RINEHART COASTAL RESEARCH CENTER
WOODS HOLE OCEANOGRAPHIC INSTITUTION

COASTAL RESEARCH

Volume 1, Number 1
September 1997

COASTWEEKS

Seminar Series

COASTWEEKS, a grassroots effort aimed at protecting and teaching about our coasts, will be celebrated this year from September 20 to October 13. The RCRC is participating by sponsoring a series of coastal seminars featuring prominent scientists who will speak at WHOI's departmental seminars during the next two weeks. The RCRC also invites you to attend a reception on Tuesday, September 30, from 3-5 at Carriage House. The following seminars are scheduled, please check bulletin board notices and the "yellow sheet" (WHOI weekly Calendar of Events) for details.

SEPTEMBER 30 ---------- MC&G
Bob Aller—Biogeochemical Cycling on Continental Shelves: the Amazon Mobile Mud-belt as a Fluidized Bed Reactor.

OCTOBER 1 ------- G&G & MPC
Dan Stanley—The Nile and Other Major Deltas: Origin and Early Occupation by Man.

OCTOBER 2 ---------- BIO
Ivan Valeila—Watershed and Receding Estuary: Results from Waquoit Bay.

OCTOBER 07---------- PO
Bob Beardsley—Preliminary Results from the U.S. GLOBEC/Georges Bank Field Program.

OCTOBER 08---------- AOP&E
Scott Glenn—Coastal Upwelling and Bio-optical Response on the New Jersey Continental Shelf.

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Turbulence Studies at Duck, NC

Waves and currents reaching the shoreline are responsible for sand movement that leads to beach erosion or accretion. Understanding the forces that drive sediment motion in the energetic nearshore and surf-zone coastal regions will assist with the development of tools for predicting the impact of hurricanes on beaches and the long-term evolution of the coastline. This has been the aim of SandyDuck '97, a large coastal field experiment that is underway in Duck, NC, sponsored by the US Army Corps of Engineers, the Office of Naval Research and the US Geological Survey.

Rebecca Beavers

This field site was too shallow for a ship, so WHOI scientists John Trowbridge, George Voulgaris and Janet Fredricks rode the US Army Corps of Engineers Coastal Research Amphibious Buggy (CRAB), a 35 foot tall motorized tripod, to carry the bottom stress instrumentation to the deployment location in Duck, NC.

Measuring the hydrodynamic forces that act on the seabed (turbulence) in the nearshore is difficult because the signal is contaminated by strong wave and wind interference. An innovative method was recently developed by John Trowbridge to separate the wave-induced and turbulent flow signals in order to obtain accurate information on bottom stresses near the coast.

RCRC and Mellon awards enabled Trowbridge to build and test equipment in time to join the SandyDuck collaborative effort. The data collected will provide accurate mean flow, turbulence and bottom stress estimates under extreme weather conditions when both breaking waves and wind-induced forcing are important. Other investigators are obtaining the high-quality surface wind and wave measurements needed to place Trowbridge's bottom stress measurements in context.

A bottom mounted frame equipped with 5 acoustic Doppler velocimeters was deployed on August 26, 1997, at a mean water depth of 4m. The current meters measure the 3 components of the flow at 5 elevations above the bed every 1/25s. Data collection is scheduled for the whole of the hurricane season, through December 1997.

Dr. John Trowbridge is an Associate Scientist in the Applied Ocean Physics and Engineering Dept. at the Woods Hole Oceanographic Institution.

A Message from the Director:

We oceanographers seem to be entering a new era, in which our research is increasingly supported by "mission-oriented" agencies and is becoming more tightly linked to specific, societal problems. This is bad news to some scientists and significantly affects the health of a place like the Woods Hole Oceanographic Institution (WHOI). It is crucial that we be able to find support for pure research, unconstrained by short-term or parochial needs of society. However, we must also accept the responsibility and leadership in addressing society's concerns.

The Rinehart Coastal Research Center (RCRC) strives to maintain a balance between these disparate research goals with a combination of internal WHOI research grants and special projects. In the last two years, most of the RCRC's budget has gone to nine "Interdisciplinary Research Grants" (see article on page 6), which cover a broad swath, from turbulence measurements in the surf zone to low-level detection of trace metals in bivalve larvae. Some of these projects have obvious and immediate societal relevance, and others will pay off decades from now by providing the building blocks for a fundamental understanding of coastal processes.

