

New England Estuarine Research Society

THE 1984 FALL MEETING

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**THE GRADUATE SCHOOL OF OCEANOGRAPHY, UNIVERSITY OF
RHODE ISLAND
AND
THE ENVIRONMENTAL RESEARCH LABORATORY, NARRAGANSETT,
ENVIRONMENTAL PROTECTION AGENCY**

PAPER SESSION I

Buskey, E.J., E. Swift and C. Mann, Graduate School of Oceanography, University of Rhode Island, Narragansett, RI.
THE SHADOW RESPONSES OF ESTUARINE COPEPODS.

Most calanoid copepods have simple eyes which are incapable of image formation. These eyes are very sensitive to small changes in light intensity, however. In nature local changes in light intensity can be caused by the passing of an organism overhead during the day producing a shadow, or by the flashes of nearby bioluminescent organisms at night. Estuarine copepods respond to both rapid increases and rapid decreases in light intensity with bursts of swimming speed that appear to function as escape responses. It is suggested that these behaviors would be appropriate for avoiding free swimming predators on copepods such as ctenophores, which would cast shadows during the day and produce bioluminescent flashes when disturbed at night.

Brewer, H.H., Dept. of Biology, Trinity College, Hartford, CT. NOTES OF A JELLYFISH WATCHER: EVIDENCE THAT TWO CONTIGUOUS POPULATIONS OF CYANEA ARE GENETICALLY ISOLATED.

Cyanea in the Niantic River and the Niantic Bay area of Long Island Sound have been observed for 10 years. The River and the Bay are connected by a narrow channel. This and other hydrographic and hydrodynamic features constrains transport between these bodies of water. Data for Cyanea supports that only limited exchange occurs. Although River jellyfish sometimes are found in the Bay, reproducing individuals have never been seen there. On the other hand, reproductively mature Bay jellyfish occasionally appear in the River, but benthic samples show that these Cyanea do not deposit planulae in this location. Furthermore, no overlap in temporal occurrence of reproducing medusae of the River and the Bay Cyanea has been observed in a decade. In addition, specimens from each site exhibit mutually exclusive morphological and allometric differences consistent with the absence of gene flow between them. The lack of gene flow between these two populations provides an unusual opportunity to examine the population dynamics of an isolated and geographically circumscribed scyphozoan population.

Tugel, J.B., M.E. Hines and G.E. Jones, Jackson Estuarine Laboratory, Univ. of New Hampshire, Durham, NH MICROBIAL IRON REDUCTION IN ENRICHMENT CULTURES OF ESTUARINE SEDIMENTS.

The reduction of Fe^{3+} to Fe^{2+} in enrichment cultures was determined using a modified ferrozine technique. Acetate and succinate were used as substrates to eliminate the influence of microbially-produced organic end products on abiotic iron reduction. Results were compared to cultures grown on the fermentable substrate glucose. The enzymatic reduction of iron was further demonstrated by the inhibition of reduction by mercuric chloride, pasteurization and the separation of oxidized iron from bacteria by dialysis tubing. Microscopic examination of bacterial growth rate, cellular integrity, and attachment of cells to oxidized iron particles demonstrated that attachment is necessary for iron reduction and the maintenance of the "health" of the iron-reducing population. Cultures isolated using oxidized iron failed to reduce manganese. Nitrate was reduced overnight with the accumulation and subsequent reduction of nitrate for = 6 days and the inhibition of iron reduction. The inhibition of sulfate reduction did not affect iron reduction. These results and those using estuarine sediment slurries suggest that microbial iron reduction is a significant process in estuarine sediments which may be regulated, in part, by cell attachment processes.

Short, Frederick T. Jackson Estuarine Laboratory, University of New Hampshire, Durham, NH 03824. EXPERIMENTAL USE OF MACROCOSM:SEAGRASS CULTURES.

Seagrasses were grown in tank culture to provide a semi-controlled environment for experiment manipulations. Eelgrass, Zostera marina was started with seedlings in sand and mud substrata for analysis of nitrogen cycling and nitrogen limited plant growth. Experimental culture studies of plant/nutrient and plant/metal interaction provide an excellent mechanism for biogeochemical analysis. Additionally, the growth of eelgrass under near optimum temperature and light conditions permits measurement of maximal rates for both above and below ground plant growth.

The use of culture systems for seagrass studies is also useful in analysis of plant/ water-column interactions. The impacts of the seagrass community in the removal of suspended sediments and nutrients have been shown in both tropical and temperate seagrass species.

