SETAC North Atlantic Chapter
2010 ANNUAL MEETING AGENDA
June 2 - 4, 2010
Village Inn Resort, Narragansett, RI

WEDNESDAY, JUNE 2

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

"Introduction to Green Chemistry." Instructors: Nicholas Anastas (Poseidon's Trident), Wei Zhang (UMass Boston), Bela Torok (UMass Boston), and Michael Viola (Warner Babcock Institute for Green Chemistry).

THURSDAY, JUNE 3

7:30 Coffee and continental breakfast
8:00 Welcome, Jim Hauri, NAC president
8:15 Welcome, SETAC North America, Greg Schiefer, President

8:30 SESSION 1
ENVIRONMENTAL CHEMISTRY (Tim Verslycke, Session Chair)

8:35 **A RETURN TO HOLISTIC ENVIRONMENTAL STEWARDSHIP THROUGH GREEN CHEMISTRY.** Nicholas Anastas (nanastas@poseidonstrident.net), Poseidon's Trident, 83 Sassamon Avenue, Milton, MA 02186

8:55 **A SIMPLE DEVICE FOR CONTROLLING pH IN AQUEOUS SOLUTIONS FOR TOXICITY EVALUATIONS.** John Williams (jwilliams@aquatecb.com), P.C. Downey, J. Garrison, K. Koch, O. Kunkel, Aquatec Biological Sciences, Inc., 273 Commerce Street, Williston, VT 05495

9:15 (student) **FLUORESCENCE SPECTROSCOPY AS A RAPID, COST-EFFECTIVE METHOD TO MONITOR AND ANALYZE LOW LEVELS OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS IN ENVIRONMENTAL WATER SAMPLES.** James Killarney (james_killarney@umit.maine.edu), H. Patterson, Department of Chemistry, University of Maine, Orono, ME 04469

9:35 (student) **USING LASER ABLATION ICP-MS TO UNDERSTAND MOOSE WITH BAD TEETH.** Cynthia S. Kendall MacKenzie (cynthia.kendall@smu.ca) and Hugh Broders. Saint Mary's University, Halifax, NS, Canada B3H 3C3

9:55 **BREAK**

10:15 SESSION 2
LOCAL ISSUES IN RHODE ISLAND (Dave Taylor, Session Chair)

10:20 **SPATIAL DISTRIBUTION OF TRICLOSAN IN A SEMI-ENCLOSED ESTUARINE EMBAYMENT; GREENWICH BAY, RHODE ISLAND.** David Katz (katz.davidr@epa.gov), M. Cantwell, M. Perron, R. Burgess, and K. Ho. U.S. Environmental Protection Agency, Narragansett, RI, 02882.

10:40 **INDICATORS OF ENVIRONMENTAL AND BIOLOGICAL MERCURY CONTAMINATION IN THE NARRAGANSETT BAY (RHODE ISLAND, USA).** David L. Taylor (dtaylor@rwu.edu) and Jennifer Linehan**,** Roger Williams University, Department of Marine Biology, Bristol, RI, 02809.

11:00 **LOBSTERS AS AN ECOTOXICOLOGICAL RESEARCH MODEL IN NEW ENGLAND COASTAL WATERS.** Tim Verslycke (tverslycke@gradientcorp.com) Gradient, 20 University Road, Cambridge, MA 02138 and Ann M. Tarrant (atarrant@whoi.edu) Biology Department, Woods Hole Oceanographic Institution, 45 Water Street, Woods Hole. MA 02543

11:20 **CAREERS IN ENVIRONMENTAL SCIENCES: VIEWPOINTS FROM ACADEMIA, GOVERNMENT, CONSULTING**

PANELIST INFORMATION

David L. Taylor, Ph.D.
Dave Taylor (dtaylor@rwu.edu) is an Assistant Professor of Marine Biology at Roger Williams University in Bristol, RI. His upper level course specialties include ichthyology and fisheries science. Dave's current research projects include mercury contaminants in commercial and recreational finfish of Narragansett Bay, RI; implementing the use of reef-ball artificial structures for oyster enhancement and finfish habitat restoration in Narragansett Bay, RI; and cohort dynamics of juvenile bluefish in estuaries and ocean beaches of RI. More information: http://faculty.rwu.edu/dtaylor/

Lisa McIntosh
Lisa McIntosh (LMcIntosh@woodardcurran.com) is Project Manager at Woodard & Curran, specializing in both hazardous waste site risk assessment and wetland science. In her role as risk assessor, Lisa has expertise in conducting both human and ecological risk assessments for state and federal agencies, toxicological evaluations, environmental sampling, data usability analysis and public communication. Her wetland-related experience includes wetland delineation, functional assessment, resource restoration and mitigation, and environmental permitting.

Ted Wickwire
Ted Wickwire (wickwire@exponent.com) has 15 years of experience in evaluating the exposure and effects of contaminants in aquatic and terrestrial ecosystems. He is an ecologist focusing on aquatic and terrestrial ecological risk assessment. He conducts and manages ecological risk assessments including: the development of quality assurance project plans, design and implementation of multi-media field sampling programs, development of conceptual models, application of wildlife exposure models, implementation of weight-of-evidence risk assessment approaches, preparation of final risk characterization reports, development of preliminary remediation goals, and risk communication. Ted incorporates ecological principles in wildlife exposure models and oversees the development of modeling packages to improve the realism of exposure modeling incorporating wildlife behaviors relative to habitat suitability.