As for special projects, we plan in the next year to make a significant investment in nearshore processes, possibly bringing in new scientific staff and developing new facilities for measurements of the hydrodynamics and sediment transport processes in the surf zone. This is an exciting area of research with extremely important implications to economic and environmental issues of the coastal zone. The funding for these research grants and new initiatives comes from the generous support of Gratia Rinehart Montgomery, the Mellon Foundation, and the other patrons of the RCRC, which allows WHOI to maintain its position of leadership and excellence in coastal research, regardless of the vicissitudes of external funding agencies.

Rocky Geyer,
Director

Events Honor Bill Grant

William D. (Bill) Grant was a Senior Scientist in AOP&E. A pioneer in the study of wave boundary layers in the ocean, he was a great proponent of interdisciplinary research and a contributor to the early development of the Coastal Research Center. His dedication and boundless energy were an inspiration to us all. Two upcoming events honor his memory.

• Bill Grant Annual Memorial Run:
Join us on Friday, October 3, at 4 p.m. at the Water Street Bridge as we run one of Bill's favorite routes along the shore to the Coastal Research Lab. Refreshments will be provided in the CRL High Bay afterward. Donations are requested and will be added to the William D. Grant Summer Student Fellowship Fund. Please contact Wayne Spencer (289-2832) or Gretchen McManamin (289-2292) to register or for more information.

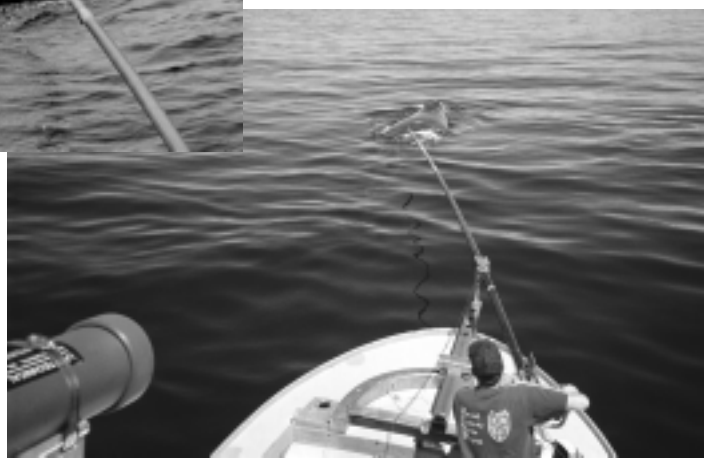
• Bill Grant Symposium:
In September 1998 the Rinehart Coastal Research Center will sponsor a symposium in Bill's name to honor his scientific accomplishments. Prominent scientists from around the world will be invited to participate in lectures and discussions on bottom boundary layer processes, sediment transport, and their influence on benthic biology.

Scientists Assess Health of Northern Right Whales

The North Atlantic Right Whale is a critically endangered species, with a population of fewer than 300 animals and a low reproduction rate. With modest support from the RCRC, Michael Moore developed a noninvasive method for gathering acoustic measurements of blubber thickness, to look for differences in body condition between animals that breed successfully and those that do not. He hopes to appraise the significance of nutrition to apparent reproductive failure of the northern species.

Moore and his colleagues recently successfully deployed a custom-engineered field probe on a 40-foot long pole in a large congregation of right whales east of Grand Manan in the Bay of Fundy. Over six days, they laid their probe on 20 to 30 animals. The boat, pole, probe, crew, and whales worked harmoniously most of the time. The final tally of usable data awaits analysis of the data tapes, but a conservative assessment is that they acquired blubber thickness data on at least 50 animals.

Michael Moore



An acoustic probe is held against a Northern Right Wale to measure blubber thickness during Michael Moore's study in the Bay of Fundy this summer. The ultrasound probe is mounted on the end of a 40 foot carbon-fiber pole, articulated on a rotating bowsprit. Stereo video cameras are used to determine the size of the whales.

This kind of data has never been collected from free-ranging large whales before. Moore and his colleagues have thus initiated a novel long term study of body condition and reproductive success in this endangered species.

This project was initiated with support from the Massachusetts Environmental Trust and the recent field work was supported by the Rinehart Coastal Research Center.

Dr. Michael Moore is a Research Specialist in the Biology Department at WHOI.

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The lecturers were selected for their important contributions to interdisciplinary, coastal research.

Dr. Robert Aller is a Professor in the Marine Sciences Research Center at SUNY Stony Brook. He has made a career of doing extremely innovative work in early diagenesis in sediments, focussing particularly on animal-sediment interactions, authigenic mineral formation, and sediment-water exchange mechanisms, in a variety of estuarine, deltaic and continental margin environments.

