Marine Resource Bulletin

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Spring 1986

Marine science technology

Virginia Sea Grant College Program-Virginia Institute of Marine Science-College of William and Mary

Virginia Sea Grant College Program

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The Marine Resource Bulletin is a quarterly publication of Marine Advisory Services of the Virginia Sea Grant College Program which is administered by the Virginia Graduate Marine Science Consortium with members at **The College of William and Mary, Old Dominion University, University of Virginia and Virginia Polytechnic Institute and State University.** Subscriptions are available without charge upon written request.

C. M. Plummer, Editor
K. Stubblefield, Graphics

Sea Grant is a partnership of university, government and industry focusing on marine research, education and advisory service. Nationally, Sea Grant began in 1966 with passage of the Sea Grant Program and College Act.

Cover: VIMS' graduate student, Rick Hoffman, loads clams in cages as part of relaying technology studies. Inset photos: VIMS' computer and ODU current meter.

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Marine notes

Va Tech supported lab focuses on seafood

Donna Soul
Sea Grant Seafood Home Economist

The Virginia Tech Seafood Processing Research and Extension Unit located in Hampton, Virginia, is an off-campus facility of the Department of Food Science and Technology.

The Center is a renovated crab and oyster processing plant at the Hampton public dock, close to the finfish and shellfish processing firms. The Center has a classroom, pilot processing lab, micro lab, test kitchen and a small library. At present, staff include a food science faculty member, marine extension agent, research associate, seafood home economist and laboratory technician.

Activities change to meet the needs of the seafood industry. The pilot lab tests equipment and develops procedures to improve seafood processing efficiency and product quality. A pasteurization system is operated for research and industry training.

The test kitchen allows staff to evaluate seafood recipes and develop new recipes for consumers. We are particularly working with underutilized species such as squid and dogfish shark. In addition, different preparation methods are tested such as microwave cooking of seafood.

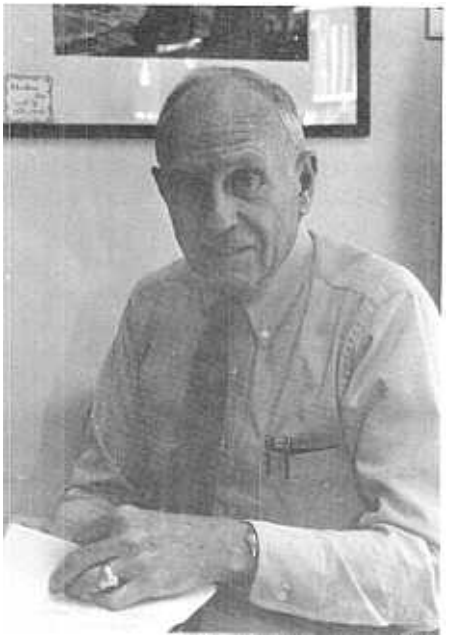
Workshops are offered to consumers, volunteers and paraprofessionals on seafood preparation. Each summer, a two week seafood course is offered by Virginia Tech's Food Science and Technology Department, sponsored by the Mid-Atlantic Fisheries Development Foundation and the Virginia Seafood Council.

For information about the class or VPI seafood publications available, contact: Mrs. Donna Soul, Cooperative Extension Service, Virginia Tech Seafood Lab, 102 S. King St., Hampton, VA 23669. 804/722-1822

Award winning city

The City of Norfolk received four awards last year for coastal management and shoreline restoration. Don Mathias, Manager of the Environmental Services Division, which coordinated the improvements, says the awards are due, in part to, "listening to marine scientists."

According to Mathias, a shoreline study prepared by Old Dominion University in 1977 provided baseline information for long range planning. Then, marine advisory agents at the Virginia Institute of Marine Science added insights and practical solutions to problems over several years.



