SETAC North Atlantic Chapter
14th ANNUAL MEETING AGENDA 2008
June 4 - 6, 2008
Atlantic Oakes Resort, Bar Harbor, Maine

WEDNESDAY, JUNE 4

All day short course, 8:00AM - 5:00PM

"Customized Population Modeling for Environmental Scientists."
Instructor: Scott Ferson, Applied Biomathematics, RAMAS.

THURSDAY, JUNE 5

7:30 Coffee and light snacks
8:15 Welcome, Mike Thompson, NAC president

SESSION 1
MERCURY IN THE AQUATIC ENVIRONMENT (David Taylor, Session Chair)

8:20 **TEMPORAL CHARACTERISTICS OF FISH TISSUE MERCURY CONCENTRATION RESPONSES TO CHANGING MERCURY INPUTS TO THE ENVIRONMENT.** Michael S. Hutcheson, C.M. Smith, J. Rose, C.R. West, O. Pancorbo, J. Sullivan, & C. Batdorf.

8:40 **(*STUDENT*) BIOACCUMULATION OF MERCURY IN YOUNG-OF-THE-YEAR ESTUARINE FISH.** Joseph T. Szczebak & D. L. Taylor.

9:00 **MERCURY BIOACCUMULATION AND TROPHIC TRANSFER IN RESIDENT ESTUARINE FOOD WEBS.** C. Chen, Jason Williams, B. Mayes; B. Jackson, V. Taylor, & J. Shaw.

9:20 **STABLE ISOTOPE ANALYSIS REVEALS DIFFERENCES IN MERCURY BIOACCUMULATION RATES IN BENTHIC VERSUS PELAGIC ESTUARINE FOOD WEBS.** David L. Taylor, J. T. Szczebak, E. J. Payne, S. A. Helming, L. Fat Ho, M. N. Piraino, and J. Linehan.

9:40 **BREAK**

SESSION 2
REGIONAL ENDANGERED SPECIES ISSUES (Alan Parsons & Patti Reilly, Session Co-Chairs)

10:00 **PESTICIDES, ENVIRONMENTAL RISKS, INCLUDING ENDANGERED SPECIES IN MAINE.** Lebelle Hicks.

10:20 **AMPHIBIAN PRESENCE AND BREEDING SUCCESS IN FRESHWATER WETLANDS AFFECTED BY COAL COMBUSTION BYPRODUCTS.** Allison Nightingale & J. Robb.

10:40 **MULTIPLE STRESSOR EFFECTS IN EARLY LIFE STAGE ATLANTIC SALMON *(SALMO SALAR)*: INITIAL FINDINGS**. Adria A. Elskus & C. Straub.

11:00 **(*STUDENT*) HEXAVALENT CHROMIUM MAY BE A RISK FACTOR FOR THE NORTH ATLANTIC RIGHT WHALE (*EUBALAENA GLACIALIS*).** Tânia Li Chen, S. S. Wise, S. Kraus, F. Shaffiey, M. Grau, C. Perkins, W. D. Thompson, T. Zheng, Y. Zhang, T. Romano, T.O'Hara, and J. P. Wise, Sr.

11:20 **(*STUDENT*) CYTOTOXIC AND GENOTOXIC EFFECTS OF CHROMIUM ON MARINE MAMMAL LUNG CELLS.** Julieta Martino, T. Li Chen, S. Wise, F. Shaffiey, O. Popa, C. E. C. Goertz, S. Krauss, J. L. Dunn, F. M. D. Gulland, W. D. Thompson, T. Zheng, and J. P. Wise, Sr.

11:40 **AFTER THE FACT.** Brian Reilly.

12:00 – 1:30 **LUNCH (Included)** NAC SETAC Business Meeting.

SESSION 3

EMERGING CONTAMINANTS (Diane Nacci, Session Chair)

1:30 **ENVIRONMENTAL FATE AND TOXICITY OF THE PBDE FLAME RETARDANTS**. Deborah Rice.

2:10 **TEMPORAL TRENDS OF TRICLOSAN IN SEDIMENT CORES COLLECTED FROM TWO URBANIZED ESTUARIES.** Mark Cantwell, B. Wilson, J. Zhu, & J. King.

2:30 **MASSDEP'S EMERGING CONTAMINANTS PROJECT: FUTURE IMPLICATIONS FOR ECOLOGICAL RISK ASSESSMENT.** Nancy Bettinger.

2:50 **STAGE-SPECIFIC EFFECTS OF ACUTE EXPOSURE TO PESTICIDES ON THE SOFT-SHELL CLAM, *MYA ARENARIA*.** Sara Lindsay, J. Chasse, R. A. Butler, W. Morrill & R. J. Van Beneden.

3:10 **BREAK**

3:30 **STAGE-SPECIFIC EFFECTS OF ACUTE EXPOSURE TO PESTICIDES ON THE SOFT-SHELL CLAM, *MYA ARENARIA*.** Sara Lindsay, J. Chasse, R. A. Butler, W. Morrill & R. J. Van Beneden.

3:30 **EVALUATION OF BEST MANAGEMENT PRACTICE FOR REDUCING RISK FROM SPRAYER TRACK ROWS IN POTATO PRODUCTION.** Allison Dunn.

350 **MECHANISTIC BASIS OF RESISTANCE TO PCBS IN ATLANTIC TOMCOD FROM THE HUDSON RIVER, NEW YORK.** Isaac Wirgin, N. Roy, M. Loftus, R. C. Chamber, & M. Hahn.

4:10 **ADJOURN**

5:00 – 7:30 ***POSTER SESSION AND RECEPTION***

(*STUDENT*) BIOACCUMULATION AND TROPHIC TRANSFER OF MERCURY IN STRIPED BASS (Morone saxatilis) AND TAUTOG (*Tautoga onitis*) IN NARRAGANSETT BAY, RI. Maria Piraino & D. L. Taylor.

(*STUDENT*) EFFECTS OF FEEDING ECOLOGY AND DIET HISTORY ON MERCURY BIOACCUMULATION IN TEMPERATE FLATFISHES. Jennifer L. Linehan, E. J. Payne and D. L. Taylor.

(STUDENT) **COMPARING SPATIAL AND TEMPORAL TRACE METAL GEOCHEMICAL SIGNATURES IN TWO BRANCHES OF THE NEPONSET RIVER WATERSHED.** Emily. R. Estes, Theodora D. Shafer, & D. J. Brabander.

(*STUDENT*) DEVELOPING A NON-LETHAL BIOMARKER FOR WATERBORNE ORGANIC CONTAMINANTS. Jennifer C. Meyers & A.A. Elskus.

(STUDENT) **MERCURY IN ALASKAN HARBOR SEALS.** Kady Marino.

(STUDENT) **FAT CELL DEVELOPMENT IN THE PRESENCE OF CHEMICAL FIRE RETARDANTS (PBDES).** Christopher Filler, Bridget Huysman, and Deena Small, Department of Biochemistry & Molecular Biology, University of New Hampshire.

POLYCHLORINATED BIPHENYLS (PCBS) AND POLYBROMINATED DIPHENYL ETHERS (PBDES) IN CURRENT AND HISTORICAL SAMPLES OF AVIAN EGGS FROM NESTING SITES IN BUZZARDS BAY, MA, USA. Saro Jayaraman, M. Cantwell, C. S. Mostello, I.C.T. Nisbet, and D.E.Nacci.

BIASES ASSOCIATED WITH BIOPSY PLUGS FOR MERCURY CONCENTRATIONS DETERMINATIONS IN FRESHWATER FISH. Michael S. Hutcheson, J. Rose, C.M. Smith, O. Pancorbo, J. Sullivan, C Batdorf, & C. J. Strube.

MERCURY IN BALD EAGLE EGGS FROM MAINE, 2000-2005. Steven E. Mierzykowski, Charles S. Todd, Christopher DeSorbo, & William Hanson.

EVALUATING EXPOSURE PATTERNS AND IMPACTS OF METHYLMERCURY ON FRESHWATER-FEEDING BALD EAGLES IN MAINE. Christopher R. DeSorbo, C. S. Todd, D. C. Evers, S. E. Mierzykowski, W. Hanson, W. W. Bowerman , C. Romanek, & R. Taylor.

A COMPARISON OF MERCURY IN MINK AND FISHER IN RHODE ISLAND. J. L. Lake, S. A. Ryba, Jonathan R. Serbst, and C. F. Brown & L. Gibson.

ASSESSMENT OF METHYLMERCURY AVAILABILITY TO BATS IN NEW YORK – 2006. Dave Yates, D. Evers, D. Braun, M. Brown, T. Divoll, J. Loukmas, A. Sauer, N. Schoch, & R. Taylor.

MAINE COMPACT FLUORESCENT LAMP STUDY. H. Jackson, S. Ladner, & Deborah Stahler.

TREASURES IN ARCHIVED HISTOPATHOLOGY COLLECTIONS: PRESERVING THE PAST FOR FUTURE UNDERSTANDING. Doranne Borsay Horowitz, E. Peters, I. Sunila, & J. C. Wolf.

MODELING RISKS OF POINT SOURCE AIR POLLUTANTS TO HUMANS AND WILDLIFE VIA FISH INGESTION: SIMPLE TO COMPLEX MODELS. Margaret .E. McVey, D. Burch, & M. Dymond.

CONTAMINANT ASSESSMENT OF WHITE SUCKERS FROM EIGHT RIVERS IN THE GULF OF MAINE DISTINCT POPULATION SEGMENT FOR ATLANTIC SALMON. Steven E. Mierzykowski.

SITE-SPECIFIC SEDIMENT BENCHMARKS ACCOUNT FOR LOW BIOAVAILABILITY OF PAH AT A FORMER MGP SITE IN MASSACHUSETTS. Allison Nightingale, P. Anderson, K. Haines, R. Cleary, P. LaGoy, & N. Azzolina.

APPLICATION OF A PROBABILISTIC, FUGACITY-BASED MODEL TO PREDICT THE FATE OF CONSUMER PRODUCTS IN WASTEWATER TREATMENT PLANTS (WWTP) AND IN LAND APPLIED BIOSOLIDS. Michael .J Bock, J. Lyndall, & T.R Barber.

7:30 – 9:30 **Maine Shore Dinner**, followed by KEYNOTE SPEAKER, **DR. WAYNE MUNNS,** USEPA, AED, NHEERL

KEYNOTE ADDRESS

FROM PICKLE JARS TO ECOSYSTEM SERVICES: WHO CARES ABOUT WATER FLEAS ANYWAY? Dr. Wayne R. Munns, Jr. (munns.wayne@epa.gov), U.S. EPA Office of Research and Development, Narragansett, RI.

We've made tremendous progress in protecting the environment since Ohio's Cuyahoga River burned in 1969 – the air, water and land of this country are cleaner due in major part to the kinds of science represented by SETAC. And yet, the environment continues to take a back seat to human health issues in many important decisions. Because humans are the deciders when it comes to environmental protection, our science can be made more influential by casting environmental effects in terms that people care most about: valued ecological properties and human well being. Two developments – one recent and one not so much – are helping to shape the future research agenda for environmental protection. The first is an expansion of consideration beyond death and reproduction of easily tested lab organisms to the risks that stressors present to real populations, communities and ecosystems. By sliding attention further along the scale of biological hierarchy, population-level ecological risk assessment provides evidence that can be linked more directly to the things we value: the vitality of ecosystems around us. Who cares if 50% of the *Daphnia* die in a pickle jar, when the real goal is a healthy lake community with frogs for catching and fish for eating? We can better inform the decisions to meet such goals by furthering the progress of the science and knowledge needed to assess risks to populations. The second development takes this decidedly anthropocentric perspective further still by concentrating on ecosystem goods and services – the outputs of ecological functions and processes that directly or indirectly contribute to social welfare (or have the potential to do so in the future). New concepts, approaches and tools are needed to evaluate the outcomes of various environmental management options in terms of their influence on the delivery of ecosystem services. We'll want to become more interdisciplinary as a Society to include the ecological, social, economic, and decision science perspectives required to support environmental decisions effectively. The game no longer is an insolated one of protecting the environment for the environment's sake, but rather is one played on an expanded field of the entire social-environmental system. By shifting our attention from classical toxicological endpoints to those reflecting societal values and human well being more directly, SETAC science will continue to play a primary role in environmental protection.