Nancy Bettinger
Nancy Bettinger has been an Environmental Analyst with MassDEP's Office of Research and Standards since 1990. Her responsibilities include writing guidance for human health and ecological risk assessment at waste sites in Massachusetts, providing technical support to MassDEP staff and private sector risk assessment consultants, reviewing risk assessments submitted under MassDEP's waste site cleanup regulations (the MCP), and contributing to risk assessment-related policy and regulation revisions initiated by BWSC.

12:00 – 1:25 **LUNCHEON & CAREER SPEED DATING** (Included)

1:25 SESSION 3
CONTAMINATED SEDIMENTS. (John Williams, Session Chair)

1:30 **EFFECTS OF TRICLOSAN ON MARINE BENTHIC AND EPIBENTHIC ORGANISMS** M.M. Perron (Monique_Perron@brown.edu), Brown University, Providence, RI, 02912; K.T. Ho, M.G. Cantwell, R.M. Burgess, M.C. Pelletier, D.R. Katz, U.S. EPA AED, Narragansett, RI, 02882.

1:50 (student) **BLACK CARBONMEDIATED DESTRUCTION OF NITROGLYCERIN AND RDX BY HYDROGEN SULFIDE: RELEVANCE TO INSITU REMEDIATION.** W. Xu (wenqing.xu@yale.edu), K. E. Dana, and W. A. Mitch, Department of Chemical Engineering, Environmental Engineering Program, Yale University, New Haven, CT 06520

2:10 **SEASONAL PHOSPHORUS DYNAMICS IN THE SURFICIAL SEDIMENT OF SHALLOW TEMPERATE LAKES: A DIFFUSIVE EQUILIBRIUM STUDY.** B.A. Lake (bjorn.lake@umit.maine.edu), S.A. Norton, and A. Amirbahman, University of Maine, Orono, ME, 04469

2:30 INITIAL RESULTS OF TWO FIELD DEMONSTRATIONS USING SEDIMITE.™ B. Amos (bamos@exponent.com), C. Menzie, & Susan Kane Driscoll, Exponent, Inc., Maynard MA; U. Ghosh, C. Cardona & S. Kwon, University of Maryland Baltimore County, Baltimore MD; and C. Gilmour, Smithsonian Environmental Research Center, Edgewater, MD.

2:50 **NAC SETAC Business Meeting**

3:10 **BREAK**

3:30 **POSTER PREVIEW OVERVIEWS**

4:00 SESSION 4
ENERGY AND ENVIRONMENT (Jimmy Hauri, Session Chair)

4:05 **OIL SPILL INJURY ASSESSMENT - SOME LESSON LEARNED.** David S. Page (dpage@bowdoin.edu), Bowdoin College, 29 Magean Street, Brunswick, ME 04011

4:25 (student) **ENVIRONMENTAL PERFORMANCES OF CONVENTIONAL GASOLINE AND WOOD-BASED BIOETHANOL IN U.S. NORTHEAST REGION THROUGH LIFE CYCLE ASSESSMENT.** Binod Neupane and A. Halog.

4:45 **A NEW MODEL FOR INVASIVE SPECIES: URINALMINTUS.** Walter J. Berry (berry.walter@epa.gov) U.S. EPA, Atlantic Ecology Division, Narragansett, RI 02882

5:05 **ADJOURN**

5:05 – 7:00 **POSTER SESSION AND RECEPTION** (cash bar)
7:00 – 9:00 **BANQUET**, followed by KEYNOTE SPEAKER, ***DR. JON C. BOOTHROYD***
9:00 – 11:00 **NAC SETAC JAM Session** (cash bar)

POSTER SESSION

(student) **A VISUAL DOCUMENTATION OF ACUTE TOXICITY IN ZOOPLANKTON.** K. Cushing, Kathryn Frazier (kafrazier@assumption.edu), and J. Hauri, Assumption College, Worcester, MA.

(student) **USING FISH SCALES AS NON-LETHAL BIOSENSORS OF SURFACE WATER CONTAMINANTS.** Daniel G. Skall (Daniel.Skall@umit.maine.edu), University of Maine, Orono, ME 04469; and A.A. Elskus, U.S. Geological Survey, Aquatic Toxicology Section, Orono, ME.

(student) **SYNERGISM AND ANTAGONISM IN TOXICITY OF MIXTURES OF PHARMACEUTICALS TO *DAPHNIA MAGNA*.** Pooja Shakya (pooja.shakya@trincoll.edu), Richard S. Kim and Alison J. Draper, Environmental Science Program, Trinity College, Hartford, CT.

U.S. EPA WILDLIFE DATABASE: A PUBLIC RESOURCE FOR ENVIRONMENTAL QUALITY INFORMATION. Melissa Hughes[a] (hughes.melissa@epa.gov), David Bender[a], Jane Copeland[b], Marguerite Pelletier[c], Anne Kuhn[c], and Diane Nacci[c]. [a]Raytheon Corporation and [b]SRA International, on contract to US EPA, Narragansett, RI 02882; [c]U.S. Environmental Protection Agency, Narragansett, RI.

