



SEA GRANT NEWSLETTER

Volume 2, Number 8

August 1, 1972

KHON to Feature HEART

During the week of July 31 through August 4, Channel 2 News (KHON) will present a five-part series of feature film segments describing the HEART system. HEART, the Hawaii Environmental Area Rapid Transit System, is a marine transportation system which is now being examined, under Sea Grant support, as an alternative to land-based mass-transit systems on the island of Oahu.

The marine alternative, as conceived by Dr. John Craven, is designed to serve most major population centers on the

(Continued on page 2.)

Billfish Behavior Brings Biologists to Big Island

Scientists from several nations will contribute their special knowledge to an International Billfish Symposium, to be held August 9 through 12 at Kailua-Kona, Hawaii. The National Marine Fisheries Service is the principal sponsor of this scientific meeting. Co-sponsors are the County of Hawaii, the Hawaiian International Billfish Tournament (HIBT), the Division of Fish and Game, and the Marine Affairs Coordinator of the State of Hawaii.

(Continued on page 4.)

Underwater and Dryland Physiologists to Hear UH Diving Reseachers

Dr. S. K. Hong, Dr. T. O. Moore, Dr. J.F. Morlock, and Mr. David Lally of the UH Department of Physiology, School of Medicine will travel to Freeport, Grand Bahama Island, to attend the Fifth Symposium on Underwater Physiology August 21 - 25. This is an international symposium held every two or three years.

A session on thermal balance, on August 25, will include a presentation by Hong, Moore, Morlock, and Lally on the thermal cost of saturation diving, respiratory and whole-body heat loss at 16.1 ATA.

From Bermuda, the men will travel to a meeting of the American Physiology

Society to be held in University Park at the University of Pennsylvania August 28 - 31. They will present a paper on heart-rate response to apneic face immersion in hyperbaric heliox environment. Also at this fall meeting, David Lally and F. W. Zechman will present a paper on the components of exercise hyperpnea in divers and nondivers.

Y.C. Lin and D.G. Baker will present a paper on the cardiac output and its distribution in the unanaesthetized rat during diving.

Doctors Hong and Moore are Principal Investigators on the UH Sea Grant Program, Human Performance in the Sea.

MOP Students Help "Children of the Sea"

Oahu high school students, guided by UH undergraduates, are planning marine-oriented workshops and an island-wide newsletter for the coming school year. The new high school level projects developed out of contacts initiated by students in the University's Marine Option Program.

Last February several MOP students had formed a high school orientation group to inform students in nearby high schools about oceanography and other marine-related courses at the University, and about the Marine Option Program. Letters were sent to Oahu school principals, and meetings with interested teachers were arranged.

During the meetings it became clear that the teachers wanted to call upon the MOP group as an information resource in their own science classes. The UH students decided they would try to meet this need. At a May meeting with teachers it was suggested that students from several high schools get together to plan the type of workshops they would like to see carried out in the coming school year, and also to set up a newsletter as a means of communications between schools. On both projects UH MOP students were to act as advisors.

The selected students were called together in June, and have been holding meetings every two weeks this summer. They have named their group Kamalii O Kai (Children of the Sea). Their officers, elected to serve during the summer, are: President, Eugene Wieneke (McKinley); Vice-President, Edward Hamada, Jr. (Iolani); and Secretary, Virginia Brown (Kailua). Advisors for the group are UH undergraduate students Alan Hong and Donna Noborikawa of the Marine Programs Office.

It is planned that Kamalii O Kai will act as a permanent clearinghouse for ocean-related materials and as a liaison between high schools and the University.

Water Pollution Experts Here

Two visiting scientists on the UH Manoa campus this summer are working and lecturing in the general area of water pollution.

Dr. Roland Wollast, Director of Research at the Laboratory of Industrial Chemistry, University of Brussels, is investigating the work in progress in Hawaii on the pollution of streams and bays. He has been available to graduate students for advice on their research projects, especially those involving reaction kinetics. Dr. Wollast has presented seminars on the kinetics of chemical reactions in natural systems and on studies of pollution in the rivers and estuaries of northwestern Europe. He currently heads Belgium's national effort for the environmental study of rivers and estuaries.

Dr. Fred T. Mackenzie, Chairman of the Department of Geological Sciences, Northwestern University, Evanston, Illinois, is consulting with UH faculty and students in oceanography and geology. Dr. Mackenzie has presented public lectures on the changes that take place in sediments in anaerobic, polluted waters and on making mathematical models of sedimentary systems.

HEART (Continued)

Honolulu side of Oahu by using high-speed craft between oceanic or canal stops. The stops include: Hawaii Kai, Niu Valley, Aina Haina, Kahala, Waikiki, Ala Wai, University of Hawaii, Ala Moana, Honolulu Harbor, Honolulu International Airport, and Pearl Harbor.

On the oceanic express loops, vehicles will travel outside the reef and approach stops only through existing channels or waterways. The local loops will operate primarily on existing canals, most of which are wide enough to accommodate this system.

Floating City Model Recovers from "Dunking"

The 1:20 scale-model floating city, which sank to the bottom of Kaneohe Bay July 7 while under tow, has been raised and put back into operation. Deck-level openings in the model's 30 flotation columns have been identified as the cause of the mishap: they had not yet been fitted with water-tight closures when the attempt was made to move the model to a new test site.

Co-principal investigator Joe Hanson has -- understandably -- been subjected to considerable hazing about the incident. The irrepressible (or unsinkable?) Mr. Hanson has provided Newsletter readers with the following technologically oriented version of the story:

MODEL IS MUDDY BUT UNBOWED

If I had a dime for every wise remark heaped on me in the last three weeks, I could retire to a quiet cabin somewhere far from the ocean. But, as the song sings, "It's all in the game."

We took an entirely conscious, calculated risk when we chose not to spend time and money to provide closures for the deck-level openings of the model's 30 flotation columns. And we had towed the model four times previously with no serious trouble. However, this was the first time the model had been picked up from an open-water mooring in heavy weather and I suppose one might conclude that the actuarial tables caught up with us. So we've developed two reactions which seem to stand the test of Ockham's razor. The first is a standard reply for which Steve Ribicoff must be given credit: "Heck, 95 percent of it was already under water." The second is 30 water-tight closures for 30 openings. Anyway, thanks to the Navy's COMSERVPAC, the model was back in operation -- muddy but unbowed -- within eleven days after we dunked it.

As far as performance goes, one has to experience this new structure to believe it. Even with people (equivalent to ten-story buildings) walking around

on the model, the motion amplitudes and accelerations are so low they cannot be perceived except with instrumentation or by sighting on the horizon. The motions induced by the largest waves we experience at station #1 in the southeast part of Kaneohe Bay -- equivalent to 45 feet -- could only be picked up by the instruments. In fact, one of our main instrumentation problems has to do with ambient noise picked up by the highly sensitive sensors required.

With the promise of additional funding for the coming year, we are now looking forward to a thorough model test program that will probably extend into early 1973.

Joe A. Hanson

People unacquainted with Kaneohe Bay were surprised to learn of the towing mishap which caused the scale-model floating city to tip and sink. Miss Sarah Craven, the very young daughter of Dr. John Craven, knows the bay quite well, and was therefore able to explain the towing accident in a straightforward way which her marine engineer-father and other technology experts should be able to understand:

HOW THE FLOATING CITY SUNK

Most people think the floating city sunk because the boat went too fast but this is how it happened. In the water there are some creatures called the sea witches. They are all horny and prickly and had hair the color of dead coral. They have very bad dispositions and love being mean. Also in the water are some sea fairies. They have beautiful skin and lovely blue green eyes. They are sweet and kind and help everybody out. When you were towing the floating city the sea witches turned it over but the sea fairies are very kind so soon it will be floating again.

Sarah Craven

KANA KEOKI Comes Home

(Part 2)

Last month's Newsletter carried a partial report of the 14-month voyage which the University of Hawaii's research vessel, KANA KEOKI, completed June 6. Additional research and exploratory projects pursued during the voyage are described here:

James Andrews, UH associate professor of oceanography, flew to Wellington, New Zealand, in September of 1971 to join the ship. He was involved in site surveys and drilling for the Deep Sea Drilling Project, sponsored by the National Science Foundation.

"Working on the KANA KEOKI we made soundings using seismic sources, surveying the contours and thickness of the ocean bottom sediments," Andrews said. "It comes down to a need to know about the basic environment in order to do anything about it. We need to know the origins, the history, and the movements of the sea floor."

Donald Hussong, junior geophysicist, was involved with the International Decade of Oceanographic Exploration, a program set up by President Nixon to foster cooperative efforts with other nations to explore the ocean for the immediate uses of mankind. One of the IDOE goals is to find places where minerals are being formed and being concentrated on the ocean floor, according to Hussong.

"The structure and formation of the Nasca Plate was used as a guide because it is one of the smaller plates known," Hussong said. "The Nasca Plate is 75 miles thick and moves five to eight centimeters a year, a fantastic rate of speed speaking geologically."

Plans are already under way for another voyage next year.

Billfish Behavior (Continued)

All sessions are open to the public, and all sport and commercial fishermen are invited to attend. Symposium dates have been chosen to coincide with those of HIBT, so that visiting sportsfishermen can attend symposium sessions. This year's symposium is expected to be the first of an annual series.

About 60 scientists from around the world will gather to discuss what is known about billfish biology, the identification of species and stocks, their distribution and abundance, physiology and behavior, and fishing methods.

A special evening session is scheduled on the subject of mercury in fish. This meeting will summarize briefly papers on mercury presented at the scientific sessions, and will feature a discussion of mercury and fish by a representative of the Bureau of Foods, Food and Drug Administration, Washington, D.C. In addition, a panel discussion between big game fishermen and billfish scientists will provide a special opportunity to examine problems related to the resource upon which both sport and commercial fisheries depend.

Marine Listings Now at OSIC

Several bibliographies on uses of marine resources and aquaculture are available at the Ocean Science Information Center in Hamilton Library, including the following:

Sears, Mary

Oceanographic index, 1946-1970.
Author cumulation and regional cumulation. 4 vols.

Coast Plains Center for Marine Development Services *Bibliography of aquaculture.* Sept. 1971. 245 p.

Bibliography of products derived from aquatic organisms. Aug. 1971. 113 p.



BERGER TO ADDRESS JAPANESE AND U.S. MICROBIOLOGISTS

Dr. Leslie R. Berger, professor of microbiology at the UH Manoa campus, will be an official U.S. delegate at the second United States -- Japan Conference on Marine Microbiology to be held at the University of Maryland, August 25 through 30, 1972. This conference, sponsored by the National Science Foundation and the Government of Japan, is limited to 10 delegates and from each country approximately 5 observers.

Professor Berger will present results of recent research from his laboratory on how high hydrostatic pressure affects a variety of biological phenomena. He will describe pressure effects on biological membranes, on the respiration of bacteria, on the activity of enzyme systems, and on the rates of photosynthesis and respiration in marine algae. In addition, he will present a theoretical paper which attempts to unify various hypotheses on the nature of "barophilic" microorganisms: those which live at very high hydrostatic pressures and low temperatures in the deep oceans.

Most of the delegates from Japan plan to return home via Honolulu during the first week of September. Persons interested in talking with any of them may call Professor Berger at 944-8553.

Japan Delegates

Yoshio Ezura, Dept. Fisheries, Hokkaido Univ., Hakodate, Japan
Yuzaburo Ishida, Dept. Fisheries, Kyoto Univ., Kyoto, Japan
Hajime Kadota, Dept. Fisheries, Kyoto Univ., Kyoto, Japan
Daiichi Kakimoto, Dept. Fisheries, Kagoshima Univ., Kagoshima, Japan
Yoshiharu Maruyama, Dept. Agricultural Chemistry, Univ. Tokyo, Bunkyo-ku, Tokyo, Japan
Ushio Simidu, Inst. Food Microbiol., Chiba Univ., Narashino, Chiba, Japan
Nobuo Taga, Ocean Research Inst., Univ. Tokyo, Nakano-ku, Tokyo, Japan
Isao Sugahara, Dept. Fisheries, Mie Prefectural Univ., Tsu, Japan

ESIC Free Data Searching Still Available

There is still an opportunity for researchers in science and technology to obtain updating computer searches. This is one part of an experimental project between NOAA's Environmental Science Information Center (ESIC) and the Ocean Science Information Center. It is designed to provide researchers with current bibliographic information in their field, to determine the effectiveness of such a service, and to work out improvements. The following data bases are available for searches:

Chemical Abstracts Condensates
GEOREF (Bibliography and Index of Geology)
Government Reports Announcements
Engineering Index Compendex
Selected Physics Information Notices

There is no charge to the requestor for this service. For more information, contact Mrs. Barbara Tillett, Ocean Science Information Center, Hamilton Library 205, University of Hawaii, or call 944-8263.

THE KEEL ROW

The VALDIVIA

...a German research vessel, will be operating out of Honolulu for several months. Her German and UH scientists are conducting joint explorations for manganese nodules.

Dr. James Andrews, UH professor of oceanography, is chief scientist for American researchers on the project who are working in cooperation with German scientists. The two groups are exchanging personnel and geological and geophysical data.

This joint effort reflects Hawaii's unique position in the Pacific for marine research and future ocean mining, according to Andrews, who has been researching manganese nodules in Hawaiian waters for several years. Dr. Norbert Hering, chief German scientist aboard

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THE KEEL ROW (Continued)

the VALDIVIA, also sees Hawaii and its research facilities as occupying a key position in exploring and developing the resources of the Pacific.

Hering believes that international cooperation between technologically advanced countries, especially in mining, is both necessary and practical. He foresees combined ocean-mining operations in which several nations share the large technical and marketing risks. Mining the Pacific's manganese nodule may someday become such an operation, according to Hering. The nodules contain more nickel and copper than manganese mined on land. This may make them an exploitable resource, since Germany must import manganese, and the United States may soon run short of nickel and copper.

Hering believes that some of the profits realized from exploiting the world's ocean beds might be paid to the United Nations, so that all people would receive some benefit. He is confident that next year's Law of the Sea conference will help decide ocean mining rights and how they will be regulated.

Dr. Hartmut Schulze, who represents the German Ministry of Science and Technology, has also been aboard the VALDIVIA for part of her voyage. This ministry organizes and supports Germany's whole program of oceanic research, both academic and industrial.

Studies of the environmental effects of manganese nodule mining are partially supported by the Sea Grant Program. The Marine Affairs Coordinator's Office of the State of Hawaii supports Doctor Andrews' studies of manganese nodules.

The VALDIVIA, a 241-foot vessel, was built in 1960 as a fishing boat. In 1970 she was acquired by two German shipping companies and rebuilt as a research vessel, with a new deck house and laboratory equipment. She carries a crew of 25, and from 17 to 19 scientists.

Laboratories on the VALDIVIA provide facilities for geological, geophysical,

and chemical work. The ship also has a photo laboratory, a tracing room, two special rooms for computers and data recorders, and a compressor room for geophysical research. She is also equipped for underwater TV up to a depth of 6000 meters. Her laboratories are equipped for analyzing all samples from the sea and from the bottom.

The nautical equipment includes two radar sets, one Decca navigator "Mark 12", one Loran RC, one automatic direction finder, a gyro compass with automatic steering gear, one super Lodar horizontal echo sounder, two deep-sea-sediment echo sounders; speed meter, course recorder, Decca-Hi-Fix; and hydrophones for checking the position of underwater equipment, as well as winches, derricks, and cranes -- both automatic and hydraulic.

The VALDIVIA is Germany's only research vessel for minerals.



The TERITU

...leaves Honolulu August 1 for a short cruise off Oahu. Dr. Richard Young of the UH department of oceanography is Chief Scientist. The purpose of this cruise is to do mid-water trawling for deep-sea animals. The TERITU returns to Honolulu on August 5.

The CHARLES H. GILBERT

...National Marine Fisheries Service research vessel, has been attempting to track a billfish tagged with an acoustic "beeper" in Kona waters. The GILBERT successfully tracked a 600-pound blue marlin for almost 23 hours during the 1971 billfish tournament; it is hoped that the 1972 attempt will produce similar results which can be presented during the Billfish Symposium.

Marine Programs and MOP Move Makai

The UH Marine Programs Office has moved makai (toward the ocean) about two blocks to Holmes Hall, 2540 Dole Street. Dean of Marine Programs John P. Craven and his staff have moved into Room 401. Marine Option Program Coordinator Barry Hill and his MOP staff are in Room 404. Dr. Craven's staff can be reached by phone at 944-7473 or 944-7474. The MOP phone number is 944-8841.

The UH Sea Grant Program Office is still located in Room 253, Spalding Hall. The Sea Grant Publications Office staff works in Room 114 Snyder Hall, but letters should be addressed to the Publications Office at Spalding Hall.

KEEL ROW (continued)

The KANA KEOKI

...is scheduled to leave Honolulu August 15 for a cruise to the Central Equatorial Pacific, southeast of Hawaii, returning to Honolulu September 10. Chief Scientist will be James Andrews, UH professor of oceanography. Several students and technicians will go along as the scientific crew. The main purpose of this cruise is to continue the manganese research project in which Andrews is involved.

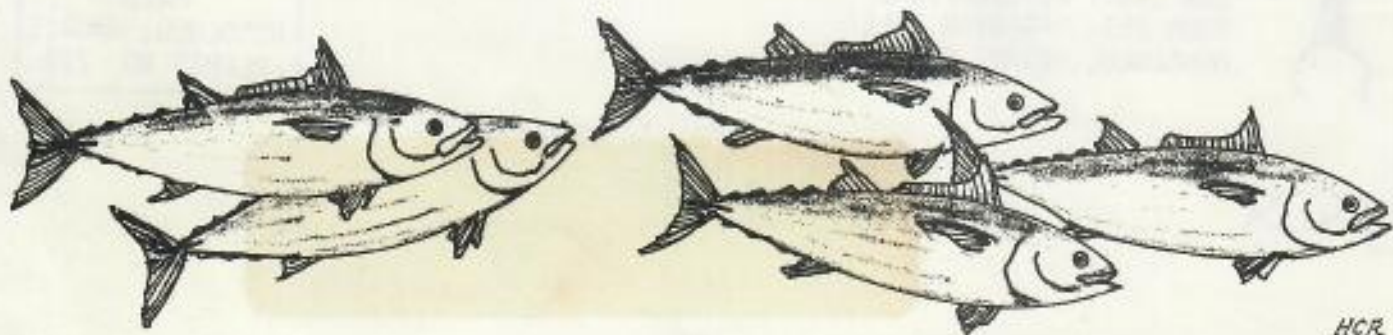
Murphy to Survey Indo-Pacific Fisheries

UH oceanography professor Garth I. Murphy will begin a six-month leave of absence from his department, beginning September 1, to assume a special research assignment from the East-West Center. As a temporary Senior Fellow with the Center, Dr. Murphy will survey the fisheries of the Indo-Pacific Region to identify problems that are holding back their development.

The need for this research was identified through a series of discussions between personnel of the Department of Oceanography, the East-West Center, and the Hawaii Institute of Marine Biology. Through the coordinating efforts of the University's Office of Marine Programs and its director, groundwork was laid for the necessary interdepartmental cooperation.

Dr. Murphy will spend about two months reviewing pertinent documents and correspondence. During November and December he expects to visit several Indo-Pacific places which are experiencing typical fisheries development problems. After collating all the materials, he will identify the potential role of the East-West Center in aiding the development of the fisheries, as well as the potential role of the broader university community.

The temporary fellowship is being funded by the East-West Center. Support for the project will also come from the National Marine Fisheries Service.



NEW SEA GRANT PUBLICATIONS

In press:

Medical Measures in Diving Accidents
(Chart, 2 sides).

Hawaii Fish 'n Facts Information Sheets Number 166, 168, and 169: *Why Fish Spoil, Fish Smoking and Drying by the Sportsman, and Sport Fishermen's Guide to Holding and Freezing Fish.* Kirby Hayes, William Schumacher and Curtis Wilder.

In print:

Costs and Earnings of Tuna Vessels in Hawaii (UNIHI-SEAGRANT-AR-72-01). Abu Ekram Ahsan, John L. Ball, Jr., Jack R. Davidson. 22 pp.

Soil Salinity Problems in Shoreline Areas of Hawaii (UNIHI-SEAGRANT-AR-71-01. Also Cooperative Extension Service Circular 462). S.A. El-Swaify, Wade W. McCall, and S. Sinanuwong. 12 pp.

Hawaii Fish 'n Facts Information Sheet Number 167: *Coming, the Wholesome Fish Act.* Kirby Hayes, William Schumacher, and Curtis Wilder.

Cardio-Respiratory Responses to Exercise in Air and Water at 1 and 2 ATA (UNIHI-SEAGRANT-TR-71-04. Also department of Physiology UHI-med-71-01). D. A. Lally, T. O. Moore, and S. K. Hong. 22 pp.



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Psychologists Schedule

Marine Topics

The annual convention of the American Psychological Association, being held in Honolulu September 2 through 8, includes several events of special interest to the marine scientific community. A symposium on diving has been scheduled for September 4. (See Newsletter story on Harold L. Goodwin.) Symposia on floating communities and on dolphin behavior also are scheduled.

Five University of Hawaii staff members will conduct a symposium, "Cities on the Sea", on Tuesday, September 5, at 10 a.m., in the Waimanalo Room of the Sheraton Waikiki Hotel. The Society of Engineering Psychologists, a division of the American Psychological Association,

(Continued on page 4.)

AQUACULTURE WORKSHOP SET

The Asia Room in Jefferson Hall on the UH Manoa campus will be the site of a Sea Grant-funded regional aquaculture conference on September 11. John E. Bardach, director of the Hawaii Institute of Marine Biology, and Jack R. Davidson, director of the UH Sea Grant program, are the principal coordinators of the informal workshop. Approximately 25 scientists and others noted for their involvement in -- and concern with -- the development of aquaculture in Hawaii have been invited.

(Continued on page 4.)



INNERSPACE PACIFICA

SET FOR OCTOBER

The Aloha Tower on the Honolulu waterfront will be the headquarters for Innerspace Pacifica '72 -- "Man in the Essential Sea" -- during the long holiday weekend of October 21, 22, and 23. The annual event is sponsored by the Hawaii Council of Diving Clubs and the University of Hawaii Marine Programs Office, and supported by the state.

Among marine science and technology specialists who will appear at this year's Innerspace Pacifica festival will be oceanographer-photographer Phillippe Cousteau; Captain George Bond, who is known as the "father of saturation diving"; Joseph MacInnis, who will describe life in habitat "Subigloo"; and diving physiologist Chris Lambertson. Exhibits will represent man's relationship to the marine environment: its utilization, conservation, and enjoyment. Some of the daytime events will be held aboard boats.

One of the largest underwater photographic galleries ever assembled will be featured in the display area. Entries from an underwater photography competition will also be included. A workshop will be held on Monday, October 23, from 9 a.m. to 4 p.m.; it is open to anyone interested in learning underwater photography skills.

Inquiries about Innerspace Pacifica '72 may be addressed to Judy Shetler, chairman, 47-621 Melekula Road, Kaneohe, Hawaii 96744.

KONA POND LIFE SURVEYED

Shoreline ponds along the Kona Coast of Hawaii are currently undergoing an aquatic survey by the Hawaii Cooperative Fishery Unit to determine their natural and scientific values. The survey, a Sea Grant coordinated effort, was proposed by Dr. John A. Maciolek in mid-May of this year. It is being funded by the US Bureau of Sport Fisheries and Wildlife.

