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ABSTRACT

Brief descriptions of 9 marine science programs for students at various educational levels are given in this special issue. Most of the accounts describe the procedures followed by the center concerned, but some specify the objectives that guide the work. Most of the projects described involve students using the facilities in active research, rather than providing lecture-demonstrations. (AL)

American Oceanography

SPECIAL EDUCATION ISSUE

CAN EDUCATION AND THIS NATION SURVIVE?

Some time back I remember quoting an unknown source as saying "Science Serves Industry, Industry Serves the Public, and the Public Serves Education." The loop stays open since no one cares to state just who or what education serves. Let us ask if education, in turn, serves science, industry, or the public. I claim it fails to serve any of these, but rather serves itself — a natural road to extinction. Let me explain and see if you agree.

SERVICE TO SCIENCE

If science is to be served, education must encourage creativity and versatility; it must religiously protect the innovator; it must expand from a base of principles, axioms and fundamental truths; it must challenge and be challenged; and it must quickly adjust to newly discovered base lines of knowledge. I regret to say that my experience in education suggests dramatic failures in these service roles from elementary through graduate schools. Itemizing these failures serves no purpose in these pages. It is my opinion you will find ample evidence in your own experience. Just as education is failing to serve science, so too is it failing to serve oceanography. Isolated cases to the contrary exist, and we shall cite some in the pages that follow.

SERVICE TO INDUSTRY

Perhaps education serves industry. I do not believe, however, that it does. Information imparted to the student or left for his discovery is channelled into classical partitions which fail to fit any problems or needs of industry. Industry doesn't want to hire mechanical engineers, electrical engineers, biologists, marine chemists, ocean physicists, etc. Industry hires people to address problems, typically characterized by systems, materials, energy, or mechanisms. Students are not being trained to apply or channel their knowledge along the lines of problems to be solved. The effect is painful and clear and getting worse. Industry has to increase their "retraining" responsibility. Ten men are being applied to a job that requires only two because of an artificial division of labor created by archaic education systems. The country and world are crying for people to solve the ocean's problems for a hungry and perplexed world, while marine biologists and other classically trained oceanographers wait to be hired. Industry screams for interdisciplinary training. Education answers by having students take two courses instead of one. Education stumbles forward, diving headlong into the 20th century. Industry is not being served.

SERVICE TO PEOPLE

Surely education must serve the people. Many of our citizens today, however, claim that education isn't relevant — too ivory tower — not socially responsible — too parochial — and not adaptive. Some claim that we treat education like a democratic social club and when our needs of the moment aren't met, we lose confidence. Richard Lyman of Stanford uses a phrase to describe a possible consequence: "a pointless rubble of ephemeral relevance". It becomes a sad commentary to our view of education.

SERVICE TO SELF

Education may too often serve itself. It may strive to train teachers to train teachers. It may be content to serve the "here and now" to avoid the controversy of service. It not only may, but has turned inward on itself. Response is to the immediacy of Federal grants, bureacracy, politics, fiscal survival, the perpetuation of now, and the intense frustration of youth being handed the helm with no navigation charts through hazardous seas.

SERVICE TO OCEANOGRAPHY

The overview is not pleasant. Our colleges are training oceanographers who will have trouble finding work. Our high schools are leaving initiative and creativity unharnessed and selling the young people a solution to a problem no one has. The elementary schools are still laboring under a six year kindergarten program where imagination is subordinated to rigid lesson plans; where survival is the teacher's main goal; and where men can claim that a one-hour unit on the hermit crab is real ocean science. Perhaps you're not concerned. I am. If the oceans are going to provide a basis for food, transportation, fuels, minerals, drugs, medicines, recreation, peace, international cooperation, and a basis for some lasting, enduring human values, perhaps you should be less satisfied.

EDUCATION AND ASO

Your American Society for Oceanography has recognized many of the problems and felt its responsibility to you, to the Nation, and to oceanography in the field of education. Last October Mr. Ronald Linsky, one of your key Board Members, wrote the ASO Board of Directors, asking that we move solidity into the education field. Part of his request reads as follows:

Oceanology throughout the United States today is in a fragmented, randomly organized status that needs a cohesive force to blend the many efforts into a workable educational package. Currently, a negligible amount of money is being spent in these United States for the development of instructional programs, materials or courses of study in oceanography.

I would, therefore, like to propose that the SOCIETY take an active role in promoting Marine Science Education throughout the nation and also that the SOCIETY take an active role as an organization to which practitioners actively or passively engaged in Marine Science Education can affiliate for the purpose of promoting programs such as the Orange County Schools Marine Science Floating Laboratory throughout the nation.

To date there are no active programs attempting to amalgamate educators and develop communication systems to further the exchange of ideas and materials to enhance the

many fragmented programs throughout the nation. I have carried out, in conjunction with Dr. Donald A. MacLean, massive workshops in the state of California each week-end since 1967 contacting more than 6000 elementary, secondary teachers and administrators. In 32 workshops not a single school district or teacher is providing a broad, well defined instructional program in oceanography nor does review of nationwide efforts reveal a comprehensive curriculum, a single textbook, adequate guide to teacher resources, or audio visual materials sufficient to encourage none but the most self reliant teacher to promote instruction in oceanography.

To further support the identified needs for in-depth programs, instructional materials in oceanography of a multimedia nature and diversified instructional approaches have to be developed. The SOCIETY has, I believe, a responsibility to provide educators materials and programs if it is to fulfill its obligation as an educationally orientated organization.

Your society has responded to Mr. Linsky's request. A meeting was held in Cincinnati, Ohio on March 11, 1970. At this meeting, educators from your society and from various parts of the Country met to plan programs which would further marine science education throughout the Nation. The actions taken were as follows:

1. Regional ASO educator groups were established with the following coordinators.

New England
James Kinney
Oceanography Education Center
Falmouth, Mass.

Mid Atlantic
Dr. Warren Yasso
Teachers College
Columbia University

Will Hon
Marine Science Project
Beaufort, N. C.

R. Wesley Batten
Math-Science Center
Richmond, Va.

South Atlantic
Ed Hougendoblar
Fort Lauderdale, Fla.

Pacific Northwest
Dr. Donald Giles
Marine Science Center
Newport, Oregon

Pacific Southwest
Ron Linsky
Orange County Department of Education
Santa Ana, Calif.

