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MARINE CAREERS IN HAWAII:
PROFESSIONAL EMPLOYMENT IN A HIGHLY COMPETITIVE MARKET

by

B. Justin Miller, Ph.D.

WORKING PAPER NO. 48

April 1982

University of Hawaii
Sea Grant College Program
Honolulu, Hawaii

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A report prepared for the University of Hawaii Sea Grant College Program; the Office of the Marine Affairs Coordinator, State of Hawaii; and the Ocean Studies Program, Hawaii Loa College.

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This work, a product of the "Sea Grant Advisory Service" project (AS/A-1), was sponsored by the University of Hawaii Sea Grant College Program under Institutional Grant No. NA79AA-D-00085 from NOAA Office of Sea Grant, Department of Commerce.

About the author

B. Justin Miller was hired as a consultant in February 1981 to conduct a survey and analysis of marine careers in Hawaii for the Sea Grant Advisory Service at the University of Hawaii. This paper is the result of that work. Miller is currently the coordinator of the UH Sea Grant Advisory Service.

The views expressed in this working paper do not reflect those of the University of Hawaii or the University of Hawaii Sea Grant College Program. Any commercial product or tradename mentioned herein is not to be construed as an endorsement.

ACKNOWLEDGMENTS

The individuals who assisted with all aspects of this study are too numerous to thank individually. However, special appreciation must go to Dr. Alf Pratte, Coordinator of the UH Sea Grant Advisory Service; Dr. John Culliney, Director of the Hawaii Loa Ocean Studies Program; Mr. H. Roy McArdle, Coordinator of UH Career Placement; Dr. Jack Davidson, Director of the UH Sea Grant College Program; and Dr. John Craven, Marine Affairs Coordinator, State of Hawaii.

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INTRODUCTION

Awareness of ocean resource values has grown rapidly in Hawaii during the past two decades, primarily as a result of federal legislation designed to develop, manage, and protect the marine resources of the country. Mandated by governmental regulations requiring environmental impact studies, and encouraged by funding from a variety of federal agencies, particularly the Office of Coastal Zone Management and the National Sea Grant College Program, researchers began in earnest to probe all aspects of the marine environment, while educators launched a drive to create a marine literate society by bringing the results of marine research to the public. Stimulated by attractively packaged information from academic programs praising the bounty, beauty, and potential of the oceans, high school and college students in increasing numbers set their sights on careers in marine-related fields. Oceanography, marine biology, marine affairs, and ocean studies departments found themselves with some of the fastest-growing programs in the college and university system, and, not accidentally, became primary sources of employment for graduates with degrees in a marine-related discipline.

A number of efforts to examine the prospects for marine employment have been attempted over the past decade. On each occasion the number of documentable marine employment opportunities requiring specialized training, e.g., ocean engineering, has fallen short of expectations. Paradoxically, students have continued to seek marine specialities and most of the well-qualified marine graduates have found (or created) marine career opportunities.

Overlooked in the excitement over "things marine" was a critical appraisal on the part of academicians and students alike of present and future career opportunities for individuals graduating with a bachelor's, master's, or doctoral degree in a marine-oriented field of study. What could one do with a B.A. or B.S. in an ocean-related field? Did one get an M.S. or Ph.D. out of interest in a new body of knowledge, or because there was really no other place to go after the bachelor's degree program was completed? During the past few years, informal discussions and assessments began to point to an overabundance of college-trained personnel in the marine field, but no data existed to verify or refute these impressions. Because programs in marine studies are still growing, while at the same time the primary source of support for marine-trained professionals (i.e., the federal government) has proposed severe budgetary cutbacks, a study of marine career opportunities in Hawaii was initiated. It was designed to develop a broad assessment of the current and projected job market, as well as to provide students, academicians, and decisionmakers with information necessary for short and long-term planning for individual careers and program emphasis.

Specifically, this report was written with three objectives in mind:

- 1 To provide a broad overview of the types of marine occupations available in Hawaii to individuals with professional training in a marine-oriented area. This information, incorporated both in the main body of the text and in the discussion, is intended

primarily for the use of high school students and college undergraduates contemplating undertaking an educational program in one of the marine disciplines. It gives up to date information on current and projected availability of jobs, as well as data on salary, advancement potential, and job security.

2. To provide current information on marine employment opportunities to faculty, career counselors, and administrators of high schools, universities, and colleges in Hawaii. Because many schools are contemplating increases in or additions to ongoing marine programs, the final section of the report is geared to a discussion of specific aspects of the professional marine occupation situation that may be of help in short and long-term academic planning.
3. To provide information on employment of marine professionals in Hawaii to legislators and state agencies, as well as to federal marine agencies. Because a significant portion of the marine economy in the state depends on federal and state funding, this information should be predictive of the effect of proposed budget cuts and may assist in decisionmaking regarding the allocation of existing funds.

APPROACH AND SAMPLING METHODS

The sampling design was developed to obtain an in-depth assessment of the occupational situation for marine-graduates for the 15-month period from January 1980 through March 1981, and a projection of the future situation through the mid 1980s. Because equal employment opportunity and affirmative action regulations require the advertisement of positions in any organization receiving federal funds, a fairly complete listing of all available marine positions in that period was obtained by using the University Bulletin and the classified section of the *Sunday Honolulu Advertiser and Star Bulletin*, as well as recruitment files of county, state, and federal governments. These positions were reviewed for information such as employing agency, type of work, subject area, training required, source of funding, and salary. As opposed to public sector positions, many available jobs in the private sector are not usually advertised. Consequently, a telephone and personal interview survey of private businesses and foundations was completed, not only to obtain an overview of the types of positions and their current availability, but also to obtain industry perceptions of future career opportunities. Information on the number of recent graduates and current students in the marine area, and on the scope of marine training programs in Hawaii, was obtained through a review of undergraduate and graduate school records from 1979 through March 1981, as well as from interviews with chairpersons of individual academic departments at the various colleges. All of the information obtained has been tabulated and is shown in Appendix A.

OCCUPATIONS IN THE PUBLIC SECTOR FOR MARINE GRADUATES

Most public sector positions in Hawaii that require advanced marine education and training are found with a few large institutions and agencies. The primary employer of marine graduates in Hawaii is, not unexpectedly, the academic community, and particularly the University of Hawaii system, including the community colleges, associated laboratories, research centers, and special projects and programs. The state and county governments also hire trained marine professionals to fill positions on all the islands, usually in the areas of aquaculture, fisheries, and harbor management. Another public employer of the marine educated has been the federal government, with research and management positions available in fisheries and the military. In 1980, there was a total of 95 public sector marine positions advertised, including 73 in the academic community, 10 with the state government, and 12 with the federal government. From January through the end of March 1981, during the period of transition in federal administrations, only 19 positions were advertised, all of them within the UH system. No marine positions were advertised throughout the study by the City and County of Honolulu. Public sector positions advertised for the academic community and with the state and federal governments are described in detail in the following sections.

Marine-Related Academic Positions

Trained marine professionals fill a wide variety of positions in the academic community, including those in areas such as teaching, research, administration, extension services, and technical support. Individuals filling these positions generally have at least a bachelor's degree with some on-the-job training in a marine activity, and most often have a master's degree or Ph.D. in a marine-related subject. Marine speciality areas are found in most traditional academic disciplines, and particularly in branches of science and engineering such as marine biology, fisheries, oceanography, and ocean engineering. The following discussion, included primarily for high school and undergraduate students contemplating undertaking academic marine careers, gives a generalized summary of the broad categories of marine academic occupations currently found in Hawaii.