(student) **MERCURY ACCUMULATION IN BRAIN AND MUSCLE TISSUES OF BLUEFISH (*POMATOMUS SALTATRIX*) AND TAUTOG (*TAUTOGA ONITIS*).** Nichole L. Ares and David L. Taylor (dtaylor@rwu.edu), Roger Williams University, Department of Marine Biology, Bristol RI.

(student) **DEVELOPMENTAL EXPRESSION OF AHR IN THE LITTLE SKATE.** Daniel Reeves (dreevite@gmail.com) and R. Merson, Biology Department, Rhode Island College, 600 Mt. Pleasant Ave, Providence, RI.

CYTOCHROME P450 2AA GENES IN ZEBRAFISH (DANIO RERIO): EXPRESSION OF CYP2AA1 AND CYP2AA2 IN RESPONSE TO PHENOBARBITAL-TYPE INDUCERS. Akira Kubota (akubota@whoi.edu)[1], ACD Bainy[1,2], BR Woodin[1], JV Goldstone[1], JJ Stegeman[1], [1]Biology Department, Woods Hole Oceanographic Institution, Woods Hole, MA; and [2]Departamento de Bioquímica, Universidade Federal de Santa Catarina, Florianopolis, Brazil.

(student) **OCCURRENCE AND TRANSPORT OF PBDE, TRICLOSAN, AND ALKYLPHENOLS IN AN URBAN ESTUARY DETERMINED USING PE PASSIVE SAMPLERS.** Victoria P. Sacks (vpsacks@gso.uri.edu) and R. Lohmann. University of Rhode Island Graduate School of Oceanography, Narragansett, RI.

(student) **FOOD CONTAMINATION: ANALYSIS FOR MERCURY AND COCKROACH ANTIGEN IN FOODS.** Richard S. Kim (richard.kim@trincoll.edu) and Alison J. Draper. Interdisciplinary Science Program, Trinity College, Hartford CT.

EVALUATION OF BIOGEOCHEMICAL VARIABLES AFFECTING DISTRIBUTIONS OF MULTIPLE METAL ION CONCENTRATIONS IN BOSTON HARBOR. Z.Dong (zdong@hsph.harvard.edu), C.G.Lewis, R.M.Burgess, B.Coull, J.P.Shine. Exposure, Epidemiology and Risk Program, Department of Environmental Health, Harvard School of Public Health, 401 Park Drive, Boston, MA.

INDUCTION OF *CYP1* GENES AND EFFECTS OF AHR AGONISTS IN *XENOPUS TROPICALIS* TADPOLES. Maria Jönsson (maria.jonsson@ebc.uu.se), Cecilia Berg, Environmental Toxicology, Uppsala University, Uppsala, Sweden; Jared Goldstone, John Stegeman, Biology Department, Woods Hole Oceanographic Institution, Woods Hole, MA.

SETAC NORTH AMERICA 32ND ANNUAL MEETING, BOSTON, MA, NOVEMBER, 2011.
Diane Nacci (nacci.diane@epa.gov), U.S. Environmental Protection Agency, Narragansett, RI, and Erin Bennett, Bioengineering Group.

THE ENCYCLOPEDIA OF EARTH (EoE). Emily Monosson (emonosson@verizon.net) PO Box 329, Montague MA.

(unmanned poster) **ASSESSING THE IMPACT OF LONG-TERM MERCURY CONTAMINATION ON WILDLIFE HEALTH IN NEW YORK, USING THE COMMON LOON AS SENTINAL SPECIES.** Nina Schoch (aclp2@juno.com), BioDiversity Research Institute's Adirondack Center for Loon Conservation; David Evers, BioDiversity Research Institute; Keith Grasman, Calvin College; and Stephanie James & Paul Calle, Wildlife Conservation Society's Global Health Program.

KEYNOTE ADDRESS

"UNDERSTANDING COASTAL GEOLOGIC HAZARDS, SEA LEVEL RISE AND CLIMATE CHANGE IN RHODE ISLAND." Dr. Jon C. Boothroyd, Department of Geosciences, University of Rhode Island.

When contemplating Rhode Island coastal geologic hazards, one must consider: 1) hurricanes (tropical cyclones), 2) extratropical cyclones ("Nor'easters"), and 3) sea-level rise. The hazards give rise to these geologic processes: 1) frontal erosion from breaking waves and swash run up, 2) storm-surge overwash, and 3) an elevated level of mean-higher high water into the future. Scale of these processes is: 1) breaking waves: 1 to 3+ meters at the shoreline, 2) storm-surge overwash: 0.5 to 4 m water depth across the shore zone, and 3) sea-level rise: 3 mm per year at present.