KEYNOTE BIOSKETCH

Dr. Wayne R. Munns, Jr. is the Associate Director for Science for the U.S. EPA's Atlantic Ecology Division (Office of Research and Development) in Narragansett, Rhode Island. A marine ecologist by training (University of Rhode Island, 1984), Wayne has expertise in developing and applying quantitative methods for ecological risk assessment, ecological modeling with particular emphasis on population dynamics, and large spatial scale environmental assessments. He has conducted research and managed programs addressing ocean disposal, hazardous waste sites, contaminated sediments, wildlife risk assessment and environmental criteria development. His current interests include population-level ecological risk assessment, ecosystem services and their valuation, bird watching, and integration of assessment approaches to enhance the value of information supporting environmental protection decisions (not necessarily in that order). Prior to joining EPA, Wayne was a Senior Scientist, Division Manager and Assistant Vice President for Science Applications International Corporation. He has been a member of EPA's Risk Assessment Forum, has advised the World Health Organization on the integration of human health and ecological risk assessment, and holds an adjunct faculty position at the University of Rhode Island. Wayne is an editor of recent books on population-level ecological risk assessment and valuation of ecological resources, and is Chair of SETAC's Ecological Risk Assessment Advisory Group.

FRIDAY, JUNE 6

7:30 Coffee and light snacks

SESSION 4

INVERTEBRATES AND POLLUTION. (Peg Pelletier, Session Chair)

8:00 **APPLICATION OF EQUILIBRIUM PARTITIONING SEDIMENT BENCHMARKS FOR PAH CONTAMINATED SEDIMENTS.** Susan Kane Driscoll, B. Amos, M. McArdle and C. Menzie.

8:20 **EFFECTS OF HYPOXIA ON ANIMAL BURROW CONSTRUCTION AND SUBSEQUENT EFFECTS ON SEDIMENT REDOX PROFILES.** Eric Weissberger, L. Coiro, & E. Davey.

8:40 **TESTING FOR DISCHARGE-RELATED CHANGE IN MASSACHUSETTS BAY BENTHIC COMMUNITIES.** Kenneth Keay, J. Blake, N. Maciolek, W. Smith, D. Dahlen & C. Hunt.

9:00 **MAINE'S BIOLOGICAL MANAGEMENT OF WATER QUALITY THROUGH APPLICATION OF THE BIOLOGICAL CONDITION GRADIENT.** Susan P. Davies.

SESSION 5

TOPICS IN ENVIRONMENTAL TOXICOLOGY & CHEMISTRY. (John Williams, Session Chair)

09:20 **ROLE OF APATITE IN REMEDIATION OF METAL CONTAMINATED SEDIMENTS.** Anna S. Knox & M. H. Paller.

09:40 **POTENTIAL SIDE-EFFECTS OF SEQUESTERING AGENTS USED IN ACTIVE CAPS FOR REMEDIATING CONTAMINATED SEDIMENTS.** Michael H. Paller & A. S. Knox.

10:00 **MOLYBDENUM ACCUMULATION IN MARINE SEDIMENTS AS AN INDICATOR OF HYPOXIC WATER CONDITIONS.** Warren Boothman & L. Coiro.

10:20 **BREAK**

SESSION 6
MAINE LOCAL AND REGIONAL ISSUES. (Janet Robinson, Session Chair)

10:40 **ANALYSIS OF ENVIRONMENTAL CONTAMINANTS IN SHELL-DISEASED AND NON-DISEASED AMERICAN LOBSTERS (*HOMARUS AMERICANUS*)**. Deanna Prince & L. A. LeBlanc.

11:00 **POLYBROMINATED DIPHENYL ETHERS (PBDES) IN NORTHWESTERN ATLANTIC HARBOR SEALS AND THEIR FISH PREY.** S. D. Shaw, Michelle L. Berger, D. Brenner, N. Lohmann, & O. Paepke.

11:20 ***(STUDENT)*** **EFFECTS OF DE-ICING SALT (NACL) ON AMPHIBIAN COMMUNITY STRUCTURE IN NOVA SCOTIA.** R. W. Russell & Sara E. J. Collins.

11:40 ***(STUDENT)*** **THE USE OF GREEN CRAB, AMERICAN EEL, MUMMICHOG, AND FISH PARASITES AS BIOMONITORS OF THE SYDNEY TAR PONDS.** Lydia S. Rockwell, K.M.M. Jones, & R.W. Russell.

12:00 **PRELIMINARY FINDINGS OF CONTAMINANT SCREENING OF MAINE BIRD EGGS: 2007 FIELD SEASON.** Wing Goodale, D. Evers, & S. Mierzykowski.

12:20 **NAC SETAC Student Awards**

12:45 **ADJOURN MEETING**

1:00 **NAC SETAC Board Luncheon Meeting**

PLATFORM SESSION ABSTRACTS

SESSION I: MERCURY IN THE AQUATIC ENVIRONMENT

TEMPORAL CHARACTERISTICS OF FISH TISSUE MERCURY CONCENTRATION RESPONSES TO CHANGING MERCURY INPUTS TO THE ENVIRONMENT. Michael S. Hutcheson (michael.hutcheson@state.ma.us), C.M. Smith, J. Rose, C.R. West, MassDEP, Office of Research and Standards, Boston, MA 02108; and O. Pancorbo, J. Sullivan and C Batdorf, Wall Expt. Stn, MassDEP, Lawrence, MA 01843.

Edible tissue mercury concentrations in largemouth bass (LMB; *Micropterus salmoides*) and yellow perch (YP; *Perca flavescens*) from 18 Massachusetts lakes were monitored annually during a period encompassing major changes in atmospheric mercury loading to lakes from 1999-2006. Eleven of the lakes were located in the northeastern Massachusetts: a mercury "hotspot". During this period, total mercury emissions to the hotspot area decreased by 87%, due primarily to new stringent mercury emissions controls required for municipal waste incinerators and the closure of several medical waste incinerators. Throughout the remainder of the state, total mercury emissions decreased by 70% over the same time period. In 8 of the 9 lakes in the northeast, mean YP mercury concentrations decreased significantly from one year prior to the imposition of stringent mercury emissions controls through 6 years thereafter. Two of the remaining 7 lakes around the rest of the state also had significant decreases. Decreases also occurred in LMB: 11 of the 18 lakes were in the hotspot and 6 of those had significant fish Hg decreases. Four of the remaining 6 statewide lakes had non-significant decreases. The time scales over which changes occurred will be discussed and projections of times for mercury concentrations to fall below fish consumption advisory levels will also be presented.

(*STUDENT*) BIOACCUMULATION OF MERCURY IN YOUNG-OF-THE-YEAR ESTUARINE FISH. Joseph T. Szczebak (jszczebak@gmail.com) & David L. Taylor, Roger Williams University, Department of Biology & Marine Biology, Bristol RI 02809

Estuaries harbor high concentrations of heavy metals and toxins resulting from anthropogenic industrialization. In addition, estuaries are utilized by many juvenile fish as nursery grounds that provide refuge from predators and access to food sources. Consequently, juvenile fish are potentially exposed to high levels of mercury (Hg) that accumulates in their tissues. Tautog (*Tautoga onitis*), winter flounder (*Pseudopleuronectes americanus*), summer flounder (*Paralichthys dentatus*), and bluefish (*Pomatomus saltatrix*) are commercially and recreationally valuable fish common in the Narragansett Bay Estuary (NBE), Rhode Island. Therefore, understanding lifelong mercury accumulation patterns in these species is important for minimizing human exposure to Hg through dietary consumption. This study focused on the initial Hg accumulation in young-of-the-year (YOY) fish occurring during NBE residence. Particularly, total Hg concentrations ([Hg]) of YOY fish were analyzed relative to fish size, age, feeding ecology, and local sediment contamination. Sediment cores (0-2 cm) were collected throughout NBE (n=53) and measured for [Hg], grain size, and total organic carbon content. Moreover, YOY tautog, winter flounder, summer flounder, and bluefish were collected (summer 2006 and 2007) using beach seines, fish traps, and hook & line. Sediment and YOY fish (whole bodies) were analyzed for [Hg] using combustion atomic-absorption spectrometry, while trophic level status of fish was determined by nitrogen stable isotope ($^{15}N/^{14}N$) analysis. The [Hg] of summer flounder and bluefish were significantly correlated with fish size and age. Similarly, the [Hg] of winter flounder and tautog increased with size and age, but this correlation was not significant within the first year of life. Furthermore, [Hg] was positively correlated with $^{15}N/^{14}N$, which suggests amplification of [Hg] with trophic level status. Finally, sediment [Hg] had no effect on fish [Hg].

MERCURY BIOACCUMULATION AND TROPHIC TRANSFER IN RESIDENT ESTUARINE FOOD WEBS. C. Chen, Jason Williams (jason.j.williams@dartmouth.edu), B. Mayes Department of Biological Sciences, Dartmouth College, 03755; B. Jackson, V. Taylor, Dartmouth College Earth Sciences Department and Trace Element Analysis Core, 03755; and J. Shaw, School of Public and Environmental Affairs, Indiana University, 47405.

Mercury concentrations in estuarine biota depend in part on bioaccumulation and trophic transfer patterns within estuarine food webs. We analyzed food web structure and organism total Hg and MeHg burden in six resident estuarine food webs (4 in the Gulf of Maine, 2 in Narragansett Bay) comprising a gradient of sediment Hg contamination. Our goal was to identify sediment and food web characteristics which predict metal concentrations in biota. Across sites, sediment % TOC showed a negative relationship with taxa sediment bioaccumulation factors, suggesting organic carbon regulates the bioavailability of total Hg. Although food web structures differed between sites, ^{15}N signatures were related to Hg in biota across sites. Mean taxa %MeHg had a significant positive relationship with mean taxa ^{15}N signature, indicating %MeHg increases with trophic level across sites. Mean taxa ^{13}C values showed a negative relationship with mean taxa MeHg and Hg burdens across sites, but the relationship was not significant. Potential reasons for differences in bioaccumulation and trophic transfer between site food webs will be discussed.

STABLE ISOTOPE ANALYSIS REVEALS DIFFERENCES IN MERCURY BIOACCUMULATION RATES IN BENTHIC VERSUS PELAGIC ESTUARINE FOOD WEBS. David L. Taylor (dtaylor@rwu.edu), Joseph T. Szczebak, Eric J. Payne, Stacey A. Helming, Loong Fat Ho, Maria N. Piraino, & Jennifer Linehan, Department of Marine Biology, Roger Williams University, Bristol, RI 02809

Mercury (Hg) is a toxic environmental contaminant that adversely affects human health, and exposure occurs primarily through the consumption of contaminated fish. Coastal marine ecosystems support substantial fisheries, and thus, are the dominant source of Hg to fish-consuming humans. Nevertheless, relative to freshwater environments, very little is known about the fate of Hg in near-shore marine food webs. In this study, we analyzed total Hg concentration in the muscle tissue of five commercial/recreational fish collected from the Narragansett Bay Estuary (Rhode Island, USA): striped bass *Morone saxatilis*, bluefish *Pomatomus saltatrix*, tautog *Tautoga onitis*, summer flounder *Paralichthys dentatus*, and winter flounder *Pseudopleuronectes americanus*. Stable nitrogen ($^{15}N/^{14}N$) and carbon ($^{13}C/^{12}C$) isotope signatures of targeted fish and their prey (forage fish, squid, decapods, and bivalves) were used to elucidate the effect of feeding history, trophic position, and carbon sources (benthic versus pelagic pathways) on patterns of Hg burden in fish tissue. The total Hg concentration of all targeted species was positively correlated with fish size and age. Moreover, total Hg concentration increased as a function of nitrogen isotopic signatures, indicating the trophic transfer of Hg through the estuarine food web. Total Hg concentration in target fish also decreased as function of carbon isotopic signatures, suggesting that Hg contamination is more prevalent in pelagic food chains. This may be attributed to the greater complexity (i.e., more trophic levels) of pelagic food chains, and thus, opportunity for Hg bioaccumulation.

