

NEERS

May 2-5, 1991

Yarmouth, Nova Scotia

ABSTRACTS

Friday, May 3rd a.m. Session I

Chair: Mike Brylinsky, Acadia University, Wolfville, NS

Dettmann, E.H., U.S. EPA; W.Brown, Computer Sciences Corporation; W.Warren, M.Fox, and D. Kester, University of Rhode Island, Narragansett, RI 02882. (401) 782-3039.

A STEADY-STATE MODEL OF DISSOLVED OXYGEN IN THE PROVIDENCE RIVER-SEEKONK RIVER ESTUARY, RHODE ISLAND.

The WASP water-quality model is used to perform steady-state simulations of dissolved oxygen concentrations, with limited nitrogen dynamics, in the Providence River-Seekonk River estuary. Transport was calculated with a salinity-driven box model. Model sensitivity analysis indicates that contributors to the dissolved oxygen budget of the water column, in decreasing order of importance, are net phytoplankton production, biochemical oxygen demand, sediment oxygen demand, and nitrification. Model results are used to suggest additional data needs for a time-dependent modeling study, and to identify critical parameters requiring priority in the design of future field studies for waste load allocation.

Drapeau, David T., Department of Marine Sciences, University of Connecticut, Croton, CT 06340 (203) 445-3481.

THE ROLE OF WATER COLUMN MICROHETEROTROPHS IN SUMMERTIME OXYGEN DEPLETION IN LONG ISLAND SOUND.

Hypoxic conditions occur annually in the bottom waters of western Long Island Sound during the summer. Oxygen profiles and light/dark bottle incubations conducted over the past several years have shown a narrow zone of net oxygen production at the surface followed by a zone of high respiration between the surface and the pycnocline. Metabolic activity below the pycnocline was characteristically low. Results of a study of bacterioplankton abundances begun in 1989, suggest that large populations of free living bacteria and the microzooplankton which graze on them are responsible for the majority of water column oxygen demand. The vertical distribution of these water column microheterotrophs is controlled in part by the phytoplankton, probably through the exudation of dissolved organic substrates. The breakdown of this apparent coupling may be related to the occurrence of oxygen depleted bottom waters.

Johnson, Jacqueline. Department of Marine Sciences, University of Connecticut, Groton, CT 06340 (203) 445-3481.

THE RECYCLING OF INORGANIC NUTRIENTS IN THE UPPER WATER LAYER OF WESTERN LONG ISLAND SOUND DURING THE PRESENCE OF STRATIFICATION.

Western Long Island Sound is a eutrophied system which is subject to seasonal stratification and bottom water oxygen depletion. Recent light/dark bottle studies examining the oxygen depletion process have indicated that significant levels of respiration occur above the pycnocline. It is expected that inorganic nutrients are being regenerated above the pycnocline. This work set out to quantify this nutrient recycling in the upper water column during stratification. Prior to the onset of hypoxia, gross production of inorganic nitrogen and phosphorous occurred above the pycnocline but below the photic zone. The regenerated nutrients are then remixed in the upper water column as daytime thermal structure breaks down. This suggests that the traditional scenario for summer time estuary nutrient depletion may not apply in Western Long Island Sound.

Manuel, J.L. and Dadswell, M.J. Biology Department, Acadia University, Wolfville, N. S. BOP 1X0 (902) 542-2201.
SWIMMING BEHAVIOR OF JUVENILE GIANT SCALLOP, *Placopecten magellanicus* IN RELATION TO SIZE AND TEMPERATURE.