The south shore of Rhode Island is a microtidal (1.05 m mean, 1.17 m spring range) mixed wave/tide dominated shore; Narragansett Bay also is microtidal (1.05 m mean Newport, 1.34 m Providence; spring range- 1.17 m, 1.47 m respectively). Geologic shore zone types and percentages are:

1) Beach plain/barrier spit – 25%,
2) Glacial stratified material bluff – 8
3) Till bluff – 23%
4) Meta-sedimentary bedrock – 8%,
5) Igneous/other Meta bedrock – 5
6) Discontinuous bedrock – 1
7) Shore protection structure – 30%

The entire system is storm driven, thus size and intensity, forward speed, path, tidal phase, and time between storms (Hayes and Boothroyd, 1969) control the resulting changes. Storm surges range from 2.9 m above MHHW (1938 category 3 hurricane) to 0.9 m (Patriots Day 2007 extratropical). Sustained southeast winds may cause extratropical surges to extend over 5-8 tidal cycles. Barrier spits and bluffs of stratified material have retreated up to a net 75 m between 1939 and 2006, although non-storm periods have allowed intermediate term temporary recovery.

Relative sea-level rise of 25.8 cm per 100 yr has resulted in a 22 cm rise since 1930 and 17 cm since 1938. Continuing frontal erosion combined with a possible accelerated sea-level rise of 1-1.5 m by 2100, and perhaps by 2050, will allow storm surges from to penetrate further inland and result in deeper water depths than present obsolete maps suggest. However, sediment budget considerations suggest that the barriers spits will continue to migrate landward with sea-level rise and not disintegrate to shoreface shoals, although they will narrow and become increasingly washover fan dominated.

KEYNOTE BIOSKETCH

JON C. BOOTHROYD
Professor of Quaternary Geology and State Geologist
Department of Geosciences

College of the Environment and Life Sciences
University of Rhode Island, Kingston, RI 02881
jon_boothroyd@uri.edu

Jon Boothroyd is primarily a field geologist specializing in coastal, braided river, and various glacial environments. He has 45 years of field experience in New England, South Carolina, Alaska, Iceland, Saudi Arabia, Madagascar, Ecuador, Mexico and the Azores. His current research interests focus on:

- Geologic mapping of Quaternary (surficial) deposits
- Late glacial and post-glacial landscape development
- Processes and development of barrier and headland shorefaces in glaciated terrain
- Coastal geologic hazards and management issues
- Long-term (years) beach changes
- Benthic geologic habitat of Essential Fish Habitat and aquaculture sites
- Geoarchaeology of New England
- Holocene stratigraphy of microtidal lagoons
- Geotechnical aspects of highway construction through, and use of, glacial materials

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FRIDAY, JUNE 4

8:00 Coffee and continental breakfast

8:30 SESSION 5
ENVIRONMENTAL TOXICOLOGY (Allison Dunn, Session Chair)

8:35 (student) **TOXICITY OF DEICING SALT COMPONENTS ON EARLY AMPHIBIAN LIFE STAGES.** S. E. J. Collins (sara.collins@smu.ca) and R. W. Russell, Saint Mary's University, Halifax, Nova Scotia, Canada.

8:55 **BEYOND THE HAZARD QUOTIENT: CASE STUDY OF RISK ASSESSMENT FOR PENINSULA HARBOUR FISH EXPOSED TO MERCURY.** R. Osborn (rosborn@environcorp.com), M.H. Henning, M. Bock, ENVIRON International Corporation, Portland, ME

9:15 **TOXICOLOGICAL IMPLICATIONS OF OCEAN ACIDIFICATION ON MARINE BIVALVES, BASED ON FREE METAL ION ACTIVITY MODELING**. William E. Robinson (William.Robinson@umb.edu) and Marianna Nappi, University of Massachusetts Boston, Environmental, Earth and Ocean Sciences Department, Boston MA

9:35 **EVOLUTION OF THE TOXIC RESPONSE.** Emily Monosson (emonosson@verizon.net) PO Box 329, Montague MA 01351

9:55 **BREAK**

10:15 SESSION 6
OTHER TOPICS IN ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY (Peg Pelletier, Session Chair)

10:20 **POPULATION-LEVEL EXPERIMENTS FOR POPULATION-LEVEL RISK ASSESSMENT: AN EXAMPLE USING THE OPOSSUM SHRIMP *AMERICAMYSIS BAHIA***. J.S. Grear (grear.jason@epa.gov), D. Borsay Horowitz and R. Gutjahr-Gobell, U.S. EPA, Atlantic Ecology Division, Narragansett, RI 02882

10:40 **ECOSYSTEM SERVICES – AN EMERGING DIRECTION FOR THE U.S. EPA**. Walter J. Berry (berry.walter@epa.gov) and W.R. Munns, Jr., U.S. EPA, Atlantic Ecology Division, Narragansett, RI 02882

11:00 **GULF OIL CRISIS.** Jack Barclay (j.barclay@att.net), University of Connecticut, NRME Wild Conservation Research Center, 1376 Storrs Road, U-87, Storrs, CT.