SESSION II: REGIONAL ENDANGERED SPECIES ISSUES

PESTICIDES, ENVIRONMENTAL RISKS, INCLUDING ENDANGERED SPECIES IN MAINE. Lebelle Hicks (Lebelle.Hicks@maine.gov), Maine Board of Pesticides Control, 28 Statehouse Station, Augusta, ME.

The Maine Board of Pesticides Control is the State Lead Agency for regulating pesticide it is a seven member public Board, appointed by the governor and confirmed by the senate. The seven members include, medical expertise (physician), a commercial applicator (structural pesticide applicator), an individual with forestry expertise, an agronomist/ entomologist from University of

Maine, a grower agricultural expertise and 2 public members environmental expertise. One of the two members chairs the Environmental Risk Advisory Committee (ERAC). This committee reviews environmental risks from specific pesticide issues. The ERAC will be composed of four standing members and two ad hoc members. The other three standing members will be qualified professionals in related environmental or ecological research disciplines such as an aquatic or terrestrial biologist, aquatic or terrestrial entomologist and environmental toxicologist. In addition, up to six members will be chosen *ad hoc* with expertise specific to the potential environmental impact in question.

The two major issues the ERAC have dealt with include mosquito control chemicals likely to be used by municipalities in the event of West Nile Virus (WNV) or Eastern Equine Encephalitis (EEE) outbreaks (2001) and potential marine invertebrate exposure to Browntail moth insecticides (2005). When the ERAC is convened, the endangered species group at Inland Fisheries and Wildlife are contacted and they have either participated as members of the ERAC or as a resource for the committee.

AMPHIBIAN PRESENCE AND BREEDING SUCCESS IN FRESHWATER WETLANDS AFFECTED BY COAL COMBUSTION BYPRODUCTS. Allison Nightingale (Allison.Nightingale@Amec.Com), Joseph Robb. Amec Earth & Environmental, Inc., Westford, MA 01886.

Historic and current operations of a northwest Indiana coal burning electrical generating station have resulted in the release of coal combustion byproducts to on-site soil and groundwater. Groundwater from the facility migrates off-site and seasonally discharges to freshwater wetlands in a national park. A springtime field reconnaissance was undertaken to determine if amphibian habitat is present in the national park wetland, and if so, to document whether amphibian populations were successfully breeding. The amphibian survey utilized a daytime visual encounter methodology to count auditory observations of calling and visual observations of adults, juveniles, larvae, and egg masses during nine consecutive weeks in 2007 at 14 downgradient and three background seasonal pools. Metals and other surface water quality parameters were measured at each location. Overall, survey results indicate that amphibians are present in and successfully utilize the national park wetland areas as breeding grounds. Analytical results and field observations indicate there may not be a relationship between exceedances of ecological risk-based surface water screening concentrations and the frequency of amphibian observations. No relationship appears to exist between observation frequency and water temperature, ph or dissolved oxygen levels in surface water. However, the size of the pool appears related to the frequency of amphibian observations, as small pools more frequently showed many amphibian observations, and large pools more frequently showed few amphibian observations.

MULTIPLE STRESSOR EFFECTS IN EARLY LIFE STAGE ATLANTIC SALMON *(SALMO SALAR*): INITIAL FINDINGS. Adria A. Elskus (aelskus@usgs.gov), U.S. Geological Survey, University of Maine, Orono, ME 04469; and C. Straub, University of Maine, Orono, ME 04469.

Maine rivers experience a broad range of stressors, including high acidity, elevated aluminum (Al) and blueberry pesticides, but the effects of these combined stressors on resident fish are unknown. We hypothesized that combinations of acid/Al (AA) + pesticides would have stronger sub-lethal effects than either stressor alone. We exposed Atlantic salmon fry for 5 days to river water alone or to the current use herbicide, Velpar^{TM} (active ingredient hexazinone) or the proposed supplement Callisto^{TM} (a.i. mesotrione), at two concentrations (0.75 & 7. 5 ppb a.i.), in the presence and absence of high acidity (pH = 3.9 - 5.2) and inorganic (toxic) aluminum (254-573 ppb) in Machias River water (DOC = 7.2 mg/L). Pesticide treatment alone had no effect on survival, but AA treatments significantly reduced survival. Of the four multiple-stressor (pesticide +AA) groups, three sustained mortalities significantly higher than those of the AA control, although a dramatic drop in pH on day 2, rather than a multiple-stressor effect, may underlie this difference in mortality. High variability masked potential treatment effects on prey-capture;

immune function assays were inconclusive. We conclude that blueberry pesticide effects on prey capture and survival may increase in the presence of acid/Al, but high variability and the dramatic drop in pH on day 2 confound interpretation of the data. Additional studies are underway.

(*STUDENT*) HEXAVALENT CHROMIUM MAY BE A RISK FACTOR FOR THE NORTH ATLANTIC RIGHT WHALE (*EUBALAENA GLACIALIS*). Tânia Li Chen[1,2,3] (tania.chen@maine.edu), Sandra S. Wise[1,2,3], Scott Kraus[4], Fariba Shaffiey[1,2], Marijke Grau[1], Christopher Perkins[7], W. Douglas Thompson[2,3], Tongzhang Zheng[8], Yawei Zhang[8], Tracy Romano[6], Todd O'Hara[9], and John Pierce Wise. Sr. [1,2,3,4,5,6] [1]Wise Laboratory of Environmental and Genetic Toxicology, [2]Maine Center for Toxicology and Environmental Health, University of Southern Maine[3] Department of Applied Medical Sciences, University of Southern Maine, Portland ME [4]New England Aquarium, Edgerton Research Laboratory, Central Wharf, Boston, MA [5]Ocean Alliance, Lincoln, MA [6]Mystic Aquarium, Mystic CT [7]Center for Environmental Sciences and Engineering, University of Connecticut, Storrs, CT [8]Division of Environmental Health Sciences, Department of Epidemiology and Public Health, Yale University School of Medicine, New Haven, CT, [9]Institute of Arctic Biology, University of Alaska, Fairbanks, AK

The North Atlantic Right Whale is one of the most endangered whale species that swims closely to the coast, being continuously exposed to a wide range of pollutants. Hexavalent chromium [Cr(VI)] is a well known toxicant and carcinogen. We tested the cytotoxic and genotoxic effects of soluble and particulate Cr(VI) in primary cultured right whale fibroblasts; and levels of total Cr were measured in right whale skin biopsies. We show that Cr is indeed cytotoxic and genotoxic to the right whale cells; and that it reaches levels of concern for the whales' health. This work was supported by Grant number NA03NMF4720478 from the United States Department of Commerce, NOAA (J.P.W.) and the Maine Center for Toxicology and Environmental Health.

(*STUDENT*) CYTOTOXIC AND GENOTOXIC EFFECTS OF CHROMIUM ON MARINE MAMMAL LUNG CELLS. Julieta Martino[1,2] (julieta.martino@maine.edu), Tânia Li Chen[1,2], Sandra Wise[1,2], Fariba Shaffiey[1,2], Oana Popa[1,2], Caroline E. C. Goertz[1,3], Scott Krauss[4], J. Lawrence Dunn[5], Frances M. D. Gulland[6], W. Douglas Thompson[1,2,7], Tongzhang Zheng[8], and John Pierce Wise, Sr.[1,2,4,7] [1]Wise Laboratory of Environmental and Genetic Toxicology; [2]Maine Center for Toxicology and Environmental Health, University of Southern Maine, Portland, Maine; [3]Alaska SeaLife Center, Seward, AK; [4]New England Aquarium, Boston, MA; [5]Department of Research and Veterinary Services, Mystic Aquarium, CT; [6]The Marine Mammal Center, Sausalito, CA; [7]Department of Applied Medical Sciences, University of Southern Maine, Portland, ME; [8]School of Epidemiology and Public Health, Yale University, New Haven, CT

According to the EPA, 90 million lbs of chromium potentially reaches the marine environment each year. Because of this marine mammals are potentially exposed to chromium. The purpose of our work was to study the cytotoxicity and genotoxicity of chromium in lung cells from steller sea lion, bottlenose dolphin and the North Atlantic (NA) right whale. Chromium induced a dose-dependent cytotoxicity and genotoxicity in all species. Steller sea lion lung cells were the most sensitive to chromium but NA right whales showed more chromosome damage than the other species. This work was supported by the Maine Center for Toxicology and Environmental Health, ESO10838 (JPW), NA03NMF4390398 (JPW), NA03NMF 4390041 (JPW), and a Fulbright Grant (JM).

AFTER THE FACT. Brian Reilly and Patti Reilly, Entrix, Inc., Seal Harbor, ME.

Organisms are exposed to contaminants in a variety of ways, but after species incur injury because of exposure to toxins, there are liability requirements set forth in federal and state statutes that call for the responsible party to compensate for loss of these Trust resources. This talk will discuss options for compensating endangered and threatened species loss through creative program development and land conservation options illustrated by several case studies.

SESSION III: EMERGING CONTAMINANTS

ENVIRONMENTAL FATE AND TOXICITY OF THE PBDE FLAME RETARDANTS. Deborah C. Rice (Deborah.Rice@maine.gov), Maine Center for Disease Control and Prevention, Augusta, ME 04333.

It is well established that levels of total PBDEs are increasing exponentially around the world: in environmental media, wildlife, and human tissue. PBDEs are transported globally, appearing in Arctic environmental media, fish, birds, and mammals. Concentrations of PBDEs in human tissues in the U.S. are much higher than in countries with more limited use of PBDEs. PBDEs readily cross the placenta, are found in the fetus, and are excreted into breast milk. The octa and penta commercial mixtures were withdrawn from the market in the U.S., but decaPDE is still manufactured and sold in the U.S. DecaBDE is present in the environment, in wildlife, in human food, and in human tissues. DecaBDE is found in sewage sludge in very high proportions, often over 90% of the total PBDEs. DecaBDE is degraded by sunlight and metabolized by mammals and fish to congeners known to be toxic. DecaBDE is bioaccumulated and concentrates up the food chain. A significant proportion of PBDEs in some wildlife is decaBDE. In Addition, human food can also contain a high proportion of decaBDE. . DecaBDE may be found in high concentrations in indoor air and dust. PBDEs produce adverse effects on behavior, immune function, and thyroid status. DecaBDE has been demonstrated to be a developmental neurotoxicant in multiple studies. There are some human data documenting adverse effects as a result of environmental exposure.

TEMPORAL TRENDS OF TRICLOSAN IN SEDIMENT CORES COLLECTED FROM TWO URBANIZED ESTUARIES. Mark Cantwell (cantwell.mark@epa.gov), USEPA Atlantic Ecology Division, Narragansett, RI; B. Wilson, J. Zhu, University of Massachusetts, Boston; and J. King, Graduate School of Oceanography, University of Rhode Island.

Triclosan (5-chloro-2-(2,4-dichlorophenoxy)-phenol) is a antimicrobial agent present in a wide array of consumer based goods such as soaps, skin creams and dental care products. It has also been incorporated into consumer textiles and plastics due to its effectiveness as a biocide in solid materials. Triclosan is only partially removed by most wastewater treatment processes, with the remainder being released to receiving waters via effluent discharge. With a Log *Kow* of 5.4, there is potential for Triclosan to sorb to particles and accumulate in sediments. Current research indicates that Triclosan may pose significant risk to a wide range of aquatic organisms. In this study triclosan was measured in dated sediment cores collected from several urbanized estuaries in order to reconstruct temporal trends of accumulation. Measurable concentrations of Triclosan first appeared in dated sediments from the mid 1960s, the start of commercial production in the US. At one coring location, concentrations increased from 6 to 86 ng/g over the length of the core, demonstrating increased sediment accumulation rates from the 1960s to the present. At another site, concentrations climbed to as high as 400 ug/kg at depths corresponding to the 1980s before dropping to approximately 60 ng/g. Work is continuing to better understand the long-term behavior and fate of Triclosan in estuaries.

