea) educational exhibitions help develop an awareness of the ocean in Hawaii's school children and adults. They show Hawaii's marine heritage in a cultural and historic perspective and promote the spirit of "malama"--of care and conservation of the ocean environment. The 1978 Makahiki Kai will be held February 13-20, 1978, at the Neal Blaisdell Center. In keeping with the 1978 Captain Cook bicentennial, the exhibits will feature the impact of Cook's arrival, with emphasis on whales and the whaling era, and special exhibits on the biology of marine mammals. There will also be displays on the various segments of the marine environment, such as the reef zone, and the deep water benthic creatures. Something new for 1978 will be a marine skills fair, where people can see and learn various marine crafts. The 1978 event will be the fifth time that the Marine Affairs Coordinator has joined with the University of Hawaii Sea Grant Program to present a Makahiki Kai marine educational experience.

AQUARIUM EDUCATIONAL PROJECT
Task Order #140 (FY 1977-78)

MAC Investment: $26,500

MATCHING FUNDS:
Private gifts: $10,000
as of November, 1977

This is a continuing project that originated in 1974 as a result of Senate Resolution #303 (1974). In addition to the activities described in the FY 1975-77 section of this report, a new program has been added in the current fiscal year. This is an exhibit depicting the relationships of the ancient Hawaiian culture with marine animals. The exhibits are part of a 4th grade curriculum unit; they will also be on general display. Another use of the exhibit will be as a pilot program in a proposal to the National Endowment for the Humanities, seeking a grant to provide for more exhibits of this nature. It is anticipated that, as an integral part of this project, at least 15,000 hours of volunteer services will be provided to the Aquarium during the fiscal year.

STATEWIDE DIVING SAFETY PROGRAM
Task Order: Pending

MAC Investment: $15,000

MATCHING FUNDS: Pending

There are more diving accidents requiring recompression-chamber treatment in Hawaii than in all the other forty-nine states combined. In 1976, Hawaii divers had 61 cases of bends or embolism that received recompression treatment. For 1977, the figure will be considerably higher; as of December 7, it was already up to 75. To make matters even worse, these figures represent a much higher percentage of the more-serious "Type II" cases (crippling effects as well as severe pain) than the national average. The national average for cases with Type II symptoms is reported as 20%. In Hawaii, the 1976 Type II figure was 46%. For the first half of 1977, 74% of the cases treated in Hawaii had Type II symptoms. These figures, obtained from the Navy recompression facility at Pearl Harbor, do not include any military-duty diving cases.

Responsibility for care of these diving accident victims has long been left to the Navy's Pearl Harbor facility. Such a course may no longer be appropriate, in light of the great case load increase in recent years (in 1970 there were only 10) and the growing number of diving accidents on the Neighbor Islands. The Marine Affairs Coordinator recognized the need for recompression chambers (also called "hyperbaric facilities") on all major islands some time ago. (Funds for such facilities were included in the budget submitted, approved, and appropriated for FY 1975-76.) A one-person hyperbaric oxygen chamber was acquired for Maui and is now operational at Maui Memorial Hospital. A double-lock, multi-person chamber is being readied for installation at Kauai Veterans Memorial Hospital. Another will be located at Kailua-Kona, while two more will be installed at a centrally located hospital in Honolulu.

The State Health Planning and Development Agnecy has issued a "Certificate of Need" for the Maui chamber, the Kauai chamber, and for the Oahu chambers. (An application for a Certificate for the Kailua-Kona chamber has not yet been filed.)

The Statewide Diving Safety Program, now being formulated, will also address the matter of manning and operating these chambers, and the training of personnel, including doctors and other medical specialists, in the use of the chambers for treatment of diving accidents. As a sub-project of this program, one of the nation's leading experts in hyperbaric oxygen medicine, Dr. Eric Kindwall of Milwaukee, was brought to Oahu and Kauai in November, 1977, for seminars and discussions regarding diving medicine, hyperbaric treatment, and the administration and operation of such facilities.

The state program will emphasize prevention, as well as treatment, of diving accidents. A number of State agencies are cooperating with MAC in this program. They include the Department of Health: County/State Hospitals Division and Emergency Medical Services Systems Branch; Department of Labor and Industrial Relations: Occupational Safety and Health Division; Department of Personnel Services: Safety Branch; and the University of Hawaii: School of Medicine and Environmental Health Office. The Mayors of Kauai and Hawaii Counties have appointed official representatives to work with MAC on this matter. MAC has taken an active lead role in instigating and coordinating the entire statewide effort. A basic state plan will be completed and presented during the 1978 Legislative Session.

BLUEWATER MARINE LABORATORY
Task Order #144 (FY 1977-78)

MAC Investment: $30,000

Other State support:
Dept. of Education: $26,750

MATCHING FUNDS:
Student Lab Fees: $10,800
Summer Training Program Tuition: 6,000
Ocean Charter Serv. in ship time 5,000

The Bluewater Marine Laboratory (BML) provides at-sea marine education and "hands-on" experience for high school students throughout the State by means of half-day cruises aboard a specially-equipped research schooner. One outstanding feature of the BML program is that the students who come aboard receive instruction from other high school students specially trained as Cruise Instructors during an intensive and exhaustive summer training program. The standard cruise concentrates on introductory marine biology; one of the BML objectives during the 1977-78 academic year is the development of a second standard cruise. Other objectives include the production of pre-and post-cruise curriculum materials for the biology cruise and the production of draft curriculum materials based on the 1977 Summer Training Program for Cruise Instructors. The BML plans to present 90 cruises during the current school year, serving 2,700 students (one class of 30 per cruise). The program receives its administrative support from the Marine Option Program of the University of Hawaii.

LCC MARINE TECHNOLOGY PROGRAM SHIP TIME

Task Order: Not Yet Written

Proposed MAC Investment: $17,500 NO MATCHING FUNDS

As in the past, MAC will provide funds for ship charter for students of the Marine Technology Training Program at Leeward Community College. While much of the training and instruction in that program can be given on land, it is absolutely essential that the students have some actual experience at sea if they are to learn to work in the marine environment. Because of the high cost of owning, operating and maintaining a ship of the necessary size (65 feet or larger) on a year-round basis, it is far more economical and cost effective to charter a ship as needed. It is anticipated that most of the ship charter days will utilized the University of Hawaii research vessel NOI'I. For information on earlier MAC support of this program, see the FY 1975-77 section of this report.

SEA GRANT MARINE ADVISORY PROGRAM

Task Order: Pending

Proposed MAC Investment: $41,000 MATCHING FUNDS:
Sea Grant: $300,000

The funds allocated, but not yet invested, for this project will be used to support marine conservation education, and other marine extension services. The specifics of the project were being worked out at the time of writing. For an example of an earlier marine conservation-education project of the Sea Grant Marine Advisory Program supported by MAC, see the FY 1975-77 section of this report.

5. FACILITIES SUPPORT

REFURBISHING HYPERBARIC CHAMBERS
Task Order #155 (FY 1977-78)

MAC Investment: $32,000 NO MATCHING FUNDS

In FY 1976-77, the State acquired two double-lock, multi-person hyperbaric (recompression/decompression) chambers, plus a silimar but somewhat larger chamber already installed on Makapuu Oceanographic Pier. The chamber on Makapuu Pier was in operational condition; the other two were not. Refurbishment of those two chambers was begun. (See Fy 1975-77 section of this report.) Funds allotted under this Task Order will continue and complete the work of making the two chambers ready for installation; this includes supplying compressors and air storage tanks. The mobile hyperbaric chamber operated by the University (See FY 1975-77 section) will be supplied a compressor and other items needed to make it fully and independently operational. One of the two chambers will be installed at the State-run hospital at Waimea, Kauai (Kauai Veterans Memorial Hospital); the other will be installed at a major, centrally located hospital in Honolulu. The mobile chamber will be sent to Kailua-Kona, Hawaii, where it will be administered by the Kona Hospital. Some refurbishment of the habitat AEGIR will be started.

MAKAPUU PIER MAINTENANCE
Task Order: Pending

Proposed MAC Investment: $5,000 MATCHING FUNDS: True Rental Value of Pier

The proposed funding will be used to help cover routine maintenance and upkeep of the Makapuu Oceanographic Pier, which is under State control, with supervision through the Marine Programs Office of the University of Hawaii. For a summary of earlier MAC support of this important facility, see the FY 1975-77 section of this report.

HIGH VISIBILITY UNDERSEA OBSERVATION STRUCTURE
Task Order #154 (FY 1977-78)

MAC Investment: $9,644

MATCHING FUNDS:
Sea Grant: $29,099;
Pan Pacific Institute: 1,000;
Dr. B. Auksmann: 4,000

A new concept for a strong undersea structure that allows much greater visibility than traditional construction methods has been developed. Instead of designing a cylindrical structure built strong enough to prevent buckling of surfaces by ocean pressures, the structure is designed "pre-buckled". This allows the use of transparent acrylic plastic as a primary construction material rather than simply for small viewports, as in conventional designs. The concept would have many uses in both recreational and scientific underwater structures. (The need for undersea observation facilities open to the public was one of the recommendations of the 1974 "Hawaii and the Sea" task force.) This phase of the project is concentrating on establishing the technical and economic feasibility of such structures, with a secondary objective of performing computer analyses for different geometric configurations of the structures. One "by-product" of the research will be the construction of such a structure, approximately six feet in diameter. In FY 1975-76 MAC gave some support to this project; for details see the FY 1975-77 section of this report.

MARINE MARSHALLING FACILITY
Task Order: Pending

Proposed MAC Investment: $2,500

NO MATCHING FUNDS

Because Phase Two of the University's Marine Center at Snug Harbor is not completed, there is a continuing need for support of this marine facility at Kewalo Basin. For information on the use of this site, see the FY 1975-77 section of this report.

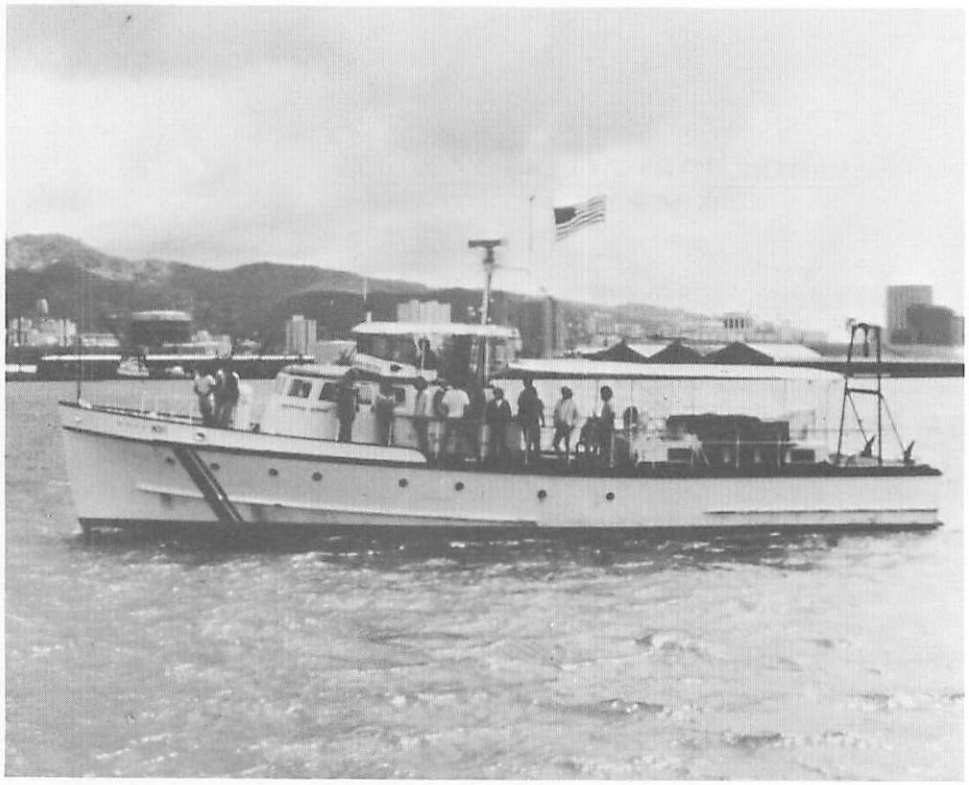
WAVE ATTENUATION STUDY
Task Order #143 (FY 1977-78)

MAC Investment: $12,150 NO MATCHING FUNDS

This is a continuing project expected to be completed this fiscal year. It began in FY 1975-76 with Sea Grant support only; both Sea Grant and MAC supported the study in FY 1976-77. (See FY 1975-77 section of this report.) The project is an engineering study of wave forces and actions in shallow water, especially after the wave has broken on a reef or been affected by nearshore beach shapes and winds.

The research is being conducted by the Look Laboratory of Ocean Engineering.

The knowledge gained in this study is needed in numerous engineering projects, such as assessment of beach stability or the design of coastal structures. Sixteen technical reports have been prepared in draft form; the findings of the research will be incorporated into a manual designed for easy use and reference by engineers and designers working in nearshore areas affected by such wave forces and actions.



III. MAC-Funded Projects, Fiscal Years 1975-76, 1976-77

In the two fiscal years 1975-77, the Marine Affairs Coordinator funded fifty-five projects, with total expenditures of $994,000. These funds were matched by $2,414,019 in federal and private grants.

Emphasis was again placed upon marine-related economic development projects, in such diverse areas as aquaculture, ocean mining, and ocean energy technology. In all, eighteen economic development projects were granted $417,000.

Fifteen marine education projects, funded at $202,000, included elementary and secondary programs such as Makahiki Kai, Blue-Water Marine Lab, and Waikiki Aquarium; ship time for college-level marine technology students; and professional symposia in several disciplines.

A total of $219,000 was expended in support of marine facilities, such as decompression chambers, the experimental vessel KAIMALINO, and pier maintenance.

Nine projects were funded in the resource assessment and conservation categories, at a cost of $158,000. These activities ranged from resource baseline studies at Molokai to green turtle surveys in the Leeward Islands, and included formation of a coastal zone data bank.

