

ABSTRACTS

New England Estuarine Research Society

Spring Meeting

24-26 May, 1979

Program and Local Chairman

M. J. Dadswell

Department of Fisheries and Oceans
Biological Station
St. Andrews, N. B.

FRIDAY, MAY 25

PAPER SESSION - CASINO

Chairman: Graham Daborn, Acadia University, Wolfville, N. S.

0840 REPRODUCTIVITY IN SOFT SHELL CLAM (Mya arenaria)
POPULATIONS NORTH OF CAPE ANN, MASSACHUSETTS

Neil Savage and Patrick Clark
Normandeau Assoc., Bedford, N. H.

Our clam gonad and planktonic larvae monitoring studies, combined with pertinent information from the scientific literature, indicate that soft shell clam populations in the Gloucester-Plum Island Sound region spawn in the spring and again in the later summer; whereas, unimodal spawning is probably the rule from coastal New Hampshire northward. We speculate that this apparent difference in spawning behavior may be associated with hydrologic and climatic conditions which also appear to favor faster growth of the Massachusetts populations.

0900 Mya arenaria - NONOBLIGATE INFAUNA

Herbert Hidu
Ira C. Darling Center, Univ. Maine at Orono

Natural adult soft-shelled clams which are removed from their burrows to trays will regress and eventually die. Hatchery reared clams, however, confined exclusively in a nonsediment environment, exhibit considerable change in shell morphology and meat condition and actually outperform sibling infaunal groups. These findings are discussed in a general context of life habitat of bivalve mollusks, and for the importance they may hold as a research tool and in commercial mariculture.

0920 THE GROWTH OF JUVENILE BAY SCALLOPS IN A PUMPED RACEWAY SYSTEM

Edwin Rhodes
National Marine Fisheries Service, Milford, Connecticut

Hatchery-produced bay scallop seed was grown in raceways supplied with flowing water from an adjacent estuary. Information on the growth and survival of the scallops under various conditions of water flow, depth and stocking density is presented. Data on the growth of scallops as related to phytoplankton (chlorophyll a) levels are summarized. The use of chlorophyll a levels measured by in vivo fluorescence techniques is discussed as a potential management tool in aquaculture production.

Linda A. Deegan
Univ. of New Hampshire, Durham, New Hampshire

The primary thrust of the research is focused on differential growth and survival of coho salmon due to: 1) delayed time of release and 2) vaccination against the Vibrio pathogen. A secondary aspect was the effects of delayed release on the migration characteristics of the Pacific salmon smolts in New England.

Basic methodology involved a tagging program, utilizing finclips, acrylic and fluorescent polymer emulsion dyes, designed to yield information on survival and growth rates, as well as differential tagging mortalities. Vaccinated and unvaccinated salmon were released at two time points in the year. The first release occurred at the normal time of migration (April-May), the second in the Fall (Oct.-Nov.). After release the population was monitored over time at fixed sample points within the estuary using a variety of sampling equipment, primarily bag seines, fyke and gill nets.

This program of release was designed to test if the delayed release of the salmon would increase survival rates (primarily due to increased size at time of release), delay time of departure from the estuary (increasing oceanic survival by increasing departure size), and decrease the extent and duration of oceanic migration (again contributing to increased survival rates and returns, and enhancing the sport fishing aspect).

Preliminary analysis indicates no advantage to delayed release, and possible increased survival with vaccination. No difference in migration characteristics was noted between release times or vaccinated/unvaccinated salmon.

1020 REGULATION OF AN INTERTIDAL COMMUNITY BY THE MACROALGAE
Ulva lactuca

Steven Edwards
Marine Sciences Institute, Univ. Connecticut

The green macroalga Ulva lactuca occurs in densities up to $204 \text{ gdw} \cdot \text{m}^{-2}$ on an intertidal mud flat in Branford Harbor, CT. At such densities the sediment is rendered completely anoxic at the surface. The infaunal community is characterized by few species, low densities and diversity, and dominance by opportunistic polychaetes. Mobile epifaunal organisms escape to the Ulva substrate for the summer.

Ulva production coincides with reproductive episodes of the invertebrates. As a result, 0-y r class invertebrates are recruited to the Ulva. During the fall, most of these organisms are exported from the mud flat along with Ulva.

