marine sciences research center

msrc

STONY BROOK
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IN THIS ISSUE

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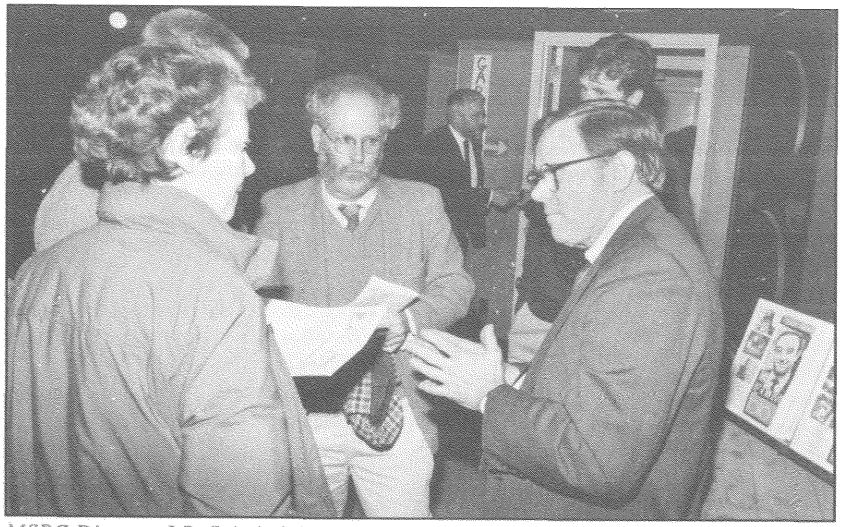
MSRC Consultants in Making Documentary on Long Island Sound

The one hour documentary, "How Sound is Long Island Sound," produced by John J. Stevens Productions, premiered at the Huntington New Community Cinema on April 13. The showing of the film followed a reception for a full house of legislators, environmentalists, and supporters of Stevens' effort to showcase the many conflicting interests, the degradation, and beauty in various parts of Long Island Sound.

Over the past year, Stevens and co-producer Liz Irwin consulted with Director J. R. Schubel and faculty members Robert Cerrato, Robert Aller, Henry Bokuniewicz, Malcolm Bowman, and Mario Vieira, who have done research on the Sound in conjunction with the Long Island Sound Study. This is a five-year project funded by the US Environmental Protection Agency, involving scientists from MSRC and University of Connecticut and a citizens action coalition.

These consultants, as well as Melissa Beristain of NY Sea Grant, were on hand to field questions about the status of the Long Island Sound Study and other issues concerning this body of water. The film will be aired on public television (WLIW) on June 20.



MSRC Director J.R. Schubel discusses documentary on L.I. Sound with audience after premiere showing. *photo by Ian Stupakoff*

MSRC Discusses Global Warming at Earth Day Symposium

The 20th anniversary of the first Earth Day celebration was commemorated in a variety of ways throughout the world on April 22. MSRC made its contribution on this special day by taking part in several different educational events sponsored by Suffolk County. One of these was a symposium, "Energy, the Greenhouse Effect and Global Change."

MSRC's Mary Scranton, Charles Wurster, and Henry Bokuniewicz discussed the phenomenon from perspectives based on their expertise. Scranton gave an overview of the greenhouse gases—their importance, amount, and sources; and the role of the ocean and deforestation in changes in the atmosphere. She said that changes that have already occurred in the Earth's atmosphere are predicted to cause approximately a 1° C increase in global temperature and by the end of the 21st century, when carbon dioxide concentrations have doubled, the temperature increase may be between 2° and 5° C. Scranton reported that increases in the greenhouse gases

newsletter

other than carbon dioxide (methane, freons and nitrous oxide) are expected to cause temperature increases as large as those from carbon dioxide alone.