11:20 **SETAC NA**

11:40 **NAC SETAC Student Awards**

12:00 **ADJOURN MEETING**

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

UPCOMING NACSETAC EVENTS

September 30, 2010
STATISTICS FOR ENVIRONMENTAL SCIENTISTS SHORT COURSE
Doyle Conservation Center
464 Abbott Avenue
Leominster MA 01453

June 8-10, 2011
17TH NACSETAC ANNUAL MEETING & SHORT COURSE
Hilton Garden Inn Freeport
5 Park Street
Freeport, ME 04032

November 7-11, 2010
SETAC NORTH AMERICA 31ST ANNUAL MEETING
Oregon Convention Center
Portland, Oregon

PLATFORM SESSION ABSTRACTS

SESSION I: ENVIRONMENTAL CHEMISTRY

A RETURN TO HOLISTIC ENVIRONMENTAL STEWARDSHIP THROUGH GREEN CHEMISTRY. Nicholas Anastas (nanastas@poseidonstrident.net), Poseidon's Trident, 83 Sassamon Avenue, Milton, MA 02186.

Green Chemistry is an emerging pandisciplinary field of science dedicated to reducing hazard through informed chemical synthesis. Twelve principles guide this design protocol, which has also been called benign by design or design for the environment. At its core, green chemistry recognizes hazard as a design flaw that must be minimized or eliminated to reduce hazard while maintaining functionality.

Society has historically practiced a more environmentally conscientious lifestyle, using each commodity to its maximum partly because of necessity and partly as a result of an acute appreciation for the environment. Scientists relied on a more holistic, systems-based approach to acquiring knowledge believing that an individual could make better decisions if they were broadly trained in all areas of natural and social sciences as well as the arts. Recycling was a necessity for survival. Only during the latter part of the 20^{th} century did these traditional practices change to a more wasteful, short-term way of thinking.

Green chemistry offers an opportunity to return to a more holistic approach to environmental stewardship by recognizing that complex natural systems require the integration of information from a number of areas of science that have become artificially divided into "specialty areas". This talk will focus on opportunities to return to holistic environmental stewardship through green chemistry can significantly reduce the environmental burden associated with the chemical enterprise.

A SIMPLE DEVICE FOR CONTROLLING pH IN AQUEOUS SOLUTIONS FOR TOXICITY EVALUATIONS. John Williams (jwilliams@aquatecb.com), P.C. Downey, J. Garrison, K. Koch, O. Kunkel, Aquatec Biological Sciences, Inc., 273 Commerce Street, Williston, VT 05495.

Ammonia is a naturally-occurring toxicant found in some municipal or industrial effluents and in some freshwater and marine pore waters. The toxicity of ammonia to freshwater and marine vertebrates and invertebrates varies greatly depending on the form of ammonia present. The form of ammonia present in solutions shifts from an ionic phase (NH_4) at low pH to an un-ionized phase (NH_3) at higher pH levels. The proportion of ammonia in the more toxic un-ionized form (NH_3) increases with increasing pH. Manipulation of pH in toxicity tests can help to distinguish whether ammonia is a dominant toxicant in aqueous solutions.

A client at a municipal treatment plant requested routine 7-day chronic tests to be conducted under reduced pH conditions with concurrent testing performed under ambient conditions. Typical mechanisms for adjusting pH include adjustments with acids (e.g., HCl) to lower pH and bases (e.g., NaOH) to raise pH. Another technique for adjusting pH employs carbon dioxide flow from pressurized systems to create a CO_2-rich environment which decreases pH. Both of these methods have potential draw-backs which will be briefly discussed.

The need for pH control in toxicity tests over a 7-day duration led to some concern about the complications of pH adjustment with acids or bases and also evaluation of potential sources of CO_2 other than commercially available cylinders. A simple and low-cost device was fabricated that utilizes gradual release of CO_2 from freshly uncapped carbonated beverages (seltzer water) to maintain pH levels lower than ambient levels. The system will be described and preliminary data will be presented to highlight the utility and performance of the device with organisms exposed to potentially toxic concentrations of ammonia.

(student) **FLUORESCENCE SPECTROSCOPY AS A RAPID, COST-EFFECTIVE METHOD TO MONITOR AND ANALYZE LOW LEVELS OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS IN ENVIRONMENTAL WATER SAMPLES.** James Killarney

(james_killarney@umit.maine.edu), H. Patterson, Department of Chemistry, University of Maine, Orono, ME 04469

Pharmaceutical and personal care product (PPCP) compounds are contaminants of emerging concern in U.S. water supplies. There is an evident need for cost-effective, rapid monitoring technologies that can detect PPCP's at the low concentrations found in the environment for purposes of modeling and assessment. This study evaluates the use of two different fluorescent spectroscopy techniques to identify and model mixtures of PPCP's in natural water samples. The first technique, synchronous fluorescence spectroscopy (SFS), involves scanning both the excitation and emission sides of the fluorometer simultaneously at an experimentally determined fixed wavelength. Our data demonstrates that we can identify a mixture of 17α-ethynylestradiol, triclosan and caffeine in spiked natural water samples using SFS. The second technique, excitation emission matrix (EEM) spectroscopy, collects a complete fluorescent profile of a sample along both emission and excitation wavelengths. The multi-dimensional spectra generated during EEM spectroscopy is a potential tool for rapid and inexpensive identification and quantification of PPCP contamination in water. Combining EEM spectra with parallel factor analysis (PARAFAC), a multi-way data analysis method, can model multiple complex EEM landscapes into chemically relevant spectral components. An added benefit of both techniques is that there are no separation techniques prior to analysis.