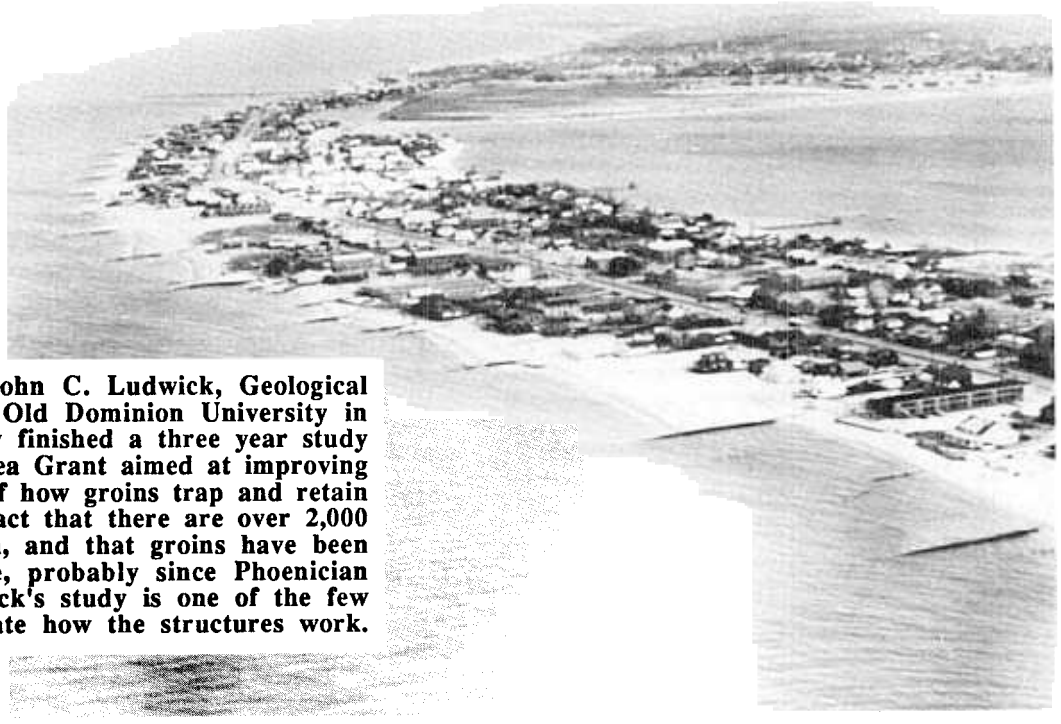
Dr. Carvel Blair, ODU Oceanographer, helped improve the quality of Norfolk's public beaches.

"Dr. Carvel Blair, a member of ODU's Oceanography Department and Head of Norfolk's Wetlands Board and Erosion Advisory Commission really deserves the credit for our program," Mathias said. "Dr. Blair used his knowledge and skill to develop a comprehensive shoreline program for the City of Norfolk."

Once the City approved, both management and beach restoration became very much a federal/state/city cooperative effort. "The Navy supplied dredge material from one of their projects for beach replenishment, the State Public Beach Commission helped with design and funding the projects, and within the City government, several departments made a tremendous effort toward improving the beaches," Mathias said.

As a result of the City's efforts, Norfolk received: The Award of Merit from the Virginia Public Beach Commission for their beach and dune building efforts and for public education; the Virginia Municipal League Achievement Award for planning and regulation on the shoreline; Coastal Zone '85 Recognition of their comprehensive shoreline enhancement program; and the Virginia Wildlife Federation Certificate for shoreline management policy, planning and regulation.

Where does the sand go?



Dr. John C. Ludwick, Geological Oceanographer of Old Dominion University in Norfolk, has nearly finished a three year study funded by Sea Grant aimed at improving understanding of how groins trap and retain sand. Despite the fact that there are over 2,000 groins in Virginia, and that groins have been used world-wide, probably since Phoenician times, Dr. Ludwick's study is one of the few designed to evaluate how the structures work.

View of groin field on Willoughby Spit in Norfolk before beach nourishment.

Each year, wind, water and human actions cause the loss of about 300 acres of Virginia's shoreline. Nationwide, homeowners, businesses and governments have spent billions of dollars trying to protect their beaches and shorelines.

One of the most common protective devices is a groin field. Although there are about ten common groin designs and as many possible building materials, in Virginia most are made of wood and placed at right angles to the shore. A series of groins placed on a beach is called a groin field. The structures are only used on sandy beaches.

A groin field is designed to trap sand which moves along the nearshore and to hold existing material on the beach. Of the 2,000 in place in Virginia, some work spectacularly well, some work for a while and then become ineffective, others never hold the beach. Why is that?

Scientists don't specifically know the answer. Although many studies have been designed to track sand loss from beaches, few have been performed in areas with structures in place. And it has only been recently that instruments have become sophisticated enough to achieve quantitative results.

Dr. Ludwick has chosen a particularly ideal site for his study -- an old groin field on Willoughby Spit in Norfolk which has recently been nourished. (Placing quantities of sand on an eroding beach is called "beach nourishment.") Dr. Ludwick was able to study the beach before the new fill was placed, and then continue his study as forces at the site were exaggerated by the system's effort to balance the new material with the old beach configuration. In addition, a terminal spit began forming shortly after the beach nourishment. This feature can be such a prime indicator of sand movement that when Sea Grant sponsored a National Sand Transport Survey of the nation's beaches, sites were chosen based on the presence of terminal spits.

In all, 537,000 cubic yards (yd^3) of sand were placed on Willoughby. Of the 12,000 yd^3 placed between the two groins selected for the ODU study site, 5,200 yd^3 have already been lost. Dr. Ludwick believes a portion of the missing sand is in the terminal spit.

Once a month for the past year and a half, the scientist and his assistants have taken measurements at the study site which include tide and current readings, bathymetric surveys, wave studies and the monthly mapping of beach change. These readings are plotted along with meterological events provided by the U.S. Navy, and tidal data from the National Oceanic and Atmospheric Administration (NOAA). When the individual data are combined they represent thousands of bits of information about beach change. The majority of the scientist's time is spent analyzing all of the information collected in order to discover a pattern of how sand is lost from the groin field.

