

New England Estuarine Research Society



FALL MEETING

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**HOWARD JOHNSON'S MOTOR LODGE
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**The University of Massachusetts
Boston, Massachusetts**

ABSTRACTS

Rhoads, D.C., Science Applications International Corporation, Newport, Rhode Island.
HYPOXIC BOTTOM FACIES IN LONG ISLAND SOUND.

During the week of August 18th, 1986, 48 benthic stations were occupied along the central axis of Long Island Sound from Throgs Neck Bridge to New Haven, Conn. and from Long Island to the Connecticut shore. Five sediment-profile images were taken at each station with a REMOTS System fitted with a Model 53 YSI digital d.o. meter. An extensive area of hypoxic bottom water (1-2 mg/l) was recorded over the entire area surveyed. This water is apparently confined to depths greater than 50 feet on the Connecticut shore but extends into shallower water on the Long Island side. any sediment-profile images show thin (0 to ca. 1 cm) biogenic mixing depths, methane gas, and populations of the opportunistic bivalve Mulinia lateralis and small tubicolous polychaetes. The mapped gradients suggest that the central Sound has recently experienced hypoxia relative to the western Sound.

Welsh, B.L., Marine Sciences Dept., Univ. of Connecticut, Avery Point, Groton, CT 06340.
LONG ISLAND SOUND HYPOXIA.

An hydrographic survey in Western Long Island Sound (New Haven to Throgs Neck), was conducted synoptically with a REMOTS benthic survey (Rhoads) August 18-23, 1986 to determine the degree and extent of hypoxia in bottom waters of the Western and Central basins. At most stations along the east-west axis, dissolved oxygen (DO) was $<2 \text{ mg.l}^{-1}$ and a distinct oxycline was present at the thermally-controlled pycnocline 6 m or more from the bottom. The western end of Central Basin tended to be more stratified and more hypoxic than Western Basin. The distributions agreed well with the hypoxic facies found in the benthic survey. Nutrient loading of surface waters with subsequent deposition of excess production appears to be a more potent factor in bottom-water hypoxia than direct BOD loading. Lateral advection of the coherent bottom water mass by net tidal transport appears to be more important than vertical wind mixing as a mechanism for reventillating the deep basins, which is consistent with the upward tilt of the oxycline on the Long Island shore.

Sisson, John D., Dept, of Biology, U. of Massachusetts/Boston, Boston, MA
Density Effects on Growth and Reproduction in the Northern Bay Scallop.

The response of bay scallops to intraspecific crowding was investigated from August 21, 1984 to July 9, 1985 on Nantucket, Massachusetts. The fall growth phase tested the effect of crowding on shell growth and nested ANOVA results demonstrated a significant, albeit slight, reduction in growth with increasing density. The spring reproductive phase tested the effect of crowding on the size of mature oocytes, yolk content, and rate of development. Although these variables varied significantly among treatments, the lack of a predicted negative (or positive) relationship strongly suggests that density has no effect. Shell length and gonad dry weight were found to be directly related ($r = .77, p .001$), indicating a reduction in fecundity at high densities, Gamete quantity, not quality, is compromised.

Falk, Kathleen. Environmental Sciences Program, Univ. of Mass./Boston, Boston, Mass. EXPERIMENTAL STUDIES OF THE FEEDING ECOLOGY OF LEITOSCOLOPLOS SPP. (ORBINIIDAE: POLYCHAETA) FROM BARNSTABLE HARBOR AND BOSTON HARBOR.

Experimental microcosms were used to study surface biodeposition rates of organic carbon resulting from the conveyor-belt feeding activity of Leitoscoloplos spp. In one experiment, worms collected from each site were cultured in their native sediments. In a second experiment, worms were cross-cultured between sediment types. Biodeposition rates of worms cultured in native sediments were 17.9 and 8.9 mg dry wt per mg dry worm per day for Barnstable and Boston Harbors, respectively. Average POC in Barnstable biodeposits was 1.07% vs. 2.8% in Boston Harbor biodeposits. Calculated assimilation efficiencies were 36.9% for Barnstable worms, and 20.6% for Boston Harbor worms. In cross-culture experiments, biodeposition rates were similar within but different between sediment types. Biodeposition rates, assimilation efficiencies and growth rates were higher in each case for worms grown in Barnstable vs. Boston Harbor sediments. Results are interpreted in support of optimal foraging theory.