Dr. Daniel Stanley is the Director of the Smithsonian Institution's Deltas/Global Change Program. He has established the most effective means to differentiate the effects of natural from human-induced factors that control lithofacies distribution and coastal development in the Alexandria region of Egypt.

Dr. Robert Beardsley is a Senior Scientist in WHOI's Physical Oceanography Department and former director of the Coastal Research Center. He is a major player in the GLOBEC Georges Bank study, which addresses the physical and biological factors influencing fish recruitment on Georges Bank.

Dr. Ivan Valiela is a Professor in Boston University's Marine Program at the Marine Biological Laboratory. He literally "wrote the book" on marine ecology, and his current research involves the effects of human activities in watersheds on the ecology of the estuarine receiving waters.

Dr. Scott Glenn is an Associate Professor at Rutgers University. He is a leader in real-time observations and modeling of coastal processes and a principal investigator in the LEO-15 coastal observatory.

RCRC Small Boat Fleet Update

Since the begining of 1997, the Rinehart Coastal Research Center (RCRC) has been required to charge fees for use of its small boat fleet. The current rates cover RCRC support for maintenance, safety/navigation equipment, training/certification, and administrative costs. We have tried to keep rates lower than for typical commercial rentals, and funds have been set aside to help cover vessel costs for small projects.

The current fee structure is:

Mytilus $275/day
19' Whaler $200/day
17' Whaler $175/day
13' Whaler $125/day
14' Inflatable $125/day

• The engine problems that have plagued R/V *Mytilus* since the spring have finally been corrected, and the boat has returned to full operation. The manufacturer provided a new engine under warranty. A differential GPS navigation system and Emergency Position Indicating Radio Beacon (EPIRB) have been purchased and installed.

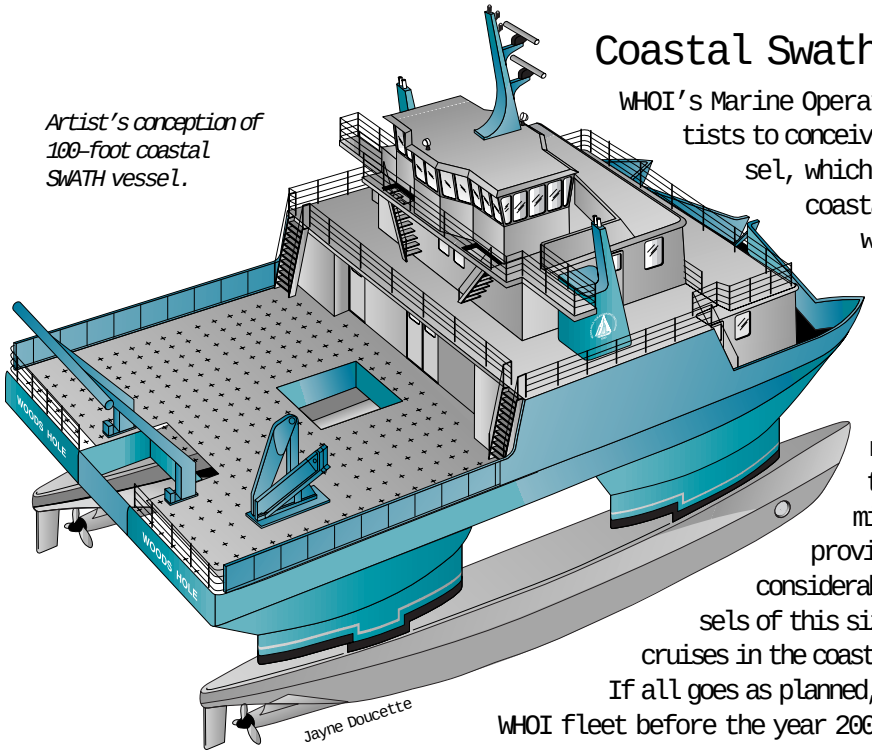
• The RCRC is hosting a winter user training session for *Mytilus* operators. The weather limitations of the vessel will be reviewed and the use of emergency equipment such as survival suits and the EPIRB will be discussed. In the interest of safety, only highly experienced operators who have attended the training session will be permitted to operate *Mytilus* during the winter season.

Contact Bebe McCall (289-2418) or Steve O'Malley (289-2286) for more information about the RCRC small boat fleet, or visit our web page at http://www.whoi.edu/coastalresearch/Fleet_Listing.html.