Teaching faculty

Although universities have taken on a wide range of functions in the community, the basic premise still holds that the primary purpose of a university is the education of students. Consequently, the teaching faculty are the cornerstones of the university system, around which all other functions are supportive. As an aid in teaching, faculty have traditionally been encouraged to conduct research in order to keep current with developments in their discipline and give students first-hand experience in that area of study.

University and college professors usually work a largely unstructured schedule in an atmosphere of free expression, often have rewarding contact with students, and obtain time off during summers and periods of sabbatical leave. Their positions are quite stable once tenure is granted. On the

other hand, there are some significant drawbacks built into the faculty position. Salaries in Hawaii, as well as on the mainland, are low relative to other professions, and, in times of excess supply, landing a marine-oriented teaching position, and then getting over the tenure hurdle, can be a formidable challenge.

Most of the marine-faculty positions in Hawaii are located at the University of Hawaii at Manoa, but a growing number are also available in the community colleges and selected private schools. Two private colleges--Hawaii Loa College and Brigham Young University-Hawaii--have shown increased interest in teaching marine-related subjects, and recently BYU purchased its own aquaculture farm. Although their programs have shown expansion in recent years, continued success in at least one of the schools is directly tied to continued federal funding.

Marine-oriented faculty positions are most stable at the university, course load is lighter, wages are often higher, and conditions in general tend to be better. Because of continual funding difficulties, comparable faculty positions in the community and private colleges tend to offer fewer rewards and less security. Many of the positions are part-time; those that are full-time are often accompanied by heavy teaching loads and lower pay than the university positions which generally require a Ph.D. Although community colleges and private schools have traditionally hired faculty at the master's degree level, they are not able to employ faculty with higher degrees due to the increasing supply of marine-trained Ph.D.'s. Unfortunately, because of their higher levels of expectation, many faculty with a Ph.D. hired by smaller schools tend to become disillusioned with the lack of facilities, low pay, and lower academic standards.

Of the 17 positions advertised during the study period for marine-oriented faculty, 11 were in the university system, primarily in marine physical sciences and oceanography. The remainder was for part-time lecturers in the community and private colleges. Average advertised starting salaries, prorated on a full-time basis, were around \$17,500 per calendar year for an assistant professor in the university system, and about \$15,000 for a comparable position in the community and private colleges.

Research associates

Whereas the original intent of university-based research was primarily a means to keep faculty members current with developments in their particular field, the rise of federal and state support for research gradually encouraged the academic community to enter into the research area. In recent years, federal funding programs, including the National Marine Fisheries Service, the Office of Coastal Zone Management, the National Sea Grant College Program, and the National Science Foundation, universities and some colleges have undertaken large-scale research efforts in marine specialty areas such as aquaculture, fisheries development, ocean energy, ocean engineering, and marine environmental assessment. Many of these efforts are not conducted by marine faculty, but by research associates with a master's degree or Ph D. in one of the marine natural or physical sciences. In the best of times, research associates have considerable freedom to

explore exciting marine questions, along with a good salary and pleasant working conditions. Most of them are not hired on a tenure track position, but rather on "soft money," meaning that their position and salary are totally dependent on continued federal support. Should this support stop, the employer has no commitment to continue the project or the position. In light of the surplus of individuals trained and qualified to be marine research associates, recent threatened across-the-board cutbacks in federal funding could result in extremely stiff competition for the few remaining positions, and most likely will necessitate a complete career reevaluation for many individuals. Eight positions in the UH system, primarily in marine physical sciences and oceanography, were advertised at both the master's degree and the Ph.D. level during the study period. Minimum advertised starting salaries were around \$13,500 per year, with a range of from \$11,500 to \$17,000.

Administrators (directors, managers, coordinators)

With the development of marine environmental studies as required by federal legislation and marine projects funded by ocean advocacy agencies such as the National Sea Grant College Program, the need has grown for an increasing number of directors and managers to take overall management responsibility for program direction, budget, and personnel. In Hawaii, every marine research project or program of any size has its own manager or director, with representative positions including administrators of programs such as Sea Grant, Coastal Zone Management, and Marine Programs; and heads of institutes such as the Hawaii Institute of Marine Biology, Oceanic Institute, and Law of the Sea Institute. Most of these administrators have specific scientific training and usually a Ph.D. in a marine field; they often learn the administrative ropes on the job. Low and mid-level administrators often come from the ranks of faculty; high-level positions include recruits from industry and from other administrative posts in the state. Both state policy and other practices make it difficult for out-of-state applicants. Marine administrators often work long hours, are away from home a considerable amount of time, and sit through endless meetings, but the rewards in terms of status and finance are usually substantial. Salaries are generally commensurate with experience and may rank among the highest in the academic system. Only two of these positions were advertised during the study period, with starting salaries ranging from \$25,000 to \$39,000.

Marine advisory agents and specialists

The Cooperative Extension Service was created as a means of extending the expertise available at land grant universities to the grass roots level through the use of local agents and specialists. Its ocean counterpart, the Sea Grant Advisory Service, was started in the early 1970s to transfer the results of federally funded marine research to marine user groups in coastal and great lakes states. Sometimes physically housed and administratively linked to CES, SGAS is staffed by professionals known as marine agents and marine specialists.

Marine advisory agents, comparable with CES agents, are often found working on a one-to-one basis with fishermen, marina operators, coastal

planners, aquaculturists, and other individuals in marine trades. They tend to be in and of the local community, acting as the link that identifies the marine users' needs, knowing where in the research community to find someone or some information to meet the users' needs, and bringing this information back to the community. The agents are often generalists with a B.A. or M.S. in a marine field, with considerable ability to communicate in the users' home environment. Marine agents who are part of the extensive and well-institutionalized CES network find themselves in a situation with good pay, excellent benefits, and job security. However, those agents who are part of the university professional staff, such as those in Hawaii, often are on soft money and subject to reductions or elimination of funding. In Hawaii, the salary ranges from \$14,000 for a marine agent with a B.S. and three years' of experience to \$20,000 for one with an M.S. and with three to five years' of experience; the usual advertised minimum starting salary is around \$16,000.

Marine specialists in the sea grant system are comparable with extension specialists in the land grant system. They generally are based on a university campus, and with few exceptions have a Ph.D. in a marine specialty area such as aquaculture, coastal planning, marine education, or fisheries. They may have faculty status, especially if SGAS is closely integrated with CES. Marine specialists often serve as researchers on specific marine research projects, and are often called upon by agents to help solve problems identified in the field. In addition to serving as a resource person for the agents, specialists also serve their own clientele. As with the agents, many of these positions are federally funded, and threatened cutbacks in the National Sea Grant College Program could lead to severe job dislocation for a large number of marine specialists across the nation. Marine specialists generally receive a higher salary than agents and are better able to move into a faculty or administrative slot in the university system. Salaries range from \$23,000 to \$35,000.

Marine advisory programs also have a group of people known as information specialists who, although not necessarily marine-trained, often work to meet the information and communication needs of marine professionals in the sea grant programs. These specialists can usually move easily into other positions should funding of marine revenues be discontinued.

During the 15-month study period, positions were only open for one marine extension agent specializing in fisheries and one marine education specialist, a situation caused in large part by reductions and threatened cutbacks in ocean funding.

Technicians, assistants, and aides

With few exceptions, every marine-oriented project and program in the academic community, as well as projects in the governmental and private sector, function with a large pool of assistants, technicians, and aides. Although some technicians are highly skilled in specific functions such as laboratory analysis and biological specimen identification, many have traditionally come into their positions with limited education and few technical skills. Technicians, assistants, and aides may perform functions such as water analysis, data collecting, feeding of fish in culture systems,

pond maintenance, report writing, or a combination of other activities, often including some office skills such as typing and filing. At present, to qualify for most positions in these categories, at least a bachelor's degree is required, and in some cases a master's degree. In addition, there is often a requirement for specific skills and abilities as well. Based on this, it has become apparent that greater competition in the marine area has resulted in an increase in the educational requirements for those positions once filled by individuals with only limited training and education.