Maciolek, UH professor of zoology and unit leader of the Hawaii Cooperative Fishery, notes that the ponds contain "unique species and communities of biota that are poorly known and essentially unrecognized scientifically".

A recent study of similar ponds on Maui, the only other island with ponds of this nature, has uncovered distinct ecotypes in species of shrimp. Seven species of shrimp representing five families were found; three of the species were new to science and are probably endemic to Hawaii.

The current survey covers more than 100 miles of Big Island coast from Kawaihae in South Kohala to Ka Lae at South Point and is believed to be the first serious attempt to determine the life systems of the island's ponds.

Current fieldwork is being conducted in the Makalawena-Kaupulehu area, 10-15 miles north of Kailua-Kona. Richard Brock and Tim Prior, UH graduate students in the Department of Zoology, are conducting the survey with the assistance of three UH Hilo campus students participating in the Marine Option Program.

Initially, the work plan called for the close examination of two Kona Coast sites well known for their diversity of ponds and pond biota; Anaehoomalu and Makalawena. However, fieldwork at the former, where Boise Cascade plans a five-hotel resort development, has been temporarily postponed due to unexpected difficulties in acquiring a trespass permit.

(Continued in column 2.)

New Address for Hanson's Staff

The System Sciences Division of the Oceanic Institute, along with the Floating City Program Office, has moved from its Snyder Hall location and is now "back home". Staff members Joe Hanson, Guy Rothwell, Steve Ribakoff, and Rosine Mary Koningsberger will have offices at the Oceanic Institute, Waimanalo, Hawaii. They can be reached by phone at 259-9631 or 259-9419.

John P. Craven who, along with Mr. Hanson, is co-principal investigator on the Floating City project, now occupies offices in Holmes Hall on the UH Manoa campus. Dean Craven's staff can be reached by phone at 944-7473.

Later this year several members of the UH faculty will aid in detecting variations in species and habitat parameters. For example, Dr. E. Alison Kay, chairman of the General Science Department and a specialist in malacology, will be asked to evaluate the mollusk samples collected by the research team. Those species deemed unusual or not identifiable in the field will be retained permanently, as will collections of specimens that are representative of important locations.

Several months ago interest in the ponds was stirred by the Kaloko Pond controversy and the resulting bill introduced by Hawaii Representative Patsy T. Mink and signed into law in July (PL92-346.) It calls for the establishment of the Honokohau Study Advisory Commission. The Commission's recommendations are expected to greatly influence decisions regarding the future status of the Honokohau National Historical Landmark. A report of the Commission's findings is due in Congress next July.

The final report of the Kona Coast survey will be available in mid-June next year and will be available to the Honokohau Commission as an informational supplement to their own findings.

What is HEART?

Honolulu, like most of America's major cities, is faced with a mass-transportation dilemma. Subways, monorails, and other dedicated right-of-way systems have been presented as potential solutions. Other nations are using their rivers, canals, or seacoasts for urban mass transit. In the Soviet Union, for example, about 300 hydrofoil boats serve mass-transit needs along rivers and canals. Marine alternatives for land-based mass transit on Oahu are now being explored.

The use of waterways for public transportation in and around Honolulu appears quite feasible. Nearly all of the areas seaward of the H-1 freeway are ten feet or less above sea level. (The Diamond Head area is an exception.) The city is interlaced with drainage canals, most of them wide enough to accommodate marine vehicles. A system which uses these canals, along with natural streams and the open ocean, has been proposed by the UH Sea Grant Program as an alternative to a land-based mass transit system. It is the Hawaii Environmental Area Mass Transit (HEART) system.

The preliminary layout for HEART utilizes the ocean as the expressway with stops at Hawaii Kai, Kahala, Waikiki, Honolulu Harbor, Honolulu International Airport, Hickam Air Force Base, and Pearl Harbor. Express vehicles will travel at high speeds outside the reef and approach terminals where possible through existing channels or waterways. Local loops will operate on canals and streams such as the Ala Wai Canal, Nuuanu Stream, Kapalama Stream, Ala Moana Canal, and Manoa-Palolo Canal. Some dredging and widening will be required. Reconstruction of bridges will also be required to permit passage of canal vessels. Preliminary estimates place cost of the system at \$140,000,000.

The system will provide for the rapid movement of people to and from suburbs to high density city locales in approximately 30 minutes, and between high-density city locales in 10 minutes.

(Continued in column 2.)

MTS Holds Annual Conference

Charles L. Bretschneider, chairman of the UH Ocean Engineering Department, and John P. Craven, Dean of Marine Programs, will attend the Marine Technology Society's 8th Annual Conference and Exposition, September 11 - 13 in Washington, D.C. Theme of this year's conference is "Applications of Marine Technology to Human Needs".

Graces Leave for Australia

UH Sea Grant staff member Jean McKean was married on August 5 to Robert Grace, associate professor of civil engineering on the UH Manoa campus. The Graces, with their family of three children, will leave this month for Australia and New Zealand, where Professor Grace will work during a year of sabbatical leave. He will rejoin the UH teaching staff in the Fall of 1973. Mrs. Grace has just completed a year's work as senior editor of an atlas of all the bays and harbors in the State of Hawaii.



Vessels under consideration for use in the HEART System are the semi-submersible ship (SSP) and large hydrofoils for oceanic routes, and captured-air bubble craft, highspeed barges, and small surface hydrofoils for the inland and Pearl Harbor loops. All of these vessels are capable of providing a safe, comfortable ride. Motions due to water conditions (waves) are minimal and generally will not produce motion sickness. The oceanic vessels are capable of traveling at an excess of 40 knots, while the inland vessels will operate at 20 knots in canals and possibly faster on the Pearl Harbor Local.

THE KEEL ROW

The TERITU

...is scheduled for a series of short cruises in Hawaiian waters this month. Among the principal investigators for the upcoming 1- to 3-day cruises are David Hurd, Brent Gallagher, and Richard Young.

The DMITRY MENDELEEV

...a 407-foot Russian research vessel, is expected to arrive in Honolulu around the 13th of September for a two-day provisional stopover. The 5,460-ton research ship stirred up a great deal of interest when she visited here last March for three days.

Her stop here represents the end of an oceanographic data-gathering leg that began in Callao, Peru several weeks ago. After departing Honolulu, she will head for the South Pacific to continue her broad research duties.

AQUACULTURE (Continued)

Prior to the meeting, participants will be asked to complete a questionnaire which is expected to aid in establishing an agenda for the workshop. According to Dr. Bardach, the workshop will provide an opportunity for aquaculture specialists to meet with representatives from industry, state and federal agencies, and UH staff members, to discuss key areas of marine resource use in the State of Hawaii.

Informational input meetings of this type were held on a regional basis throughout America during 1972. Charles Black, president of the Mardela Corporation, supervised the running of these workshops.

In the second phase of this project a national report will be synthesized from the material gathered at each of the regional input meetings. It will provide the basis for a national assessment of aquaculture research priorities. Constraints on the development of aquaculture will be appraised and the appropriate research-support roles for government and private interests will be considered.

The KANA KEOKI

...is currently cruising in the Central Equatorial Pacific, southeast of Hawaii, continuing the manganese research project of her chief scientist, James E. Andrews. This cruise, which began on August 15th, carries a scientific crew of several students and technicians. After her return on September 10, preparations will begin for a 35-day cruise to the Northern Pacific. Wilton Hardy will act as chief scientist for the project. The main objective for the cruise, according to Tom Daniel, research assistant to Dr. Hardy, is to procure highly accurate bathymetric and oceanographic readings for use in future experiments in the survey region. The target date for departure from Honolulu is September 22.

PSYCHOLOGISTS (Continued)

will hear John P. Craven speak on "Technological Aspects"; Hugh Burgess on "Architectural Design Aspects"; James A. Dator on "Social Science Aspects"; and Reuel N. Denney on "Humanistic Aspects". Herbert B. Weaver, chairman of the symposium session, is a professor of psychology on the UH Manoa campus.

Dolphin behavior research at the University of Hawaii, the University of California, and the Naval Underseas Center at Kailua will be described at a symposium on Thursday, September 7, at 9 a.m. in the Moorea Room of the Ilikai Hotel. Divisions 6 (Physiological and Comparative) and 3 (Experimental) of the APA have scheduled the session, "Recent Advances in the Study of the Behavior of Dolphins".

Speakers will include Ross L. Pepper, Frank A. Beach III, and Paul Nachtigall of the Naval Underseas Center; Louis M. Herman, Carolyn J. Madsen, and Michael P. Yunker of the University of Hawaii; and Kenneth R. Norris and Tom Dohl of the University of California at Los Angeles. Roger Thompson of the University of Hawaii will chair the Thursday APA session.

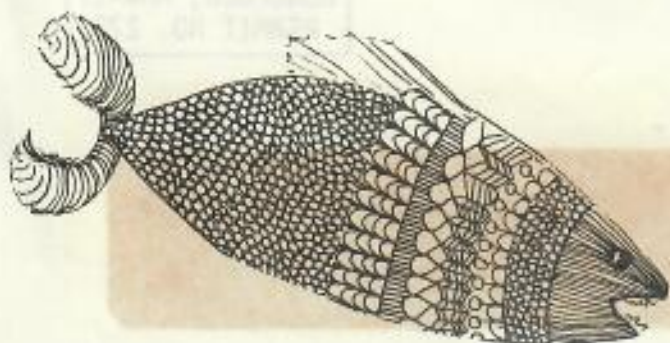
Goodwin Here for APA and Sea Grant

Harold L. Goodwin, deputy director of the National Sea Grant Program, will participate in a professional symposium on diving during his trip to Hawaii in early September. The symposium, "Selection and Training for Scientific and Technical Diving", is a scheduled session of the American Psychological Association's national convention to be held in Honolulu September 2 through 8. Goodwin will direct the discussion of ideas presented by speakers at the diving symposium, scheduled for 9 a.m. Monday, September 4, in the Oahu Room of the Sheraton Waikiki Hotel.

Goodwin plans to consult with officials of the Oceanic Institute, the Hawaii Institute of Marine Biology, and FishFarms Hawaii on a number of aquaculture projects which are of concern to the National Sea Grant Program. He will be in Hawaii through September 9.

OSU Conducts Workshop

A marine extension workshop, designed to increase the effectiveness of extension and advisory staff members throughout America, was conducted by Oregon State University's Sea Grant Marine Advisory Program in August. Margaret Lucas, who is the UH advisory services specialist in ocean engineering, attended the two-week professional training workshop.



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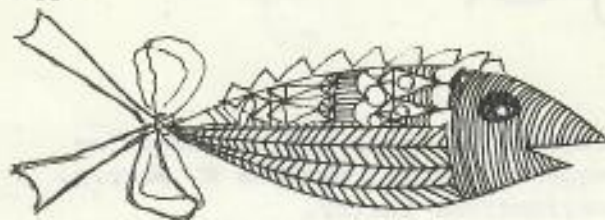
Economics and Market Potential of the Precious Coral Industry in Hawaii (UNIHI-SEAGRANT-AR-71-03A). Kok-Kian Poh. 22 pp.

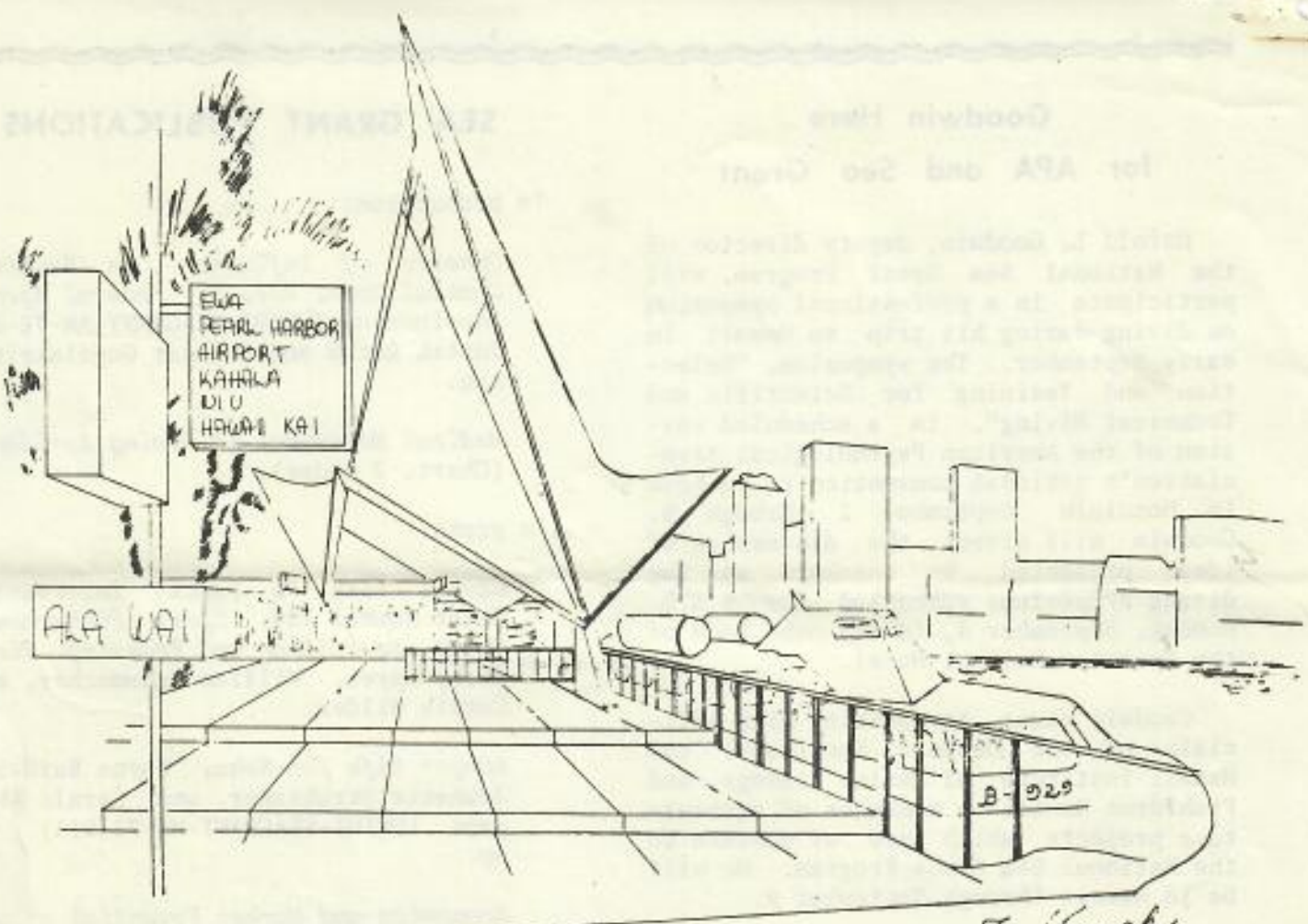
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J. L. Luchke
July 7th 1970

Artist's rendering of a terminal on the proposed HEART mass-transit system.



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SEA GRANT NEWSLETTER

Volume 2, Number 10

October 1, 1972

UH Receives Full

Sea Grant College Status

The University of Hawaii, along with the University of Wisconsin, was officially named a Sea Grant College by Secretary of Commerce Peter G. Peterson in September. A ceremony will be held on October 17 in Honolulu, officially awarding Sea Grant College status to the University.

Robert M. White, administrator of the National Oceanic and Atmospheric Administration, will represent the U.S. Department of Commerce at the recognition ceremony. Robert Abel, director of the National Sea Grant Program, will also be in Honolulu for the event. Arrangements are being completed through the office of University of Hawaii President Harlan Cleveland.

Jack R. Davidson, director of the UH Sea Grant Program, called the University's new official status an acknowledgement of its having fully met the spirit of the Sea Grant College legislation. He attributed the University's accomplishments in marine science fields to the "ideas, talents, and energies of many people" and to the cooperative spirit in which they have worked.

The first four Sea Grant Colleges were named in 1971. They were the University of Rhode Island, Texas A&M University, the University of Washington, and Oregon State University.

Moore and Craven

to Speak in Japan

Terence Moore, UH associate professor of physiology, will participate as a member of a panel representing NOAA's Manned Undersea Science and Technology Program, at an international marine conference in Japan this week. The panel, which will be concerned with diving physiology and medicine, is part of the 2nd International Ocean Development Conference, October 4 - 9, to be held in Tokyo. Moore will discuss bone necrosis in divers and bubble detection as it relates to "bends" in divers. Moore is a principal investigator for the UH Sea Grant project, "Human Performance in the Sea".

(Continued on page 2.)

Law of the Sea Conference Postponed?

The United Nations-sponsored conference, Law of the Sea, originally planned for 1973, may be postponed until the following year. George Sheets reported this development when he spoke to the Hawaii State Chapter of the Marine Technology Society, on September 26. Sheets is principal investigator on the UH Sea Grant project, Law of Coastal Zone Management in Hawaii. In his speech to MTS members he reviewed the current position

(Continued on page 2.)

Floating City Travels to Birthday Party

October 3 marks the second anniversary of the formation of the National Oceanic and Atmospheric Administration. During the coincident week, NOAA's component agencies and offices, including the National Sea Grant Program Office, are holding Open House in Washington, D.C. Those visiting this anniversary celebration will be able to view the University of Hawaii's model of the Floating City as part of the Sea Grant display.

This will be the second time the Floating City model has travelled to the mainland. It was displayed at the Marine Technology Society meeting in Seattle on February 25 - 26, 1972.



Speak in Japan (continued)

John P. Craven, UH Dean of Marine Programs, Dr. Ludwig Seidl, associate professor of ocean engineering, and Takeo Kukuchi, a graduate student in ocean engineering, also will attend the Tokyo conference. Kukuchi will serve as interpreter for Craven, who will chair a session on marine resources. The theme for the conference will be "Ocean and Tomorrow's World". In all, 178 technical papers will be offered by scientists representing 21 countries.

David Wallace, Associate Administrator for Marine Resources of the National Oceanic and Atmospheric Administration, will address the opening session of the conference, presenting the United States government position on ocean development. While in Tokyo Wallace will also participate in the Technical Conference on the Means of Acquisition and Communication of Ocean Data, sponsored by the World Meteorological Organization, and the U.S. - Japan Marine Resources and Engineering Coordinating Committees meetings.

(Continued on page 5.)

Aquarium to House New Research

An experimental facility for keeping deep-sea fishes and invertebrates alive is to be developed this winter at the Waikiki Aquarium Laboratories, under the direction of UH zoology and oceanography department personnel. Sea Grant and the National Science Foundation are both providing support to the project. It will be conducted by students Phil Lobel and Fletcher Riggs, and directed by Deetsie Chave (zoology) and Richard Young (oceanography). Maintaining the deep-sea animals in an aquarium will depend on development of a suitable refrigeration system and good water circulation. The animals will be kept in a darkened room, illuminated only by red light similar to the lighting used in a photographic darkroom.

Several other UH staff members, including Julie Brock, George Losey, John Stimson, and Maxwell Doty, are setting up experimental projects at the Aquarium Laboratories. Space for the projects became available when Biomedical personnel moved into a new Kewalo Basin facility.

Law of the Sea (continued)

of the United States in United Nation deliberations on the Law of the Sea regime, and implications for the State of Hawaii.

Sheets holds a law degree from the University of Arizona. Since coming to the University of Hawaii in 1968, he has made a special study of Hawaii's unique coastal situation. The total shoreline of the islands of Hawaii is equivalent to about one half the total open-sea shoreline of the 48 mainland contiguous states. Because of Hawaii's geography, proposed federal laws covering interstate and foreign involvements which might be appropriate for the mainland situation could potentially be unfair and inappropriate in the State of Hawaii.

The Bar Association of Hawaii last month notified Sheets that he had fulfilled all the requirements for the practice of law in the State of Hawaii.

Marine Lectures Scheduled

National Sea Grant Program Director Robert Abel and UH physiologist Richard Strauss are among speakers scheduled for the UH sponsored technical lectures on marine science topics, to be held in conjunction with Innerspace Pacifica on October 18 and 19. All sessions will be held in Auditorium B-103 of the Biomedical Science Building on the UH Manoa campus. They are open to the public.

Strauss, a physician specializing in diving physiology and medicine, recently joined the UH physiology department as an investigator on the Sea Grant project, Human Performance in the Sea.

The lecture schedule is as follows:

Wednesday, October 18

7:00 - 8:00 p.m.

Eugenie Clark: "Red Sea Eels"

8:30 - 9:30 p.m.

Richard Strauss: "Spinal Cord
"Bends"

Thursday, October 19

7:00 - 8:00 p.m.

Paul Webb: "Thermal Problems Related to Diving"

8:30 - 9:30 p.m.

Robert Abel: "Prospects for Employment and Graduate Study in Marine Science and Technology"

INNERSPACE PACIFICA '72

by
Gay McBroom

A rare treat is in store for Hawaii's residents next month as the world's leading talents in the diving world assemble to take part in Innerspace Pacifica '72 -- an underwater film festival/sea symposium designed for general public interest. The three-day program, October 21 - 23, to be held at the Aloha Tower complex during the day will feature lectures, exhibits, and underwater demonstrations. Nighttime at the HIC Concert Hall will be devoted to film programs on all major aspects of the sea world. Each day will have separate programming. Monday, October 23, will offer an incomparable full-day underwater photography workshop.

Personalities arriving for the event include Joseph MacInnes from Canada, Stan Waterman, Paul Tzimoulis, Eugenie Clark, Masao Kudo from Japan, and our own local authorities, John Craven, Taylor "Tap" Pryor, Peggy Lucas, and Richard Grigg.

Tickets for Innerspace Pacifica '72 will go on sale in early October. Daytime tickets will be sold for \$1.50 and nighttime performances are \$4.00. Because the HIC Concert Hall has a seating capacity limit of 2100, people wanting to attend the film festival are urged to buy advance tickets when they become available.

New Books from the University Press

The University Press of Hawaii announces two books which will be of interest to both the Hawaii scientific community and the general public.

Now in print is *A Natural History of the Hawaiian Islands: Selected Readings*, E. Alison Kay (editor). Paperback, 665

pp, 1972. \$10.00. Dr. Kay is chairman of the UH Department of General Science.

In press is *Hawaiian Reef Animals*, E.H. Chave and E.S. Hobson. 128 pp with 87 color plates. \$7.50. Dr. Chave is an assistant researcher in the UH Department of Zoology.

THE KEEL ROW

The TOWNSEND CROMWELL

...has returned to Honolulu after a 5-week cruise to the central Pacific. The National Marine Fisheries Service research vessel spent 30 days in the Line Islands, about 1900 km directly south of Hawaii, where her scientific field party investigated patterns of flow of surface currents downstream of Christmas and Fanning Islands.

Known as island wakes, these patterns of surface flow are of special interest to both oceanographers and fishery scientists because they are often outstanding fishing grounds. The mission of this CROMWELL cruise was to study the physical, chemical, and biological characteristics of the wakes to better understand their importance to the ecology of oceanic fishes.

A periodic wake system, one in which eddies are formed and shed periodically as the water flowing past an island moves downstream, was present downstream of Christmas Island, according to Dr. Richard A. Barkley, field party chief on CROMWELL. Numerous bird flocks, fish schools, and abundant seaweed and neritic (coastal) plankton were found closely associated with the wake as far as 200 km downstream of the island.

The wake downstream of Fanning Island was much less turbulent, probably because the island is more streamlined and considerably smaller, Barkley said. Nevertheless, a close association between water in the wake and the presence of coastal animals was also observed at Fanning.