Mid-West
Harley Hardison
Omaha, Nebraska

2. Implement the following national programs under ASO sponsorship:

a. 1970-71 National Marine Science Education Survey

b. 1970-71 **Aquatic Science Curriculum Project** This could be partially or fully funded from grants as other similar projects.

c. 1970-71 Regional Symposia for Educators (Mini-Conferences)

d. 1970-71 National statement of policy regarding Marine Science Education

3. Membership drives initiated by the area coordinators will begin immediately.

4. ASO to become involved in sponsorship or supportive roles in:

   a. Teacher training programs
   b. Curriculum materials development

5. ASO establish a resources center or provide resource materials for educators and the general public.

6. A portion of the ASO Newsletter be devoted to education on a continuing basis.

At the Cincinnati meeting, some of the more progressive programs were reviewed and are reported in this supplement. This entire connection of articles is representative of what is happening. The programs are just beginning and your help is needed. Please read this supplement carefully. Tell us when you agree or disagree. Tell us what you think ASO could do to help education. Tell us what help you can provide. There isn't time for a slow evolution of progress in oceanographic education. We need a revolution in ideas. Without your support we can't do it. With your support - - it can happen.

CONTRA COSTA–ALAMEDA COUNTY AQUATIC BIOLOGY PROGRAM

In April 1969, a group of biology teachers from Contra Costa and Alameda Counties met to formulate a plan. Field experiences in aquatic and marine sciences, so vital to a complete biology program, were limited in the Bay Area. Why? Only six to ten miles of Bay shores are open to the public!

As a result of teacher interest, Dr. William Landis, Science Coordinator for the Contra Costa County Department of Education, arranged for a pilot program in marine sciences to begin. In February, George J. Castellani was appointed County Staff Consultant to direct this program.

Events happened quickly. Thanks to the 12th Naval District and the cooperation of Lt. Commander R. J. Moore of the Pt. Molate Fuel Department, Winehaven, the old picturesque winnery building at Pt. Molate, with its classrooms, was made available for this project. Other sites quickly became available stretching all the way up the San Joaquin to Frank's Tract in the Upper Delta.

With sites available, the teachers met and began to discuss philosophy and program. These sites are being designed as research centers. In conjunction with California Fish and Game, U. S. Geological Survey, California State Water Pollution Board and the U.S.D.A. — Soil Conservation District, research problems of significance are being designed. Teachers with their many experiences and talents will be working together to assemble a series of activities for students to undertake at the stations. An excellent opportunity exists to introduce diversity at various levels and it is not to be missed.

With continued good fortune, the Pt. Molate site will be functioning in September — an opening all have been waiting for.

The financing of this program is unique. In California, half of the fish and game fines collected revert to the county where the infraction occurred. Thanks to Contra Costa County's Board of Supervisors the money necessary to finance this pilot study is being made available.

Oregon State University Program

by Donald Giles

Marine Science Education Specialist

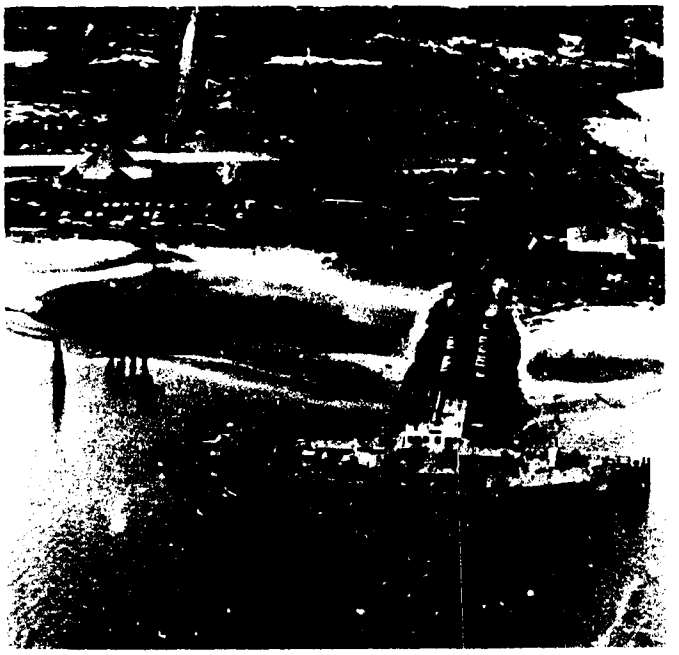
Oregon State University's Marine Science Center in Newport houses two university research laboratories, one State resource agency laboratory, a ship support system and a public education wing. The Yaquina Marine Biology Laboratory is operated through the Department of Oceanography with staff members coming from that Department and the Department of Zoology. Also in the lab is an ESSA marine meterologist. Staff members and graduate students are engaged in discipline oriented research projects. The Pacific Fisheries Laboratory is operated through the Department of Fisheries and Wildlife with the staff and students investigating mission oriented problems. The Oregon Fish Commission will be staffing a new laboratory at the Center in June. OFC personnel are currently using facilities in the Pacific Fisheries Laboratory as are Oregon Game Commission and Federal Water Pollution Control Administration staff members. The ship support system supplies logistic support for operating OSU's R/V YAQUINA, R/V CAYUSE and R/V PAIUTE.

Responsibility for public education programs is vested in the Public Wing which is open daily 10 to 4 with no admission charge. This wing contains an aquarium-museum, a 180-seat auditorium, conference rooms, and a small book store offering titles in marine science and natural history. During 1969, 213,000 visitors used the facilities. Included in this number were 12,500 school children, grades K-12, representing 200 schools. To assist effective use of the museum-aquarium, a four level guidesheet series has been developed. Guidesheets help the student focus his attention on the available subjects. The levels defined are primary (K-3), intermediate (4-6), junior high (7-9) and high school (10-12).

Museum panels or displays offer opportunities to learn about a wide variety of topics. For example the following are shown:

1. Historic oceanographic cruises traced on a large chart with major oceanographic institutions identified.
2. Models of the layers of the earth and a detail of Oregon's continental shelf.
3. Dynamics of coastal geology shown through views of various changing beach formations.
4. Tides and tidal forces demonstrated with models and recording tidal gauge.
5. General ocean circulation and Oregon upwelling and coastal fog.
6. Cycling of energy through the marine environment.
7. Characteristics and significance of an estuary using Yaquina Bay as a model.
8. Commercially important marine creatures in Oregon.
9. Shore birds of the Oregon scene.