Stockmayer, M.A., Biology Department, University of Massachusetts/Boston Boston, MA 02125. HISTOPATHOLOGICAL ANALYSIS OF Mya arenaria FROM BOSTON HARBOR.

A preliminary investigation was undertaken to determine whether any pathology was present in soft-shell clams (M. arenaria) sampled from two Boston Harbor sites (Bird Island flats near Logan Airport and Raccoon Island flats near Weymouth). Clams from a relatively unpolluted site on Nantucket Island, MA were used as controls. Results indicate that the Boston Harbor clams have a higher incidence of overall pathology particularly in the kidney and gill. Abnormal conditions observed include: hyperplasia of gill epithelium, infiltration of amebocytes in gill tissue, mucous activity, and kidney concretions. Other conditions noted were sloughed epithelia cells, intracytoplasmic inclusions in epithelial cells of the digestive diverticula, and in one case an extensive hematopoietic tumor.

Wilson, W.H., Manomet Bird Observatory, Manomet, MA. THE IMPORTANCE OF EPIBENTHIC PREDATION IN A BAY OF FUNDY MUDFLAT COMMUNITY.

The intertidal mudflats at Porter Point in the Minas Basin, Bay of Fundy, are dominated by deposit-feeding organisms: the polychaetes Tharyx acutus, Heteromastus filiformis, and Scoloplos fragilis, and a podocopid ostracod. The site is unusual in that the amphipod Corophium volutator, the numerical dominant in most intertidal flats in the Minas Basin, is absent. In areas where the polychaetes above and Corophium co-occur, fish and shore-bird predators reduce only Corophium abundance. Experiments were performed at Porter Point to test whether epibenthic predators, in the absence of their preferred prey, depress the abundance of polychaetes. Caging experiments revealed that fish predators prey on Tharyx during the summer but not on other species. Shorebirds, mainly Semipalmated Sandpipers, do not affect the abundance of any taxon at Porter Point. In the absence of preferred prey, fish predators switch to an alternative prey while shorebirds avoid Porter Point and feed in Corophium-rich areas.

James McKenna, Oceanography Dept., University of Rhode Island,
Narragansett, R.I.
Simulation Model of Benthic Dynamics for Narragansett Bay

A numerical, model was constructed to simulate the response of the Narragansett Bay benthos to various scenarios of carbon supply. Physical mixing (bioturbation), decay of organic matter, and the consumption and utilization of organic matter by three groups of macrofauna are the basic processes included in the model. The decay of organic matter is simulated as a simple function of temperature and depth. The physiological responses of the macrofauna are functions of temperature and body weight.

The three macrofaunal groups are formulated to represent functional feeding groups. The first group is the true filter feeders, typified by Mercenaria mercenaria. The second group is composed of true deposit feeders. The last group represents those species which prefer to filter-feed, but will switch to surface deposit feeding if suspended material is insufficient. Parameters for each functional group are based on literature values for representative species. The model predicts the carbon content of the 10 cm deep sediment column and the biomass of the three macrofaunal groups.

Brousseau, D.J., Dept. of Biology, Fairfield University, Fairfield, CT. LIFE TABLES FOR TWO FIELD POPULATIONS OF MYA ARENARIA FROM LONG ISLAND SOUND.

Life tables were constructed for two populations of Mya arenaria from Long Island Sound, based on schedules of age-specific fecundity and mortality determined under natural conditions. Mya arenaria shows a basic conservatism in general life history pattern. In both populations, fecundity increases with increasing female size; sexual maturity is attained at 1 yr of age; a single annual breeding season occurs and survivorship curves approximate a type III. Differences in the age-specific parameters exist, however; both age-specific fecundity and survivorship are significantly higher in the Stonington population. These differences in the structure and dynamics of two semi-isolated local populations is probably due to environmental heterogeneity. Reduced body size due to slower growth in coarse substrate, as well as the increased maintenance demands resulting from burrowing and valve activity in large-grained sediment, may account for the lower egg production and lower survival rates found in the Westport population.

Rodriguez, V.¹, and J. Rodriguez,² 1. Graduate School of Oceanography, Narragansett, R.I. 02882, 2. Dept. de Ecologia, Univ. de Malaga, Spain. PLANKTON DYNAMICS AND NUTRIENT CYCLING IN A HARBOR SYSTEM.