Twenty-eight of these positions were advertised in the University of Hawaii system during 1980, and six during the first quarter of 1981, most of them as aquaculture technicians, coastal zone management assistants, and administrative assistants for a variety of marine education programs. Approximately 80 percent of the positions advertised in 1980, and all advertised in 1981, were funded with soft money, with starting salaries ranging from \$9,600 to \$13,400 per year. Because of projected cutbacks in federal funding, individuals in these positions will continue to have little job security, and, without financial commitment by the university, many of them may find themselves without a job.

Breakdown of recently advertised marine-related academic position openings

Seventy-three positions were advertised in the academic sector during 1980, and an additional 19 in the first quarter of 1981. Data on the 1980 positions were analyzed and tabulated to determine minimum education required, funding source, permanence of position, percentage of time of employment, salaries, openings by academic discipline, and employer. Other job parameters were looked at to obtain a broader picture of current and projected employment opportunities, and data from the first quarter of 1981 were used for comparison to determine whether there were any obvious trends.

Minimum educational requirement. Table 1 shows the minimum education required for the positions advertised in the UH system. All positions requiring a high school diploma (10) were in the assistants' category and without exception were advertised at or near the lowest pay rate permissible. Positions requiring at least a bachelor's degree (30) were generally at the technician and aides' levels, and most of them required a degree in natural or social science. In addition, these positions all required considerable work or technical experience, often involving such skills as laboratory techniques, report writing, computer usage, culture techniques, water analyses, or biological identification. The positions requiring at least a master's degree (19) were more varied. Eight were for research support, five for faculty at community colleges, three for writers, and two in education and administration. Again, these all required additional specific skills, such as demonstrated teaching experience, past extension work, past research activity, or administration experience. They tended to be the most general, with the least clearly defined job duties. Positions requiring a Ph.D. were primarily of three categories: faculty (7), research associate (4), and administration (3). With the exception of the three administrative posts, the Ph.D. positions were primarily involved with specifically defined marine research, or a combination of research and teaching.

TABLE 1. MINIMUM EDUCATION REQUIRED FOR 92 ADVERTISED MARINE ACADEMIC POSITIONS

Positions	Degree							
	High School		B. A. /B- S.		M. S.		Ph. D.	
	#	%	#	%	#	%	#	%
1980	10	14	30	41	19	26	14	19
1981 (first quarter)	1	5	10	52	2	11	6	32

During the first quarter of 1981, there was a definite increase in the number of positions requiring a bachelor's degree or a Ph.D., and a decrease in the number of jobs available to high school graduates and those with a master's degree. The decrease in positions, particularly for those requiring a master's degree most likely represents a continuing trend toward hiring Ph.D. 's to perform jobs formerly requiring less training.

Job permanence and funding. Table 2 shows the job permanence or degree of job commitment vested in positions advertised within the UH system. For this study, temporary jobs are defined as those with no possibility of continuation, whereas funding-dependent jobs are those which continue as long as the grant is renewed. During 1980, no jobs below the Ph.D. level were considered to be permanent, and most of them were grant-supported and dependent upon continued funding.

During 1981, this trend appears to be continuing, with less job permanence at all levels and increased dependence on federal funds.

This becomes particularly significant when the figures in Table 2 are correlated with data on funding from Table 3. Here it becomes obvious that since most of the positions at the bachelor's degree level are both federally supported and dependent on continued funding, any action on the part of the federal government to change the funding situation will have a significant impact on marine-related employment in Hawaii. This will be discussed in more detail later.

Percentage time of employment. One factor necessary to evaluate the salary for any position is the percentage time of employment. Data in Table 4 show that many of the positions were only funded part-time; at the master's degree level, the majority were in this category. This seems to reflect the desire of most community colleges to only hire part-time faculty, as well as the real constraints of the funding situation.

Salaries. Table 5 contains a breakdown of average minimum advertised salaries, prorated on a full-time basis, for individuals with increasing levels of college education. The figures are admittedly low, and it is likely that actual starting salaries may be considerably higher than the advertised minimum as a result of negotiation.

TABLE 2. JOB PERMANENCE OF 92 ADVERTISED MARINE ACADEMIC POSITIONS

Positions	Degree							
	High School		B.A./B.S.		M.S.		Ph.D.	
	#	%	#	%	#	%	#	%
1980	5	50					5	
Temporary	5	50	7	23	5	26	4	36
Funding-dependent			23	77	14	74		29
Permanent	0	--	0	--	0	--	5	36
1981 (first quarter)							2	
Temporary	0	--	4	40	0	--	3	33
Funding-dependent	0	--	6	60	2	100		50
Permanent	0	--	0	--	0	--	1	17

TABLE 3. SOURCE OF FUNDING FOR 92 ADVERTISED MARINE ACADEMIC POSITIONS

Positions	Degree							
	High School		B.A./B.S.		M.S.		Ph.D.	
	#	%	#	%	#	%	#	%
1980								
Federal	7	70	25	83	10	53	4	29
State and other	3	30	5	17	9	47	10	71
1981 (first quarter)								
Federal	1	10	7	70	1	50	4	60
State and other	0	--	3	30	1	50	2	40

TABLE 4. PERCENTAGE TIME OF EMPLOYMENT FOR 92 ADVERTISED MARINE ACADEMIC POSITIONS

Positions	Degree							
	High School		B.A./B.S.		M.S.		Ph.D.	
	#	%	#	%	#	%	#	%
1980	4						2	
Part-time	6	40	10	33	11	58	12	14
Full-time		60	20	67	8	42		86
1981 (first quarter)								
Part-time	0	--	4	40	2	100	0	--
Full-time	1	100	6	60	0	--	6	100

TABLE 5. AVERAGE MINIMUM STARTING SALARIES FOR 92 ADVERTISED ACADEMIC POSITIONS

	Degree			
	High School	B. A. /B. S.	M. S.	Ph. D.
1980	\$10,068	\$13,128	\$14,040	\$17,808
1981 (first quarter)	--	\$12,180	--	\$19,944

Position openings by discipline. Most of the positions advertised during the 15-month period (over 60 percent) required a college degree in natural science, oceanography, marine science, or geology. Overall, the highest number of positions (about 33 percent) tended to be in the natural sciences, but these were at a significantly lower level and were less secure than openings in oceanography and geology, which were generally higher paying and with more potential for future growth.

Positions with the State Government Requiring Marine Education

The state of Hawaii hires trained professionals to work in aquatic biology, fisheries and aquaculture, and boats and harbor management. These positions require a variety of skills and are at the technician, research, and administrative levels. Aquatic biologists are hired to carry out research and management studies such as on the biology and ecology of reef fishes, inshore fishes, and other species of commercial importance. Although the advertised positions occur at a range of entry levels, most require at least a bachelor's degree in a natural science or several years of on-the-job experience. Fisheries biologists are hired to fill a variety of positions involved with the propagation of marine and freshwater fishes and other marine animals. Technician jobs require a high school diploma or appropriate work experience, whereas higher-level jobs generally require a bachelor's degree and some previous applicable work experience. Five positions in the general biologist category were advertised in 1980, all of them requiring at least a bachelor's degree, and two required advanced degrees or specialized expertise as well. Starting pay ranged from \$10,428 for technicians to \$16,032 for the Biologist IV. No positions were advertised the first quarter of 1981.