The 11,000 gallon sea water aquarium consists of 17 tanks ranging in volume from 2,500 to 5 gallons. Several thousand specimens representing about 110 species are generally on display. A dissecting microscope is mounted between two small aqyarua ifferubg a magnified view of hydroids, bryozoa, tubeworms, etc. A well received feature is a large handling pool stocked with starfish, sea anemones, crabs, snails, chitons, sea cucumbers and so forth. There is an octopus available for petting.



When groups come on a scheduled visit they are met in the auditorium by a member of the staff who presents through slides a history of the Center and the work currently being done. He then explains the guidesheet exercise and has the class go into the Museum-Aquarium section. After the group has toured and responded to questions put forward on the guidesheet, and handled the animals in the open pool, the staff member again joins the class for a question and answer period in the auditorium. The length of time spent at the Center may vary from one and one half hours to two hours.

A separate "Career Opportunities" program is being developed to function with existing programs in school systems. Job opportunities and related information are discussed by cooperating Center staff and members of the community. Students may meet an aquatic biologist, laboratory technician, ship personnel specialist, marine fisheries extension agent and even a local restauranteur who talks about food services in a tourist area. Each describes how to get into his field, what schooling, training or apprenticeship programs exist and outlook for the future.

Funding for the public education program comes from the Cooperative Extension Service and the Department of Oceanography. Additional technical assistance is contributed by the Department of Fisheries and Wildlife, Oregon Fish Commission, Oregon Game Commission, Federal Water Pollution Control Administration and Environmental Sciences Service Administration.

Those wishing to visit the Center and use the programs are asked to write Donald E. Giles, Marine Science Education Specialist, Marine Science Center, Marine Science Drive, Newport, Oregon 97365, giving 1) name of school, 2) grade level, 3) preferred dates, 4) arrival time 5) number of students. The Center will respond confirming a date. Every attempt is made to accommodate all those who wish to schedule, however, it sometimes happens that rearrangements must be made.

A NEW COURSE IN MARINE SCIENCE

Maxwell Cohen, Teacher

Far Rockaway High School is situated on the Rockaway "Peninsula" (actually, a barrier beach) with the shores of the Atlantic only one mile to the south and the flats of Jamaica Bay a few blocks to the north. Each of our 3400 students sees the ocean or the bay every day of the week. We are located in a marine-oriented community and we have learned to think marine since childhood. Fishing, skin-diving and swimming are as popular in the Rockaways as are baseball and football in other communities. It is not a surprise, therefore, that Far Rockaway High School has become a pacesetter in the nation's drive to educate for ocean-awareness by instituting a sophisticated course in ocean science.

EVOLUTION OF A COURSE

The new course in marine science is actually a descendant of a time-honored course in biological laboratory techniques instituted at this school several years ago by David Kraus, the department chairman. The biological techniques course has been established essentially to meet the needs of bright science-oriented upper-termers who aspired to continue their science studies at college. Since 1964, biological techniques has been taught by the writer. A course of this type naturally reflects the special interests and experiences of the instructor and it was not long before the new teacher's enthusiasm for marine biology began to manifest itself in the everyday routine of the techniques class. Fresh crabs, seastars and clams from the nearby ocean became subjects for dissection; jellyfish, mud snails and marine worms from Jamaica Bay became organisms for experimentation; water samples from the ocean and bay replaced milk and urine as the objects of bacterial counts, pH determination and estimation of salt content. The switch in emphasis was gradual but inexorable and by early 1969 the biological laboratory techniques course, at the urging of the enrolled pupils, was ready for an official change of emphasis and title. Authorization was granted and the changeover to Marine Science became a reality in September of 1969.

THE STUDENTS

The new course is composed of two classes with a maximum enrollment of twenty students in each class. Each student was admitted to the class upon written application, the prerequisite grade of 90% in biology and 10th year math, and the recommendation of a science teacher. Regents chemistry is a corequisite course. Several of the students stated that they hope to specialize in some phase of marine science on the college or graduate level.

THE COURSE

Although the emphasis has been on the biology (mainly physiology, anatomy, and ecology) of marine organisms, with a strong emphasis on local forms, the winter season was dedicated largely to the study of the chemistry of seawater. Saltwater samples were analyzed for their chemical constituents. Problems of desalination, density and temperature considerations and the use of the sea as a source of mineral wealth were discussed at length.

LOCAL FORMS ON DISPLAY

The problem of maintaining study organisms in the classroom was more formidable in anticipation than in reality. Each student was assigned the task of maintaining, in partnership, a small aquarium containing a few of his choice organisms. Success was immediate and, to this date, the losses have been minimal. The first impression upon a visitor to our "marine lab" is one of complete surprise as he observes the many aquaria inhabited by unfamiliar denizens of the intertidal zone: lobsters, marine worms, sea anemones, urchins, clams, periwinkles, and a variety of crabs. He feels no more at ease when told that every organism on display is within a toe's touch of a casual seashore bather and can be obtained in local waters no deeper than one's knees.

FIELDWORK, AN ESSENTIAL ASPECT

All of the organisms used in the course were obtained by the teacher and his students in the local intertidal areas. It was discovered that the time required for such work makes it an impractical activity for regular school hours. All of the field trips and collecting trips, therefore, have been conducted on a voluntary basis on school holidays. It is interesting to note, however, that the attendance on one field trip was greater than the total enrollment in the course. On that occasion, even parents and friends removed their shoes to help in the collection of specimens.

PROSPECTS FOR THE FUTURE

At the time of this writing, midway in the first year of the course, we have dissected our way through the various sponges, coelenterates, and mollusks that inhabit Rockaway's shores. As the weather and water become warm again we shall resume our investigations utilizing available arthropods and echinderms. We also expect to engage in a study of the algae and plankton of the sea, hoping for a clearer understanding of the role these organisms in the food chains of the ocean. Until that time, however, we will focus our microscopes upon the bacteria of local waters in an attempt to determine the extent of human contamination and other microbial pollution. Perhaps we will develop within ourselves a deeper understanding of man's relationship to his environment and the ease with which he can upset Nature's delicate balance. If this goal is achieved we will consider our efforts worthwhile.

FAR ROCKAWAY HIGH SCHOOL
Oceancrest Boulevard and B. 25th Street
Far Rockaway, New York 11691

* * * * *

"A HANDS ON PRACTICE OF SCIENCE"

Ronald B. Linsky
Coordinator Marine Sciences and
Director Floating Laboratory Program
Orange County Department of Education
Santa Ana, California

This school year will be remembered by 10,000 students from Orange County as the one they went to school on the sea. They will be participants in a program that is an extremely unique curriculum innovation. Through the Orange County Department of Education Office an ESEA, Title III Operational Grant has been developed for the world's only Floating Marine Science Laboratory for secondary school students. The operational program began as a pilot study during the 66-67 school year and received such favorable support and enthusiasm at the state and local level that a three year operational grant was approved for 67-70.

