



GROUNDWATER FLOW INTO GREAT SOUTH BAY

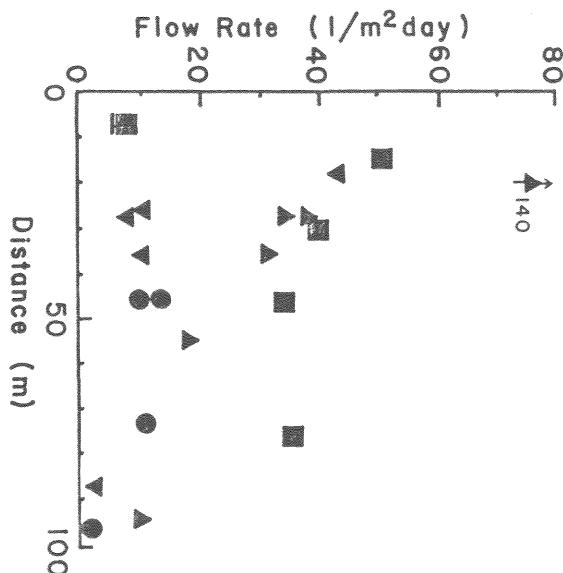
Last summer Dr. Henry Bokuniewicz and Mr. Michael Zietlin made the first direct measurements of the flow of groundwater across the floor of Great South Bay. The percolation of groundwater from aquifers across the Bay floor is called the submarine outflow and is one of several ways in which the Bay is supplied with freshwater. Other sources include stream flow, overland runoff, and rain falling directly on the Bay. Of these, stream flow is probably the most important and it is measured routinely by the U.S. Geological Survey as well as by State and local agencies. The streams entering the Bay, however are relatively small and, as a result, it was expected that the contribution of direct, groundwater seepage would be substantial. Documenting these flows is important for understanding the water budget of the Bay which controls the Bay's salinity and water quality.

In 1964, E. J. Pluhowski and I. H. Kantowitz of the U.S. Geological Survey completed an exhaustive study of the hydrology of the Babylon-Islip area bordering the Bay. They stated "Submarine outflow can not be measured directly but may be computed indirectly by considering the water balance equation. . ." Their estimate of the groundwater supply into the Bay was made by the process of elimination and some guess work. Previous estimates had been made in a similar way and although the various investigations could not agree on the magnitude of the submarine outflow, it seemed clear that the flow was substantial.

Last summer Prof. Bokuniewicz and Michael Zietlin set out to measure directly the submarine outflow into Great South Bay using a simple method devised by R. F. Lee. The measuring device is the top of an oil drum which is pushed, open end down into the sediments. There is a small hole in the top which is attached to an empty plastic bag. Groundwater flows up through the sediment and into the bag. From the amount of water collected during a known time you can calculate the rate of flow.

With a modest grant from the N.Y. Sea Grant Institute, Mr. Zietlin built two instruments and the first test measurements were made with the help of Mr. Thomas Caruso off Islip. In two tests that day, 40 ml and 107 ml were collected in twenty minutes. These represent flow rates of a few liters per day per square meter. During later trials, flows as high as 180 liters per day per square meter were measured. The flow was found to be confined to a narrow band about 100 m wide at the shore with the flow rates decreasing rapidly offshore. The total inflow of groundwater was estimated to be 200 million liters per day or about 15% of the total freshwater inflow.

This work is being continued under grants from the Long Island Regional Planning Board and the New York Sea Grant Institute.



Measured flow rates in liters per square meter per day at various distances from shore. Values were measured in Great South Bay at Islip (●,▼), at Hecksher State Park (■) and at Bayport (▲).