The state also hires employees to manage activities associated with boats and harbors on all the major islands. Although these positions do not require any specific marine education, broad familiarity with the oceans and ocean issues would be a definite advantage for the applicant. Higher-level positions require a B.A. in business or public administration; lower ones generally are filled by individuals with a H.S. diploma and experience with boats and boating. For the five positions advertised during 1980, starting salaries ranged from \$8,352 for Harbor Attendant I to \$21,012 for Harbor District Manager VIII. No positions were advertised through March 1981.

Anyone applying for positions with the state must be a resident of Hawaii and should be prepared for a long wait ranging from three to five months between the time an application is submitted and the position is filled.

Positions with the County Governments Requiring Marine Education

Although there were no advertised marine positions at the county level in the period studied, this does not mean there is a lack of ocean development and management in all counties. For the past several years Maui County has retained a research biologist as well as an aquaculturist to assist in the development of a baitfish project on Maui and Molokai. The former position requires a master's degree plus experience, while the latter requires a bachelor's degree and aquaculture experience.

Positions with the Federal Government Requiring Marine Education

Positions in Hawaii for trained marine professionals are often advertised by federal agencies such as the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the Environmental Resources Section of the U.S. Army Corps of Engineers, and the Naval Ocean Systems Center. Of the 12 positions that were open in 1980, 10 were for individuals trained in the natural sciences to work on fishery-related projects, porpoise training, and environmental surveys. All of the positions were on the federal government GS scale, ranging from a GS 6 (\$14,000/year) for a biological technician up to a GS 14 (\$43,700/year) for Supervisory Fishery Biologist. One position was open for a marine surveyor (GS 12) requiring a B.A. in the field, and another for a marine cargo specialist (GS 10) requiring prior experience.

All positions filled by the federal government are preceded by a rather long and complex application process, involving a series of rating procedures best described by staff at the U.S. Job Information Center. Although the application process is difficult, these positions are the highest paying and most stable once an individual is in the system.

Average advertised minimum starting salaries offered by the federal government for master's degree level positions are \$3,600 higher than in the University of Hawaii system, and a full \$12,000 higher at the Ph.D. level. Because of the recently imposed federal hiring freeze and severe cutbacks imposed by the new administration, many of the 1980 advertised positions may not be filled, and only one new federal position, with the Naval Oceans Systems Center, has been advertised during the first quarter of 1981.

OCCUPATIONS IN THE PRIVATE SECTOR FOR MARINE GRADUATES

Jobs and job openings in the private sector for marine graduates are more difficult to evaluate, both because the positions oftentimes are not advertised and because there is some reluctance on the part of business

to freely discuss personnel matters. However, interviews with a representative sample of marine private industries, including major Hawaii-based corporations, environmental consulting companies, commercial diving operations, aquaculture corporations, commercial fisheries organizations, utility companies, and private educational enterprises, have resulted in a surprisingly uniform assessment of the employment situation.

Generally, most of the private operations have three levels of employment: a small cadre of highly trained professionals, usually with a Ph.D. in an ocean-related natural or physical science; a larger body of trained technicians and managers at the B.A., B.S., or M.S. level; and a large pool of unskilled, but often college-educated, laborers. Based on recent experience, there is little turnover in the upper-level professional positions, but a somewhat higher turnover rate in the lower levels. Most of the companies are not growing or are growing very slowly at present. Hence, relatively few positions are available.

Review of Private Sector Positions Available to Marine Graduates

Positions in commercial aquaculture

Considerable federal funding has gone into aquaculture research and development over the past decade, and this activity has led to the establishment of new aquaculture operations throughout the country. In Hawaii, major emphasis has been on the Malaysian prawn, but culture of oysters and shrimp has also gone commercial. Some of the operations are small "Mom and Pop" ventures with low investment and few employees, but an increasing number of companies are substantial-sized subsidiaries of large mainland-based corporations. A typical moderate-sized company will consist of a small core (<5 percent) of highly trained professionals with a Ph.D. degree, and a middle level of technical experts with a B.A. or M.S. in charge of algal production and culture operations. Most of the remaining staff, and most of the recent position openings, fall in the semi-skilled category, requiring a person willing and able to learn fast, work long hours, and accept minimum wages. According to one company, individuals with a bachelor's degree and no work experience are not competitive because they often have few useful skills, yet expect high pay. Typical salaries range from \$14,000 to \$18,000 per year for the technical positions, and \$6,000 to \$8,000 per year for most others.

At this time, it is still too early to estimate growth and resulting employment opportunities in the industry over the next few years. Despite projections in the Hawaii aquaculture plan (Aquaculture Planning Program, 1978) that predict rapid growth toward a total of 954 direct and indirect jobs in aquaculture in 1985 and 2,134 total jobs by 1990, there is no definite estimate on how many of these positions will be filled by college-trained personnel. Some experts base predictions on the 1:3:6 ratio of one trained leader with a graduate degree for every three college-educated technicians and six laborers with no college experience. Others state that the ratio is more like one professional for every 10 laborers. The number of persons at the highest levels could increase, however, if Hawaii's aquaculture operations continue to develop in sophistication

along the lines of Taylor Pryor's oyster projects on Oahu and Terry Astro's tilapia projects on Kauai.

A study prepared for the chancellor of community colleges in June 1980 by Elaine Dung and Lawrence S. Wakui states: "Since aquaculture involves high risk factors and intensive capital investment, it is recommended that interested people, contemplating starting their own farm operation, be educationally prepared, and for those who seek employment within the industry, educational preparation opens more doors for job opportunity in this expanding field. However, it is also concluded that the industry is still in its developmental stages and the prospects of trained persons finding employment are limited. The industry currently utilizes unskilled workers who are trained on-the-job for the manual tasks that are performed on aquafarms."

Positions in commercial fisheries

A large number of people are employed in the commercial and recreational fishing industry, including skippers, fishermen, processors, distributors, and seafood retailers, but few available positions in this extensive industry require any specific marine education at most four year colleges or graduate schools. Although an understanding of the biology of fish may be valuable in knowing where to find the fish, this skill can be acquired through first-hand observation as well as through academic training. The few exceptions to this statement involve fishermen who have training as fisheries biologists, or who hire fisheries biologists, in order to be able to scientifically assess where the stocks are at any particular time throughout the year. Undoubtedly a degree in fishery science would be a great advantage to any large fishing operation, and it is possible that more professionals trained in this area will be hired as the competition for a limited resource increases. This, however, is not the opinion of state and regional fisheries experts who feel there just is not enough money available for retaining trained professionals. At present, individuals with a degree in a fishery-related science will find few positions open in the state, particularly with the coming demise of federal funding for a wide variety of fishery-related projects. Staff of the Western Pacific Regional Fishery Management Council feel that few openings will exist in the region over the next few years. After that, the situation may improve for all levels of employment if the industry expands as projected in the *Hawaii Fisheries Development Plan* (DLNR, 1979). According to this plan: "The 1990 direct employment effect will be 1,200 new jobs in both harvesting and processing, and approximately 2,000 jobs by the year 2000. Although precise figures on full-time fisheries-related employment were unobtainable, the increase represents a substantial increment, probably over 100 percent. Current cannery employment is estimated to be 425 persons, but with increased landings the cannery would have to add a second shift or expand its plant. Employment in both harvesting and processing will primarily be of the low entry skill variety, although income in the harvesting sector can be considerably above the state's average once experience is gained.

"Furthermore, the expansion of the fishery will also create secondary employment in terms of technical service to vessels and processing equipment (marine engineers, electricians, diesel engineers, refrigeration

specialists). This skilled labor component has not yet been estimated but it will be required for optimal development of the industry.