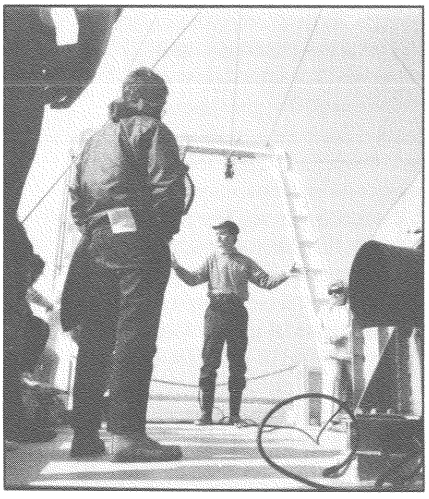
Henry Bokuniewicz discussed how sea level rise would affect Long Island and other coastal communities. Ice melt, the most important factor in sea level rise, is causing an increase of about 1 inch every eight years from 1900 and continuing to 2000. He predicted that from 2000 to 2100 sea level will rise faster and by 2050 it would be about 1 foot higher than it is today.

Long Island, having a slope of 1:100 to 1:1,000, could have water moving inward 100 to 1,000 feet. This, plus the predictions that storms will become more frequent and severe, will compound the effects at the shoreline.

In occupied areas to protect our economy, Bokuniewicz said that we could try to hold our own against the sea or move inland and yield the coast to inundation. Whatever we do, he said, "It's not too early to start thinking about these things."

Charles Wurster compared U.S. energy consumption and official policy to that of other western nations, and proposed that with appropriate changes in U.S. policy, energy consumption and thus greenhouse gases could be reduced. He suggested the following policy changes: increase energy efficiency, convert to solar energy, stop deforestation, increase economic incentives for reduced consumption, and redirect the subsidies for fossil fuel and nuclear energy to pioneer and improve alternative energy sources.

Other events in which MSRC students, faculty, and staff participated were a beach walk and clean up at Smith Point and instructional cruises of Long Island Sound aboard the R/V ONRUST.



LIMRI Director Bill Wise conducts Earth Day tours aboard R/V ONRUST

Foes of Floatables Workshop

The "Foes of Floatables and Medical Type Wastes" met in a workshop on March 22 at MSRC to discuss solutions to the basic causes of wash-ups of floatable wastes. Wash-ups of floatables, including medical-type wastes, precipitated numerous beach closings throughout the summer of 1988 and are a potential threat to tourism in any year, given certain wind conditions.

The "foes" included New York and New Jersey managers of state and city park beaches, county health commissioners, legislators, departments of environmental protection and conservation, the U.S. Environmental Protection Agency, New York Sea Grant, and scientists from MSRC's COAST and Waste Management Institutes.

This working group has been in action since the fall of 1988 when they created a "Floatables Management Plan" to coordinate, unify, and broaden the participation and scope of the short-term Floatables Action Plan. This latter plan, implemented in 1989, was a multi-agency program to handle floatable wash-ups on beaches effectively, to site potential wash-ups and alert beach operators, to remove floatables from the New York Harbor before release to the ocean, and to reduce accidental spillage of floatable materials during marine garbage transport in the harbor. Together, these two plans provided a strong regional strategy that resulted in the summer of 1989 being much improved over previous years.

The recent workshop participants addressed several important sources of floatables that remain to be eliminated. New York City street cleaning has been reduced as a result of budget cuts, so a large amount of floatable litter waits to be washed into the combined sewage and storm sewer system during rainfalls. Another large inventory of stranded floatables available to be refloated is in the back bays of the New York Bight—along the northern coast of New Jersey and southern coast of Long Island.

The ultimate source overall is people —people who need to be educated about littering, recycling, and reducing use of plastic disposable items. In addressing these topics, the "Foes" mainly proposed education and publicity to

- Increase public participation in using waste bins at beaches and parks.
- Promote sound disposal practices, particularly, not flushing plastic materials down toilets.
- Promote voluntary recycling at marinas and beaches.