A wheel was used to stimulate juvenile scallops with shell height between 4 and 35 mm to swim in an aquarium. Swim sequences were recorded and analysed using VCR equipment. Scallops ascended in the water column in straight, spiral or twisting patterns, and the majority never swam horizontally. Two types of swimming were observed. Stable swimming, with a consistent body angle (the angle that the scallop makes with the horizon), was recorded over the size range of scallops examined. In stepwise swimming, the body angle alternated between steep (98° S.D. $\pm 13^{\circ}$) and more horizontal angles ($51^{\circ} \pm 9^{\circ}$). Stepwise swimming was observed among the smaller (mean 8mm S.D. ± 3 mm) scallops. Maximum and mean velocities were positively correlated with both shell height and temperature. Clap rate increased with increasing temperature [$Cr-0.29t(^{\circ}C) + 1.3$]. Body angle expressed a significant relationship with shell height. Below 10mm shell height the mean angle was 82° ; between 30 and 35mm the mean angle was 38° .

Potts, M.S., Dept. of Zoology, University of New Hampshire. Durham, NH 03824. EFFECTS OF HEMATOPOIETIC NEOPLASIA ON THE SOFT-SHELL CLAM. The soft-shell clam, *Mya arenaria*, is susceptible to a blood disorder, known as hematopoietic neoplasia (Hn), in which atypical cells invade the hemolymph and connective tissue of the circulatory, digestive, reproductive, and excretory systems. Hn reduces productivity of clam populations through organ dysfunction and mortality. In this study, clams were collected monthly from Buzzards Bay, MA and diagnosed for Hn. Disease effects on excretory function and hemocyte phagocytosis were investigated using the radiopharmaceuticals Tc-99m-Disofenin, - DTPA, and -Sulfur colloid. The agents were injected into the anterior adductor muscle, and distributions were determined by scintigraphy and gamma well counting. Whole body DTPA levels were reduced at a faster rate in normal clams than in Hn clams. The mechanism of reduced DTPA excretion may lead to a toxin buildup in the animal and contribute to the overall disease state. Disofenin localized in the clam nephridia and was found primarily in this organ within 20 hours. No consistent differences in rate of localization were found between Hn and normal clams. Sulfur colloid was differentially concentrated in clam hemocytes. Hn clams had lower levels of sulfur colloid in the cells and higher levels in the plasma than controls, indicating reduced phagocytic capabilities in the Hn clams. This may contribute to a decreased ability to remove foreign material from the circulation, and to repair wounds.

LUNCH

Friday, May 3 p.m. - Session II

Chair: Sherman Boates, Acadia University, Volfville, NS

Dzierzesk, M.J., Department of Earth Sciences and Institute for the Study of Earth Oceans and Space, University of New Hampshire, Durham, NH 03824. VEGETATIVE CHANGES IN A HYDROLOGICALLY ALTERED SALT MARSH ECOSYSTEM.

Little River Marsh in North Hampton, New Hampshire is a tidal salt marsh that has been altered hydrologically. Reduced tidal inundation which has caused a shift from salt marsh plant species to freshwater plant species. *Lythrum salicaria*, a freshwater species, has replaced *Spartina patens*, a dominant salt marsh species, resulting in a 70% reduction in area originally dominated by *Spartina patens*. Factors which appear to slow the progression of *Lythrum salicaria* from invading the remaining 30% of this salt marsh include both nitrogen availability and porewater salinity. *Lythrum salicaria* and *Spartina patens* were enriched with either nitrogen or phosphate. *Lythrum salicaria* showed an increase biomass when enriched with nitrogen while *Spartina patens* showed an increase in biomass when treated with phosphate. N:P ratios in the nitrogen plots were significantly higher than the control or phosphate plots for both species. N:P ratios in the phosphate plots for *Spartina patens* were significantly lower than the control when compared to the same for *Lythrum salicaria*. The effect of porewater salinity on the distribution of *Lythrum salicaria* was determined by both field and laboratory studies. *Lythrum salicaria* was not found in areas where porewater salinities exceeded 6 ppt while *Lythrum salicaria* grown in microcosms did not survive when porewater salinities exceeded 9 ppt. The salinity results from this research can be used to explain why there was a 10% increase in area vegetated by *Spartina patens* between 1981 and 1984. In the early 80's the only opening to the ocean was blocked for a short period of time. It is probable that *Lythrum salicaria* advanced its invasion at this time and then receded when the saltwater returned, allowing the area to be revegetated by *Spartina patens*.