The occurrence of Ulva every summer sets back the development of the biotic community and maintains it at an early stage of succession characterized by high net production, strong dominance and low diversity. This suggests that Ulva can be a keystone species.

1040 FOOD AND FEEDING ECOLOGY OF Apeltes quadracus AS RELATED TO
INTRASPECIFIC COMPETITION FOR AVAILABLE FOOD RESOURCE ITEMS

Stephen Souza
Marine Sciences Institute, Univ. Connecticut

Data concerning the food and feeding ecology Apeltes quadracus is analysed in terms of intraspecific competition for available food resources.

Samples are collected at bi-weekly intervals from an intertidal eelgrass bed located in Barn Island Hunting Area, a Southeastern Connecticut brackish water environment. A random sample consisting of a fixed number of males, females, and when available, juveniles are obtained at each sample date. The length, weight, sex, reproductive state, and stomach fullness of each fish is recorded. Digestive tract contents are measured, enumerated, and identified to the lowest possible taxon. Stomach and intestinal contents are treated separately. The percent composition, percent occurrence, and the dietary importance value of each prey item in the stomachs are computed. The sample is also analysed in terms of dietary. Overlap and similarity among the respective size classes. Seasonal trends are assessed from data lumped into three major time intervals. In addition to the fish samples, the available planktonic and epifaunal food resources are simultaneously sampled. These samples are segregated into size classes, and the prey items in each size class enumerated and identified to the lowest possible taxon. Together, the fish and food resources data are utilized to determine selectivity and the diversity and changes in diet as related to changes in available food resources.

Initial findings show a high incidence of feeding on harpacticoid copepods throughout the year. Other prey items within a particular size range contribute to varying degrees depending largely on the time of year. Diet overlap is very high among the size classes, although subtle differences which could lessen the amount of intraspecific competition do exist. Diet diversity appears to be greatest in the winter months when food resources are most scarce and at a minimum in the summer when food resources are more plentiful.

1100 COMPARISON OF THE FORAGING STRATEGIES OF THE AMERICAN LOBSTER
(Homarus americanus), THE ROCK CRAB (Cancer irroratus) AND THE GREEN CRAB
(Carcinus maenas).

Robert Elner
Department of Fisheries and Oceans, St. Andrews

The foraging strategies and predatory behavior of lobsters, Homarus americanus, rock crab, Cancer irroratus, and green crab, Carcinus maenas were compared on a number of mollusc and echinoderm prey species. With unlimited prey availability, green crabs actively chose edible mussels, Mytilus edulis, close to the predicted optimum size. Lobster and rock crabs showed no such well defined size-preferences on mussel prey. With scallop, Placopecten magellanicus, and sea urchin, Strongylocentrotus droebachiensis, prey, both lobsters and rock crabs showed distinct and constant preferences for certain sized prey. This preferred size increased with predator size. Time-lapse recordings suggest that prey size selectivity is the result of mechanical rather than active behavioral preferences in lobster and rock crabs. Green crabs showed similar mechanical size selectivity on gastropod prey. The predatory techniques used by crabs and lobsters were compared. Crabs, despite their smaller, weaker, chelae were able to open similar sizes and species of prey to lobsters. It is suggested that there is significant competition for resources between lobsters, green crabs and rock crabs.

1120 RESPIRATORY PHYSIOECOLOGY OF A SALT MARSH INTERTIDAL,
DEEP BURROWING BIVALVE.

Michael Hutcheson, MacLaren Marex Inc., Dartmouth, N. S.

The habitat of the stout razor clam, Tagelus plebeius, will be described. Microhabitat variations in temperature and oxygen concentration were measured. Mud surface temperature changes of 9°C were measured during tidal excursion, while burrow temperatures remained within 1°C of ambient. Partial pressures of oxygen of burrow water during this period decreased from near 160 down to 30 mm Hg. Clams exhibited varying respiratory responses to decreasing oxygen availability and had a loss of respiratory independence of oxygen as temperatures were increased to 5 and 10° above the acclimation temperature. The anaerobic metabolic capabilities of the clam will be discussed. Survival under anoxic conditions for greater than 100 hours was recorded.