PAPER SESSION 2

Requejo, A. G. Marine Chemistry and Geochemistry Laboratory, Battelle New England Marine Research Laboratory, Duxbury, Massachusetts. APPLICATION OF TRITERPANES AND STERANES IN MARINE SEDIMENTS AS INDICATORS OF FOSSIL FUEL POLLUTION.

Triterpanes and steranes are fossil hydrocarbons of microbial origin which are ubiquitous constituents of fossil fuels. The occurrence and distribution of these compounds has been used as a prospecting tool in the field of petroleum exploration, but has received little application in environmental studies. The potential of these compounds as indicators of fossil fuel pollution will be discussed and examples from various regional estuaries presented.

Eganhouse, Robert P., Environmental Science Program, University of Massachusetts, Boston, Massachusetts
APPLICATION OF ORGANIC GEOCHEMICAL TECHNIQUES TO THE STUDY OF CONTAMINATED COASTAL SEDIMENTS

A combination of elemental, stable isotopic and molecular methods are used to illustrate the means by which the depositional and diagenetic histories of nearshore sediments contaminated by municipal wastes can be reconstructed. Emphasis is placed upon the use of several potential tracers to aid in the differentiation of source materials to sediments. In some cases where the history of discharge is known, molecular tracers and their distributions in a stratigraphic column can be used as geochronological tools.

Libbey, A.J. Jr., U.S. Coast Guard R&D Center and UConn Marine Sciences Institute, Avery Point, Groton, Connecticut, 06340

ANALYSIS OF TRACE ORGANICS IN AQUATIC ENVIRONMENTS. PART I: DI-n-BUTYL PHTHALATE ESTER.

A literature method employing the amberlite resin, XAD-2, for the extraction and separation of trace organics from aquatic environments was modified and applied in combination with gas chromatography-electron capture detector to the analysis of di-n-butyl phthalate ester (DBP) in real world samples. DBP associated with particulate matter was analyzed in samples from the Connecticut River and the Thames River.

Douglas, G.S., Dept. of Oceanography, Univ. of Rhode Island, Narragansett, RI. 02882

THE GEOCHEMISTRY OF DISSOLVED ORGANIC COPPER AND CHROMIUM IN NARRAGANSETT BAY INTERSTITIAL WATERS.

Dissolved organic copper and chromium complexes were measured in both overlying and interstitial water of Narragansett Bay sediments using C18 reverse-phase liquid chromatography and atomic adsorption spectroscopy. In the interstitial and overlying water, the isolation procedure recovered 22-67% of the total dissolved copper, 23-55% of the total dissolved chromium and 14-40% of the DOC. The distribution of both total and organic copper decreased with depth in the core and exhibited a subsurface maximum near the 0 Eh level (z=2-4 cm). Below that depth, both forms of copper continued to decrease until an apparent equilibrium with sulfide minerals was established. Dissolved chromium exhibited a different geochemistry, with both organic and total chromium increasing in concentration with depth in the core, possibly due to remobilization from some mineral phase such as chromic hydroxide or chromite.

E. J. Hoffman, J. S. Latimer, G. L. Mills, C. G. Carey, and J. G. Quinn
Graduate School of Oceanography, Univ. of Rhode Island, Narragansett, R. I.
02882

PATHWAYS OF POLLUTANT ENTRY TO NARRAGANSETT BAY

We recently completed a three year project designed to assess the magnitude of pollutant entry to Narragansett Bay from a variety of sources. Each pollutant we studied (petroleum hydrocarbons, polycyclic aromatic hydrocarbons, copper, zinc and lead) had different entry patterns. For example, urban runoff was the major source of hydrocarbons, higher molecular weight polycyclic aromatic hydrocarbons, zinc, and lead to the Bay. Sewage treatment plants were the major contributors of lower molecular weight polycyclic aromatic hydrocarbons and copper. In light of these current pollutant input inventories, we evaluated several abatement measures currently under consideration. Industrial pretreatment regulations of the Bay Commission, when enforced, should reduce the Bay copper budget by 53 tons/year, or 43% of the total copper input inventory. Abatement of dry weather CSO discharges have already reduced the copper inventory by 26 tons/year.

PAPER SESSION 3

Bill, Robert G., Lt(jg) NOAA. NMFS, Milford, Ct. A Case Study on the Effects of Contaminated Dredge Spoils on Heart and Ventilatory Rhythms of the American Lobster.