COAST and Waste Management Institutes Planning Marina Recycling Center

MSRC and the Town of Brookhaven's Department of Waste Management have initiated a pilot recycling project for Port Jefferson Harbor. This very active port has a major ferry service, several marinas that draw a large boating crowd, and businesses that generate a large volume of pedestrian traffic. Altogether, there are over 60 stores and 20 restaurants in the harbor area.

The potential amount of disposable wastes from these operations is enormous. The project's goal is to encourage recycling of plastic, glass, metal, and newspaper and to provide education materials and an information display in the harbor area. Besides demonstrating that recycling is feasible in this setting, the program will offer a chance to document the character and amount of solid wastes recycled.

The program's administrators, Doreen Monteleone and R. Lawrence Swanson of MSRC and Sean Walter of the Town of Brookhaven, plan to have the program running by late May and continuing throughout the summer.

MSRC Visited by Nobel Laureate Dr. Arno Penzias

Faculty and staff were privileged to have an informal "preview" with Nobel Laureate, astronomer, and author Dr. Arno Penzias of Bell Labs before his lecture on main campus for the University Distinguished Lecture series on April 3. Author of "Ideas and Information: Managing in the Information Age," Penzias gave MSRC his prescription for handling large amounts of data so that they can be processed into usable forms.

One important part of that prescription is having convenient access to the data so that the amount of human

CINDY LEE
Keeping Track of Carbon and Nitrogen in the Ocean

MSRC's Cindy Lee and two colleagues (John Hedges of University of Washington and Stu Wakeham of Skidaway) have built a better particle trap. And with the new trap, Lee and her colleagues hope to finally set to rest a contentious question that has persisted for years: Exactly how much carbon from the ocean surface moves down to the ocean floor and into sediments where it is available for benthic organisms to use?

Carbon (C), like nitrogen and other elements, is taken from the atmosphere at the ocean surface by phytoplankton and incorporated into their cells and those of animals eating the phytoplankton. Sinking particles such as those from decomposing phytoplankton and zooplankton remains contain organic C and nitrogen. As the particles decompose, carbon dioxide, one of the greenhouse gases, is formed and returned to the ocean's waters. Carbon is thus used, recycled, and used again.

Particle flux is vital to benthic marine organisms, bringing life-supporting elements such as carbon, oxygen, and nitrogen from the surface of the ocean to the deeper ocean and sediment communities. Scientists hope that by keeping track of how much C is where at what time—a sort of flux balance sheet—they can better understand oceanic and atmospheric processes involving carbon dioxide, such as global warming.

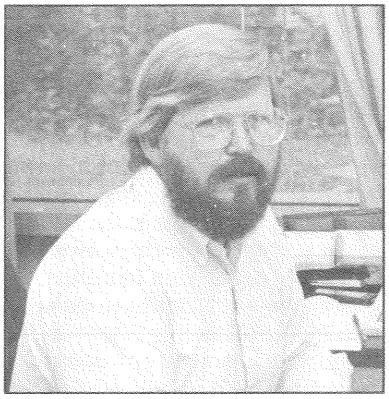
After 12 years of studying organic C flux, including the better part of her 11 years at Woods Hole Oceanographic Institution and four at MSRC, Lee will at last be able to determine exactly how much C is drifting to the sea floor from sinking surface particles. "For the first time it will be possible to determine particle flux accurately," she said. The new sediment trap, called the IRS trap (for Indented Rotating Sphere) eliminates 99% of the living organisms from the trap, according to Lee.

With the traps used previously, organisms swimming at the same depths that the traps were set could swim into the trap, which contains a poison to prevent bacterial decomposition, and get preserved along with the drifting particles from above. This jumble of mixed organic C from both living "swimmers" and decomposing surface sources made it difficult at best to sort out what came from surface waters. Student Ningli Zhu has been working with Lee to determine which poisons are most effective at preventing bacterial decomposition of the particles.