Ryder, Cheryl A. (1), Linda A. Deegan (2), Jack T. Finn (1). (1) Univ. of Mass., Dept. of Forestry and Wildlife Mgmt., Amherst, MA 01003 (413) 545-2757 and (2) Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA 02543 (508) 548-3705. SENSITIVITY OF AN ESTUARINE IBI TO INDIVIDUAL METRICS AND TEMPORAL VARIATIONS. The Index of Biotic Integrity (IBI), effective in measuring biological integrity of streams and their fish community, may also be useful in assessing the condition and providing long term monitoring of estuarine ecosystems. We adapted the IBI to an estuarine system by modifying the measured fish community variables (metrics) to include factors of geographic variation, fish use of an estuary seasonally, and use by species of diverse life histories. The applicability of this IBI was examined by assessing (1) the relative sensitivity of the total IBI score to these individual metrics, and (2) the effect of temporal variation in samples. The value of specific metrics is addressed. Data used for IBI application testing was collected by trawl and seine within Buttermilk Bay, a New England estuary.

Neill, Christopher. Marine Biological Laboratory, Woods Hole, MA 02543. CONTROL OF EMERGENT PLANT PRODUCTION IN SALINE PRAIRIE MARSHES: DO THEY FUNCTION LIKE COASTAL SALT MARSHES? Prairie marshes on saline soils resemble coastal salt marshes in many respects. Both experience periodic water level fluctuations, have high pre water concentrations of Na⁺, Cl⁻ and SO₄²⁻, and exhibit nitrogen-limited plant growth. Unlike coastal salt marshes where *Spartina* production is greater on more aerated creekbank soils, emergent plant production in prairie marshes is higher in sites with more reducing soils, deeper flooding and less pore water movement. This is caused by the timing of flooding and chemistry of floodwater. Flooding with low salinity water from spring snowmelt prevents pore water salinities from reaching levels (>15 o/oo) that are common in unflooded marshes and that are near the tolerance limits of many emergent plants. Flooding with freshwater also increases nitrogen mineralization, leading to higher nitrogen availability compared with unflooded marshes. Although the factors that control production in these two systems are similar (nitrogen, salinity, Eh), their mechanisms of operation are quite different.

Mawhinney, Kim. Biology Department, Acadia University, Wolfville, NS
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MUDFLATS ARE NOT ALL CREATED EQUAL

The effect of prey abundance on the distribution and body condition of Semipalmated sandpipers, *Calidris pusilla*, (hereafter called SEMI's) was investigated at different foraging sites in the upper Bay of Fundy, Nova Scotia. In the Minas Basin, SEMI's distribute themselves both spatially and temporally to the main prey source, *Corophium volutator*. The foraging density of SEMI's was positively correlated with prey density. SEMI's made increased use of the higher prey-density mudflats as the total population of 'peeps' increased over the migratory period and decreased use of low prey-density mudflats more quickly as the total population of 'peeps' decreased. The total body weight of SEMI's at all sites increased during the pre-peak migratory period. SEMI's foraging on different mudflats were not structurally different but those foraging on mudflats with high-prey densities tended to be in better condition than those feeding on mudflats with medium and low-prey densities. During the post-peak period, larger birds in good condition foraged on the high prey density mudflats, while smaller birds, in poorer condition fed at medium and low-prey density mudflats. These results suggest that "mudflats are not all created equal" and that factors other than the density of prey are influencing how different mudflats are used by SEMI's.

Hampson, George R., Biology Department, Woods Hole Oceanographic Institution, Woods Hole, MA 02543 and D. M. Burdick, Jackson Estuarine Laboratory, University of New Hampshire, Durham, NH 03824.