"Finally, the expanded use of aquacultured baitfish for the aku bait-boats should expand employment in that industry, although there might be a substitution effect in commercial fishing if vessels reduce their crew size as a result of no longer needing extra manpower to catch bait."

Individuals with a degree in business, accounting, or economics are already more in demand, as are a whole variety of individuals trained in the use and repair of boats, gear, and processing equipment. Because these positions do not require marine academic training, they consequently were not analyzed for this study. Information on them, however, may be obtained from the Marine Technician Program, Leeward Community College.

Positions with marine environmental consulting companies

In response to passage of strict environmental legislation during the late 1960s and early 1970s, a number of environmental consulting companies, many of them marine oriented, were started to conduct biological surveys prior to and during construction and operation of major industrial projects. These companies, usually started by a small group of trained biologists with Ph.D.'s, grew rapidly, and served as a ready source of jobs for marine scientists graduating at all levels of education. This activity reached a peak in the mid 1970s, but, because of a variety of reasons, many of them economic, segments of the industry now appear to be in a slow decline. Jobs are still available, particularly at the technician level, but most companies said they have done little hiring in the past two years. Opportunities appear to be best for individuals trained to conduct water analyses, particularly for toxic substances. Starting salaries tend to be low due to the surplus of applicants.

Positions with utilities and other major corporations

Many utility companies, faced with the high costs of hiring private consulting companies in the 1970s to do federally required environmental impact studies, began to set up environmental divisions as part of their own overall operations. These divisions usually include a staff of marine biologists who study the effects of sedimentation, thermal enrichment, and entrainment on marine life, as well as evaluate the work of other private consultants. Generally at the M.S. or Ph.D. level, these individuals are well paid, and hence there has been little turnover in their jobs. Upper-level staff can expect to earn salaries in the \$30,000 range, and individuals starting at the B.A. level may expect \$18,000 to \$20,000 per year. With the general decrease in environmental concern nationally, these special corporate divisions have declining workloads, and openings are rarely available.

Other major companies such as Dillingham Corporation and Matson Navigation Company report a minimum need for university-trained marine personnel during the next two to three years. Beyond that period the demand for college graduates may increase if the Pacific region becomes more involved

in research and development stimulated through the national and international focus on alternative sources of energy and ocean mining, transportation, and law. The major need for college-trained personnel for larger companies in the past has been for engineers and managers, according to personnel directors. Industry officials in Hawaii indicate a preference for persons trained in management, engineering, and other disciplines to have a marine orientation in their training. Officials also indicate that college-trained students who have a general education are being recruited because of the need for flexibility in large companies.

Positions with public education corporations

Facilities-based public education corporations such as Sea Life Park are exciting places to visit, and many students developed their first interest in the marine environment while visiting the sea tank or watching porpoises being trained. Unfortunately, these companies tend to be staffed by a few highly trained professionals, most with a Ph.D. in a biological science, and a larger cadre of individuals who accept part-time, low-paid positions and slowly work themselves up the ladder. Even though these companies may receive hundreds of job inquiries each year, the one or two actual openings are usually filled by those individuals who began as volunteers, or have had some prior experience with the company's operations. Having a bachelor's degree does not seem to be as important as the ability to work hard and accept retraining. Starting wages tend to be at or around the minimum.

A number of private companies that provide experiential marine education for the public have also evolved in Hawaii over the past decade. Responding to the heightened public fascination with the sea and its secrets, the companies provide diving trips, sailing adventures, scuba lessons, and services for that segment of the tourist industry looking for more than a visit to the beach. These companies, still in growth stage, are generally run by an individual trained in the marine sciences and also skilled in business and finance. Openings for low-level posts appear from time to time. As is the case for other public education ventures, working for these companies may be a pleasant experience, but at the present time they can only offer limited job security and low pay.

Commercial diving positions

Most everyone has seen attractive movies of divers floating effortlessly through the clear warm waters of a tropical sea, and this vision tempts many to seek careers in the diving profession. Unfortunately, most of the diving jobs are not in clear tropical seas, but rather in the cold murky waters where major offshore construction projects are underway. Diving, in reality, is dangerous, difficult, and oftentimes unpleasant work. Because of the limited amount of marine construction taking place in Hawaii, and also due to the large number of "free lancers" who are willing to take part-time diving jobs, employment tends to be unpredictable and the jobs are generally lower paying than on the mainland. Most companies prefer to hire individuals who have graduated from a certified diving school, although some say they place equal importance on personality traits such as common sense, dependability, honesty, and the demonstrated ability

to get a job done. Some companies receive as many as 200 unsolicited inquiries each year, in spite of the fact that few full-time positions are open. Full-time salaries may be \$20,000 or higher, when available.

SURVEY OF PROFESSIONAL MARINE TRAINING PROGRAMS, WITH INFORMATION ON STUDENTS ENROLLED DURING SPRING 1981

In spring 1981, a survey was made of the programs which were training marine professionals in Hawaii, the number of students enrolled in these programs, and their fields of study. This information on the background of marine professionals preparing to enter the job market was sought for comparison with the actual positions available in the state, the logical conclusion of which would be to determine which students will have the best chance of obtaining future employment in Hawaii. The reality, however, is that statistically valid conclusions on this subject were far beyond the scope of this study, and the data can only be taken as an incomplete but nonetheless valid start at getting a handle on marine training in Hawaii.

Results of a survey in March 1981 of schools and colleges throughout Hawaii indicate that approximately 360 undergraduate students and 154 graduates were enrolled in educational programs, with a primary focus on some marine discipline. The following breakdown gives further data on these programs, the types of training available, and the student enrollment.

University of Hawaii at Manoa

Marine degrees offered:

Bachelor's with marine option
Master's with marine emphasis
Ph.D. with marine emphasis

Marine students enrolled in spring 1981:

Bachelor's	161
Master's	70 (approx.)
Ph.D.	84 (approx.)
	315

The major source of training for marine professionals in Hawaii is the University of Hawaii at Manoa. Records current to April 1, 1981 indicate that 161 undergraduates in 32 majors were involved in marine training through the Marine Option Program on the Manoa campus. Data in Table 6 show the breakdown by major of undergraduates in the Marine Option Program. This program takes undergraduate students from a broad spectrum of disciplines and, through a combination of courses and practical experiences, attempts to give them a marine skill. Over half (75) of those with declared majors (135) in the Marine Option Program are specializing in life and environmental sciences.

TABLE 6 LIST OF UNDERGRADUATES, BY MAJOR, ENROLLED IN THE MARINE OPTION PROGRAM, UH MANOA, DURING SPRING 1981

Agriculture	11
Agricultural Engineering	1
Anthropology	1
Art	2
Asian studies	1
Biology	21
Business	2
Chemistry	1
Communications	3
Economics	1
Education	1
English	2
Civil Engineering	1
General Engineering	2
Electrical Engineering	2
Mechanical Engineering	7
Geology	2
Geography	1
Hawaiian Studies	1
Health, Physical Education, and Recreation	1
Japanese	1
Journalism	2
Liberal Studies	5
Liberal Studies/Environmental Studies	8
Mathematics	1
Music	1
Nursing	2
Nutrition	1
Physics	1
Political Science	2
Psychology	4
Zoology	46
Undecided	26
TOTAL	161

At the graduate level, approximately 74 students in seven majors were working on marine-related master's degrees and 84 students from 6 departments were completing the Ph.D. program with dissertation research on a marine topic. Data in Table 7 show the breakdown of master's degree and Ph.D. students who were enrolled in a training program involving research for a thesis or dissertation focusing on a marine topic. As was the case for the undergraduate students, a high number of candidates for both degree programs were enrolled in the life sciences.