(Continued)

As a result of the study, Dr. Ludwick has already confirmed that the Willoughby site is unusual in that tidal currents and waves perform an equal role in sand loss from the beach. In most areas, it is primarily the waves which effect sediment movement. In addition, Dr. Ludwick believes he may have isolated several specific mechanisms of sand loss.

There are a number of important by-products of the ODU research. An immediate result of the study was the development of improved, low-cost experimental equipment for surf zone studies such as this one (See story below). For planners, a major benefit will be an improved ability to predict how long fill placed on a protected beach might be expected to remain.

Large nourishment projects like the one in Norfolk require long range planning, both for finding the proper material and for funding. If city planners knew when they would need to re-nourish a beach, it would simplify their job and assure continually protected and high quality beaches.

Of particular interest to Dr. Ludwick is the possibility of working with coastal engineers to design structures which would specifically fulfill the dynamic needs of a given beach. The geologist hopes that experimental structures can be designed, placed in the area and studied over a period of time.

The primary importance of a study such as this to a research scientist like Dr. Ludwick, however, is the possibility of answering the question -- where DOES the sand go?

Kym Young

Dr. John C. Ludwick, Geological Oceanographer, Old Dominion University, Norfolk.

ODU research leads to advanced technology

When senior scientists like Dr. John C. Ludwick of ODU set out to study a subject, they are generally assisted by several of their graduate students who share an interest in the research. As part of the Sea Grant funding for the Willoughby Spit groin study, funds for PhD candidate Dennis L. Lundberg were included to aid him in developing electronics for a low-cost current meter which could be used in future studies.

Current meters such as those used for the ODU research cost $50-70,000 and most universities can't afford to set out 20 or 30 meters to blanket the surf zone. Often, if the weather deteriorates during research, the costly equipment is lost or damaged.

Lundberg has created an electronic data acquisition system for use with an inexpensive current meter developed at the University of Michigan. A plastic pipe houses a propeller which turns with the direction of the current. A small shade attached to the propeller interrupts a pair of photodiodes each time the propeller passes, sending an electronic signal to shore-based monitors. A priority encoder electronically sorts signals from up to six current meters at a time. Current direction and velocity can be interpreted from the encoded messages. The meter includes digital electronics which provide direct computer analysis capability.

The system is easily built and repaired, making it ideal for university research labs. Lundberg will perform final tests this summer, gauging the accuracy of his system with that of the traditional meters used by Dr. Ludwick in the groin study.

A graduate student who recently completed his studies at ODU, David L. Timpy, developed a modification to another piece of equipment used in the Willoughby project, a capacitive wavestaff.

The wavestaff measures wave features, the direction of the waves and the elevation of the water surface as the waves form and move across the surface. Scientists can extrapolate an approximation of the size and amount of sediment moved by relating the sediment to the wave features.

Timpy modified the wire on the wavestaff which sends signals to shore. Previously, water clinging to the wire altered signals and often distorted data. By using a thinner wire, Timpy proved that more accurate data could be obtained.

Another PhD candidate taking part in the study, Hyo Kang, has used a method called "plane table surveying" to develop bathymetric charts of the changing study site. The charts are correlated to other events such as weather and tide.

The plane table sits on a mobile tripod which moves out into the water. Using an aledaide, an optical surveying device, the scientist focuses on a stadia rod placed on the bottom. By reading the elevations indicated on the rod, the scientist can determine the bottom topography. In the marine environment this is known as bathymetry.

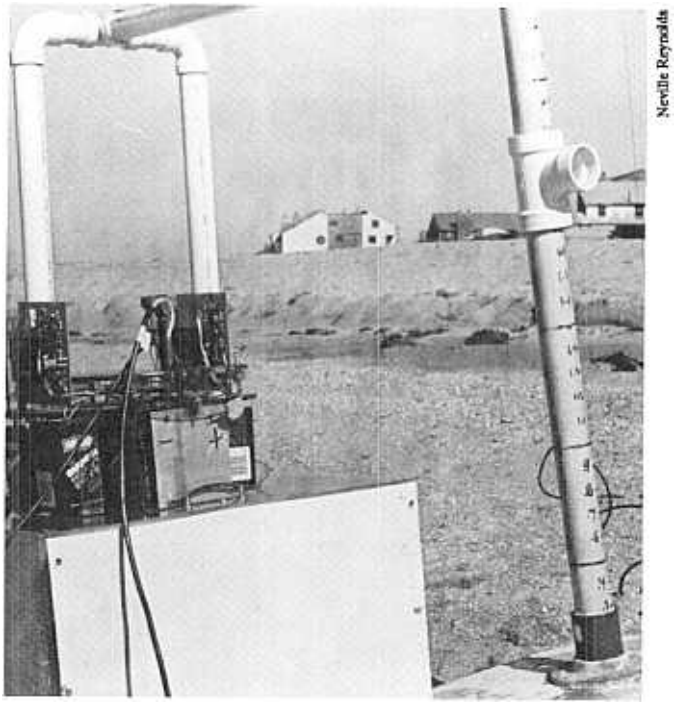
In his study, Kang established his bathymetric surveys based on data from the National Geodetic Survey data base so that years from now, any future surveys can be accurately compared to show changes in the area.