MASSDEP'S EMERGING CONTAMINANTS PROJECT: FUTURE IMPLICATIONS FOR ECOLOGICAL RISK ASSESSMENT. Nancy Bettinger (Nancy.Bettinger@state.ma.us), MassDEP, Office of Research and Standards, One Winter Street, Boston, MA 02108.

The Massachusetts Department of Environmental Protection has initiated the Emerging Contaminants Project in an effort to identify and assess environmental problems associated with contaminants that are unregulated or inadequately regulated at present. The project involves identifying contaminants to be considered emerging contaminants (ECs), screening the list to prioritize chemicals or groups of chemicals for assessment, and providing technical support for EC management approaches. This presentation focuses on the ecological risk assessment implications of two high-priority groups: endocrine disrupting chemicals and nanoparticles.

Contaminants from both groups are likely to be encountered in the future by ecological risk assessors in two ways: (1) as targets of risk assessments conducted in the vicinity of industrial facilities using or producing them, and (2) as "background" contamination present in water ways resulting from various sources, including septic system drainage and treated waste discharges . In either case, current risk assessment guidance and practice may be inadequate to assess or account for environmental exposures and effects due to these contaminant groups. Analytical techniques typically employed to characterize environmental contamination are not applicable to nanoparticles and may not be adequate for some endocrine disruptors. Further, many of these substances have modes of action and biological effects that differ from those of more common contaminants of concern and are not necessarily amenable to the measures of effects conventionally employed in ecological risk assessments. While there are significant gaps in our knowledge, ongoing research efforts continue to provide important insights into the nature and effects of nanoparticles and endocrine disruptors. To ensure that emerging contaminants are adequately controlled, regulatory agencies will have to re-evaluate and adjust policies and guidelines within existing programs. The considerable technical challenges presented to investigators by these contaminants call for continual adaptation of risk assessment practices and creative problem solving by the risk assessment community.

STAGE-SPECIFIC EFFECTS OF ACUTE EXPOSURE TO PESTICIDES ON THE SOFT-SHELL CLAM, *MYA ARENARIA.* Sara Lindsay[1](slindsay@maine.edu), J. Chasse[2], R.A. Butler[1,3], W. Morrill[1], and R.J. Van Beneden[1,2]; [1]School of Marine Sciences and [2]Dept. of Biochemistry, Microbiology and Molecular Biology, University of Maine, Orono, ME, 04469.

A combined laboratory and modeling approach was used to assess the impact of selected pesticides on different life stages of the soft-shell clam, *Mya arenaria*. Clams were exposed as veligers, pediveligers, or 2 mm juveniles to hexazinone (Velpar®), 2,4-D (2,4-dichlorophenoxyacetic acid) or phosmet (Imidan®). Exposure to 2,4-D significantly impacted larval survival and development time. Pediveliger exposures resulted in significantly lower predicted survival to spat than did veliger exposures. Correspondingly, modeled population size after 20 years was ~ one order of magnitude lower. Juvenile clams exposed to 2,4-D showed an initial growth delay; however, they were significantly larger than controls at two years post-exposure suggesting a possible hormetic effect. Significant differences in gonadal differentiation in clams treated as juveniles were not observed. Juvenile exposure did not significantly affect predicted population size. Laboratory survival rates for larvae exposed to hexazinone and imidan were generally higher than those for 2,4-D. Hexazinone had no significant effect on larval survival following acute exposure. In contrast to 2,4-D, exposure of veligers to hexazinone resulted in greater predicted population declines than did pediveliger exposures. Data from the early-life-stage exposures were used to generate a stage-specific matrix model to predict the effect on clam populations. These studies suggest that both the stage of exposure and the specific chemical used are important in predicting population effects.

EVALUATION OF BEST MANAGEMENT PRACTICE FOR REDUCING RISK FROM SPRAYER TRACK ROWS IN POTATO PRODUCTION. Allison Dunn (allison.dunn@ec.gc.ca), Environment Canada, 16th Floor, Queen Square, 45 Alderney Drive, Dartmouth, NS B2Y 2N6.

Previous Environment Canada work suggests that compacted sprayer track rows (i.e. the rows a tractor passes over numerous times a season for pesticide applications) in potato fields may lead to concentrated flow and compromise the filtering function of buffers along streams. A study was undertaken in 2007 to investigate the contribution of runoff from sprayer track rows and evaluate whether a best management practice (mulch treatment) can reduce the risk from these rows. Nine sample collectors (3 per treatment: bare sprayer track, mulch-treated sprayer track, control) were deployed in the study field. Following each rainfall-induced runoff event, runoff volumes, toxicity to *Daphnia magna*, sediment, pesticide and nutrient loads were measured for each collector. Seven runoff events occurred in 2007 resulting in 61 toxicity, 63 pesticide and 61 water quality analyses. While pesticide analyses are pending, preliminary water quality data reveal that

mulch-treatment resulted in statistically significant reductions in total phosphorus, nitrate-nitrogen and total suspended solids leaving the row compared to non-treated sprayer track rows. If the pesticide results align with the water quality data, mulching in sprayer track rows may become a recommended practice for reducing the risk from these rows in potato production.

MECHANISTIC BASIS OF RESISTANCE TO PCBS IN ATLANTIC TOMCOD FROM THE HUDSON RIVER, NEW YORK. Isaac Wirgin (wirgin@env.med.nyu.edu), Nirmal Roy, Mathew Loftus, Department of Environmental Medicine, New York School of Medicine; R. Christopher Chambers, NE Fisheries Center, NOAA; Mark Hahn, Woods Hole Oceanographic Institution.

Atlantic tomcod (*Microgadus tomcod*) is a common benthic species in major estuaries along the Atlantic coast of North America. Tomcod from the Hudson River (HR), New York, USA, exhibit dramatic resistance to PCBs and PCDDs, but not PAHs. The HR tomcod population may be the most geographically widespread resistant vertebrate population ever reported, extending for at least 150 km of mainstem river. Resistance is manifest at a variety of early life-stage toxic endpoints and aryl hydrocarbon receptor-mediated cytochrome P450 1A induction. Because HR tomcod bioaccumulate high levels of these contaminants and are the only wintertime spawners in the HR, they are at a critical node in the HR food web. Thus, resistance probably has impacts on the community level because of trophic transfer of these persistent contaminants. We detected a genetic polymorphism (six-base deletion) in the aryl hydrocarbon receptor2 (AHR2) that was almost fixed in the HR population, but was absent or nearly absent in tomcod from six other Atlantic Coast estuaries including two in close proximity to the mouth of the HR (Niantic River, CT, and Shinnecock Bay, NY). In contrast, a selectively neutral marker, the mitochondrial DNA (mtDNA) control region, revealed a positive correlation between genetic distance and geographic distance. The variant HR and normal AHR2 proteins were *in vitro* expressed and compared for their abilities to bind TCDD and to drive TCDD induced reporter gene expression in AHR deficient COS 7 cells in transient transfection assays. The *in vitro* expressed HR AHR2 protein was less efficient at binding TCDD than the normal allele. Similarly, the HR AHR2 protein was less effective than the normal allele in driving TCDD induced gene expression. Our results suggest that the variant AHR2 allele is the mechanistic basis of resistance and has been strongly selected for in this highly impacted ecosystem.

SESSION IV: INVERTEBRATES AND POLLUTION

APPLICATION OF EQUILIBRIUM PARTITIONING SEDIMENT BENCHMARKS FOR PAH CONTAMINATED SEDIMENTS. Susan Kane Driscoll (sdriscoll@exponent.com), B. Amos, M. McArdle and C. Menzie, Exponent, 8 Winchester Place, Suite 303 Winchester, MA 01890

This study was conducted to examine the application of Equilibrium Partitioning Sediment Benchmarks (ESBs) for assessing the toxicity of polycyclic aromatic hydrocarbons (PAHs) in sediments at former manufactured gas plant (MGP) and coke sites. Samples of freshwater sediment from four MGP and coke sites in the U.S. Northeast and Midwest were analyzed for 34 individual PAHs, total organic carbon, “black” carbon (potentially composed of pitch, soot, and other forms of pyrogenic carbon), and sediment toxicity (28-day *Hyalella azteca* toxicity test). The sum of the Toxic Units in each sample was calculated from a one-phase model that accounts for sorption of PAHs to total sediment organic carbon, and a two-phase model that accounts for sorption to black carbon as well as to natural organic carbon. Although both the one-phase and two-phase models accurately predicted concentrations of PAHs that were not toxic to aquatic invertebrates, the two-phase model was more often in agreement with results of sediment toxicity tests. While the bioavailability and toxicity of PAHs may vary at other sites, the two-phase model correctly predicted that sediments from these sites with concentrations of total PAHs as high as 52 mg/kg were not toxic to invertebrates.

EFFECTS OF HYPOXIA ON ANIMAL BURROW CONSTRUCTION AND CONSEQUENT EFFECTS ON SEDIMENT REDOX PROFILES. Eric J. Weissberger (weissberger.eric@epa.gov), L.L. Coiro, E.W. Davey, U.S. Environmental Protection, Agency Atlantic Ecology Division, 27 Tarzwell Drive, Narragansett, RI 02882

We investigated the effects of mild hypoxia on the burrowing behavior of three marine species (the hard clam *Mercenaria mercenaria*, the polychaete worm *Nereis virens*, and the amphipod *Leptocheirus plumulosus*) and consequent effects on sediment redox profiles. Animals were introduced at natural densities into defaunated sediment cores and allowed to burrow for four months at mildly hypoxic (2 mg l^{-1}) and saturated (7 mg l^{-1}) dissolved oxygen levels. Sediment redox profiles were taken at varying temporal intervals for the duration of the experiment. At the end of the experiment, cores were imaged using computed tomography to quantify burrow volume and location. For all species, burrow volume remained constant over DO treatments, but burrows were shallower in hypoxic treatments compared to normoxic treatments. Redox profile discontinuity depth was shallower in hypoxic treatments compared to normoxic treatments for experiments with and without animals, indicating that water column oxygen concentration influences both bioturbation and diffusion of oxygen into the sediment. In hypoxic treatments, clams and worms increased the RPD depth relative to no-animal controls. In normoxic treatments, all species increased RPD depth relative to controls. These results suggest that under hypoxic conditions, burrowing infauna may increase the depth to which oxygen penetrates the sediment, but not to the same degree as they would under normoxic conditions.

TESTING FOR DISCHARGE-RELATED CHANGE IN MASSACHUSETTS BAY BENTHIC COMMUNITIES. Kenneth Keay (kenneth.keay@mwra.state.ma.us), Massachusetts Water Resources Authority, Boston MA; James Blake and Nancy Maciolek, ENSR, Woods Hole, MA; Woollcott Smith, Temple University, Philadelphia PA; Deirdre Dahlen and Carlton Hunt, Battelle, Duxbury MA.

The Massachusetts Water Resources Authority studies benthic communities in Massachusetts Bay as part of an ambient monitoring program required under the NPDES discharge permit for its offshore effluent outfall, which came online in September 2000. Soft-sediment sampling for contaminants, infauna, and tracers at 23 stations within 7 km of the discharge and 8 stations spread from Cape Ann to Cape Cod has been conducted annually since 1992, providing 9 years of baseline sampling and 6 years of discharge monitoring results through August 2006.

Testing for the effects of secondary effluent discharge on sediments and benthic communities in this dispersive and dynamic coastal environment has been challenging. No discharge-associated changes in community composition, abundance, or diversity have been observed through 2006 monitoring, nor have contaminant concentrations increased. Sensitive BACI analyses on contaminant, tracer and infaunal data confirm that only levels of the spore-forming bacterium *Clostridium perfringens* in sediments show strong evidence of an increase related to outfall discharge.

MAINE'S BIOLOGICAL MANAGEMENT OF WATER QUALITY THROUGH APPLICATION OF THE BIOLOGICAL CONDITION GRADIENT. Susan P. Davies (Susan.p.davies@maine.gov), Maine Dept. Environmental Protection, SHS 17, Augusta, Maine 04333.