LONG-TERM EFFECTS OF #2 FUEL OIL ON A SALT MARSH IN BUZZARDS BAY, MASSACHUSETTS. October 9, 1974 oil barge BOUCHARD 65 spilled an undetermined amount of #2 fuel oil off the west entrance of the Cape Cod Canal in Buzzards Bay, Massachusetts. Qualitative samples of dead and moribund marine invertebrates were collected and recorded (4,360 specimens, 105 species). Long-lasting effects were on the salt marsh plant community in Winsor Cove; 3-year sampling was initiated on oil impact on individual plant species along a transect from the high tide to low tide. Control site was also selected at a nearby marsh. By September 1977, marsh grass in the lower intertidal zone in Winsor Cove was shown to be incapable of reestablishing itself by reseedling or rhizome growth. Erosion rates measured in the affected area as a result of the marsh degeneration were 24 times greater than the control site. Winsor Cove was revisited in 1990 to determine long-term effect. Original transect lines were relocated. Seaward leading edge of the peat marsh was totally eroded to the extent of the high tide mark; the mid-shore region and lower shore is in the process of being reestablished by *Spartina alterniflora* and the beginning of the formation of a new salt marsh. Estimates of percent cover at these locations were from 5%-40%.

Geyer, Heidi E., Linda A. Deegan, and John T. Finn. The Ecosystems Center, MBL, Woods Hole, MA and University of Massachusetts, Amherst, MA (508) 548-3705. INVERTS AND ALGAE: THE CORRELATION.

Large amounts of macroalgae in eelgrass beds of Waquoit Bay may decrease suitable nursery habitats for juvenile fishes by affecting food abundance and availability. The effects of macroalgae on the abundance and diversity of free-swimming and benthic invertebrates was studied in a large scale macroalgae removal/addition experiment. Increased macroalgal density results in increased free-swimming and benthic invertebrates. Invertebrate abundance and diversity were greater within the benthic macroalgal mat than at the algae-water interface. However, invertebrates within the macroalgal mat, although more abundant, may be less available for predation by juvenile fishes.

Deegan, Linda A., J. Finn, C. Ryder and S. Ayvazian. The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA 02543 (508) 548-3705. DOES THE INDEX OF BIOTIC INTEGRITY WORK IN ESTUARIES?

Last time we presented the theory of an Index of Biotic Integrity for estuaries. This time - the reality. Can fish assemblages tell us more about the relative health of an estuary than nutrient or chlorophyll numbers? You be the judge.

Kaldy, James E., Dept. of Plant Biology; Fredrick T. Short, Dept. of Natural Resources and Jackson Estuarine Laboratory, Center for Marine Biology, University of New Hampshire, Durham, NH 03820 (603) 862-2175.

THE EFFECTS OF LIGHT AND NUTRIENTS ON THE EPIPHYTE ASSEMBLAGES OF EELGRASS IN MESOCOSMS.

Shallow water submerged angiosperms such as eelgrass (*Zostera marina*) form communities that are an integral part of coastal marine ecosystems, especially estuaries. Epiphytes growing on eelgrass blades have been shown to contribute substantially to the primary production of estuaries, but they also reduce eelgrass photosynthesis. We hypothesized that light reduction and nutrient addition affect epiphyte abundance and species assemblage. Mesocosms were set up in a factorial design to experimentally evaluate the effects of light reduction (100%, 33% and 10% of full sunlight) and nutrient enrichment (ambient and 6 times ambient) on the eelgrass community. Eelgrass blades were periodically removed and examined for epiphyte species composition, percent cover, and biomass/unit area of leaf. Epiphyte biomass decreased with reduced light ($P=0.030$), and increased with enrichment ($P=0.020$). No interaction was evident ($P=0.420$). The epiphytic algae, which consisted primarily of diatoms, showed species changes in response to the treatments.

Hoven, Heidi, Dept. of Plant Biology and Jackson Estuarine Laboratory, University of New Hampshire, Durham, NH 03824; Ray Grizzle, Livingston University, Livingston, AL 35470; Frederick Short, Dept. of Natural Resources and Jackson Estuarine Laboratory/Center for Marine Biology, University of New Hampshire; Linda Kindblom, University of Maine, Orono, ME 04469.