The school day will begin for these students about 6:00 AM when they board a bus for the trip from their school to the historic Balboa Pavilion at Newport Beach where the

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LANDLOCKED OCEANOGRAPHY

Patricia S. Charlier
University of Illinois at Chicago Circle

About the same time that coastal educators were busily moving the little red schoolhouse out to sea in such programs as the Orange County California floating marine science laboratory, landlocked schools were involved solving similar problems of uniting ocean and student.

In mid 1967, a milestone in oceanographic education was passed when twenty-five landlubbers from the Greater Chicago area were air-lifted to a "Sea-Camp" on the Pacific Coast of Baja, California. There were more would-be participants than spaces available. Prior to departure students had taken, on campus, a 6 weeks, 6 hours a week, course in general oceanography. These students from Northeastern Illinois State University were primarily upper classmen in teacher education or graduate students and teachers in Chicago area schools.

Perhaps stimulated by Sea Camp experiences, several teachers have conducted marine sciences studies in Chicago area elementary and junior high schools.

A co-curricular activity dealing with the marine environment was launched by Timothy Sullivan at Oakview Junior High School. It was originally offered on a voluntary basis for qualified pupils. Received with great enthusiasm, the program had to be expanded to meet demands, and in 1969 it became part of the regular 8th grade curriculum.

The course is taught as a final unit called "Oceanography — Seas of Challenge and Opportunity." It starts by defining the scope of oceanography and discussing scientific methods. Bringing in social studies aspects, the reasons for studying the marine environment are set forth and a historical survey of sea exploration focuses on some major discoveries and scientists. The areas of geological, physical and chemical oceanography are examined with some depth, as is life in the sea, in each instance emphasizing the relationship of oceanography with traditional science courses. The course ends with a discussion of the ocean's economic resources, including military uses, power production, medical uses, and career opportunities. Equipment needs were modest and relatively inexpensive: heat convection apparatus, steam tables, biological specimens, 35 mm slides and some films.

At the elementary school level, Emil De Julio received approval and support for a gifted children program at Mozart School in Chicago. Oceanography is the core of the program; it was selected as the outstanding vehicle to give pupils an appreciation of the interdependence of geology, biology, botany, zoology, chemistry, physics and mathematics. Practical applications of concepts taught are used to foster interest in conservation and the wiser use of natural resources. Pupils carry out research, independent study, take field trips, and are encouraged to develop projects involving Lake Michigan. Equipment is drawn from the audio-visual and biology departments.

Participants, on the basis of scores attained in the School Learning Ability Test, are selected from grades 4, 5 and 6. The special class meets daily for a forty minute period and pupils are programmed out of their home rooms or reading groups. The whole program is conducted in close contact with the parents, who were told how and why their children were selected and who will be invited to submit comments and evaluation.

The total budget amounted to approximately $600 including expendable samples. At this writing it appears that the program will be continued next year.

A 1969 survey of all Illinois schools, conducted by Harold Prehn of the Office of Superintendent of Public Instruction, showed that 870 teachers teach Earth Science to 44,729 pupils and over 50% have no more than two years of experience in teaching the subject. Among these instructors 90% had no preparation at all in oceanography and two thirds of them had neither ever had a course in either meteorology or astronomy, or even combined earth science. When asked which subject these teachers would prefer to see taught at workshops and institutes over 50% selected oceanography. In fact, a Title III NDEA workshop in oceanography, organized under the auspices of the Illinois Superintendent of Public Instruction's Office, drew about 40 participants in Fall 1969 and most participants enrolled in courses at local universities for further formal studies in oceanography.

The case has thus been well proven: the interest in marine sciences is not limited to coastal areas nor to graduate schools, it is acute at pre-university levels. It is equally true that an ocean is not needed to draw interest, or to teach the subject. The close relationship between the present and future role of ocean and large inland bodies of water, on the one hand, and on the other environmental and ecological control points to the need for a program similar to the Earth Sciences Curriculum Project and similar programs in physics and biology. We need to consider an Aquatic Sciences Curriculum Project.

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boat is berthed. Their laboratory will be the Fury II, a 65 foot sport fishing boat equipped for marine studies. From 7:30 AM to 4:00 PM the boat will cruise between Seal Beach and Dana Point while the students conduct scientific experiments, collect the data, and record the results. The results will be tabulated and sent weekly to the University of Southern California, University of California, Irvine, U.S. Bureau of Commercial Fisheries, Scripps Institution of Oceanography, the California Department of Fish and Game and the Fishery and Oceanography Center for their permanent records.

One of the unique features of the program is the "Hands On" involvement of the students in the daily operation of the program. Each class will be divided into groups of four or five students. Each group is given specific responsibilities on a rotational basis during each of the station stops. It is while anchored or drifting at each of the stations that data are collected by the students. The operations performed include the Bathythermograph (BT) to determine temperature plotted against depth, Van Dorn Bottle for water sampling, Nansen Bottle, another sampling bottle, Secchi disc for turbidity determination, and working with the radio direction finding equipment to plot the exact location of the boat while on station.

Other equipment used by the students include the Plankton Net, Microscopes, Trawl Net, pH Meter, Oxygen Analyzer, Peterson Grab, Ekman Current Meter and Echo Sounders.

This is not a pleasure cruise as the students soon find out. Each one is expected to operate each of the various pieces of equipment during the day, plus identify the organisms collected, and carry out the chemical analysis of the sea water.

Sailing home brings the day to a close, even though tired from the day's activities, the students are eager for more. This is science practiced in a "Hands On" investigation of media constituting 70 per cent of their world.

RAMP

by Sebastian Cultrera

The Regional Academic Marine Program (RAMP) is directed toward the ultimate achievement of the following objectives. During the two years of operations certain of these have been attained in part or in full.

RAMP will extend to the youngest citizens of our region a gradually expanding program of education in the marine sciences. The end result will be adults who understand the ocean environment and its inhabitants with relationship to their economic and physical well-being so that in the future the promotion of good conservation will no longer fall on deaf ears, and the people of tomorrow will more intelligently take heed and make the necessary commitments to insure the preservation of our marine resources.