Several hydrographic and biological variables, as well as the seasonal distribution of the zooplankton in Malaga harbor (SE of Spain) were studied during an annual cycle. Seawater samples and horizontal catches were taken every fifteen days in five stations at three depths. Temperature, transparency, salinity, dissolved oxygen, nitrite, nitrate, phosphate and chlorophyll a were measured. Temperature and light appear to be the most important factors affecting the phytoplankton biomass. Copepods were the most abundant group in the zooplankton. Fifty species were identified, however the community was generally dominated by a reduced number of species of the genus Acartia. The Cladoceran biomass was higher in the offshore stations than the inshore ones. The seasonal occurrence of this group and the succession of their species was strongly controlled by temperature.

Choromanski, J., and S. Stiles, National Marine Fisheries Service, Milford, CT.

A RECIRCULATING SYSTEM TO OBTAIN BIVALVE SPAWN FOR USE IN POLLUTION STUDIES OF FIVE LONG ISLAND SOUND SITES.

In an effort to assess the effects of water quality or reproductive success of bivalves from different areas of Long Island Sound, a system has been developed to spawn target species in the laboratory using seawater from the target sites. The system is a closed recirculating unit that provides flowing seawater, at a specific temperature range, over the bivalves to induce spawning. Induction of spawning with flowing seawater has proved preferential to use of a static system. A recirculating system is necessary due to the limited volume of seawater that can realistically be transported from the collection site under the proper conditions of reduced light and temperature.

This recirculating spawning system can hold thirty-five adult bivalves and has a seawater capacity of 80 liters. Heating to spawning temperature is achieved in 1.5 hours with 4 quartz immersion heaters, incidental heat from the submersible recirculating pump and a water bath. Once spawning has been induced, usually within 2 hours of reaching 27 C, spawners are removed from the system and placed in individual dishes containing site seawater to collect and quantify the spawn. In this way embryos are provided for cytogenetic, heavy metal, and hydrocarbon analyses, as well as for bioassays of site differences on egg viability.

Mantel, L.H., M. Sommer, A. Ng, and L. Buck. Department of Biology, City College, NY. NEUROENDOCRINE EFFECTS ON OSMOREGULATION OF THE GREEN CRAB, CARCINUS MAENAS.

When crustaceans are subjected to a dilute external medium, osmoregulatory responses are brought about by neuroendocrine reflexes, resulting in a reduction of permeability and an increase in uptake of salts. We are investigating the effects of dopamine, serotonin, cyclic AMP (cAMP), and extracts of neuroendocrine tissue on whole-animal responses to reduced salinity and on activity of Na-K-ATPase, an enzyme involved in uptake of salts, in isolated gills of C. maenas. We found that injection of dopamine (10^{-5} M) or hemolymph from a crab acclimated to 40% sw, into a crab in 100% sw, allows that crab to acclimate more quickly after transfer to 60% sw than do controls. Serotonin at 10^{-5} M does not have that effect. Injection of dopamine or incubation of isolated gills in dbcAMP increases the activity of the Na-K-ATPase enzyme in the microsomal fraction of gills, and also increases the concentration of cAMP in the gills. Extracts of pericardial organ, a neuroendocrine tissue known to contain dopamine and serotonin, also increase enzyme activity. It is likely that dopamine works by activating enzyme already present in the gills, and that cAMP is a second messenger for this effect.

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Gratto, G.W. and M.L.H. Thomas, Division of Sciences, Univ. of New Brunswick, Saint John, N.B. FOOD LIMITATION ON A MIGRATORY STAGING AREA AS A POTENTIAL SOURCE OF MORTALITY IN JUVENILE SANDPIPERS.

Sandpipers fly directly from staging areas in the Bay of Fundy to overwintering grounds in South America so sufficient fat reserves for the long flight must be deposited while birds are feeding in the bay. Rates of consumption of benthic prey, primarily the amphipod Corophium volutator, were used to estimate the rates of fat deposition throughout the migratory period from late July through September. Sandpipers arriving in September (juvenile birds) required an estimated 27 to 36 days to deposit the 10g fat considered necessary for the flight. Since this is considerably longer than the 10 to 14 days birds are thought to remain in the bay, it is probable that many juvenile birds are leaving with insufficient fat reserves to successfully complete the flight. As further evidence of in-flight mortality, a sample of juvenile birds arriving in South America had a mean fat content of 0% of lean body weight. The decrease in the rate of fat deposition observed through the period birds were present in the Bay of Fundy was the result of a decrease in abundance of large amphipods, forcing later birds to feed on smaller-sized prey.