1140 THE ECOLOGICAL ROLE OF Asterias vulgaris IN THREE SUBTIDAL COMMUNITIES AT
THE ISLE OF SHOALS, N. H.

Alan Hulbert, Dept. of Zoology, Univ. New Hampshire

Field studies of three subtidal communities arranged at three depths of 8 m, 18m and 30 m on a single transect from the intertidal to 35 m indicate that Asterias vulgaris, the dominant asteroid present, has a different ecological role in each of these communities. The differences between communities include population structure, predatory relationships and migration rates of Asterias vulgaris.

FRIDAY, MAY 25

PAPER SESSION - CASINO
Chairman: Weldon Bosworth, Normandeau Assoc.

1410 ONGOING STUDIES INTO THE BALANCE BETWEEN AUTOCHTHONOUS AND ALLOCHTHONOUS CONTROL OF DETRITAL DYNAMICS IN SMALL ESTUARIES

B. L. Welsh
Marine Sciences Institute, Univ. Connecticut, Bedford, N. H.

Several aspects of the hydrodynamics of small estuaries favor the import of organic materials from external sources. These include:

1. High-amplitude fluctuations and unidirectional nature of freshwater flow.
2. Interactions between gravity and differential tidal velocities.
3. Interactions between biogeochemical characteristics of the benthos and differential turbulence characteristics over the tidal cycle.

Investigations in two estuaries in Long Island Sound reveal why import is favored, some characteristics of the materials imported, and how these imports are affecting the basic ecological characteristics of the area. Assuming a relatively set combination of hydraulic characteristics for a given estuary, allochthonous loadings will be controlled by production rates beyond its boundaries. Hence there is no internal ecological feedback control to such additions, as there would be to autochthonous production. One outcome seems to be that the basic nature of small estuaries may be more a function of their characteristic abilities to process detrital inputs than by their primary production characteristics.

1430 THE ORIGIN AND TRANSPORT OF PLANT MACRO-LITTER ON A NORTHERN MASSACHUSETTS SALT MARSH

Alan Brontein, and Ernest Ruber
Northeastern University, Boston, Massachusetts

There has in recent years been considerable interest in the question of export of marsh materials to the bay portion of the estuary. We have found no evidence of such transport as it applies to particulate detritus (presented before NEERS by Bob Murray in 1977).

In the present study we present data from flotation drift studies of tagged litter bundles. These were placed in various locations at low and high tide in the fall and again in the spring and then observed for transport after varying periods of time. Drift-line litter has been examined for species of origin, has been quantified for the area studied and is associated with production of the relevant plants in the same general area.

1450 ECOLOGY OF DIPTERA IN THE SUPRALITTORAL WRACK COMMUNITY OF THE LOWER BAY OF FUNDY AND THEIR POSSIBLE ROLE IN NUTRIENT CYCLING IN COASTAL WATERS

Steven Marshall, Ann Konecny, and Michael Dadswell Carleton University, Ottawa, Ontario, and Department of Fisheries and Oceans, St. Andrews, New Brunswick..

Supralittoral wrack piles of stranded seaweed drift (mostly *Fucus* and *Ascophyllum*) are formed on the shores of the lower Bay of Fundy during each neap-spring tide cycle. Wrack was sampled every three days from May to November by removing previously (Day 0, peak spring tide) installed, 15 x 15 x 50 cm wire cages, containing 200 gm dry weight seaweed. Organisms were separated from the seaweed using a Berlese funnel. The wrack community was diverse, consisting of insects, amphipods, arachnids and oligochaetes. Dominant organisms were dipteran larvae and adults and the amphipod *Orchestia platensis*.

Dipteran larvae appeared within a few days of fresh wrack pile formation. Most species had a 2-week-larval and 2-week-pupal period so adults of that generation were emerging as the next spring-tide wrack pile formed. Larvae feed directly on the seaweed and were capable of reducing the wrack to a brown, water soluble fluid (SLS) in a few weeks. It is proposed that the breakdown of the supralittoral seaweed deposits through the action of the wrack community results in significant cycling of nutrients in coastal waters of the area.