I. RESOURCE INVENTORY AND ASSESSMENT

MOLOKINI ISLAND - PAPOHAKU BEACH BASELINE STUDY
Task Order #110 (FY 1976-77)

MAC Investment: $10,000

MATCHING FUNDS:
Maui Land and Pineapple Company, Inc,: $3,000

Well-planned management of shoreline resources is becoming increasingly important because of stress on the marine environment created by increasing shoreline development. For a management program to be able to assess the effects of such activities, a scientific "picture" of the particular environment at a specific point in time is needed; preferably, this point should be prior to stress being applied to that environment. Such a "picture" is provided by a baseline data study. In the summer of 1976, a resort complex was under construction at Papohaku Beach on Molokai; at the same time the tiny island of Molokini, in the Alalakeiki Channel between Maui and Kahoolawe, was being considered for environmental protection under the status of Marine Life Conservation District. A group of University of Hawaii Marine Option Program students who had been specially trained in marine life identification and underwater transect methods presented a proposal for a baseline data study of Papohaku Beach and Molokini Island to the Marine Affairs Coordinator. Because such data is of great importance to environmental management, the project was funded. Private industry also realizes the importance of such baseline data; Maui Land and Pineapple Company, Incorporated, provided an additional $3,000 so the study could be extended to cover Honolua Bay on Maui. The studies were carried out during the summer of 1976 and twenty copies of the compiled data were distributed to such organizations as the State Division of Fish and Game, Sea Grant, National Marine Fisheries Service, Office of the Marine Affairs Coordinator, UH Department of Zoology, Hawaii Coastal Zone Data Bank, and the U.S. Fish and Wildlife Service.

HAWAII COASTAL ZONE DATA BANK

Task Order #90 (FY 1975-76)
Task Order #122 (FY 1976-77)

MAC Investment:
$12,000 in FY 1975-76
$20,000 in FY 1976-77

MATCHING FUNDS:
FY 1975-76
Navy's Marine Environmental Management Office: $10,000;
Hawaiian Electric Co.: 8,000

The Hawaii Coastal Zone Data Bank (HCZDB) grew out of the Sea Grant sponsored study of Kaneohe Bay (which started in 1968) and other marine environmental studies. Using the University of Hawaii computer, it filled the need for an established method of organizing marine environmental data and storing it in standardized form for later retrevial and use. Early users included the Hawaii Institute of Marine Biology, the Navy's Marine Environmental Management Office, and Hawaiian Electric. The MAC funding for FY 1975-76 was used to enter data from 874 fish transects conducted by or for the State Division of Fish and Game into the data bank. Biomass surveys of marine benthic algae collected over a 3-year period off the Waikiki reef edge were also entered. MAC funding for FY 1976-77 was intended to help purchase equipment for remote-access linking into the ALOHA computer network at UH. The HCZDB ran into difficulties during this period; however. First, the ALOHA network was almost completely shut down. Matching funds from the Navy that had been counted on for support did not materalize due to budget cuts. Because of the uncertainty of financial support, the full-time computer operator for the HCZDB resigned for other employment. The HCZDB was kept alive, but barely functioning from that point. As of fall, 1977, several proposals to revitalize the system, with adequate funding and a lead agency to provide needed management capabilities, were under study and consideration.

STATE-FEDERAL FISHERIES SURVEY OF NORTHWESTERN HAWAIIAN ISLANDS

Task Order #128 (FY 1976-77)

MAC Investment: $23,500

MATCHING FUNDS:
National Marine Fisheries Service: $320,500
Federal Fish & Wildlife Service(Interior): 59,500

The Northwestern Hawaiian Islands (NWHI) are that part of the State of Hawaii which lies northwest of Kauai and Niihau, beginning with Nihoa Island, and extending northwesterly to Kure Atoll. (Although geographically part of the Hawaiian chain, Midway is not part of the State of Hawaii.) All of the land areas of the NWHI from Nihoa to Pearl and Hermes Atoll have long been part of the Federal wildlife sanctuary, the "Hawaiian Islands National Wildlife Refuge", which is administered by the Fish and Wildlife Service of the U.S. Department of the Interior. That Department has for some time been planning to extend the Federal Refuge from the land areas out to include the waters inside the barrier reefs that surround many of the small islands; where there is no barrier reef the Refuge would be extended to cover the submerged fringing reefs and the waters above them. The purpose of such an extension of the Refuge would be to ban the taking of fish and other marine creatures that might be part of the food web supporting the birds and marine mammals the Refuge was established to protect. This would of course prevent anyone, including citizens of the State of Hawaii, from harvesting what appear to be substantial resources of edible and marketable fish and shellfish in those waters.

No accurate scientific information exists, however, as to the size of these resources. Further, there is little data regarding what role, if any, these fish and shellfish actually play in feeding the creatures of the Refuge, and how many might safely be harvested from year to year. For these reasons, the State of Hawaii has opposed, and continues to oppose, any seaward extension of the Refuge by the Department of the Interior. In at least tacit recognition of the validity of the State's opposition, the Fish and Wildlife Service took part in discussions with the National Marine Fisheries Service, the State Division of Fish and Game, and MAC, concerning the situation.

These discussions resulted in an agreement that a need existed for a comprehensive and cooperative investigation of both the food habits of the creatures of the Refuge and the extent of the fish and shellfish populations of the waters in question, and the connection between them. A "Tripartite Cooperative Agreement" was written, involving the State of Hawaii, the Fish and Wildlife Service, and the National Marine Fisheries Service; it called for a 5-year cooperative survey and investigation to be carried out by the parties involved with the aid of the Federal fisheries research ship TOWNSEND CROMWELL. Funds to support the State's efforts in this project were appropriated to MAC by the 1976 Legislature and were provided by MAC to support the State Division of Fish and Game in its part of the survey. The first cruise involving State Fish and Game personnel began in early July, 1977.

PRECIOUS CORAL MANAGEMENT
Task Order #134 (FY 1976-77)

MAC INVESTMENT: $1,050 NO MATCHING FUNDS

The State Division of Fish and Game, Department of Land and Natural Resources, has the responsibility of managing the coral resources of the State of Hawaii, including the precious corals found in relatively deep waters in the channels between the major islands of the State. In late 1976 and early 1977, the Division began drawing up regulations to manage the harvest of these resources which are used as a basic product in Hawaii's growing precious coral jewelry industry. These regulations were based on data gathered between January, 1971, and October, 1976, in research dives involving a small manned submersible. (This research was conducted by University of Hawaii personnel and funded in part through MAC.) To enable it to better manage the resource, the Division of Fish and Game had need of further data. The best way to collect the needed information was by manned submersible. Under this Task Order, the operators of the only such underwater craft in Hawaii, Deepwater Exploration, Limited, agreed to permit an agent or representative of the Division to accompany the submersible on coral harvesting expeditions to gather the necessary data. This information is now available to help the Division manage the precious coral resource under Division of Fish and Game Regulation #41, which took effect on September 23, 1977.

STONEY CORAL RESOURCE STUDY
Task Order #138 (FY 1976-77)

MAC Investment: $9,854 NO MATCHING FUNDS

Reef-building stoney corals provide a vital living area for many important species of marine creatures. The reefs they build also help reduce beach and shoreline erosion by reducing the force of waves breaking against the shore. For some time there has been a growing concern that, in certain areas, there has been over harvesting of stoney coral colonies for sale as curios. This concern was formally expressed by the 1977 Legislature in the passage of House Resolution 619 (H.D.1) which requested the Division of Fish and Game to draw up regulations to manage all forms of coral in all areas of the State. The Division did not possess the information necessary for drawing up valid regulations, nor did it have the manpower and financial resources to obtain such information. MAC therefore initiated actions leading to this project Task Order, under which the Hawaii Institute of Marine Biology (HIMB) will conduct the needed research and investigation, with HIMB contributing $4,350 to the project in the form of salaried personnel. First efforts were directed at obtaining information on the amount of stoney corals harvested around Oahu. Securing such information from harvesters and sellers of the corals proved virtually impossible, as there was no legal requirement that they divulge information to the researchers. While there is a legal requirement that coral harvesters be licensed as commercial fishermen and report their harvest to Fish and Game, the researchers obtained a strong impression that many harvesters are unaware of that rule, or simply choose to ignore it. Efforts were switched to seeking information on the amounts of stoney coral being shipped out of Hawaii. In that effort they learned that a great deal of stoney coral sold locally is imported from the Philippines; they are also attempting to learn just how great an amount is imported, rather than locally harvested. The project did not actually get underway until summer of 1977; when the work is completed the information will be given to the Division of Fish and Game for use in drawing up regulations regarding stoney corals.

II. MARINE CONSERVATION

GREEN SEA TURTLE MANAGEMENT STUDY

Task Order #113 (FY 1976-77)
Task Order #118 (FY 1976-77)

MAC Investment: $4,236 (T.O. #113)
$18,362 (T.O. #118)

No Direct Matching Funds

The purpose of this project is to develop basic biological information relevant to the wise, long-term management of the Hawaiian green sea turtle population. The Hawaiian green sea turtle is a traditional and prized food source, but is believed to be dwindling in numbers, becoming a possible candidate for the Federal endangered species list. It is hoped that this project will provide information that will enable the State to manage the turtle population as a non-endangered, harvestable resource. A special appropriation for this project, which is planned as a three-year investigation, was made by the 1976 State Legislature. The Tripartite Agreement for the State-Federal Fisheries Survey of the Northwestern Hawaiian Islands (see report in this section) regards this project as an integral part of that long-term study. Task Order #113 allotted funds for a special study of feeding habits of a sub-adult population in the waters of Hawaii County; this study was conducted by Marine Option Program students from the Hilo Campus of the University of Hawaii and was under the scientific supervision of the Principal Investigator of the overall study. The sub-study was conducted July-September, 1976, and a detailed report filed. The major study got underway in September, 1976; it involved much field work in the Northwestern Hawaiian Islands. It should be noted that, while this report states there were "No Direct Matching Funds", that the U.S. Coast Guard has provided transportation to various locations in the Northwestern Hawaiian Islands for project researchers; the Air Force has helped with aerial spotting of turtles during regular missions, as has the Coast Guard, and the Navy is also providing cooperative support. For further information, see the current projects section of this report.

MICROMOLLUSK PROJECT
Task Order #83 (FY 1975-76)

MAC Investment: $5,000

MATCHING FUNDS:
U.S. Army Corps of Engineers: $5,000

Micromollusks are mollusks with shells less than 10 millimeters in greatest dimension; they are common to all marine ecosystems in the Hawaiian Islands. Analysis of assemblages of such mollusks for species composition, diversity and abundance provides insight into the structure and ecological status of coastal ecosystems of which they are a part. The utilization of micromollusks as biological indicators provides scientists and coastal zone planners information on the status of shoreline ecosystems, and makes possible the early detection of changes and the degree of stress in those ecosystems.

Information on micromollusk assemblages has been accumulating over several years in the form of individual reports, including data on Mamala Bay and Kailua Bay collected for the City and County of Honolulu, on Kahe Point for Hawaiian Electric Company, and on the Kona Coast for Hawaii County. Micromollusk data is also available from the Quality of Coastal Waters Project conducted from 1970 to 1974 with substantial Sea Grant support by the University of Hawaii Water Resources Center.

This body of data could not be properly utilized in its then existing form. Funds from this task order were used to organize and standardize the format of material collected in past years, in order to make it available and useful in baseline studies of benthic marine communities, especially those associated with environmental impact statements. Baseline composition of micromolluskan assemblages were identified in tidepools, calcareous shorelines, reefs, shallow bays, and harbors on Kauai, Oahu and Hawaii. These descriptions have been submitted to the Water Quality Committee of the U.S. Army Corps of Engineers for inclusion in the classification of nearshore marine ecosystems which is being worked out by the committee. The data is also being prepared for entry into the Hawaii Coastal Zone Data Bank. (see T.O. #90)

Although matching funds were not available at the onset of this project, the U.S. Army Corps of Engineers subsequently provided partial matching funds for analysis of the characteristics and distribution of micromollusk fauna of Kaneohe Bay. Study of Kaneohe Bay Micromollusks involved collection of sediment samples at a variety of sites within the bay, analysis of samples for species composition, standing crop, species diversity and trophic structure, as well as a study of the biology and life history of some of the more commonly occurring species.

HIMB/EPA KANEOHE BAY SEWAGE RELAXATION STUDY

Task Order #99 (FY 1975-76)
Task Order #111 (FY 1976-77)

MAC Investment: $14,500 (FY 1975-76)
$30,000 (FY 1976-77)

MATCHING FUNDS:
Environmental Protection Agency:
FY 1975-76: $167,000
Fy 1976-77: $184,000

By sometime in late 1977 or early 1978 (there have been several delays in the construction work) a new sewage outfall system will divert sewage that has long been discharged into Kaneohe Bay into the open ocean outside Kailua Bay. The Federal Environmental Protection Agency (EPA) accepted a proposal from the Hawaii Institute of Marine Biology (HIMB) to make a "before and after" study of the bay to determine just what the actual effects of this relaxation of sewage stress on Kaneohe Bay would be. Under the proposal, the University of Hawaii was to provide salaries for two technicians to monitor the various data stations and instruments. The University was unable to meet this financial commitment, so the MAC Office provided the necessary funding. The study is designed to run for at least three years; further information concerning its importance will be found in the Current Projects section of this report.

KAUAI COASTAL ZONE RESOURCE SURVEY

Task Order #89(FY 1975-76)

MAC Investment: $10,000

MATCHING FUNDS:
DPED: $ 2,334
Sea Grant: 3,250

The 1974 "Hawaii and the Sea" Task Force recommended the establishment of a minimum of one additional marine park for each of Hawaii's major islands. Marine parks which either prohibit or restrict consumptive uses are needed to provide residents and visitors with an opportunity to observe Hawaiian reef life in its natural state. The decimation of marine ecosystems by shell and coral collecting, spear fishing, gill netting and other practices continues to increase, and marine parks are needed to assure the conservation of marine life in certain areas.