Further analysis of the wide variety of marine training opportunities available at the UH Manoa campus is beyond the scope of this report, but data gathered from interviews with chairpersons and students of each major department are presented in related discussions throughout the remainder of this report.

TABLE 7. LIST OF MARINE GRADUATES FROM DECEMBER 1978 THROUGH DECEMBER 1980 AND POTENTIAL GRADUATES ENROLLED DURING SPRING 1981 BY MAJOR AND DEGREE PROGRAM

	Graduates		Students Enrolled During Spring 1981	
	M.S.	Ph.D.	M.S.	Ph.D.
Zoology	1	7	18	32
Oceanography	9	7	16	27
Geology and Geophysics	6	3	20	10
Ocean Engineering	--	3	10	9
Botany	2	--	1	2
Chemistry	1	3	1	2
Urban and Regional Planning	--	--	4	--
Animal Sciences	1	--	2	--
Agricultural Engineering	1	--	--	--
Economics	--	3	--	--
Microbiology	1	--	--	--
Anthropology	1	--	--	--
Biomedical Sciences	1	--	--	--
TOTAL	22	29	74	84

Leeward Community College

Marine degree offered: Associate of Arts in marine technology

Marine students enrolled in spring 1981: 109

Leeward Community College has a well-developed Marine Technology Training Program leading to an Associate of Arts degree in marine technology. Although other schools in the state offer selected courses in the marine trades, this is the only program designed to graduate students with the education and skills required for getting an entry-level position after two years of schooling. Although all students receive broad training in the marine trades, each student in addition concentrates in one of three areas: shipboard operations, commercial diving, or commercial fishing.

Because of the nature of the training and the projected employment focus, few students from this program compete in the same job market open to graduates of the other more academically oriented programs. In spite of the rather limited opportunities for marine employment in Hawaii,

students from the Marine Technology Training Program still have had reasonable success in landing marine jobs. According to the program director, approximately 30 percent of the graduates in the shipboard program obtain employment on small charter, sail, and fishing boats, whereas over 50 percent of the diving program graduates find suitable employment. Most graduates of the fishing program can get at least an entry-level position with a fishing company, and this is expected to improve if projections in the *Hawaii Fisheries Development Plan* (DLNR, 1979) prove accurate. Indications are, however, that graduate marine technologists in all three programs have a better chance for employment if they are willing to relocate to the mainland, where a considerably higher level of marine construction is occurring.

Other Colleges in the UH System

Marine degree offered: A.A. with marine orientation

Marine students enrolled in spring 1981:

Windward Community College	17
Honolulu Community College	6
UH Hilo	30
Kauai Community College	23
Maui Community College	<u>9</u>
TOTAL	85

Courses and programs in the marine field are currently being conducted at colleges throughout Hawaii, many of them as a part of the Marine Option Program. A backyard aquaculture project, coordinated by Jeff Hunt of Windward Community College, is developing as a major focus for an expanding marine effort. It involves several courses in the marine field. This program gives students a practical skill, as well as a chance to perform a community service relevant to the area. Even though the program is not designed to provide vocational training in aquaculture, managers of several aquaculture companies stated that graduates of WCC with an A.A. and technical aquaculture experience are finding some success with employment in the fledgling aquaculture industry. Although the potential exists at WCC for a full-scale training program in aquaculture technology, at present there appears to be insufficient demand to merit this level of commitment. According to school records for spring 1981, 17 students had a major involvement with the ocean at WCC--all were with the Marine Option Program. Based upon earlier records, approximately 5 percent of these students will enter the aquaculture field upon graduation.

Marine science courses are also taught at Honolulu Community College, primarily in preparation for student transfer to a four-year program in oceanography or aquaculture. According to Dr. Chennat Gopolakrishnan, coordinator of the marine effort, in spring 1981 six students were enrolled in a two-year certificate program involving three marine courses and a practical skill in the marine field.

Hawaii Loa College

Marine degree offered: B.A. in ocean studies

Marine students enrolled in spring 1981: 6

Projected number of graduates per year: 15 to 20 by 1985

Hawaii Loa College has established an Ocean Studies Program as one of its major areas of emphasis for a bachelor's degree in the liberal arts. The program is designed to prepare students for entry into graduate school, based on the philosophy that a broad liberal arts education is preferable to a concentrated technical program. Led by a well-known marine scientist and author, the program has recently received recognition through a grant from the National Science Foundation to develop its program in the marine sciences. Projected activities include shipboard research experiences in Kaneohe Bay and laboratory research in the new Hawaii Loa aquaria system and at the Hawaii Institute of Marine Biology.

At present, students receive little training in marine applications and internships are not available. Projected plans call for the establishment of work experiences and internships with a variety of ocean-related industries and governmental agencies throughout the state, an activity that will add an important component to this expanding program. Because of its broad approach to education in the marine field, Hawaii Loa College has the potential of becoming a leading source of graduates in the entire marine liberal arts area, and could, if wisely managed, develop an area of excellence in the marine social sciences.

Brigham Young University-Hawaii

At present, there is no specific marine training program at BYU-Hawaii, although two of its departments are currently planning expansions into the marine area. The Biology Department now offers two general interest courses (oceanography and marine science) in the marine field, and by the fall of 1981, plans are to include an advanced course in marine biology. The department will then offer a bachelor's degree program with a marine emphasis, geared for people contemplating attending graduate school in the marine area. It will not emphasize specific technological skills necessary for employment, although practical experience may eventually be offered through a proposed internship program.

The Hawaii Institute of Tropical Agriculture and Human Resources has added a functioning aquaculture farm to its facilities, and in the fall of 1982 a projected upgrading of the associates degree in tropical agriculture to a four-year program will include a course or courses in aquaculture. Most likely this will follow the guest lecturer approach, and will offer an organized program of internships. The objective of this program will be to train individuals from Pacific rim countries for middle management positions, a process requiring all-around training in business, technology, machinery, and management. Students of this program will be specifically trained with employment as a primary goal.

RELATED ASPECTS OF THE MARINE EMPLOYMENT SITUATION IN THE STATE

Impact of MAC and SG Funding on Marine Occupations

The results of the marine occupations survey indicate that, in Hawaii, much credit for the growing utilization of the sea must be given to the Office of the Marine Affairs Coordinator, headed by Dr. John Craven, and the UH Sea Grant College Program, directed by Dr. Jack Davidson. According to the 6th annual report from the MAC office to the state legislature and governor, for every dollar spent, three additional dollars have been attracted for MAC-funded projects. Since the MAC office was created by the state legislature in 1971, MAC has funded over 200 projects, nearly 70 percent of which have attracted matching funds. Many of these matching dollars have come from federal sources, in particular the UH Sea Grant College Program, which has worked with MAC on a large number of ocean-related projects which have already passed from applied research to degrees of commercialization. A significant number of professional marine positions in Hawaii are currently funded by, or originated with funding from, these two sources, and the best hope for continued growth of the marine effort in the state is vigorous support for these programs at all levels of the marine community. This support is particularly important in light of the current budget cuts being proposed in Washington, D.C.