THE SEAGRASS, *Zostera Marina* AS A TRAP FOR LARVAL MUSSELS: THE "HONAMI" EFFECT

Our observations of the *Zostera marina* (eelgrass) canopy undulating in response to rapid tidal currents ("honami"), and the settlement patterns of *Mytilus edulis* (blue mussel) onto these blades of eelgrass, suggest a potentially very important hydrodynamical effect on larval settlement. Early post-larval and juvenile mussels consistently occurred in substantially higher abundances at the distal tips (top 30 cm) of eelgrass compared to the lower portions of the blades. Larval settlement of this type is found extensively in eelgrass meadows near the mouth of the Jordan River, Maine and elsewhere along the New England coast. Underwater observations made while measuring tidal current profiles showed a dramatic waving response of eelgrass which produces up to a 50% variability in the mid-water current speeds. Because the upper portion of eelgrass leaves moved through more of the water column per unit time while undulating in high current speeds than during times of low current speeds, we hypothesize that this mechanism resulted in the greater recruitment of mussels occurring on upper portions of the blades than on the lower portions. The distal tips were much more likely to encounter larvae. We suggest that seagrass waving may affect hydrodynamical conditions above the canopy such that greater larval numbers are directed into the bed than would arrive by other settlement mechanisms. Our hypothesis has major implications for measuring larval recruitment in both field and flume studies.

Burdick David M., James E. Kaldy and Jaimie Wolf, Jackson Estuarine Laboratory, Center for Marine Biology; and Fredrick T. Short, Dept. of Natural Resources and JEL/CMB, University of New Hampshire, Durham, NH 03824 (603) 862-2175

EUTROPHICATION OF EELGRASS COMMUNITIES

Eelgrass is one of the first estuarine species to be displaced by eutrophication. Excess nutrient loading in estuaries stimulates all plant growth, but eelgrass is usually outcompeted by other primary producers. Phytoplankton, epiphytes, or macroalgae can become competitively favored, resulting in eelgrass decline. In Waquoit Bay, Massachusetts, eelgrass beds have been eliminated by elevated phytoplankton populations in Jehu Pond, by epiphytes in Eel Pond, and by macroalgal mats in Hamblins Pond. Eelgrass communities established in mesocosms with ambient and elevated (six times ambient) N and P levels were monitored. In one experiment, eelgrass declined in each of the three treatment tanks relative to the three replicate controls, but the dominant competitor was different in each tank owing to differences in the number of grazers and their predators. Thus, top-down control of the primary producer community was evident. In a second mesocosm experiment, amphipod numbers were carefully controlled by the introduction of fish as they were required. The effects of nutrient additions on eelgrass decline were similar to the previous experiment, but a balance among the three algal forms resulted in no clear dominance by any one plant form.

Carlson, Noel C. and Frederick T. Short. Department of Natural Resources and Jackson Estuarine Laboratory, Center for Marine Biology, University of New Hampshire, Durham, NH 03824 (603) 862-2175.

TESTING TRANSPLANTING TECHNIQUES TO OPTIMIZE RESTORATION OF *Zostera Marina L.* Over the last decade, dramatic declines of eelgrass, *Zostera marina L.*, have been documented along the East Coast of the United States. These losses have resulted from eutrophication in some estuaries and the recurrence of the "wasting disease" in other estuaries. As a result of these losses, methods for artificial restoration of eelgrass through transplanting were tested. Three 5 x 100 metre plots were transplanted in June and July of 1990 in Great Bay, New Hampshire: Transplanting techniques included: Method 1) planting both adult plants and individual seedlings with attached root systems directly in the mud, Method 2) anchoring the adult plants to the sediment surface with a metal staple, and Method 3) inserting plugs of adult plants collected as cores from the field, placed into peat pots, and then into holes in the sediment. Except for an initial loss of plants in Method 1, plants in both Method 1 and 2 demonstrated rapid vegetative expansion over the four month study period. In Method 1, the mean expansion area of individual seedlings was 0.36m², while for adult plants with two shoots the mean area was 0.48m². In Method 2, the mean expansion area for the same period of time was 0.33m². The plants in Method 3 never expanded from the initial diameter of the 11 cm peat pot due to the impenetrable wall of the pot.