Terri Corbett

R/V Mytilus in Nantucket Harbor

Coastal Swath Vessel Design Underway



Jayne Doucette

Artist's conception of 100-foot coastal SWATH vessel.

WHOI's Marine Operations Department is working with scientists to conceive the next generation coastal research vessel, which would be able to work the northeast coastal waters throughout the year and have a wider "weather window" than the current fleet of coastal vessels, while keeping the daily cost reasonable.

These attributes may be met with a 100-foot SWATH (Small WAterplane Twin Hull) vessel, which has passed its preliminary design phase and will next be subject to model tests. The SWATH design optimizes sea-keeping ability, and the twin-hull provides a wide expanse of deck area as well as considerable lab space relative to conventional vessels of this size. The ship will be suitable for 1 to 2 week cruises in the coastal waters of the North Atlantic.

If all goes as planned, the coastal SWATH vessel will join the WHOI fleet before the year 2000.

An Experiment to Study Solute and Solids Transport in the Seabed

The biological redistribution of dissolved and particulate substances in the seabed has fundamental implications for a wide range of oceanographic phenomena. Despite their central importance, the mechanisms of bioirrigation (solute transport) and bioturbation (solids transport) are still poorly understood, especially relative to the mathematical models that have evolved to describe them. For example, it is unclear how seasonal fluctuations in the abundance of common benthic invertebrates will impact seabed transport rates.

To better understand this issue, Bill Martin and Rob Wheatcroft used RCRC funding to conduct an experiment in Buzzards Bay last summer. The experiment centered around the three-fold, in situ enrichment of the abundance of the worm, *Nephtys incisa*, in otherwise unaltered patches of the seafloor. Martin used small benthic flux chambers and Wheatcroft used noble-metal tracers to make comparisons between transport rates inside and outside the enriched patches.

Tom Kleindinst

Bill Martin prepares one if his tripods housing benthic flux chambers for deployment.

Whereas many oceanographic "experiments" are merely well-posed observational programs, this research was unusual for an oceanographic field study since it represented a true experiment, in which a variable (*Nephtys* abundance) was altered and a response (solute and solids transport rate) was measured. The enrichment was successful and the experiment should yield important information about the effect of organisms on the rates of benthic exchange.

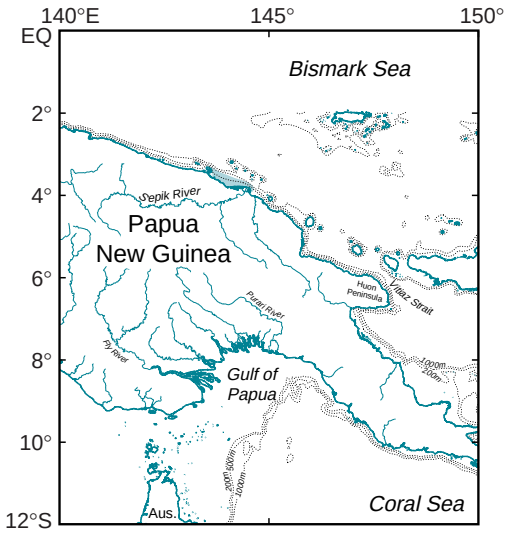
Dr. William Martin is an Associate Scientist in the Marine Chemistry and Geochemistry Department and Dr. Robert Wheatcroft is an Associate Scientist in the Applied Ocean Physics and Engineering Department at WHOI.

New Adjunct Scientist Studies Sediment Transport in New Guinea

With support from the Rinehart Coastal Research Center, Gail Kineke participated in a research cruise aboard the Australian research vessel Franklin in the coastal waters of Papua New Guinea. The cruise was part of TROPICS (Tropical River-Ocean Processes In Coastal Settings), an international research effort that aims to understand the effects that tropical rivers carrying large quantities of sediments and nutrients have on the physics, biology and geology of their receiving waters and the underlying seafloor environment.

The study area was located in the vicinity of the mouth of the Sepik River on the northern coast of Papua New Guinea. The adjacent continental margin is very narrow, dropping to depths of two thousand meters several miles off the coast. A string of active volcanoes rise above sea level. At the mouth of the river is a deep canyon that cuts across the shelf, which may be a typical configuration of river mouths during low stands of sea level.

The suspended sediment measurements taken near the mouth of the Sepik River indicate that sediment carried by the river takes various dispersal routes. A surface buoyant plume carries a thin (often less than 2 meters thick) layer of turbid sediment out into deep water, where it meets the blue ocean waters in sharp fronts. Much of the sediment, however, flows down the canyon, near the bottom or at intermediate depths, spreading out in layers that follow subtle changes in water density.