To date, Kang has performed 30 surveys during which 150 points were measured. That amounts to some 4500 surveyed points.

Kang is also responsible for charting all of the data collected by other students and Dr. Ludwick. The graphic illustration, done by hand, is a work of art. Scientifically, the chart shows a comparison between predicted tides versus plotted tidal elevations to illustrate deviation. Also illustrated are the behavior of the shoreline in relation to the changing tide and the volume of sand that remains on the beach. Significant events such as storms or flood tides indicate meteorological events that caused some of the peak activity on the beach.

Technological advances such as those developed at ODU provide better information for researchers and more answers to questions about the environment they study. As knowledge increases, instrumentation is developed to help answer the next level of questions.

Careful documentation of research provides other scientists with basic data on which to build. Agencies can use the precise data bases for design, planning or as a reference for their own surveys.



Neville Reynolds

Electronics and power supply for capacitive wave-staff built by David L. Timpy shown on beach at Willoughby Spit.

Sea Grant catalogs Bay data bases

Since the introduction of the computer as a common tool for scientists, the amount of stored data has increased to staggering proportions. But how available is that information?

According to one of the experts, Dr. David Evans, Computer Center Manager at the Virginia Institute of Marine Science, "The problem of the 80s is really finding a way to catalog all that stored information so that it is of use to present and future scientists."

The National Oceanic and Atmospheric Administration (NOAA) has been building a massive environmental data base since 1980. Called, "A National Environmental Data Referral Service (NEDRES)," the publicly available system collects information from scientists and agencies all over the United States. However, most submissions are voluntary and there is no present way to assure that all research information is being provided to NEDRES.

Dr. David Smith, Assistant Director of the Virginia Sea Grant College Program, decided to assure that information about the Chesapeake Bay will be available on the national system and that it will be cataloged for Bay area users.

Starting this year, Smith and his associates began visiting every Virginia facility, research center, regulatory agency, college or university and organization that might have environmental data about the Chesapeake Bay. Once they find information, they must convince researchers to take the time to add the information to Nedres and to the catalog.

This is a joint project with Maryland Sea Grant surveying their state in the same manner as Virginia. The catalog will cover the entire Bay area.

To date they have located over 100 data sets between Virginia and Maryland. Some are so small they have only a few hundred observations recorded, and some contain thousands of observations such as the large holdings of the EPA Chesapeake Bay Program.

If a complete catalog can be compiled, it will still require voluntary contributions to keep current. A cataloged Chesapeake Bay data base can save agencies money by preventing duplication of studies; it can save researchers time if work they need has already been performed and is available for their review; and it can save private industry money in preparing environmental studies.

People on the water

"If we don't help VIMS, they can't help us."

Roy Davis Waterman

Roy Davis started harvesting clams 18 years ago. At times, he has worked 18-24 hours a day to create the successful business he is now turning over to his sons-in-law. The company handles 10-12 million clams each year. Four to 7 million of those are first harvested in polluted waters, then relayed to approved waters off Poquoson where they will cleanse their systems of impurities.

Every year nearly 25-30 percent of the relayed clams are lost from breakage during moving or from being smothered in silt and old oyster shell on the bottom. This year, working with scientists from the Virginia Institute of Marine Science, Mr. Davis is testing wire cages for moving and holding the clams. At present, four cages are being built to the waterman's specifications for summer testing.

"If they are inexpensive, convenient to move, allow the clams to cleanse themselves and prevent theft and breakage," Davis says, "We could increase our harvest by 25-30 percent." If the cages do work, next year Davis intends to use a barge outfitted with lifts on both sides to lower and raise the cages which Davis estimates will weigh about 600 pounds each and hold about 5,000 clams.

Although Roy Davis has made all the arrangements with VIMS for the experiments, designed the cages, and set in motion a possible minor revolution in clamming; he won't be around for the height of this year's season. "The two boys, (sons-in-law Johnny Weisner and Danny Watkins), will handle the whole operation this year," he says with a smile. "My wife and I will be playing golf in California."

Waterman and work to improv

Clam relaying takes place e when large numbers of the sl located in polluted waters of t placed on bottom in clean wa potentially harmful microorg harvesting in two weeks. Beca are lost during relaying eac working in Poquoson to ex containers for moving and losses. This Sea Grant fur research and applied benefits

Scientist at work

harine scientist
e clam relaying

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metal framework, wire covered
s which are being tested this
1' high by 4' long by 4' wide.
the cage top opens to provide
for loading and unloading the
Wooden 4" by 4" skids raise
cage above the bottom so that
l circulate to all of the clams.
ps attached to the top enable
esters to lift the cages using
ndard winches on patent tong
boats.

"We couldn't do a large scale test like this on location without Mr. Davis' help."