RAMP will offer elementary programs for fifth, 6th and seventh grade children. Two of these programs were carried out in the spring of 1969. The sixth grade classes were introduced to a group of animals known as the Echinoderms and the fifth grades to the Mollusks. Our approach was a classroom-laboratory-field activity. The children spent some time in a classroom which differed somewhat from many conventional classrooms in that the teaching was done on an informal discussion-demonstration participation basis. During this phase, the teacher discussed the material with the students. They then watched as an instructor demonstrated and had an opportunity to participate. This was followed by a laboratory session, in which, after a preparatory discussion, the children were allowed to explore and ask questions as they investigated specimens which were presented alive to each of the participating groups. At the end of these indoor activities, the sixth grade classes were transported to the seashore where they found the animals in their natural environment.

The field trip added considerably more credence to their previous discussions by showing the reality of these animals as integral parts of the environment, both with respect to their role in the food chain and to the part the organisms played in conserving their environment.

Evaluation of this unit of work which involved approximately one-hundred and fifty Kittery sixth grade students and ninety from the town of Eliot was extended over a period of six weeks and was carried on using a pre-test based on the material to be presented. They were advised that the results of the test would have no bearing on their academic standing and that they were primarily a means of determining how much they were able to learn within the two week period. At the termination of this segment of time, these groups were given the same test as a post-test without having previously been told that this would occur. This eliminated the possibility of a carry-over of questions and answers in anticipation of the repeat test and ruled out the tension commonly associated with the learning process when a student is preparing for a future examination. The average percentage increase was approximately 25.5 points. This indicated that our students had indeed accumulated an amount of familiarity with the animals not evident at the beginning of the session.

The second half of the sixth grade program took place during the summer of 1969. There were fifty-two students involved. These students registered and were from Kittery and Eliot. They were selected on the basis of the interest shown during the spring session, their ability to cope with the type of material to be presented, and not necessarily on their level of achievement. The large group was divided into three sections, each to be carried through the program for a period of two weeks. These children attended class each day and one-half hours with as much outdoor work as possible included in the schedule. The field trips were determined by the time of the low tide. Transportation was provided by the parents.

In an effort to carry on the expansion of RAMP educational activities a complete marine environment study unit was prepared and is being implemented with Kittery seventh graders as a pilot program. After the initial trial run these units and techniques will be refined and the material made generally available as with the grade six units prepared in 1968.

This same approach will continue to be used as far as possible in developing RAMP in future years to include grades one-twelve. Each year we anticipate completing segments of this expanding type of marine education.

Another objective of this operation was the extension of this special education to the secondary level. In this area the high school biology teacher became involved in the project and spent considerable time writing supplementary units to the current text on Sponges, Coelenterates and Marine Worms. These are enrichment units incorporating marine organisms into chapters which discuss terrestrial and fresh water counter parts. In this way the students in grade ten who are enrolled in the biology course are able to make maximum use of the environmental laboratory of their coastal region as well as being able to accomplish academically as much as students in other schools in the country.

An additional secondary program was carried on during the summer of 1969. The RAMP staff offered a course in marine biology to eighteen secondary students of the region. This was made up of formal classroom instruction, laboratory experience, and field work. In addition to the areas of marine ecology, marine invertebrates and salt water algae, a unit on marine fishes was added to the course content.

Further evaluation of this type of secondary program was made by means of a questionnaire which was sent to students who participated in the program during the summer of 1968.

It is apparent from these that the RAMP Program of 1968 had a profound effect upon the thinking and direction of the people who participated. Long range evaluations will have to be continually made of the program through these students as they pursue courses of study and direct themselves toward vocations which RAMP may have been instrumental in suggesting. Therefore, the long-term evaluation of RAMP will be by far a more significant one. This will have to be accomplished by periodic follow-ups on these students as they leave their high schools and seek further education or vocation.

The RAMP staff has constructed ten classroom units and guides which can be used as model curriculum by other schools for incorporation into their own science education. They are included in this report.

As a result of our program, we will continue to illustrate how oceanology can be interwoven with the traditional sciences presently being taught in our schools. RAMP will enrich the traditional science courses by showing biological, chemical, and physical applications to the ocean through demonstrations and by guiding students as they work with this material at the RAMP facility, in the field, and in their school classrooms.

Another objective has been the dissemination of information to the adult population of our area by bringing them in closer contact with the resources of the ocean. RAMP extends to this group the opportunity of seeing and hearing outstanding people in the field of oceanology in person or by way of various audio-visual media. In the spring of 1969, the schedule included a series of classes in layman's marine biology. These classes were scheduled for a period of six weeks and each week from 7:30 to 9 P.M. on Monday, and had thirty members.

Outline for an Elementary Program

About 18 months ago, we printed an article in the Newsletter about a pilot study in elementary level marine education. Many of the points seem relevant to the topics in this special supplement. Consequently, we are reprinting the story. — Ed.

The responsibility for service to science exists in all grades. The specific responsibilities of elementary schools toward oceanography have been well defined in a pilot study sponsored by the Link Foundation. These responsibilities are as follows:

- Provide information and experiences to familiarize the children with marine environments.
- Develop proper attitudes toward marine conservation and develop an understanding and appreciation of the oceans as vital food sources.
- Acquaint children with the methods of inquiry used by marine scientists.
- Correlate marine science with other parts of the curriculum.
- Develop an awareness of careers in oceanography.

Any oceanography program in elementary schools is based on the assumption that the curriculum should provide a sequence of marine science experiences which permit selected concepts to be developed and expanded as the child moves through intermediate grades. Well planned experiences in the primary grades should lead to the specific introduction of oceans and plant and marine life in the fourth grade. In the fifth grade, this base can be extended by presenting material on seashores and sea resources as well as the classification of plants and animals. With this background, the sixth grade can develop moving seas and ocean formations along with ocean research, oceanography careers and conservation.

There are many reasons why good elementary programs haven't yet appeared. Some feel that oceanography creates a problem in specialization rather than providing an opportunity for diversification. There is a question as to whether the content of such programs should be organized around major ideas in science, around student interest, or around classical divisions of science. In addition to basic questions of concept, there are real problems associated with the availability of reference material and curriculum guides. To overcome these problems, the Graduate School of Oceanography at the University of Rhode Island has developed a series of resource units entitled *Oceanography for the Young*. The resource units present interviews with teachers and scientists, teaching initial concepts about the oceans, available resources and science programs in the elementary school, childrens' bibliographies, recreational activities associated with the sea, as well as other guides for oceanography programs in elementary schools.