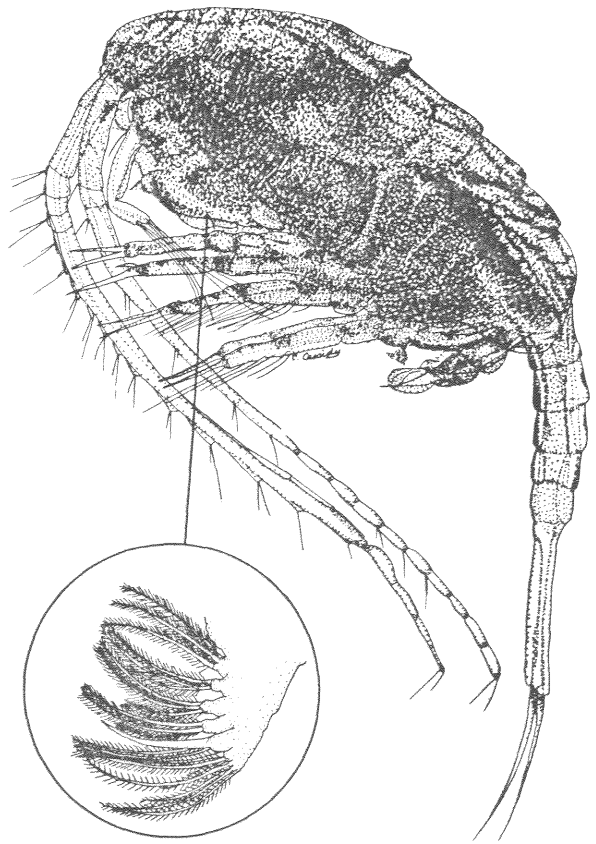
MARINE FOOD CHAINS AND THE EFFECTS OF POLLUTION – DOMINICK NINIVAGGI

Many human activities affect food chains in coastal waters. Food chains in marine waters are composed of microscopic algae (phytoplankton) which use plant nutrients and sunlight to grow, and tiny herbivorous animals (zooplankton), which together with the algae comprise the first two links in the chain. These initial links are critical to the production of species of interest to man, such as fin and shellfish. While the public generally becomes concerned only when organisms higher in the food chain, such as commercial fishes, are affected by deleterious changes in the environment, understanding of events occurring lower in the chain may be essential for truly effective environmental protection. An example of such an event is the consumption of phytoplankton by copepods (very abundant zooplankton), a critical link in food chains leading to finfish. Human-induced changes in the phytoplankton may affect organisms higher in the food chain by altering the availability of the phytoplankton to copepods.

Sewage and toxic materials in coastal waters can cause changes in the phytoplankton. Often, smaller forms of phytoplankton are favored by the presence of pollutants. Herbivores even smaller than copepods, which can better utilize the small phytoplankton, may be favored. These smaller herbivores are less readily converted by the food chain into valuable fish species, and may form links leading to undesirable forms, such as jellyfish. The ability of the larger copepods to effectively consume the available algae may determine the abundance of fish near the top of the food chain.

The ability of copepods to consume phytoplankton is determined by the sieve-like properties of their filtering limbs (see Fig. 1). My advisor, Professor O'Connors, and I have been studying the ability of copepods to consume phytoplankton of various sizes. We have discovered that the filtering limbs of at least one important Long Island Sound copepod do not permit this species to efficiently consume small phytoplankton, which are characteristic of those found in polluted waters. While this research is still in progress, we speculate that, in addition to potentially reducing food resources for finfish, the reduced consumption of small algae by copepods may partially account for reduced amounts of dissolved oxygen (a basic measure of water quality) in Long Island Sound waters, as a result of the decay of uneaten phytoplankton. Our research suggests that the indirect effects of pollution on marine food chains may be worth consideration in coastal zone management.

Mr. Ninivaggi is a graduate student at MSRC. The work described here is part of his research for the M.S. degree.



RECENT PUBLICATIONS

- CHIANG, H.C., B.J. METTLER, A. OKUBO, and A.S. ROBBINS. 1978. Coupling of midge individuals in a swarm, *Anarete pritchardi* (Diptera, Cecidomyiidae). *Ann. Entomol. Soc. Am.* 71:859-861.
- McHUGH, J.L. 1978. Review of: "The Aquatic Explorers: A History of the Fisheries Research Board of Canada" by Kenneth Johnstone. Univ. of Toronto Press. *Quart. Rev. of Biol.* 53(4): 423-424.
- OKUBO, A. 1979. Patchy structures in marine ecosystems. I. Balance between dispersion and reproduction. *Aquabiology* 1(1):32-37.
- SWARTZ, S.M. and B.H. BRINKHUIS. 1978. The impact of dredged holes on oxygen demand in the Lower Bay, New York Harbor. Special Report 17, Marine Sciences Research Center, State University of New York. 80 pp.
- TERRY, O.W. and D.M. CHASE. 1979. Mariculture in New York State. Proceedings of a Symposium. New York Sea Grant Institute. 96 pp.
- WONG, K.C. and R.E. WILSON. 1979. An assessment of the effects of bathymetric changes associated with sand and gravel mining on tidal circulation in the Lower Bay of New York Harbor. Special Report 18, Marine Sciences Research Center, State University of New York. 24 pp.