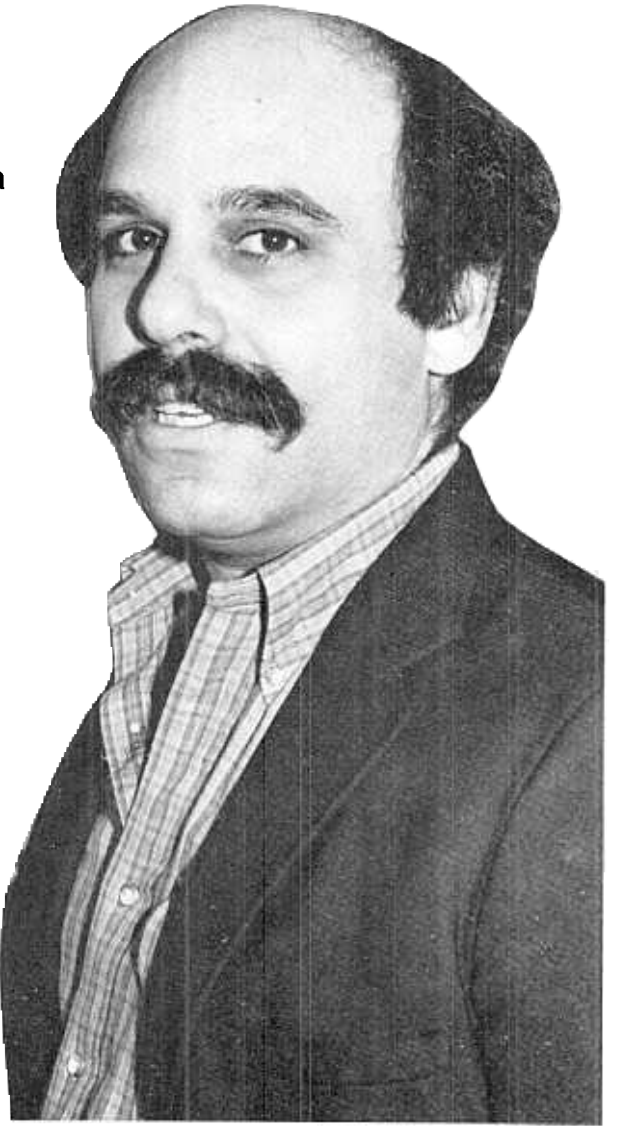
Dr. Howard Kator has been a research scientist at the Virginia Institute of Marine Science at Gloucester Point for 12 years. He received his PhD from Florida State University in Biological Oceanography. Most of Dr. Kator's work has involved the study of marine bacteria.

Currently, he and his co-worker, marine scientist Martha Rhodes, are performing three major studies of bacteria: the survival of enteric bacteria in estuarine water; the significance of nitrogen conversion in the upper James River; and the ability of certain bacteria to break down seafood wastes.

In addition, through Sea Grant funding this summer the two scientists will study bacteria in clams that have been relayed in wire cages. At the beginning and end of each relaying period, clams will be taken from cages on Roy Davis' beds in Poquoson for chemical and microbiological analyses.

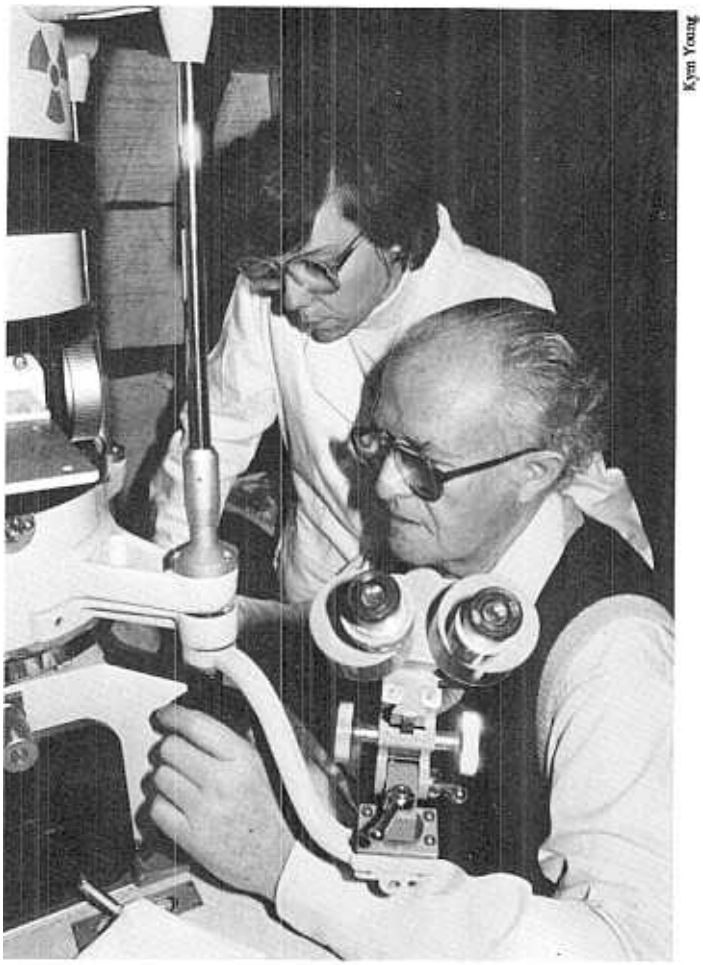
The scientists hope to gather enough information to establish a data base for clam relaying and the rate of cleansing in cages. The new information will help state regulatory agencies set standards and will tell innovative watermen like Mr. Davis whether a new method of clam relaying will work.