The United States Clean Water Act offers no explicit definitions to facilitate implementation of the Act's long term goal to "restore and maintain…biological integrity of the Nation's waters". The Biological Condition Gradient (BCG), a narrative gradient model developed by US EPA, that describes six tiers of biological condition, provides operative definitions that enable uniform interpretation of stages of biological degradation in rivers and streams across the country. The BCG is consistent with ecological theory and independent of sampling and analytical methods. The BCG facilitates interpretation of biological responses to common stressor gradients and it is consistent with a broadly agreed upon understanding of "good" versus "bad" biological conditions. BCG concepts have also been developed for application in wetland and estuarine settings.

The State of Maine has employed BCG concepts since the inception of the Biological Monitoring Program in the early 1980s. Benthic macroinvertebrates and algae are assessed to determine attainment of water quality standards. We began the process of biological criteria development by incorporating explicit narrative standards for aquatic life uses in the state's water quality standards law. The four classes each contain specific language that defines the expected biological condition; classes range from "natural" to "maintenance of structure and function". Maine's integrated, biologically-based approach to managing water quality has resulted in widespread preservation of high-value ecological resources while still accommodating societal and economic needs.

SESSION V: TOPICS IN ENVIRONMENTAL TOXICOLOGY & CHEMISTRY

ROLE OF APATITE IN REMEDIATION OF METAL CONTAMINATED SEDIMENTS. Anna Sophia Knox (anna.knox@srnl.doe.gov) and M.H. Paller, Savannah River National Laboratory, Aiken, SC, 29808.

This study evaluated the application of rock phosphate (apatite) in active caps. In contrast to passive capping with inert materials, active or reactive capping involves the use of capping materials that react with sediment contaminants to reduce their toxicity or bioavailability. Contaminated sediment from Times Branch, SC was amended with apatite to evaluate the suitability of this material for use in active caps. A sequential extraction was conducted on the solid phase from the amended sediments to evaluate metal retention and bioavailability. Early extraction steps (exchangeable, amorphous Mn and Fe oxides, and organic fractions) recovered metal fractions that were less strongly bound than the fractions collected in the later extraction steps (crystalline oxides, sulfides, aluminosilicates and residual fractions). The less strongly bound fractions included metal species likely to be retained by the treated sediment; they were termed the Potentially Mobile (Bioavailable) Fraction or PMF. The strongly bound fractions collected in later extraction steps were used to calculate the Recalcitrant Factor (RF). Addition of apatite (from 2.5% to 10%) significantly reduced the PMF but increased the RF for several elements, especially Pb, Zn, Co, Cd, Cr, and Ni with the highest shifts in metal mobility observed with the highest dose of amendments. Addition of 10% NCA to the sediment resulted in about a 40% reduction in the PMF values of Co, Cd, Pb, and Zn. These results indicate that rock phosphate is suitable for inclusion in active caps designed for the remediation of sediments contaminated with metals.

A COOPERATIVE APPROACH TO TRANSPORT/FATE/EFFECTS MODELING IN THE NRDA POTENTIAL SIDE-EFFECTS OF SEQUESTERING AGENTS USED IN ACTIVE CAPS FOR REMEDIATING CONTAMINATED SEDIMENTS. Michael H. Paller (michael.paller@srnl.doe.gov) and Anna S. Knox, 773-42A, Savannah River National Laboratory, Aiken, SC 29808

Unlike passive caps composed of inert materials, active caps consist of chemically active sequestering agents that are applied over contaminated sediments to reduce contaminant mobility and bioavailability. However, these materials must be evaluated for potentially harmful effects on benthic organisms before they are used in aquatic environments. We evaluated three sequestering agents (North Carolina apatite, organoclay, and sand coated with the biopolymers xanthan/chitosan) as well as construction sand (used in conventional passive caps) in ten day sediment toxicity tests that employed *Hyalella* in freshwater and *Leptocheirus* in brackish water. Exposure to 100% biopolymer coated sand and 100% apatite did not affect or marginally affected survival in freshwater. Although organoclay was not toxic in brackish water, as little as 5% organoclay mixed with uncontaminated reference sediment depressed survival in freshwater. Additional freshwater tests showed that the worm *Llyodrilus* was less sensitive to organoclay than *Hyalella,* although growth was reduced at higher exposures. Exposure to 100% construction sand resulted in significant mortality of *Hyallela* showing the sensitivity of this organism to substrate composition. North Carolina apatite and biopolymer coated sand are unlikely to have deleterious affects on aquatic organisms. Organoclay requires further research, but this material

may need to be isolated with a surficial layer of uncontaminated sediment or other nontoxic material in some applications. Future work will include additional laboratory studies and field surveys of pilot-scale sediment caps to verify laboratory results.

MOLYBDENUM ACCUMULATION IN MARINE SEDIMENTS AS AN INDICATOR OF HYPOXIC WATER CONDITIONS. Warren S. Boothman (boothman.warren@epa.gov) and L Coiro, U.S. Environmental Protection Agency, Narragansett, RI, USA.

Direct monitoring of hypoxic water column conditions over large spatial and temporal extents is difficult due to the substantial logistical and financial investment required. Recent studies have indicated that concentrations of molybdenum (Mo) in marine sediments may serve as a useful surrogate for direct measurement of hypoxic and anoxic conditions in overlying waters. Analyses of field samples show a strong relationship between accumulation of Mo and the period of time dissolved oxygen (DO) concentrations in near-bottom waters are hypoxic (below 3 mg/L). In laboratory experiments, marine sediments were exposed to seawater maintained at DO concentrations between 0.7 and 3.5 mg/L, as well as a control (saturated), and sampled biweekly for 12 weeks. Molybdenum was found to accumulate in the top 1 cm of sediment in treatments with reduced DO concentrations, and was linearly related to the time of exposure. Rates of accumulation were statistically significant for treatments with DO $\leq$ 2.8 mg/L and not statistically different from each other. The mean rate of accumulation is similar to the highest rates of accumulation determined in anoxic marine basins worldwide. When compared with accumulation rates in field locations, the rates may be used to determine the frequency with which waters overlying sediments have been hypoxic, and may be used as a surrogate measure of long-term hypoxic exposure.

SESSION VI: MAINE LOCAL AND REGIONAL ISSUES

A**NALYSIS OF ENVIRONMENTAL CONTAMINANTS IN SHELL-DISEASED AND NON-DISEASED AMERICAN LOBSTERS (*HOMARUS AMERICANUS*)**. Deanna Prince (dprince@maine.edu) and Lawrence A. LeBlanc, School of Marine Sciences, University of Maine, Orono, Maine, 04496.

Epizootic shell disease is a virulent form of shell wasting disease in the American lobster, and is present in significant amounts in Long Island Sound and southern New England waters. An investigation is underway to determine whether there is a relationship between shell disease and contaminant body burdens. Lobsters were obtained from Long Island Sound and Narragansett Bay and selected tissues were analyzed for a suite of trace elements using ICP-MS following a microwave-assisted nitric acid digestion. In addition, a multiresidue method was developed for the detection and quantitation of several organic compound classes including polychlorinated biphenyls, polybrominated diphenyl ethers, alkylphenols, bisphenol A, and steroidal estrogens. Concentrations of trace elements in non-diseased and shell-diseased individuals were highly variable and ranged from 0.2 ppm (cobalt) to 12.7 ppm (cadmium) in hepatopancreas and 0.2 ppb (cadmium) to 600 ppb (arsenic) in hemolymph. Cadmium concentrations were significantly higher in shell-diseased lobsters in both hepatopancreas and hemolymph ($p < 0.002$) while manganese was significantly higher in the hepatopancreas of non-diseased lobsters ($p<0.001$). Method development for organic analysis is ongoing and involves extraction of hemolymph with Oasis SPE cartridges, fractionation on 100% activated silica gel columns, and purification with gel permeation chromatography. Hepatopancreas is extracted with acetonitrile using accelerated solvent extraction and purified as described above. Initial results from hemolymph extractions are promising, with good (70-95%) recovery of analytes from all compound classes.

POLYBROMINATED DIPHENYL ETHERS (PBDES) IN NORTHWESTERN ATLANTIC HARBOR SEALS AND THEIR FISH PREY. Susan D. Shaw, Michelle L. Berger (mberger@meriresearch.org), Diane Brenner, Marine Environmental Research Institute, P.O. Box

1652, Blue Hill, ME 04614, USA; and Nina Lohmann , Olaf Paepke, Eurofins-ERGO, Neuländerkamp 1, 21079 Hamburg, Germany

Harbor seals (*Phoca vitulina concolor*) from the northwestern Atlantic inhabit polluted near-shore environments and are highly contaminated by polybrominated diphenyl ethers (PBDEs) and other persistent organic pollutants (POPs). Our previous work reported mean blubber ∑PBDE concentrations ranging from 332 ng/g, lipid weight in adult females to 3659 ng/g, lw in pups. BDE 209 was detected at low levels (1 to 8 ng/g, lw) in four of ten seal samples analyzed, indicating that BDE 209 is bioavailable and can be accumulated in wild seals. Here, we examined PBDE levels and patterns in harbor seal prey fish collected by trawl along the mid-Maine coast in spring 2006. Whole body composites of seven species were analyzed for 35 PBDE congeners (mono- through deca-BDE). Mean ∑PBDE concentrations in the fish were relatively low, ranging from 0.3 to 4.2 ng/g wet weight, or 18.2 to 81 ng/g, lw. In fish and seals, BDE-47 dominated the congener profiles but the contribution of other congeners varied. Overall, the fish contained a greater proportion of tri-BDE 28, tetra-BDEs 49, 66 and 75, and penta-BDE 100 than did the seals, likely reflecting differences in dietary exposure and/or metabolism between fish and seals. BDE 209 was detected in 44% of the fish samples at concentrations similar to those in the harbor seals (0.2 to 8.2 ng/g, lw). Hexa-BDEs 154 and 155 were among the predominant congeners in both fish and seals. These congeners were identified as specific debromination products of BDE-209 in fish. Although not analyzed in the seals, octa-BDEs -197 and -203 and nona-BDE-207 were detected in 26-39% of the fish samples. The accumulation of BDE-209 and its derivatives in marine food webs is of concern because of the potential carcinogenicity and developmental neurotoxicity of these compounds and because deca-BDE is still in high-volume use.

(*STUDENT*) EFFECTS OF DE-ICING SALT (NACL) ON AMPHIBIAN COMMUNITY STRUCTURE IN NOVA SCOTIA. R. W. Russell, Sara E. J. Collins (sara.collins@smu.ca), Saint Mary's University, Halifax, Nova Scotia, Canada.

Amphibian populations are extremely sensitive to environmental disturbance and declines are increasing over the planet at alarming rates. Chemical pollutants in road runoff water are an environmental concern. In northern latitudes, a major pollutant in runoff water is salt (NaCl), used as a de-icing agent. Chloride concentrations are increasing in many roadside freshwater systems, often exceeding mandated limits. Amphibians are particularly sensitive to chemical contamination due to their permeable skins and high dependence on freshwater ecosystems to complete their lifecycles. In this study, 26 roadside ponds were surveyed for amphibian species richness and chloride concentration. A series of acute toxicity tests (LC50) were performed on 5 common amphibian species using a range of environmentally significant NaCl concentrations. Field surveys indicated that spotted salamanders and wood frogs did not occupy high chloride ponds. Toxicity tests showed these two species to be the most sensitive to chloride. American toads were the least sensitive and spring peepers and green frogs showed intermediate sensitivities to chloride. Results indicate that road salts are having negative effects on amphibian community structure and species richness by excluding sensitive species from high chloride environments and by inflicting fitness reducing, sub-lethal effects on others. Road salt application is, therefore, a potentially important factor contributing to amphibian declines in northern latitudes.

(*STUDENT*) THE USE OF GREEN CRAB, AMERICAN EEL, MUMMICHOG, AND FISH PARASITES AS BIOMONITORS OF THE SYDNEY TAR PONDS. Lydia S. Rockwell[1] (rockwelll@hotmail.com), K.M.M. Jones [2], R.W. Russell [1]. [1]Department of Biology, Saint Mary's University, Halifax, NS, N3B 3C3; [2]Department of Biology, Cape Breton University, Sydney, NS, Canada, B1P 6L2.