(student) **USING LASER ABLATION ICP-MS TO UNDERSTAND MOOSE WITH BAD TEETH.** Cynthia S. Kendall MacKenzie (cynthia.kendall@smu.ca) and Hugh Broders. Saint Mary's University, Halifax, NS, Canada B3H 3C3.

Mammalian teeth have evolved to enable individuals to capture, handle and process food and, in some species, for self-defense. In animals with permanent dentition, the teeth provide an elemental record of diet and certain environmental conditions or exposures. As such, teeth have been used to study ancient populations, habitat movements, historical contamination, etc. In this study, we use the teeth of Atlantic Canadian moose (*Alces alces*) to determine whether differing environmental conditions among populations can be detected within the teeth of individuals and whether elemental concentration levels may be correlated to declines in dental condition among animals of certain populations. Laser ablation ICP-MS was used to determine the concentration of 17 different elements in tooth enamel hydroxyapatite. Elements known to be either essential or toxic were chosen for analysis. This multi-element analytical technique enabled parallel measurements that were used in chemometric analyses to characterize the dental composition of multiple populations. Elements which may be implicated in the declining dental condition of studied populations as well as the advantages of this method in the context of environmental toxicology are discussed.

SESSION II: LOCAL ISSUES IN RHODE ISLAND

SPATIAL DISTRIBUTION OF TRICLOSAN IN A SEMI-ENCLOSED ESTUARINE EMBAYMENT; GREENWICH BAY, RHODE ISLAND. David Katz (katz.davidr@epa.gov), M. Cantwell, M. Perron, R. Burgess, and K. Ho. U.S. Environmental Protection Agency, Narragansett, RI, 02882.

Triclosan is an anti-microbial agent commonly used in the formulation of many personal care and consumer products. Much of the triclosan used by consumers enters the aqueous waste stream following use and is partially removed in waste water treatment plants (WWTP). However, the portion not removed during treatment enters receiving waters via the plant effluent. Once in the environment, a significant portion of triclosan is adsorbed to particles, removed from the water column, and deposited in sediments. Currently, little information exists on the factors controlling the fate and transport of triclosan in the estuarine environment.

This study aims to determine the spatial distribution of triclosan concentrations in surface sediments of a semi-enclosed embayment in which the input of WWTP effluent is thought to be the primary source of triclosan. A statistically randomized hexagonal grid design was implemented to identify station locations for sampling of sediments. Surface sediments were collected using a Van Veen sediment sampler, extracted and analyzed for triclosan using GC/MS-

EI. Preliminary results indicate that triclosan levels in Greenwich Bay correlate with those of the sediment's total organic carbon percentage. A strong declining trend in sediment triclosan concentrations is observed from the WWTP to the mouth of Greenwich Bay, indicating that it is being rapidly removed from the water column to the sediments of this embayment.

INDICATORS OF ENVIRONMENTAL AND BIOLOGICAL MERCURY CONTAMINATION IN THE NARRAGANSETT BAY (RHODE ISLAND, USA). David L. Taylor (dtaylor@rwu.edu) and Jennifer Linehan**,** Roger Williams University, Department of Marine Biology, Bristol, RI, 02809.

Environmental mercury contamination is of particular concern because it bioaccumulates in aquatic food webs and exposure has deleterious effects on biota, including humans. The potential health risks associated with mercury exposure justifies the development of monitoring programs that link environmental and biological mercury contamination. Sediments collected from the Narragansett Bay, RI (0-2 cm; 51 sites) were analyzed for total mercury (Hg) and methylmercury (MeHg) using atomic-absorption spectrometry and isotope dilution gas chromatography-inductively coupled plasma mass spectrometry, respectively. These data were used within the Geographic Information System to analyze spatial relationships between sediment mercury reservoirs (Hg and MeHg) and: (1) site-specific biogeochemical and abiotic conditions, and (2) neighboring point sources of mercury, land use patterns, and watershed characteristics. Moreover, the utility of estuarine invertebrates and forage finfish as bio-indicators of environmental MeHg pollution were assessed. Sediment mercury concentrations were correlated with total organic carbon (Hg), total area of "urban" land use and human population within a 10 km radius of a site (Hg and % MeHg, respectively), and dissolved oxygen concentration (MeHg and % MeHg). A positive correlation between sediment MeHg levels and the Hg content of bivalves, polychaetes, and finfish was also found. Conversely, zooplankton, gastropod, and macrocrustacean Hg body burdens were not significantly related to environmental MeHg. The effectiveness of estuarine biota as bio-indicators of environmental MeHg contamination is taxon-specific, and is likely influenced by feeding ecology, longevity, and site fidelity.

LOBSTERS AS AN ECOTOXICOLOGICAL RESEARCH MODEL IN NEW ENGLAND COASTAL WATERS. Tim Verslycke (tverslycke@gradientcorp.com) Gradient, 20 University Road, Cambridge, MA 02138 and Ann M. Tarrant (atarrant@whoi.edu) Biology Department, Woods Hole Oceanographic Institution, 45 Water Street, Woods Hole. MA 02543.