Banquet: Special Speaker: Wendy Smith. "What Kathy and Ed Rhodes are doing in Chile, and my trip to find out."

Rhodes, E. W. and K. S. Rhodes, Cultivos Marino, Internationales, Castile 30, Caldera (III), CHILE, and W. M. Smith, Massachusetts Water Resources Authority, 100 First Avenue, Charlestown Navy Yard, Boston, MA 02129 USA (617) 242-6000.

A SCALLOP AQUACULTURE PROJECT IN CHILE.

In Chile, aquaculture is used to produce salmon, scallops, and *Gracilaria*, mainly for export. Until now, culturing the Chilean northern bay scallop *Argopecten purpuratus* has consisted of deployment, on longlines, of seed painstakingly and intermittently collected at sea. The scallop mariculture project of Cultivos Marinos Internacionales (CHI) includes a hatchery, capable of producing 2 million 1 mm seed per day, and a nursery to grow the scallops to 5 mm so they can be cultivated to market size in the nutrient-rich, coastal waters of northern Chile. Phytoplankton are cultured in the hatchery to feed the larvae and post-set. In the nursery, the scallops are nourished by 50 million liters/day of seawater. In five years, CHI hopes to be producing 1 million market-size scallops per day and employ 800 people in production and processing.

Saturday, May 4th a.m. Session III

Chair: Peter Larsen. Bigelow Laboratory, Maine.

Cranford, Peter J. and Donald C. Gordon. Habitat Ecology Division, Department of Fisheries and Oceans, Bedford Institute of Oceanography, Dartmouth, NS 82Y 4A2 (902) 426-3277.

INFLUENCE OF SUSPENDED CLAY ON SCALLOP FEEDING EFFICIENCY AND GROWTH.

Sources of suspended solids in the marine environment include; land-based erosion, resuspension, seabed dredging, ocean dumping, oil-well drilling and trawling and dredging for fish and shellfish. Once in suspension, fine particles settle slowly and may be transported considerable distances. While contaminants associated with some particle types may exhibit a degree of toxicity to commercially important scallop stocks, most of the solids discarded to the marine environment are biologically inert. The potential impact of bentonite clay on the growth and physiology of adult sea scallops was examined under ecologically relevant sedimentary and current conditions during gametogenesis. A combination of short (one hour) and long term exposures (two months) of scallops to concentrations of bentonite less than 10 mg l⁻¹ provided information on somatic and reproductive growth and physiological functions. Scallops exhibited a low tolerance to suspended clay and physiological acclimation abilities were limited. When added to unfiltered seawater, bentonite levels as low as 2 mg l⁻¹ reduced food uptake while 10 mg l⁻¹ caused tissue resorption and high mortalities within one month. In contrast, the addition of less than 1 mg l⁻¹ to a diet of cultured algae increased ingestion rate and may be beneficial as a food supplement for scallop brood stock in hatcheries.

Pederson, Judith. Massachusetts Coastal Zone Management, 100 Cambridge St., Boston, MA 02202 (607) 727-9530.

GULF OF MAINE MONITORING PLAN AND PROGRAM.

The Gulf of Maine Council has approved a monitoring plan which provides a framework for research and monitoring activities. The implementation portion of the plan is under review and will include a process for initiating new efforts and integrating ongoing activities.

Based on recommendations from the scientific community, several hypotheses have been proposed for implementation of the monitoring program. In addition, regular hydrographic data is proposed for long term trend analyses. This paper discusses the proposed hypotheses, recommended hydrographic studies and proposes a process for implementation.