MSRC ASSOCIATES

We welcome as new MSRC Associates

John Burness
Alice Winthrop Dunne
Saul Seiff
Long Island Rail Road
Marine Environmental Council of
Long Island Inc.
Stony Brook Harbor Association

For information about joining the Associates, please contact Jeri Schoof, Marine Sciences Research Center, SUNY at Stony Brook, Long Island, NY 11794; (516) 246-6543.

AWARDS

The Coal Waste Artificial Reef Project, described in the December 1978 Newsletter, received funding for the second half of the 1978-79 year bringing the total support to just over one million dollars.

MONICA BRICELJ has been awarded a one-year Sea Grant Traineeship for her graduate work with Dr. ROBERT MALOUF on the relationship of clam growth to the availability and utilization of food.

Prof. H. H. CARTER was granted additional support by New York ERDA for refinement and application of MSRC's thermal effects model of power plant cooling water.

Prof. AKIRA OKUBO may return to his experimental station in the corn fields of Minnesota. The NSF has granted a supplemental award for his work with Dr. H. C. Chiang of the University of Minnesota on insect swarming.

PHILIP ZION, who will be enrolling in MSRC's graduate program this fall, has been selected for a Stony Brook Graduate Council Fellowship.

Profs. IVER DUEDALL and PETER M. J. WOODHEAD received a grant from the Natural Resources Division of Maryland to study the effects of coal wastes in the Chesapeake Bay.

Profs. H. H. CARTER and D. W. PRITCHARD were awarded a grant by the Academy of Natural Sciences of Philadelphia for their proposed thermal plume study at the Calvert Cliffs nuclear power plant on the Chesapeake Bay.

FRANK J. ROETHEL, Ph.D. candidate, received a Dissertation Grant-in-Aid from the Graduate School for his research on "Interactions of Stabilized Power Plant Coal Waste with the Marine Environment."

Profs. H. J. BOKUNIEWICZ, H. H. CARTER, and R. E. WILSON were funded by the New York Sea Grant Institute to carry out a 12-month physical study of the eastern portion of Great South Bay. The study will involve measurements of submarine

inflow and continuous measurements of sea level changes within eastern GSB.

PEOPLE AND MEETINGS

Profs. H. H. CARTER, R. E. WILSON, and J. R. SCHUBEL visited the Netherlands Institute for Sea Research (NIOZ) at Den Burg, Texel, the Netherlands on 1-4 April 1979 for a meeting with representatives from NIOZ, the Royal Netherlands Meteorological Institute (KNMI), Delft Hydraulics Laboratory, and the Rijkswaterstaat. The purpose of the meeting was to discuss and critique up-coming Eulerian and Lagrangian diffusion experiments in the North Sea by the Dutch and off the south shore of Long Island by MSRC scientists.

MYRNA JACOBSON presented a talk entitled "Coal Combustion Products--A New Artificial Substrate for Epibenthic Community Development" at the Smithsonian Tropical Research Institute in Panama (March) and at the Benthic Ecology meetings in New Hampshire (April). This research was part of the C-WARP project co-directed by IVER W. DUEDALL and PETER M. J. WOODHEAD.

Prof. J. L. McHUGH was invited to participate in the Coastal Zone Issues Symposium at the Yale School of Forestry and Environmental Studies. The title of his 22 February 1979 lecture was "Is Extended Jurisdiction Working?"

