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S. Grillo

SUSB President John H. Marburger III (second from left) and MSRC Director J. R. Schubel (far right) with Noyes Fellows Lisa Campbell, Brian Duncan, and Jennifer Jesty (left to right).

JESSIE SMITH NOYES FELLOWS

MSRC students Lisa Campbell, Brian Duncan, and Jennifer Jesty have been selected as Jessie Smith Noyes Fellows for the 1981-82 academic term. The Noyes fellowships, established in 1975 through a grant from the Jessie Smith Noyes Foundation, are awarded each year to outstanding graduate students working on environmental problems in coastal waters.

Lisa Campbell received her bachelor's degree in biology from the University of California at Santa Cruz in 1976, and plans to obtain her Ph.D. at the Center. Her Noyes fellowship will enable her to study cyanobacteria, organisms which could be a significant source of food for New York area shellfish. Ms. Campbell's advisor is Prof. Edward Carpenter.

A master's degree candidate at the Center, Brian Duncan graduated from SUNY Stony Brook with a B.S. in biological sciences. Working with his advisor, Prof. Charles Wurster, Mr. Duncan will examine whether local species of phytoplankton (microscopic marine plants) can develop a resistance to PCBs.

After receiving her bachelor's and master's degrees in chemistry from Oxford University, Jennifer Jesty enrolled in the Center's Ph.D. program. She will explore the effects of pollutants on bacterial nitrogen transformations in marine sediments. Ms. Jesty's advisor is Prof. Edward Carpenter.

Noyes fellowships are administered by the Stony Brook Foundation, a not-for-profit corporation formed to encourage and accept gifts and endowments in support of the University at Stony Brook; it also administers scholarships and loan programs for Stony Brook students.

MSRC ASSOCIATES

We welcome Donald Bruckmann, N. L. Halpern, Mr. and Mrs. John Marshall, and John M. Olin as new MSRC Associates and Mr. and Mrs. Harry Carter, Mr. Irving Like, and Mr. R. Goodman as continuing Associates.

AMERICAN MUSEUM OF NATURAL HISTORY FUNDS MSRC STUDENT'S RESEARCH

Mary Gibbons enjoys working with clams. Apparently, others share this enthusiasm for her research efforts.

For the fourth time this year, Ms. Gibbons--a Ph.D. candidate at the Center--has received a grant to support her research on the hard clam (*Mercenaria mercenaria*). The Lerner-Gray Fund for Marine Research of the American Museum of Natural History has awarded Gibbons $400 for her studies on the predation of juvenile hard clams by crabs; she was the only individual at the University at Stony Brook to receive a Lerner-Gray award this year.

Although she has identified about 20 predators that feed on juvenile hard clams, Gibbons has concluded that crabs represent the most serious threat. One crab can eat several hundred juvenile hard clams in one day, she said; other predators such as a snail or a starfish will eat only one juvenile clam per day. Focusing on three types of crab--calico, mud, and hermit--Gibbons is attempting to determine why crabs have such a large "daily clam requirement" and how the energy within the clams is distributed throughout the crabs that consume them. She has also discovered that crushed gravel (the material driveways are constructed of) is an effective medium in which to plant juvenile clams--it provides cover for the clams and, for some reason, crabs avoid the graveled surface.

Ms. Gibbons received her B.S. and M.S. degrees from the University of Delaware. In January, she received a grant from the Sigma Xi Society for her work on the

predation of clams by crabs; this research was again granted support in April by the Montauk Marine Basin. She also received a Sea Grant scholarship.

PEOPLE AND MEETINGS

"A New Look at Dealing with the PCB Problem" was the topic of Prof. J. R. SCHUBEL's 2 September presentation at the Conference on Fisheries Resources of the Hudson River, sponsored by the Hudson River Environmental Society. Schubel also served as coordinator of a workshop on the need for an Office of Marine Pollution Assessment-sponsored synthesis activity on pollution in Chesapeake Bay, and served as the U.S. Correspondent at WESTPAC's October meeting in Jakarta.

The United Nations Educational, Scientific, and Cultural Organization appointed Prof. HARRY CARTER to a working group on the biological effects of thermal effluents in the marine environment. Carter attended the group's first meeting, held in Yugoslavia in late September.

At the request of the National Sea Grant Program, Prof. ROBERT MALOUF chaired a committee that authored a five-year plan for research priorities in hard clam aquaculture.

Prof. DENNIS HANISAK made his Canadian radio debut when he was interviewed by the Canadian Broadcasting Co. in early August. The CBC spoke with Hanisak about the marine biomass project, the Center's attempt to determine the feasibility of growing seaweed to be harvested for the commercial production of natural gas. Later in the month, Hanisak and Prof. BRUCE MACLER, two of the project's co-directors, conducted a tour of the Center's Flax Pond greenhouse, where seaweed growth experiments are conducted. In attendance were Vice President for University Affairs James Black, local media representatives, and representatives of the sponsoring agencies.

The Town of Brookhaven asked Prof. J. L. McHUGH to serve on a committee to advise the Town's shellfish program. McHugh will help evaluate the environmental aspects of the Town's responsibility toward the program. Prof. Malouf will serve as committee chairman.