Marine Career Counseling and Placement

At present, there is a significant gap between the employment expectations of individuals either training for or contemplating undertaking a professional marine career, and the realities of the current and projected employment situation. Fueled by a decade of governmental funding, public excitement and expectations over the ocean frontier now permeate American society, and this excitement carries over into the career choice of many students. This choice is often based on the glamour of Cousteau-type activities, or idealistic goals such as saving the whales, rather than on any real understanding of the type of marine work available. In fact, of the nearly 30 marine students interviewed during the course of this study, the vast majority had little or no awareness of what they would do with their degree, or of the post-graduation employment situation. In light of the frustration and despair that grip so many of these well-trained individuals when, after years of education, they finally realize the severity of job competition, it is imperative that some system be developed to accurately assess trends in marine employment, and that access to this system be available to students throughout Hawaii before career choices are made. As part of this process, an effort should be made to increase the scope of career programs such as Career Kokua, as well as to continue monitoring and filing, for student reference, the position openings in the marine field as initiated by this study. In addition, an effort should be made by each school and department to counsel incoming students relative to future employment opportunities, as well as to follow up on the employment success of graduates. Out of 12 UH departments and schools graduating marine professionals, only one appeared to make any organized attempt to offer either counseling or placement services, and only two had any regular system for monitoring post-graduation employment success. It will

take significantly increased counseling and placement effort before students will be able to make a well-founded decision on whether they want to pursue a marine career, and which marine field will bring them closest to their career expectations.

Value of Internships or Work Experience to Employment Potential at the Bachelor's Degree Level

As a result of data analysis of over 200 marine-related positions available through the public and private sectors in 1980 and the first quarter of 1981, it has become clear that most positions requiring a bachelor's degree in a marine field at this time also require extensive, and oftentimes quite specific, technical expertise. This experience may be in such activities as laboratory analysis, specimen identification, pond management, organism culture, or computer use, but it generally should be of sufficient scope and duration to permit an evaluation of the student's skills, effectiveness, and reliability. Because of this common requirement for actual work experience, it is imperative that any program of marine study, and particularly those in the liberal arts and natural marine sciences, initiate some form of work study or internship program to give students who only pursue a bachelor's degree a competitive edge when they enter the work force.

A survey of employers engaged in a wide range of marine activities (see Appendix B) indicated a willingness, and in fact even an excitement, over the prospects of a well-planned and executed internship program. Many employers felt that such a program could not only provide them with a short-term source of badly needed help, but would also give them a chance to evaluate the performance of prospective employees in a non-binding work arrangement. Most employers, however, also expressed some reservations about such a program. It is imperative that any school developing an internship program consider the following suggestions in the planning process.

1. A well-thought out set of internship guidelines should be developed, both as a code or set of rules for students to follow, and as an explanatory device for the prospective employer.
2. Internships should be picked very carefully and students matched to the internships with great sensitivity, because just a few mismatches, if not handled properly, could lead to an overall discredited and hence ineffective program.
3. One individual from each program should be designated as the contact person for all initial negotiations, as well as for continuous monitoring, troubleshooting, and evaluation.

The UH-Manoa campus has the potential for an effective internship function in its Marine Option Program. With few exceptions, however, present evidence indicates that the work experiences students obtain under the present internship program are not of sufficient duration to ensure skills

development, nor are they effectively tailored to current and future job availability.

Marine Professional Employment Opportunity at the Master's Degree Level

At one time a master's degree provided a competitive edge to marine-trained individuals seeking jobs as lab technicians, research associates, and teachers in community and junior colleges. Although this may still be so for some expanding professions (e.g., marine physical science), recent data resulting from the marine career survey (Tables 1 through 5) seem to indicate that, especially in the case of the natural marine sciences and liberal arts, the master's degree no longer provides this advantage, and may, in some cases, actually prove to be a disadvantage in job competition. Universities will rarely hire an individual to a faculty position without a Ph.D., and increasing numbers of research associates and faculty positions at smaller community and private colleges are eluding the master's degree graduate in favor of the large number of Ph.D.'s seeking jobs for which they are obviously overqualified, but nonetheless willing to accept at low pay.

The value of the master's degree is being assaulted from below as well. Many companies have stated that they will hire a person having a bachelor's degree with some specific applicable experience over one with a master's degree since the latter, even though better educated, often expects to command higher wages with no guarantee of higher quality of work. Because of this trend, those individuals currently contemplating attending graduate school and majoring in a marine field should carefully consider their career objectives and the employment potential the master's degree may or may not offer before making a final decision. It is entirely possible that several years of on-the-job training or a specialty skill such as scuba diving may afford a better chance for securing employment.

Oversupply of Professionals in the Natural Marine Sciences

Several different indicators point to an oversupply of professionals in the natural marine sciences at all levels of training. Among them are the following:

1. Nearly all employers interviewed mentioned that they receive large numbers of unsolicited applications from marine biologists for non-existent positions, as well as applications from marine biologists for advertised positions for which they are vastly overqualified, or not really qualified at all. In some cases, as many as 10 to 20 percent of the applicants for biological technician positions advertised at the bachelor's degree level have come from natural marine scientists with a master's degree or Ph.D.
2. As will be seen from a review of the data on position openings in the academic community summarized in Tables 1 through 5, jobs for natural scientists, on the average, tend to be the least

secure and lowest paid of those available to marine professionals in Hawaii. High-level openings rarely appear in either the academic or the business community, and few jobs are supported by hard money.

3. A review of graduate school records on employment for master's degree and Ph.D. students showed that, on the average, physical scientists and engineers have the highest success among marine professionals, and natural scientists the lowest. In fact, many Ph.D. 's had not secured relevant employment for up to a year after graduation, and some had switched fields entirely.

In spite of the fact that natural scientists in the marine field have a comparatively poor record of employment success, data presented earlier in this report showed that the majority of undergraduate students in the Marine Option Program, and a high percentage of graduate students, are still pursuing specialized training in this area. An analysis of the reasons why students choose to pursue careers with poor employment potential is not presented in this report. Some suggestions, however, have been that the natural marine sciences are attractive to a wide range of individuals who love nature, adventure, and the outdoors. They become turned on to the beauty and challenge of the sea and its life as presented by the mass media and never really think about the availability of positions or actual demands required of the job. According to some UH faculty, many students training to be marine life scientists actually have a strong liberal arts orientation and basically become uncompetitive in the post-graduation science job market because they have gone to great efforts to avoid taking the physical, chemical, and statistical courses that would have made them able to compete in life science fields where jobs are readily available.

Because of the continuing large number of students entering in the field, and their poor record of employment success, it is extremely important for students to make a careful assessment of their employment goals before they start a program. It is also important for natural science faculty and administrators to critically evaluate to what end they are teaching students.

EMPLOYER RECOMMENDATIONS FOR FINDING AND OBTAINING A MARINE PROFESSIONAL POSITION

Position Openings in a Marine-Related Field

There is no centralized clearinghouse for position openings in the marine field in Hawaii, and employment agencies generally are not aware of jobs normally sought by marine professionals. Nonetheless, there are ways to find job openings; some of them are advertised and easily available, others are only found through lots of hard leg work. The following summary includes the most often used sources, and some of the better techniques suggested by employers.

Advertised positions

University Bulletin. All positions funded through the University of Hawaii system, including all community colleges, associated laboratories, and research centers, as well as many RCUH positions, are advertised through the University Bulletin. This can be obtained from the Office of University Relations, Room 2, Hawaii Hall, and is available in the graduate library and posted at various places throughout the UH system.

Hawaii Department of Personnel Services. All long-term state government positions are posted at the department's headquarters, 825 Mililani Street, Honolulu, and announcements are sent to all satellite city halls.

Federal Job Information Center. Any federal jobs available in Hawaii and the U.S.-administered Pacific are advertised through the Job Information Center, Room 1310, Prince Kuhio Building, Honolulu. Details for each position are released as the position opens, and all positions are listed in a newsletter released quarterly. A recorded daily update can be reached by telephone at 546-2167.

UH Manoa Office of University Placement and Career Planning. For students or graduates of the University of Hawaii system, a wide range of information on current position openings in the marine area is available at the office located at 2442 Campus Road.