Howard Kator
Micro-biologist



Kator and Rhodes hope to develop a permanent data base which can be used in their own work and by other scientists. Sea Grant projects like the clam relaying analysis often benefit basic research and applied industry needs at the same time.

Extract from starfish yields medical clues



Kym Young

Dr. Lionel I. Rebhun and Dr. Carolin Walker at work in University of Virginia biological lab.

At the University of Virginia in Charlottesville, biologist Dr. Lionel Rebhun's curiosity is about to be satisfied thanks to Sea Grant research funding. For years, the scientist remembered an intriguing 1951 report by Dr. L. V. Heilbrunn which indicated that extracts from certain marine organisms prevented cell division. Rebhun hoped that someday he would have time and funds to pursue Heilbrunn's study.

In 1983, with Sea Grant funding and assisted by Dr. Carolin Walker and Mr. Charles Hubbard, Dr. Rebhun took extracts from starfish ovaries and began experimenting. The results have been astounding. Using sea urchin eggs and seven different types of cultured animal cells, the UVA team has been able to confirm that some substance within the ovaries of starfish prevents cell division.

Recently, they have also determined how the substance works. In the cell, as mitotic division is about to occur, chromosomes normally move into a spindle-like structure which then separates them into equal groups at opposite poles of the cell. Then, like fingers grasping the center of a balloon and squeezing, two proteins, actin and myosin, form a ring-like structure attached to the cell membrane. This ring constricts, pulling the membrane with it, and cleaving the single cell into two cells. The extract from the starfish breaks the attachment points of the ring to the membrane and prevents the ring from completing the cleavage of the cell. In addition, the substance or ovotoxin detaches actin networks from the cell membrane even during non-division stages causing rapid cessation of cell movement and cell shape changes.

Literally thousands of laboratory tests were required to reach this point of understanding. First, the ovaries from the starfish Pisaster giganteus (a west coast starfish that grows to 3 feet in diameter), were extracted. Heilbrunn had reported that starfish seemed to be the most potent of the various marine organisms he had tested. For each test, the material must be homogenized, heated and then filtered by a process that allows substances of low molecular weight to pass through.

Next, the viscous material is subjected to column chromatography. This is a process for separating solutions of closely related compounds by allowing the solution to seep through an absorbent gel so that each compound becomes absorbed in a separate layer depending upon its molecular weight. The various chemical compounds filter out at different velocities and are collected in small aliquots (fractional equivalents). In this case, activity was found in both low molecular weight and high molecular weight fractions.

Because this series of tests normally requires several weeks to run, one of the first accomplishments of the Rebhun team was to develop a shorter testing procedure. This has allowed them to more quickly separate the low molecular form of the ovotoxin and increase the number of

tests which can be performed. At this point, however, Dr. Rebhun still does not know the exact chemical nature of the ovotoxin.

What he has learned offers important insight into how the cell functions and a number of avenues for future medical research. Since the substance causes the disconnection of part of the cytoskeleton (inner-cell scaffolding) from the cell membrane (the outer-cell layer), it may affect natural communication within the cell. This finding would be of significance for researchers seeking to understand hormone actions, growth mechanisms and other areas of medical research.

Another hope is that once the substance is purified and completely identified, it will offer some clue to how rapidly multiplying cells such as those in tumors might be prevented from dividing. At present, however, since the toxin prevents division in every type of cell tested, the importance of the findings is the increased information about cell division, not as an anti-tumor substance.

Dr. Rebhun received his PhD in Zoology and Biophysics at the University of Chicago. Dr. Carolin Walker obtained her degree at Case-Western Reserve University and did Post-Doctoral studies at the Eleanor Roosevelt Cancer Institute at the University of Colorado Medical School.

Dr. Lionel Rebhun talks about his research:

"The major work in our laboratory concerns the mechanisms by which cells divide and the control systems which are involved. One area of study concerns the use of spindles, the major organelle concerned in separation of chromosomes in all higher cells.

"These organelles are isolated from eggs of invertebrates (sea urchins and clams), and are analyzed for the major proteins which are present in spindles. They are also analyzed for how they are organized in three dimensions.

"The ultimate aim of these studies is to find media in which the spindles will separate chromosomes in the test tube and so allow us to better experiment with the mechanisms involved in cell division. This work has been supported by the National Institute of Health and the American Cancer Society.