Funds from this task order supported a study of potential marine park sites on Kauai conducted by a group of Hilo Marine

Option Program students. This study included a survey of fish, invertebrate and algal biota at selected sites, as well as a public opinion survey assessing resident reaction to the establishment of marine parks. The public opinion survey, which incorporated mail-out questionnaires and on-site interviews, indicated a generally favorable response to the concept of marine parks, with 66% of the adult Kauai residents polled favoring the establishment of marine conservation areas.

The biological data generated by this project will provide valuable input to the Hawaii Coastal Zone Data Bank (see T.O. #90), and all information collected should assist the State in formulating its Coastal Zone Management plan.

OFFSHORE SAND MINING DEVELOPMENT: PHASE ONE
Task Order #102 (FY 1975-76)

MAC Investment: $14,729

MATCHING FUNDS:
Value of designs and blueprints for sand sampler developed by Fred Casciano

Two major sectors of Hawaii's economy, the tourists and construction industries depend upon a readily available supply of sand for beach replenishment and concrete. Offshore sand deposits totalling hundred of millions of cubic yards have been identified at many sites, but in most cases the quality of the sand and its suitability for various uses has not yet been evaluated. In keeping with the recommendations of the 1974 "Hawaii and the Sea" Task Force, the Hawaii State Legislature authorized the Marine Affairs Coordinator to identify and evaluate the State's offshore sand resources. This task order provided funds for the construction and testing of an environmentally sound sand sampling device designed by Mr. Frederic M. Casciano of Ocean Innovators.

Fairly sizeable sand samples are needed for analysis as to grain size and general suitability for construction purposes. The historic method of gathering samples, which sinks a corer by vibration, requires a large support vessel and cannot economically provide samples of sufficient volume for the necessary quality determination tests. With the use of the sand sampler designed by Fred Casciano, which sinks a corer by jetting, the State can acquire adequate size sand samples at approximately one-fifth the cost prossible by the vibration-coring method. The new device probes vertically in the sand by water jet action, with its vertical motion controlled remotely aboard the surface vessel. Tests were carried out in 50 feet of water off Waikiki in June 1976, and the device was demonstrated successfully at that time. The tests indicated that the model would be effective in water depths to 100 feet, and capable of penetrating 25 feet of sand.

OFFSHORE SAND MINING DEVELOPMENT: PHASE TWO
Task Order #120 (FY 1976-77)

MAC Investment: $30,000

MATCHING FUNDS:

The sand sampler designed and tested under Phase One of this project (above) was further developed to permit operation in water depths in excess of 200 feet (maximum test depth was 222 feet). A program of sampling was then carried out along the west and south shore of Oahu, in areas that had previously been identified as probable locations of significant sand deposits by a University-Sea Grant program of seismic investigation that did not recover sizeable samples. A total of 265 samples (each containing some 40 to 60 pounds of sand) were collected from 124 bore holes or attempted bore holes. Eighteen locations produced no samples due to encountering hard surfaces, usually coral, a few inches below the overlying sand bottom. Samples are being analyzed, at no cost to the State, by Pacific Concrete and Rock Company, which has indicated an interest in recovering offshore sand for their operations. Good commercial grades of sand have been identified from some locations; as of early fall, 1977, analysis of the samples was not completed.

The new type sand sampler developed as part of this project performed well in actual operations. If it is patentable, the patent will belong to the Research Corporation of the University of Hawaii under the task order agreement. As of fall, 1977, a preliminary patent search was under way.

HILO LOBSTER INVESTIGATION
Task Order #79(1975-76)

MAC Investment: $6,300

MATCHING FUNDS:

Sea Grant:	$ 4,000
Hawaiian Sea Foods:	3,100
Restaurant Owners:	1,500
Horizon Air Freight:	500
Various Hilo Residents:	444

The large consumer demand for lobster in Hawaii had aroused interest in the possibilities for a commercial lobster fishery in the County of Hawaii. This study was undertaken to determine the feasibility of such a fishery by gathering information regarding distributions, densities, and optimal entrapment techniques of lobster populations in Hawaiian waters. The study was focused around Hilo Bay, and all specimens captured were measured, tagged and released. Although the catch rate in this area was found to be too low for the establishment for a profitable fishery at the present time, the information collected on population density and distribution may serve as a basis for further biological studies of Hawaiian lobsters.

CHANOS CHANOS (AWA) AQUACULTURE
Task Order #70 (extended from FY 1974-75)

Additional MAC Investment: $2,700 (FY 1975-76)

Begun in FY 1974-75 with an investment from MAC of $15,000, this project was conducted by Marine Option Program students from the University of Hawaii; its goal was to experiment with and evaluate methods of pond rearing the marine finfish Chanos Chanos, also known as awa, or milkfish. (See MAC 3rd Annual Report.) The project had originally requested more than $15,000, but additional funds were not available at that time. The funds did prove to be needed, and were awarded so that the studies could be completed. A detailed report on the project's findings was prepared and is on file at the MAC Office.

NATURAL ENERGY PROPOSALS
Task Order #91 (FY 1975-76)

MAC Investment: $38,000 NO MATCHING FUNDS

Past efforts at establishing a major facility at the Natural Energy Laboratory of Hawaii (NELH) focused on a land-based engineering test facility (LBTF) for ocean thermal energy conversion (OTEC) heat exchangers and subsystems. A major proposal to develop this facility was submitted to the Energy Research and Development Administration (ERDA) for funding, with the expectation that ERDA would proceed rapidly with an OTEC program. Although the content of the proposal was well received, it did not receive funds because ERDA had not yet determined whether a land-based test facility was to be part of its OTEC program plan.

Recent information from ERDA has indicated that the decision on an LBTF will be made in FY 1978. Based on favorable recommendations from TRW Incorporated and the Lockheed Corporation on the risk reduction of a land-vs sea-based test facility, the NELH Board continued efforts to make the Ke-ahole Point site available for development immediately upon ERDA's decision to proceed. These preparations include land transfer, environmental impact statements, and necessary master planning.

In addition, the Laboratory has been able to attract the first two OTEC heat exchanger biological fouling and corrosion field tests. Biofouling is considered by ERDA to be a critical OTEC issue.

TUNA BAITFISH "BEHAVIOR" PROJECT
Task Order #88 (FY 1975-76)

MAC Investment: $3,000

MATCHING FUNDS:
None

This project took an unusual approach toward solving the problem of providing the Hawaii-based skipjack (aku) tuna fishing fleet with a source of live bait that is as effective as the normally-used baitfish nehu, but that is also easier to obtain and has a longer lifespan in the baitwells than does nehu. Threadfin shad meets the latter two requirements, but earlier experiments in using shad as bait were not considered successful by the commercial fishermen who tried it.

The shad seemed to catch fewer tuna, and the fishermen believed it was because shad behaved differently than nehu when thrown into the water. It was believed that the shad dived deeply, luring the tuna down away from the fishing boat, but that the nehu did not dive so deeply. A scientist who had done considerable work in modifying the behavior of fish suggested that it might be possible to modify the behavior of large numbers of shad so that they would not dive deeply, and to do so in a manner that would be inexpensive enough to make the shad so modified a cost-effective baitfish.

Investigations carried out under this Task Order showed that actually both shad and nehu seemed to dive deeply, but the nehu then seemed to head back toward the fishing boat, while the shad headed away from it, leading the tuna out of reach of the fishermen. Conditioning the shad to return to the boat might be possible, but it was judged to be a behavior modification that would be so expensive as to then make the shad impractical to use as bait. A planned second phase of the project was therefore not carried out.

TUNA BAITFISH
Task Order #114 (FY 1976-77)

MAC Investment: $10,000

MATCHING FUNDS:
Sea Grant: $25,000

This Task Order helped to continue the biological work on topminnows (mollies) that had been conducted at Hawaii Institute of Marine Biology in FY 1975-76 with Sea Grant and MAC support. One part of the project involved a number of behavioral experiments involving mollies. By studying various aspects of fish behavior, including such things as color preference or light-intensity preference, it is often possible to alter the design of a rearing tank or pond so as to increase production efficiency. The researchers learned, for example, that if adult mollies are grouped in the center of the rearing facility, the young will move to the side areas; if these areas are shaded, or have low light intensity, the young will tend to remain there. This makes it easier to remove only adult fish from the center without also inadvertently removing the young ones. It was also learned that if pellitized food is used, larger fish would keep smaller ones away from the food pellets. For more uniform growth rates it is therefore important to use finely ground food, rather than pellets, when rearing mollies. Lessons learned from these experiments were incorporated into the design of a large (about 24 ft x 12 ft) rearing tank at HIMB. They will also be incorporated into a baitfish rearing pond to be constructed on Maui during FY 1977-78. Studies of the natural diets of mollies, and investigations into disease problems were also conducted. Further State funding for this baitfish aquaculture research will come from the Aquaculture Development Program in FY 1977-78.

SALTWATER AGRICULTURE
Task Order #105 (FY 1975-76)

MAC Investment: $3,600

MATCHING FUNDS:
Sea Grant: $3,005

Ninety-seven percent of the water on the Earth consists of saline or salty water in the oceans, and the majority of the remainder is frozen into the icecaps of Greenland and Antartica. As a result, less than one percent of the world's total water supply is directly available to man as fresh water. Desalination processes for obtaining fresh water from the oceans generally require large amounts of energy, and have to date proven impractical as a means of supplying fresh water for growing agricultural crops. The development of techniques for using saline or saltwater for agriculture would be of enormous benefit to the human race.

Funds under this task order were used to support research conducted by the University of Hawaii's Botany Department aimed at the development of plant species that can be raised either with full seawater irrigation or a mixture of fresh and seawater. The project is also involved with devising techniques for raising plants in towers, rather than over a broad two-dimensional area, in such a manner that seawater or a seawater/freshwater mix can be used. Successful development of such techniques might make possible agriculture of land plants on such things as lava flows or floating platforms at sea, and would be of considerable benefit to Hawaii.

Work completed during FY 1975-76 included testing of more than thirty varieties and species of plants for saltwater tolerance. The most successful plants in saltwater were members of the Cruciferae, such as cabbage and broccoli. Studies indicate that breeding experiments per se are not necessary to acquire salt tolerant commercial leaf and vegetable crops, since many of the "garden store" varieties can tolerate salt, and even grow at rates better than control plants at certain salt concentrations. It is, however, apparent that certain physiological changes occur in salt water, such as decrease in chlorophyll and an increase in sodium, that require further study to determine the importance of these factors in ultimate salt water crop productions.

Previous Sea Grant funding for this project had run out, and no further funding was available for some months during FY 1975-76. The lapse of funds would have seriously set back the project due to the necessity for continuous care and culture of the experimental plants. MAC funds were used to continue the project until it received further Sea Grant funding for 1976-77.

HIMB ANIMAL AQUACULTURE
Task Order #93 (FY 1975-76)
Task Order #87 (FY 1975-76)

MAC Investment: $25,250 (T.O. #93)
$10,000 (T.O. #87)

MATCHING FUNDS:
Sea Grant: $268,136

Fiscal Year 1975-76 was the last year in which UH Sea Grant funded various aquaculture projects under a single project: "HIMB Animal Aquaculture". Major components of this project were: Moi culture studies; Malaysian prawn genetics; prawn production systems engineering; and tuna baitfish culture. The overall project was supported with $25,250 from MAC via Task Order #93. Additional support proved to be needed for the prawn genetics work; this was provided by making another $10,000 available via Task Order #87. Main support for the work came from Sea Grant: $268,136.

Following is a brief summary of the progress made during FY 1975-76 in the various project areas:

MOI CULTURE: A method of weaning larvae from living to non-living food at the age of one month was discovered, which reduced the dependency on brine shrimp as a food source. No adverse effects due to vitamin defiency were noted. The use of non-living (dry) food opened the possibility of using automatic feeders to increase feeding frequency and hence growth.

MALAYSIAN PRAWN GENETICS: Over 90% of the cultured Malaysian prawns (Macrobrachium rosenbergii) are derived from just a few animals brought to the Anuenue Fisheries Research Station in 1965. These few were not representative of the genetic variation believed to exist in the entire species; this variation should includes differences in economically important characteristics such as growth rates, size, tolerance to environmental extremes, and disease resistance. Techniques for molecular tagging of similar genetic groups were developed. The chromosome number in Macrobrachium was determined. The relationship between post larval and adult size was investigated, as was that between larval growth and water temperature. Brood stock was imported from Sri Lanka, Malaysia, Australia and Palau and incorporated into a mating scheme in an attempt to find stock superior to the present stock in economically desirable characteristics. Prawns from northern Australia were found to develop through the larval stages some ten days faster than Anuenue stock.

PRAWN PRODUCTION SYSTEMS: A detailed analysis of current prawn production and management practices was completed, and an engineering/management analysis made on alternate methods; results were published by Sea Grant under the title, "An Analysis of

Alternative Prawn Production System Designs in Hawaii". An effective method of separating larvae from juveniles, using behavioral differences, was developed. Using computer programs, a predictive prawn population model for earthen ponds was created. A scale model prawn harvesting device was designed and built; demonstrations have indicated that such mechanical harvesting equipment can reduce labor costs.

TUNA BAITFISH: The project studied various factors affecting topminnows (Poecilia vittata), also known as "mollies". These fish may offer an effective substitute for nehu as a live bait for the Hawaiian pole-and-line skipjack (aku) tuna fishery. The studies provided the information essential to construction of a pilot production brood stock facility.

NOTE: For FY 1976-77, Sea Grant changed it methods of providing support to these aquaculture projects; each subsection was funded as a separate project, and MAC matching support funds were handled the same way. Progress made on these projects during FY 1976-77 is therefore reported (below) in that way, as individual projects.