A proposed pilot project will be conducted this summer and fall to institute cooperative efforts between New Brunswick, Nova Scotia, Massachusetts, Maine and New Hampshire. The project will determine growth rates and contaminant loadings in mussel tissues and compare caged organisms to indigenous mussels. If possible, clean and dirty sites will be compared.

Sung, Windsor. ENSR Consulting and Engineering, 35 Nagog Park, Acton, MA 01720 (508) 635-9500.

SOME OBSERVATIONS ON DISSOLVED COPPER AND ZINC IN BOSTON HARBOR.

A number of studies conducted from 1972 to 1989 on metals in Boston Harbor were reviewed. Dissolved copper and zinc collected from surface waters during the summer were chosen for further analysis. The harbor was segmented into four different regions and a volume-weighted "average" was calculated for each data point. The "average" concentrations thus calculated showed strong correlations with the mass flux data from the two wastewater treatment plants on Deer Island and Nut Island. Regression analysis indicates an average residence time of about three days for dissolved copper and zinc within the harbor. This compares well with values obtained from more sophisticated tidal exchange models. Dissolved copper and zinc values have been declining within the harbor.

Burn, P. R., R. H. Moore, A. J. Fischman, and H. W. Strauss. Suffolk University and Massachusetts General Hospital, Beacon Hill, Boston, MA 02114. (617) 573-8248.

SALINITY EFFECTS ON ANTENNAL GLAND ACTIVITY IN LOBSTER.

Antennal gland activity was observed in lobster which had been maintained in the laboratory in normal salinity sea water (= 34 ppt), and for different periods under conditions of reduced salinity (= 24 ppt). Control animals, and those exposed to reduced salinity for periods ranging from 15 minutes to three days, were injected into the pericardial sinus with 300 uCi Tl-201 in 0.1 ml saline. Tl distribution was determined by scintigraphy in 28 animals, and by gamma well counting following dissection in 16 animals. Increased antennal gland uptake of Tl was apparent at three hours of exposure to reduced salinity water; however, no increase was apparent in animals tested after 2 or 3 days of exposure. This is consistent with observations that lobster in moderately reduced salinity water undergo an initial period of volume regulation, which subsides as internal and external media become isotonic.

Howell, V. Hunt and W. H. Watson. Zoology Department, University of New Hampshire, Durham, NH 03824 (603) 862-2100.

DIFFERENCES IN THE DISTRIBUTION OF MALE AND FEMALE LOBSTERS IN THE GREAT BAY ESTUARY.

In 1989 and 1990 we trapped and examined more than 7,000 lobsters to determine their spatial and temporal distribution in the Great Bay Estuary. In both years we found that the population in the upper estuary was dominated by males. In 1989, the ratio of males to females at the Nannie Island site, farthest from the coast, was 8.:61 and in 1990 it was 4.5:1. As one moves from this site toward the coast, the sex ratio gradually changes, approaching the more typical 1:1 ratio. The sex ratio also differs between size classes. There are about equal numbers of males and females in the smaller size classes, while in larger animals the ratio of males to females gradually increases from 1.5:1 (70-80 mm CL animals), to 12:1 in animals larger than 90 mm CL. In contrast, all size classes of animals collected in coastal waters had sex ratios approaching 1:1. Currently, our hypothesis is that differences in the migratory behavior of mature male and female lobsters gives rise to the observed sex ratio differences between coastal and estuarine lobster populations. This research was supported in part by a grant from NOAA (Sea Grant).

Watson, Win H. and W. H. Howell. Zoology Department, University of New Hampshire, Durham, NH 03824 (603) 862-2100.

MOVEMENTS OF LOBSTERS IN THE GREAT BAY ESTUARY.