The Northeast Coast is the most densely populated costal region in the U.S., and the ratio of watershed drainage to estuary water is relatively small, raising concerns about environmental quality in these waters. Many crustacean species have key ecological functions in New England coastal waters, and some –such as the American lobster- are of significant importance to the New England economy, yet their chemical exposure and the potential impacts of such exposure are largely unknown. Lobsters were recently used as an experimental model for two complementary research projects by our group. In one project, we developed a mechanistic lobster-based *in vitro* assay that can be used to evaluate levels of commonly used pesticides in coastal areas and their potential effects on coastal crustacean populations. A suite of chemicals were screened in the laboratory, and preliminary field validation experiments were conducted in Cape Cod coastal waters. In a second project, we measured gene expression in wild lobsters to evaluate the potential role of environmental stressors in the recent outbreak of epizootic shell disease in southern New England. This work was done as part of a multi-institutional research consortium called the New England Lobster Research Initiative.

SESSION III: CONTAMINATED SEDIMENTS

EFFECTS OF TRICLOSAN ON MARINE BENTHIC AND EPIBENTHIC ORGANISMS M.M. Perron (Monique_Perron@brown.edu), Brown University, Providence, RI, 02912; K.T. Ho, M.G. Cantwell, R.M. Burgess, M.C. Pelletier, D.R. Katz, U.S. EPA AED, Narragansett, RI, 02882.

Triclosan is an anti-microbial and anti-bacterial compound that has been widely used since the 1970s in consumer products, such as toothpaste, deodorant, and shampoo. Due to its

widespread use, triclosan has been detected in various environmental media including wastewater sludge, receiving waters, and sediments. It has been shown that triclosan is acutely toxic to numerous aquatic organisms, but very few studies have been performed on estuarine/marine organisms or benthic organisms. For whole sediment toxicity tests, the sediment dwelling estuarine amphipod, *Ampelisca abdita*, and the epibenthic mysid shrimp, *Americamysis bahia*, are commonly used organisms. In the present study, median lethal concentration values (LC50) were obtained for both of these organisms using water-only and whole sediment exposures. Acute water-only toxicity tests after 96 hours resulted in LC50 values of 73.4 and 74.3 µg/L for the amphipod and mysid, respectively. For the seven day whole sediment toxicity test, LC50 values were 303 and 257 mg/kg (dry) for the amphipod and mysid, respectively. These whole sediment values are equivalent to interstitial water LC50 values of 230 and 190 µg/L for the amphipod and mysid, respectively. In addition to the acute toxicity tests, a simplified food web study with triclosan will be discussed. These data provide some of the first toxicity data for triclosan with marine benthic and epibenthic species.

(student) **BLACK CARBONMEDIATED DESTRUCTION OF NITROGLYCERIN AND RDX BY HYDROGEN SULFIDE: RELEVANCE TO INSITU REMEDIATION.** W. Xu (wenqing.xu@yale.edu), K. E. Dana, and W. A. Mitch, Department of Chemical Engineering, Environmental Engineering Program, Yale University, New Haven, CT 06520

The in-situ remediation of sediments contaminated with explosives, including nitroglycerin and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), is desirable, particularly at bombing ranges where unexploded ordinance (UXO) renders excavation dangerous. Sulfides generated by biological sulfate reduction in sediments are potent nucleophiles and reductants that may contribute to the destruction of explosives. However, moderately hydrophobic explosives are likely to sorb to black carbons, which can constitute 10-30% of sediment organic carbon. In this study, we evaluated whether the black carbons accelerate these reactions or simply sequester explosives from aqueous phase reactions. Using environmentally-relevant sulfide and black carbon concentrations, our results indicated that black carbons accelerated the destruction of both compounds, yielding relatively harmless products on the timescale of hours. For both compounds, destruction increased with sulfide and graphite concentrations. Using sheet graphite as a model for graphene regions in black carbons, we evaluated whether graphene regions mediated the reduction of explosives by promoting electron transfer from sulfides. However, our results demonstrated that the process was more complex. Using an electrochemical cell that enabled electron transfer from sulfides to explosives through the graphite, but prevented nucleophilic substitution reactions, we found that nitroglycerin destruction, but not RDX destruction, could be explained by an electron transfer mechanism. Furthermore, surface area-normalized destruction rates for the same explosive varied significantly for different black carbons, indicating that surface functionality may be important. While black carbon-mediated destruction of explosives by sulfides is likely to be a significant contributor to the natural attenuation of explosives in sediments, a fundamental characterization of the reaction mechanisms involved, and the influence of black carbon surface functional groups on their reactivity is needed to develop a thorough understanding of the process.

SEASONAL PHOSPHORUS DYNAMICS IN THE SURFICIAL SEDIMENT OF SHALLOW TEMPERATE LAKES: A DIFFUSIVE EQUILIBRIUM STUDY. B.A. Lake (bjorn.lake@umit.maine.edu), S.A. Norton, and A. Amirbahman, University of Maine, Orono, ME, 04469.