Other attempts are being made to fill the gap in oceanography curricula. The American Geological Institute conducts the Earth Science Curriculum Project at the University of Colorado. While this outstanding program in earth sciences is oriented to secondary schools, many of the publications and demonstration materials made available can be applied at the elementary levels. The Earth Science Curriculum Project under Dr. Joseph Weitz has made great strides toward making young people aware of and interested in their environment. Reference material and sources can be obtained by writing to the Earth Science Curriculum Project, P. O. Box 1559, Boulder, Colorado 80302. Our young people are our future.

THE ONSHORE LABORATORY

by JoAnne Simonds

The Balboa Pavilion, located on the shore of Newport Bay in Balboa, California, is the center of unique educational activity each school day. Some mornings junior high school students begin to arrive at seven a.m. They are excited about the day's activities. Seventy students will take part in a full day "hands-on experience." Half the day they will spend aboard the Orange County Floating Laboratory; the other half will be spent participating in exercises in the Onshore Laboratory.

The Onshore Laboratory was established two years ago in conjunction with the Floating Laboratory. While 35 students go on the boat in the morning the remaining 35 stay in the Onshore Laboratory. The two groups switch places in the afternoon.

While the students are in the "hand-on" experience of science begins or continues. There are seven stations around which the students, already divided into seven groups of five, rotate. The students have lab sheets which serve as an outline for their activities and as data sheets to be turned in for recording later. After an explanation of activities and use of equipment the students start the various exercises. After 20 minutes the students rotate on to another station.

The stations are as follows:

I. Water Sample Analysis

By use of a bucket thermometer, a water sampling bottle, color kits, and a secchi disc students test the water temperature at various levels, the visability and color of the water. They perform this task from the dock.

II. Data Recording

In the lab, students compile the temperature readings from previous classes and graph the results. They also complete a graph of their own temperatures for a profile of the water temperature that particular day. Plankton numbers and types the days found are also recorded.

III. Sediment Sample and Analysis

Here the students take samples by a coffee can on the bay beach next to the pavilion at various tidal levels, sift the sand and decide on the type of sediment and list organisms and items found at the different levels.

Secondly, by use of a bottom sampler off the dock, they sample the bottom of the bay, compare it to the shore studies and describe its color, type, odor and organisms found in it.

IV. Study of Attached Organisms

There are three areas to study and compare organism growing around the building: the dock, the pilings, and suspended blocks. By hand lens collecting samples, using a dissecting scope, sketching pilings, etc., the groups become aware of larval attachments, tidal effects on the organisms on the pilings, and growth arrangements of these organisms.

V. Identification of Fish and Algae

After a short explanation, students find it fun and helpful to use a key to identify fish and algae common to the Newport area They also get a chance to handle the specimens.

(Continued on Page 8)

CARTERET COUNTY MARINE SCIENCE PROJECT

by *W.T. Hon*

Carteret County is in the middle of the North Carolina coast, and includes that spearhead of land known as Cape Lookout. It is just south of Cape Hatteras, which is an unusually clear breaking point in the north-south distribution of plants and animals. Beaufort and Morehead City are protected by the necklace of barrier beaches which stand between them and the ocean. The shallow sounds behind these "banks," as they are called, have always yielded richly to fisherman and now display their richness to classes of eager young explorers who are part of the Marine Science Project.

(Continued from Page 7)

VI. Disection of Fish Caught Aboard the Floating Laboratory

Opportunity to work with fresh specimens.

VII. Collection and Identification of Plankton

Students collect plankton, with a small plankton net, off the dock and bring samples into lab to study under the microscopes.

After the day is over and 70 students have been onboard the floating lab and spent 3 hours in an onshore lab it is almost certain that with this great opportunity to sample and see these surroundings they have become more aware and conscious of their ocean environment.

Another program is conducted on days when the Onshore-Onboard program is not in operation. Elementary children are given the opportunity to visit the lab and participate in a variety of programs. Five hourly sessions are offered, however each session or program is flexible depending on the desires of the visiting teacher, the age level and preparation of the children.

The sessions offered are:

1. The Story of the Whales
2. Marine Ecology
3. Animals of the open sea
4. Animals of the tidepools
5. Man working and living in the sea

Visiting teachers can choose to participate in one program or all four depending on time, money, and age level.

The children have a wonderful time at the laboratory. Not only do they have a chance to learn more about the ocean but they are at the ocean, able to see and feel the animals available, occasionally going to see a stray seal or pet pelican. They will hold a live crab or see a fisherman catch a flounder; they will see big and powerful fishing boats, fast moving catamarans or gliding sailboats; they will hold a wiggling anchovie and screech a little from the slime and scales left on their hands.

The children are always excited and enthusiastic. It is a fun trip for them as well as a wonderful learning experience. The lab has helped expose thousands of Southern California school children to the wonders of the ocean. It is hoped that the enthusiasm created there is carried over into the classroom by the teachers in followup studies. Futhermore, keeping the idea of exposure in mind, teachers can make classes fun and education stimulating for the children, and learning will come naturally from there.

Largely because of their affection for the sea, coastal people are reluctant to think of the drastic changes time and progress will bring. They do not know how to weigh what they now do against other uses of marine resources.

The Marine Science Project is therefore an examination of a region's attitude toward a sea that embraces it physically, culturally and economically. In these counties where the spoken words all have a briny flavor and the family trees are rooted in the sea like mangroves, the new generation must rethink its value judgments.

The approach has been through the public schools. The target has been grades four through twelve, building from gentle coaxing at the lower level to a tough, elective, college prep program for upperclassmen in the high schools.

The message has been ecology. The chief tool has been the field trip. The classroom has not been deserted, but every classroom presentation implies a coming field experience, and each page of written material is treated as a temporary stand-in for reality. To a degree unique in this area, the students go out into the field and do what students are usually accustomed only to talking about.

Neither the educational principles nor the scientific materials are earth-shaking. However, the need for some group to translate technical jargon about the nature and significance of coastal ecology into readable popular materials has long been known. Compared with the rocky coast to the north or tropical seas to the south, the mundane mid-Atlantic coast has been ignored.

It is true that the publishing companies have rediscovered the sea, but they print books of predigested facts about the seashores of broad geographical areas or about the great new adventures in ocean engineering.

There is no book which makes a foot-soaking in a *particular* marsh more meaningful. This is to say that there are now many reference books for background lectures on oceanology, but nothing to give school teachers and students a field approach to coastal ecology in this region, the middle of the Atlantic seaboard of America. There is a great demand for such materials.