Lee, who has recently been promoted to full professor, focuses primarily on cycling of organic matter because it directly relates to the cycling of many life-sustaining elements—carbon, nitrogen, oxygen, phosphorous, and sulfur. One important C-containing compound in the ocean is methane. "The water column is supersaturated with methane and nobody knows exactly why," she said. Since it is known that methylamines—breakdown products of proteins—produce methane, MSRC Coastal Marine Scholar Marie De Angelis is working with Lee and colleague Mary Scranton to examine whether methane formation from methylamines is an important process in the ocean. These researchers are also beginning to examine another source of oceanic methane. Zooplankton, which graze on phytoplankton, appear to be producing methane in their guts as a product of digestion and expelling it, similar to cows.

Nitrogen (N) is also required for all life, yet it is generally the limiting nutrient for plant growth—the base of the food web—in the ocean. Lee's research group is trying to get a picture of the oceanic N budget by studying three main processes: release of N through protein decomposition, exchange through atmospheric transport, and adsorption. Student Silvio Pantoja has just begun a project with Lee developing novel molecular probes to investigate protein decomposition. Xiaohua Yang, a student working with Lee and Mary Scranton, is studying surface to air transport of N-containing amines, compounds which may play a role in the acidity of the atmosphere, perhaps even a minor role in acid rain formation. Adsorption—attachment of elements or compounds onto particles—is one of the most important processes in controlling the distribution of many compounds and elements. Lee's student Xuchen Wang studied adsorption of amines by sediment particles, particularly by dying and decomposing *Spartina*, a marsh grass. Mingyi Sun, a student of both Lee and MSRC colleague Bob Aller, is investigating how much chlorophyll, the C- and N-containing pigment that gives plants their green color, reaches the sediments from the surface and what happens to it once in the sediments.

To clearly understand the carbon and nitrogen balance sheet, Lee sees the need to understand the organic chemistry occurring as particles are moving to the sea floor. Dynamic chemical processes are continuously changing the particles as they slowly sink. Microbial activity can also alter and consume the organic matter until just a fraction of the original material remains. This complex chemistry poses many intriguing questions about the flux balance sheet that await answering, perhaps by Lee and her group. How much carbon and nitrogen reach the bottom? How much is usable and used by organisms as a food source? How much is cycled back into the water column? "Maybe the molecules reaching the bottom are all degraded at that point and not a valuable food source," she conjectured. Whatever the fate of sinking particles, Lee is dedicated to learning it.



ROGER FLOOD
Sedimentary Geology of the Sea Floor: Furrows, Mud Waves, and Submarine Fans.

Marine geologist Roger Flood is in search of unusual bedforms—topographic features of sea and lake bottoms that are formed when sediments are moved by a fluid flow. One such feature is furrows, alternating troughs and ridges caused when currents flow over fine-grained (cohesive) sediments.

Furrows, observed by Flood and his colleagues on both sea and lake floors, range from about a half meter to tens of meters high and can be spaced as much as 10 meters apart, so that wide flat areas are found between the troughs. Several years of research have recently shed light on how these furrows may have been formed by a fluid flow. The pattern of the flow is helical, and this built-in instability causes sediments to form and maintain furrows.

Formation of furrows shows that sedimentary erosion and deposition processes are more complex than many models predict. These models assume that a flat surface with no variability is produced. These features also tell of an environment that is very different from the quiescent places the bottoms of deep lakes and oceans were once believed to be.

Flood and his colleagues have seen furrows at depths of 100 - 150 m in certain places on the bottom of Lake Superior, and he believes these may be correlated with the annual gales of November when current meters measure flows up to about 30 cm/sec (about 6/10 knot) at 100 m water depth. "This current was associated with an intense storm passing over the lake, yet is impressive, given the great depth," said Flood. "It tells us that, although people like to work in the summer in these northern lakes, much of the sediment transport phenomena may actually be occuring in the winter." As a result of these findings, Flood and other scientists are putting out meters to measure currents throughout the year.