For the past 3 years we have been using both tag/recapture techniques and acoustic telemetry to measure the movements of lobsters within the Great Bay Estuary System. Results reported here are based on more than 10,000 animals we tagged from January 1988 to December 1990, and 20 animals that were equipped with sonar transmitters and tracked for periods ranging from 2 weeks to more than 1 year. In general, animals move into the estuary in the late spring and early summer, remain relatively stationary or move down the estuary during the summer, and then move further down the estuary in the fall to their overwintering sites. While most lobsters moved short distances, some traveled up to 40 miles. There is a year-round population of lobsters in the estuary, and there also appears to be some exchange between estuarine and coastal populations. Our data support the hypothesis that lobsters use behavioral mechanisms, such as seasonal migrations up and down the estuary, to avoid low salinity conditions in the late winter and spring, and to take advantage of warmer waters during the remainder of the year. This research was supported in part by a grant from NOAA (Sea Grant).

Brylinsky, N. The Acadia Centre for Estuarine Research, Acadia University, Wolfville, N. S. BOP 1X0 (902) 542-2201

A SHORT-TERM STUDY TO EVALUATE THE POTENTIAL IMPACT OF FLOUNDER DRAGGERS ON AN INTERTIDAL BENTHIC HABITAT AND COMMUNITY.

As part of a programme to evaluate the potential impact of fishing activities on benthic systems, a short-term field study was conducted to document the changes that occur in benthic habitats and communities resulting from the activities of commercial flounder draggers. The study was carried out within the intertidal zone of the Minas Basin, Bay of Fundy to take advantage of the ability to sample and make observations within the intertidal during the long exposure times that characterize this macrotidal system. The results suggest that the impact, as measured by changes in chlorophyll a and benthic macrofauna biomass, is relatively minor.

Barr, Bradley W. Massachusetts Coastal Zone Management, 100 Cambridge Street, Boston, Massachusetts 02202 (617) 727-9530 X 409, FAX (617) 727-2754.

STELLWAGEN BANK NATIONAL MARINE SANCTUARY: LESSONS LEARNED IN DEVELOPING CROSS-JURISDICTIONAL RESOURCE MANAGEMENT PROGRAMS.

The proposed Stellwagen Bank National Marine Sanctuary, if ultimately designated, will be the first National Marine Sanctuary in the waters of the Gulf of Maine. Stellwagen, located at the entrance to Massachusetts Bay, supports a highly productive biological community, including an important commercial and recreational fishery and whale nursery and feeding area, and is thought to be an important factor in the physical processes at work in the Bay. As the development and implementation of a cross-jurisdictional management program, the process leading to Sanctuary designation has provided some interesting insights and lessons of potential benefit and application to the ongoing Gulf of Maine Initiative. Some thoughts on the role of the scientific community in these efforts, from the perspective of a resource manager involved in program and policy development, will be offered.

Elvin, David W. Vermont Information Systems, Inc. 28 Birch Road, Shelburne, VT 05482.

APPLICATIONS OF A MULTIMEDIA HABITAT AND TAXONOMIC RESOURCE FOR ESTUARINE RESEARCH.

A network of multimedia workstations is planned for those marine research institutions bordering the Gulf of Maine involved in species diversity, biological survey, or environmental assessment programs. The workstation integrates images of organisms and habitats, digital graphics, database output, and a GIS to offer the user access to a variety of taxonomic resources at a single site. The system can be used for interactive tutorials and identification keys, and direct comparison of field or laboratory video data with an image library. Through the GIS, visuals of habitats or species can be related to specific locations or to other databases describing physical and chemical features. An organization is being developed to coordinate the accumulation of visual data and its dissemination among participating members.

Larsen, Peter F., Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, ME 04575

KARE - A NOVEL APPROACH TO FUNDING ESTUARINE RESEARCH

The Kennebec Area Research Endowment (KARE) has been established at the Bigelow Laboratory to address contemporary and future environmental issues related to the Kennebec estuary, its watershed and their considerable influence on the Gulf of Maine. KARE is unique in its unrestricted, proactive nature, its holistic focus on a single, well-defined socio-economic/environmental unit, and, especially, in its support by a coalition of industry, the private sector and the public. KARE is truly a self-sustaining, landmark partnership of business and environmental interests working to provide the understanding needed to support enlightened environmental management now and in the future.