Program Objectives

The plan for the Carteret County Marine Science Project outlined three interwoven appraoches:

A. A program of curriculum development, including teaching units and field trip guides for grades 4-10 and two advanced biology courses, and other special publications.

B. A program of teaching and in-service training to help develop, test and use the curriculum materials.

C. An education center, in the form of a facility to serve as interpretive center, demonstration area, field trip nucleus, laboratory, reference library and information center.

The Program

Second Grade

- A TOUR OF MUDFLAT TOWN: a guide for a field trip led by students of the "Marine Ecology" class.

Third Grade

- A DAY WITH DON AT CAPE LOOKOUT SEASHORE: third grade supplementary reader.

- DON EXPLORES A TIDAL FLAT: third grade supplementary reader.

Fourth Grade

- HOW SEA ANIMALS LIVE: fourth grade unit on individual adaptation to marine environment.

Fifth Grade

- LIVING COMMUNITIES OF THE SEASHORE: a unit in relationship that ties individual plants and animals together in coastal communities.
- BOGUE SOUND TREASURE HUNT: a look at life on the bottom of an estuary by dredging up samples.

Sixth Grade

- THE OCEAN AND MODERN MAN: considers man's role in using coastal resources and affecting environments.
- PORT: GATEWAY TO THE WORLD OCEAN: a field trip to a port terminal.

Seventh Grade

- SALT MARSH, SOUND AND SEA BEACH: a survey of coastal areas emphasizing population dynamics; field trip is a cross-section through the Outer Banks.

Eighth Grade

- THE SEA AND ITS BOUNDARIES: a study of coastal processes and oceanography, with a beach field trip.

Tenth Grade

- THE FIELD APPROACH TO COASTAL ECOLOGY: two units, one for fall and one for the spring, which use coastal environments to demonstrate basic principles of ecology; fall field trip to a salt marsh, spring trip to many other natural communities.

Eleventh and Twelfth Grades

- MARINE ECOLOGY: a full-year elective course in advanced biology, with emphasis on methods of scientific investigation.
- EXPERIMENTS WITH SEA WATER: four chemical analyses suitable for use by regular chemistry classes.
- DUNE DETECTIVE: a series of field exercises to guide investigators in reconstructing the events which have shaped the natural communities of a barrier beach.

All Grades

- THE FIELD EXPERIENCE: a guide for teachers in the rationale and techniques of field ecology.
- MARINE SCIENCE FILM CATALOGUE: description and grade level rating of about 50 movies and film strip series.
- NORTH CAROLINA: OUR ROLE AT THE EDGE OF THE SEA: a summary of the state's marine resources, management programs and educational opportunities; designed as the framework for a current events high school course called "Coastal Affairs".
- THE MAJOR NATURAL COMMUNITIES OF THE CAROLINA COAST: a major volume describing environmental factors, plants and animals of ocean beach, dune, sound, salt marsh, tidal flat and jetty habitats.
- A CHECKLIST OF MOLLUSCS OF N.C.: an unillustrated tabulation of species and ecological preferences.
- THE REGIONAL MARINE SCIENCE PROJECT: a description of experiments in the school use of field ecology as an approach to understanding coastal environments.

The education center (Sea Lab) was eliminated, along with all other Title III construction, in the budget cuts of 1967. Emphasis was shifted to curriculum development, using schools as the field trip centers. However, in the summer of 1969 a county marine science council was formed and it adopted the Sea Lab project. Proposed as a state and federal (Coastal Plains Regional Commission) project, it received approval of the State Marine Science Council in September, was divided into two phases and scheduled for construction in 1970 and 1971. The interpretive center, phase two, is part of the state plan for use of funds which are supposed to become available in July of 1970.

The Center, when complete, will utilize materials developed by the Marine Science Project on a statewide basis. School systems will receive teaching units and field trip services at cost. In-service training will be supported by grants. The general public and special interest groups will also utilize the center. The Sea Lab program will be related to that of other marine science agencies and other education agencies in the area.

The significant point of Sea Lab construction is that Title III served its function well. The planning grant and three-years of operation were sufficient to develop and prove the value of the approach to the extent that the State has taken over financial support, and even seen the need for the proposed facility. The county program was a true pilot project, to be expanded by 1971 to give comparable services to at least 40 counties. The nature of the Title III project's influence is shown by the fact that funds to be used in the future were set aside for a *research* facility, but have been altered in main thrust by the Carteret County Public School proposal.

DISSEMINATION

County: All biology teachers and half of the elementary teachers have attended in-service. Most have taught the curriculum units for 1-3 years (depending on grade level) and accompanied a field trip related to the unit. Forty newspaper articles have partially informed the public program and talks to all civic clubs have explained the work of the project to community leaders.

State: In various conferences and in-service workshops, 70 professional educators, 400 North Carolina science teachers, and about 600 college science majors have observed the project or heard slide lectures about it. At least fifteen news articles, most about the Sea Lab, have appeared in other papers. In-service training announcements and one feature article have appeared in North Carolina education journals. The staff has assisted six other Title III projects in their planning.

Nation: The program was explained at formal conferences to AETS in 1968, to Pacific coast marine educators in 1969, to NEA principals in 1970, and to NSTA in 1970. Packets of curriculum materials have been sent to about 300 educators on request. About half of these are within the state and the other half predominantly Atlantic seaboard. Thirty states and six foreign countries are represented in the correspondence.

Oceanology Field Trip Program

Simi Valley Unified School District

Encouraged by Ron Linsky, Director of the Marine Science Floating laboratory and coordinator of marine science in Orange County, last Spring members of the staff of Valley View Junior High School in Simi Valley initiated a semester course in the Simi Valley Unified School District, entitled "Oceanography" which began this past Fall. The instructors held little hope for an "on board" program to augment this course. Then, a few weeks later, the Santa Barbara Underseas Foundation was formed by interested persons in Ventura, Santa Barbara, and San Luis Obispo Counties. This foundation was formed to encourage and provide the means for study of the oceans by students of all ages in the three counties.

As the foundation developed, it was found that the group would be able to provide facilities and services for all three counties and recommended that San Luis Obispo and Ventura counties attempt to form their own organizations.

On November 3, 1969, 33 interested persons met at Captain Jack's at Channel Islands Harbor to discuss the possibility of forming such an organization. Among those 33 persons attending were Bill Brisbee of Moorpark College, the man who was responsible for calling the meeting, Bill Connelly, owner of the Island Packer, John Prince, Principal of Valley View Junior High School, Lee Strong, Oceanology instructor at Valley View and Tom O'Neal, biology instructor at Ventura College.