Some of the processes active in the lake are probably similar to those active in the deep sea. But doing geological research in the deep sea is difficult and expensive. By constrast, the relative ease of working in the more active, shallower coastal waters is part of what prompted Flood to move in 1988 to MSRC after almost 10 years with Lamont-Doherty Geological Observatory.

To understand the dynamics of cohesive sedimentation, geologists have turned to look at features such as furrows not only as an oddity to be investigated in its own right, but also as a useful tool. "Understanding bedforms can give us immediate information about the environment where the furrows are found, " said Flood. If we go to a new environment and collect side scan sonar data, such as we did in Port Jefferson Harbor, and see these features in the main channel, it suggests immediately that the sediments are fine-grained and accumulating and that the currents are often strong enough to move the sediment surface."

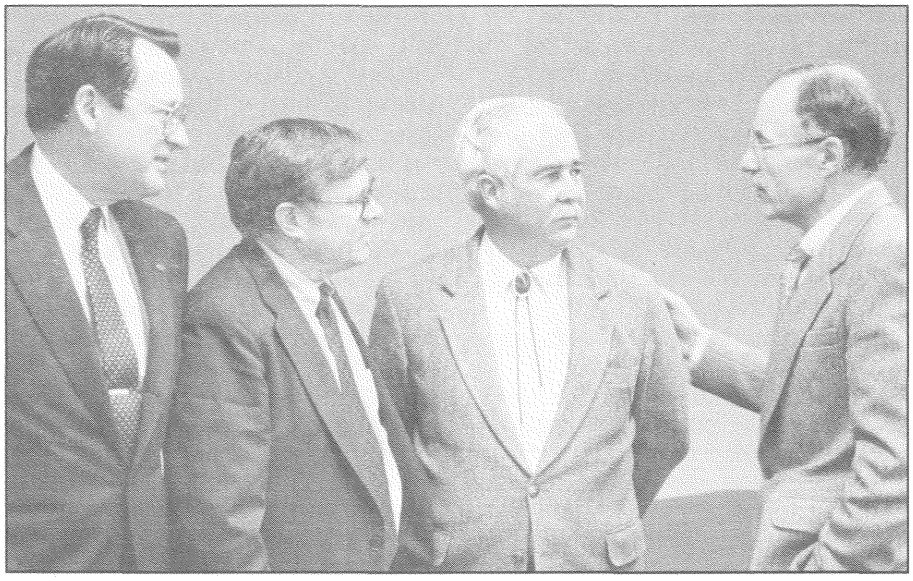
By analyzing and understanding how these features are created by natural processes in the field, Flood hopes to answer some important questions about their geological history: How have these features changed through time, and what processes are likely to have been important in that change? He also hopes to gain insights on sediment dynamics that will allow him to supplement and extend his laboratory studies.

Preferential depsosition on the floors of oceans and lakes may also mean that pollutants are concentrated in certain parts of the bed and not in other parts. Flood has found a possible correlation between location of furrows in Lake Ontario and distribution of pollutants. Pollutants are measurably higher along the south shore of the lake between the Niagara River and Rochester. From the evidence he has seen, furrows are developing exactly in this region, predictions about the likelihood of a pulse of sediments being introduced into the water column."

This summer for two days, Flood will be diving to the furrows on the bottom of Lake Superior in a submersible to take core samples and, using an echosounder small enough to fit into the submersible, to make recordings of the sediment structures about a meter below the surface. He expects the acoustic profiles to provide evidence that at certain times in the past there have been very strong storms which scoured the bedforms and that the bedforms have filled in in the absence of these events. With this information, Flood may be able to gain insight into his geologically focused studies, for example, to tell how frequently storms have been occurring.

The marine geologist also is interested in two other features of the deep ocean—mud waves, up to 100 m high hills formed where strong, deep currents deposit sediment loads, and submarine fans, thick sediment deposits formed where rivers empty into the deep ocean.