The Sydney Tar Ponds, one of Canada's most contaminated sites, is being remediated of toxic levels of polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and metals. This study explored the use of a diversity of resident organisms as potential monitors of the effectiveness of Tar Ponds remediation. Concentrations of 18 EPA priority PAHs in green crab (*Carcinus maenas*), American eel (*Anguilla rostrata*), mummichog (*Fundulus heteroclitus*), and

sediment samples were analyzed from the Sydney Tar Ponds and two reference sites. PAH concentrations in all samples from the Tar Ponds were significantly greater compared to both reference sites. PAHs were detected in all Tar Ponds species, but crabs accumulated the greatest concentrations. We propose that crabs are the most appropriate biomonitor due to high site specificity, accumulation of PAHs, and low ability to metabolize PAHs. Parasite communities of eels and mummichogs were also evaluated as biomonitors. Unlike fishes from the reference sites, only traces of parasites were found in fishes from the Tar Ponds. As remediation proceeds at the Tar Ponds we propose that the levels of parasites will increase; thus, the increase in abundance and prevalence of parasites in the fishes from the Tar Ponds can be used as a biomonitor of the Tar Pond remediation.

PRELIMINARY FINDINGS OF CONTAMINANT SCREENING OF MAINE BIRD EGGS: 2007 FIELD SEASON. Wing Goodale (wing.goodale@briloon.com), David Evers, BioDiversity Research Institute (BRI), and Steve Mierzykowski, U.S. Fish and Wildlife Service.

Collaborators: Brad Allen and Charlie Todd, Maine Department of Inland Fisheries and Wildlife; Linda Welch, Maine Coastal Islands National Wildlife Refuge; Scott Hall, National Audubon; Julie C. Ellis, Shoals Marine Lab; Dr. Kurunthachalam Kannan, New York State Department of Health.

We measured 192 contaminants in 23 species across Maine to determine in which species, habitats, and locations these anthropogenic compounds are concentrating. We analyzed 60 egg composites for mercury (Hg), polychlorinated biphenyls (PCB), polybrominated diphenyl ethers (PBDE), perfluorinated compounds (PFCs), and organochlorine pesticides (OCs). Our preliminary findings are 1) Hg, PCBs, PBDEs, PFCs, and OCs are found in all species sampled across marine, estuarine, riverine, lacustrine (lake), and terrestrial ecosystems; these are the first records of PFCs in Maine birds. 2) Hg, PCBs, PFCs are all found at levels that may cause adverse effects—there are currently no established adverse effects thresholds established for PBDEs in bird eggs. OCs are all significantly below adverse effects thresholds. 3) Our Hg, PCB, and OC levels were generally consistent with levels recorded around the country. Certain species had PBDEs higher than other locations, while other species had lower levels. PFOS have not been widely studied in eggs; therefore, we could not directly compare our results to other areas. 4) The total PCBs levels we recorded are lower than those in the past, indicating a continued decline in PCBs. 5)Bald eagles have the highest overall contaminant load of the 23 species measured. 6) We found all of the compounds across the entire state, but overall contaminant loading tends to be highest in southern coastal Maine. This geographic pattern suggests that these compounds are entering the environment both through atmospheric deposition, because they are found across the entire state, and through local point sources, because we detected higher levels in urban and industrial areas. 7) PCBs, PBDEs, PFCs, and OCs levels are positively correlated, indicating that birds with high levels of one compound tend to have higher levels of the others. PBDEs and PCB have the strongest relationship. 8) Birds that feed on terrestrial prey accumulated higher brominated PBDEs; DecaBDE is found in eight species with gulls and peregrine falcon having the highest levels. 9) Of the samples we analyzed, birds feeding in estuaries have the lowest contaminant levels. 10) The mouth of the Kennebec and Isles of Shoals tended to have high concentrations of contaminants. *Funding Support*: Casco Bay Estuary Partnership, Maine Community Foundation, Maine Department of Environmental Protection's Surface Water Ambient Toxics Monitoring Program (SWAT), Maine Outdoor Heritage Fund, John Merck Fund, and U.S. Fish and Wildlife.

POSTER SESSION ABSTRACTS

(*STUDENT*) BIOACCUMULATION AND TROPHIC TRANSFER OF MERCURY IN STRIPED BASS (*Morone saxatilis*) AND TAUTOG (*Tautoga onitis*) IN NARRAGANSETT BAY, RI. Maria N. Piraino (mpiraino346@hawks.rwu.edu) & D. L. Taylor, Roger Williams University, Department of Biology & Marine Biology, Bristol, RI 02809.

Mercury is a toxic environmental contaminant known to be hazardous to human health, and humans are exposed to mercury primarily through the consumption of contaminated fish. Mercury bioaccumulates through the aquatic food chain, with concentrations varying across fish species partly due to differences in diet history and feeding ecology. This study analyzed the mercury concentration ([Hg]) of two commercially and recreationally important fish with diverse life history characteristics: striped bass (*Morone saxatilis*) and tautog (*Tautoga onitis*). Tautog are demersal fish that feed primarily on mollusks and crustaceans, whereas striped bass are pelagic and consume fish and crustaceans. Striped bass, tautog and their prey were collected from Narragansett Bay, Rhode Island, using otter trawls and hook & line (June-August 2006 and 2007). Muscle tissue biopsies and stomach contents (recovered prey) of adult target fish were extracted. Muscle biopsies, recovered prey, and whole body bioavailable prey (taken directly from the field) were analyzed using atomic absorption spectrometry. In addition, nitrogen stable isotopes of target fish and bioavailable prey were measured using automated continuous-flow isotope mass spectrometry. The rate of Hg bioaccumulation was greater in striped bass than in tautog and was explained by species-specific differences in feeding ecology and diet history. For example, [Hg] was significantly higher in the recovered and bioavailable prey of striped bass than tautog. Furthermore, nitrogen stable isotope analysis suggested that striped bass maintain a higher trophic level status than tautog.

(*STUDENT*) EFFECTS OF FEEDING ECOLOGY AND DIET HISTORY ON MERCURY BIOACCUMULATION IN TEMPERATE FLATFISHES. Jennifer L. Linehan (jlinehan371@hawks.rwu.edu), Eric J. Payne and David L. Taylor, Roger Williams University, Department of Marine Biology, Bristol, RI 02809.

The summer flounder, *Paralichthys dentatus*, and the winter flounder, *Pseudopleuronectes americanus*, support valuable recreational and commercial fisheries in Narragansett Bay, Rhode Island. A possible human health risk occurs from consuming these flatfish if they bioaccumulate appreciable levels of mercury (Hg) over time. Factors impacting the Hg concentration of fish tissue, however, vary based on species-specific life history characteristics, such as feeding ecology and diet history. In this study, summer and winter flounder were collected throughout the Narragansett Bay Estuary from June 2006 to September 2007. Tissue samples were analyzed for total Hg concentration using atomic absorption spectroscopy, and Hg data were subsequently analyzed relative to fish body size and predicted age. Moreover, the effect of trophic processes on species-specific Hg bioaccumulation rates were assessed using nitrogen stable isotope analysis of target and bioavailable prey species as well as stomach content extraction. Hg bioaccumulation rates were greater in summer flounder relative to winter flounder, and this was attributed to the feeding ecology of summer flounder and their higher trophic level status, determined through nitrogen stable isotope analysis, in the estuary. The mean total Hg stomach content was higher for summer flounder than winter flounder, but it was not significant and this could be attributed to summer flounder's more varied and complex diet (squid, fish and macrocrustaceans). The bioavailable prey for summer flounder tended to have more total Hg than winter flounder's prey, which consists of amphipods and small decapods.

(*STUDENT*) COMPARING SPATIAL AND TEMPORAL TRACE METAL GEOCHEMICAL SIGNATURES IN TWO BRANCHES OF THE NEPONSET RIVER WATERSHED. Emily R. Estes (eestes@wellesley.edu), T. D. Shafer, Environmental Studies Program, and D. J. Brabander, Department of Geosciences, Wellesley College, Wellesley, MA 02481.

The Neponset River, one of the three main rivers draining into Boston Harbor, was the second industrialized river in New England during the colonial period. This early industrial reliance on water as a power source led to the creation and subsequent contamination of hundreds of mill ponds throughout New England. In this study, we compare a series of ponds from two different sub-watersheds—the East Branch and Spring Brook—using X-ray fluorescence to analyze sediment cores. While depth versus concentration profiles and surface sediment data from the East Branch demonstrate the existence of point sources related to current land use and previous industrial activity, Spring Brook sediments record more diffuse sources that may be useful in articulating metal concentrations associated with a regional urban background. Surface sediment concentrations of lead in all ponds exceed the effects range median (ERM) value of 99 ppm. However, while Spring Brook samples exceed ERM by a factor of 2 on average, East Branch samples were 5 to 39 times greater than ERM. For Factory Pond, the most heavily polluted East Branch site, urban background levels of lead as defined by Spring Brook samples comprise about 40% of contamination in excess of the ERM. More accurately defining an urban background and answering questions about transport mechanisms will allow us to consider remediation techniques and management approaches appropriate for each sub-watershed.

(*STUDENT*) DEVELOPING A NON-LETHAL BIOMARKER FOR WATERBORNE ORGANIC CONTAMINANTS. Jennifer C. Meyers (JenCMeyers@gmail.com), School of Marine Sciences, University of Maine, Orono, ME 04469; and A.A. Elskus, U.S. Geological Survey, University of Maine, Orono, ME 04469.

Cytochrome P4501A (CYP1A) expression is an established biomarker for organic contaminant exposure in vertebrates, and is found in most tissues. The CYP1A enzyme is known to be induced by dioxin-like compounds such as 3,3',4,4',5-pentachlorobiphenyl (PCB-126), found in aquatic environments. Our objective is to develop a non-lethal biomarker using gill filaments and scales to detect EROD activity indicating organic contaminant exposure. We will also determine the sensitivity, reliability, and time course for induction and duration of this enzyme. We exposed Atlantic salmon (*Salmo salar*) to two concentrations of PCB-126 (0.01 µM & 0.001 µM, static exposure), acetone (vehicle), and untreated water for 24 hours before relocating the fish to clean water. Our time points include 6 and 24 hours during exposure, and 48 hours, 14 and 34 days post exposure. The tissue samples collected include gill filaments and scales (non-lethally) and whole livers (lethally, EROD analyses in progress). The gills but not the scales exhibited a does-response in EROD activity. Signs of disease and distress were not observed in fish sampled non-lethally and held for 34 days post sampling. Further testing in the scales is needed to establish if this is a reliable method due to high variability between the exposure groups, and to determine sensitivity to varying contaminant concentrations.

(STUDENT) **MERCURY IN ALASKAN HARBOR SEALS.** Kady Marino.

(STUDENT) **FAT CELL DEVELOPMENT IN THE PRESENCE OF CHEMICAL FIRE RETARDANTS (PBDES).** Christopher Filler (cji2@unh.edu), Bridget Huysman, and Deena Small, Department of Biochemistry & Molecular Biology, University of New Hampshire.

The objective of our research was to investigate the effects of Polybrominated Diphenyl Ethers (PBDEs) on human health, specifically in relation to fat cell development. These flame retardant chemicals are incorporated into a majority of household items, including carpeting, upholstery and electronics. As these chemicals are released into the air and are inhaled through dust mites or ingested through food sources, PBDEs tend to accumulate in high concentrations within lipid-soluble structures (especially fat tissue). Within rat models, PBDE exposure has been found to reduce insulin sensitivity in fat cells and modulate thyroid function. However, it is currently unclear how PBDEs impact these cellular processes.

To investigate the effects of PBDEs on fat cell development, we examined gene expression using quantitative reverse transcriptase PCR (qRT-PCR) on adipose tissue isolated from the fat pads of PBDE-exposed rats. In addition, analyses of differentiation potential, gene expression and

cellular morphology were also conducted in 3T3-L1 pre-adipocytes treated with PBDES in culture. It was found that exposure to PBDEs changed gene expression in both fat pads and 3T3-L1 preadipocytes. Using immunofluorescent methods, PBDEs were also demonstrated to have suppressed adipogenesis and exert a profound effect on 3T3-L1 size and morphology. These results support the hypothesis that PBDEs alter the physiology of immature and mature fat cells *in vivo* and in cell culture models. These novel data are expected to contribute to a better understanding of the link between PBDEs and pathological conditions associated with aberrant adipocyte development.