Marine life is normally sparse in the tropical ocean, but within the wakes of both Christmas and Fanning Islands numbers of small animals, particularly crab and mollusc larvae, were found in the plankton samples. Barkley believes that this downstream train of food organisms may be one of the major attractions that bring oceanic fish such as the skipjack tuna near islands.

Shell collectors may be interested to know that larval and young forms of such reef molluscs as cowries and cone shells were found to be excellent indicators of "island water." They were abundant for over 200 km downstream in a band only about 20 km wide. Outside this narrow band no coastal mollusc larvae were found, although oceanic forms such as the beautiful deep blue pelagic snail, *Ianthina*, were fairly common.

(Continued on page 5.)

UN Conference Invites Banner

UH Zoology Professor Albert H. Banner recently attended two planning conferences concerning research on the problem of ciguatera, a poisoning caused by eating fish that carry a toxic substance. Several areas of the Pacific Ocean harbor fish that can produce ciguatera poisoning.

Banner attended a Sea Grant conference in La Jolla on August 30, at which plans for Sea Grant-sponsored research on ciguatera were discussed. Also attending from the University of Hawaii were David B. Boylan and Martin Rayner. On the basis of this conference, it is likely that the Office of Sea Grant will help support the research. A multidisciplinary group at the University of Hawaii has been carrying on ciguatera research since 1955.

On September 18-20, the World Health Organization and the Food and Agriculture Organization, United Nations, with funds from the United Nations Development Program, sponsored a small conference in Geneva, Switzerland, also to deal with the planning of a research program on ciguatera. Dr. Banner was invited to attend, together with seven other participants from Europe, Asia, and the United States.

THE KEEL ROW (continued)

The information collected by CROMWELL indicates that the other Line Islands -- Fanning, Washington, and Palmyra -- are downstream of Christmas Island. This was further confirmed on the last day of the survey when a member of CROMWELL's shore party found a single drift bottle on the north shore of Palmyra Island.

It had been released a short distance east of Christmas Island on January 3rd of this year by the master of the SS SAMOA BEAR.

SWFC plans further studies of island wakes, both in the Line Islands and downstream of the Hawaiian Islands in January and February of next year.

The KANA KEOKI

...departed September 22 for a northern Pacific cruise, with Wilton Hardy (oceanography) as chief scientist. The ship is due back in Honolulu at the end of October.

The TERITU

...is scheduled for two short cruises early this month. J.P. Vansant (HIMB) will be chief scientist for trawling operations off the Waianae coast, October 4 and 5, to collect mid-water samples of potential tuna forage organisms. On October 12 and 13 Roger Hanson (microbiology) will be chief scientist investigating some biological nitrogen transformations such as nitrogen fixation, and formation of nitrites and nitrates. Three graduate students will also be conducting research on this cruise to Station Kaioli. Otto Yamada (microbiology) will study population density of phytoplankton. A botany department student will also be investigating phytoplankton and an oceanography student will do work on zooplankton.

MOP and HIG Sponsor Training Cruises

The M/V MOE IPO has just returned from a 10-day series of orientation cruises for 260 high school and college students on the islands of Maui and Hawaii. The program, similar to those conducted aboard the TERITU and the VALIANT MAID, included instruction in the use of the plankton net, the Isaacs-Kidd biological trawl, nansen and niscen water samplers, a bottom dredge, and a demonstration of the bathythermograph.

Responsibility for the shipboard lectures was shared by two graduate students from the Department of Oceanography, John Walters and Phil Lambertson, along with Barry Hill, Marine Programs Assistant for Curriculum Development, who directs the Marine Option Program (MOP), and two former MOP students and recent UH graduates, Marlene Spencer and Gordon Yamasaki.

The 260 students who participated in the half-day cruises were from Hilo College, Hilo Community College, Hawaii Preparatory Academy, Kohala High School, Konawaena High School, Hilo High School, and Maui Community College. The program was sponsored by MOP and the Hawaii Institute of Geophysics. A similar series is being planned for Oahu high school students.

Speak in Japan (continued)

Howard Eckles, who is NOAA's Assistant Associate Administrator for Marine Resources, is the Official United States representative to the U.S. - Japan Marine Resources meetings. Eckles and Wallace passed through Honolulu on their way to the Tokyo conferences. Donald P. Martineau, Deputy to Wallace in NOAA, was a member of the party in Honolulu, but did not go on to Japan.

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COASTAL ZONE COMMUNIQUE



Sea Grant Programs
255 Spalding Hall

University of Hawaii
Honolulu, HI 96822

Communique No. 1 October 11, 1972

Justin Rutka, Advisory Specialist

In October 1966, Congress enacted the National Sea Grant College and Program Act (Public Law 89-688), authorizing grants for three kinds of marine resource development: (1) education and training of marine scientists, engineers, and technicians; (2) programs of applied research in marine resource development; and (3) programs in extension or marine advisory services. These objectives are carried out through grants made to selected academic institutions after the pattern of the land grant colleges. The University of Hawaii is one such institution.

The role of the Advisory Specialist is to serve as a link between sources and users of marine information. The job entails communicating research results and marine-related issues to people who can use them, and communicating to researchers and educators the needs and problems of the people Sea Grant is attempting to assist. With this in mind, inquiries and feedback from readers are welcome.

THE FIRST ISSUE ... AN AWAKENING

A combination of forces has produced unprecedented changes in America's society. Once widely dispersed rural populations have deserted the interior and have concentrated in the nation's coastal zone. This migration has been accompanied by accelerated population increases and an explosion in the use of nearshore resources. The influx of population and the resultant spread of suburban complexes have seriously eroded the limited supply of open shoreline. Public access to these areas is at a premium. The use of coastal waters as a receptacle for agricultural, industrial, and human pollutants is increasing. Concurrently, an expansion of affluence and leisure time has caused a sharp increase in marine-based recreation, thus intensifying the often conflicting array of activities taking place in the coastal zone. The result has been a qualitative deterioration of the environment in its livability and esthetic appeal, and a widespread concern with the specter of increasing natural resource scarcity.

In response to these pressures, an awareness has grown on many fronts that the coastal zone cannot possibly support all uses or users harmoniously. Indeed, the much-beloved phrase "balanced development" quite often has reflected a failure to recognize the physical limitations of the coastal zone and the inherent tolerances and capacities of the ecosystems therein. More and more segments of society are now demanding that institutions be shaped not only to meet the conflicts arising from obtaining access to the use of coastal resources but also by the ecological factors relating to the needs of the resources themselves. Although this awareness has been sporadic and slow in coming, it nonetheless has already resulted in the shaping of social machinery needed to handle some of the problems of conflicting use.

Coastal zone consciousness at the national level began partly on faith, partly on pragmatism, but mostly on a clear vision that something had to be done. In 1969, the U.S. Commission on Marine Science, Engineering and Resources published Our Nation and the Sea--A Plan for National Action, which underscored that, unlike single-purpose federal programs, solutions to our coastal zone problems would require simultaneous achievement of multiple goals, many of which conflict with each other. National coastal zone management and general land use legislation now before Congress offers some hope that, in the years to come, the many users of the coastal zone will have sufficient resources to apportion among themselves, and that these resources will be worth utilizing and sharing. The pending inception of federal legislation should not, however, lull state and local planning officials and the public into complacency. Passivism in coastal policy formation, while waiting for eventual passage of federal legislation to help the state along in planning a coastal zone management program, can only make pressing problems more intense and increase the eventual role of the federal government in local coastal resource management.

That there exists a widespread interest in Hawaii's coastal affairs is attested by the almost weekly coverage of controversial aspects of shoreline developments by the local media. These reports deal mostly, but not exclusively, with the alleged incompatibility of large-scale resort and suburban complexes with the larger overall social developmental goals of the state, with environmental quality, and with unimpeded public access to shoreline areas which are held in trust for the use of all citizens. While the affected citizenry is highly concerned, their concern is fragmented and isolated within the narrow confines of their respective areas. Thus, they have been basically ineffective in controlling the rate of encroachment on the remaining open shorelines. Our historical "highest and best use" market approach to coastal development, primarily dictated by consideration of revenue maximization, has been likened to a cancer spreading destructively until it kills the host and itself. While there is a need for development, the relevant questions center on the desirability of using prime shoreline areas to satisfy these demands, when alternative sites could be used.

The intent of this communiqué is to heighten the level of coastal zone consciousness of public planners, concerned citizen groups, and general users of the coastal zone by bringing the issues of national, state, and local coastal resource management before the public. Too often issues of social importance remain buried in lengthy conference, research, and government hearing reports which are not readily available or are incomprehensible to the people affected the most. It is hoped that this and future issues of the communiqué will provide a common focus for collective action in view of impending adoption of either special coastal zone or general land use legislation.

It is especially urgent for those affected to be involved now since, should Congress enact coastal-related legislation shortly, subsequent state legislation may be necessary to qualify for federal planning assistance. As a condition for federal funding, recipient states will have to demonstrate that they possess the necessary infrastructure to develop comprehensive land and water management programs. In addition, full opportunity for public involvement in the state planning process will have to be provided. Since the potential enactment of state coastal-related management legislation could set the pattern of shoreland development for years to come, it is imperative that diverse citizen group and county government views be reflected, as the ultimate test of federal programs is what happens in the local communities. Here is where the big job will have to be done.

Following issues of the committee to be retained at these intervals will
 (I) identify the characteristics of the overall work; (II) an overview
 of progress, problems, and prospects in carrying Hawaii's coastal management
 (III) alternative approaches to federal legislation — separate coastal zone manage-
 ment for Hawaii and planning; (IV) comparative coastal zone management
 (V) a well-known statement of view on coastal management in Hawaii
 (VI) the structure of management and planning
 (VII) a detailed description of Hawaii's system of coastal
 zone and shoreline management with special emphasis on the State Land Use Commission;
 (VIII) a comparison of the approaches taken or planned by other coastal states;
 and (IX) a statement on shoreline development and control in Hawaii with an account of
 problems of public access.

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SEA GRANT NEWSLETTER

Volume 2, Celebration Edition

October 17, 1972

Formal Ceremony Honors University

The University of Hawaii officially became a Sea Grant College on Tuesday, October 17, during ceremonies at the East-West Center on the Manoa campus. University President Harlan Cleveland received a plaque, symbolizing the University's designation as one of six Sea Grant Colleges in America, from Robert White, Administrator of the National Oceanic and Atmospheric Administration (NOAA), the parent organization of the National Sea Grant Program.

Representing the marine sector of the University at the ceremonies were Jack R. Davidson, Director of Sea Grant Programs, and John P. Craven, Dean of Marine Programs. The State of Hawaii was represented by Lt. Governor George Ariyoshi. Senator Hiram Fong, one of the co-sponsors of the original Sea Grant Act, spoke for the United States Congress.

Robert Abel, Director of the National Sea Grant Program, stressed that in addition to being an honor for the University of Hawaii, the designation of Sea Grant College status also imposed a responsibility to maintain its demonstrated excellence in carrying out its programs, with due concern for the restrictive budgetary situation which all agencies face in common.

Manganese Symposium First Marine Event This Week

The week of October 16 - 23 features important ocean science events in Hawaii. It started with a two-day "Symposium/Workshop on Manganese Nodule Deposits in the Pacific". About 100 people considered scientific, legal, technological, economic, and environmental aspects of manganese nodule recovery and processing, and suggest ways that Hawaii can prepare itself for the world-wide activity in this area which is surely coming.

The workshop chairman was James Andrews of the UH Department of Oceanography. Andrews' work and research in manganese nodules, much of it funded by Sea Grant, sparked the concept of the conference. An important contribution also was made by

National Sea Grant Program

The National Sea Grant Program is designed to apply science to the sea, and to help devise technologies for making use of the ocean's resources. Originally a part of the National Science Foundation, Sea Grant became part of the newly formed National Oceanic and Atmospheric Administration (NOAA) in October, 1970, by Executive Order of President Richard M. Nixon. The parent agency of NOAA is the Department of Commerce. Since its beginning, the Sea Grant Program has been under the direction of Robert Abel.

Sea Grant financially supports programs of applied research, and educational and advisory services on a matching-fund basis of two Sea Grant dollars for every dollar from nonfederal sources. Sea Grant support can go to colleges and universities "and other suitable institutes, laboratories, and public or private agencies". The Oceanic Institute, at Makapuu Point, has direct Sea Grant funding for its mullet aquaculture project, for example. To date, the National Sea Grant Program has supported work in 90 colleges, universities, private institutes and agencies in 30 states. Work carried out under Sea Grant support ranges from single projects to broad-based university centers.

researchers aboard the R/V VALDIVIA of the Federal Republic of Germany; they supplied much valuable new data on manganese resources.

Also on October 17 came the official awarding of Sea Grant College status to the University of Hawaii in a ceremony at the East-West Center. On October 18, 19, and 20, marine science and technology experts will direct technical lectures and seminars at the University. The public events of Innerspace Pacifica take place Saturday and Sunday, October 21 and 22. Wrapping things up, on October 23, is a workshop on underwater photography. The office of the State Marine Affairs Coordinator is a major sponsor of both Innerspace Pacifica and the manganese nodules conference.

The University of Hawaii's Sea Grant Program began its fifth year last month, with 24 projects plus a program of advisory services. Of these projects, 16 have been under way for a year or more, while 8 are projects starting up this year, "Sea Grant Year 05".

UH Sea Grant projects range from the highly technological, such as studies of floating communities, to the highly environmental, such as studies of the quality of Hawaii's coastal waters and the reefs in Kaneohe Bay. They deal with improvement of Hawaii's fisheries, with making better use of marine proteins for human food, and with the development of plant and animal aquaculture. They study what happens to working divers in the sea and how coral reefs might be made to grow at increased rates. All the projects deal with sea-related problems and opportunities that face Hawaii today and may become even more significant.

Sea Grant's start in Hawaii dates from March 1, 1968, when the University submitted a proposal for an Institutional Support Grant, drawn up under the supervision of Dr. Wytze Gorter, at that time head of the University's Graduate Division. The proposal presented a five-year program directed toward fulfilling the objectives of the Sea Grant funding of \$501,000 was asked, with matching University funds of \$302,700.

On June 10, 1968, the University was awarded an Institutional Support Grant of \$435,400; it was one of six to receive institutional funding in Sea Grant Year 01. Dr. Gorter headed the program in Year 01. The next year Dr. Albert Tester first took over direction of the program; later Dr. Morton Rosenberg, Associate Dean of Research and Fellowships, took the helm.

For Year 03, University and National Sea Grant Program officials decided that the growing UH Sea Grant Program needed the guidance of a full-time director. Selected for the position, and taking over at the start of Year 03, was the present director, Dr. Jack Davidson. Prior to heading Sea Grant, Dr. Davidson was Professor and Chairman of Agricultural and Resource Economics at the University. His specialty was developing, conducting, and channeling research into the mainstream of the economy; that specialty exactly matches the purposes of Sea Grant.

During Year 02 a 10-member advisory group (5 from the University, 5 from the community) developed an integrated plan that called for selecting projects as they fit into a number of well-defined "problem areas". This scheme went into operation with the start of Year 03. It has been followed since, with some restructuring of areas based on experience and changing circumstances.

For Year 05 the project areas are: aquaculture, fisheries, coastal environment management, ocean bottom resources and ocean engineering, human performance in the sea, and education. Advisory services are coordinated through the office of the Director of Sea Grant Programs at the University. Separate stories in this issue of the Newsletter briefly describe each area and its projects.

Harmful materials may still be entering Kaneohe Bay, but the pollution is not unnoticed. With generous help from Sea Grant, the bay now may be the most intensively studied body of water in the world. The hoped-for goals of the Sea Grant studies are to bring back the outstanding water quality that Kaneohe Bay once possessed, and to help speed the recovery of damaged reefs.

The Kaneohe Bay studies are vital parts of two major UH Sea Grant projects in the general category "Coastal Environment Management". One is a continuing, many-faceted investigation of the quality of the coastal waters of Hawaii. The project is concerned with solving specific problems of existing pollution, and with discovering ways to prevent future coastal water pollution from such sources as land development and population growth.

The other project is the most intensive study of coral reefs ever undertaken anywhere; the reefs in Kaneohe Bay receive a major part of the attention. This project has three main phases. The first is a study of the normal functioning of a reef community. The second phase studies what happens when a reef community is disrupted or destroyed by either natural or man-caused processes. (Not only the reefs are being studied, but also the plant and animal life in and around them, and the effect of waves breaking against them.) The third phase of this long-term project seeks to find how a reef community can be stimulated to recover quickly from a destructive event.

Another project of considerable importance to the citizens of Hawaii is a five-year study of beaches and surf. If you have visited beaches at different seasons of the year, you have observed that they do not necessarily remain the same for long. Sand may be washed ashore and enlarge the beach. Later, the sand may move out -- sometimes overnight -- leaving only stones, rocks, and mud. Some of this movement occurs in nature, but man's construction projects directly or indirectly change the movements of sand. Building a groin to protect the sand on one section of beach may change the movement of waves and currents so as to remove sand from a neighboring beach. Without careful study and specific data on factors influencing beach movement, it is not possible to predict accurately how seawalls, groins, and other structures will affect the shoreline. This project seeks to make accurate prediction possible and to make the information easily available to anyone who needs it, whether government official, land developer, or private citizen.

Two other major projects concern the economic and institutional aspects of multiple and often conflicting uses of the coastal zone, and the laws related to management of the coastal zone in Hawaii. The goal is to put together ultimately a workable plan that will respect and protect the rights of all who use the ocean.

Education

If the total U.S. shoreline, following every bay and inlet, were stretched out, it would reach around the world at the equator more than three times. Yet most people have little practical or theoretical knowledge of the ocean. Even among people born and raised here in Hawaii, many have never been beyond the reef or aboard a ship. Ocean sciences have long been regarded as subjects suitable for study only at the university graduate level. So a college graduate from a good university may not know any more about the ocean than he did as a schoolboy.

Sea Grant education projects are directed toward overcoming this general lack of knowledge. It is not a basic purpose of Sea Grant to train PhD-level ocean scientists. Rather, Sea Grant aims to make the general public more knowledgeable about the ocean and the opportunities it offers, to provide training in practical marine-related skills, and to give impetus for the development of new campus and off-campus courses.

One major educational Sea Grant project at the University, the Marine Option Program, provides for undergraduate students to acquire both theoretical and working knowledge of the ocean. The Marine Option Program is designed to supplement existing departmental programs. To obtain a Marine Option Program certificate, the student must take some classroom work and must acquire a marine skill. The skills range from scuba diving to celestial navigation, according to the student's individual interests.

Another educational project, the Marine Technician Training Program, is carried out at Leeward Community College. Although Hawaii needs several new marine technicians each year, until the start of this project in Sea Grant Year 02, there was no formal training program for marine technicians in Hawaii. A two-year program combining academic and technical courses leads to an "associate of science" degree; over half the credits can be transferred to the University and applied toward a regular four-year degree.

During this past summer, financial support from the State's Marine Affairs Coordinator made it possible for all the students in the program to spend considerable time at sea, aboard the National Marine Fisheries Service research vessel, CHARLES H. GILBERT. The students served as crew members in many capacities, took active parts in fishing for skipjack tuna (aku) (including searching for nehu for use as bait), and also gained experience in tagging marlin.

The National Sea Grant Program recognizes the need for making new scientific findings available to all ocean scientists, and for introducing new pertinent knowledge into college curricula. A project at the University concerns disease, abnormality, and injury in marine animals. The need for such knowledge in aquaculture is both obvious and pressing. Pathologic specimens are being collected and used in laboratory courses.

A workshop-type course provides guidance in setting up and running aquariums. Many people in Honolulu keep an aquarium in an office, or other

Human Performance in the Sea

A scuba club makes a deep dive. Two divers are severely bothered by nitrogen narcosis, one to the extent that he endangers his buddy's life and his own. Others are affected only slightly, or not at all. Why are some divers more intoxicated by nitrogen under pressure than others?

A team of professional saturation divers goes down 600 feet to spend several days working on an undersea research project. The loss of heat in the helium-oxygen atmosphere surrounding them in the habitat is much more acute than had been anticipated; it is so weakening that they cannot accomplish all their assigned tasks. How can heat loss and its effects on diver performance be better predicted, and possibly overcome?

These are two of the important questions relating to diver safety and performance that are being thoroughly investigated by a long-range Sea Grant project at the University of Hawaii. The results have already provided much new and useful information for both sport and professional divers here and on the Mainland.

In one phase of this project, six divers last winter spent 9 days in the Makai Range habitat, *Aegir*, under pressure equal to a depth of 500 feet. Among the factors studied were heat loss from breathing and from the body in general; nutritional aspects; the length of time that common drugs remain in the body in a pressurized atmosphere; and the loss of efficiency in performing tasks and receiving sensory impressions under the high pressures of an undersea atmosphere. Studies have also been made of divers actually under water at depths from 15 to 60 feet in the open ocean.

The project now has an experimental diving chamber that can reproduce the pressure of any ocean depth down to 300 feet. Later this fall, with the aid of a \$25,000 allotment from the State Marine Affairs Coordinator, the project will obtain a 4-chamber diving bell system which can take divers down into the ocean to a depth of 600 feet. This diving system will also be available for use with ocean engineering projects in the state.

To harvest the ocean's resources, divers will sometimes need to go far below the surface. This project is doing much to assure that they will be able to work efficiently and come up safely.

Education (continued)

place of business. (Many are maintained in local restaurants, for instance.) The course will offer help to aquarium owners in keeping their specimens alive and healthy. At present there is a heavy drain on local stocks of reef animals, as replacements for fish that have died because of lack of knowledge on the part of the aquarium owner.

Still another project, originated in Year '05, is to develop a graduate-level program in near-shore, environmental ocean engineering.

Finally, a comprehensive course on the aquaculture of marine plants is being developed. The course is being offered, on an experimental basis, at the University this fall.

Advisory Services

"How long would it take me to get downtown from Hawaii Kai, if we had a water transit system?"

"How would a floating city handle its waste disposal?"

"I caught a strange fish today. Nobody around here knows what it is. How can I find out?"

"Where can I learn what is really being done to clean up the pollution in Kaneohe Bay?"

Such questions, or any question that involves the ocean, can be directed to the UH Sea Grant Program office. Just dial 944-7331, ask for the Advisory Service, and explain what you want to know. If the advisory specialists cannot give you an answer at once, they will either get it for you or direct you to the source that can best handle your query. There is no charge, and anyone may use the service. It is part of the Sea Grant concept of helping people to be well informed about the ocean and about marine affairs in general.

Lately many people have been asking Sea Grant how to start raising prawns in their ponds; the answer to this one is that unless you have a great deal of special training, or can take the time to get it, you had better not attempt aquaculture -- at least as a profit-making venture. Aquaculture is at least as complicated as high-intensity scientific farming and many basic problems have yet to be solved.

Questions about diving or ocean engineering are especially appropriate; one of Sea Grant's full-time Advisory Service staffers is Peggy Lucas, an ocean engineer and a member of the world's first team of woman aquanauts. But she and staffer Justin Rutka and Advisory Service Coordinator John Ball, Jr., will handle questions on any aspect of the ocean, from economic to environmental. If an answer exists, they will see that you get it.

If you should need a marine reference book, technical report, or other document that relates to the ocean, a unique library service is also available.

An Ocean Science Information Center, located in Hamilton Library, provides a single statewide source for marine-related information. With funding from the Sea Grant Advisory Program, OSIC has collected and located marine-related documents throughout the state and is preparing a computerized index to this information, to be published as a section of the Marine Atlas for Hawaii. (Anyone with reprints, technical reports, product catalogs, or other marine-related documents may contribute to the Center.) OSIC also participates with NOAA's Environmental Science Information Center in a computerized, updating literature search system.