Honolulu Advertiser/Star Bulletin. The Sunday classified section of the *Honolulu Advertiser and Star Bulletin* contains one of the widest listings of current position openings in the state.

Unadvertised positions

Word of mouth. Many times employees know when co-workers are planning to leave a job, and a considerable number of future openings can be uncovered through informal conversations.

Visiting potential employers. Although not always productive, some jobs are uncovered by systematic visits to personnel departments of agencies or companies in a geographic area.

Creation of new positions. As appears to be the case for nearly all professions, many of the potential positions, and often the best ones, are not advertised, but created by energetic, perceptive, and innovative individuals. Several companies and agencies stated that they had no advertised openings in 1980, and yet throughout the year they hired several marine-trained individuals at the bachelor's and master's degree levels. In all of these cases, individuals created their positions by singling out an organization they wished to work in, then learned as much as possible about the organization, found where the company had needs, and volunteered to fill those needs. In most cases the individuals proved their worth and were offered newly created full-time positions.

Suggestions for Improving the Chances of Obtaining a Marine-Related Professional Position

There is no set formula for obtaining a position in an increasingly competitive market, but there are certain professional skills that can be stressed in a student's education program, particularly those that relate to communication skills, that will enhance an individual's chances of obtaining a good marine professional job. The following ideas are among those most often mentioned by the approximately 75 employers of marine professionals interviewed throughout Hawaii from January through April of 1981.

1. Have a Hawaii residency

Although all public agencies, and even most private corporations, adhere to equal opportunity procedures when hiring, this generally means equal opportunity if the applicant is living in Hawaii. Letters and resumes from out of state are generally answered, but most of them are then discarded.

2. Be familiar with the organization

This means that employers, especially in some of the newer aquaculture corporations, are more likely to hire applicants who are familiar with their operations. Chances are better if the employer has had the opportunity to observe the person at work in that operation.

3. Have a demonstrated ability in a specific skill or technology

No matter what an individual's education, most employers are also interested in what the person can do. Anyone who has demonstrated proficiency with technical skills, and has also shown through an internship or part-time employment the ability to think clearly and work conscientiously, will have a competitive edge in most job opportunities.

4. Have a broad knowledge of marine affairs in Hawaii

A general knowledge of laws in fisheries, coastal zone management, and land use, as well as an awareness of the broad range of current marine issues, will give a person a competitive edge for many positions.

5. Be able to write clearly

Many of the marine-related positions require the ability to produce well-written proposals for obtaining funding and clearly written reports to justify projects completed. This skill is especially important since so many marine positions are grant-dependent.

6. Be able and willing to speak intelligently before a variety of audiences

Many positions, especially those related to the academic community, require either the ability to sell a certain point of view in a public hearing, or to hold a logical coherent argument in a meeting or seminar.

7. Be able to get along with a wide range of audiences

Many of the marine-related careers involve substantial contact with students, governmental officials, and the public. Because of this, a demonstrated record of public relations skills would be of significant value.

8. Be willing to accept a low-level, low-paying, entry-level position

Many employers stated that, in light of their large pool of applicants from which to choose, they will have a preference for those applicants who are willing to start at the bottom and prove themselves in a work setting. This means, initially low pay, long hours, minimal flexibility, and little status.

9. Have the perseverance to stick to a goal, no matter how discouraging

Many individuals may resent the fact that they have considerable education and yet seem to get few benefits of the affluent society. In the final analysis, the only reasonable alternatives are to make a commitment to persevere with hard work and good attitudes until the situation improves, or to accept the necessity for retraining in another field.

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- Dung, E., and L.S. Wakui. 1980. "Aquaculture occupational task analysis." Study prepared for the chancellor of community colleges in June 1980. 44 pp.

APPENDICES

Appendix A. List of Public Sector Employers and Number of Positions
Advertised

Academic	1980	1981 (first quarter)
Community colleges		
Honolulu Community College	1	0
Windward Community College	3	0
Leeward Community College	0	1
Maui Community College	1	0
U.H. Manoa Departments		
Oceanography Department	6	3
Geology and Geophysics Department	2	1/2
Ocean Engineering Department	1	0
Botany Department	3	0
Agricultural Engineering Department	2	0
Urban and Regional Planning Program	3	0
Zoology Department	0	1
Chemistry Department	0	1/2
Research projects/programs		
Hawaii Cooperative Fishery Research Unit	2	1
Hawaii Underwater Research Laboratory	4	1
Mid-Pacific Research Laboratory	2	1
Hawaii Institute of Marine Biology	10	1/2
Hawaii Institute of Geophysics	7	1/2
Prawn Aquaculture Program	8	1
Education programs		
Sea Grant Advisory Service	12	2
Marine Option Program	4	2
Waikiki Aquarium	1	0
Other	1	4
TOTAL	73	19
State of Hawaii		
Fisheries	5	0
Marine Transportation	5	0
TOTAL	10	0
Federal Government		
Fisheries and natural sciences	10	0
Other	2	1
TOTAL	12	1

Appendix B. Partial List of Individuals Interviewed, January to April 1981

Andrea Ventura	Sea Life Park
Ray Tougas	Pacific Diving Industries
Eric Guinther, Staff	AECOS, Inc.
Barry Goldstein	Kahuku Sea Food Plantation
Ron Nolan	Solar Aquaculture Farms
Jancy Roberts	Oceanic Institute
Steve Coles	Hawaiian Electric Company, Environmental Division
Paul Struhsaker	Easy Rider Corporation
Kitty Simons	Western Pacific Fishery Management Council
	Law of the Sea Institute
Kent Keith	Ocean Resources Office, DPED
John Corbin	Aquaculture Development Program, DPED
John Craven	Marine Affairs Coordinator
Jim Shon	Marine Affairs Office
Larry Wakui	Aquaculture Occupational Task Force
Jeff Hunt	Backyard Aquaculture Program, Windward Community College
Aaron Lin	BYU Hawaii, Tropical Agriculture Department
Roy McArdle	UH Career Planning and Placement
John Hawkins	Marine Education Office, DOE
Phil Helfrich	Hawaii Institute of Marine Biology
Staff	Federal Job Information Center
Staff	U.S. Fish and Wildlife Service
Alice Thomas	Department of Personnel Services
Pat Harris	Career Resource Center, Kaimuki High School
Rob Zimmerman	Career Kokua
John Culliney	Ocean Studies Program, Hawaii Loa College
Varis Grundmanis	
Sherwood Maynard	Marine Option Program, UHM
Barbara Lee	
Mark Valencia	East-West Center, Environment and Policy Institute
Phil Bossert	Hawaii Loa College, Administration
Douglas Pendelton	Sea Trek Hawaii
Jim Maragos	U.S. Army Corps of Engineers, Environmental Division
Tom Finley	Frederick J. Marcy and Associates
Joan Yim	CZM Office, State of Hawaii
Helene Takamoto	Environmental Control Office, State of Hawaii
Staff	UH Graduate School, UHM
Ron Iwamoto	Chaminade University of Honolulu
Dale Hammond	BYU Hawaii, Biology Department
Frank Peterson	Geology and Geophysics Department, UH
Judson Ihrig	Chemistry Department, UH
Stanley Margolis	Oceanography Department, UH
Stephen Young	Agricultural Engineering Department, UH
Sidney Townsley	Zoology Department, UH
Thomas Dinell	Urban and Regional Planning Department, UH
Alf Pratte	Sea Grant Advisory Service, UH
Jack Davidson	Sea Grant College Program, UH
Deetsie Chave	Hawaii Undersea Research Laboratory