1510 SEDIMENTATION AND MICROBIAL METABOLISM IN A SHALLOW NEW ENGLAND ESTUARY

Ernie Matson and John Buck
Marine Sciences Institute, Univ. Connecticut

The sediments of Quiambog Cove are anoxic within mm of the mud/water interface, and sulfide concentrations reach 3 to 5 mm 30 cm below. Organic carbon (OC) is deposited at a rate of 140 to 390 mol OC m⁻² y r⁻¹, and the standing crop is about 130 mol OC m⁻² in the top 10 cm. Supplies of SO₄⁻², as a respiratory oxidant, are not depleted in April or July at the 30 or 60 cm horizon in the sediment pore waters.

A more complete array of pore water samples was taken from 15 stations during April (5°C) and July (20°C) to examine relationships among major biochemical species (SO₄⁻², NH₄⁺, dissolved organic carbon (DOC), titration alkalinity (TA), and carbohydrate). Significant correlations existed between net SO₄⁻² depletion and NH₄, DOC, and TA accumulations in April but not in July. TA and DOC changed significantly between April and July, but net SO₄⁻² depletion did not. Further, estimates of aerobic and anaerobic metabolism indicated that the biochemical oxidation at 10°C in the first cm was equivalent to net annual carbon deposition, but metabolic rates (ca. 3 umol 2H⁺ cm⁻³ hr⁻¹) were similar down to 6-8 cm in the mud.

Common diagenetic models do not fit these data, and several mechanisms appear to regulate specific pore water equilibria on different time scales. Oxidative processes other than O₂ and SO₄⁻² respiration (i.e. chemolithotrophy and fermentations) may be very important in the early diagenesis of Quiambog sediment organic matter.

1550 ANIMAL-SEDIMENT RELATIONSHIPS IN THE UPPER REACHES OF THE
BAY OF FUNDY: IMPLICATIONS FOR THE DEVELOPMENT OF TIDAL
POWER

Michael Risk, Dept. of Geology, McMaster University, Hamilton, Ontario

Intertidal flats of the upper reaches of the Bay of Fundy support benthic invertebrate assemblages which have some of the highest population densities and the lowest species diversities ever recorded for similar communities. Values of secondary productivity are very high. These flats are feeding grounds for most of North America's migratory shorebirds, and for large numbers of fish.

Population structure of the infaunal communities is greatly dependent on sediment characteristics. Newly-deposited muds, for example, have shear strengths so low as to effectively exclude most of the typical mud-living organisms. Rapid changes in erosion and accretion rate may cause catastrophic mortalities.

Construction of tidal power barrages will undoubtedly alter the sediment dynamics of the upper reaches; the most likely result will be sand deposition near the barrage site, and mud mantling of the adjacent intertidal flats. Although proper barge design could minimize some of the effects, it is possible that the total productivity of the system could drop dramatically for several years after construction. The resulting effects on migratory birds and both nearshore and offshore fisheries have yet to be quantified.

1610 CLAMDIGGING: HOW MUCH OF A SEDIMENTARY DISTURBANCE TO
A TIDAL FLAT?

Franz Anderson and Luther Black
Jackson Estuarine Laboratory, Univ: New Hampshire

Sedimentary processes may regulate the abundance and distribution of both resident and colonizing fauna. To better understand these processes, we have begun a year-long study which will describe and evaluate seasonal sedimentation in Lowes Cove, a tidal flat on the Damariscotta River, Maine. This study is subject to seasonal disturbance by clamdiggers harvesting the natural population of Mya arenaria, the soft shell clam.

Each month a set of 56 surface sediment samples and a series of six surveying profiles are taken along representative traverses. The sediment samples were separated into grain-size fractions to characterize the sediment texture. Changes in the monthly traverse profiles have revealed spatial and temporal changes in deposition and erosion. Maps of surface sediment texture across the cove relate to these depositional and erosional patterns.

To examine the role of clamdigging in local sedimentation, a preliminary study compared textural changes between an experimentally dug plot and an undisturbed area of the flat. During the four week study of microtopography and surface texture, the mounds and depressions left by clamdigging remained as distinct features on the flat. The surface texture of the dug area became coarser as waves and tidal currents winnowed the mounds and filled the depressions. Transport of fine sediments from the dug area suggests that clamdigging activity may play an important role in the yearly sedimentation of the tidal flat.