At last, preliminary plans for an ocean trip were made between Valley View Junior High School and Bill Connelly. Bill Connelly purchased a partnership in the PAISANO, a 65 foot converted aviation rescue boat. The PAISANO is powered by twin diesels, capable of cruising at 12 knots. The vessel has plenty of deck space for students, two bait tanks, radar, radio, and depth finder. After many conversations between Bill Connelly and John Prince, plans for the cruise were finalized for January 23, 1970.

The floating classroom included 45 eighth and ninth grade science students, Lee Strong and Ermen Fedel, science instructors at the school, John Prince, the principal, and Bill Connelly.

The PAISANO left at 10:00 a.m., January 23, from Captain Jack's in the Channel Islands Marina in Oxnard. The vessel will steer a course for the area where the Santa Clara river empties into the sea. The second stop was opposite the Edison Company plant midway between Ventura and Oxnard. The third location was in deep water between Anacapa Island and the Channel Islands Marina. The final stop was located near the sewer outflow at Port Hueneme. The boat returned to the marina landing at 2:00 p.m., minus one old plankton net which broke and sank.

Since the trip of January 23, Simi Valley Unified School District has purchased a basic oceanography sampling kit which was initially used by 42 staff members of the Simi Valley School District on April 3, as they went to sea in the Paisano. The stations had been revised to include the use of the new equipment. One of the main purposes of the trip was to test the procedures written for the new equipment and to revise them as needed prior to the next student trip.

1. Plankton retrieval and examination.

kton retrieval.

3. Navigation, (using hand bearing compass, radio direction finder, and radar).
4. Water sampling (for determination of O_2, pH, specific gravity, temperature).
5. Secchi disc and weather.

The Paisano left the dock at 3:30 p.m. and visited three areas:

1. Waters opposite Edison plant, midway between Oxnard and Ventura.
2. Three miles directly west of Channel Islands Harbor.
3. In the area adjacent to the Port Hueneme sewer outflow.

All five teams were highly successful with their activities with the exception of the viewing of plankton under the microscope. It was discovered that an artificial light source is needed. Other minor problems were encountered and recorded so that the necessary revisions could be made prior to the student trip scheduled for May 4th.

On Monday, May 4, 1970, 50 students from Valley View Junior High School and Sequoia Junior High School will leave at 9:00 a.m. from Simi for Channel Islands Harbor. Upon arrival, 25 of the students will remain on the bus and will be transported to the site of the seashore life program south of Point Mugu. They will spend a brief period there, familiarizing themselves with the intertidal life in that area. They will return to Channel Islands Harbor to board the Paisano for a 2½ hour oceanology program afloat.

The other 25 students having completed the cruise on the vessel, will board the bus and spend part of the afternoon exploring the intertidal area.

In subsequent weeks the classes will assemble the data, study it, and draw some conclusions where applicable.

It is our hope that the above few activities are but a beginning of the marine science program in Ventura County. With the proximity of the sea and the Channel Islands and the efforts of members of the county committees, the study and appreciation of the sea can be a real part of everyone in Ventura County and surrounding areas as well.

MARINE BIOLOGY AT ROSLYN SUMMER HIGH SCHOOL

by James Klausen

The marine biology program was conceived as a summer enrichment experience for the high school students at Roslyn Sr. H.S., Roslyn Heights, N.Y. The program has been fairly standard treatment of invertebrates, fish, algae, and ecology in the lecture-lab portion with the field work devoted to individual research projects. The student's work has been evaluated on a pass-fail basis to take off the grade pressure and encourage the enjoyment of learning. The students spend approximately 6 hours a week in two sessions at a rocky beach, part of the county park system, doing research and another 6 hours per week in 3 sessions in lecture-lab, with the emphasis on lab.

This year major revisions are in the works. Behavioral objectives have been written (see below). Those in the cognitive domain will necessarily make the program more rigorous. Those in the affective domain will necessarily change the character of casual conversation with students as well as reorient the criteria of evaluation. The time allotment and scope of the program wll remain unchanged. The field research experience has been most important. It is an opportunity for high school students to spend some time in real research of their own conception, something few regular school year courses can offer. This aspect of the course will remain unchanged.

Another new feature of the couse this year will be an exploration of some non-verbal forms of teaching. For example, it is very difficult for people to empathize with the natural rhythms that exist in nature. The veneer of culture has led man to deny his identity as an animal and all that implies. To encourage a better understanding of these rhythms and forces, a variety of nonverbal activities are planned. By way of an example, students will lie at least ½ hour on a still beach with their bodies half in and half out of the water as the tide is rising. The result should be a "gut" feeling for tide and a better appreciation of its role in the intertidal community.

The program has been in existence for 3 years and has served the needs of a community located on Long Island Sound. The innovations described should enhance the effectiveness of the program and increase its value.

BEHAVIORAL OBJECTIVES

Plants and Animals

Cognitive

1. The student can connect a structural feature with an adaptive value 80% of the time.

(Continued on Page 12)

CUT ALONG THIS LINE

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Area of primary interest in oceanography:_____

(Continued from Page 11)

2. The student can select the environmental niche a particular organism is adapted to 80% of the time.

3. The student can extrapolate reasonable possible results of changing that niche.

4. The student can identify most of the major problems to be solved if an organism is to live and give examples of how these problems are solved by various phyla of marine plants and animals.

Affective

1. The student will exhibit greater respect and appreciation of living things by causing minimal environmental disturbance and correcting those who do.

Ecology

Cognitive

1. The student can describe the interrelation of physical and biological factors in the marine environment.

2. The student can list five ways the local marine environment is important to community residents.

3. The student can make reasonable predictions as to the effects of specific disturbances on the marine environment.

Affective

1. The student will take some positive action to sustain the local marine environment.

Pollution

Cognitive

1. The student can list three types of pollution found locally.

2. The student can connect the types of pollution with their sources.

Affective

1. The student takes some positive action to lower the level of pollution in the local marine environment.

Skills

Cognitive

1. The student's observation skills will improve to the extent that, given a particular situation, the student can make 75% of the observations the teacher can make.

2. Given an appropriate problem, the student will use a controlled experiment to solve the problem.

3. The student will show increased speed and effectiveness in researching basic facts and concepts in the library.

Affective

1. The student will apply the criteria of the controlled experiment in evaluating appropriate life situations. (ex. advertising, "old wives tales", common sense, medical quackery, etc.)

FOR ADDITIONAL INFORMATION

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