Loder, T.¹, C. Vorosmarty², and F. Short³. ¹Dept. of Earth Sciences, ²Complex Systems Research Center, and ³Jackson Estuarine Laboratory, University of New Hampshire, Durham, N.H. 03824
THE SPECTRUM EFFECT: NUTRIENT CYCLING IN TIDALLY-DOMINATED SALT MARSH ESTUARIES.

Significant differences in nutrient concentrations have been observed between spring and neap tidal waters in several New England marshes. During neap tide periods, input from marsh channel sediments and channel wall seepage causes nutrient concentrations to increase. During spring tide periods, flooding of the marsh surface allows uptake of nutrients to occur through plant uptake and microbial immobilization onto litter. This, coupled with increased dispersion, causes concentrations to drop. A plot of nutrient concentration vs. salinity for these different tidal regimes shows a series of offset curves comprising a "spectrum". A heuristic model of these processes has been developed which illustrates the importance of these different nutrient source and sink terms. The model results compare with field data collected from several New England marshes.

Berounsky, V.M. and S.W. Nixon, Graduate School of Oceanography, University of Rhode Island, Narragansett, RI 02882 NITRIFICATION AND A NITROGEN BUDGET FOR THE PROVIDENCE (RI) RIVER ESTUARY.

The Providence (RI) River Estuary is a complex urban waterway with nutrient-rich input waters. Most of the ammonium (83%) enters with freshwater flows from rivers and sewage treatment plant effluent, while most of the nitrate plus nitrite (92%) enters with rivers and with seawater from upper Narragansett Bay. A preliminary budget for the Providence River, which accounts for major sources and losses of nitrogen, showed there is a net input of NH_4^+ of ~30 million moles annually and annual inputs of NO_3 plus NO_2 are balanced by exports. Processes within the river, mainly phytoplankton uptake, benthic fluxes, nitrification and denitrification can account for these differences.

A previously unmeasured transformation has been nitrification, the bacterial oxidation of NH_4 to NO_2 and then to NO_3 . Rates of pelagic nitrification, recently measured for an annual cycle in the Providence River, show that this process is a significant source of NO_3 and NO_2 .

Beatty, Lynn L. Grad. Sch. Oceanography, U.R.I., Narragansett, R.I. 02882. The emergence of suspension feeders as an important component of the benthos in eutrophied systems.

In estuarine areas, benthic macrofauna can respond dramatically to increases in phytoplankton resulting from eutrophication. Preliminary data from the 1985-86 MERL study indicate changes in the principal species between control and nutrient addition tanks. By late summer, the number of deposit feeders increased two to three fold in nutrient over control tanks. The most significant member of this group was the polychaete Mediomastus ambiseta, which was present in numbers up to 150,000/m² in one nutrient tank, versus a peak of only about 40,000/m² in the controls. Additionally, suspension feeders became very abundant in the nutrient tanks, whereas they remained a minor component of the species composition in the control tanks. The three most numerically important species, spionid polychaetes Polydora ligni and Streblospio benedicti, and the amphipod Ampelisca abdita, reached highs by late summer into early fall of 173,000/m², 38,000/m², and 46,000/m², respectively, in the nutrient addition tanks. Some thoughts on the observed trends will be presented.

Heufelder, G. R. Barnstable County Health and Environmental Department, Barnstable, Massachusetts. BACTERIOLOGICAL MONITORING IN BUTTERMILK BAY, MASSACHUSETTS, A CASE STUDY.

Fecal coliform sources were investigated in Buttermilk Bay, southeastern Massachusetts. Among the major contributors of allochthonous bacterial indicators were stormwater runoff and freshwater streams. The ecology of fecal coliform in the embayment was investigated and many protected reservoirs of the organism were defined. Significant aftergrowth of fecal coliforms in sample water from selected sites indicates that sufficient nutrients are available in the environment to support fecal indicator aftergrowth. In addition to supporting aftergrowth, nutrient rich water from selected sites was shown to absorb ultraviolet light which is the major bactericidal component of solar radiation. The implications of eutrophication in affecting the bacteriological quality of embayments is discussed.