"We are also experimenting with the process of cell cleavage, a major target of ovotoxin. We have isolated and purified a major enzyme involved in cleavage which appears to control the interaction of the two contractile proteins -- actin and myosin. This protein requires calcium and a special calcium target protein called calmodulin, in order for it to allow actin and myosin to interact and result in contraction.

"We are also studying mammalian cells in culture which are blocked in cleavage at one temperature, but which can cleave at another. Our hope is to identify the points of blockage and therefore of control of the cleavage furrowing activity. This work is supported by the National Institute of Health.

"Finally, we are studying some of the initial stages in development, specifically with respect to the initiation of and physiological function of endocytosis (fluid ingestion) in sea urchin egg development."

Kym Young

Dr. Carolin Walker plates cells in culture dishes to test the ability of ovotoxin to inhibit cell division.

Fish house kitchen

The year round oyster

Shirley Berg
Executive Director
The Virginia Marine Products Board

The Virginia Marine Products Board is a state agency fully funded by the seafood industry. The Board conducts research and promotes Virginia seafood products through a comprehensive marketing program designed to upgrade and expand both domestic and foreign markets. This program is part of what makes Virginia's seafood industry outstanding.

This summer, we are emphasizing that Virginia oysters are available year round from the waters of the Chesapeake Bay. Nutritionally, oysters are an excellent source of high quality protein, minerals, and vitamins and are easily digested.

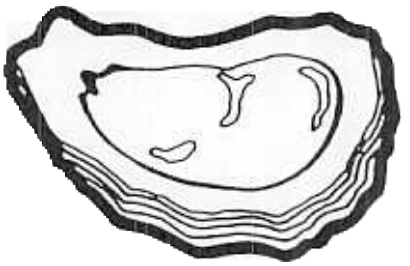
When buying shucked oysters, the liquid should be clear with no sour smell. Oysters in the shell should be tightly closed. Discard any whose shells do not close when tapped gently.

To help consumers think about oyster dishes in the summer, we have developed a number of recipes which are perfect for warmer weather, lighter eating. So put away your chowder, soup and heavy casserole recipes for colder weather, and try these!

Marinated Oysters Williamsburg

1 pt. fresh shucked standard Virginia oysters
1 pt. cherry tomatoes
6 oz. fresh whole mushrooms
6 green onions, cut into 2 inch lengths
1/4 cup chopped pimento
1 cup cider vinegar
1/2 cup salad or olive oil
1/2 cup water
2 cloves garlic, minced
1 teaspoon sugar
1 teaspoon salt
1/2 teaspoon dried oregano leaves, crumbled
1/4 teaspoon pepper
salad greens

Thaw oysters if frozen. Drain oysters. Remove any remaining shell particles. Rinse cherry tomatoes in cold water. Clean mushrooms thoroughly with a damp cloth. Cut large mushrooms in half. In a 2 quart bowl combine oysters, tomatoes, mushrooms, green onions and pimento. In a 1 quart bowl, combine vinegar, salad oil, water, garlic, sugar, salt, oregano and pepper; mix thoroughly until sugar is dissolved. Pour marinade over oysters and vegetables. Cover loosely and marinate in refrigerator at least 12 hours. Drain and serve on salad greens.



Oysters Maxwell, Egg Noodles & Spinach

Serves 6

Richard J. Nelson, C.E.C.
Executive Chef
Sheraton Airport Inn
Richmond

1 lb. small zucchini cut in thin strips
1 pt. oysters and juice
1 lb. fresh tomatoes, peeled, seeded, cut in strips
1 lb. mushrooms, sliced
2 Tbsp. butter
1/2 cup chopped onion
1/2 tsp. sugar
1/3 cup finely snipped fresh dill or 1 tsp. dried dill
1/4 cup white wine
salt and pepper to taste

In a large skillet melt the butter and saute the onions for two minutes. Then add zucchini and mushrooms and cook for one minute more. Add the seafood and cover. Simmer for two to three more minutes. Add the tomatoes, sugar, wine, dill and salt and pepper to taste. Heat thoroughly for two minutes and serve over egg noodles with spinach.

EGG NOODLES AND SPINACH

4 oz. medium egg noodles
1-10 oz. package of fresh spinach
2 Tbsp. butter
salt and crushed black pepper

Cook medium noodles in salt and water and drain. Heat butter in skillet. Clean spinach, cut off stems and drain and cut in strips, add to butter. Cook for 2 minutes, season with black pepper and salt to taste. Add to noodles and heat. Ready to serve.

For a free recipe brochure, request "Oysters 'R' For Always" from:

The Virginia Marine Products Board
P. O. Box 1248
Newport News, VA 23601

How deep is the water?

Samuel Clemens was an American author who wrote about life on the Mississippi River. Clemens used a different name for his writing; one which came from an old method used to measure water depth.

Before electronic methods for measuring depth (called sonar), seamen dropped weighted lines (lead lines) over the side of the boat or ship. The lead line was marked in fathoms. One fathom equals six feet. Early navigation charts were created by this method. It helped captains know if the water was deep enough for their ships, particularly when they were approaching port where the water was more shallow.