1630 NEW HAVEN HARBOR OTTER TRAWL INVERTEBRATES

Paul Ferreira and Andrew McCusker, Normandeau Assoc. Bedford, N. H.

A program of monthly otter trawl sampling has been underway in New Haven Harbor, Connecticut since 1971. The program has been part of a biological monitoring study concerned with environmental impact evaluation of the United Illuminating Company's New Haven Harbor Station: a 460 MW oil fired electric generating station. Results of these studies have shown that New Haven Harbor is "highly" utilized by epibenthic macroinvertebrates as well as finfish, despite the area's extreme urban and industrial development. The harbor is utilized as receiving water for three primary sewage treatment plants, paper mills, and other industrial discharges, while its use as an oil port is evidenced by the widespread presence of oil-contaminated sediments. Dominant epibenthic species included: sand shrimp (Crangon septemspinosus), starfish (Asterias forbesi), rock crab (Cancer irroratus), lady crab (Ovalipes ocellatus), lobster (Homarus americanus) and mantis shrimp (Squilla empusa). Spatial, seasonal and annual abundance trends are presented for each of these species and consideration is given to effectiveness of the study design for characterization of harbor utilization by these species.

SUBTIDAL BENTHIC STUDIES IN NEW HAVEN HARBOR (CT) A
CLASSICAL APPROACH IN A NON-CLASSICAL SYSTEM

Andrew J. McCusker and David J. Hartzband
Normandeau Assoc., Durham, N. H.

Benthic faunal assemblages in New Haven Harbor (CT) must survive in a habitat exposed to oil spillage, large ship traffic and discharges from four sewage treatment plants. Benthic monitoring studies, carried out to evaluate impacts of a 460 MW plant, found an assemblage characterized by extreme temporal variability and high spatial variability. Though the total number of taxa was high, the number of species which were frequently important was not. The absence of any persistent taxa and the apparent minimal role of macroinfaunal interaction in determining species distribution and abundance present a difficult problem in evaluating impacts.

Species inventories generated by benthic studies conducted under the supervision of Normandeau Associates, Inc. (NAI) from 1973-1977 and by Rhoads and Michael (R&M) from 1974-1978 were combined, and the resulting species list comprised over 300 taxa. Fourteen ubiquitous or dominant species were identified as "characteristic" of New Haven Harbor benthos.

An examination of spatial and temporal patterns of species richness revealed that most sampling stations supported few species at any time and that no recognizable seasonal patterns were evident. Species richness and diversity at control stations were found to be consistently greater than at inner harbor stations. Faunal density was spatially and temporally quite variable, and was marked by annual summer minima and fall recovery: most dense populations were recorded in late fall/early winter. An "August effect" of reduced summer richness and density appears to have been associated with three combined factors of sufficient depth to allow dissolved oxygen diminution at the bottom, an organic-rich silt-clay substratum, and location in the inner harbor. This combination of factors, in conjunction with the other environmental stresses in the harbor, appear to be responsible for mass mortalities during peak stress periods in August.

Numerical classification analyses identified four station clusters in the harbor; two resembled community types that have been identified from other east coast estuaries. Stations in the inner harbor, due to their more variable fauna, did not cluster well, and only one group of three similar stations was identified. Two sediment-controlled community types were recognized from the control samples.

The results of the study will be discussed in light of evaluation of impacts caused by the New Haven Harbor Station.

PAPER SESSION, CASINO

Chairman: Michael Risk, McMaster University, Hamilton, Ontario

0830 THE BENTHOS AND BENTHIC ENVIRONMENT OF KENNEBECASIS BAY, N.B. A FJORD-LIKE ESTUARY

Martin L. H. Thomas,
Division of Sciences, Univ. of New Brunswick at Saint John, N.B.