Yarish, S.M. Marine Sciences Research Center, SUNY, Stony Brook, N.Y. 11794. BENTHIC NITROGEN REGENERATION IN LONG ISLAND SOUND SEDIMENTS.

In situ fluxes of NH_4^+ and $\text{NO}_3^- + \text{NO}_2^-$ across the sediment-water interface, porewater NH_4^+ and $\text{NO}_3^- + \text{NO}_2^-$ concentrations and the rate of NH_4^+ production were measured seasonally in sediments at 18 m depth in Long Island Sound.

All benthic NH_4^+ fluxes were positive and decreased exponentially with temperature with mean fluxes of 7.6, 1.9 and 0.9 mmol NH_4^+ /m²-day at 5, 10 and 20°C respectively. Fluxes of $\text{NO}_3^- + \text{NO}_2^-$ were not significantly different from zero at all temperatures. Benthic NH_4^+ fluxes can supply an average of 41% of the nitrogen required for primary production in Long Island Sound.

NH_4^+ production rates determined from sediment incubation experiments decreased exponentially with temperature and with depth in the sediment. Measured NH_4^+ production rates agreed with those predicted from NH_4^+ fluxes at high temperatures and diverged as temperature decreased. Quantitative models of porewater NH_4^+ and NO_3^- and NO_2^- concentrations indicate that the rate of nitrification and denitrification increases as temperature decreases. At 5°C, approximately 15% of the NH_4^+ produced from organic matter decomposition may be lost from the marine ecosystem by denitrification.

Redmond, M.S. and K.J. Scott. Science Applications International Corporation, C/O Environmental Protection Agency, Narragansett, R.I. 02882. PREDATION ON AMPHIPODS BY THE POLYCHAETE NEPHTYS INCISA.

The majority of polychaete nephtyid worms are active predators. Nephtys incisa, however, has been considered a non-selective deposit feeder. A toxicity test conducted to determine the response of the tubicolous amphipod Ampelisca abdita to contaminated sediments showed that mortality of A. abdita was correlated with the presence of indigenous N. incisa. In further experiments, N. incisa were held in uncontaminated sediment with A. abdita and another amphipod, Microdeutopus sp., for several weeks. Examination of Nephtys gut contents revealed identifiable portions of both amphipods. We conclude that N. incisa will prey upon these amphipods when they are available. Predation by N. incisa may be a factor in the exclusion of ampeliscid amphipods from the Nephtys-Nucula community common in southern New England.

Batdorf, C., and T. Hruby, Massachusetts Audubon Society, Gloucester, MA
COMPARING TWO INTERTIDAL BENTHIC COMMUNITIES WITHIN GLOUCESTER HARBOR.

Sediment cores for sampling benthic populations from a sandy mud and a fine sand intertidal area within Gloucester Harbor have been collected quarterly since 1983. This sampling is part of a monitoring program to track water quality changes within the harbor which prior to 1984 had raw sewage discharged into the outer harbor. Presently there is primary sewage discharged and after 1988 will have no sewage input from the treatment plant. Differences in infaunal species and their abundances have been found in the two substrates. Populations in sandier substrates were more constant than in muddy substrates. More rapid changes within the intertidal benthic communities may cause a need for bi-monthly sampling rather than quarterly sampling practiced in subtidal research.

Heber, M.*, M. Hughes*, S. Schimmel**, and W. Berry*; *SAIC, **U.S.EPA,
Narragansett, RI 02882. RESULTS OF TWO 7-DAY FISH TOXICITY TEST METHODS USING
COMPLEX EFFLUENTS ENTERING MARINE/ ESTUARINE WATERS.

Two 7-day toxicity tests, using the sheepshead minnow (Cuorinodon variegatus) and the inland silverside (Menidia berullina), have recently been developed, primarily to detect the chronic toxicity of effluents entering marine/estuarine environments. These static renewal tests measure effects on growth and survival and incorporate features of both acute (96-hr) and early life stage (29-day) toxicity tests. Toxicity tests with complex effluents and single compounds have been conducted. Growth was generally the more sensitive endpoint for both fishes. Effect concentrations in these tests were generally within a factor of three of those from early life stage tests. In addition, effect concentrations from an informal inter-laboratory comparison of the sheepshead minnow toxicity test were also within a factor of three.