MOI PROJECT: HIMB ANIMAL AQUACULTURE
Task Order #116 (FY 1976-77)

MAC Investment: $15,000

MATCHING FUNDS:
Sea Grant: $40,000

A preliminary feasibility study of "moi ranching" was conducted. The term "moi ranching" refers to rearing moi in captivity to the juvenile stage and then releasing them into the ocean to augment natural stocks. From a review of the biology of moi, and the results of sea ranching operations with other species, it was concluded that there may be significant potential for moi ranching in Hawaii. (Moi generally stay close to shore, so that released fish would remain accessible to fishermen.) More research is needed, however, to prove the complete feasibility of the concept. Other research during the year concerned problems with feeding and experiments with artificial diets; the latter were terminated prematurely when the fish became infested with digenetic trematodes; a study of the trematode infestation was begun. In the fall of 1977 a comprehensive report describing in detail the results of all work on moi culture was being prepared. State support for the moi project during FY 1977-78 will come from the Aquaculture Development Program, rather than MAC.

OCEAN METALS (MANGANESE NODULES)

Task Order #103 (FY 1975-76)
Task Order #117 (FY 1976-77)

MAC Investment: $87,000 (FY 1975-76)
$66,000 (FY 1976-77)

MATCHING FUNDS:
Sea Grant: $36,678 (in FY 1975-76)
$18,000 (in FY 1976-77)

Since June of 1973, MAC has been supporting scientific investigations of the manganese-enriched deposits (nodules or crusts) found in the waters of the Hawaiian archipelago. These Task Orders (#103 & #117) provided continuing support for that work, which was designed to assess the resource potential of the archipelago's manganese deposits, and to coordinate efforts with a Sea Grant project studying the origin of the deposits. Earlier MAC-supported work had shown that the Hawaiian deposits had concentrations of cobalt several times greater than cobalt concentrations in the deep sea nodule deposits several hundred miles south of Hawaii. The Hawaiian deposits, however, appear to contain only about one-third as much nickel and about one-twenty-fifth as much copper as the deep sea deposits.

A survey cruise conducted under this project in November, 1975, sampled (by dredging and photography) deposits of the Kauai Channel, of the Penguin Banks south of Molokai, and of the Alenuihaha Channel between Maui and Hawaii. A November, 1976, survey cruise investigated areas of the Northwestern Hawaiian Islands (near Gardner Pinnacles, French Frigate Shoals, and Nihoa), and also an area south of Kauai. A phosphorite deposit of unknown extent was discovered on the submarine banks of Gardner Pinnacles during this cruise. Study of samples and information collected has been conducted continuously throughout the project. Chemical analyses were made of all newly acquired material. The realiability of all previous analyses was reviewed, and many older samples reanalyzed. A digitized base map of Hawaiian archipelago bathymetry was constructed for use in displaying acquired data. Cooperation was continued with other manganese projects, national and international, via exchange of sample and information interchange.

A Hawaii Institute of Geophysics/Sea Grant report incorporating knowledge gained under the MAC-Sea Grant projects through the middle of 1976 has been published. Papers for submission to appropriate technical journals are being prepared. Support for the project was continued during the 1977-78 fiscal year. For details, see the current projects section of this report.

BRINE SHRIMP PRODUCTION
Task Order #124 (FY 1976-77)

MAC Investment: $10,000

MATCHING FUNDS:
DLIR: $94,126

This Task Order was in support of an on-going project producing live brine shrimp which had the aim of developing methods for high density culture of brine shrimp and brine shrimp eggs, an important basic food for many aquaculture projects and also for aquarium fish. The principal investigator of the project refused to provide MAC with any scientific information or data derived from the research, choosing to regard all of the findings as proprietary information, despite the fact that they were obtained with the help of public funds. All of the MAC funds had been budgeted for equipment and supplies. Following the refusal of the principal investigator to cooperate, MAC re-obtained possession of all major non-expendible equipment purchased for the project; original cost of the repossessed equipment had been $4,560. Future MAC funding for this operation is not anticipated.

ICLARM
(International Center for Living Aquatic Resources Management)
Task Order #80 (FY 1975-76)
Task Order #129 (FY 1976-77)

MAC Investment: $20,000 (FY 1975-76)
$10,000 (FY 1976-77)

MATCHING FUNDS:
Rockefeller Foundation
$403,000

The International Center for Living Aquatic Resources Management (ICLARM) was established in 1974, by the Rockefeller Foundation, and located in Hawaii. Its purpose was to increase the world's food supply by discovering, developing and disseminating new and improved methods and techniques for fisheries, fisheries management, and aquaculture. A considerable amount of ICLARM's research efforts were conducted or assisted by Hawaii-based institutions, such as Oceanic Institute, East West Center, and Hawaii Institute of Marine Biology. MAC funding, by agreement with ICLARM, was used to cover administrative overhead charges by these institutions, and to meet expenses of the ICLARM staff here. When ICLARM was established in Hawaii, all parties concerned were aware that such location might be only temporary, and

that ICLARM might later move closer to the developing nations on or near the western rim of the Pacific, as its efforts were intended to benefit these nations. Early in 1976, the Rockefeller Foundation announced that ICLARM would move to the Philippines at the beginning of calender year 1977. Support for the last six months of 1976 (first half of FY 1976-77) was requested from MAC. The providing of such support was deemed to be in the best interest of Hawaii, as there is an excellent chance that much future ICLARM research may be conducted by scientists in or from Hawaii. The providing of such support was approved by the State Attorney General's Office, via a "Request for Public Purpose Clearance for Private Subsidies."

AFRC PRAWN PRODUCTION SYSTEM
Task Order #132 (FY 1976-77)

MAC Investment: $15,000

MATCHING FUNDS:
Sea Grant: $35,000

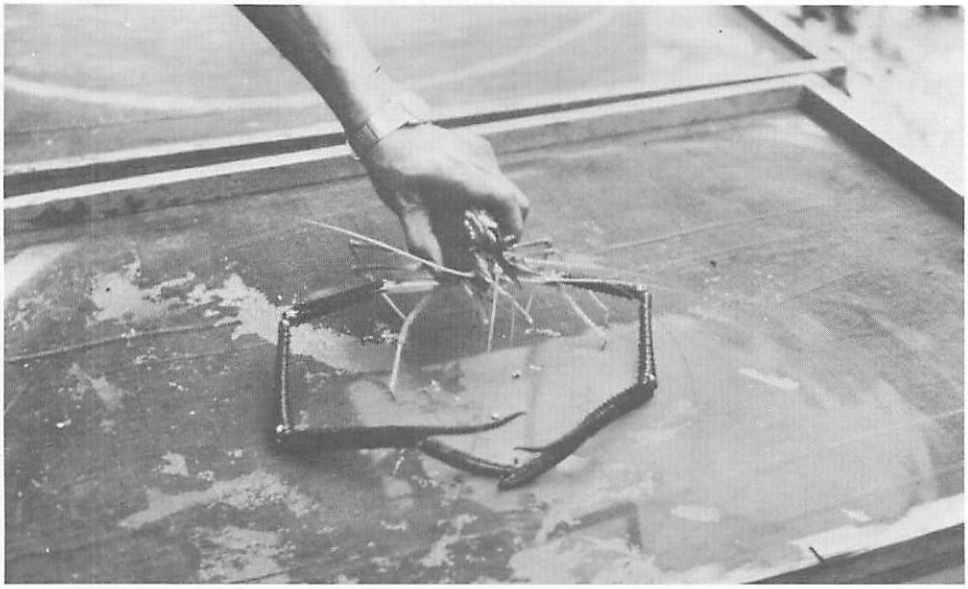
Work during this fiscal year was in conjunction with prawn aquaculture work being carried on by the State at the Anuenue Fisheries Research Center (AFRC). A means for mechanically separating prawns by size was developed; such separation is considered quite important to the development of sophisticated management strategies and will improve harvesting efficiency. A brine shrimp separator, for culling out unhatched brine shrimp eggs for prawn feeding was also developed and demonstrated. A prototype silt pump for pond maintenance has already been put in developing a high-density, high survival prawn nursery that should considerably increase production efficiency. A number of technical publications and manuscripts were prepared on the following subjects: Optimization of prawn larvae culture; automated larvae/post-larvae separation; continuous hatchery design; dynamic prawn population models; and optimization of restocking and harvesting schedules. State support for this important work will be provided in FY 1977-78 by the Aquaculture Development Program, rather than MAC.

MALAYSIAN PRAWN GENETICS
Task Order #115 (FY 1976-77)

MAC Investment: $30,400

MATCHING FUNDS:
Sea Grant: $54,000

A temporary broodstock facility designed to individually house and maintain nearly 1,000 prawns for genetic experimentation was brought near completion at the Anuenue Fisheries Research Station. Preparations were completed for sending a member of the research team on a ten month (June 1977-March 1978) expedition to collect and send back breeding stock prawns from various areas of the world where the species appears naturally. Between June 1977 and November 1977, breed stock "founder" prawns were received from New Guinea, Australia, Malaysia (North Borneo) and Sri Lanka, and placed in the new holding facility. Matings of Anuenue stock with prawns earlier imported from Palau, Sri Lanka and two Australian strains were achieved and the progeny groups were being grown to harvest size to assess growth differences and to establish genetic lines. A total of fourteen areas of progress were reported by the project. One interesting finding was that larval development time is not correlated with adult size, indicating that fast-developing larvae do not necessarily become the largest adults. In fact, growth of runted juveniles was found to be proportionately greater than that of initially larger animals when the former were regrouped into a class of one size. Indication from this is that growth in the species is not entirely under genetic control, but is also influenced by other factors. The project is continuing, with further state funding coming from the Aquaculture Development Program.



ORNAMENTAL FISH CULTURE
Task Order #136 (FY 1976-77)

MAC Investment: $10,000 NO MATCHING FUNDS

The Interim Report of the Hawaii Aquaculture Planning Program, issued in early 1977 by the Department of Planning and Economic Development, included ornamental (or "home aquarium" type) marine fish in its list of species suitable for culture in Hawaii. Preliminary investigations indicated a large market for such fish existed on the U.S. Mainland and in many other nations. A report from the United Nations Food and Agricultural Organization, on file in the MAC Office, estimates the total yearly sales of aquarium fish and supporting equipment and supplies at the rather surprising figure of four billion dollars U.S. ($4,000,000,000) a year. Information obtained from the State Division of Fish and Game states that in FY 1976-77, a total of 147,270 marine ornamental fish and invertebrates were collected in the wild by commercial collectors and sold for a total return of $240,700. The market for such ornamental marine fish appears to be growing; if the demand could be supplied by aquaculture methods, rather than collecting wild specimens, the stress on existing populations of these attractive reef fish would be considerably reduced, and a worthwhile industry might be created. A proposal for preliminary research work on the rearing of such fish under controlled conditions was submitted to MAC jointly by Hawaii Institute of Marine Biology and the Oceanic Institute and funded under this Task Order. Work focused on two species of damselfishes (Maomao and Alo'ilo'i) and three species of butterflyfishes (Longnose butterfly, Lemon butterfly, Potter's angelfish), and involved collecting, spawning and larval rearing.

The project's final report to MAC stated that its most important achievement was the induced spawning of the longnose butterfly fish and that the most important remaining problem is to improve larval rearing techniques for small-egged marine fish such as this species. Other successes included one larval-rearing trial with Maomao in which 49 fish were reared to metamorphosis. For reasons detailed in the final report, there was no induced spawning of any species except the longnose butterfly. Problems included an infestation of the ciliate parasite, Cryptocaryon irritans, which caused mortalities among breeding stocks maintained in tanks. Problems with feeding were also encountered. Based on the results of this preliminary project, and on an assessment of the state of marine fish culture technology, the researchers recommended that a problem-oriented (rather than a species-oriented) program of research on ornamental fish culture be undertaken, utilizing a small number of species. They further recommended that such a program be run in parallel with programs for rearing marine food fish, since they view the basic problems

of larvel rearing as similar. Further State support for this project in FY 1977-78 is dependent upon the Aquaculture Development Program.

OCEAN ENERGY FARM
Task Order #107 (FY 1975-76)

MAC Investment: $10,000

MATCHING FUNDS:
Sea Grant: $116,702

This project was a result of the Sea Grant-funded Tropical Marine Agronomy Program at the University of Hawaii, which has advanced seaweed culture to the commercial stage in several areas of the world. Seaweed is in demand because of its food value to humans, livestock and certain aquaculture species of aquatic animals, and as fertilizer. It is also in demand for its carrageenan content; carrageenans are key substances in the manufacture of various food products, rubber, medical-related products, and cosmetics. Fastgrowing varieties of seaweed also offer potential raw material for transformation into packageable energy in the form of methane gas. This project was designed to carry out basic experimentation in the planning of a proposed Ocean Energy Farm Project to be conducted jointly with the Naval Undersea Center at the Natural Energy Laboratory of Hawaii at Ke-ahole Point. The purpose of this project was to obtain information on the growth rate effects of variations in temperature, light, water quality and water movement. Field work was begun and carried forward. The project was planned as a multi-year study, but MAC was unable to provide support in FY 1976-77 as monies for ocean energy related projects were transferred by the Legislature to another agency, which provided further support. Field work was then completed; as of October, 1977, analysis of the data had not been finished.

IV. MARINE EDUCATION

LEEWARD COMMUNITY COLLEGE MARINE TECHNOLOGY PROGRAM
Task Order #106 (FY 1975-76)

MAC Investment: $6,600 NO MATCHING FUNDS

There is a significant need to upgrade the quality of vocational and educational skills due to rapid increase by industry, recreation and State safety facilities in the use of small boats.

This task order provides for the Leeward Community College Marine Technology Program to purchase instructional equipment, tools and multi-media material for a course in the maintenance and repair of outboard and small boat engines.

SHIP TIME FOR LCC MARINE TECHNICIAN TRAINING PROGRAM
Task Order #108 (FY 1975-76)
Task Order #131 (FY 1976-77)

MAC Investment: $4,000 (FY 1975-76) NO MATCHING FUNDS
$10,000 (FY 1976-77)

While some of the instruction given in the Marine Technician Training Program at Leeward Community College can be given in classrooms or on shore, some must be given aboard a ship, under actual sea-going conditions, if it is to have any practical value. Chartering an appropriate-size vessel for specific program requirements, as needed, is far less expensive, and far more cost effective, than buying and maintaining a ship large enough to meet all the program needs. The funds for FY 1975-76 were used to charter the vessel EASY RIDER for a five-day training voyage for the program. The FY 1976-77 funds provided seven half-days of at-sea training aboard the research schooner MACHIAS, and 17 days of sea time aboard the University research ship NOI'I. Not all of the money was expended during the fiscal year, as the NOI'I, while on a training cruise to Hilo, was discovered to have developed considerable damage to the hull that required taking the ship out of service until it could be repaired. The sum of $270 was used to fly the ten students aboard back to Oahu; the balance of the funds will be used to provide sea time during the 1977-78 school year.