Prof. AKIRA OKUBO was Visiting Professor on Kyoto University's Faculty of Science from December 1978 through March 1979. During this period, he was supported by the Japan Society for the Promotion of Science (JSPS) Fellowship. The JSPS was created by the Japanese Government to provide public support for scientific research and to promote international cooperation in science. During his visit, Professor Okubo gave two series of lectures on mathematical ecology at Kyoto University, Lake Biwa Research Institute, Osaka University, Nagoya University, Ehime University, Japan Ecological Society, and Japan Atomic Energy Environment Center. He tells us that he spent a period of time in meditation at old temples in Kyoto and Nara, and studied under a Shinto priest for conducting a special Shinto ceremony: exorcism.

Dr. NANAKA SHIGESADA, Assistant Professor of Biophysics, Kyoto University, is visiting MSRC from April 1979 to April 1980 as part of MSRC's Visiting Scholar program. She is working with Professor AKIRA OKUBO on mathematical modelling of the spatial distribution of plankton. Her visit was arranged with the assistance of Professor R. F. JONES, Director of SUSB's Office of International Programs.

Prof. P. K. WEYL gave an invited seminar in January to the Dana Club of Yale University's Department of Geology and Geophysics. The title of his presentation was "Micropaleontology and the Ocean Surface Climate."

MSRC PROFESSOR GORO HONORED

MSRC Adjunct Professor Fritz Goro was honored by the American Society of Magazine Photographers with its Life Achievement Photography Award as the *Foremost Scientific Photographer*. Since retiring after 34 years on the staff of LIFE magazine, Professor Goro has been a regular contributor to SCIENTIFIC AMERICAN and other journals. He has also taught scientific photography at MSRC.

Mr. Goro's early training was in art at the Bauhaus in Weimar under Gropius, Moholy-Nagy, Feininger, Klee, and Itten. Part of the philosophy of the Bauhaus was the integration of art with science and technology. Probably no one has been as successful at achieving this as Fritz Goro.

Will Faller, editor of PHOTOGRAPHY and professor at NYU, recently pointed out:

"From his art background and his intense sensitivity to life, Fritz has produced the most beautiful and meaningful photographic translations. He has created through his photographs, unique images which are a gift to art, science and photography."

MSRC GRADUATE STUDENT STUDIES IN TROPICS

Robert Richmond, a first year student, spent the early part of 1979 in the tropics. From the end of December, until early March, he served as teaching assistant for a graduate course in Tropical Ecology given in Costa Rica under the auspices of the Organization for Tropical Studies. The course, coordinated by Dr. Barbara Bentley of the SUSB's Department of Ecology and Evolution, included participants from a number of U.S. institutions as well as the Universidad Nacional de Costa Rica.



MSRC scientists H. H. Carter, W. S. Reeburgh (Adjunct Professor) and R. E. Wilson place their fingers in the dike near Texel (the Netherlands) to hold back the Wadden Sea.

After the course, Bob went on to the Smithsonian Tropical Research Institute in Panama, where he spent a month doing research as a Smithsonian Short Term Fellow. The research is designed to determine how and why reproduction and recruitment of corals vary along an environmental gradient of terrigenous sedimentation. The project benefited from the advice of Professor Peter Woodhead, and from grants in aid from the MSRC Associates and the International Studies Program directed by Professor R. F. Jones.

MSRC SCIENTISTS INVITED TO ROME

Professors P. K. Weyl and J. R. Schubel and Adjunct Professors R. H. Meade and W. S. Reeburgh were invited to an international meeting on River Inputs into Ocean Systems held in Rome in March. The meeting was sponsored by UNESCO and a variety of other U.N. agencies. Approximately 50 scientists were invited to the meeting to define problems relating to three questions: (1) How do river water and river-borne sediments acquire their chemical qualities in response to climatic, geological and cultural factors? (2) What transformations occur when a river meets the sea? and (3) What is the ultimate flux of constituents to the open oceans via rivers?

Weyl was rapporteur for the session "Man's Influence on RIOS and Comparison of Pathways to the Coastal Zone." Meade, Reeburgh and Schubel presented papers: Meade-- "Man's Influence on the Discharge of Fresh Water, Dissolved Material and Sediment by Rivers to the Atlantic Coastal Zone of the U.S."; Reeburgh-- "Anaerobic Methane Consumption and Its Effect on Carbon and Sulfur Cycles in Marine Sediments"; Schubel and Hirschberg-- "Transportation and Accumulation of Fine-grained Sediments in Estuaries."



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