Hruby, T., Massachusetts Audubon Society, Lincoln, MA 01773.
OPEN MARSH WATER MANAGEMENT IN MASSACHUSETTS: FROM BASIC RESEARCH TO
MANAGEMENT IN THREE YEARS.

The introduction of Open Marsh Water Management (OMWM) as a method for mosquito control on salt marshes has been a rapid process, where we have been able to progress from basic research to an ecologically sound management technique in 3 years. The success has been based on positive results from a research program that has integrated the need for a sound experimental design with the goals and needs of the mosquito control agencies. To date 3 marshes have been experimentally altered to improve the habitat for predators of mosquito larvae. Though the marshes are widely dispersed and are controlled by varied environmental factors, reductions in larval numbers have exceeded 90% during most of the breeding season. This control was achieved without causing major changes in the vegetation, bird usage, fish diversity, and invertebrate diversity. Based on the research results, a manual of methods has been prepared and is now being used by mosquito control agencies in Massachusetts and Rhode Island.

Cooney, J.J., and G.W. Pettibone, Environmental Sciences Program, University of Massachusetts, Boston, MA 02125. INTERACTIONS BETWEEN TIN AND ESTUARINE BACTERIA.

The effects of four organotin compounds were examined on natural populations of microorganisms in sediments from Boston Harbor. Mono-, di-, and trimethyltins were toxic to organisms from these sediments, and the di- and trimethyl compounds were more toxic than the monomethyl compound as measured by either viable counts or by [³H]-thymidine uptake. Tetramethyltin was not toxic. Approximately three to eight times as much organotin was required to achieve the same effect measured by thymidine uptake as measured by viable counts. The results of replica plating experiments suggest that most estuarine organisms which are resistant to one methyltin will be resistant to other methyltins. LC-values suggest that at concentrations reported for methyltins in aquatic environments, methyltins alone are not likely to cause major alterations in the microbial flora. But these compounds may combine with other stressors to alter the composition of natural populations.

McManus, P.J. and K.E. Keay, Gulf of Maine Research/U. of Mass. at Boston. CHANGES IN A BENTHIC INFAUNAL COMMUNITY ALONG A POLLUTION GRADIENT IN AN INTERTIDAL MUDFLAT AT SAVIN HILL COVE, DORCHESTER MA.

Effluent from a combined sewer overflow is discharged at the mouth of Savin Hill Cove, an intertidal mudflat in Boston's Outer Harbor. Bacterial indicators show a strong gradient from the mouth of the cove to the head. On June 5 1985 sediment particle size, total organic carbon, carbon/nitrogen ratio, and tidal exposure measurements were begun at 12 stations along a 420 meter transect across the flat. On this date, and on September 26, 1985 five 5.3 cm² faunal cores were taken at 7 stations (June) and 3 stations (Sept.) and preserved. All organisms retained on a 0.063mm sieve were identified to species level where possible.

Among the noteworthy findings which have emerged from a variety of community analyses applied to these data: I) Infaunal density and diversity decrease dramatically across the transect. The relatively diverse fauna at the head of the cove was attenuated to a sparse assemblage dominated by Polydora ligni, Streblospio benedicti, Capitella spp. and oligochaetes at the most polluted stations. II) A combination of dispersal ability and adaptation to oxygen deficient sediments appears to be associated with occurrence at the most polluted sites

Turner, R.D., Museum of Comparative Zoology Harvard University, Cambridge MA. MARINE FLORA AND FAUNA OF THE NORTHEASTERN UNITED STATES: MOLLUSCA.

A series of keys published by NOAA will considerably improve identification of shallow-water marine organisms. A discussion will be presented on the history and organization of the series, the schedule for publication of keys on mollusks, and progress in gastropod systematics.

Watling, L., Ira C. Darling Center, University-of Maine, Walpole ME. MARINE FLORA AND FAUNA OF THE NORTHEASTERN UNITED STATES: AMPHIPODA.

A contribution to the keys on flora and fauna is being prepared which will update E. L. Bousfield's Shallow-water Gammaridean Amphipoda of New England. The proposed form of this publication and progress in Weastern Atlantic amphipod taxonomy will be discussed.