As the boat slowly made its way through the water, the seaman yelled out the depths to the navigator, "Mark one, Mark two. . . " This meant a depth of six feet, then twelve feet.

Twain was an old word for "two," so Samuel Clemens, who actually worked on the riverboats, used the pen name "Mark Twain."

ACTIVITY

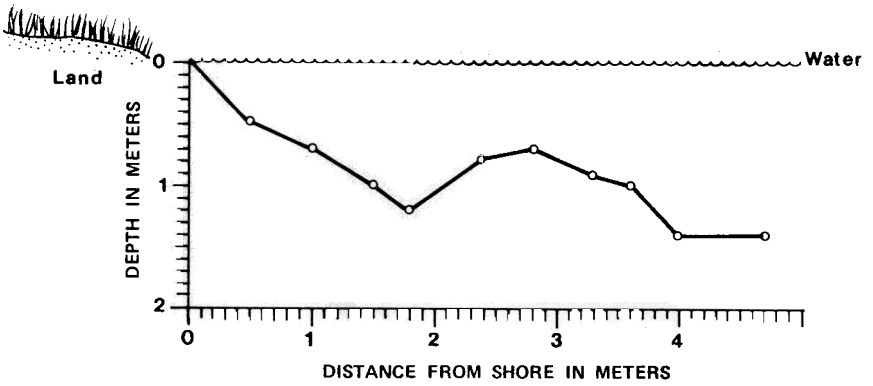
1. Using heavy string, put a fishing weight on one end.
2. With a meter stick, mark the string at one meter distances with a bright waterproof marker or contrasting string. Now go back and put in marks for each tenth of a meter.
3. Decide on a beginning and ending spot for your measurements.
4. Decide at what intervals to drop the line.
5. Walk out on a pier, along a riverbank, or out in a shallow pond in as straight a line as possible.
6. Drop the line straight down into the water until the weight just touches the bottom. This takes practice to make sure the weight just reaches the bottom and the line is straight.
7. Now record the depth measurements as you take them.

What do the numbers tell you?

Your numbers may look like this:

0, 5/10, 7/10, 1, 1 2/10, 8/10, 7/10, 9/10, 1, 1 4/10, 1 4/10

8. Using graph paper, draw what your measurements revealed.



You have just drawn a bathymetric chart.

WOULD YOU LIKE TO USE SONAR TO MEASURE THE DEPTH OF THE OCEAN FROM A RESEARCH VESSEL?

9. Talk to your science teacher or school librarian about marine science software programs. OCEANOGRAPHY, one of the programs listed by the Computerized Marine Education Network (CME), has a special program which includes a simulated bathymetric study aboard a modern research vessel. YOU get to derive the bathymetry.

For information about the MARINE SCHOOLHOUSE SERIES or to order a copy of this Wavelet, write: Marine Advisory Services, Virginia Institute of Marine Science, Gloucester Point, VA 23062. Mark envelope: "Publications request."

Computer technology in the classroom -- educational programs

Susan Walton
Gloucester Intermediate School

Simulations of field experiences are a great way to use the computer. Teachers who cannot find time or funding for field trips can lead students on excursions, taking population samples, making appropriate calculations, asking leading questions to help them draw conclusions and even helping students to graphically represent what they have learned -- all without leaving the classroom.

TAG, a program from Minnesota Educational Computing, samples a fish population. It allows the user to select a number of fish to be tagged and then releases them into the general population. Samples are taken at sites of the student's choice. Sample size is also by choice.

Often, students are introduced to physical features of the ocean's environment by graphing a set of data the instructor insists is from a sonar transect. OCEANOGRAPHY, available on a Computerized Marine Education Network disc, offers a more exciting alternative. The student is given the visual stimulus of seeing a representation of a sound pulse being sent to the ocean floor, and offered an opportunity to calculate the actual depth rather than just copying facts. This approach is closer to what would actually be seen on a research vessel.

Computers can be an incredibly useful tool in the same way that audio-visual aids and laboratory equipment are helpful to teachers. Drill and practice programs quiz the students on their knowledge with multiple choice or other forms of questions. Tutorial programs present textbook-like screens of information to the learner. Simulations recreate life situations and get the learner involved in decision making about the scenario. Computer materials are available that predict results of environmental manipulation that could not be tested in reality. The game, problem solving, and skill building categories need little explanation. Computers can also make lab work and data analysis a cinch.

Many simulations are very effective as activities for small groups at a single work station. Another option is to allow an entire class to interact in demonstration style, possibly replacing the computer's small monitor with a television hook-up. Such large group settings are valuable as the entire class brainstorms on the input and predicts the results. Large groups may also relieve the tension some students feel when using computers.

The Computerized Marine Educational Network can help. This network is designed to help marine educators locate materials to fit their needs without wading through the pages of computer catalogs or purchasing unsuitable items. It also serves to connect interested parties via a newsletter and direct contacts such as workshops so that individuals can share ideas and teacher produced/public domain software.

For more information on the network, contact either:

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Address correction requested