Prof. MARY SCRANTON made two field trips to Massachusetts to study the hydrogen cycle in an anoxic salt pond, in collaboration with Dr. Craig Taylor of the Woods Hole Oceanographic Institute.

Prof. B. H. BRINKHUIS traveled to Australia to present a paper on marine biomass at the 10th International Botanical Congress in Sydney. Prof. Brinkhuis, a third co-director of the Center's seaweed project, also lectured on marine biomass at the Australian Institute of Marine Science and Australia's Griffith University.

The New York State Assembly Committee on Environmental Conservation chose MSRC as the site for its 24 August public meeting. The committee attempted to determine if the Department of Environmental Conservation had sufficient funding to manage marine fishery resources. The hearing, which was attended by Assemblyman George Hochbrueckner (D-Coram), was arranged through Prof. McHugh.

MSRC STAFFERS AID NATIONAL PARK SERVICE

When the National Park Service faced an unforeseen difficulty during its August construction of a new dock at the Fire Island Sailor's Haven marina, Service personnel turned to MSRC staff members David Hirschberg and C. Lee Arnold for help. Workers had encountered an unusual deposit of sand over mud on top of the hard estuary bottom; this mud was not firm enough to support dock pilings. In order to determine the piling length needed to go through the mud and reach bottom, the Service asked Hirschberg and Arnold to investigate the thickness of the mud deposit.

Using a standard engineering probe, Hirschberg and Arnold found the depth to hard bottom to be 2 m. The deposit, they concluded, was caused by the presence of another dock already constructed at the site, which interfered with the coastal processes that normally sweep away such mud deposits. When the National Park Service received the results of Hirschberg and Arnold's measurements, it decided not to extend the dock any further.

AWARDS

Funding at a level of $156,000 was approved for the Fiscal Year '81 Scope of Work under the Cooperative Agreement with the National Oceanic and Atmospheric Administration. Prof. J. R. Schubel will administer the award.

The Sigma Xi Scientific Research Society awarded Grants-in-Aid of Research to students Catherine Drew, Amy Knutson, George Nardi, and Harvey Simon. Monies received from the Society for these awards are matched by the Center.

Students George Nardi and Harvey Simon departed for the British West Indies, where they will assess the maximum sustainable yield of the spiny lobster and queen conch. These fisheries represent a major source of income to the islands. Nardi and Simon's research will be supported by a Biomedical Grant through the International Exchange Program.

Prof. Iver Duedall received funding from the University of Rhode Island to publish the proceedings of the Second International Ocean Dumping Symposium.

Graduate Council fellowships were awarded to students Joseph Kerner and Philip Zion.

Prof. Glenn Lopez was granted a University Award for his work on sediment-microbe associations in a coastal marine environment.

Student Glynis Nau-Ritter will study at New York University's Institute of Environmental Medicine through an Intercampus Doctoral Fellowship.

Students Joe Bergstein, Amy Knutson, John Nicholson, and James Novelli were named Sea Grant Scholars.

MICROZOOPLANKTON: THE FOOD WEB PUZZLE IS NOT YET COMPLETE—G.M. CAPRIULO

In the ocean single-celled, microscopic plants called phytoplankton form the base of the food chain. They in turn are fed upon by microscopic animals known as zooplankton, which are eaten by fish. Several steps exist between the phytoplankton cell and the fish; the number and complexity of those steps may vary depending on several characteristics of the phytoplankton species present, such as size, shape, and nutritional worth. These characteristics determine the types of zooplankton that will be present, which determines the number and kinds of fish that will be found. These complex interactions are known as a food web.

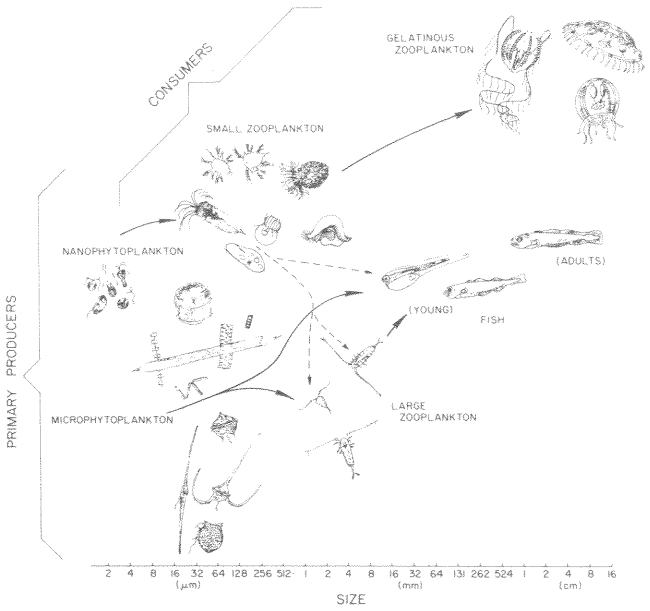
The phytoplankton at the base of the food web are influenced by many interactive environmental factors, both physio-chemical and biological, which determine what species will be present (species composition) in what amounts (abundance) and how fast they will grow (growth rate=primary production). Of all the members of the zooplankton the copepods (large zooplankton) and certain members of the microzooplankton (small zooplankton) stand out as the apparent dominant grazers of the phytoplankton. The copepods are inefficient feeders on the smallest phytoplankton and show preference for larger phytoplankton. The copepods are a major food source for fish species important to man and have been extensively studied. In contrast, the microzooplankton have largely been ignored in most ecological studies.