Several bibliographies have been prepared. A slide collection, newspaper clipping file, pamphlet file, technical reports, unpublished documents, reprints, and the union-index are housed in Science & Technology Reference, Hamilton Library.

Aquaculture

Can man learn to farm the ocean scientifically and systematically for plant and animal products, as he now skillfully farms the land? Can the sea provide a rapidly growing world population with far more food than it now provides through those primitive hunting processes called "fishing"? The potential is clearly there, but in all except a few cases the necessary technology is almost totally lacking.

One major aim of the Sea Grant Act is to develop the knowledge and techniques needed to make aquaculture a full-scale oceanic partner to land-based agriculture.

Several aquaculture projects were initiated at the University of Hawaii during the first four Sea Grant Years. For the current year they have been grouped into two major programs: tropical animal aquaculture and tropical plant aquaculture.

Animals being investigated for possible commercial aquaculture include omaka (*Caranx mate*), yellow ulua (*Gnathanodon speciosus*), Japanese yellowtail, moi (*Polydactylus savillii*), goatfishes, and mahimahi (dolphin fish) in the finned fish category; also being studied are opihi, octopus, Samoan and white crabs, and shrimp. The work with the shrimp seem closest to the point where culture could go commercial; in the finned-fish research, many basic problems have yet to be solved.

The animal aquaculture studies cover five major areas: ecology, reproductive biology, nutrition, disease, and facilities engineering. Teams work in each area. In addition to marine biologists, the various teams include specialists in animal diseases, animal nutrition, chemistry, microbiology, agricultural engineering, and marine engineering.

Seaweeds such as kelp, and other marine plants ...including many species of tiny algae...play a more vital part in the modern world than is generally realized. Many tons of sea plants are processed to obtain colloids: ingredients needed to keep emulsions stable. Colloids of ocean origin are used in many milk-based products, toothpaste, hand creams, paint, ink, insect sprays, shampoos, and many other products. One phase of the plant aquaculture project involves developing better means of farming some of the most useful sea plants, and setting up and operating pilot production plants, primarily in the Philippines.

The other major phase of the plant aquaculture project seeks efficient ways of producing algae to feed animals raised in aquaculture projects.

Advisory Services (continued)

The Ocean Science Information Center has a new publication to assist researchers in locating information in the University of Hawaii libraries: "Law of the sea; Administration of the oceans -- Where to begin." OSIC publ. no. 7, Sept. 1972. A bibliography is also available as a supplement to the guide. For a free copy, contact Mrs. Barbara Tillett, Ocean Science Information Center, Hamilton Library, University of Hawaii or call 944-8263.

Ocean Bottom Resources and Ocean Engineering

Imagine that it is 1982. Honolulu has far less automobile traffic, fewer traffic jams, and far more open space along the ocean front for recreational use than it did in 1972.

An impossible dream? No. Technologically it is both possible and practical. Environmentally it is highly desirable. How could it happen?

Suppose that instead of building more and more land-swallowing roads that quickly become clogged with more and more cars, a water-borne mass-transit system has been established. Commuters from Hawaii Kai and Ewa slip downtown in relaxed comfort on swift, smooth-riding, environmentally sound hydrofoil craft. These run far offshore, not interfering with swimmers, surfers, or pleasure boaters. At key transfer stops the express hydrofoils connect with canal craft that carry people back and forth easily and quietly on the many canals now lacing Honolulu. (Some have been deepened or widened a bit where needed.) A network of non-polluting mini-buses serves areas not reached by canals. Passengers transfer easily from minibus to canal craft or express hydrofoil.

How was that extra ocean-front open space gained?

Many of the activities that crowded the shoreline in 1972 have been moved well out to sea, aboard stable, deep-floating platforms that ride steady in waves and storms. These platforms provide many extra acres of space adjacent to the ocean, without using up ocean-front land. Natural parks now occupy much of the shoreline. Some of the platforms support industrial and commercial uses. Others serve as marine science research centers. Some have attractive apartments. All help ease the crushing demand for more space.

Neither of these concepts is an impractical vision. Both are completely possible with today's technology. And the UH Sea Grant Program is investigating both concepts as possible solutions to many of the problems of today's urban living. The floating community concept is taken so seriously that it was featured on the cover of the U.S. Department of Commerce's weekly magazine, "Commerce Today" (Sept. 4, 1972 issue).

The water transit system is referred to as the HEART system; it stands for Hawaii's Environmental Area Rapid Transit system. Hydrofoils are used for public transport in many countries. When President Nixon exchanged "head of state" gifts with a Russian leader recently, Nixon's gift was a Cadillac. The Russian gave him a working hydrofoil. The Soviets can spare the craft; they have more than 250 hydrofoils in passenger transit service. American manufacturers can build excellent hydrofoils, but so far the U.S. Navy has bought most of them.

The floating community and HEART projects fall into the Sea Grant category, Ocean Bottom Resources and Ocean Engineering. While they are the most unusual projects in this area of Sea Grant concern, there are two others, both potentially important to Hawaii.

Sea Grant researchers are evaluating the offshore sand deposits that lie near our islands in many places. They are devising ways to recover offshore sand, both for construction use and for replenishing beach sand that has been washed away or carted away for building projects. (Starting in 1975, it will be illegal to take sand from Hawaii's beaches for construction projects and similar use.) The sand project investigators have been carefully checking sand movement, to make sure that any underwater deposits marked for possible use are not those that would in a few months be moved back onto beaches by natural processes.

Other investigators are seeking undersea resources of the precious pink and black corals used for making jewelry. One of their goals is to develop means of harvesting that do not destroy any unharvested coral. Another goal is to determine the natural replacement rates, to permit establishing a limit on how much may be taken from a bed, so there will always be a supply without wiping out a valuable and beautiful natural resource.

Fisheries

The demand for food from the sea is growing at least as fast as world populations are growing, yet in Hawaii commercial fishing is a static industry. Two general fisheries exist in Hawaii. One is for the tunas that are caught offshore, while the other is for bottom fish and other inshore fish.

The larger tunas such as yellowfin (ahi) usually go into the sashimi (raw fish) market, while skipjack tuna are usually processed at the cannery. At least twice the Hawaiian landings of skipjack tuna could be processed if the local fleet could supply it. However, with a limited number of boats, a short season, and the dependence on live bait, the fleet is operating close to full capacity under the existing methods.

Much of the Sea Grant effort over the years has been directed at the bait problem. Our fishermen prefer a small anchovy, nehu, to all other available species of bait. But while its baiting performance is outstanding, the nehu's keeping ability is poor. Even under the best of conditions nehu have had a very poor record of survivability in existing bait wells.

The cooperative work on nehu has aimed at improving the survival aboard ship and determining the factors that could increase the supply of bait. The result has been the development of a list of bait-handling tips and improvements in bait well design that are being incorporated in the design of newer boats. More is now known about nehu, and supplementary and alternate species of bait are being sought.

Last year another project was begun, to investigate how inshore fisheries should be managed.

(Continued on page 6.)

Sea Grant College Criteria

How does a university obtain the designation "Sea Grant College"? This designation is not lightly given: of some 70 universities that have received Sea Grant funding to date, only 6 have been awarded that status. An official Policy Statement spells out the requirements in these words:

"The criteria for Sea Grant College designation are implicit in the concept of such a college as a major intellectual, research, and educational center with broadly based programs in marine affairs, which is both a leader and a resource in realizing opportunities or solving problems of the marine environment.

"The essence of Sea Grant College research activity is a team approach to well defined marine problems or opportunities in which pertinent disciplines and specialties are joined in a concerted, multi-disciplinary, programmed effort to find solutions, knowledge, methods, or technologies that will yield the basis for management decisions, economic returns, social values, or a combination of these.

"The problems or opportunities selected for study by the Sea Grant College should be relevant to the area or region served by the University, and to the nation as a whole.

(Continued on page 7.)



This large saltwater tank at the Hawaii Institute of Marine Biology is used to produce phytoplankton cultures as food in the work to develop improved diets for aquaculture animals. HIMB Director John E. Bardach (center) and UI Sea Grant Advisory Service Coordinator John Ball, Jr. (left) recently showed the facilities to Leonard Mitchell (right), Assistant to National Sea Grant Director Robert Abel.

Book on Ocean Explorers Published

This special issue of the SEA GRANT NEWSLETTER is the second work of marine affairs writer Howard Pennington to be published this week. On October 19, a book by Pennington was published by Little, Brown and Company, of Boston. Titled, "The New Ocean Explorers: Into the Sea in the Space Age", it covers important occurrences in ocean sciences and technology from 1963 to 1972.

Although worldwide in scope, the book has much coverage of people and events here in Hawaii. The aquaculture projects of Takuji Fujimura and David Olsen are described, as are those at the Oceanic Institute. Considerable space is given the record-setting 516-foot, five-day dive in the Makai Range habitat; a number of people involved in Hawaii's ocean science and technology programs are mentioned or quoted. The book includes 36 pages of photographs, many showing events in Hawaii.

Fisheries (continued)

Since little has been known about the requirements of Hawaiian fish during larval and juvenile stages, decisions have of necessity been based on adult fish requirements. Yet larval and juvenile forms are much more apt to be killed off by unfavorable conditions than adults. Until this project began, very few Hawaiian fish species could be identified at egg and larval stages. Now, the larvae and immature stages of many species are being identified, sometimes by the basic process of raising the unidentifiable eggs and larvae until they grow into something recognizable. This study will also help show which species have the best potentials for being cultivated through aquaculture.

A project beginning this year will make an economic analysis of various commercial tuna species in the Pacific, and try to determine such things as the best way to allocate fishing fleets to various known fishing areas in relation to the present location of canneries, and, conversely, the best locations for canneries in relation to known fishing areas.

Finally, one project in the fisheries area is investigating the processing properties for fish proteins, so that so-called lower grades of fish, or unwanted species, can be processed into palatable and nourishing food for human use.

In production:

Spheres of Influence in Hawaii's Coastal Zone, Vol. I: Federal Agency Involvement (UNIHI-SEAGRANT-AR-72-03). Justin Rutka and Chennat Gopalakrishnan.

Medical Measures in Diving Accidents (Chart, 2 sides).

In press:

Hawaii Fish 'n Facts Information Sheet Number 169: *Sport Fishermen's Guide to Holding and Pressing Fish*. Kirby Hayes, William Schumacher, and Curtis Wilder.

In print:

Longer Life for Nehu. Wayne Baldwin, Jeanette Struhsaker, and Gerald Akiyama (UNIHI-SEAGRANT-MS-72-01A). 24 pp.

Economics and Market Potential of the Precious Coral Industry in Hawaii (UNIHI-SEAGRANT-AR-71-03). Kok-Kiam Poh. 22 pp. Second printing.

Hawaii Fish 'n Facts Information Sheets Number 166, 167, and 168: *Why Fish Spoil, Coming, the Wholesome Fish Aot, and Fish Smoking and Drying by the Sportsman*. Kirby Hayes, William Schumacher, and Curtis Wilder.

Costs and Earnings of Tuna Vessels in Hawaii (UNIHI-SEAGRANT-AR-72-01). Abu Ekram Ahsan, John L. Ball, Jr., and Jack R. Davidson. 22 pp.

Soil Salinity Problems in Shoreline Areas of Hawaii (UNIHI-SEAGRANT-AR-71-01. Also Cooperative Extension Service Circular 462). S.A. El-Swaify, Wade W. McCall, and S. Sinanuwong. 12 pp.

Other UH Marine Activities

Long before the start of the Sea Grant Program, the University of Hawaii was a major center for ocean research and education. Today graduate-level marine studies are offered in the departments of oceanography, zoology, botany, microbiology, geosciences, ocean engineering, psychology, architecture, physiology, and agricultural economics. Some 90 courses relating to the marine area are offered; enrollment in these courses exceeds 2,000 students. Marine research is conducted at the Hawaii Institute of Geophysics, Hawaii Institute of Marine Biology, Look Laboratory of Ocean Engineering, the Water Resources Research Center, and the Pacific Biomedical Research Center. The Hawaii Institute of Geophysics maintains two research vessels, the 160-foot KANA KEOKI, and the 90-foot TERITU.

"Educational programs should be directed both to the education and training of specialized personnel at all appropriate levels, and to the general education of the student body on the relationships of the marine environment to air and land environments and to human affairs.

"An aggressive, well-conceived and executed program of publications, extension services, and demonstrations should serve the university's region in much the same way that agriculture extension services and experiment stations traditionally have served the agricultural community. Programs utilizing the mass media should be directed to informing the public of regional progress and problems in marine affairs.

"The Sea Grant College component of a University should be well integrated with the colleges and departments of the University so that it may gain maximum strength and cooperation from the full institutional structure, but should be identifiable as a distinct, major program of the University. It should have the strong and active backing of the University administration, and an identified Sea Grant coordinator or director of high competence and stature who has a full time staff devoted to Sea Grant affairs.

"The Sea Grant College should have strong, continuing relationships with State and local agencies, Federal laboratories in its area, business and industry, and other educational institutions, drawing on all as appropriate for advice and cooperation, and utilizing their facilities and competence. This direct involvement with the overall marine community of the area may take the form of giving and receiving advice, joint research activities, joint planning, sharing of facilities, or any other form which will serve the essential purpose of establishing strong communications and mutually supporting links between the Sea Grant College and the people it serves. Interrelationships between the Sea Grant College and the executive and legislative branches of the State government especially should be strong, with the State's (or other sponsor in the case of private institutions) participation emphasized, where appropriate, by the State or other non-Federal funds specifically earmarked or appropriated for Sea Grant matching purposes.

"Any University supported under the Sea Grant Program may qualify for designation as a Sea Grant College, if its activities are consistent with this concept."

In the fall of 1971, the first four institutions to be judged as having met all of these requirements were officially designated Sea Grant Colleges. They were the University of Rhode Island, University of Washington, Oregon State University, and Texas A&M University. In mid-1972 two more institutions were awarded the coveted designation: the University of Wisconsin and the University of Hawaii.



University of Hawaii President Harlan Cleveland is shown here signing an official document received from NOAA Administrator Robert White at Tuesday's ceremony, formally designating the University a Sea Grant College. Left to right are Lt. Gov. George Ariyoshi, Dean of Marine Programs John Craven, U.S. Senator Hiram Fong, Cleveland, White, and Jack Davidson, Director of the UH Sea Grant Program. Story on page 1.



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BACTERIAL INDICATORS OF WATER QUALITY

QUALITY of COASTAL WATERS

PROJECT BULLETIN

Project Bulletin No. 7/December 1972

L. S. Lau, Principal Investigator

By Reginald H.F. Young

(Editor's note: Dr. Young is Associate Professor of Civil Engineering and Associate Sanitary Engineer of Water Resources Research Center.)

Bacteriological densities are an integral part of any water quality standard to protect such uses as the drinking water supply, recreation, and propagation of fish and shellfish. The objective of these involves the detection of fecal contamination from all warm-blooded animals, since this is the natural link to the occurrence of pathogenic (disease causing) organisms in polluted water. Methods for the direct detection of pathogenic organisms are generally too complicated and expensive for use in field determinations. To circumvent this difficulty an organism or group of organisms is utilized to identify pathogenic organisms in water. The coliform organism group was selected as an indicator because these bacteria are always present in large numbers in fecal wastes of humans and other warm-blooded animals and are relatively easy to detect, isolate, and enumerate.

*Standard Methods*¹ defines the coliform bacteria group as "all of the aerobic and facultative anaerobic, Gram-negative, non-sporeforming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C." This definition is considered general and includes a heterogeneous group of bacterial species, most of which have

little health significance. The ability to ferment lactose, however, led to the development of simple techniques for identifying the presence of the coliform organisms.

The coliform group includes not only organisms that have fecal origin, such as *Escherichia coli* but also organisms that live on dead matter in the soil, such as, *Aerobacteria aerogenes* which is commonly found in runoff, even from virgin watershed areas, and would be expected to thrive and even multiply in some cases in polluted waters.

Water quality standards typically express maximum allowable bacterial concentrations statistically most probably number (MPN) by the multiple tube fermentation test or the actual count per unit volume as determined by the newer membrane filter technique. Other indicator bacteria systems have been proposed in the past but for reasons that have been considered unsatisfactory in comparison with the coliform bacteria with the exception of the fecal streptococci group which are normal inhabitants of the intestines of humans and other warm-blooded animals. Recent developments in methodology, including high temperature incubation, differential media, and membrane filter techniques have focused attention on the fecal coliform and fecal streptococci groups of bacteria as pollution indicators. It has long been known that coliform bacteria from the gut of warm-blooded animals would produce gas from lactose broth at 45°C while the coliforms from non-fecal sources would fail to grow. This trait of the fecal coliform has been adapted to a standardized procedure now involv-

¹ *Standard Methods for the Examination of Water and Wastewater*, 13th Edition, 1971, American Public Health Assoc.

ing a multiple tube dilution technique with a lactose broth media or a membrane filter technique, both with incubations at near 45°C.

COLIFORM STREPTOCOCCUS RELATIONSHIP

The density relationship between fecal coliforms (FC) and fecal streptococci (FS) can be used to effectively distinguish between the contribution of human and non-human warm-blooded animal wastes. Geldreich has reported that the ratio between FC and FS density exceeds 4:1 (FC:FS) in human fecal material and in domestic wastes. This relationship was reversed in studies of packing house and dairy farm effluents, representative of livestock and poultry fecal contamination, with a FC:FS ratio generally less than 0.7:1. Studies of stormwater and fecal material from cats, dogs, and rodents yielded the same low FC:FS relationship. Similar relationships has been developed with the density between fecal coliforms and total coliforms (TC).

STATE WATER QUALITY STANDARDS

The state of Hawaii standards for water quality list specific levels for coliform bacteria for each water classification. For Class AA coastal waters (waters designated for oceanographic research, shellfish and marinelife propagation, coral reef and wilderness area conservation, and esthetic enjoyment), there is a median total coliforms limit of 70 organisms/100 ml. For Class A coastal waters (recreational uses and esthetic enjoyment) and the fresh waters Classes 1 (potable supplies) and 2 (all other waters) there is a median limit on total coliforms of 1000/100 ml. Fecal coliforms should not exceed an arithmetic average of 200/100 ml for Classes A and 2 and 20/100 ml for Classes 1 in any 30-day period. For Class B coastal waters (small boat harbors, commercial, shipping, and industrial use, bait fishing, and esthetic enjoyment), there is only a limit on fecal coliforms with an arithmetic average of less than 400/100 ml during any 30-day period.

It was on the basis of these standards that both Keehi Lagoon and Manoa Stream were classified as polluted and posted by the State Department of Health in events much publicized by the local news media two to three years ago. Since sources of direct sewage discharge into these water bodies, particularly Manoa Stream have not been publicly identified, it is appropriate to examine the indicator bacteria relationships for these waters to differentiate between human waste contamination and that contamination that might "naturally" occur in a watershed. This is significant for all watershed areas in the state, for if undeveloped areas show levels of coliform densities in excess of the State Water Quality Standards, then some modification or changes should be made in the Standards or their enforcement. It is also important that the effects of the waste water treatment plants discharge and non-point sources of contamination be distinguished for coastal waters.

WRRC WATERSHED STUDIES

Several watersheds have been studied by the Water Resources Research Center since 1970 on a seasonal basis to ascertain their water quality characteristics in both wet and dry weather conditions. This work includes the Manoa, Kapalama, and Kalihi watershed areas. Total coliform, fecal coliform, and fecal streptococci densities were obtained for all three watersheds. The watersheds represent undeveloped residential, urbanized-industrialized, and undeveloped -residential-industrialized, drainage areas, respectively.

At all stations on Manoa Stream, the state Standards for both total and fecal coliform densities were exceeded in both dry and wet weather conditions. However, the range in FC:TC was 0.01 to 0.09 for dry weather and 0.03 to 0.14 for wet weather conditions while the range in FC:FS was 0.14 to 0.59 for dry weather and 0.31 to 1.06 for wet weather conditions. The physical and chemical data for Manoa Stream were indicative of an excellent quality, in rela-

tion to The U.S. Public Health Service Drinking Water Standards. The bacterial density relationships show that the fecal organisms are predominantly of wild animal origin with a possible contribution from some human source during wet weather conditions.

Reported results of surveys of two high-mountain watersheds in Montana show a similar low density of coliforms and streptococci in closed undeveloped regions similar to Manoa Valley. The closed watershed actually yielded water with higher total and fecal coliform counts than the watershed open to recreational activities. The cause of this was considered to be due to a higher wild animal population in the closed area which is relatively free of human activity.

In Kapalama Canal, bacterial densities at all stations, over a one-year study period, exceeded the state standards. Average FC:TC for the Canal was 0.25:1 in Class 2 waters. The FC:FS relationship varied from 1.5:1 in the upper reaches of Class 2 waters to 6.0-9.0:1 in lower reaches of Class 2 waters to less than 0.5:1 in Class A waters. These results give indications of definite human sewage contamination from cesspools or sewers in the Class 2 water upstream of the tidal barrier which is located between Class A and Class 2 waters. Downstream of the barrier, there may be both a dilution effect and a natural die-off of the coliforms in the saline waters leading to the alteration in FC:FS ratio. Since the Canal waters discharge into Honolulu Harbor and probably into the Kalihi ship channel they may be a source of contamination for Keehi Lagoon. The chemical data for the Canal is of much poorer quality than those for Manoa Stream.

Varied results were obtained for Kalihi Stream, however, the total and fecal coliform levels were again in excess of the state Standards on most surveys. The FC:TC relationship ranged from 0.026 to less than 0.001 from the forest reserve to the reach under tidal influences. The FC:FS relationship had a higher level of variability but was less than 0.7 for 3 of 4 stations in

dry-weather conditions and ranged from 0.9 to 1.4 in wet-weather conditions. Thus, there is probably some fecal contamination from cesspool overflows, street washings or sewer mains under high runoff conditions.

KANEOHE BAY DRAINAGE BASINS

A number of the streams in the Kaneohe Bay drainage basin were surveyed in 1968-69 and the results show a similar pattern of excessive total coliform levels, but with FC:FS relationships indicative of extremely low orders of fecal contamination and the latter of mostly wild animal origin.

HEALTH DEPARTMENT MONITORING

Indicator bacteria densities in coastal waters are the subject of continuous and regular monitoring by the State Health Department. Their results have been compiled for ready access and retrievability in a computer-based system developed by Jackie Miller of the Water Resources Research Center staff. However, the total results are too voluminous to review in this brief document. In areas that are under study in the Quality of Coastal Waters project available data does show that coliform densities are in general conformance with the state Standards. At Sandy Beach, for example, all reported results since 1963 are less than the Class A standard for that area. At Waikiki, a similar situation exists with only 4.5 percent of the 1285 individual samples between 1969 and 1971 having a MPN index greater than 1000/100 ml. Coastal areas on Kauai near the Kilauea and McBryde plantations have similar low coliform levels. Observations at 6 stations in the Hawaii-Kai Marina have yielded high densities at only two sites, but all results are within the Class A levels for that area. Corollary results obtained in the Oahu Water Quality Program study between June 1970 to February 1971 show median total coliform levels in coastal and offshore waters in most areas around the island to well within the state standards. Median and maximum levels in ex-

cess of the Standards are generally related to high runoff and stream discharge or obvious wastewater discharge such as at the Sand Island outfall.