MARINE TECHNICIAN SHARK FISHERY TRAINING

Task Order #109 (FY 1975-76)
Task Order #123 (FY 1976-77)

MAC Investment: $7,000 (FY 1975-76)
$7,500 (FY 1976-77)
DPED Investment: $7,500 (FY 1976-77)

MATCHING FUNDS:
Sea Grant: $3,500

The State Legislature had for some time been interested in various possible methods of controlling shark nearshore populations. The Marine Affairs Coordinator and the Department of Planning and Economic Development were interested in exploring the possibilities of utilizing shark meat as human food, both to control sharks and to provide a new source of human food and additional revenue for Hawaii's commercial fishermen. The Marine Technician Training Program at Leeward Community College was interested in providing at-sea experience, and knowledge of shark fishing methods, to its students. A cooperative project was developed; it also included the Waikiki Aquarium and the UH Sea Grant Marine Advisory Program. The fisheries/research ship EASY RIDER was chartered; its captain helped set up the program and lay out the method of operation. MAC funding provided for two fishing expeditions, one of eight days off Oahu and Maui, the second of eleven days, off Kauai. The DPED funding paid for a second expedition off Maui; Sea Grant's support provided fuel, crew and supplies for a fourth, shorter cruise. Marine Technician students were active in all of the expeditions, receiving considerable at-sea and on-the-job experience. On the Kauai expedition, SEAFLITE provided valuable assistance by carrying student crews between Oahu-Kauai at no charge, so that the crews could be rotated without having to have the fishing ship return to Oahu and twice as many students could receive experience at sea. Shark meat was supplied to the fish markets, and the Sea Grant Marine Advisory Program provided publicity and public relations support. A great deal of media coverage was given to the idea of shark as food; a number of major retail seafood outlets put the shark in their counters and generally sold out quickly. The program clearly demonstrated that shark, when properly handled and properly prepared, becomes a delicious food that some people eat and enjoy. Since that time, shark has occasionally been offered (and purchased) at the commercial fish auction in Honolulu.

MAKAHIKI KAI '76
Task Order #101 (FY 1975-76)

MAC Investment: $5,000

MATCHING FUNDS:
Sea Grant: $19,621

One of the major principles guiding the Marine Affairs Coordinator is the establishment of programs dedicated to a better understanding and knowledge of the marine environment. In support of this concept, the MAC provided partial funding for the third annual "Makahiki Kai" festival of the ocean at the Exhibition Hall of the Honolulu International Center, during March 2-8, 1976. This Sea Grant-sponsored festival honoring Hawaii's aku fishermen was attended by nearly 17,000 students and adults on Oahu, and nearly 20,000 students and adults during its neighbor island tour aboard the SSP KAIMALINO. Exhibits included a 25-foot wave machine, a sand erosion model, and life-size murals of Hawaiian tunas and sharks. A display on the culturing of the Malaysian prawn was also featured, as well as the focal attraction, and 8-foot diameter tank containing live marine animals. Arrangements between the Naval Undersea Center and the MAC Office made possible the transport of exhibits aboard the SSP for the first time, (see T.O. #92) providing an opportunity for youth and adults throughout the State to better see and understand the marine heritage of Hawaii.

MAKAHIKI KAI '77
Task Order #125 (FY 1976-77)

MAC Investment: $11,231

MATCHING FUNDS:
Sea Grant: $28,450

This was the fourth annual Makahiki Kai--the educational, entertaining Festival of the Sea for school children that is jointly sponsored by Sea Grant and MAC. The 1977 Makahiki Kai was not scheduled for Oahu, but was taken to Molokai, Lanai, Kauai, Maui and Hawaii, both at Hilo and at Kona. Students from 30 public and five private schools attended in groups; an estimated total of 6,000 school children viewed the various exhibits, all of which concerned the marine environment. Oahu residents later had an opportunity to see much of the 1977 Makahiki Kai, as exhibits from it were displayed at Ala Moana Center during August, 1977, in connection with the Voyages Into Ocean Space lecture series (see current projects section of this report).

HIGH VISIBILITY UNDERSEA OBSERVATION STRUCTURE
Task Order #96 (FY 1975-76)

MAC Investment: $5,250

MATCHING FUNDS:
Sea Grant: $29,911
Pan-Pacific Institute: $ 2,580

The 1974 Hawaii and the Sea Task Force recommended that undersea observation facilities be included as part of the State's marine parks. A new structural concept for undersea viewing structures has been developed which makes use of transparent acrylic plastic both as a principal construction material and a primary viewing surface. This concept would permit the economical construction of large undersea observatories for scientific and recreational uses. Extensive analysis and design have been performed on the concept to date. This work has established the technical and economic feasibility of constructing high visibility undersea observatories which utilize this concept.

This concept marks the inception of a bold new approach to the design of undersea structures. A new cylindrical shell construction technique, combines with extensive use of transparent acrylic plastic, will provide one-atmosphere undersea facilities with unrestricted opportunity for visual observation of the marine environment. A detailed design for a land-based ocean aquarium was completed during fiscal year 1975-1976.

SYMPOSIUM ON MARINE AFFAIRS
Task Order #104 (FY 1975-76)

MAC Investment: $5,300

MATCHING FUNDS:
Sea Grant: $2,705

The first student Symposium on Marine Affairs held at the Hilton Hawaiian Village in Honolulu on May 20 and 21, 1976 provided an opportunity for nearly 160 public and private high school students to engage in day-long seminars pertaining to various marine disciplines.

The program entailed presentations by five professionals; John P. Craven on Law of the Sea; Kem Lowry and Kelvin Char on Coastal Zone Management; Spencer Malecha on Aquaculture and Richard Shomura on the Aku Fishery--during the morning session. Twelve student papers pertaining to the same topics were presented in four group seminars during the afternoon session. These sessions were monitored by the five professionals.

The MAC investment was utilized to defray preparation expenses and the expense incurred for the publication of the proceeding.

AQUARIUM LECTURE SERIES
Task Order #95 (FY 1975-76)

MAC Investment: $1,820

MATCHING FUNDS:
Sea Grant: $500.00

The Marine Studies Lecture Series organized by the Waikiki Aquarium was designed to increase the flow of knowledge of the Hawaiian marine environment to interested adults who do not normally have an opportunity to enroll in formal university course work. The ten-lecture series was offered for the second consecutive year during the fall of 1975, and was co-sponsored by the MAC, Sea Grant, and the University of Hawaii College of Continuing Education. The program of lectures was designed for the general public, and covered a wide variety of marine topics presented by experts in each subject area. Lecture topics included geology, waves and currents, coral growth, ecology of coral reefs, reef fish and behavior, marine algae, marine invertebrates, sharks and propoises.

Each of the ten lectures in the series was presented at four different sites; Waikiki Aquarium on Oahu, Maui Community College on Maui, and at Kona and Waimea on Big Island. Average attendance per week was about 180 people, ranging in age from 13 to 70 years. The series was enthusiastically praised, and a post-series questionnaire indicated the large marjority of participants rated the speakers as excellent and informative.

AQUARIUM EDUCATIONAL PROJECT

Task Order #81 (FY 1975-76)
Task Order #127 (FY 1976-77)

MAC Investment: $18,500 in FY 1975-76
$16,000 in FY 1976-77

MATCHING FUNDS:
Junior League: $7,000 (FY 1975-76)
Junior League: $7,000 (FY 1976-77)
Private Gifts $10,000 (FY 1976-77)

This project is designed to offer innovative marine educational programs for the entire community at all age levels. A major component of the program is the "marine docent" program which trains volunteers (docents) to give guided lecture tours of the Aquarium to classes of school children and other groups. Curriculum materials are developed for teachers to use with classes both before and after their tour of the Aquarium. Other activities under this project include marine life classes for adults; guided reef walks; special workshops and lectures, and marine life classes and field trips for children. Approximately 20,000 school children per year are served by the docent-conducted aquarium tours. In FY 1976-77 more than 12,240 hours of volunteer time were donated; if valued at the State minimum wage of $2.40 per hour, this volunteer time would be worth $29,376. For further information on this project, see the current projects section of this report.

MARINE OPTION PROGRAM REEF HABITAT PROJECT
Task Order #82 (FY 1975-76)

MAC Investment: $6,000 NO MATCHING FUNDS

The one-to-twenty scale model of the "floating city" was acquired by the Blue-Water Marine Laboratory Program for use as a floatable "reef habitat" marine laboratory in Kaneohe Bay. A wide variety of educational uses were contemplated, and MAC allocated funds to renovate the structure and to begin construction of necessary shelter and support facilities. Because of the press of other projects on the Blue-Water Marine Laboratory staff, complicated by an inability to recruit a sufficient student work force to carry out the renovation, little was accomplished on the project for a number of months. MAC finally re-allocated unexpended funds originally planned for the project to cover administrative needs.

15th INTERNATIONAL CONFERENCE ON COASTAL ENGINEERING
Task Order #85 (FY 1975-76)

MAC Investment: $18,000

MATCHING FUNDS:
Registration Fee:
$ 41,700

The 15th International Conference on Coastal Engineering, held in Honolulu from July 11, to July 17, 1976 was the materialization of the late Governor John A. Burns' invitation to coastal engineers and scientist from around the world. The Governor foresaw the necessity for Hawaii's coastal engineers and scientist to discuss with fellow colleagues the topic of coastal utilization. This topic is of the utmost significance to Hawaii since the entire State may be regarded as a coastal area.

The conference convened 500 delegates from 30 countries to participate in the discussion and presentation of professional papers relating to coastal utilization. A majority of the papers presented pertained to water wave action generated by winds and earthquakes. Subsequent topics dealt with breaking, surge and runup, outfalls, and other related topics. There were eight papers presented pertaining to problems which are pertinent to Hawaii's coastal area such as, tsunamis, wave runup, during the winter months on the North Shores of Oahu, as well as, the

design and construction of the Reef Runway and Sand Island Outfall.

The Marine Affairs Coordinator's Office provided $18,000 to defray preparation expenses. Matching funds of $41,700 came from the $75.00 registration fee for delegates and a $30.00 registration fee for 120 spouses.

INNERSPACE PACIFICA '75
Task Order #94 (FY 1975-76)

MAC Investment: $1,000

MATCHING FUNDS:
Hawaii Council of Diving Clubs: $1,000

The Marine Affairs Coordinator, in conjunction with the Hawaii Council of Diving Clubs, (HCDC), has been a sponsor of two successful Innerspace Pacifica festivals in past years. These educational informative programs have been aimed a helping the people of Hawaii better understand the marine environment and the current level of man's involvement in it. The 1975 Innerspace Pacifica funded by this task order included an international photo contest featuring the best in underwater still photography from all over the world, as well as Hawaii. An exhibition hall featuring an array of the newest equipment, and the latest marine and diving research was included with the participation of many local ocean-oriented firms. An outstanding array of recent films from the world's best-known underwater cinematographers was one of the primary attractions. HCDC's net return from the festival was $1,835.60, which is to be used in support of their diving safety programs.

HI-IMPORT
Task Order #98 (FY 1975-76)

MAC Investment: $1,000

MATCHING FUNDS:
Transportation to and from Hawaii

Hawaii's geographical distance from other population centers places a constraint on personal contact between individuals involved in marine research, development and education in Hawaii with colleagues from elsewhere. Opportunities for dialogue and exchange of ideas with out-of-state marine scholars and scientists occasionally arise as these individuals travel to Hawaii while on vacation or sabbatical leave, as a stopover on their way to other destinations, to teach or conduct research as visiting professors, or to serve as consultants. Funds may be required to enable such marine experts to extend their stays in Honolulu or to travel to the neighbor islands to present lectures, conduct seminars, participate in conferences, symposiums, or serve in some consulting or advisory capacity.

The purpose of this task order was to provide funds to cover certain expenses, excluding transportation costs to and from Hawaii, for out-of-state scientists, scholars and researchers whose knowledge and expertise may be shared with the local marine community. These funds will not cover travel expenses for any resident of Hawaii or travel expenses or support outside the State. During fiscal 1975-76, $160 of this fund was used to cover per diem and airline stopover charges for Dr. John Liu, enabling him to present two lectures involving current theory about temperatures of the earth's interior and its bearing on plate tectonics. Faculty of the University of Hawaii, students, and the public attended the symposium.

In FY 1976-77, $100 was used to help sponsor a well-attended lecture on Soviet aquaculture given at the East West Center by Dr. S.I. Doroshov, who has been responsible for aquaculture projects in the Soviet Union and in Cuba. So far in FY 1977-78, $177.84 was allotted to support a lecture by Dr. William Dickinson, a speaker in the Voyages Into Ocean Space series presented during the summer of 1977. The lecture was one of a series of "Decision Makers' Seminars" held in connection with the Voyages Into Ocean Space lectures.

BLUE-WATER MARINE LABORATORY

Task Order #86 (FY 1975-76)
Task Order #121 (FY 1976-77)

MAC Investment: $30,000 (FY 1975-76)
$30,000 (FY 1976-77)

MATCHING FUNDS:
Sea Grant: $18,589 (FY 75-76)
McInerny Found: 7,500 (FY 75-76)
Student Lab Fees: 14,020 (FY 75-76)
Student Lab Fees: 10,676 (FY 76-77)
DOE: 15,300 (FY 76-77)

The Blue-Water Marine Laboratory is a continuing program of the University of Hawaii, in cooperation with the State Department of Education (DOE), that offers high school students a unique opportunity to participate in basic oceanographic research methods at sea, and to gain an understanding of processes relevant to marine problems and resources. This is accomplished by providing high school classes with half-day instructional and hands-on-experience cruises aboard a specially-equipped research ship. In FY 1975-76, a total of 2,645 students from Oahu, Maui, Lanai, Molokai, Kauai and Hawaii participated. In FY 1976-77 the program experienced some funding difficulties. Sea Grant was no longer able to provide financial support because of a national policy that specific programs can only be funded for a reasonable "start up" period, not on a continuing year-after-year basis.