According to Flood, by studying modern depositional processes and the features they form, we can get a much clearer understanding of geological processes over time—what has actually gone into making the sediment deposit that we see today. "We ought to be able to see and understand all the pieces that are at the bottom of a body of water as easily as we see all the pieces that are on land," Flood said. "It should not be a secret what the bottom of the ocean, or an estuary, river, or lake looks like."



From L, Gordon Ray, Sr. V-P, NEC America, J.R. Schubel, James O'Brien, Arno Penzias

labor to process the data is reduced. "The object is to get the data into some form that is comfortable to use, so that people will use it," advised Penzias. "You should avoid sending students off to look through stacks of moldy paper—something nobody wants to do." He suggested one easy and inexpensive approach to processing paper data would be to convert the paper pages to microfilm.

Another part of Penzias' prescription is visualization of data into graphic form to get people interested. "Endless tables don't get people interested," said Penzias. As an example of such visualization, he showed the audience a reproduction of an 1869 map representing Napoleon's Russian Campaign of 1812, where his troops were reduced from 422,000 to 10,000. In the graph, the size of the army, related to time and temperature during advance, is denoted by a wide brown band, and during retreat, by a thin black band. This simple, yet striking conceptualization of several data sets was reprinted in a book by Edward R. Tuff, "Visual Display of Quantitative Information," which Penzias recommends for all faculty and students.

Spring Semester's Lawrence Distinguished Visiting Scholars

Dr. James O'Brien, Secretary of Navy Professor of Meteorology and Oceanology from Florida State University visited MSRC April 2-8. Dr. O'Brien is known for his work on global scale ocean modeling.

Dr. Barry Hargrave, benthic ecologist and senior scientist at the Bedford Institute of Oceanography visited MSRC from April 16-19.

ALUMNI NOTES

Alumnus José Zertuche (Ph.D., 1988) returned to his country after leaving MSRC and is now the Subdirector for Research of the Universidad Autónoma de Baja California, México. He continues working there with an old friend—the same species of seaweed, *Eucheuma uncinatum*, that he studied for his thesis.

Eucheuma is a commercially important species, because it yields carageenan when processed, a product widely used in yogurt, ice cream, and other foods requiring a smooth, uniform consistency. But to be used commercially, there must be a steady, reliable source. *Eucheuma* usually only grows to the end of summer and then dies off, but Zertuche has worked on getting the seaweed to grow all year round. By cutting old tissue and leaving the apical growth, *Eucheuma* keeps growing. The cultures are started in the lab from spores, then transplanted to outdoor tanks, where they grow 10-15 cm branches. The next step is the open water, where the scientists control growing conditions by choice of placement. *Eucheuma* is located near a sewage outfall, which serves as a source of fertilizer. The seaweed does very well in this environment, and in fact, it won't grow in pristine waters. To further protect the stiff branches from breaking apart in the ocean waves, they are placed in suet, onion, or potato bags.

Now that Zertuche has perfected a way to produce a steady source of seaweed, Mexico's present practice of importing foreign-processed carageenan may soon be changed. "I predict that in the near future, we are going to process carageenan here in México," said Zertuche.

AWARDS & HONORS

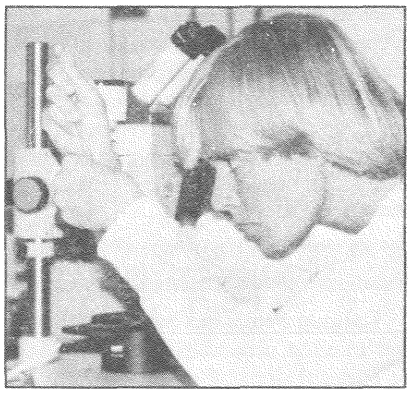
Hartmut Peters has been invited to give a review presentation on "Mixing in the Tropical Oceans" at the international Tropical Oceans-Global Atmosphere (TOGA) conference in Honolulu in July. TOGA is an international program to study large-scale, long-term processes resulting from air-sea interactions in tropical oceans and the short-term climate fluctuations, called "El Niño."