SUMMARY

Overall results obtained to date from watershed areas on Oahu indicate that coliform densities alone are not indicative of bacterial quality and sources of contamination of surface waters. The fecal coliform/fecal strepto-

coccus and, possibly, the fecal coliform/total coliform relationship are direct indicators of type and kind of fecal pollution. Thus, their adoption as indices for water quality standards would provide a direct and immediate assessment of fecal contamination of non-point sources of pollution and the distinction between the impact of such sources and that of direct waste discharges into the coastal water environment.

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DR. ERNEST ROSS
ANIMAL SCIENCE
HENKE 119



SEA GRANT NEWSLETTER

Volume 3, Number 2

February, 1973

Honolulu to Host Transport Seminar

A panel discussion on marine transportation is scheduled as part of the Seventh International Transportation Seminar - Pacific, to be held February 5 through 7 in Honolulu. The three-day conference is being co-sponsored by the UH College of Business Administration and the Aloha Chapter, National Defense Transportation Association.

UH Dean of Marine Programs John P. Craven will address a Monday morning session of the "SITS-PAC" conference, following a keynote address by Ed Foreman, Regional Director, U.S. Department of Transportation. Other speakers at the seminar, which will be held at the Ilikai Hotel, include Admiral Noel A.M. Gayler, USN; NDTA President Robley Mangold; and NDTA Executive Vice President G.W. Collins.

Miller to Speak In Scotland

UH Marine biologist John M. Miller (HIMB) will report on his Sea Grant sponsored research at an International Symposium on Larval Fishes to be held in Oban, Scotland in May 1973. Larval fish specialists from Germany, Norway, the United Kingdom, India, and the Union of Soviet Socialist Republics are scheduled with Miller to discuss the distribution of marine fish larvae in relation to environmental factors. Ten other panels will consider other aspects of larval fish biology. While in Europe, Miller will visit laboratories in Sweden, Denmark, England, France, and Italy.

(Continued on page 4.)

Proceedings of ECOPUSH Seminar Ready

The University of Hawaii's Center for Engineering Research (CER) is making available the summary proceedings of a November conference on marine and freshwater aquaculture which was co-sponsored by CER, the State of Hawaii Department of Planning and Economic Development, and a National Science Foundation "Public Understanding of Science" Program. The aquaculture meet was one of a series called "ECOPUSH", which began a year ago and will continue through May of 1973.

This conference series is intended to serve as a medium through which the public may gain a better understanding of the application of science and technology to the solution of contemporary societal problems, particularly those related to preserving and enhancing the environment. The acronym, ECOPUSH, represents the title for the series -- Environmental Conference on the Public Understanding of Science in Hawaii.

(Continued on page 4.)

Goodwin Coming

Harold L. Goodwin, Deputy Director of the National Office of Sea Grant, will be in Hawaii February 6, 7, and 8 to attend a series of Pacific aquaculture conferences. He will also attend the Pacific Island Development Corporation meetings in American Samoa, February 12 through 14. The National Oceanic and Atmospheric Administration recently appointed Goodwin interim coordinator of NOAA aquaculture programs.

Russia to Provide Ship Time for PanPac - UH Work

The USSR Institute of Oceanology, a branch of Russia's Academy of Sciences, has approved a proposal submitted by George Harvey of the Pan Pacific Institute of Ocean Science. Russia will provide ship time and shipboard laboratory facilities for the planned marine research, which domestic funding organizations have not had the money to supply.

Harvey's current research represents a continuation of work begun at Scripps Institution of Oceanography in 1963. New methods of collection and analysis developed by Harvey and his staff will be employed in the proposed work aboard a Russian research vessel.

Harry Zeitlin, UH professor of chemistry, and Kaare Gundersen, UH professor of microbiology, will participate in the planned work along with several other UH researchers. The American scientists will be seeking sea-surface microlayer data in areas of organic and inorganic chemistry, microbiology, and surface chemistry, and will make a detailed study of particulate material in the sea-surface microlayer and underlying water, as well as in the air above the sea surface.

Harvey is scientific director of the Pan Pacific Institute of Ocean Sciences (PanPac). The institute was established in May of 1972, and is incorporated as a nonprofit institution. The staff includes scientists who hold research and/or teaching posts at many universities and laboratories in Asia, as well as American institutions. A number of European scientists have also expressed interest in working with the Hawaii-based PanPac. A member of the institute accompanied the last cruise of the DMITRY MENDELEEV on the leg between Hawaii and Japan, and has written a paper to be published in a Russian scientific journal.

PanPac is dedicated to the restoration and maintenance of a healthy marine environment around the Pacific

Basin. It is directed toward the increased utilization of sea water for the benefit of the human populations of the Pacific Ocean region. PanPac is organized to serve all of the nations of the Pacific and to work with them toward solving their specific problems.

The institute is currently engaged in basic research on the production of food and on waste disposal in marine waters. A Pacific-wide data-gathering program also is planned: it will monitor nearshore conditions and will accumulate data on long-term environmental changes and interrelationships.

Sea Grant Welcomes New Staff Member

The UH Sea Grant Program Office has taken on another new staff member. Mrs. Rose T. Pfund, formerly Publications Editor for the Water Resources Research Center, will be the information specialist for Sea Grant's Advisory Program at the University of Hawaii.

Council Guides Proposal

The UH Sea Grant Advisory Council has been meeting during December and January to shape the Year 06 proposal. Director Jack Davidson wishes to express his thanks for the generous assistance of the Council members, including the following: Doak Cox, Director of the UH Environmental Center; John P. Craven, Dean of Marine Programs; Andrew Gerakas, DPED; Richard Grigg, UH Department of Oceanography; John C. Hance, AMFAC Inc.; Philip Helfrich, HIMB; Frank J. Hester, National Marine Fisheries Service Area Director; Charles L. Bretschneider, UH Department of Ocean Engineering; Richard Marland, Office of Environmental Quality Control; M. Scott McLeod, Hawaiian Tuna Packers; Ralph A. Patterson, Kentron Hawaii, Ltd.; George Wilkins, NUC; and George P. Woollard, Director of the Hawaii Institute of Geophysics.

(Continued in column 2.)

UH Will Have Task Force On Coastal Issues

Members of the University community who have professional interest and expertise in the field of coastal zone planning are prepared to organize a task force to formulate a position on coastal issues in Hawaii. At a January 18 seminar the implications of recent federal and state activities in this area were reviewed.

The National Coastal Zone Management Act passed by Congress last October authorized, but did not appropriate funds to assist the states in coastal planning. Although Hawaii was the first state to pass a land-use law which centralized the planning function in a state agency, it has not yet formulated a comprehensive policy for coastal zone planning and its management.

Governor Burns has charged the Department of Planning and Economic Development with the task of implementing the provisions of the federal coastal zone measure, and has urged that agency to utilize the University of Hawaii and its advisory services in developing a coastal zone plan. The January seminar, coordinated by Justin Rutka, UH Sea Grant Advisory Specialist, and George Sheets of the Center for Engineering Research, covered several aspects of the coastal zone management problem. Participants highlighted the following points:

- Land use and coastal zone policy formation ought not to be separate and competing entities. The two functions should be synchronized.
- The State of Hawaii should develop its own plan.
- The new federal act provides that states should set up mechanisms to regulate land uses having a significant impact on the quality of coastal waters. Water quality standards could be considered in planning for the coastal zone.

(Continued in column 2.)

The group decided on two courses of action. During the current session of the State Legislature, this ad hoc group will follow legislative developments and will be available to answer questions on various aspects of coastal planning. The Department of Ocean Engineering has expertise in coastal and harbor engineering and in coastal circulation and water quality. Members of the Department have been involved in beach erosion and beach protection studies, studies on estuaries (tidal flow, salinity profile, sedimentation), studies on water quality and circulation studies, and studies regarding the effects of dredging operations on the coastal environment. Other disciplines represented in this ad hoc group include experts in water resources and water quality, marine biologists (ecologists), sedimentologists (geologists), economists (shoreline use), and experts in legal matters.

The long-term plan is to establish a broadly-based task force including all those who are interested in coastal zone problems. This group will arrange informal seminars whereby specialists in the aforementioned disciplines will present their views on relevant problems. It is expected that such seminars will provide a general body of knowledge which can assist the State in formulating a coastal zone plan.

Zoology Seminars Announced

Two zoology seminars are scheduled for early February on the UH Manoa campus. Dr. Tsuneo Tomita will speak on "Light-Induced Response in Vertebrate Photoreceptors and Postsynaptic Neurons" at 3 p.m. on Thursday, February 8, in St. John Laboratory Room 011. Dr. Tomita is a physiology professor at Keio University School of Medicine, Tokyo.

Dr. Frank Carey of Woods Hole Oceanographic Institution will speak on warm-blooded fish at 3:30 p.m. on Friday, February 9, also in St. John Laboratory Room 011.

ECOPUSH (continued)

The seminar format has been followed, with participants selected from citizen groups, government, education, industry, the public and private business sectors. A conference chairman and planning committee was established for each of the six conferences, and it is anticipated that the interaction developed between the various sectors during the planning and implementation of the program will continue to provide an effective force in the community long after the close of a particular seminar. Each conference also has been encouraged to develop recommendations or resolutions to submit to the appropriate governmental agencies to reflect the considered viewpoint of an informed segment of the public.

Co-directors of the ECOPUSH conference series are George Sheets (CER), John W. Shupe, Dean of the UH College of Engineering, and Robert M. Kamins, who is a professor of economics on the UH Manoa campus. The conferences and their chairmen are as follows:

- | | |
|--------------------|---|
| Jan. 27-28
1972 | Solid Waste Recycling
George Sheets, CER,
Chairman |
| Nov. 9-10
1972 | Aquaculture
Eugene Grabbe, DPED,
Chairman |
| Jan. 11-12
1973 | The Public Cost of Private
Development
Tom Creighton, Citizens
for Hawaii,
Chairman |
| Mar. 8-9
1973 | Hawaii's Ocean: The Lost
Frontier,
John P. Craven, Marine
Programs,
Chairman |
| Apr. 12-13
1973 | Energy, The Ultimate
Environmental Problem?
Doak Cox, Env. Center,
Chairman |
| May 17-18
1973 | Fresh Air, Pure Water
- What's the Cost,
Who Should Pay?
Robert Kamins, Econ. Dept.,
Chairman |

Miller to Speak (continued)

The overall purpose of the University of Hawaii larval fish research project has been to determine the extent to which the inshore marine environment is utilized as nursery grounds by marine fishes. Owing to the primitive state of larval fish knowledge -- fewer than 5% of the 580 species of Hawaiian fish larvae had been described -- much effort was expended to learn their identity. To identify a larval state, a size series must be assembled from collections (or reared from eggs) which includes identifiable juveniles.

To date, 210 kinds of larvae have been identified. Although fewer than half of the Hawaiian species are now known, these include most of the common inshore larvae. For example, 89% of the larvae taken off Kauai in January of 1971 could be identified.

In Year 04 approximately 300 collections of fish larvae were made in winter and summer off Kauai, Maui, Oahu, and Lanai. Inshore habitats samples (28 in all) ranged from pristine waters to sewage outfalls such as the one off Sand-Island, Oahu. Included were waters receiving all major types of effluents, as well as harbors.

In addition to fish larvae, the same number of zooplankton samples were taken. Zooplankton are the food of virtually every marine animal at some stage in its life history, and they include the larval stages of all the commercially important invertebrates, e.g. crabs, clams, and shrimp. Owing to their small size and relatively poor mobility, both larval fishes and zooplankton were expected to show adverse effects of stress in inshore waters, even more than adults. Such proved to be the case. On Kauai, for example, numbers of larval fish species and individuals ranged from 245 individuals of 18 species per 1000 m³ of water at Anahola Bay (unstressed) to 4 individuals of 3 species per 1000 m³ at nearby Nawiliwili Harbor. On Maui, at La Perouse Bay and Kahului Harbor, cor-

(Continued on page 5.)

Miller to Speak (continued)

responding numbers were 326 larvae of 42 species and 3 larvae of 1 species, respectively.

Numbers of both individuals and species were significantly higher at leeward stations than windward; a stress seemed to have proportionately larger depressing effect on windward habitats. These observations have serious implications concerning locations of new outfalls.

Zooplankton volumes showed similar, but less predictable, patterns in relation to stress. Values ranged from 7 grams per 1000 m³ at Nawiliwili to 84 grams per 1000 m³ at Kalalau, Kauai.

Twelve transects of Kaneohe Bay have been sampled over the past year. These data show responses to stress on a smaller scale. South Kaneohe Bay is stressed, while the Northern Bay is not. Four patterns of fish larvae were evident: (1) high density in the south with diminished number northward; (2) the reverse of (1); (3) high densities near reefs; no north-south gradient; and (4) no significant pattern throughout the Bay. Fish larvae of about 90 species were classified according to apparent response. In addition to these four patterns, some species were taken primarily in the vicinity of import routes (e.g. Sampan Channel) into the Bay. Evidently these latter species do not breed in the Bay.

Species exemplifying pattern 1 apparently thrive in stressed waters. These species would be expected to increase in numbers when stress is applied to their habitat. It may also be inferred that these species would respond favorably to culture, since culture media are not unlike organically stressed (nutrient-rich) natural waters. In contrast, species representing pattern 2 are expected to be most adversely affected (depressed in numbers) by stress. Unfortunately, many of the "valuable" species are in this category. Species of patterns 3 and 4 should be relatively unaffected by

stress -- at least within the stress range in Kaneohe Bay. The data from bays other than Kaneohe Bay are at best suggestive, being based on winter and summer samples only. Many of the locations were inadequately sampled; variation between replicate samples was high.

It does seem safe to conclude that both fish larvae and zooplankton show depressed diversity and numbers with stress. Further elucidation of these responses would be possible only with additional data on seasonal abundance. Considering the rapid development of Hawaii's shorelines, and the fact that the inshore fishes alone are worth at least \$1,000,000 annually to the State, the utility of these inshore nursery grounds should be determined.

Surprising numbers of larvae of extremely deep-water species were taken inshore. These kinds of larvae are being explored as possible indicators of high water quality due to offshore currents. As such, they may prove good biological indicators of areas where effluent will be rapidly dispersed.

The occurrence of offshore larvae in virtually all the inshore habitats sampled further shows the uniqueness of Hawaii's inshore environment. The residence times of waters adjacent to shorelines are very short compared with large mainland estuaries. This fact makes it important to consider the mobility of planktons and fish larvae between bays. A fish larva may, during the course of its development (2 - 4 weeks), be swept into many bays each with its own stress.

Miller's Sea Grant project has received endorsement by two State of Hawaii agencies: the Division of Fish and Game and the Office of Environmental Quality Control, and by the Kauai County Planning Commission.

A manuscript on the development of *Caranx mate* and another describing the Kaneohe Bay sampling system have been completed and accepted for publication.

Tomsky Leaving for North Sea Job

Jackson Tomsky, a diving instructor at Leeward Community College and special assistant to UH Dean of Marine Programs John P. Craven, will be leaving the University at the end of February. Tomsky has accepted a position in Europe with J. Ray McDermott, an ocean engineering firm which specializes in providing services to the offshore oil industry.

The company reportedly has a contract to lay 70 miles of 36-inch pipe in the North Sea, at depths of 200 to 304 feet. The firm will employ the latest saturation diving techniques, and Tomsky's position will be that of Superintendent of Diving.

The Tomskys will make their home in Brussels, Belgium.



THE KEEL ROW

The KANA KEOKI

...left Tahiti January 20 on Leg 3 of her current voyage, under chief scientist John F. Campbell (HIG). The ship is on its way to Guyaquil. The scientific party aboard is engaged in seafloor assessment, under sponsorship of the International Decade of Ocean Exploration (IDOE). Later this month Loren W. Kroenke (HIG) will take over as chief scientist, on an NSF-sponsored leg.

The TERITU

...has been engaged in short cruises in Hawaiian waters. On January 24 and 25 a party under chief scientist Robert R. Harvey (HIG) launched two electric field recorders. During the first week of February a team working under chief scientist Richard E. Young will perform mid-water trawls off leeward Oahu.

THE KEEL ROW (continued)

The TOWNSEND CROMWELL

...left Kewalo Basin January 26 on a cruise to the central Pacific. Scientists aboard the National Marine Fisheries Service vessel are bound for the Line Islands to examine the oceanic wakes created by Christmas and Fanning Islands. This is the second of two cruises whose major missions have been to determine how the wake flow affects the distribution and abundance of plants and animals in the surface waters, with particular emphasis on tunas and tuna larvae.

Studies made in the area last August and September showed marine life to be present in the island wake area at a density 5 to 10 times greater than found in the open ocean.

Activities will include physical oceanographic data-collecting, using a salinity-temperature-depth recorder and Nansen casts, longline fishing and trolling for tunas, plankton tows, mid-water trawl hauls, and the collecting of reef and bottom organisms for comparison with animals caught at sea.

Near Christmas Island drifting buoys will be released and tracked for 10 days and drift bottles will be released, as part of a study of surface currents in the vicinity of Fanning and Christmas.

Included in the field party of seven are Mss. Beatrice Burch, formerly with the sorting center of the Smithsonian Institution, and Mary Lynne Godfrey, who is making her first cruise after 22 years on the scientific staff of the NMFS Honolulu Laboratory. TOWNSEND CROMWELL made news in 1964 when the first woman sailed as a member of a scientific field party. Since then women have sailed regularly as field party members.

Cruise leader on the CROMWELL is fishery biologist Everet C. Jones. The NOAA ship is expected to return to Honolulu around March 4.

MOP NEWS

On a recent Kamalii o Kai orientation cruise aboard the R/V TERITU, students from Mid-Pacific Institute, McKinley High School, St. Louis High School, Damien High School, and Farrington High School expressed enthusiastic interest in a proposed lecture-tour of Sea Life, Incorporated's facilities and a marine science floating laboratory.

Ian Bund, President of Sea Life, Incorporated, then met with Marine Option Program students Joan Matsuzaki, JoAnne Kushima, and Alan Hong to discuss the proposed activities. From their meetings, a program for 50 to 100 students per visit has been set up. Tentatively, tours of Sea Life Park, Oceanic Foundation, and Makai Range are to be followed by lectures and films.

During or after each series of four visits, students will be encouraged to participate through an essay and photography contest. Each student will be charged a nominal fee of \$2.50, which will cover all visits and give access to Sea Life Park for a full year. From these and other passes sold through Kam Kai, 50¢ will be set aside in a special fund to support Kam Kai activities.

Bund and Ed Shallenberger would also like to have MOP students working on the State of Hawaii Marine Programs Exhibit, so that a State of Hawaii Marine Resources Exhibit can be developed for educational purposes.

If the University of Hawaii is able to obtain the facilities for a floating laboratory, it will be similar to the Orange County Marine Science Floating Lab. Students will have had exposure to the ocean through in-class study prior to boarding. On board, they will learn and help in the correct operation of equipment used in oceanographic studies and the identification of marine life.

A study that could possibly be run in a floating lab was carried out on the TERITU in January, when students and an instructor from Hawaii Preparatory Academy collected and studied mesopelagic organisms and environmental factors affecting their distribution.

Kam Kai is also working with students and teachers from Waialua High School, St. Francis, Sacred Hearts Academy, and Kaimuki High School on an oceanography camp to be held March 30 through April 1. Tentative plans include a tour of the Hawaii Institute of Marine Biology's facilities on Coconut Island, near-shore exploration, snorkeling in Kaneohe Bay, and a slide show on visitor impact.

For Marine Option Program students working at the Naval Underseas Center, Dr. Ross Pepper of NUC will give a course, beginning March 1, on marine mammals, their taxonomy, their morphology, care and handling, and training. This marine mammals course may be developed into a regular University of Hawaii course.



NEW SEA GRANT PUBLICATIONS

In production:

Directory of Marine-Related Activities in the State of Hawaii, 1973 Edition (UNIHI-SEAGRANT-MS-73-01).

Spheres of Influence in Hawaii's Coastal Zone, Vol. I: Federal Agency Involvement (UNIHI-SEAGRANT-AR-72-03). Justin Rutka and Chennat Gopalakrishnan.

Medical Measures in Diving Accidents (Chart, 2 sides).

In press:

Hawaii Fish 'n Facts Information Sheet Number 169: *Sport Fishermen's Guide to Holding and Freezing Fish*. Kirby Hayes, William Schumacher, and Curtis Wilder.

Atlas of Kaneohe Bay: A Reef Ecosystem Under Stress (UNIHI-SEAGRANT-TR-72-01). Stephen V. Smith, Keith E. Chave, and Dennis T.O. Kam.

In print:

Erosion and Accretion of Selected Hawaiian Beaches, 1962 - 1972 (UNIHI-SEAGRANT-TR-72-02). J. F. Campbell. viii + 23 pp.

In print (continued)

Longer Life for Nehu. Wayne Baldwin, Jeanette Struhsaker, and Gerald Akiyama (UNIHI-SEAGRANT-MS-71-01A). 24 pp.

Hawaiian Shallow Marine Sand Inventory: Part 1. Introduction and Part 2. Ahu o Laka Sand Deposit, Kaneohe Bay, Oahu (SEAGRANT 69-1. Also Hig-69-10). Ralph Moberly, Jr. and J. Frisbee Campbell. 24 pp. Re-issued.

Economics and Market Potential of the Precious Coral Industry in Hawaii (UNIHI-SEAGRANT-AR-71-03). Kok-Kian Poh. 22 pp. Second Printing.

Hawaii Fish 'n Facts Information Sheets Number 166, 167, and 168: *Why Fish Spoil, Coming, the Wholesome Fish Act, and Fish Smoking and Drying by the Sportsman*. Kirby Hayes, William Schumacher and Curtis Wilder.

Costs and Earnings of Tuna Vessels in Hawaii (UNIHI-SEAGRANT-AR-72-01). Abu Ekram Ahsan, John L. Ball, Jr., Jack R. Davidsoh. 22 pp.

A Preliminary Study of Ocean Waves in the Hawaiian Area (SEAGRANT 69-2. Also Hig-69-16). Francis P. Ho and Lynn A. Sherretz. 36 pp. Re-issued.




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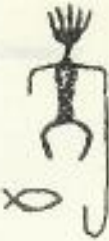
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COASTAL ZONE COMMUNIQUÉ



Sea Grant Programs
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Communiqué No. 7 February 26, 1973

Justin Rutka, Advisory Specialist

Although the Coastal Zone Management Act of 1972 (PL 92-583;S.3507) was signed into law October 27 by President Nixon, it was accompanied with a note of reservation:

"S. 3507 recognizes the need for carefully planned, comprehensive management programs to ensure the most rational and beneficial use of the coastal zones. This bill also recognizes that the States can usually be the most effective regulators of such a planning process. I will instruct the Secretary of Commerce to carry out this statute in a way which focuses Federal efforts on the adequacy of State processes rather than to become involved in the merits of particular land use decisions.

"But the coastal zones are not the only areas which need this sort of long-range attention. This is why I proposed to the Congress in February of 1971 the National Land Use Policy Act -- a bill which would help the States establish management programs for a wide range of areas which are of critical environmental concern. It is my strong hope that the next Congress will expand on the coastal zone bill which was passed this fall by approving my National Land Use Policy Act. I signed S. 3507, then, as an important first step toward a more comprehensive program.

"S. 3507 locates administrative responsibility for this program in the Department of Commerce rather than in the Department of the Interior as I would have preferred -- and as I called for in my proposed Land Use Policy Act. This action is not sufficient reason in my judgement for vetoing the bill, but it does underscore once again the importance of creating a new Department of Natural Resources, as I have recommended, so that we can reverse the trend toward the fragmentation and fractionalization of Federal programs and begin to coordinate our environmental efforts more effectively."