In FY 1974-75 the McInerny Foundation had contributed $15,000 to help support the program. For FY 1975-76 the University Foundation allowed the program to request only $7,500 from the McInerny Foundation, rather than increased or even level funding. Because of a belief that the University Foundation would not approve any request of funds from the McInerny Foundation in FY 1976-77, no such request was instituted. The program director later was informed that his belief was correct.

The 1976 Legislature had appropriated $25,000 to the DOE for support of the program as an expansion item. At the beginning of the fiscal year the DOE was unable to provide any of those funds, but the DOE Superintendent assured MAC that every effort would be made to provide support, so MAC continued to support the program at the same level of funding as in FY 1975-76. Later in the year the DOE was able to provide $15,300 to the program. By reducing the number of cruises, and carrying five more students per cruise, the program was able to serve 2,760 students from six islands in FY 1976-77.

MARINE CONSERVATION EDUCATION
Task Order #135 (FY 1976-77)

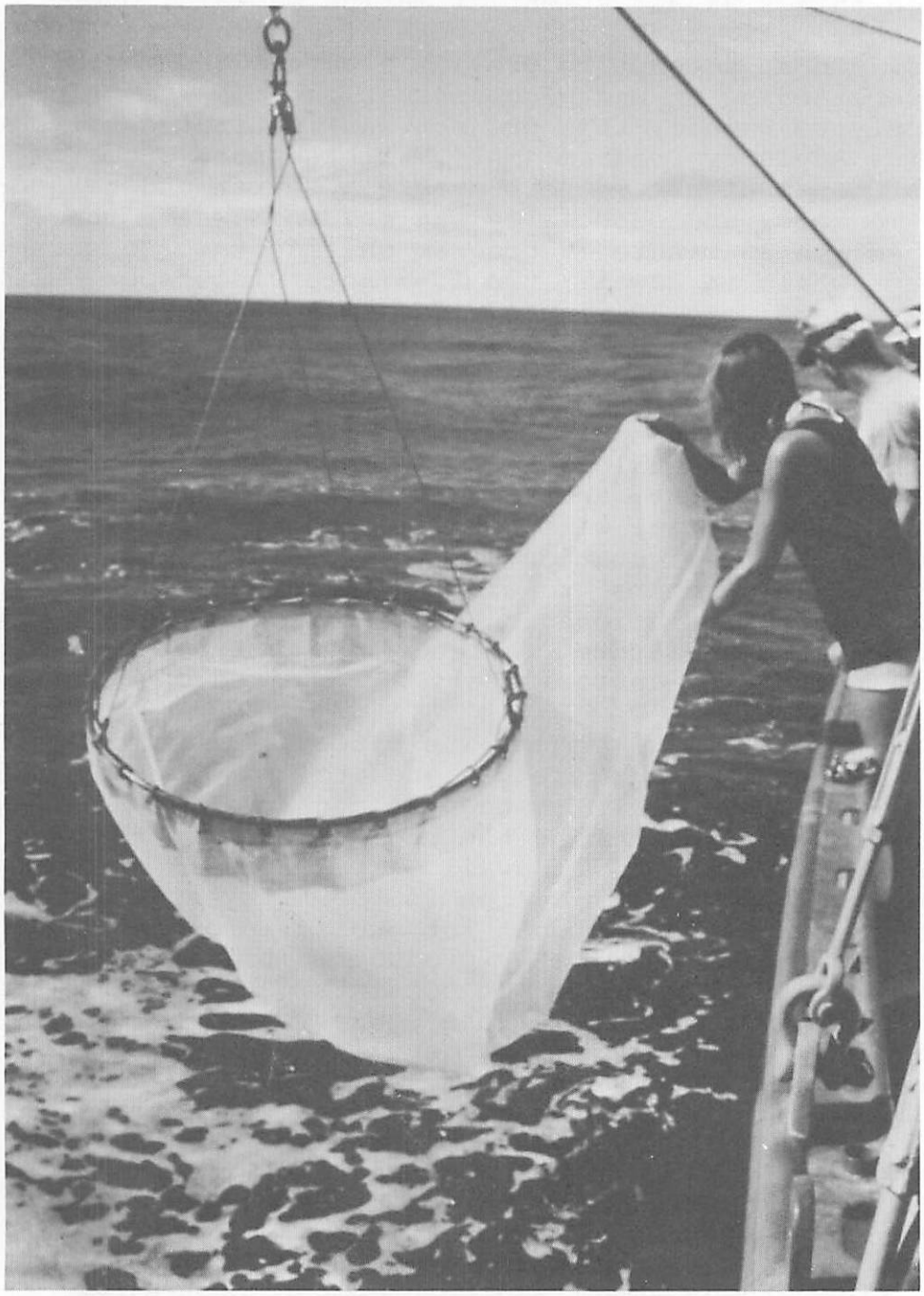
MAC Investment: $17,864

MATCHING FUNDS:
Sea Grant: $27,112

Many of Hawaii's citizens lack a sufficient understanding of marine conservation principles and laws. This lack is demonstrated by such things as harassment of marine mammals, overfishing of inshore reef areas, and the use of destructive fishing techniques. In an attempt to provide a better and more widespread understanding of marine conservation laws and principles that apply to Hawaii, this project was instituted by the Sea Grant Marine Advisory Program (MAP), with support from the Marine Affairs Coordinator. To help create a better understanding of marine mammals, and especially whales, in Hawaii, the project produced: A 30-minute TV program on videotape concerning the humpback whale in Hawaii; two 15-minute videotapes based on the 30-minute tape; one 30-minute video cassette for nationwide distribution; a series of twelve radio spot announcements, four of which are on audio tape with narration and-background whale sounds and "songs"; six TV spot announcements based on the same theme as the radio spots, which is to raise public awareness of the Humpback whale and reduce harassment, including unintentional harassment; and a one-page "whale watchers guide". All of this material will be available and distributed during the 1977-78 whale migaration season. In addition, in order to train "whale watchers" to aid in collection of data for a survey of whale populations in Hawaiian waters, seven workshops were held around the State. Attended by some 300 people, they provided a network of approximately 100 trained observers.

The second phase of the project was titled, "In Harmony With the Sea". Its components are designed to increase the public's awareness of resource management concepts, conservation principles and ethics, and the reasons behind the regulations of the State Division of Fish and Game. (The Hawaii State Division of Fish and Game is the only such organization in the fifty states of the U.S. that does not have a budget for public information activities of this nature.) The major product is titled, "Ancient Hawaii--In Harmony With the Sea". It consists of a 15-minute slide/audio tape packet focusing on the conservation concepts and techniques of old Hawaii and their application to current Hawaii. There is also video tape of the slide show on a video cassette for broadcasting purposes and an 8-page illustrated booklet based on the slide presentation material. The second segment of this phase is called, "I'a of Hawaii--Present Day Kapu Systems". ("I'a" is Hawaiian for fish, or marine animal.) Basic unit of this segment is a 15-minute slide/audio tape presentation developed in coordination with State Fish and Game; it focuses on fishery management and enforcement principles, with specific laws or regulations discussed to illustrate these

principles. This presentation was also produced on a video cassette. Remainder of the segment consists of three six-page pamphlets: "Illegal Fishing Techniques in Hawaii"; "He'e and 'Olepe--Octopuses and Shellfish"; and "ula and Papa'i--Lobsters and Crabs".



V. FACILITIES SUPPORT

PIPELINE SURVIVAL UNDER OCEAN WAVE ATTACK

Task Order #97 (FY 1975-76)
Task Order #97 Amended (FY 1976-77)

MAC Investment: $10,600 (FY 1975-76)
$ 5,000 (FY 1976-77)

MATCHING FUNDS:
Sea Grant: $37,179 (In 1975-76)
$15,000 (In 1976-77)

In FY 1974-75, MAC provided $5,000 for this project, via Task Order #54, titled, "Ocean-Energy-Related Wave Study"; Sea Grant provided matching funds of $37,000 that year. (See MAC 3rd Annual Report.) The project involves the measurement of waves, water motion under waves, and concurrent forces exerted on a test pipe laid on the sea floor, near Kewalo Basin, in order to better derive information for the designers of submarine pipelines set parallel to wave crests. Work during FY 1975-76 was a continuation of studies in the previous year, and was done using the pipe placed off Kewalo Basin. At the same time this research was in progress, two Mainland wave-pipe-interaction laboratory projects were being conducted with Sea Grant funding; one was at Texas A and M University, the other at Oregon State University. It was agreed that it would be useful for the Principal Investigator of this project to work closely with the personnel of one of these laboratory projects, in order to compare results and come to some agreement on design procedures. The fact that Oregon State had a unique large wave tank and was more directly comparable with the work of this project, it was decided that the cooperative work should be done at Oregon State. (Of the $15,000 in Sea Grant matching funds shown above for FY 1976-77, $10,000 came from Sea Grant monies awarded to Oregon State University.) This cooperative work was carried on during second half of FY 1976-77. Data generated would be useful in such undertakings as building sewage outfalls and in constructing pipelines for Ocean Thermal Energy Conversion (OTEC) projects.

REFURBISHMENT OF HABITAT AEGIR
Task Order #61 (Amended FY 1975-76)

MAC Investment: $17,300

MATCHING FUNDS:
Sea Grant: $91,376

In FY 1974-75, MAC had invested $20,000 in refurbishing the habitat AEGIR for a 30-day "dry dive" saturation experiment conducted by the man-in-sea hyperbaric physiology program of the University's School of Medicine; this was matched by $135,193 in Federal funding, as reported in the MAC 3rd Annual Report. That $20,000 was all that had been available during that fiscal year, although it was not enough to cover the refurbishment costs. These costs were met by this additional investment of $17,300 in FY 1975-76; the Sea Grant matching funds for the project in that same year were $91,376.

RENOVATION OF A COASTAL ZONE RESEARCH VESSEL
Task Order #78 (FY 1975-76)

MAC Investment: $13,500

MATCHING FUNDS:
None available
Project vital to marine interest in Hawaii

Various marine programs of the State and University of Hawaii have long had a need for an intermediate-size research ship, larger than outboard-powered whalers and similar boats, and smaller than deep ocean research ships such as the KANA KEOKI and MOANA WAVE. The MAC has funded the chartering of such intermediate-size ships in the past. The R/V NOI'I, a 65-foot vessel which has been turned over to the Hawaii Institute of Geophysics by the U.S. Government, now fulfills the State and University's need for an intermediate-size coastal zone research ship after conditioning and modification.

Funds from this task order helped provide for the repairs, alterations, and maintenance needed before the vessel could be put into useful service. Extensive work performed on the vessel during drydocking included hull planking and replacement, as well as overhaul of the ship's generator and engines. The vessel has since been heavily used.

MAKAPUU PIER MAINTENANCE
Task Order #100 (FY 1975-76)

MAC Investment: $5,000

MATCHING FUNDS:
True rental value of pier

The Makapuu oceanographic pier is the base for a number of ocean facilities and activities, including the habitat AEGIR and the submersible STAR II. The State has control of the oceanographic pier, with supervision exercised through the Marine Programs Office of University of Hawaii. The Marine Affairs Coordinator has previously invested $5,000 in 1973 and $5,000 in 1975 via task order #30 and #65 respectively, for upkeep and maintenance of the pier. An equal sum was required in 1976 to handle the routine maintenance and upkeep, such as electrical and plumbing work, necessary on a facility exposed to the corroding effects of salt water and salt air.

WAVE ATTENTUATION STUDY
Task Order #112 (FY 1976-77)

MAC Investment: $12,000

MATCHING FUNDS:
Sea Grant: $32,000

How do waves act in shallow waters, after breaking on a reef and/or being affected by various beach shapes and by nearshore winds? Little engineering information was available on this subject, which can have significant impact on structures built in or immediately adjacent to areas where such wave actions take place. This project was started in FY 1975-77, with Sea Grant support only, to find answers to these questions. Field work in nearshore waters began in FY 1976-77, with joint MAC and Sea Grant support. MAC support was continued in the current fiscal year (FY 1977-78); for more information see the current projects section of this report.

SSP KAIMALINO
Task Order #92 (FY 1975-76)

MAC Investment: $59,000

MATCHING FUNDS:
Naval Undersea Center: ship charter & crew services

The acceptance and success of the State's contemplated interisland ferry system will in large part depend on its ability to employ ships that can provide an acceptable level of comfort to the average passenger crossing Hawaiian channels. Hawaii's interisland channels are generally in such a rough and choppy condition that the level of comfort provided by ships of conventional design is completely unacceptable to the average passenger. The Naval Undersea Center has designed and built a new type of craft designed specifically for Hawaiian and other exceptionally rough waters. The Department of Transportation requested the assistance of the MAC in securing the use of the ship, which is called the SSP KAIMALINO, for various tests desired by the State. (SSP stands for Semi-submerged Stable Platform.)

The MAC provided funds in FY 1974-75 for construction and maintenance work necessary to ready the KAIMALINO for such ocean trials as needed by the State. As was anticipated, funds available during FY 1974-75 were not sufficient to complete all the necessary work. Thirteen thousand dollars of the funds under this Task Order were used to improve conditions aboard the bare-walled SSP, by the installation of acoustic and thermal insulation, and other modifications.

On March 20, 1976, the KAIMALINO, under charter to the State Department of Transportation, was used for a series of three demonstration rides for State and City-Council lawmakers and administrators concerned with transportation matters, and also for members of the State's Marine Highway Task Force. As part of the demonstration of the SSP's superior riding qualities, a conventional monohull ship of approximatley the same length as the KAIMALINO went along; its greater pitch, heave and roll graphically showed the roguher ride provided by a monohull under the same sea conditions. The relative motions of the two ships were also captured on motion picture film for further study.