Kennebecasis Bay, part of the Saint John River estuarine complex is a fjord-like body of water. Most of the bay lies in about 35 m of water but is cut off from the Bay of Fundy by two shallow sills. Renewal of deep water in the bay is spasmodic and unpredictable and normally consists of water at about 20 o/oo salinity. Dissolved oxygen levels in the bottom waters reach very low values (< 1 ppm) at times. The highly stratified nature of the surface waters and shallow compensation depth of 2-4 m severely limits primary production by both plankton and macro-plants. The benthos is interesting and unusual. It comprises several species typical of much deeper, oceanic waters as well as rare estuarine species. Several are unidentified and probably new species. The dominant trophic group are detritivorous suspension and deposit feeders.

0850 THE INTERNAL WAVE OF KENNEBECASIS BAY, N.B. AND ITS INFLUENCE ON THE BENTHIC ENVIRONMENT

F. H. Page,
Division of Sciences, Univ. of New Brunswick at Saint John, N.B.

The fjord-like Kennebecasis Bay Estuary harbours a progressive internal wave which varies seasonally in depth. In spring, low density high runoff surface waters produce a pycnocline at 12 m. In August the low runoff allows surface water density to increase, yielding a 1-3 m pycnocline. The internal wave amplitude decreases seasonally and with distance up river.

The benthos of Kennebecasis Bay can be divided into 3 zones: a shallow, relatively fresh water zone, a deep bottom water zone and an intermediate zone which corresponds to the substrate area influenced by the internal wave and seasonal pycnocline migration. Each zone is characterized by a distinct faunal assemblage and set of physical conditions.

0910 A QUALITATIVE AND QUANTITATIVE STUDY OF THE MEROPLANKTON IN COBSCOOK BAY, MAINE

Martha O'Brien
Wellesley College, Wellesley, Ma.

A qualitative and quantitative analysis of the meroplankton in Cobscook Bay, Maine was undertaken during the summer of 1978. A reversing falls within Cobscook Bay provided a natural division for two regions of study. Group composition and abundances of meroplankton were determined for both the inner and outer regions of the bay. The double oblique towing method was used to collect samples during a six-week period.

Twelve meroplanktonic forms were identified. These were contained in the classes: Crustacea, Pelecypoda, Gastropoda, Polychaeta, Ascidiacea, and Hydrozoa. Fish eggs and larvae were also collected. The cirripedian nauplius was the dominant larval form throughout the sampling period.

Sampling was designed to give insight into the dispersal patterns of these larval forms. Samples collected at two tidal phases were compared. Statistical tests revealed no significant differences in composition or abundance of meroplankton between the two phases; therefore, no conclusive information on the movement of the larval forms was obtained. Meroplankton abundance differences between the two regions of the bay provides information on the distribution of the benthic invertebrates.

0930 ZOOPLANKTON IN THE INNER BAY OF FUNDY

Graham R. Daborn, Kim W. Strong, Carol Gilmurray, Cathy Pennachetti,
Department of Biology, Acadia Univ., Wolfville, N.S.

Recent studies of zooplankton composition in Minas Basin, Shepody Bay, Cumberland Basin and Chignecto Bay have shown striking regional differences in summer populations. Chignecto Bay has a relatively high diversity of species, although sampling at frequent intervals over a complete tidal cycle suggests that populations are patchily distributed. Minas Basin and Shepody Bay have a restricted fauna that is sparsely distributed and dominated by smaller copepods such as Eurytemora and Centropages. The larger Calanus are infrequently encountered. Cumberland Basin, which is extremely turbid, exhibits the most restricted zooplankton fauna, one that is dominated by Pseudodiaptomus and Neomysis. Continuing studies involve sampling through complete tidal cycles at predetermined anchor stations in the headwater bays to investigate seasonal variations in abundance and composition.

1010 THE BIOLOGY OF THE AMPHIPOD Corophium volutator IN THE WESTERN MINAS BASIN, NOVA SCOTIA

Gary Gratto,
Department of Biology, Acadia Univ., Wolfville, N.S.

Corophium volutator was studied along six intertidal transects in the western Minas Basin for the eighteen-month period from May 1977 to October 1978. Densities varied greatly throughout the study area, ranging from nil at stations with sandy substrates to 40,000 to 60,000/m² at stations with a substrate of coarse silt overlying firm clay.