Between the 91st and 92nd Congress, the Nixon Administration became convinced that a more broadly-based national land use policy was not only desirable but essential for effective planning because of the interrelation of the hinterland to the coastal zone. On May 8, 1971, Russell E. Train, Chairman of the Council on Environmental Quality, advised the U.S. Senate Commerce Subcommittee on Oceans and Atmosphere that:

"The Administration is sensitive to the concern of this Committee that the issue of coastal zone management be given priority attention. We are likewise concerned that the States not complicate their reform of land use law by creating separate institutions over the coastal zone which might later compete with and complicate the ability of the States to address the total problems of land use planning and regulation within their borders. Certainly, the signs around us are unmistakable that States are now more willing to approach the land use regulatory issues on a broader basis . . ."

This note, coupled with President Nixon's guarded message, indicates that fundamental differences of approach (land use versus coastal zone management) still remain. The National Land Use Policy Act, currently under consideration, lists coastal wetlands as the first among "areas of critical environmental concern" which are to receive priority attention. Just exactly how this duplication of emphasis between the Coastal Zone Management and pending national land use legislation will be finally resolved is impossible to predict. However, there are indications that the guidelines approach to coastal zone planning can be accomplished along with a land management approach.

The Conference Committee Report accompanying S.3507 stated: ". . . what the Congress (Senate and House) agreed upon was basically a water-related coastal zone program administered by the Secretary of Commerce with required full coordination with an concurrence of the Secretary of Interior. This compromise recognizes the need for making coastal zone management fully compatible with national land use policy, while making use of the special competence of the National Oceanic and Atmospheric Administration in the Department of Commerce in managing the nation's coastal areas." The language adopted by the Conference Committee made it clear that "the (inland) coastal zone has been limited to those lands which have a direct and significant impact upon coastal waters," with the implication that, under this act states should set up institutional mechanisms to regulate only those land uses that have a significant impact on the quality of coastal waters.

While most mainland coastal states have enacted coastal zone legislation similar to the national Act, Hawaii has waited for Washington to move first and has not yet formulated a policy in this area. On the other hand Hawaii, was the first state in the country to pass a land use law which centralized the planning function in a state agency, almost a decade before the initial inception of the National Land Use Policy Act designed to induce other states to adopt somewhat similar measures.

Given the above political realities, Marc Hershman suggests that by designing and utilizing dynamic water quality laws, a management strategy can perhaps be devised for dealing with many, but not all, coastal resource-use problems. Some difficulties, however, are inherent in the implementation and applicability of the author's proposals. Nevertheless, from the conceptual standpoint, the author's ideas merit consideration. This is especially so since the State Department of Health is in process of developing revisions of Chapter 37-A, Water Quality Standards, of the Public Health Regulations.

WATER QUALITY LAWS AS A COASTAL ZONE MANAGEMENT TOOL*

Marc J. Hershman⁺

The proposition I would like to offer is that current state water quality laws and water pollution abatement laws can be the fundamental tool for effectuating coastal zone management objectives if 1) current state laws are expanded to include what I call dynamic water quality concepts; and 2) that these dynamic water quality concepts be translated into water management standards for particular geographical areas in accordance with agreed upon coastal zone management objectives.

Before explaining how state laws governing water quality should be expanded or amplified for coastal zone management purposes, there are a few points I would like to stress regarding why I chose to focus on water quality laws and what some of the prerequisites are before any coastal zone management programs can begin.

Most federal bills for coastal zone management¹ or land use policy² focus on both planning and management for the coastal zone but provide very few guidelines. They express what overall objectives should be achieved by planning and management. They give overview authority to the secretary administering the act. They encourage the adoption of implementing laws, regulations and institutional reorganization, but do not require these. Even the administration's land use bill, the most explicit on state organization; leaves a great deal of latitude to the states. Hence, the main purpose of the federal coastal zone management program will be to provide money to assist state programs. If states formulate their own program so as to achieve objectives of the Federal bills, this probably means that existing state agencies and programs will be expanded and redirected for coastal zone management purposes, rather than a wholly new approach adopted, such as a coastal zone authority suggested by the Stratton Commission Report.³

From the perspective of individual states, since such coastal zone management has already been performed (in fields of living resources, recreation, mineral production, etc.), there will be strong pressure from the states not to reorganize but to rely on existing agencies and personnel. Many states will argue that what they have done is the best approach, and will argue that it needs augmentation rather than a complete overhaul. This may be the best approach in coastal zone management. It would cause the least turmoil, and it would cost the least. Existing institutions may be able to do the job as well as any new ones created. Even if states choose to adopt a new law and a new agency, they will probably pattern the new group after old groups and use the same personnel.

Before describing how state level water quality laws and institutions can do the coastal zone management job, let us ask the question of whether water control laws or land-use laws are most suited for coastal zone management.

Coastal states are experimenting with a variety of land use controls for effectuating coastal zone management objectives. Many coastal zone management commentators foresee some sort of planning and zoning modeled after the urban environment. Some states have instituted wetlands conservation laws, requiring permits for uses of wetlands or marshlands, which is a type of zoning. Other land use laws include: Site selection laws (Maine), land use commissions (Hawaii), land purchase programs (New Jersey), and public management leases for wildlife and recreation programs, such as in Louisiana.

*Early draft paper presented at the second annual meeting of the Coastal States Organization, Seattle Washington, July 30, 1971.

⁺Research Director, Coastal Resources Law Sea Grant Legal Program, Louisiana State University Law Center, Baton Rouge, Louisiana 70803.

¹Coastal Zone Management Act of 1972, PL 92-583.

²S.632, 92nd Congress, 2nd Session, "Land Use Policy and Planning Assistance Act of 1972," pending adoption; introduced by Senator Jackson.

³Commission on Marine Science, Engineering and Resources (CMSER), Volume 1, *Science and Environment* (Washington, D.C.: U.S. Government Printing Office, February 1969). CMSER is popularly known as the Stratton Commission, after Julius A. Stratton, Chairman of the numerous task groups comprising the Commission body.

In considering regulation of land use, the following types of legal arguments and problems are raised which impede operation of a regulatory program: 1) that the private landowner can do what he wants with his land; 2) that the regulation constitutes a taking of private property for which compensation should be paid. Once land-use laws are enacted they normally contain grandfather clauses and other exclusionary clauses all of which tend to undermine the reasons advanced for having the land-use law in the first place. Unless the money is available for eminent domain proceedings with respect to areas critical for coastal zone management objectives, these issues are going to be in the courts for a number of years, with a resulting delay in any effective regulatory programs.

If we switch our attention from the land and laws which regulate the use to which the land may be put, and focus attention on the water which is adjacent to that land, under it, over it, and perhaps distributed through the surface layers of the land, we may be able to achieve the same regulation of use, but link that regulation to a water quality or water management standard.

Protecting water and insuring its availability has long been a basic concern of government. Federally, there is a navigational servitude and the many spin-off federal programs based on the navigational servitude. At state and local levels, the police power has long been applied to water supply and water protection because of its intimate association with the public's health and welfare. Recently, the public trust doctrine has been dusted off to insure that the state acts with the total public in mind in dealing with common resources. Many states have an appropriation scheme regulating water rights. Water conservation laws, water supply districts, and many other state and local institutions are available to control water.⁴ Hence there is a fairly firm grip on the resource by government -- a much firmer grip than there is on land as a resource.

Since coastal areas are so intimately associated with water, I suggest that water controls could be a better tool for coastal zone management than land controls: 1) the sanctity of private property argument is avoided; 2) we already have fairly sophisticated water control laws which can be adapted for coastal zone management; 3) the administrative apparatus associated with state water control laws can be adapted for coastal zone management purposes; 4) state water quality agencies tend to be more centralized in state government thus avoiding the problems of local pressures inherent in zoning issues; 5) the federal navigational servitude and the resulting permit programs of the Corps of Engineers (to be discussed in more detail later) are available; and 6) there is greater experience and expertise in measuring water quality parameters.⁵ Hence the development of criteria for certain uses and standards for meeting coastal zone management objectives will be more precise when stated in terms of water characteristics rather than land characteristics.

Before any management tool for meeting coastal zone objectives can work, there must be a coastal zone management plan or set of objectives which the state has agreed upon. Whether water quality laws, or land use laws are ultimately chosen they are only the means by which an efficient and effective plan can be implemented. Basic decisions must be made about which areas are to be preserved, which areas are going to be used, and for what purposes those areas are going to be used. There is no simple answer to that problem. It is the issue with which most states are grappling at this moment.

Assuming that states will rely on existing institutions for coastal zone purposes, that coastal zone management objectives for specific coastal regions have been established by the state and that water quality laws provide fewer constitutional and technical obstacles than land use laws, how can water quality laws be adapted for coastal zone management use?

Water quality laws usually regulate the quantity and quality of pollutants entering or changing a water body. Louisiana's water quality statute for example, is short, simple and broadly worded but emphasizes only pollution control. Louisiana's stream control commission handles waste disposal, establishes pollution standards, and may prohibit discharges which are unreasonable. California has one of the more sophisticated water quality laws, but it is at heart a pollution control statute. Water quality control plans are required on a regional basis and enforcement is based on a violation of discharge requirements rather than proof of pollution or nuisance. Whether a statute is like California's or Louisiana's⁶, it is primarily designed to prevent pollution and is applicable to surface water, and only that surface water found in a defined surface formation called a stream, river, bay, lake, etc.

⁴See Eamon T. Morahan and Hiroshi Yamauchi: (1) *A Preliminary Survey of Public Water-Related Agencies in Hawaii*; (2) *Hawaii's System of Water Rights: An Economic Evaluation*; (3) *A Study of Water Institutions of Hawaii*; Technical Reports No's 55 (May 1972), 57 (August 1972), and 58 (August 1972), respectively; Water Resources Research Center, University of Hawaii.

⁵See Water Resources Research Center, *The Quality of Coastal Waters: First Annual Progress Report*, Technical Report No. 60, Water Resources Research Center, and Sea Grant Program No. UNIH-SEAGRANT-72-01, University of Hawaii, Honolulu, Hawaii, September 1972.

⁶For an interpretation of some provisions of the Water Quality Standards of the State of Hawaii (Public Health Regulations Chapter 37-A) see, Doak C. Cox, "A Definition: Best Practicable Treatment or Control in Hawaii Water Quality Standards," *Quality of Coastal Waters Project Bulletin*, No. 4, May 1972, Sea Grant Program--Water Resources Research Center, University of Hawaii.

I propose that dynamic water quality concepts should be added to water quality laws. Dynamic water quality concepts would define some of the natural functions of water in relation to the surface of the earth. It would define then as quality characteristics that may be preserved or used -- rather than the traditional definition of water quality in terms of what man puts in or how man changes a water body.

There are three categories of dynamic water quality characteristics: the "erode and carry" characteristic, the "water circulation" characteristic and the "water saturation" characteristic. The ability of water to erode and carry either land, decaying materials or living organisms to other areas is a water quality characteristic. For example, ocean waters and wave action have considerable impact on sand dunes, sand drift, bars, inlets, and spits along coastal waters. Sand is eroded at one place and carried to another. Further, the dynamic building up and breaking down of islands and shorelines in marsh areas is a process of water eroding at one place and building at another place. Hence, the ability of water to erode, carry, and deposit materials is subject to a degree of control and regulation by the water quality agency.

The second dynamic water quality characteristic is "water circulation" -- the direction of movement of water and its circulation patterns which are essential for salinity control in coastal areas and for maintenance of estuary ecosystems. For example, the Florida everglades and cypress swamps are maintained by water flowing in a southerly direction over the surface of the land. The water quality officials of Florida could be more involved in development vs. preservation controversies if the movement of water over the surface is defined as one of their water quality characteristics. Louisiana's marshlands are dependent upon the circulation of fresh water through the marshes which originate from a few main sources. To control these, these could be considered water quality characteristics. Finally, tidal flow has always been considered a fundamental characteristic of estuarine areas⁷, and should be defined as a water quality characteristic.

A third dynamic water quality characteristic could be referred to as degrees of water saturation in a body of surface or subsurface materials such as sand, clay, or decaying matter. Hence, marshes, tundra, aquifers, swamps, or floodplains would be included as capable of regulation under water quality laws. In this way, water quality administrative bodies could directly control dredge land operations. Since the water plays a significant role in compacting, breaking apart, moving through, or holding the surface materials together, they should all be characterized as water quality characteristics capable of regulation. Engineering criteria may be developed regarding how structures and facilities must be built to preserve essential features of the quality characteristic.

These dynamic concepts of water quality relate to the movement of water over the surface of the earth and the work it does while moving. Recently, turbidity and salinity control have been introduced as water quality tools. These are transitional concepts which begin to hint at dynamic water management.

The beauty of dynamic water quality concepts are that they are easily translated into management standards and can be applied to achieve coastal zone management objectives. One traditional management tool for water quality control is upgrading. Elkhorn Slough in Monterey Bay, California, near Moss Landing, was the subject of adversary proceedings before the California Water Quality Board. A decision in favor of upgrading resulted in preserving the area for fish and wild life resources, while de-emphasizing its use for industrial development.

Another management tool might be the identification of critical areas. When scientists establish that a particular dynamic surface process is critical for some ultimate coastal zone management objective, that area could be identified, drawn on a map or chart, and dynamic water quality criteria established to make sure that the process continues unimpeded. For example, the fresh water edge of Louisiana's marshes is a critical stage in the journey of fresh water through the marshes to the sea. The water in this edge of the marshes circulates very little, and tends to be stagnant. Hence there is little flushing action. The combination of the importance of this fresh water edge with the poor circulation could be an established dynamic water quality characteristic, with implementing engineering criteria and management standards designed to recognize the water quality characteristic. The result might be to limit construction of facilities and clearing of land adjacent to the region thus limiting waste deposits and soil erosion.

Water diversion is another management tool. The possibility of diverting fresh water into marshes and estuaries to regenerate those marshes by allowing more sediment to build up thus creating more habitat for wild life would be an especially important management tool. The management tool would be the diversion of water into those marshes which have been denied fresh water because of flood control projects developed over the last fifty years.

One very useful byproduct of expanded definitions of water quality at the state level is their usefulness in the state certification process for federal permits and licenses. Under the water quality improvement act of 1970, states must certify that the proposed project for which a federal license or permit is sought will not significantly affect applicable water quality standards. Regulations have indicated that "applicable water quality standards" include those for interstate or coastal waters under the federal water pollution control act, and state adopted water quality standards. Hence, states have a chance to apply their water quality standards for all Corps of Engineer permits (structures in navigable waters and refuse act permits), FAA permits for airport flight patterns and hence airport locations, Department of Transportation and interstate highway routes, and many others.

⁷See Doak C. Cox, *Estuarine Pollution in the State of Hawaii, Vol. 1: Statewide Study*, Technical Report No. 31, March 1970, Water Resources Research Center, University of Hawaii, Honolulu, Hawaii, 151 pp.

If dynamic water quality standards are adopted by states, these standards can be implemented and enforced by federal agencies. Over the next year or more, the United States Corps of Engineers⁶ will be issuing forty thousand or more permits for dumping into navigable waterways of the United States or their tributaries under the refuse act permit program. Hence, these Corps of Engineers permits can be conditioned by factors relating to a state's coastal zone management plans where those plans result in dynamic water quality criteria for navigable waters or tributaries.

Two very recent developments indicate that the states will still be playing the major role in establishment of standards and issuance of permits under the FWPCA and the new Refuse Act Permit Program. EPA's administrator supports a plan whereby the administration of the Refuse Act Permit Program would primarily be under EPA rather than the Corps of Engineers. EPA relies upon the states to implement water quality standards through permits and discharge requirements. Hence, states will play the primary role. Another development is that the nationwide base-level standards for liquid effluents which were to be issued for 22 basic industries have been determined incapable of direct application to specific industries by EPA's Washington Office. They have directed their regional offices to use the base-level standards in conjunction with other techniques in determining effluent specifications. Hence, EPA regional offices, in conjunction with state enforcement agencies, must make the decisions regarding permissible effluents for the 40,000 or more applicants who were to have submitted their requests for permits to the Corps by July 1, 1971. Thus, the primary focus continues to be on the states in the water quality field.

In addition to the specific requirement that states certify the effect federal permittees or licensees would have on water quality standards, under the National Coastal Zone Management Act and the administration's Land Use Bill, coordination between other federal permit programs and coastal zone management programs is required. Hence, it is almost certain that states which define their coastal zone management objectives clearly and precisely, will have the full benefit of federal assistance in implementation and enforcement.

I have proposed that water quality laws be made a basic mechanism for achieving coastal zone management objectives. Although water controls may not be applicable in some geographical areas, and strong water regulation may still raise constitutional issues in litigation arising under new or expanded statutes, I believe that the approach is constitutionally sound, one which is currently operating but in need of expansion and development, and the one most related to the coastal zone and dynamic coastal processes which provide us with the rich natural and cultural resources we wish to sustain.

* * *

A revised version of the above text by Mr. Herakman will be printed in the "Proceedings (1971) annual meeting of the Coastal States Organization" to be published by the University of Michigan Sea Grant Program. Permission to reproduce the above material in slightly edited form is gratefully acknowledged.

* * *

VIEWPOINT -- by Dr. L. Stephen Lau, Director, Water Resources Research Center

The author's concept is believed to be only partially rational and hence partially effective because the components of the coastal-environment consists of more than just water. In other words, water quality management is a necessary but not sufficient condition in coastal zone management. One may ask: Should a proposed land development in the coastal zone be approved on the sole basis that it would meet water quality criteria? Under normal circumstances, one would also look into other issues such as schools, transportation, air quality, and visual impact. All of these are not especially amenable to control or management via water.

The Quality of Coastal Waters Project has given some thought on "The Role of Coastal Water Quality in Environmental Management" as outlined in the *Quality of Coastal Waters Project Bulletin*, No. 1, February 1972, Water Resources Research Center Sea Grant Program, University of Hawaii.

* * *

Opinions of readers on the ideas expressed in this and earlier issues of the Communique would be appreciated. Space permitting, a future issue of the Communique series could be devoted exclusively to reader viewpoints.

Justin Rutka

⁶The recently passed amendments of 1972 to the Federal Water Pollution Control Act transfer the authority and responsibility for the Federal Industrial Wastewater Permit Program from the Corps of Engineers under Section 13 of the Rivers and Harbors Act of 1899, to the Environmental Protection Agency. It also provides that the administrator shall issue guidelines for effluent limitations under which permits shall be granted.

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Garrels to Speak in Moscow

UH oceanographer Robert M. Garrels, who occupies the Captain James Cook Chair of Oceanography, has accepted an invitation to speak in Moscow on March 12. Academician A.P. Vinogradov, acting on behalf of the USSR Academy of Sciences, asked Garrels to address Russian scientists at the Vernadsky Institute of the Academy. The occasion is the annual celebration of the birth of V. I. Vernadsky, a noted geochemist. Garrels is flying to Moscow as a guest of the USSR Academy of Sciences. His topic will be "Cycling of Carbon, Oxygen, and Sulfur through Geologic Time".

(Continued on page 7.)

HIG Members to Speak in Oregon

George P. Woollard, director of the Hawaii Institute of Geophysics, along with several of his colleagues, will be traveling to Oregon State University this month to attend the annual meeting of the Geological Society of America. Woollard's team will present papers dealing with various aspects of the NASCA plate at the four-day conference beginning March 22. Among those to speak are: John Rose, on gravitational properties of the NASCA plate; Ralph Moberly, stratigraphic properties of the NASCA plate; and Alex Melahoff, magnetism associated with the NASCA plate.

The membership of the conference is expected to represent most of the geophysicists conducting research in the Western states.

Meeting Set on Hawaii's Ocean Frontier

UH Engineering Dean John W. Shupe will offer introductory remarks when a conference in the ECOPUSH environmental series convenes March 8 in the Cleghorn Room of the Princess Kaiulani Hotel. Theme of the two-day meet will be "The Ocean: Hawaii's Lost Frontier?"

Several other UH research and instructional staff members are scheduled to speak at the conference, including Richard Grigg (oceanography), Ben Finney (anthropology), Gavan Daws (history), Garth Murphy (oceanography), Stephen Lau (Water Resources Research Center), John P. Craven (Marine Programs), and John E. Bardach (Hawaii Institute of Marine Biology). Speakers from industry, the Hawaii State Government, and the private sector are also scheduled.

Shupe is a co-director of the ECOPUSH conference series, along with George Sheets (Center for Engineering Research) and Robert M. Kamins (economics). Public participation is invited, and information may be obtained from David Harada or Billie Jean Paschal at 944-8788.

Wrasse Research Expanded

George Losey (zoology) will return to Hawaii about March 15, after spending two weeks observing deep-water cleaner fish in Puerto Rican waters. Losey spent several days training at PRINUL -- at the Puerto Rico Inter-National Undersea Laboratory -- before going down in the submersible "La Chalupa" for his ocean-bottom research.

(Continued on page 7.)

NEW DIRECTIONS IN HAWAII'S FISHERIES

By John Ball, Jr., Acting Coordinator, Sea Grant Advisory Services

The current session of the legislature has before it a number of marine-related issues. Several matters are the outcome of Sea Grant work and expanding capability within the areas of research, advisory services, and education.

One focal point is the future of the fishing industry in Hawaii. Three House Resolutions, HR-30, HR-39, and HCR-8, ask for direct input to planning and implementation of improvements and modernization of existing fisheries. This input is to come from the State of Hawaii Division of Fish and Game and the Marine Programs Office as well as the Sea Grant Program.

The position of Hawaii's fishing industry is unique to our state and an understanding of its full range is helpful in deciding public policy. Some of these issues and a possible course of action are discussed below. The text is taken from testimony prepared for the House Committee on Water, Land Use, and Development.

First, skipjack tuna do apparently represent an underexploited, migrating resource which shows a definite seasonal pattern in abundance. The traditional method of catching skipjack tuna has not managed to pay the wages and returns to investment that would attract replacements to those resources leaving the fishery, much less cause an expansion in capacity. The one exception to the second statement is the ANELA. This new vessel was built with a loan from the State's Division of Fish and Game; her catch rates and annual performance should be of considerable interest to the Legislature, as it seeks ways of expanding the economic base of the State.

Part of the skipjack catch and most of the other fish caught in the State are consumed fresh, dried, or smoked. One can say that this represents the highest value nutritionally and therefore economically, and that the aesthetic and recreational qualities of much of the State's fishing are significant. Therefore, if we take an overall look at

the resources, we should be concerned with the full range of activity, from commercial and quasi-commercial to sports and recreational fishing. All these groups land fish with food value, and purchase vessels and consume supplies which have significant multiplier effects in other segments of the economy.

However, if we choose to confine ourselves to that range of fishing which has direct and primarily economic importance to the fisherman, the question at hand is one of adopting and/or developing new technologies which are within the ability of the State to demonstrate and the fishing industry to use.

Testing and proving out yet-untried, large-scale technologies for skipjack tuna -- such as purse-seines -- are, at this point, beyond the financial resources of the State. However, the situation is different for the small-boat fisheries that depend on the in-shore and bottom-fish resources, as well as the tunas. A small investment by the State will yield reasonable returns in technology which will be picked up quite quickly by the industry. A possible action mechanism is outlined below.

The Advisory Services Program within the Sea Grant at the University has, as one of its principal missions, the delivery of information and new technology to marine users. The other principal mission is to get problems in the marine field back to the resource people who might solve them. In other words, we are the marine equivalent of the agricultural extension service.