Following this demonstration, the Marine Highway Task Force recommended that the State proceed to a conceptual design of an SSP type ship, such as the KAIMALINO, so that the State can evaluate feasibility of using SSP ships for an inter-island auto-passenger ferry, including construction and terminal costs. (An SSP is now the only type of ship under consideration for possible inter-island auto-passenger ferry service.)

The remainder of the funds under this Task Order supported a dual purpose cruise of the KAIMALINO during the month of May, 1976. The ship made its first crossings of the Molokai and Alenuihaha Channels, and visited Molokai, Maui, two ports on the island of Hawaii, and Kauai. During these cruises and channel crossings motions of the ship in three phases were recorded for later use along with observations of wave conditions at the time of the recordings. The channel crossings demonstrated at first hand that the SSP-type design does indeed provide an acceptably comfortable ride even in rough Hawaiian channel waters. At the same time, while making these crossings, the KAIMALINO also transported the 1976 Makahiki Kai exhibition to Molokai, Maui, Hawaii and Kauai. In all, some 9,000 students and teachers from the Neighbor Islands visited the KAIMALINO and the Makahiki Kai exhibits during the 26 days that the KAIMALINO was employed on this dual project.

NUC-MEMO MARINE MICROCOSM FACILITY AND PROCESSING CENTER

Task Order #77 (FY 1975-76)

MAC Investment: $5,000

MATCHING FUNDS:
Naval Undersea Center: $25,000

Investigations of marine microcosms, or small-scale communities of organisms, are one of the most useful means of gaining an understanding of the functional dynamics of larger communities. Various physical parameters affecting marine organisms, such as temperature, nutrient level, etc. can be regulated in a microcosm; this provides basic data which may be applied toward solving environmental problems. Both Hawaii Institute of Marine Biology (HIMB) and the Naval Undersea Center (NUC) have planned a long-term study of reef and estuarine microcosms. The Marine Microcosm Facility and Processing Center funded by this task order is designed to increase intercommunication and exchange of services between HIMB and NUC, and facilitate multiple use of single microcosms.

Six long-term microcosm experiments have been completed through use of this facility, including intercomparison of NUC and HIMB facilities, as well as experiments in copper toxicity, elevated nutrient and temperature levels, sediment transfer and panel transfer. The microcosm facility has also hosted a University of Hawaii engineering project using recycled algal culture as a means of fixing solar energy.

THREE RECOMPRESSION CHAMBERS
Task Order #119 (FY 1976-77)

MAC Investment: $45,830 NO MATCHING FUNDS

Three recompression chambers were purchased with funds from this Task Order. The first two are double-lock, two-man chambers capable of being pressurized to 130 pounds per square inch; these chambers had previously been used as backup chambers for divers working on the Sand Island sewer outfall project. They were purchased for the State from Morrison-Knudsen Company for $9,950 each. The doublelock, two-man chamber installed at Makapuu Oceanographic Pier was purchased at auction for the sum of $3,010; of this, $2,000 came from funds under this Task Order, and the balance was supplied by the Research Corporation of the University of Hawaii. The balance of the funds (23,930) was used toward making the two chambers purchased from Morrison-Knudsen ready for installation. (The chamber on Makapuu Oceanographic Pier was installed and in operational condition when purchased.) Further funding is being supplied during FY 1977-78; for more details see the current projects section of this report.

MAUI RECOMPRESSION CHAMBER
Task Order #126 (FY 1976-77)

MAC Investment: $20,000

MATCHING FUNDS:
Maui Recompression Chamber Service, Inc. $24,000

Funds allocated under this Task Order were used to help purchase a monoplace hyperbaric (high pressure) oxygen unit for use in treating victims of diving accidents on Maui via recompression and controlled decompression. The matching funds were raised via public donations under the leadership of the Maui Recompression Chamber Service, Incorporated, a non-profit organization established for the specific purpose of raising such funds. Ownership of the unit has been turned over to Maui Memorial Hospital and the State Department of Health. The unit is located at Maui Momorial Hospital. For further information on recompression facilities, see the current projects section of this report.

MOBILE RECOMPRESSION CHAMBER
Task Order #130 (FY 1976-77)

MAC Investment: $8,100

MATCHING FUNDS:
Sea Grant: $74,525*

From Sea Grant, the University of Hawaii acquired possession of a standard double-lock, multi-person recompression chamber. (This type of chamber is designed, and commonly used, for treatment of diving accidents, primarily "bends" and embolism.) Purpose of the transfer was so that the chamber could be used in the Sea Grant-funded "Human Performance in the Sea" research project conducted by the Department of Physiology, School of Medicine, UH. It was determined that the recompression chamber could be of far more use to the research program, and to the State, if it could be mounted on a towable trailer and made into a completely self-contained, mobile unit. The trailer was supplied by the University, and MAC provided $8,100, the estimated cost of creating the envisioned, self-containted unit. Part of the plan was to overhaul and use an existing diving compressor as the source of compressed air. More work was required on the compressor than had been anticipated; funding under this Task Order was not sufficient, therefore, to provide a workable compressor and air filter. The rest of the work was done, however, and a useable unit was created; the air storage tanks simply had to be refilled from some operating compressor. During FY 1976-77, the unit was taken to Kailua-Kona, Hawaii, where physicians were instructed in the use of such recompression chambers. It was also used by the Marine Technician Training Program, Leeward Community College, for teaching students to be commercial diving tenders. It is planned that a compressor will be mounted on the unit during FY 1977-78, making the unit complete mobile. It is intended that this chamber will become part of a State-wide network of recompression chamber facilities being established during FY 1977-78.

*The matching funds represent the funding of the "Human Performance in the Sea" research project from Sea Grant, including funding for the training at Kailua-Kona, and the cost of the chamber itself, listed as $9,725. All of the funds used for making the unit mobile came from MAC

KEWALO BASIN MARINE SUPPORT FACILITY

Task Order #84 (FY 1975-76)
Task Order #133 (FY 1976-77)

MAC Investment: $2,800 (FY 1975-76)
$2,100 (FY 1976-77)

NO MATCHING FUNDS

A site directly next to the National Marine Fisheries Service installation at Kewalo Basin has for some time been used as a storage area, marshalling yard and location of a small machine shop used by the University's Tsunami Research Program and Pacific Equatorial Research Laboratory. Other users, on an occasional basis, are the Joint Tusnami Research Program, the UH Departments of Oceanography, Ocean Engineering, and Civil Engineering. Eventually these activities will be moved to the University Marine Center at Snug Harbor, but this cannot be done until Phase Two of the Center is completed. The space is rented from the State Department of Transportation; no funds were available in the University budget for the rental. Therefore MAC allocated funds to cover rent and water charges, plus some other maintenance costs.

REPLACING CHEMICAL ANALYZER AT HIMB

Task Order #137 (FY 1976-77)

MAC Investment: $10,915

RUCH provided $2,000 toward purchase

The single most heavily used piece of general laboratory instrumentation at Hawaii Institute of Marine Biology (HIMB) is a CHN analyzer. This is a specialized gas chromatograph used to determine the amounts of carbon, hydrogen, and nitrogen in water or organism samples. Information furnished by the CHN analyzer is vital to many important projects. For example, the determination of nitrogen content in the diet of aquaculture species is a major consideration in developing optimum nutrition. The instrument formerly used at HIMB was ten years old and showing serious signs of general system deterioration. Repairs were becoming necessary almost monthly and were ceasing to be cost effective. Because the support of necessary marine facilities is an important function of MAC, the sum of $10,915 was made available for purchase of a new instrument; the additional necessary $2,000 was supplied by RCUH. The CHN analyzer purchased with the funds became operational at HIMB in August, 1977.

CONTINUED SUPPORT FOR SMALL UH WORKBOAT
Task Order #55 (Amended FY 1976-77)

MAC Investment: $1,700 NO MATCHING FUNDS

The University-owned 26-foot diesel-powered catamaran TINKERII is used by the JKK Look Laboratory of Ocean Engineering as a support platform for in-water projects; it is also used as a diving boat for the Leeward Community College Marine Technician Training Program diving courses. On May 11, 1977, the boat sunk at its dock because of failure of a valve. The University had no funds available for raising and refurbishing the craft; MAC therefore provided the needed funds as part of the MAC responsibility to support important marine facilities in the State.

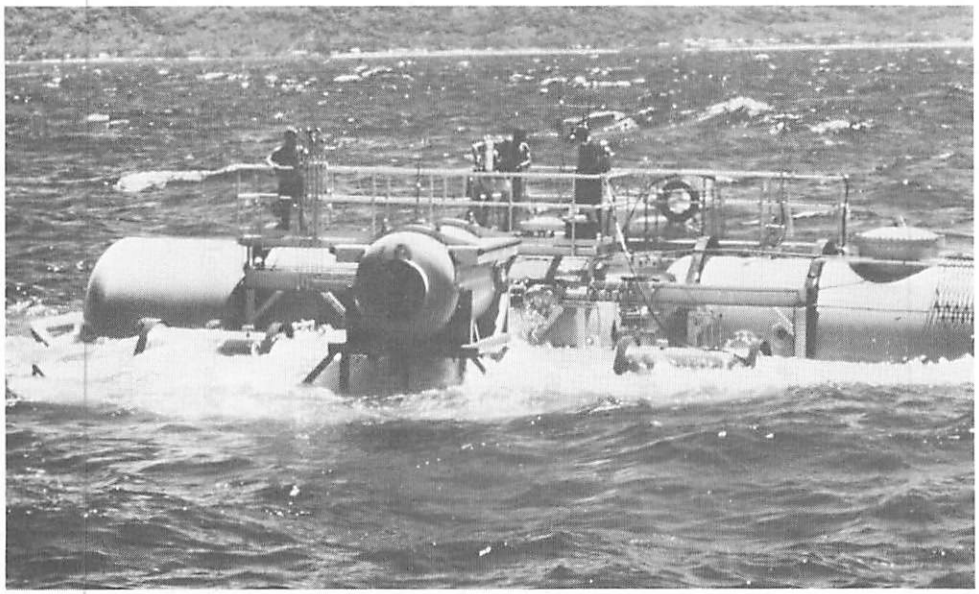


TABLE IV. SUMMARY OF MAC FUNDED PROJECTS, YEARS 1970-1977

(By Categories)

CATEGORY I. MARINE RESOURCES INVENTORY AND ASSESSMENT

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Precious Coral Survey	01	01/71 - 06/71	$ 45,000	$62,276 Makai Range in-kind $177,826 NSF	$285,102
Marine Atlas	10	09/71 - 06/75	70,000	-0-	70,000
Precious Coral Survey	32	06/73 - 06/74	30,000	In ship time and support	30,000
Continued Work on Atlas of Marine Resources	39	12/73 - 09/75	5,000	-0-	5,000
Continuation of Marine Atlas Fish Data Computerization	46	07/74 - 12/75	5,000	-0-	5,000
Exploratory Dives for Precious Coral	59	11/74 - 06/77	30,000	In ship time and support	30,000
Bibliography for Ocean Science Information Center	66	04/75 - 06/75	5,000	$3,795 Sea Grant	8,795
Hawaii Coastal Zone Data Bank	90	07/75 - 06/76	12,000	$8,000 Hawaiian Electric $10,000 MEMO/NUC	30,000
Molokini Island-Papohaku Beach Baseline Study	110	07/76 - 06/77	10,000	$3,000 Maui Land & Pineapple	13,000
Hawaii Coastal Zone Data Bank	122	09/76 - 06/77	20,000	$24,000 NUC 5,000 Hawaiian Electric 2,000 EPA	51,000
Leeward Archipelago Resource Study	128	11/76 - 06/78	23,500	$320,500 NMFS 59,500 Fish and Wildlife Service	403,500

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Precious Coral Management	134	01/77 - 06/77	$ 1,050	-0-	$ 1,050
Stoney Coral Resource Study	138	06/77 - 02/78	9,854	-0-	9,854
TOTALS			$266,404	$675,897	$942,301

CATEGORY II. MARINE RESOURCES PRESERVATION, CONSERVATION, RESTORATION

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Marine Park Design	02	01/71 - 06/71	$ 25,000	-0-	$ 25,000
Marine Park Design	08	07/71 - 06/76	25,000	$220,000 Sea Grant	245,000
Micromollusks Project	83	08/75 - 06/76	5,000	$5,000 U.S. Army Corp of Engineers	5,000
Kauai Coastal Zone Resource Survey	89	07/75 - 06/76	10,000	$3,250 Sea Grant $2,334 National Coastal Zone Act 1975	15,584
EPA/HIMB Kaneohe Bay Sewage Relaxation Study	99	12/75 - 06/76	14,500	$167,000 EPA	181,500
Green Sea Turtle Management Study	113	07/76 - 09/77	4,236	-0-	4,236
EPA/HIMB Kaneohe Bay Sewage Relaxation Study	111	07/76 - 06/77	30,000	$184,000 EPA	214,000
Green Sea Turtle Management Study	118	09/76 - 06/78	18,362	-0-	18,362
TOTALS			$807,993	$576,584	$1,384,579

CATEGORY III: MARINE-RELATED ECONOMIC DEVELOPMENT

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Aquaculture Studies - Fish Farms Hawaii	04	06/71 - 05/72	$ 21,915	In-kind from Fish Farms Hawaii	$ 21,915
Aquaculture and Ocean Energy Studies	05	06/71 - 06/72	5,000	$5,000 County of Hawaii	10,000
Tuna Baitfish Study (Threadfin Shad)	06	06/71 - 01/73	15,000	In-kind tuna industry	15,000
Manganese Resource Study	21	07/72 - 06/73	60,000	$20,000 NSF $20,000 NOAA In-kind Ocean Resources	100,000
Development of High Density Prawns and Catfish Culture	24	06/72 - 12/72	31,800	$6,000 Maui County In-kind Fish Farms Hawaii	37,800
Geothermal Energy Investigation	29	04/73 - 04/74	5,000	$10,000 Atherton Richards $252,000 NSF $16,000 Others	283,000
Ship Support for HIMB Aquaculture Program	31	06/73 - 06/75	20,000	$250,000 Sea Grant aquaculture funding	270,000
Aquaculture Research Facility Modifications	38	06/73 - 06/75	10,000	Partial funds from Sea Grant funding--see T.O. 31	10,000
Sand Mining Experiment, Monitoring, and Inventory	42	08/74 - 06/75	17,985	$29,450 Kamehameha Development Corporation	47,435
Further Support for Sand Mining Test, Monitoring and Sand Inventory (Amend)	42	12/74 - 06/75	12,000	-0-	12,000
Manganese Nodule Investigation in Hawaiian Channels	43	07/74 - 06/75	50,000	$43,694 Sea Grant	93,694
New-Area Manganese Resource Survey	45	07/74 - 06/75	45,000	-0-	45,000