POLYCHLORINATED BIPHENYLS (PCBS) AND POLYBROMINATED DIPHENYL ETHERS (PBDES) IN CURRENT AND HISTORICAL SAMPLES OF AVIAN EGGS FROM NESTING SITES IN BUZZARDS BAY, MA, USA. Saro Jayaraman[1] (jayaraman.saro@epa.gov), M. Cantwell[1], C. S. Mostello[2], I.C.T. Nisbet[3], and D.E.Nacci[1]: (1) U.S.EPA, Office of Research and Development, Narragansett, RI; (2) Massachusetts Division of Fisheries & Wildlife Westborough, MA; (3) I.C.T. Nisbet and Company, North Falmouth, MA.

We measured concentrations of polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) in eggs from breeding colonies in Buzzards Bay, MA, USA. Eggs from two piscivorous bird species, common (*Sterna hirundo)* and roseate (*Sterna dougallii*) terns, were collected in the spring of 1972, 1994 - 96, 1998 – 99 and 2005. Prior to analyses, we predicted temporal declines in tern egg PCBs in association with declines since the 1970s in sediment PCBs from a nearby Superfund site, New Bedford, MA. However, we expected a temporal increase in PDBE concentrations in tern eggs, reflecting local and globally-transported industrial contamination from these compounds primarily used in recent years as flame retardants. As predicted, PCB concentrations have declined since 1972 in eggs from both tern species. For example, total PCB concentrations, reported as the sum of eighteen selected PCB congeners, averaged 157,322 ng/g lipid for 1972 samples and 34,602 ng/g lipid for 2005 samples of common tern eggs. PCB congener patterns in tern eggs have also changed. The predominant congeners found in tern eggs collected in recent years included PCBs 118, 153 and 138, which contributed to 66-70% of total PCBs; whereas lower chlorinated PCBs predominated the PCB patterns from earlier years (1972). PBDEs were measured in extracts from these same egg samples using a novel negative ion mass spectrometer method (described elsewhere) and reported for eight selected congeners. As expected and in contrast to the decline observed for PCBs, total PBDE concentrations increased from detection limit (< 3 ng/g) in1972 samples to an average of 1,086 ng/g lipid for 2005 common tern egg samples. Results from these analyses were also compared to PCB and PBDE concentrations measured for recently collected (2003) eggs of tree swallows (*Tachyineta bicolor*), insectivorous birds drawn to nesting boxes located in the Superfund site. Statistical analyses are underway to evaluate contaminant-specific interspecies variations, assess the influence of the Superfund site on PCB contamination, and characterize the potential for adverse effects from these toxic contaminants in avian eggs.

BIASES ASSOCIATED WITH BIOPSY PLUGS FOR MERCURY CONCENTRATIONS DETERMINATIONS IN FRESHWATER FISH. Michael S. Hutcheson (michael.hutcheson@state.ma.us), J. Rose, C.M. Smith, MassDEP, Office of Research and Standards, Boston, MA 02108; O. Pancorbo, J. Sullivan and C Batdorf, Wall Expt. Stn, MassDEP, Lawrence, MA 01843; C. J. Strube, Normandeau Associates, Bedford, NH 03110.

Evaluations reported in the literature have reported that biopsy samples are reliable predictors of fish fillet mercury concentrations. Switching to a field biopsy sampling methodology offers a number of advantages over fillet based analyses. We have conducted an intercomparison study to determine the degree of agreement between tissue mercury concentrations determined on edible freshwater fish fillet subsamples and on 4 mm biopsy plug samples taken from the same fish. 317 individual fish (123 largemouth bass, *Micropterus salmoides*; 194 yellow perch, *Perca flavescens*) were used. Initial trials where fish were sacrificed in the laboratory and biopsy samples taken under controlled laboratory conditions provided excellent agreement between the

two measures of mercury concentration (1-5% differences) with no significant differences between the measures. Biopsy samples taken on anaesthetized fish in the field (62 YP and 8 LMB) did not agree as well with fillet-based values being 11.5 - 14% greater than the biopsy plug samples. A second field verification round produced similar results of biopsy samples biased 4-12% low compared to fillet samples. The differences will be contrasted with historical lab replicate variability and acceptability criteria and will be discussed in relation to their use in fish tissue mercury monitoring programs.

MERCURY IN BALD EAGLE EGGS FROM MAINE, 2000 – 2005. Steven E. Mierzykowski (Steve_Mierzykowski@fws.gov)[1], Charles S. Todd[2], Christopher DeSorbo[3], William Hanson[4]. [1] U.S. Fish and Wildlife Service, Maine Field Office, Old Town, ME, [2] Maine Department of Inland Fisheries and Wildlife, Bird Group, Bangor, ME, [3] Antioch New England Graduate School, Keene, NH, & [4] FPL Energy Maine Hydro, Lewiston, ME.

Between 2000 and 2005, thirty non-viable bald eagle (*Haliaeetus leucocephalus*) eggs were recovered from nest territories located near freshwater habitats in Maine. Egg contents were analyzed for total mercury (Hg) using cold vapor atomic absorption spectroscopy. Mean Hg concentration was 0.47 µg/g, fresh wet weight. Eggs from three nest territories had Hg levels above a suggested threshold for reproductive effects in birds (0.80 µg/g). Mercury was significantly higher in eggs from nest territories associated with lakes and ponds than rivers ($p=0.02$). Analytical results were compared to Hg measured in 25 bald eagle eggs collected during previous decades. No significant trend in mean Hg residues was evident among decades ($p=0.89$). Mercury hot spots, however, exist within the state. Non-viable eggs from one nest territory exhibited chronically elevated Hg levels (> 0.80 µg/g) over the last 35 years. The bald eagle is proposed for de-listing from the state's Endangered Species List. Although there has been a significant increase in eagle abundance and distribution in interior Maine, lingering Hg contamination likely contributes to low productivity and rate of recovery in the state's bald eagle population.

EVALUATING EXPOSURE PATTERNS AND IMPACTS OF METHYLMERCURY ON FRESHWATER-FEEDING BALD EAGLES IN MAINE. Christopher R. DeSorbo (chris.desorbo@briloon.org), BioDiversity Research Institute, 19 Flaggy Meadow Rd., Gorham, ME 04038, C. S. Todd, 650 State Street, Maine Department of Inland Fisheries and Wildlife, Bangor, ME 04401, D. C. Evers, BioDiversity Research Institute, 19 Flaggy Meadow Rd., Gorham, ME 04038, S. E. Mierzykowski, US Fish and Widllife Service, 1168 Main Street, Old Town, Maine 04468, W. Hanson, FPL Energy Maine Hydro, 150 Main St., Lewiston, ME 04240, W. W. Bowerman , Clemson University, 261 Lehotsky Hall, Clemson, South Carolina 29634, C. Romanek, Savannah River Ecology Laboratory, Drawer E, Aiken, SC 29802, and R. Taylor, Texas A&M University, College Station, TX 77843.

We present preliminary findings from years one and two of a three-year (2004-2006) effort to evaluate spatial and temporal patterns of mercury exposure in Bald Eagle (*Haliaeetus leucocephalus*) nestlings and adults in Maine as well as to assess impacts on long-term productivity. Nestling blood displayed a significant negative correlation to productivity (3, 5, and 10-year). Nestling blood and adult feathers both reflected higher mercury exposure in lacustrine habitats compared to riverine sites. Statewide spatial patterns indicated that mercury exposure was highly variable with distinct "biological hotspots," many of which were in agreement with other species sampled within the same area (e.g., Common Loons *Gavia immer,* and yellow perch*, Perca flavescens*). Preliminary comparisons to previous sampling efforts in 1991-1992 indicate no significant change in methlymercury availability as indicated by eagle nestlings in lacustrine habitats; while riverine sites may indicate a potential increasing trend compared to those over a decade ago. Shed adult feathers (primarily flight feathers) ranged from <1 ppm to 87.4 ppm (fw) with a significant portion exceeding levels reported in other populations. Mercury and other contaminants (i.e., OCs, PCBs) are also being analyzed in eagle eggs for this population. Findings suggest that a portion of Maine's freshwater-feeding Bald Eagle population is exposed to high levels of methylmercury, which may be limiting the recovery of this breeding population.

A COMPARISON OF MERCURY IN MINK AND FISHER IN RHODE ISLAND. James L. Lake, Stephan A. Ryba, Jonathan R. Serbst (serbst.jonathan@epa.gov), Atlantic Ecology Division, National Health and Environmental Effects Research Laboratory, Office of Research and Development, U.S. EPA, 27 Tarzwell Dr. Narragansett, R.I. 02882; and Charles F. Brown and Lori Gibson. Rhode Island Department of Environmental Management, Division of Fish and Wildlife P.O. Box 218, West Kingston RI 02892.

Comparison of total mercury concentrations and nitrogen and carbon stable isotope values in muscle tissue and stomach contents of mink (*Mustela vison*) and fisher (*Martes pennanti*) from Rhode Island in 2000- 2003 showed results which appeared to reflect dietary differences between these two predatory mammals. Mink are considered to be more dependent on aquatic resources for food and, therefore, to accumulate higher levels of Hg than fisher. The results of this study supported these contentions. Fish were found in the stomach contents of 22 of 45 mink, and other aquatic prey was found in 26 of the mink stomachs. In fisher, fish was found in one of 25 stomachs and most of the other stomachs contained small mammals and birds. As in previous work, mink could be easily separated into two groups based upon their habitat, and these groups showed differences in the total Hg concentration, $\delta^{13}C$ and $\delta^{15}N$ in muscle tissue. The salt marsh group (SMG) had a significantly lower mean Hg concentration (2440 ng/g(dry), s.d. = 1530, n = 12) and higher mean values of $\delta^{13}C$ (-15.8 ‰, s.d. = +/- 2.3, n = 12) and $\delta^{15}N$ (14.5 ‰ . s.d. = +/- 1.2, n = 12) than the upland group(UPG)-mean Hg concentration (4931. ng/g(dry), s.d. = +/- 1690, n = 27), mean $\delta^{13}C$ (-26.2. s.d. = +/- 1.2, n = 29) and mean $\delta^{15}N$ (11.3. s.d. = +/- 1.7, n = 29). Fisher showed mean values of Hg (628 ng/g(dry), s.d. = +/- 508, n = 24) and $\delta^{15}N$ (7.7 ‰, s.d. = +/-1.2 , n = 24) that were significantly below those of either mink group; and, the mean $\delta^{13}C$ value (-22.5 ‰, s.d. = +/- 0.81, n = 24) was intermediate between SMG and UPG. The correspondence between stomach contents and muscle tissue for these predators was assessed by comparing relationships between these sample types for Hg concentration, $\delta^{13}C$ and $\delta^{15}N$. Comparisons of total Hg muscle concentrations (dry weight), $\delta^{13}C$ and $\delta^{15}N$ between stomach contents and muscle tissue showed significant relationships for Hg in SMG, UPG and fisher; for $\delta^{13}C$ the relationship was significant for UPG, but not for SMG or fisher; for $\delta^{15}N$ the relationship was significant for SMG, UPG, but not for fisher. The lack of a relationship for the stable isotopes between stomach contents and muscle for fisher appears to result from the high variability of their diet. The mean $\delta^{15}N$ difference between stomach contents and muscle tissue found here was 3.9 ‰ for SMG, 3.9 ‰ for UPG and 3.6 ‰ for fisher. These values compare closely to 3.4 ‰ which has been suggested as a generalized increase in $\delta^{15}N$ between predator and prey. Over this trophic step the total Hg concentration (dry weight) increased by factors of 3.9, 3.2 and 5.3 for SMG, UPG and fisher respectively. This study also demonstrates the utility of stable isotopes for: delineating populations of mink, assessment of predator - prey relationships, and, supplying a framework for quantifying contaminant bioaccumulation.