The routes that the sediment takes as it leaves the river mouth zone have profound influence on

New Guinea – page 6

New RCRC–Funded Research Projects

The Rinehart Coastal Research Center has formalized the process of awarding internal grants for research by establishing an annual call for proposals. Funded proposals must address coastal themes, should be interdisciplinary, innovative, and relevant to society's interest in the stewardship of coastal resources. The larger awards require participation from members of at least two different departments.

In 1996 and 1997, RCRC solicited proposals from the WHOI community for interdisciplinary coastal research. The 1996 call focussed on 4 specific areas: Sediment-water interactions, coastal instrumentation, predictive modeling, and coastal biodiversity. The 1997 call did not restrict the scientific scope of the proposals, as long as they were consistent with the goals of the RCRC.

Nine proposals have been funded in this two year period, with budgets generally in the $30,000 to $60,000 range. Although these are not large grants by ONR or NSF standards, they provide opportunities for more innovative and interdisciplinary investigations than are usually supported by traditional funding agencies. The following projects received support.

1996 Awards ----------

- David Caron: Predicting Blooms of the Brown Tide Alga, Aureococcus anophagefferens, Based on Pelagic and Benthic Trophic and Nutrient Coupling.
- Dennis McGillicuddy: Physical Forcing of Phytoplankton Population Abundance in the Western Gulf of Maine.
- William Martin and Robert Wheatcroft: The Relationship between Macrofaunal Abundance and Composition, Particle Mixing, and Sediment Irrigation: In Situ Experiments in Buzzards Bay.
- James Moffett and Michael Twiss: Metal Chemistry in Coastal Waters and Its Relationship to Bioaccumulation and Trophic Transfer.

1997 Awards ----------

- John Trowbridge: Direct Measurement of Bottom Stress in the Wind- and Wave-forced Nearshore Environment.
- Daniel McCorkle: Radiocarbon Content of Ground Water and Submarine Ground Water Discharge in the South Atlantic Bight: An Initial Survey.
- Michael Moore: Health Assessment of the Northern Right Whale.
- Lauren Mullineaux and Stanley Hart: Use of Trace Elements in the Larval Shell as a Marker of Bivalve Dispersal.
- Christopher Weidman, Steven Lentz and John Hayes: Creation of a Digital Database for US East Coast Lightship Oceanic and Atmospheric Records.

New Guinea – from page 5

the geochemical processes that affect the sediment and its receiving waters. They also determine the nature of the deposits that will ultimately result from the large flux of sediment originating from the rapidly eroding islands of the Western Tropical Pacific.

Dr. Gail Kineke is an Assistant Professor at Boston College and an Adjunct Scientist at the Woods Hole Oceanographic Institution.

George Hampson Retires from WHOI

Marjorie Clancy

George Hampson displays a previously unidentified species at his retirement party.

After several decades at the Woods Hole Oceanographic Institution, George Hampson retired this summer. He plans to continue participating part time in WHOI projects.

George received accolades and gifts, including the "diver's collage" from Dive Supervisor Terry Rioux, at an August 20 retirement party.

George worked with Howard Sanders for most of his career at Woods Hole, making a number of important contributions to our knowledge of the diversity of benthic organisms in coastal and abyssal waters. He gained national recognition for his studies of the 1969 oil spill in West Falmouth, which still provides one of the most important benchmarks for the long term effects of oil on the coastal, benthic environment.

Few individuals have been as deeply committed to environmental stewardship as George, both as a researcher and as a citizen. George has made innumerable contributions to conservation on Cape Cod, for which he was named Citizen of the Year by