Black Rock Harbor, Bridgeport, Ct. was dredged in 1983 and the resulting dredge spoils were deposited at a designated underwater site off New Haven, Connecticut. These sediments were heavily contaminated with a mixture of petroleum hydrocarbons, as well as heavy metals, and therefore are the object of an extensive set of studies designed to measure any environmental impact at and surrounding the dump site. For one facet of the study, Homarus americanus, were held in wire mesh cages at the dump site and at an uncontaminated control site. After 30 days the lobsters were retrieved and physiological measurements made on these animals revealed a lower heart rate and lower gill bailer rate in dump site lobsters. In addition, a much higher gill-clearing or "cough" response was measured in lobsters from the dump site. This set of observations was followed by a series of laboratory studies where lobsters were held in tanks containing dump site sediment and control site sediment. Again a higher "cough" rate and lower heart and gill bailer rates were measured in dump site sediment lobsters.

Jackie, E. and Nacci, D. EPA Environmental Research Laboratory
Very Rapid Aquatic Toxicity Testing

In recent years, several very rapid aquatic toxicity tests have been developed to meet the growing needs for inexpensive aquatic toxicity testing. Three of these tests in various stages of development are being evaluated in our laboratory. Microtox, rapid sea urchin embryo test and a sperm toxicity test were compared to the longer, more conventional fish and Daphnia tests using pure compounds, water effluents, and sewage sludge supernatants. The results are encouraging for rapid toxicity testing and indicate revolutionary trends such as automation for future aquatic toxicity testing.

Zajac, R.N., Marine Sciences Inst., Univ. Connecticut, Groton, CT.
SUBLETHAL PREDATION EFFECTS ON POLYDORA LIGNI'S REPRODUCTION AND POPULATION DYNAMICS

Sublethal predation was found to reduce fecundity in P. ligni. Loss of one or two palps yielded mixed results in two experiments. Losses of posterior segments (but not including gametogenic segments) always reduced fecundity, and increased brood development time by approximately 100%. Worms continued to reproduce while regenerating segments. The costs of regeneration in terms of lost fecundity were estimated to range between 10% and 29% for palp loss, and between 49% and 80% for posterior segment loss. Since posterior segment loss appears to be more critical to individual fitness than palp loss, anti-predatory features to reduce such losses in spionids are discussed, as well as the impact on Polydora ligni's population dynamics.

Jones, J.P. and H.M. Rines, University of Rhode Island.

A COMPARATIVE ANALYSIS OF GROWTH IN BAY SCALLOPS FROM SOUTHERN RHODE ISLAND.

Measurements of growth in different body components of the bay scallop Argopecten irradians over its entire life cycle were initiated to refine our understanding of energy partitioning in New England populations. Weights of six body components (adductor muscle, digestive gland, gonad, mantle, gill and remaining minor tissues) along with morphometric measurements were gathered at two to four week intervals for analysis of organ-specific growth. The growth patterns of the five somatic components are similar throughout the life cycle, each component changing in tandem with the others, with no particular organ enduring the brunt of weight loss in energetically unfavorable circumstances. Gonad growth deviates from somatic growth by showing a ten fold dry weight increase in only five weeks beginning in late April. This burst of reproductive development, following five months of no growth, is apparently supported entirely by external food sources, since the somatic tissues do not decrease in weight and even grow slightly during this time. The lack of growth during the winter with abundant food, followed by dramatic growth in May, initiated when the temperature rises only 2 or 3 °C strongly suggests that internal regulation of the process is of primary importance with external food supplies or whole animal energetics not limiting growth at this time.

Shipp, R.C., and S.A. Staples, Oceanography Program and Department of Geological Sciences, University of Maine, Orono, Maine, and D.B. Packer, Marine Systems Laboratory, Smithsonian Institution, Washington, D.C.

GEOLOGIC CONTROL OF MOLLUSCAN COMMUNITIES IN A COASTAL BAY, WESTERN GULF OF MAINE
Studies of the controls of coastal geomorphology and the molluscan benthic communities were conducted in Gouldsboro Bay, a glaciated coastal bay in eastern Maine. The distribution of geomorphic features was determined by interpretation of vertical and oblique aerial photographs and ground-truth maps. The distribution of benthic mollusks was examined by sieving of replicate box cores. Three major zones were established by evaluating the factors controlling the distribution of geomorphic features within the bay. These zones were differentiated on the basis of co-occurrence of geomorphic features, sediment texture and abundance, and inferred cycles of erosion and accumulation. The structures of the benthic molluscan communities corresponded closely to the geomorphic zones within the bay. This relationship between geomorphic zones and benthic communities may be applicable to the remainder of the Maine coast.