ASSESSMENT OF METHYLMERCURY AVAILABILITY TO BATS IN NEW YORK – 2006. Dave Yates[1] (dave.yates@briloon.org), David Evers[1], Dave Braun[2], Michelle Brown[2], Tim Divoll[1], Jeff Loukmas[3], Amy Sauer[4], Nina Schoch[5] and Robert Taylor[6]. [1] BioDiversity Research Institute, 19 Flaggy Meadow Rd, Gorham, ME 04038, [2] Texas A&M Trace Element Research Lab, [3]New York Department of Environmental Conservation, [4]Syracuse University, [5]Wildlife Conservation Society, & [6]Texas A&M University.

More than half of the species of bats in the U.S. can be characterized as foraging over water for emergent insects. There have been very few investigations measuring the exposure of mercury (Hg) to bats. Because of factors that relate to the bat's natural history and vulnerability to anthropogenic stressors, over half of the species in the United States are listed as endangered and threatened or are under consideration for listing. Bats comprise about one-quarter of the mammalian species and constitute a substantial portion of the mammalian biological diversity in the United States. We present findings from a pilot effort to evaluate Hg exposure in multiple bat species from New York State. We sampled blood and fur from 96 bats at eight sites in New York State. Samples were analyzed for total Hg (>95% Hg in fur is MeHg). We found that 16% and 5%

of the bats sampled had fur Hg concentrations that exceeded the lowest observed effects levels in dosed mice (i.e., 10.8 ug/g, fw) and furbearers (i.e., 20.0 ug/g, fw), respectively. This study demonstrates the potential risk of anthropogenic releases of Hg in the air sheds and watersheds of New York State for bats and parallels risks found in diurnal invertivores – songbirds.

MAINE COMPACT FLUORESCENT LAMP STUDY. Heather Jackson, Stacy Ladner, Deb Stahler (Deborah.Stahler@maine.gov), Bureau of Remediation and Waste Management, Maine Department of Environmental Protection, 17 State House Station, Augusta, Maine 04333.

This study was undertaken to improve cleanup guidance of broken compact fluorescent lamps [CFLs]. CFLs were broken in a small/ moderate sized room and were cleaned up by a variety of methods. Three different flooring surfaces were included: pre-finished hardwood, short-nap and long-nap carpet. Mercury concentrations in the room were continuously monitored at one and five foot heights. In addition, various containers were evaluated for how well they limited release of mercury vapor from broken lamp debris. Room air concentrations from breaking/ cleaning a single compact fluorescent lamp often exceeded the Maine Ambient Air Guideline (MAAG) of 300 nanograms per cubic meter (ng/m^3) for some period of time, with short "spikes" above 25,000 ng/m^3. Venting can significantly reduce the mercury air concentrations. Following the pre-study cleanup guidance produced visibly clean floors; however, all types of floors tested, especially carpets, can retain sources that produce high concentrations near the break, especially when agitated. Concentrations can rebound when rooms are no longer vented, particularly on carpeting, with certain lamps or during/after vacuuming. Vacuuming proved to be problematic and is not recommended for CFL cleanup. Glass jars with metal covers were found to be better than other containers for limiting mercury emissions from lamp debris. Double re-sealable polyethylene bags did not adequately contain vapors. Maine DEP pre-study cleanup guidance was generally found to be sound. However, cleanup guidance was modified as a result of this study.

TREASURES IN ARCHIVED HISTOPATHOLOGY COLLECTIONS: PRESERVING THE PAST FOR FUTURE UNDERSTANDING.

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Extensive collections of histopathology materials from studies of marine and freshwater aquatic organisms are archived in the Registry of Tumors in Lower Animals (RTLA), the U.S. Environmental Protection Agency, NOAA's National Marine Fisheries Service, and other agency or academic institutions. These collections are valuable resources for scientists seeking to understand health/disease in diverse species, train new invertebrate pathologists, predict risks from biotic/abiotic stressors (e.g., toxicant impacts on organisms in multiple locations), determine disease status through DNA extraction and analysis, supply data for historical reconstructions (e.g., when a virus first affected a host species), examine trends in parasite distribution and prevalence, and improve interpretation of host/parasite population fluctuations for modeling ecosystems. However, they are in danger. For example, RTLA's collection (www.pathology-registry.org) now at Experimental Pathology Laboratories, Sterling, VA, formerly National Cancer Institute funded, lacks current funding for maintenance or processing of additional case submittals. To ensure future availabilities of these irreplaceable resources, online databases with cross-linking records of materials for search and retrieval—as is being developed for the EPA's Atlantic Ecology Division's collections— can provide access, but these collections need cross-agency support to improve their database capabilities, maintain histoslides, and provide hands-on examination and study.

MODELING RISKS OF POINT SOURCE AIR POLLUTANTS TO HUMANS AND WILDLIFE VIA FISH INGESTION: SIMPLE TO COMPLEX MODELS. Margaret E. McVey (mmcvey@icfi.com), ICF International, Blue Hill, ME; D. Burch, ICF Int. Research Triangle Park, NC; M. Dymond, Minnesota Pollution Control Agency.

When emitted from industrial point sources to air, chemicals that are persistent, bioaccumulative, and toxic (PBT) have the potential to deposit to both local and distant watersheds and to bioaccumulate in aquatic organisms to levels that are toxic to both wildlife and humans. ICF has assisted in the development and implementation of relatively simple to complex computer models that predict multi-media fate and transport of air emissions of PBT chemicals in local watersheds. In this presentation, ICF will provide an overview of three levels of modeling: (1) an Excel-based steady-state model of air deposition and potential bioaccumulation in fish developed for and with the State of Minnesota; (2) a hypothetical, spatially simple, screening scenario developed from EPA's TRIM.FaTE model and used to estimate *de minimus* emission rates nationwide, and (3) a full site-specific dynamic simulation version of TRIM.FaTE with hourly time steps, seasonal changes in weather, and 30+ year time horizons for refined ecological and human health risk assessments, used for a case study of mercury emissions in Maine. We compare and contrast the models with respect to their applications, technical capabilities with respect to aquatic food web modeling, and transparency and ease of use. All three models employ biokinetic submodels for chemical uptake and depuration from aquatic organisms rather than bioconcentration or bioaccumulation factors.

CONTAMINANT ASSESSMENT OF WHITE SUCKERS FROM EIGHT RIVERS IN THE GULF OF MAINE DISTINCT POPULATION SEGMENT FOR ATLANTIC SALMON. Steven E. Mierzykowski (steve_mierzykowski@fws.gov), U.S. Fish and Wildlife Service, Maine Field Office, 1168 Main Street, Old Town, ME.

White suckers (*Catostomus commersoni*) are a common sentinel species used in state, regional, and national biomonitoring programs to illustrate contaminant conditions and trends. White suckers were collected for tissue residue analyses between 2003 and 2006 to assess contamination in eight Gulf of Maine rivers where the endangered Atlantic salmon (*Salmo salar*) is considered a Distinct Population Segment (DPS) under the Endangered Species Act. Ninety whole-body white suckers, collected from 27 locations among the eight DPS-designated rivers, were analyzed individually (n=25) or in multi-fish composites (n=22) for organochlorine compounds and trace elements.

Of 22 organochlorine compounds included in the analytical scan only two were detected with any regularity - polychlorinated biphenyls (PCBs) and p,p'-DDE. Total PCB was detected in all sucker samples from the Dennys River (mean 0.041 µg/g), two fish from the Pleasant River (0.007 µg/g, 0.018 µg/g), and four composite samples from the East Machias River (mean 0.005 µg/g). Total PCB in suckers from the DPS rivers were similar to levels reported in regional and national biomonitoring programs. Although Total PCB was detected in 25 samples, and suckers from the Dennys River had six-fold higher Total PCB concentrations than fish from two other DPS rivers, Total PCB concentrations in DPS river white suckers did not exceed suggested biological effect levels. DDE, a metabolite of the insecticide DDT, was found in 12 of 28 samples (median 0.003 µg/g) from the DPS rivers at levels three to fifteen times lower than levels reported in regional and national biomonitoring programs, and two orders of magnitude below a suggested DDT tissue threshold-effect level of 0.60 µg/g.

The mean mercury concentration for all white sucker samples (0.22 µg/g) from the DPS rivers was at the suggested tissue effect threshold level (0.20 µg/g). Mercury is frequently found in biota at elevated levels in New England. Relative to higher trophic level fish species such as smallmouth bass (*Micropterus dolomieui*), elevated levels of mercury (> 0.50 to 1.00 µg/g) are not commonly found in white suckers in New England. Among the DPS rivers, the highest mercury levels were found in white suckers from the Machias River (0.69 µg/g) and to a lesser extent in the West Branch of the Sheepscot River (mean 0.35 µg/g). In DPS river white suckers,

concentrations of 18 other trace elements appeared lower or similar to median values reported in Maine, regional, or national biomonitoring programs.

SITE-SPECIFIC SEDIMENT BENCHMARKS ACCOUNT FOR LOW BIOAVAILABILITY OF PAH AT A FORMER MGP SITE IN MASSACHUSETTS. Allison Nightingale (allison.nightingale@amec.com), Paul Anderson, Kevin Haines, AMEC Earth & Environmental, Inc., Westford, MA 01886; Robert Cleary, Peter LaGoy, Bay State Gas Company, Westborough, MA 01581; Nick Azzolina, ENSR, Ithaca, NY 14850

During the investigation of the former Springfield Gas Works near the Connecticut River in Springfield, Massachusetts, bulk sediment and sediment porewater from the river were analyzed for parent and alkylated polynuclear aromatic hydrocarbons (PAH), and 28-day *Hyalella azteca* and 20-day *Chironomus dilutus* bioassays were used to investigate whole sediment toxicity, at 15 site and four reference locations. Dose-response analyses examined the relationships between toxicity and PAH in sediment, PAH in porewater, and Toxic Units (TU) calculated using the U.S. Environmental Protection Agency equilibrium partitioning methodology.

From the dose-response relationships, we derived site-specific sediment and porewater benchmarks protective of benthic invertebrates for evaluating PAH concentrations at other river locations where bioassays were not undertaken. The sediment benchmarks are substantially higher than benchmarks commonly recommended by regulatory agencies and are consistent with sediment benchmarks developed using bioassay data from other pyrogenic-origin PAH sites.

The site-specific sediment organic carbon-porewater partition coefficients (K_{oc}s) derived from porewater and sediment data are substantially higher than default K_{oc}s, indicating strong sorption to organic carbon and lower bioavailability of PAH than assumed by default K_{oc}s. Benchmarks developed from site-specific bioassay and organic carbon partitioning data provide a more realistic assessment of potential risks from pyrogenic PAH in sediment than standard default approaches.

APPLICATION OF A PROBABILISTIC, FUGACITY-BASED MODEL TO PREDICT THE FATE OF COSUMER PRODUCTS IN WATEWATER TREATMENT PLANTS (WWTP) AND IN LAND APPLIED BIOSOLIDS. Michael J. Bock[1] (mbock@environcorp.com), J. Lyndall[2], and T.R Barber[2]. ENVIRON INTERNATIONAL CORP, 1. Portland ME. 2. Cleveland OH.

The potential impacts of new and existing ingredients in consumer products that are, or potentially could be, released into the environment can be assessed by predicting the fate of these chemicals during processing by WWTPs. Given the range of uncertainty and environmental variability, probabilistic fate and transport models provide a more complete picture of the range of potential environmental conditions. Using fugacity-based equilibrium models, we constructed a probabilistic model for the analysis of chemicals in consumer products that are released to the environment via household wastewater. This model considered the release into the domestic waste stream and processing in a modern WWTP, and predicts the concentration of these chemicals in effluent and biosolids. In addition, fugacity-based modeling was used to predict the range of chemical concentrations in the surface water, sediment, and aquatic organisms, as well as soil and biota in a biosolids-amended field. The model represented the range of expected environmental variability using distributions of input parameters observed and/or reported in the literature. The results of the model served as the foundation for a scientifically sound risk assessment.