Hampson – page 7

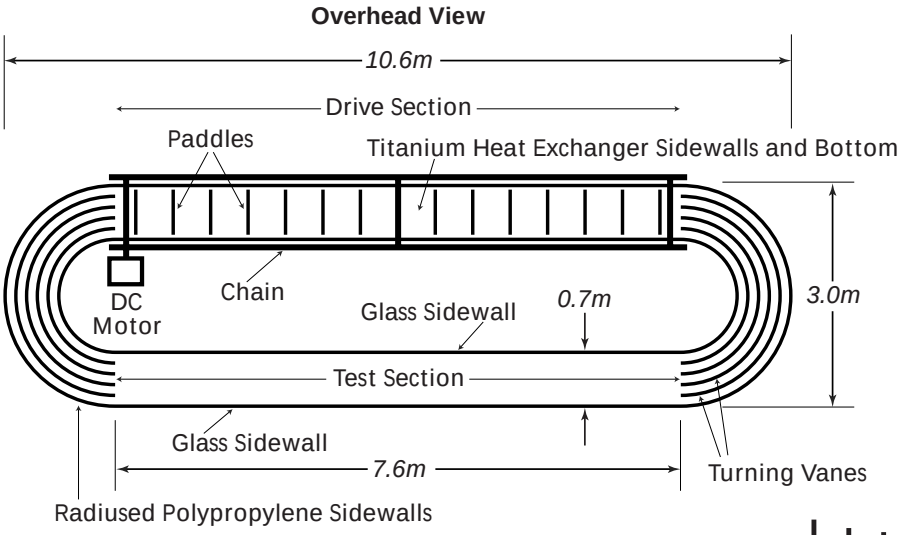
New "racetrack" flume to be constructed in CRL

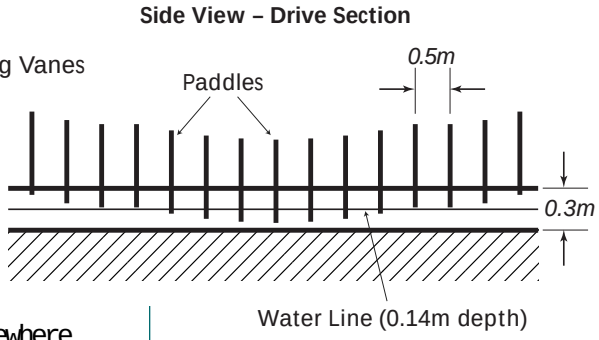
Construction of a large "race track" flume will begin in the Coastal Research Laboratory this fall, with funding provided by the NSF Major Research Instrumentation program. The new flume should be completed within one year.

This flume was designed by John B. Southard (MIT). The first prototype was built at Friday Harbor Laboratories (Univ. Wash.). It is a major improvement over our existing "paddle-wheel" flume. The most important difference is that the flume channel is the same width and depth everywhere so there are no depressions that could accumulate organisms or particulates, the channel is longer and wider, and the flow-driving mechanism produces a wider range of well-behaved flows. The channel bottom is constructed of seamless polypropylene, with glass sidewalls along the test section straightaway and polypropylene walls elsewhere.

The flow-driving mechanism is a horizontally oriented conveyor belt of paddles that extends the entire length of one straightaway and is designed to minimize regions of unnaturally high shear. Turning vanes are located in the bends, spaced to maintain equal water volume between them, to limit cross-stream flow.

The flume will be used for interdisciplinary and disciplinary studies in biology, sediment transport and hydrodynamics.





Scale drawings of the new Racetrack Flume that will be built in 1997-98. Vertical scale is exaggerated 200% in the side view.

Hampson–from page 6

the *Cape Cod Times* in 1989. Early on, George recognized the unique attributes of the Cape's environment and has labored steadfastly to protect it against the threat of careless development. He was a cofounder and active member of The 300 Committee, a nonprofit land trust that has helped the Town of Falmouth acquire almost 1,000 acres of conservation land.

While a member of Falmouth's Planning Board, George championed the regulation of upland land use in order to protect the Cape's water supply. He has also been active since the 1960s in developing strategies for the monitoring and protection of Buzzards Bay, which earned him the Guardian Award in 1992 from the Coalition for Buzzards Bay.

As a teacher, George has inspired high school to graduate students with the excitement that he feels at unraveling the complexities of natural processes.

George was one of the first recipients of WHOI's Vetlesen Award for his contributions to science and his selfless commitment to the enterprise of science at the Oceanographic. This award, based on nominations by his fellow WHOI employees, demonstrates how his impact has been felt far beyond Woods Hole village, in his science, outreach activities, and personal commitment to environmental protection.

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THE RINEHART COASTAL RESEARCH CENTER is committed to the support and enrichment of coastal research activities within the WHOI community, particularly those research activities that directly affect the protection and enhancement of coastal resources. This mission is accomplished through facilitating research and education, providing facilities and equipment, and promoting interdisciplinary communication.

RESEARCH: Annual call for proposals • Special Topics • Rapid response and other mini-grants

EDUCATION: Post-doctoral support • NSF Coastal Trainees

FACILITIES: Small boats • Coastal Research Laboratory (CRL) • Flumes and tanks (at CRL) • Coastal instrumentation

COMMUNICATION AND OUTREACH: Newsletter • Website • Scientific seminars, meetings and workshops • Annual Open House

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