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Providing Ponds for Aquaculture Research	57	11/74 - 06/75	$ 10,000	Part of Sea Grant monies under T.O. 31	$ 10,000
International Center for Living Aquatic Resources Management (ICLARM)	58	11/74 - 06/75	20,000	$215,000 Rockefeller Foundation	240,000
Skipjack Tuna Baitfish Project	64	01/75 - 06/75	1,500	$1,250 Sea Grant In-kind support from NMFS	2,750
CHANOS CHANOS Aquaculture Project	70	06/75 - 06/76	17,700	$16,221 Molii Fishpond and Mr. George Uyemura	31,221
Technical Training Film on Mullet Aquaculture	71	06/75 - 06/76	10,000	$7,500 ICLARM (Part of T.O.58) $2,500 Oceanic Foundation	20,000
MOI Aquaculture Research at HIMB	74	06/75 - 06/76	3,000	Part of matching funds in T.O. 31	3,000
Natural Energy Laboratory	76	06/75 - 06/76	30,000	-0-	30,000
Natural Energy Laboratory	236	11/74 - 12/78	50,000	$50,000 County of Hawaii	100,000
Hilo Lobster Investigation	79	07/75 - 06/76	6,300	$4,000 Sea Grant $3,100 Hawaiian Sea Foods $1,500 Restaurant owners $500 Horizon Air Freight $444 Private	15,844
International Center for Living Aquatic Resources Management (ICLARM)	80	07/15 - 06/76	20,000	$300,000 Rockefeller Foundation	320,000
Malaysian Prawn Genetics	87	07/75 - 06/76	10,000	Partial matching funds from T.O. 93	10,000
Tuna Baitfish Project	88	07/75 - 06/76	3,000	-0-	3,000

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Natural Energy Proposals	91	07/75 - 06/76	$ 38,000	-0-	$ 38,000
HIMB Animal Aquaculture Project	93	07/75 - 06/76	25,250	$268,136 Sea Grant	293,386
Offshore Sand Mining Development, Phase I	102	01/76 - 06/77	14,729	In-kind	14,729
Ocean Metals (Manganese nodules)	103	10/75 - 06/77	87,000	$36,678 Sea Grant	123,678
Ocean Energy Farm Project	107	03/76 - 06/77	10,000	$116,702 Sea Grant	126,702
Tuna Baitfish Project	114	07/76 - 08/77	10,000	$25,000 Sea Grant	35,000
Malaysian Prawn Genetics	115	07/76 - 08/77	30,400	$54,000 Sea Grant	84,400
MOI Aquaculture	116	07/76 - 08/77	15,000	$40,000 Sea Grant	55,000
Ocean Metals (Manganese nodules)	117	07/76 - 08/77	66,000	$18,000 Sea Grant	84,000
Offshore Sand Mining Development, Phase II	120	07/76 - 12/77	30,000	-0-	30,000
Brine Shrimp Production	124	09/76 - 06/77	10,000	$94,126 Department of Labor and Industrial Relations	104,126
International Center for Living Aquatic Resources Management (ICLARM)	129	07/76 - 12/76	10,000	$103,000 Rockefeller Foundation	113,000
AFRC Prawn Production System	132	12/76 - 02/78	15,000	$35,000 Sea Grant	50,000
Ornamental Fish Culture Project	136	03/77 - 09/77	10,000	-0-	10,000
TOTALS			$850,679	$2,047,806	$2,898,485

CATEGORY IV. MARINE EDUCATION AND TRAINING

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Hyperbaric Diving Studies	03	01/71 - 01/72	$ 55,000	$187,000 Office of Naval Research $44,000 Sea Grant In-kind Makai Range	$ 286,000
Marine Exhibit Booth	07	07/71 - 06/72	10,000	$10,000 Hawaii marine industry	20,000
Hyperbaric Diving Studies In-Situ	09	08/71 - 06/72	55,000	In-kind Makai Range $334,325 ONR	389,325
I.D.O.E. Conference	11	09/71 - 06/73	25,000	-0-	25,000
Innerspace Pacifica '71	13	10/71 - 06/72	6,000	$6,000 Hawaii Council of Dive Clubs	12,000
At-Sea Training Cruises for Future Marine Technicians	14	01/72 - 06/75	20,000	In-kind NMFS	20,000
Diving Training Tank for LCC	15	01/72 - 09/72	3,000	$3,000 Sea Grant	6,000
Shell Structures Conference	16	10/71 - 10/72	6,000	$20,000 ONR $15,900 NSF $4,420 Private	46,320
Innerspace Pacifica '72	22	07/72 - 03/73	10,000	$10,000 Hawaii Council of Dive Clubs	20,000
Microtubule Conference	23	05/72 - 09/72	800	$800 Private	1,600
Okinawa Expo Planning	25	07/72 - 06/75	27,000	-0-	27,000
S.N.A.M.E. Conference	26	01/71 - 03/72	4,000	$4,000 SNAME	8,000
Diving Survey by Daniel Kali	27	04/72 - 12/72	3,500	$3,500 NIH	7,000
Manganese Nodules Symposium	28	09/72 - 03/73	6,000	In-kind	6,000

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Blue-Water Marine Laboratory	33	06/73 - 06/75	$ 10,000	$11,000 Sea Grant $5,000 McInerny Foundation $2,700 Student Lab Fees	$ 28,700
Maintenance of Two LCC Marine Tech Training Boats	36	06/73 - 06/75	5,000	$10,000 Sea Grant	15,000
Makahiki Kai 1974	40	05/74 - 06/74	3,000	$5,650 Local industry	8,650
Blue-Water Marine Laboratory	47	07/74 - 06/75	20,000	$24,000 Sea Grant $18,500 McInerny Foundation	62,500
Aquarium Redevelopment Project	48	07/74 - 06/75	9,000	$9,000 Sea Grant	18,000
International Woollard Symposium	49	09/74 - 06/76	15,000	$30,000 NSF $20,000 ONR	65,000
Conference on Physiology of Man in the Sea	50	09/74 - 06/76	6,000	$130,000 Sea Grant	136,000
Conference on Seaward Advancement of Industrial Societies	51	09/74 - 06/75	5,000	$31,889 Sea Grant $4,675 Oceanic Foundation	41,564
Makahiki Kai 1975	63	11/74 - 06/75	5,000	$3,760 Sea Grant $7,525 Private	16,285
LCC Marine Technology Training Program	67	04/75 - 06/75	10,000	$25,392 Sea Grant	35,392
Providing Sea Time (Ship Support) for LCC Marine Tech Program	68	04/75 - 06/75	3,000	Sea Grant--see T.O. #67	3,000
Continuation of Aquarium Redevelopment Program	69	06/75 - 06/76	5,000	-0-	5,000
Polynesian Voyaging Society's Hawaii-Tahiti Canoe	72	06/75 - 06/76	2,000	$50,000 PVS $7000 Hawaii Bicentennial (1976) Commission in private and Federal funds	59,000

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
International Conference on Coastal Engineering	73	06/75 - 07/76	2,000	$20,072 Sea Grant	$ 22,072
Aquarium Education Program	81	07/75 - 10/76	18,500	$7,000 Junior League	25,500
MOP Reef Habitat Project	82	07/75 - 06/76	6,000	-0-	6,000
15th International Conference on Coastal Engineering	85	08/75 - 06/76	18,000	-0-	18,000
Blue-Water Marine Laboratory	86	07/75 - 06/76	30,000	$14,020 Lab Fees $18,589 Sea Grant $7,500 McInerny Foundation	70,109
Innerspace Pacifica '75	94	07/75 - 01/76	1,000	$1,000 Hawaii Council of Dive Clubs	2,000
Aquarium Lecture Series	95	07/75 - 06/76	1,820	$500 Sea Grant	2,320
High Visibility Undersea Observation Structure	96	07/75 - 06/77	5,250	$29,911 Sea Grant $2,580 Pan Pacific Institute	37,741
HI-IMPORT	98	07/75 - 06/77	1,000	-0-	1,000
Makahiki Kai '76	101	01/76 - 06/76	5,000	$19,621 Sea Grant	24,621
Symposium on Marine Affairs	104	01/76 - 06/76	5,300	$2,705 Sea Grant	8,005
LCC Marine Technology Program	106	02/76 - 06/77	6,600	-0-	6,600
LCC Marine Technology Program Ship Support	108	04/76 - 06/76	4,000	-0-	4,000
LCC Shark Fishery Training	109	06/76 - 06/77	7,000	$3,500	10,500

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Blue-Water Marine Laboratory	121	09/76 - 09/77	$ 30,000	$15,300 Department of Education $10,676 Lab fees	$ 55,976
LCC Marine Technician Shark Fishery Training	123	09/76 - 06/77	7,500	$7,500 Department of Planning and Economic Development	15,000
Makahiki Kai 1977	125	11/76 - 06/77	11,231	$28,450 Sea Grant	39,681
Aquarium Education Program	127	11/76 - 06/77	16,000	$7,000 Junior League $10,000 Private gifts	33,000
NOI'I Ship Time for LCC Marine Technology Program	131	12/76 - 06/78	10,000	-0-	10,000
Marine Conservation Education Program	135	03/77 - 08/77	17,864	$27,112 Sea Grant	44,976
TOTALS			$2,531,171	$1,272,072	$3,803,243

CATEGORY V. MARINE FACILITIES SUPPORT

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Porpoise Facility Support	12	09/71 - 08/72	$ 5,000	$300,000 National Science Foundation	$ 305,000
R/V VALIANT MAID	17	01/72 - 12/72	10,000	$10,000 OEO Maui Community Development Corporation	20,000
Diving System Hahn-Clay Hyperbaric Chamber	18	01/72 - 06/73	25,000	In-kind Hahn and Clay	25,000
Makai Range Acoustic Propagation Program	19	05/72 - 06/73	25,000	$49,300 ONR In-kind Makai Range	74,300
HIG-ONR Long Range Acoustic Propagation Program	20	07/72 - 06/73	38,000	$180,000 ONR	218,000
Maintenance Makapuu Pier	30	06/73 - 06/75	5,000	-0-	5,000
Look Lab Facilities - Mini Bell Diesel Engine Facility/AEGIR	34	07/73 - 01/75	54,000	In-kind	54,000
Manganese Nodule Analytical Facility	35	06/73 - 06/76	41,000	$67,771 NSF	108,771
Special Maintenance Support for University's R/V KANA KEOKI	37	06/73 - 06/74	25,000	$640,000 NSF	665,000
Charter of VALIANT MAID for HIMB	41	07/74 - 06/75	6,500	$238,000 Sea Grant	244,500
Manganese Nodules Analytical Laboratory	44	07/74 - 06/75	45,000	-0-	45,000
Kewalo Basin Temporary Marine Marshalling Area	52	10/74 - 06/75	3,472	-0-	3,472
Refurbishment of 1 to 20 Scale Model of Floating City	53	10/74 - 06/75	5,000	-0-	5,000

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Maintenance and Repair of Three Small Workboats	55	10/74 - 06/75	$ 6,700	In-kind Look Lab	$ 6,700
Additional Charter of VALIANT MAID for HIMB	56	11/74 - 06/76	13,500	Part of Sea Grant monies in T.O. 41	13,500
Salinometer for University Research Ship MOANA WAVE	60	11/74 - 06/75	4,000	$26,500 various Federal agencies	30,500
Refurbishment of Habitat AEGIR	61	11/74 - 06/76	37,300	$221,569 Sea Grant $5,000 NOAA	263,869
Development of Oceanic Foundation Wave Sensor Buoy	62	11/74 - 06/75	5,500	$70,000	75,500
Maintenance of Makapuu Oceanographic Pier	65	01/75 - 06/75	5,000	-0-	5,000
KAIMALINO - Preparing Semi-Submerged Platform (SSP) for State testing	75	06/75 - 06/76	7,000	In ship charter and crew services of Naval Oceans System Center	7,000
Ocean Energy-Related Wave Study	54	10/74 - 06/75	5,000	$37,000 Sea Grant	42,000
NUC-MEMO Marine Microcosm Facility and Processing Center	77	07/75 - 06/76	5,000	$25,000 NUC	30,000
Renovation of a Coastal Zone Research Vessel	78	07/75 - 06/77	13,500	-0-	13,500
Kewalo Basin Marine Support Facility	84	08/75 - 06/76	2,800	-0-	2,800
SSP KAIMALINO	92	07/75 - 06/76	59,000	In-kind	59,000

TITLE	T.O. NO.	DURATION	FUNDING		
			MAC	MATCHING	TOTAL
Pipeline Survival Under Ocean Attack	97	07/75 - 06/77	$15,600	$52,179 Sea Grant	$ 67,779
Makapuu Pier Maintenance	100	12/75 - 06/78	5,000	-0-	5,000
Wave Attenuation Project	112	07/76 - 08/77	12,000	$32,000 Sea Grant	44,000
Three Recompression Chambers	119	07/76 - 06/78	45,830	-0-	45,830
Maui Recompression Chamber	126	08/76 - 06/77	20,000	$24,000 Maui Recompression Chamber Service	44,000
Mobile Recompression Chamber	130	10/76 - 06/78	8,100	$74,525 Sea Grant	82,625
Kewalo Basin Marine Support Facility	133	01/77 - 06/77	2,100	-0-	2,100
HIMB CHN Analyzer	137	05/77 - 09/77	10,915	-0-	10,915
TOTALS			$571,817	$2,052,844	$2,624,661