PAPER SESSION 4

Chinman, R.A., GSO/URI, Narragansett, R.I.
HYPSOGRAPHIC ANALYSES OF NARRAGANSETT BAY

Ever since the founding of the Narragansett Marine Laboratory, extensive research on Narragansett Bay has been conducted through a wide spectrum of subjects. In spite of this long and scholastic history, there has been no study detailing the bathymetry and hypsography of the Bay. The process of performing this type of study by hand is tedious and lends itself, instead, to computerization.

Approximately four thousand irregularly spaced depth readings from Coast and Geodetic Survey chart 1353 were digitized and transformed, using SYMAP interpolation, into a uniform grid of about 26,000 unit-area depth stations. In addition; ten distinct geographic elements, forty-one 1 km wide latitudinal segments and numerous cross-sectional area transects were designated. Hypsographic analyses of the whole bay, as well as, the individual elements and segments show that: (1) The area of the Bay proper (including Mt. Hope Bay and Sakonnet River) is 341.72 km², (2) The mean depth of the Bay proper is 7.8 m, (3) 50% of the Bay's volume (excluding Mt. Hope Bay and Sakonnet River) is south of the northern tip of Jamestown Island and (4) 75% of the bottom area is less than 11 m in depth.

Additional analyses and bathymetric maps and transects will be presented.

Richardson, K.A., University of Rhode Island.
Barnstable Harbor Wetlands Classification Using Landsat Thematic Mapper

The Landsat Remote Sensing Lab in cooperation with the Northeast Fisheries Center of the National Marine Fisheries Service performed a wetlands classification for Cape Cod Massachusetts using Thematic Mapper (TM) data from Landsat IV. The data set is a winter scene December 8, 1982 Row 11 Path 31.

The use of the TM with the increased spatial resolution for wetlands application was the primary interest for the startup of the project. The additional information that would be obtained from the blue, slid-infrared, and thermal bands was the second most important consideration for information processing. Selection of the training site was to obtain wetlands data for the western Cape Code land and near-shore areas. The resulting unsupervised classification clearly identified wetlands classes of the Barnstable Harbor area. Some of the classes were identified with the aid of aerial photography of the area.

Gordon, D.C. Jr., P.J. Cranford and P. Schwinghamer, Marine Ecology Laboratory, Bedford Institute of Oceanography, Dartmouth, N.S.

ECOLOGICAL IMPORTANCE OF FUNDY SALT MARSHES

Cumberland Basin, a 118 km² estuary with an average tidal range of 11 m, contains 17 km² of salt marsh. Almost half is low marsh (*Spartina alterniflora*) which is frequently flooded by water up to 4 m deep for periods as long as 4 h per tide. The annual net aerial primary production is estimated to be 272 g Cm⁻² or 2084 tonnes C for the entire Basin. Although the ratio of low marsh area to open water area (178 km² MSL) is only 0.1, annual phytoplankton primary production is very low, 15 g Cm⁻² or 1170 tonnes C, because of excessive turbidity. High tidal energy promotes the export of dead vegetation from marshes and distributes it widely about the estuary. *Spartina* macrodetritus constitutes the major fraction of material collected with zooplankton nets. Microscopic observations indicate that microdetritus (< 600 µm) comprises the major fraction of both the suspended and sediment organic carbon reservoirs. It is hypothesized that fresh detritus is an important food source for mysids which are a major prey item for migratory shad from the entire US east coast.

Greene, Roger, Senior Information and Education Specialist, RI DEM, 22 Hayes Street, Providence,
THE NARRAGANSETT BAY NATIONAL ESTUARINE SANCTUARY

The Narragansett Bay National Estuarine Sanctuary was designated part of the National Estuarine Sanctuary Program in 1980. The mission of this national program, as stated in the Federal Register "Is the establishment and management, through Federal-State cooperation, of a national system of estuarine sanctuaries representative of various regions and estuarine types in the United States. Estuarine sanctuaries will be established to provide opportunities for long-term research, education and interpretation."

The Office of Ocean and Coastal Resource Management has worked closely with the American Littoral Society to establish a biogeographic classification system to facilitate the selection of estuaries that will be designed as National Estuarine Sanctuaries. There are 27 biogeographic sub-categories in all, to insure a wide variety of sanctuary types.

NOAA has been awarding grants for research to be conducted within estuarine sanctuaries. The information obtained from these research projects will be used to enhance resource protection. The Sanctuary Programs Division at NOAA has established the Research and Education Information Coordination and Exchange Program to facilitate the exchange of information.