Mary Scranton attended the April American Chemistry Society meeting in Boston where she presented a paper, "Methane Fluxes in the Southern North Sea: The Role of European Rivers," coauthored with student Kathleen McShane.

Scranton will be one of about 60 participants in a Department of Energy (DOE) meeting June 18-20 in Norfolk, Virginia on ocean margins and global change. The DOE is restructuring their marine program for the next decade and has invited the scientists, many leaders in their fields, to develop an implementation plan.

Scranton has also recently conducted two workshops on global change for the university's Center for Science, Mathematics and Technology Education seminar series for high school science teachers.

Jeannette Yen received two travel awards to attend the international symposium on the Norwegian Research Program for Marine Arctic Ecology this past May. She presented a paper, "Predatory Feeding and Reproductive Ecology of an Antarctic copepod, *Euchaeta antarctica*. Yen has also received funding by NSF for a study on sensory reception in crustacean zooplankton. She will be collaborating with Dr. Dan Hartline of the Bekesy Laboratory of Neurobiology of University of Hawaii on this project.



Graduate Student Interns at the Nation's Capital

Susan Sponaugle, a recent M.S. graduate and currently a Ph.D. student in fisheries biology at MSRC, was picked from a pool of applicants in a 31-state competition to serve as an aide in Washington, DC. During her year's stint, she served on the U.S. House of Representatives subcommittee on Fisheries and Wildlife Conservation and the Environment, working for Rep. Gerry Studds of Massachusetts.

This is a subcommittee of the Merchant Marine and Fisheries Committee, of which Long Island Congressman George Hochbrueckner is a member. Both the committee and subcommittee deal with all fisheries issues, and Sponaugle's particular responsibility as an aide was to conduct research for developing national seafood inspection legislation. The decision to create this legislation was spurred by a lack of public confidence in the safety of seafood and subsequent drop in consumption between 1988 and 1989. Some of the questions she tried to answer were, What is the nature of the diseases? What foods are a problem, why, and how can we deal with them? What should we be looking for in a seafood product? How can we best test for that, and what is feasible to do? Another aspect of the movement is promotional—to instruct people who have little or no experience with fresh fish how to handle and prepare it.

Which agency will ultimately administer the legislation is yet to be decided. The main contenders are the Food and Drug Administration (FDA), US Department of Agriculture (USDA), and National Marine Fisheries Service (NMFS), and each is trying to prove that it should be in charge. Sponaugle, who researched and held meetings with all of the agencies, feels the program might be best served by a combination administration. "The FDA is best at setting standards, so they could do that part," she said. "The USDA is most experienced at plant inspections, so they would be best at taking charge there, while NMFS would be best at administering fishing boat inspection."

Many different stages are involved in trying to pass legislation, and Sponaugle was involved at every step—from answering phone inquires and letters to setting up and holding hearings with involved agencies and the public. After the hearings, the legislation must be passed through the subcommittee, then the full committee, then on to the House floor. Ultimately it goes to the full Senate.

Sponaugle was impressed with how long and complicated a process passing legislation is. "Each stage goes very slowly," said Sponaugle, who left right in the middle of the process, "so getting the legislation passed can take years." She was also impressed with how staff-dependent congressmen are for what to say and do. "The staff in many cases ends up having a lot of power," she said.

These days, back as a graduate student, Sponaugle sorts through field samples and ponders whether her findings will ever be useful or important to fisheries management. She said that she can't help but compare all the unknowns and indefinite aspects of graduate research to her days of making immediate, important decisions as a bureaucrat in Washington. Even minus the power of a legislative aide, Sue Sponaugle is happy to be back conducting research and feels as if she is still part of the team pushing this legislation through the labyrinthine process.

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