Recent findings demonstrated that the smaller phytoplankton are often the dominant forms throughout the world ocean and account for a major percentage of its primary production. Microzooplankton (whose concentrations can be as high as 30,000 individuals per liter of sea water) are known to feed on these smaller phytoplankton. To truly comprehend the nature of marine food webs, a thorough understanding of their feeding ecology is required. Developing such an understanding for one major group of zooplankton (tintinnids) has been the objective of much of my research.

I have found that Long Island Sound microzooplankton ingest as much as 41% of the phytoplankton standing crop per day. Of striking significance was the finding that as a community the microzooplankton can exhibit the same rates of magnitude ingestion, and filtering rates as those noted for copepods. Highest tintinnid ingestion rates occurred in summer when small algal cells were dominant. Feeding behavior was flexible within size limitations, and effort was maximized on the largest-sized food the animal could handle. Food does not appear to be a limiting factor for growth during summer, suggesting that these microzooplankters may be predation limited in the field.

When copepods and tintinnids were fed identical natural food they were found to feed most efficiently on differently sized food. The copepod to tintinnid ingestion ratio went from 147:1 to 24:1 as the food peak shifted from larger to smaller food while the ratios of maximum filtering rates remained the same. This highlights the inefficiences with which estuarine copepods feed on smaller food. This ingestion ratio, multiplied by the appropriate abundance values, can be used as a means of categorizing various marine ecosystems as having a micro or macro zooplankton mediated biomass flux from the primary producers to the larger carnivores.

Conventional thinking has modeled a typical plankton food web as in the illustration below, solid lines. Larger phytoplankton are ingested by copepods, which in turn become the food of commercially important fish species. The microzooplankton feed on the smaller algae and this energy is thought to be lost to the gelatinous zooplankton. I as well as others have evidence, however, that tintinnids are eaten by copepods as well as larval and juvenile fish. Also, the tintinnids are ingesting



Plankton Food Web

food that copepods can remove only with extremely low efficiency, and making a high percentage of it (due to the extremely high efficiency with which marine protozoa convert algal food to their own new biomass) available to the copepods and fish which feed on them, at a more palatable size. It is also important to note that since microzooplankton such as tintinnids have very high growth rates compared to the lower growth rates of the copepods, they can respond almost instantaneously to pulses of phytoplankton, thus acting as stabilizers of the water column community by capturing energy which might otherwise be lost to the sediments and associated benthic community and making it available to larger zooplankton at a later time.

In summary, tintinnids and other microzooplankton appear to be integral parts of most marine food webs, not necessarily as food for gelatinous zooplankton but rather as an alternate food source (dashed lines, illustration) for other zooplankton and fish.

G. M. Capriulo conducted the study described here as part of his Ph.D. research. His advisor is Prof. Edward Carpenter.

PUBLICATIONS

BOKUNIEWICZ, H. B. 1981. Seasonal beach at East Hampton, NY. Shore and Beach 49: 28-33.

BOKUNIEWICZ, H. B. 1981. Monitoring seasonal beach responses: an educational and public service program. J. Geol. Education 29: 121-127.

BOWMAN, M. J. and W. E. Esaias. 1981. Fronts, stratification, and mixing in Long Island and Block Island Sounds. J. Geophys. Res. 86: 4260-4264.

CARTER, H. H. 1981. A dye diffusion study of Great South Bay. MSRC Special Report 43.

DUEDALL, I. W. et al. 1981. Stabilized power plant scrubber sludge and fly ash in the marine environment. Pages 315-346 *in* B. H. Ketchum, D. R. Kester, and P. K. Park (eds.), Ocean Dumping of Industrial Wastes. Plenum, NY.

RECENT MSRC GRADUATES

Five students completed requirements in August for the M.S. degree:

ARCOS, DAGOBERTO, Upwelling and the distribution of chlorophyll *a* within the Bay of Concepcion, Chile (Prof. R. E. Wilson).

CHU, GORDON, Behavior and transport of anthropogenic radionuclides in the Peconic River, NY (Prof. Ramesh Dayal).

GOODRICH, DAVID, The tides of New York Bight (Prof. R. E. Wilson).

KELPIN, GERALDINE, Depuration and its implications for Long Island's hard clam industry (Prof. J. R. Schubel).

McMANUS, GEORGE, Elimination of PCB residues by the copepod *Acartia tonsa*, and effects of PCB on fecundity, egg viability, and survival of nauplii (Prof. William Peterson).

V. Abolins

MSRC Prof. Dennis Hanisak (left) at seaweed tanks with Chairman James Larocca, NYS Energy Research and Development Authority (second from right) and others from sponsoring agencies. Seaweed cultivation is part of MSRC's research on harvesting seaweed for commercial production of natural gas.

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