Since the Narragansett Bay National Estuarine Sanctuary was established in 1980, a variety of research projects have been carried out there, with financial assistance from NOAA grants.

POSTER ABSTRACTS

Anderson, F.E. and T.C. Shevenell, Jackson Estuarine Laboratory, University of New Hampshire, Durham, NH 03824. THE PROBABILITY OF UNDERWATER RESUSPENSION OF ESTUARINE SEDIMENT BY RAIN.

Laboratory studies of artificial raindrops demonstrate that drop induced vortex rings can initiate sediment movement in waters at least 40 cm deep. The vortex rings are capable of moving coarse sand (1.4 to 2.0 mm) as well as the semi-cohesive fine-sediment layer found at the surface of many muddy intertidal areas. For those rings which initiated sediment motion the probability of drops resuspending sediment decreased with increasing depth. We feel rain is an important mechanism for putting fine-grained sediment into, suspension in the absence of wind-induced waves.

Chase, G. L., U.S. Fish & Wildlife Service, Newton Corner, Mass. NATIONAL WILDLIFE REFUGE SYSTEM MASTER PLANNING AND LAND ACQUISITION

The National Wildlife Refuge system is a network of United States lands and waters managed specifically for wildlife by the U.S. Fish and Wildlife Service. Region 5, which covers 13 states including New England, contains 53 refuges within its jurisdiction. Current mandates require that refuge master plans and acquisitions proposed, go through a formal planning process before funding is provided and acquisition proceeds. As a result, environmental impacts must be addressed in compliance with the National Environmental Policy Act (NEPA) of 1969. Master plans and associated environmental impact statement documentation are scheduled for all refuges in Region 5. In the next 10-15 years the Service proposes to acquire under the migratory bird program about two million acres of waterfowl habitat nationwide. In Region 5 this effort will concentrate primarily on preserving those areas which have designated as critical for wintering and nesting habitat. Acquisitions for endangered species will be developed through the Regional Endangered Species Program Coordinator and with appropriate Recovery Teams for delineation of critical habitat needs. Purchases of areas will be through the Endangered Species Act with LWCF monies.

Curran, Mark D. and R. Scott Carr, Battelle New England Marine Research Laboratory, Washington Street, Duxbury, Massachusetts and Mike Mazurkiewicz, University of Maine, Dept. of Biology, Portland, Maine. EVALUATION OF THE ARCHIANNELID DINOPHILUS GYROCILIATUS FOR USE IN SHORT-TERM CHRONIC BIOASSAYS.

The Archiannelid Dinophilus gyrociliatus is a minute (<1mm in length) species which completes its life-cycle in 11 days at 20°C. Sexual dimorphism is conspicuous in Dinophilus gyrociliatus with small eggs developing into dwarf males and large ones developing into females. Reproductive potential can be determined in 7-day experiments at 20°C with this species.

In this study we have evaluated the use of D. gyrociliatus for use in short-term toxicity testing utilizing reproductive potential as an endpoint. Various aspects of the life history of this species were studied and the culture techniques and testing protocols were optimized. Replicate bioassays were performed with a variety of organic toxicants and a complex refinery effluent in order to compare the sensitivity and suitability of this species for use as a standardized bioassay organism.

U.R.I. SEA GRANT
SEA GRANT WORK IN ESTUARIES.

The University of Rhode Island Sea Grant Program will display research results from its major interdisciplinary study of the coastal ponds in southern Rhode Island. The results displayed will cover numerical modeling of water circulation patterns, beach erosion and tidal delta sedimentation and management recommendations. Also displayed will be samples of publications produced by the URI Sea Grant Program. (These are available from the URI Publications Unit housed across the street from the Watkins Building in the new Marine Resources Building)

Environmental Research Laboratory, USEPA, Narragansett, RI

The Application of a hazard assessment research strategy to the ocean disposal of dredged material: An overview

To illustrate the application of the hazard assessment strategy to the ocean disposal of dredged material, the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) are jointly conducting a comprehensive site specific case study. This study, the aquatic portion of the Field Verification Program (FVP), is designed to evaluate and field validate current methodologies for predicting the consequences of dredged material disposal. The dredge site for the FVP is Black Rock Harbor (BRH) in Bridgeport, Connecticut. Approximately fifty-five thousand cubic meters of dredged material has been disposed of in the Central Long Island Sound Disposal Area. The research approach involves the conduct of predictive laboratory tests using the BRB dredged material in conjunction with pre-and post-disposal field studies at the disposal and reference sites.