The overall Sea Grant Program also sponsors applied-research programs and educational projects. These change from year to year in response to new needs. For example, in the fisheries area, researchers are proposing to do several projects which have to do with bait, kona crabs, and planning new fisheries programs (from a biological point of view).

(Continued on page 3.)

In the Advisory Services Program we have settled on a program of subject-matter specialists who, in the past, have been assigned to the areas of coastal zone management, ocean engineering, and special projects in recreation and other areas. We have not had the resources to put together a complete fisheries advisory program at the University.

If this is an area of sufficiently high State priority, here is a mechanism for accomplishing this kind of work in the Sea Grant Advisory Services. A small investment in people and gear would enable a quick up-dating of our fisheries. There are two sources of information and consultation which we would be able to tap, through our regional Pacific Sea Grant Advisory Program (PASGAP).

The first is a very aggressive small-boat program housed at Oregon State University. They have a good number of improvements that have already had quite an impact on their comparative modern fisheries. We have the ability to tap these resources on a consulting basis, through our regional program.

Secondly, and more importantly, members of this group at Oregon State University have been called upon to develop small boats and fisheries methods for two tropical Pacific areas. The first project was in American Samoa; the second, on Ponape in the Trust Territory, is currently under way. A good amount of developmental work that has an application in Hawaiian fisheries will have been done by the end of the Ponape project.

In summary, the Advisory Services Program within the Sea Grant Program at the University of Hawaii is set up to do marine extension work. While we lack the necessary in-house resources to man a program in fisheries, there is an existing mechanism set up to provide for regional consultation. An input of funds from the State could allow the program to draw upon experience gained in the small-boat projects in Samoa and Ponape,

as well as upon the existing expertise of the west coast. The Sea Grant Program at the University of Hawaii is carrying on research work in fisheries and is proposing to study the various aspects of a number of fishery resources--in the next proposal to the National Sea Grant Office.

SSRS Featured at Oceaneering Meeting

Two UH Sea Grant researchers journeyed to San Juan, Puerto Rico, last month to present papers at the First Carribbean Oceaneering Conference. They were Frederick Casciano, designer of the Sea Grant funded Submarine Sand Recovery System (SSRS), traveling on Sea Grant funds, and Irving Swatzburg, a research aide supported by the Marine Programs Office. Casciano's paper, entitled "Development of an SSRS for Hawaii", emphasized the commercial prospects of his hydraulic sand-mining system. Swatzburg's paper was titled "Cueing Strategy for an At-Sea Maintenance Facility".

The conference theme concerned ways of exploiting the ocean's resources, in order "...to yield a direct return on time, money, and political resources; by individuals, private business, and government agencies and institutions." Most of the scientists in attendance represented South American and Carribbean nations. According to Swatzburg, "Among the South American countries represented, Venezuela and Brazil demonstrated the greatest potential in ocean resource exploration and exploitation activities."

Swatzburg indicated that many attendees at the Puerto Rico conference expressed interest in the functioning of the Hawaii SSRS. The system has captured wide-spread attention since the testing of the full-scale prototype in December. Procedures for patenting the device have been initiated.

Another Carribbean Oceaneering Conference is tentatively planned for Puerto Rico in 1975.

Pacific Groups Using OSIC

The Ocean Science Information Center at the UH Hamilton Library has expanded the services it provides to marine science investigators and organizations in the Pacific. OSIC director Barbara Tillett during a January trip to Washington, D.C. made final arrangements with NOAA's Environmental Science Information Center (Environmental Data Service) to increase the number of computerized literature searches available through OSIC.

Regular information services have also been expanded to serve additional NOAA agencies and Sea Grant recipients in the Pacific. Requests are currently being received from Japan, Australia, Palau, Ponape, and Fiji.

FISH DO IT TOO!

EVERYTHING YOU EVER WANTED TO KNOW ABOUT THE BEHAVIOR OF LOCAL FISHES BUT WERE AFRAID TO ASK

An infrequent visitor to coral reefs offers here his own subjective review of the book, *Hawaiian Reef Animals* by Edmund S. Hobson and E.H. Chave (1972. Honolulu: The University Press of Hawaii. 135 pp).

In what must be one of the most striking Hawaii nature books of this or any other year, Dr. Hobson, a fishery research biologist and photographer, and Dr. Chave, a tropical marine animal ecologist, have put in tandem their impressive talents to present a carefully selected cross-section of Hawaiian reef animals. At once a masterful blend of natural history and Hawaiiana, a narrative of exceptionally interesting tidbits of information and precautionary hints to the novice snorkler and scuba diver, and a potpourri of gorgeous, close-up photographs of reef dwellers in their natural settings, *Hawaiian Reef Animals* is sure to delight almost all readers. Deliberately avoiding wasting the layman's time on multipaged taxonomic details, Hobson and Chave have scored a first in raising the reader's familiarity with reef life.

Mystics will learn that the foul odor of palani (surgeonfish) can be attributed to the legendary Ke'emalu who lost control and urinated on the back of a helpful palani. Sunburned mamas from the mainland will be tickled to relate to their rotund spouses that they caught a glimpse of the elusive *Forcipiger longirostris* -- an honor previously shared by the one and only Captain Cook. Having carefully read the section on butterflyfishes, their husbands will smugly retort: "What you probably saw, dear, was a *Forcipiger flavissimus* (a common butterflyfish) and not a *F. longirostris*." Dieticians will be enthralled to learn that the uhu's frequent defecating probably results from ingesting bits of rock fragments while grazing on algae off the surfaces of rocks and dead coral. Fine-mashed, homogenized coral may one day be merchandized as laxative capsules under a copyrighted brand name, "Uhu-Uhah". Marriage counselors will be able to advise their snorkler clients that when they spot two uhu rubbing their snouts, "it is time to stow (their) gear and return home, where an unfaithful wife need(s) punishing." Even in these enlightened days, so-called "deviants" have been frequently charged with rudely upsetting social conventions; they will find justification in that sex switches of wrasses and parrotfishes are probably a behavioral norm. Using Darwinian evolutionary logic, they may now argue that what is true for some fishes may in fact be true for some people.

Such samples make for extremely pleasurable reading. And there is more, much more! If you have invited 50 guests to a Saturday luau and can't find a pig, no need to worry. Simply go down to the Chinatown fish market and haggle for a bucket of scrumptious kumu or other "sea pigs" which can be justifiably served as near-perfect substitutes. If you have somehow wronged the gods and feel that you must sacrifice your wife or girl friend for appeasement, no worry! Sacrifice a red weke (goatfish); it will do just fine. If you happen to be a haole, sacrifice an aholehole (silver perch) instead. If you're a night-tripper who desires a mind-blowing experience, eat a

(Continued on page 5.)

FISH DO IT TOO ! (Continued)

weke pahulu, preferably caught off the islands of Kauai or Molokai during the summer months. Hallucinations or morbid nightmares are what you may get. And be prepared to awake with a case of acute depression. Does your pregnant wife crave eating a hilu (a certain wrasse)? If so, chances are excellent that she will give birth to a quiet, dignified child, perhaps destined to become a governor.

Not all of Dr. Hobson's text is of "Alice-in-Wonderland" vintage. Meticulously chosen information on ecological realities provide a perfect blend. An encounter with a tiger shark is no moment for levity, but a picture of this infrequent reef visitor is conspicuously lacking. Not all prominent eels on the reef are gluttonous morays; relatively docile white eels can be readily viewed by those brave enough to try night diving. Ever have a tiny yellow papio take up station directly in front of your face mask? Ever wonder why? This weird behavior is succinctly explained on page 26.

And this brings me to the shortcomings of the book. Pity the shore fisherman or diver interested in gamefish and foodfish, for here is one group of readers that may be disappointed. The photograph and accompanying narrative of the single ulua (blue jack) will be viewed and read time and time again for lack of fair representation of other game species. Whatever became of the other uluas and papios, the uku, the oio (bonefish), the omaka, the barracuda, the mullet, the awaawa (ladyfish), the moi, akule, and opelu that were glaringly absent? Perhaps the relatively drab colorations of these species make for less striking photographs? Were these fishes too elusive for Dr. Hobson's close-up lens? Or are they overfished and nowhere to be found? (Rumor has it that desperate fishermen have been placing offerings at Ko'as (fishing shrines) but to no avail. They have been coming home empty-handed. Should offerings of a different kind be placed before the Fish and Game heiau, the temple of the new religion, to assure better luck?)

Is the omission of recreational species intended? Such creatures may not be true reef fishes in a restrictive definition of coral reefs. However, are not sandy bottoms, tidal mudflats, and submerged rock outcrops associated closely with Hawaii's reefs? If not, then why did the weke a'a and leaping blenny qualify, while the oio and mullet miss out? Both of these species have been frequently observed on the coral formations of Hanauma Bay and nearby locales. Why are there nearly a dozen vivid photographs of butterflyfishes, seven of wrasses, and eight of surgeonfishes, and only a single ulua? It could be that a striking collection of color photographs promises higher sales to tourists and home-grown snorkelers. Hawaii's fishermen have been ignored for too long!

Dr. Chave's shorter text on invertebrates is more balanced and, to the reader unfamiliar with such animals, more informative than Dr. Hobson's exquisite section on fishes. Did you know that the seemingly unrelated, wierd assemblage of corals, jellyfishes, snails, worms, urchins, crabs, shrimps, lobsters, and octopi all have a unifying characteristic? They are all invertebrates or animals without backbones, a fact that is inspirational to the biologically uninitiated. A fish is a fish (except possibly the anglerfish on page 97) to almost all people, but how can an octopus be related to the hardly discernible opihi (Hawaiian limpet)? Find out by reading the section on invertebrates. Illustrated by Dr. Hobson's unusual photographs, Dr. Chave's text conveys not only the fascination of easily unnoticed marine lifeforms, but the wonders and beauty of the interdependence and interrelationships of marine ecosystems.

I would recommend purchasing two copies of *Hawaiian Reef Animals*: one for the "field" to study, underscore, and smudge-up to one's heart's content; the other to preserve in a home library for future enjoyment. It will be a long time before another book can offer as much.

Justin Rutka

Manganese Nodule Report Written

UH Oceanography Chairman Keith Chave met recently with scientists from Lamont Geological Observatory, Columbia University; Battelle West, Seattle; Washington State University; and the NOAA marine mining research facility at Tiburon, California, to write a report on IDOE-sponsored manganese nodule research. This report marks the completion of the initial phase of work on manganese nodule surveys and origins of the nodules.

The manganese research group met at the Tiburon laboratory on February 22 and 23, to complete a final report on the first phase of the research, and to make recommendations for continuing work in the field. The report will be issued this month.

Chave summarized the group's findings for Newsletter readers, as follows:

Three hypotheses have been proposed to explain the origin and distribution of ferromanganese accumulations on the seafloor: (1) The elements came directly from the water column. (2) The elements arrived by emanation from igneous rocks below. (3) The elements naturally occurring within the sediment column

were mobilized and redeposited at particular sites. There is no clear-cut evidence, to date, whether any of these processes was important in forming ferromanganese accumulations. Furthermore, the mechanisms which concentrate economically valuable metals with the ferromanganese -- nickel, cobalt, copper, perhaps others -- are equally unknown.

Geochemical and mineralogical studies of the micro- and macro-nodules and crusts, and of the environments in which they occur, can provide evidence on their origin, and allow the prediction of the locations and value of commercially exploitable deposits. Only if standardized analytical methods are used, throughout, will realistic economic evaluations be possible.

Contributors to the manganese nodule report and possibly some other researchers in the area will present their results at the American Geophysical Union meeting in Washington in mid-April, at which time the outline of an enlarged, long-term proposal on manganese research will be offered, in coordination with the staff of the IDOE office.

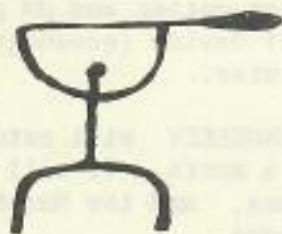


The DMITRI MENDELEEV held open house for UH scientists when the Russian vessel stopped here recently. Shown (left to right) are UH oceanographer Klaus Wyrski, USSR geologist N. W. Logvinenko, UH graduate student Daniel Davids, UH oceanographer J.H. Jones, and USSR technician Genadi Phillipe. (Photo by Bekisu)

Diving Physiology - Medicine Seminars Scheduled

The UH Department of Physiology has initiated a series of meetings on the physiology and medicine of diving in humans and animals. Research seminars and reviews of recent publications will be featured. Terence O. Moore, associate professor of physiology at the University, will discuss "Helium: How Inert Is Inert?" at a 3 p.m. seminar on Tuesday, March 6, in the physiology departmental library of the Biomedical Sciences Building. Moore is a member of the research team directing the Sea Grant project, Human Performance in the Sea.

In general, the seminars on diving physiology will be held on the first Tuesday of each month. All interested persons are invited to attend and participate. Monthly notices giving details of seminar topics and speakers may be obtained by contacting Richard H. Strauss at 948-8640.



GARRELS (continued)

Garrels looks forward to meeting some of the Russian scientists with whom he has corresponded professionally. He suggested to the Newsletter reporter that he feels deeply honored to give this address because few American scientists have received invitations of this type.

Garrels came to the University of Hawaii a year ago to fill the Captain Cook Chair, which is endowed by the Honolulu Advertiser. He was formerly a professor at Scripps Institution of Oceanography.

Wrasse Research (continued)

The fish species involved in this latest phase of Losey's project is a wrasse, *Thalassoma bifasciatum*. The behavior of the Puerto Rican wrasse will be observed in detail, and the observations will be incorporated in a comparative study of cleaner fishes, along with data Losey has obtained on species inhabiting Indo-Pacific waters.

The PRINUL facilities were completed last year through cooperative efforts of the Marine Resources Development Foundation and numerous Puerto Rico government agencies. Previous saturation diving missions have involved scientists from the Smithsonian Institution, NOAA, and several private organizations in the mainland United States, as well as Puerto Rican researchers. Losey's participation in the February dive of the PRINUL submersible has made possible a "first" in fish research: no previous comparative study of deep-water cleaner fish in Atlantic and Pacific waters has been completed.

Losey is an assistant professor of zoology on the UH Manoa campus. He is principal investigator of the Sea Grant sponsored innovative course, Marine and Freshwater Aquaria. His behavioral research on cleaner fish has included extensive field observations in the waters of Eniwetok and the Hawaiian Islands, as well as laboratory experimentation at the HIMB Coconut Island facilities.

Sea Grant Staffer To Marry

Miss Margaret "Peggy" Lucas will be married on April 7 in Denver, Colorado, to Michael Bond. Peggy has resigned the job she has held since June of 1972, as Advisory Services Specialist with the University of Hawaii Sea Grant Program. Peggy's fiancé is with the San Francisco offices of Eckbo, Dean, Austin, and Williams, a consulting firm. The Bonds will make their home in San Francisco.

The Sea Grant staff wishes Peggy every happiness!

THE KEEL ROW

The DMITRI MENDELEEV

...stopped briefly in Honolulu, the week of February 19, and a number of Honolulu residents informally visited the ship's laboratories. Scientists aboard the MENDELEEV are conducting hydrographic and gravimetric profile studies, west-to-east, from Japan to Mexico.

The MENDELEEV is 124 meters (406+ feet) long and weighs 6,700 metric tons. It was built in East Germany in 1969. There are six other vessels of the same type and size; some are fitted out as passenger ships. The vessel has a gyroscopic stabilizer with retractable wings. It is obviously a very stable ship: UH visitors noted that laboratory glassware is stored on open shelves and counters, with no special support or housing. There are television monitors on the captain's bridge, and an intercom system which permits communication with all laboratories. 110-V and 220-V current both are widely available. Electronic equipment is scattered through several shipboard laboratories.

A computer occupies an impressive amount of space aboard the MENDELEEV. It is the second largest type of computer produced in Russia. Paper tape is used for data, with magnetic storage for programs and memory.

Laboratory facilities are available for mineralogical, chemical, geochemical, geophysical and biological testing. Using corers, researchers bring up bottom sediments and study samples on board the ship. In a typical shipboard geochemistry laboratory, unstable compounds of iron, manganese, and arsenic can be analyzed.

Work now being carried out on the MENDELEEV was begun in 1969, aboard another ship, the VITYA, which is now in Vladivostok. That city is also the home port of the MENDELEEV.

The ship is carrying 164 people on its current cruise, including 80 crew

members and 84 in the scientific party. There are 21 women scientists, and 19 women in the ship's crew. The recreational lounge houses television, stereo equipment, and a piano. On deck a game of "sea billiards" was in progress, the day UH visitors went aboard. (In sea billiards, balls are replaced by thick wooden disks.)

Visitors were shown a deepsea camera assembly of impressive size. It includes two TV cameras, quartz lights, and a pair of grappling claws for seizing bottom samples.

The chief of geology and sedimentology in the ship's party, Dr. N.W. Logvinenko, served as host for groups of UH visitors that included Keith E. Chave, J.H. Jones, and Klaus Wyrтки (oceanography), Albert H. Banner (zoology), Kaare Gundersen (microbiology), and the Newsletter editor. Genadi Phillipe, an electronics technician on the MENDELEEV, shared host duties and UH graduate student Daniel Davids (oceanography) served as interpreter.

The MENDELEEV will return to Hawaii in about a month. It will also stop in Fiji, Samoa, and the Marshalls on its way back home.

David Hurd, post-doctoral fellow in the UH Department of Oceanography, will join the MENDELEEV some time this spring for two months of research in the Southwest Pacific. He will leave the ship when it reaches Tokyo.

The GLOMAR CHALLENGER

...will leave Christ Church, New Zealand, on March 2 with UH oceanographer Stanley Margolis aboard. This is the second antarctic drilling leg for the GLOMAR CHALLENGER. The shipboard research is part of the Deep-Sea Drilling Project sponsored by the National Science Foundation and operated through Scripps Institution of Oceanography.

THE KEEL ROW (continued)

Margolis will be one of the sedimentologists on this cruise. He is a specialist in glacial marine sediments and has been studying cores from antarctic areas.

The GLOMAR CHALLENGER will return to Wellington, New Zealand, on April 20. James E. Andrews (HIG and oceanography) will assume the duties of chief scientist on the following leg of the research vessel's voyage.

The VALDIVIA

...returned to Honolulu February 16 for re-outfitting. Minor equipment changes and conversion at Pier 40 are nearing completion, and the ship is expected to depart shortly after March 1 for another cruise in Pacific waters. The VALDIVIA is a German research vessel which has been operating out of Honolulu since last summer. UH researcher James Andrews (oceanography and HIG) is heading a team of American scientists working cooperatively with German scientists in exploration for manganese nodules. The VALDIVIA is expected back in Honolulu before the end of March.

The TERITU

...was employed on several short cruises last month. MOP students directed a high school orientation cruise February 12-14. Tom Newbury (oceanography) was chief scientist on February 15-16 for a cruise to collect zooplankton samples at night, for a study of population turnover rates.

On February 19-23 the TERITU cruised to Penguin Banks, where J.P. Vansant (oceanography, HIMB) headed a party investigating distribution and abundance of Kona crabs. On February 26-28 Robert Harvey (HIG) directed a party which retrieved electric field recorders.

The KANA KEOKI

...is scheduled to reach Guyaquil about March 4. Loren W. Kroenke (HIG) will continue as chief scientist during March on an IDOE-sponsored leg. The KANA KEOKI is expected in Antofagasta at the end of the month.

MOP Students

Moving on Two Projects

Undergraduate students in the University of Hawaii's experimental Marine Option Program (MOP) will participate in two shipboard projects during March and April. Based on recommendations of Captain G.E. Haraden of the NOAA ship RAINIER, MOP students will again serve as crew members on a hydrographic survey ship. During September and October MOP students participated in a cruise of the RAINIER. Similar cruises aboard the FAIRWEATHER, another NOAA ship, are now planned.

Four students from Manoa and four from the Hilo campus will sail with the FAIRWEATHER. Each cruise will last two weeks. These undergraduates will be receiving valuable training and experience in hydrographic survey techniques normally open only to graduate students.

The second project scheduled for MOP students in April involves diving in the waters off three Hawaiian islands. Sponsored by Professor Arthur Reed of the UH Zoology Department, the project will concentrate on gaining diving experience in Hawaiian waters, bay-survey techniques, and various biological studies.

The waters to be studied surround Molokai, Kahoolawe, and Maui. Twenty MOP students will live aboard the UH research vessel TERITU, April 15-22, a period of one week. By operating off the TERITU, students are expected to gain much shipboard experience. Hiking on Haleakala, Maui, is also planned.

NEW SEA GRANT PUBLICATIONS

In production:

Behavioral Effectiveness at 16 ATA.
Joseph P. O'Reilly (Technical Report)

Eucheuma Farming for Carrageenan.
Maxwell S. Doty. (Advisory Report)

Spheres of Influence in Hawaii's Coastal Zone, Vol. I: Federal Agency Involvement (UNIHI-SEAGRANT-AR-72-03).
Justin Rutka and Chennat Gopalakrishnan.

Medical Measures in Diving Accidents
(Chart, 2 sides).

In press:

Hawaii Fish 'n Facts Information Sheet Number 169: *Sport Fishermen's Guide to Holding and Freezing Fish.*
Kirby Hayes, William Schumacher, and Curtis Wilder.

In print:

Hawaiian Shallow Marine Sand Inventory: Part 1. Introduction and Part 2. Ahu o Laka Sand Deposit, Kaneohe Bay, Oahu (SEAGRANT 69-1. Also HIG-69-10). Ralph Moberly, Jr. and J. Frisbee Campbell. 24 pp. Re-issued.

In print (continued):

Erosion and Accretion of Selected Hawaiian Beaches, 1962 - 1972 (UNIHI-SEAGRANT-TR-72-02). J. F. Campbell. viii + 23 pp.

Economics and Market Potential of the Precious Coral Industry in Hawaii (UNIHI-SEAGRANT-AR-71-03). Kok-Kian Poh. 22 pp. Second Printing.

Hawaii Fish 'n Facts Information Sheets Number 166, 167, and 168: *Why Fish Spoil, Coming, the Wholesome Fish Act, and Fish Smoking and Drying by the Sportsman.* Kirby Hayes, William Schumacher and Curtis Wilder.

Costs and Earnings of Tuna Vessels in Hawaii (UNIHI-SEAGRANT-AR-72-01). Abu Ekram Ahsan, John L. Ball, Jr., Jack R. Davidson. 22 pp.

A Preliminary Study of Ocean Waves in the Hawaiian Area (SEAGRANT 69-2. Also HIG-69-16). Francis P. Ho and Lynn A. Sherretz. 36 pp. Re-issued.

Atlas of Kaneohe Bay: A Reef Ecosystem Under Stress (UNIHI-SEAGRANT-TR-72-01). Stephen V. Smith, Keith E. Chave, and Dennis T.O. Kam.



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COASTAL

ZONE

COMMUNIQUE



Sea Grant Programs
255 Spalding Hall

University of Hawaii
Honolulu, Hi. 96822

Communique No. 8 March 30, 1973

Justin Rutka, Advisory Specialist

Recent developments in pending state legislation and in the federal administration have a significant bearing on the coastal zone subject.