The sex was determined of all individuals over 5 mm in a number of samples each month. Males comprised from 8.5 to 18% of the population through the year. Egg-bearing females were present from April to October 1978 with the greatest percentage, 56%, occurring in May.

Three cohorts a year are present. A single cohort over-winters, producing a cohort in early June and another in early July. These two cohorts mature rapidly and produce, in late August, the cohort which will over-winter. Growth rates were determined to be 0.06, 0.21 and 0.38 to 1.34 mm/week in winter, spring and summer and early autumn, respectively. Production was calculated as 21.64 g/m²/year with a P:B ratio of 2.64.

1030 SPACE UTILIZATION BY SANDY BEACH AMPHIPODS: RESPONSE TO PHYSICAL FACTORS OR BIOLOGICAL INTERACTIONS?

Edward B. Hatfield & Robert A. Croker,
Jackson Estuarine Laboratory, Univ. New Hampshire.

Space utilization by two sandy beach amphipods at York Beach, Maine may reflect biological interactions as well as response to fluctuation in physical environmental conditions. Over eight years, the distributional pattern of the upper limit of the lower intertidal - subtidal Acanthohaustorius millsii is similar to the pattern of the lower limit of the upper intertidal Haustorius canadensis. The compartmentalization of beach space by females, juveniles, and the total populations of these species and by a third amphipod, Amphiporeia virginiana, was particularly vivid during the summer reproductive period. Ovigerous females of H. c. and A. m. are not found within the preferred beach level of the other species. The fecundity of A. m. females was drastically reduced and mortality increased in the presence of H. c. in the laboratory.

1050 THE ECOLOGY OF Hyale nilssoni (RATHKE) 1843, AN AMPHI-ATLANTIC AMPHIPOD

Clare McBane,
Department of Zoology and the Jackson Estuarine Lab, University of New Hampshire.

New Hampshire open coastal and estuarine populations of the obligate intertidal amphipod, Hyale nilssoni were compared for life history features, zonation, abundance, and preference for algal species. During a year study period, juvenile recruitment peaked twice, while total population abundance declined during winter months. Open coastal animals generally were larger in size than estuarine individuals. Field and laboratory results indicate that the species exhibits algal and zonal preferences within the intertidal zone of rocky shores.

1110 PRELIMINARY OBSERVATIONS OF THE LIFE HISTORY OF Mysis mixta
(CRUSTACEA: MYSIDACEA) IN COASTAL NEW HAMPSHIRE WATERS

Stephen A. Grabe and Elizabeth R. Hatch,
Normandeau Associates, Inc., 15 Pickering Ave., Portsmouth, NH

Aspects of the life history of Mysis mixta were investigated from macrozooplankton samples collected during 1978 from three stations along the New Hampshire coast. Sexually mature individuals, predominantly females, were present January-April and late December. Spawning occurred March through mid-April. Juvenile M. mixta were first collected during early March and were relatively abundant into early June after which they were collected infrequently and in low numbers. Fecundity was estimated for females with intact marsupia; growth rates of the spring generation were estimated. Relationship between carapace length-total length and carapace length-dry weight were calculated.

1130 SUBSTRATE AS A FACTOR IN SHRIMP DISTRIBUTION

Ronald S. McMahon,
Marine Research Laboratory, University of Connecticut, Noank, Conn.

Field and laboratory studies of the autumnal movements of three grass shrimp, Palaemonetes pugio, Palaemonetes vulgaris, and Palaemonetes intermedius suggest that substrate preference may be a factor governing their distribution. Field studies have shown that during summer months, these species inhabit tidal creeks and the shallow subtidal zone of the estuary. However, during the fall the shrimp move to nearby deeper subtidal waters, which have abundant vegetation. Laboratory experiments were designed to determine if substrate preference was an important factor in the shrimps' seasonal distribution. A randomized complete block design was employed. Each of the three species was separately presented a free choice among four types of substrates in partitioned experimental troughs. The substrates presented reflect the natural choices found in the field: fine sand, mud, loose peat, and fine sand covered with vegetation. Results of the experiments show that distributions on different substrates are not random, and that departures from the expected distributions are highly significant. The implications of autumnal movements and substrate preference will be discussed with regard to the shrimps' distribution during the winter months.