The Seventh Legislature of the State of Hawaii is currently deliberating several coastal-related proposals: (1) An Administration-sponsored package which authorizes the Land Use Commission to establish "areas of State concern" and to exercise heightened authority over such areas. The Administration's position is that the existing land use law has not been fully effective in promoting more rational urban growth and in managing environmental resources. The state's answer is to give the Land Use Commission sweeping powers to override other state agencies and the counties when it decides that "areas of critical State concern" are being threatened; (2) A coastal zone planning measure before the Legislature is an initial Administration reaction to the National Coastal Zone Management Act. This bill is a statement of intent authorizing the Department of Planning and Economic Development to plan for Hawaii's coastal zone if and when federal monies become available to carry out the provisions of the congressionally-mandated law. (See Communique No. 3, November 21, 1972.); (3) There are several resolutions advocating the establishment of a Temporary Commission on State-Wide Environmental Planning whose function would be "to provide policy guidance for State General Planning by incorporating into State and County plans those specific policy statements which assure fullest consideration of the environment and human life styles and to assign responsibility to the appropriate agencies for implementing the plans and policies."

At the federal level the budget for fiscal year 1974 (beginning July 1, 1973) contains an apparent death sentence for the Coastal Zone Management Act (P.L. 92-583) signed into law last October. There is a deliberate omission of funds with which to implement state coastal zone plans under Public Law 92-583. Strangely enough, there is \$20 million in the fiscal 1974 budget for land use planning in the Department of the Interior budget to effectuate the still pending, Nixon Administration-backed National Land Use Policy Act.

When the President signed the coastal zone law, he expressed preference for the Department of the Interior to administer national land use legislation. In passing the national coastal zone measure to be administered by the National Oceanic and Atmospheric Administration within the Department of Commerce, an agreement was reached to make the coastal zone program compatible with any future land use program that Congress may pass and assign to the Department of the Interior. Whether the advocates of a separate federal coastal zone program can still prevail under the recent moves of the Office of Management and Budget remains to be seen. However, there is a possibility that some federal funds for coastal zone planning may eventually be found under the 701 program of the

Department of Housing and Urban Development. This prospect needs more careful review by the Office of Management and Budget.

In any case, a management plan for lands most proximal to the coastal that is distinct from a management scheme for other lands of the state may be inadvisable.

In the following text, Peter Ryner extends Marc Hershman's earlier paper by suggesting that a state may in fact weaken its coastal zone management program by restricting management objectives to water quality standards. This is not to say that water quality regulations should not be used as a principle tool in implementing agreed upon management objectives. To the contrary, given the above political realities, the use of water quality standards may offer a viable alternative in planning for Hawaii's coastal zone.

Prompted by research evidence, the State Department of Health has requested the University of Hawaii "Quality of Coastal Waters" group to assist in developing revisions of the Water Quality Standards of the State's Public Health Regulations. A special advisory group has been formed to initiate discussions relating to the review of concepts of water quality standards, especially in light of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500), and to identify the dimensions of the task and the general approaches to be taken in response to the Health Department's request. It is expected that the Department of Planning and Economic Development, which has been designated by the Governor as the state's coastal zone planning unit, will effect a liaison with the "Quality of Coastal Waters" advisory body through the Department of Health.

* * * * *

WATER QUALITY LAWS AS A COASTAL ZONE MANAGEMENT TOOL -- COMMENTARY

Peter C. Ryner⁺

I would like to comment upon the article by Marc Hershman which appears in your Coastal Zone Communique of February 26, 1973. As I understand him, Mr. Hershman has proposed that water quality regulations be relied upon as the primary mechanism of implementing and enforcing a state's coastal zone management program. If this is going to be done, then each segment of the coastal zone plan will have to be written with a linkage to a water quality parameter. While in many cases this should not be too difficult, it is an important step in the process which perhaps was not sufficiently emphasized by Mr. Hershman.

The efforts of Minnesota are perhaps of interest in relation to the questions of water quality and resource management. Largely in the interest of having a good legal basis for any state-level action affecting private property owners, Minnesota planned all of its shoreland areas on the basis of water quality standards, and I suspect that Mr. Hershman may have had this in mind. Using the recognized police powers associated with protecting water quality, all public waters of the state were set into various categories of preservation,

⁺Research Associate, "Coastal Zone and Shorelands Management Project", Sea Grant Program, University of Michigan, North University Building, Ann Arbor, Michigan 48104.

limited use, or development. Then specific shore use regulations, including type of activity and set-backs, were constructed for each water type. Thus, while concentrating upon the maintenance of a certain quality of water, they established a comprehensive set of land use plans within shoreland areas based on land use practices which would not disrupt public water quality.

However, there are several limitations to this approach, perhaps the greatest being that water quality is often more directly linked to atmospheric dynamics than to land dynamics, as mentioned by Dr. Lau. Furthermore, it would seem that the most important step is to first determine what regulations are necessary, but more basic, to determine, in Mr. Hershman's words, "which areas are to be preserved, (and) which areas are going to be used, and for what purposes..." (page 3)

I suggest that it is during the critical first phase of coastal zone management that a consideration of the water quality of the coastal zone can be most rewarding. The recognized state right to control water quality allows a mechanism for implementing management objectives. Moreover, the complex hydrologic cycle, the tolerance levels of water dependent organisms, and socially desired potentials of coastal resources provide a valuable set of possible constraints and guidelines for use in the initial establishment of coastal zone management goals. Starting with global parameters of oxygen production and carbon dioxide absorption, the water-air system is a key element in the biosphere and should be protected at all costs. On a more local basis, the limitations of various aquatic systems, such as estuaries, can be identified and recognized in primary goals and proscriptions. Moving inland, human and natural systems can be identified to provide further guidance in the consideration of what should be protected, what should be used with caution, and what is available for general exploitation and at what rates.

I agree with Mr. Hershman that designating certain water quality standards with various coastal zone management objectives will facilitate enforcement. However, to consider these standards as primary or principle management tools is to weaken any state program in two critical ways.

1. The state has several objectives in any management program, and a broad range of existing or potential tools, Air quality, noise, health, and land use controls...these are just some of the important areas where the state has effective and recognizable powers. Water quality is increasingly a federal and international concern, and its regulation is in large part dictated by federal minimum standards, often centered on human health criteria rather than on the vitality of natural systems. Any one tool is too frail weed to depend upon, particularly one that has such a history of federal override. It would be senseless to ignore the potentials of using a combination of tools in a dynamic implementation program.

2. By centering on water quality, the state would be perpetuating very narrow, and in my opinion a too narrow, focus of the federal legislation. The coastal zone is a dynamic stress configuration of energy flows, bio-geo-chemical cycles, and socio-cultural and techno-economic human systems. If the federal legislation makes an artificial distinction between land and water, totally failing to include the vital link of the atmosphere (a critical element in all natural coastal systems), it does not mean that the states should or need accept such a direction. In fact, the burden of the state will be to combine various

federal programs into the interlinked reality of water, land, and air, and of social, economic, ecologic, political, and technical needs. It may well be that for several states an artificial management section that accepts the definition of coastal zone which the federal legislation seems to support is not in their best interest. If coastal zone management deals mainly with water issues, rather than with water-air-land issues and with man-man/man-nature issues (the reality of state coastal zone problems), then, perhaps, coastal zone management in some cases is not a sufficient or viable concept. I think that it can be, but in order to be of value to states, the definition of the coastal zone should be expanded and more stress must be placed upon the integration of several systems, rather than creating artificial management boundaries which have more relation to ease of administration than to complex realities of real world problems and opportunities.



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SEA GRANT NEWSLETTER

Volume 3, Number 4

April, 1973

Ariyoshi Advocates "Leap Forward"

Where does the ocean stand in the minds of Hawaii's people?

This question was examined carefully last month when members of Hawaii's academic, industrial, and government quarters convened the fourth meeting of the ECOPUSH series. ECOPUSH is the acronym for Environmental Conferences On Public Understanding of Science In Hawaii.

Speakers at the conference, titled "The Ocean: Hawaii's Lost Frontier?", devoted much of the first day to a discussion of the role of the sea prior to Captain Cook's discovery of the Islands in 1778. At that time, it was pointed out, Hawaiians were entirely self-sufficient and held a deep, abiding respect for the sea. In old Hawaii, the sea was recognized as the source of nearly all food as well as being the preferred arena for recreation. Today Hawaii imports nearly 80% of the commodities used. That works out about seven tons per person, quite a long way from self-sufficiency by any standards.

A highlight of the conference was a talk by Gaven Daws, UH historian and current president of Life of the Land. Daws vividly traced the evolution of man's relationship with the ocean from the early symbiotic association experienced by the Hawaiians in pre-Cook days to the modern day assumption by the people of Hawaii that the ocean is a large

(Continued on page 5.)

Helfrich is Delegate at NWF Meeting

The Conservation Council for Hawaii was unanimously voted to be an official affiliate, when the National Wildlife Federation held its 37th annual meeting in Washington, D.C., last month. The NWF claims about 3.5 million members and supporters, and as a private, nonprofit organization seeks to attain conservation goals through education.

Sea Grant Investigator Philip Helfrich, who is Associate Director of the Hawaii Institute of Marine Biology and Past president of the Conservation Council for Hawaii, was the official state representative at the conference. According to Helfrich, the theme of the conference centered on land and energy problems.

(Continued on page 2.)

Site Team Coming

A Sea Grant site team visit to University of Hawaii facilities has been scheduled for April 17 and 18. The site team members will include Arthur Alexiou, Director, Institutional Support Program, National Sea Grant Program; Robert B. Abel, Director, National Sea Grant Program; Donald Giles, Marine Science Center at Newport, Oregon State University; Burr H. Steinbach, Marine Biological Laboratory, Woods Hole, Massachusetts; John Loefer, U.S. Office of Naval Research; and James H. Wakelin, Jr., Assistant Secretary for Science and Technology, U.S. Department of Commerce.

Cleaner Fish Observed In Caribbean

UH zoologist George Losey, back from a field trip in the Caribbean Sea off Puerto Rico, reports that reef fishes there must "work" harder than Hawaiian reef fishes to obtain the services of a cleaner fish. Losey's observations indicate that a Caribbean reef fish usually seeks out a cleaner fish and poses for it, in order to be cleaned of ectoparasites, while hungry cleaner fish in Hawaiian waters frequently seek out a host fish.

Losey spent two weeks investigating host-cleaner relationships in Caribbean waters. The reef fishes that he observed carried a much heavier load of external parasites than reef fishes in Pacific waters near the Hawaiian Islands.

There are two species of major cleaners in the Puerto Rican waters: a wrasse and the neon goby. The density of the neon goby population is more than ten times that of any cleaners Losey has seen in Pacific waters. Neon gobies live only on coral heads of a suitable size; they were observed on 20% of these coral heads. Losey noted what appears to be a partnership or symbiotic relationship between the two species of major cleaners. The wrasse is highly visible, while the neon goby is hard to see. A number of neon goby fish were always observed near each wrasse. Losey believes that this symbiosis between the two cleaner species has several aspects.

The work of another experimenter in the Bahamas several years ago suggested that cleaners were essential to the health of reef species. When the experiment was repeated in Hawaiian waters, researchers did not get the same results. It appears that reef fish species in this part of the Pacific do not require the presence of cleaner fish. After observing the heavy parasite load carried by fishes in waters off Puerto Rico, Losey believes that the conclusions drawn from the early work in the Bahamas may have been correct for those waters. It appears that the presence of

cleaners contributes to the stability of the reef fish population. The mechanism for control is present in Hawaiian waters, and would operate if the load of ectoparasites should increase. Meanwhile, the local cleaner fish feed on mucus and scales along with the relatively light load of external parasites carried by Hawaiian reef fishes.

A seminar on Losey's Caribbean research is tentatively scheduled for a Friday afternoon in late April or early May. The UH Department of Zoology office, 948-8617, may be contacted for details.

NWF (continued)

Among the speakers at the conference was Stewart Udall, chairman of the Overview Corporation. Udall focused upon Hawaii to illustrate examples of energy and environmental problems. He indicated that Hawaii had many environmental problems and "they need help" -- alluding specifically to water pollution, transportation, housing, and endangered species. He told of an "absurd waste" of energy on Oahu that resulted from poor planning: air conditioners are used in Waikiki hotel rooms, despite unusually high air quality. Mr. Udall lauded the National Wildlife Federation on its new affiliate in Hawaii.

Other speakers were: Senator Henry Jackson of Washington; William D. Ruckelshaus, Director of the Environmental Protection Agency; James C. Fletcher, Administrator for NASA; Russell E. Train, Chairman of the Council of Environmental Quality; S. David Freeman, Director of the Ford Foundation's Energy Policy Project; Dixy Lee Ray, Chairman of the Atomic Energy Commission; James E. Akins, presidential advisor on energy; Mrs. Shirley Temple Black and Arthur Godfrey, well known conservation advocates; and Mrs. Richard Nixon.

Conference on Energy Set

"Energy, the Ultimate Environmental Problem?" will be the theme of a two-day public conference to be held in April under sponsorship of the UH Center for Engineering Research and the UH Environmental Center. This latest in the series of environmental conferences is set for April 12 and 13 in the Cleghorn Room of the Princess Kaiulani Hotel.

Conference speakers will discuss the environmental problems associated with the use of energy, including problems of energy resource availability and energy waste disposal. They will review other resource and waste-disposal problems that will require energy for their control, waste-disposal problems whose abatement may be accompanied by the production of energy, and related esthetic problems. The conference chairman will be Doak Cox, director of the UH Environmental Center. Public participation is invited. Information may be obtained by calling Billie Jean Paschal or David Harada at 948-8788.

Atlas Shows How Man-Made Stresses Affect Kaneohe Bay

The University of Hawaii Sea Grant Program announces the publication of the *Atlas of Kaneohe Bay: A Reef Ecosystem Under Stress* by Stephen V. Smith, Keith E. Chave, and Dennis T.O. Kam. The atlas represents the results of extensive work in a number of scientific disciplines. It provides documentation of components and interaction among components of the most thoroughly studied coral reef system in the world. Data in the atlas also demonstrate the effects of man-made stresses on a reef community.

The atlas is available without charge to public interest groups concerned with the bay and to members of the scientific community who can make professional use of it. If you would like to receive a copy, direct a request to the Sea Grant Publications Office, 253 Spalding Hall, University of Hawaii, Honolulu, Hawaii 96822.

Hearing Set on Wildlife Refuge

A major part of the leeward Hawaiian Archipelago is being proposed as a Wilderness Area within the National Wilderness Preservation System, to protect its valuable natural resources. A public hearing will be held starting at 9 a.m. Saturday, April 14, at the Airport Holiday Inn, 3401 N. Nimitz Hwy., to consider action on the proposal.

The areas considered include the islets, shoals, and atolls (Nihoa, French Frigate Shoals, Laysan, Lisianski, Maro Reef, Necker) that presently constitute the Hawaiian Islands National Wildlife Refuge.

Marine resources and natural values of the area include:

1. The only known nesting ground of the green sea turtle in the central Pacific.
2. The world's only population of a tropical seal -- the Hawaiian Monk seal.
3. Unexploited reef communities with diverse speciation including rare and unusual fishes.
4. The only Hawaiian true atolls -- French Frigate Shoals and Pearl and Hermes Reef.

This area has been under increasing threat of exploitation by commercial interests. Its terrestrial and marine values are of exceptional scientific and educational importance. Wilderness Area status would protect these resources under federal law. Persons interested in endorsing this preservation are encouraged to present oral or written statements at the hearing. Testimony should be submitted in writing at the hearing if it is to be considered by the secretary of the interior.

Written comments will be accepted until May 14 at the Regional Director's Office, Bureau of Sport Fisheries and Wildlife, P.O. Box 3737, Portland, Ore., 97208.

Hawaii Loses CROMWELL

The TOWNSEND CROMWELL, NOAA research ship, has been deactivated, leaving the central Pacific Ocean without a fishery research ship. According to Dr. Frank J. Hester, director of the NMFS Southwest Fisheries Center Laboratory in Honolulu, "an austere budget precludes her further use at this time". Since her commissioning in 1964, the CROMWELL has traveled more than 233,000 nautical miles, almost the distance from the earth to the moon, in the service of fishery and oceanographic science. The Honolulu laboratory of NMFS will now share with the La Jolla (California) laboratory the one remaining research vessel of the Southwest Fisheries Center, the DAVID STARR JORDAN out of San Diego.

The CROMWELL returned to Kewalo Basin in March with samples of marine life collected during six weeks of work in the Line Islands, 1200 miles south of Hawaii. Unusually high concentrations of skipjack tuna larvae were found just offshore of Christmas Island during this last cruise of the CROMWELL. A major mission of the cruise was to determine the patterns of flow of surface currents in the vicinity of Christmas Island, and the distribution of tuna larvae within and without the island wake system, Dr. Hester explained.

This was the second of two cruises designed to investigate the physical and biological downstream effects of small oceanic islands located in major ocean currents. The first took place last August.

Christmas Island was selected for this study because it represents a simple situation: a single small island with no other islands upstream, located in the strong regular flow of the North Equatorial Current, and with a nearshore environment that is practically unmodified by human activity.

The skipjack larvae, caught in fine mesh trawl nets at a depth of 75 to 90 meters (250 to 300 feet), were about 10 times more numerous downstream from Christmas Island than they were upstream or away from the island to the north or south, according to fishery biologist Everet C. Jones, who served as field party chief. They may have been caught up in an eddy that rotates slowly in the lee of the island.

Biologists on board CROMWELL also observed many large manta rays 2 to 3 meters (6 to 10 feet) across, feeding just outside the entrance to Christmas Island lagoon. The rays were concentrated in the interface between the murky lagoon water, which was going out with the tide, and the clearer oceanic water.

From a small skiff the biologists towed a plankton net in among the harmless giant rays. They found the rays feeding on one of the highest concentrations of plankton ever encountered in tropical waters. The tiny drifting plants and animals were one to two hundred times as numerous as in the nearby open ocean.

Are skipjack tuna attracted to islands, as they appear to be, for purposes of feeding and spawning, or are they merely passing by? The heavy concentration of plankton appears to explain how the giant manta finds sufficient food in rather barren tropical waters. It may also account for some of the attraction islands appear to have for tuna and other large oceanic fishes.

The basic information gained from the two Christmas Island cruises will next be applied to the much more complicated situation around Hawaii. Here the several islands of different sizes and shapes introduce highly variable flow patterns into the already irregular currents moving toward Hawaii from the east, and human activity has created great changes in some of the nearshore waters. Scientists hope to learn how all this affects the catches of Hawaii's fishing fleet.

Ariyoshi (continued)

buffer zone that somehow protects the Islands against the ills and pitfalls experienced by human beings elsewhere. "Hawaii is no longer an Island paradise", says Daws. "Rather it's a simple extension of the mainland...With modern transportation and the corresponding increase in population, one can expect the development of 'mainland problems' to mature very shortly, unless the belief that the ocean is an infinite guardian is abolished."

Lieut. Governor George Ariyoshi spent some time on the second day of the conference talking about the "future spirit" of the ocean. In his prepared remarks he stated that Hawaii was ready to take a leap forward in transportation technology, and that the transportation system for the State must employ the sea as a medium. He also restated his support for HEART (Hawaii's Environmental Area Rapid Transit System), the proposed marine transportation system for Oahu. In his talk the lieutenant governor recognized the vital role which the UH Sea Grant Program has played in focussing attention on marine alternatives for rapid transit.

John P. Craven, the State Marine Affairs Coordinator, wrapped up the conference with an informal presentation which reflected his views on the future shape of social concepts relating to housing, transportation, energy production, and waste disposal.

Aquarium Seeks Volunteers

unpaid teacher

A docent program which will provide tour guides at Waikiki Aquarium has been initiated by Aquarium Director Charles DeLuca and UH Assistant Researcher Edith Chave (zoology). Community members and UH students in the MOP Program may volunteer for docent training by contacting Jane Culp at 737-9676. Training will be given on Saturday mornings. It is expected that docents will be on duty at the Aquarium every morning except Monday and on Sunday afternoons.

Craven to Give Keynote Speech

UH Dean of Marine Programs John P. Craven will be keynote speaker for a session on industrial-government relations in offshore resource development at the Fifth Annual Offshore Technology Conference, April 30 through May 2, in Houston, Texas. A 200-paper technical program is scheduled for the international meeting.

The Offshore Technology Conference, which was founded in 1968, is jointly sponsored by eleven international engineering and scientific societies and is recognized as the world's leading annual meeting on offshore technology.

MOP Undergrads Get NSF \$ \$

The National Science Foundation has awarded a grant of \$17,000 to a Marine Option Program (MOP) project concerning an artificial reef. This project, solely engineered by University of Hawaii MOP students, will be directed by student Carla Miyamoto and guided by the project's advisor, Arthur Reed (UH Department of Zoology).

Officially titled "Study of Colonization and Development of Corals on an Artificial Reef", the project centers on a reef outside of Pokai Bay, Oahu. The reef consists of several car bodies, weighted rubber tires, and concrete pipes placed there by the Hawaii State Division of Fish and Game.

Intensive surveys by the students will be done on populations of algae and herbivorous fish, in addition to coral. Equipment will include: eight wire-mesh cages for comparative studies on algal growth; plankton tows and fish transects for population studies; and physical parameter measures.

NFS has designated and will support 12 students to work 12 weeks this coming summer. Preparatory work began in September of 1972.

NEW SEA GRANT PUBLICATIONS

In production:

Impact of Recreational Fishing Expenditures on the State and Local Economies of Hawaii. Robert G. Hoffman and Hiroshi Yamauchi. (Advisory Report)

*Environmental Factors Affecting Stress and Mortality of the Hawaiian Anchovy (*Stolephorus purpureus*) in Captivity.* Jeannette W. Struhsaker, Wayne J. Baldwin, and Garth I. Murphy. (Technical Report)

Medical Measures in Diving Accidents (Chart, 2 sides).

In press:

Hawaii Fish n' Facts Information Sheet Number 169: *Sport Fishermen's Guide to Holding and Freezing Fish.* Kirby Hayes, William Schumacher, and Curtis Wilder.

Behavioral Effectiveness at 18 ATA (UNIHI-SEAGRANT-TR-73-01). Joseph P. O'Reilly. 75 pp.

Eucheuma Farming for Carrageenan (UNIHI-SEAGRANT-AR-73-02). Maxwell S. Doty. 21 pp.

Spheres of Influence in Hawaii's Coastal Zone, Vol. I: Federal Agency Involvement (UNIHI-SEAGRANT-AR-72-03). Justin Rutka and Chenmat Gopalakrishnan. 89 pp.

In print:

Erosion and Accretion of Selected Hawaiian Beaches 1962 - 1972 (UNIHI-SEAGRANT-TR-72-02). J.F. Campbell. viii + 23 pp.

Economics and Market Potential of the Precious Coral Industry in Hawaii (UNIHI-SEAGRANT-AR-71-03). Kok-Kian Poh. 22 pp. Second Printing.

A New System for the Commercial Harvest of Precious Coral (UNIHI-SEAGRANT-AR-73-01). Richard W. Grigg, Boh Bartko, and Claude Brancart. 6 pp.

Hawaii Fish n' Facts Information Sheets Number 166, 167, and 168: *Why Fish Spoil, Coming, the Wholesome Fish Act, and Fish Smoking and Drying by the Sportsman.* Kirby Hayes, William Schumacher and Curtis Wilder.

Costs and Earnings of Tuna Vessels in Hawaii (UNIHI-SEAGRANT-AR-72-01). Abu Ekram Ahsan, John L. Ball, Jr., Jack R. Davidson. 22 pp.

Atlas of Kaneohe Bay: A Reef Ecosystem Under Stress (UNIHI-SEAGRANT-TR-72-01). Stephen C. Smith, Keith E. Chave, and Dennis T.O. Kam.

A Preliminary Study of Ocean Waves in the Hawaiian Area (SEAGRANT 69-2. Also HIG-69-16). Francis P. Ho and Lynn A. Sherretz. 36 pp. Re-issued.



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