Phosphorus (P) and iron (Fe) pore-water concentration profiles were inferred temporally in 2009 using diffusive equilibrium polyacrylamide gel samplers in a mesotrophic and eutrophic lake in Maine. The profiles were modeled to determine benthic fluxes and zones of production/consumption in the sediment. The results show that for both lakes, Fe and P exhibit similar patterns. Early in the year, deeper sediments have zones of production which supply the upper sediment with P and Fe. When the oxycline reaches the sediment-water interface (SWI), a large reservoir of reducible P and Fe has accumulated. During hypolimnetic anoxia, initially there is a large flux value of both Fe and P which steadily declines as the stratification period progresses due to the depletion of the solid phase and a lessening of the chemical gradient

caused by hypolimnetic accumulation. The zones of Fe and P production also create chemical gradients that diffuse downward replenishing the solid phases at depth. Vivanite [$Fe_3(PO_4)_2$] and hydroxyapatite [$Ca_5(PO_4)_3(OH)$] are supersaturated in the zones of consumption suggesting these mineral formations are possible sinks of Fe and P. The differences between the two lakes are the size and the proximity to the SWI of the production zone. Also, the eutrophic lake has more evidence of microbial uptake of P and a higher degree of rapid transformations at the SWI.

INITIAL RESULTS OF TWO FIELD DEMONSTRATIONS USING SEDIMITE.™ B. Amos (bamos@exponent.com), C. Menzie, & Susan Kane Driscoll, Exponent, Inc., Maynard MA; U. Ghosh, C. Cardona & S. Kwon, University of Maryland Baltimore County, Baltimore MD; and C. Gilmour, Smithsonian Environmental Research Center, Edgewater, MD.

Two research projects are examining the efficacy of SediMite™ in treating contaminated sediment *in-situ*. Both studies involve the application of SediMite™ to a field demonstration plot contaminated with hydrophobic chemicals, including PCBs, DDx, and methylmercury. The results of a laboratory treatability study with mercury-contaminated sediment from a tidal creek and the results of 2-month post-SediMite™ application monitoring of a PCB-contaminated estuarine wetland are presented.

The mercury-treatibility study reported reductions in concentrations of total and methylmercury in sediment pore waters, and in bioaccumulation of methylmercury by the oligochaete, *Lumbriulus variegatus* in a 14-day sediment/water microcosm study. SediMite™ treatment reduced bioaccumulation by roughly 2/3 relative to the unamended controls. SediMite™ treatment also increased partitioning of mercury and methylmercury to the solid phase, and reduced methylmercury concentrations in pore waters by more than 90 percent.

The 2-month post-SediMite™ application monitoring reported the presence of activated carbon as deep as 5 cm in treated sediment. In a 14-day bioaccumulation study using *L. plumulosus*, PCB biouptake was reduced approximately 87% in treated sediments over control. Aqueous concentrations of PCB homologs in sediment porewaters, measured by polyoxymethylene (POM) strips, were reduced by 55% to 89%.

SESSION IV: ENERGY AND ENVIRONMENT

OIL SPILL INJURY ASSESSMENT - SOME LESSON LEARNED. David S. Page (dpage@bowdoin.edu), Bowdoin College, 29 Magean Street, Brunswick, ME 04011

The assessment of injury is a key element in all NRDA processes and provides key information input for the inevitable litigation. This paper discusses injury assessment for past oil spill events as related to litigation issue, using examples from past oil spill trials, including the *Zoe Colocotronis* and *Amoco Cadiz* litigations. Scientific study designs for injury assessments must incorporate concurrent sampling for biological and chemical analyses where sampling sites in both oiled and unoiled locations are selected in an unbiased manner. Recovery is defined as "the return to baseline services" which is what the spill zone would be had the spill not occurred. Determination of progress to recovery requires comparisons of data from oiled and comparable unoiled locations. From a defense point of view, scientific studies designed to fairly represent the actual state of the spill zone as a whole are generally most useful because plaintiff studies often focus on a limited number of heavily oiled locations not representative of the spill zone as a whole and ignore non-spill sources of any environmental changes observed.

(student) **ENVIRONMENTAL PERFORMANCES OF CONVENTIONAL GASOLINE AND WOOD-BASED BIOETHANOL IN U.S. NORTHEAST REGION THROUGH LIFE CYCLE ASSESSMENT.** Binod Neupane (binod_neupane@umit.maine.edu) and Anthony Halog. School of Forest Resources, University of Maine, Orono.

A comparative life cycle assessment of conventional gasoline and wood-derived bioethanol is carried out for U.S. Northeast region. We compared the energy consumptions and environmental impacts associated with these fuels in transportation system. The Greenhouse gases, Regulated Emissions and Energy use in Transportation ((GREET) is used to model and compare the performances. The functional unit is defined as one-mile distance traveled by a light

duty truck. Potential environmental impacts considered are global warming potential and acidification potential.

The study results show that wood derived bioethanol, particularly in E85 scenario, has significant environmental merits over conventional gasoline in global warming potential. On the other hand, gasoline performs better in acidification potential impact category. In terms of energy consumptions to convert into liquid fuel, bioethanol consumes higher energy compared to conventional gasoline. Since trees sequester carbon dioxide during growth, global warming potential was found very low (E10) and even negative (E85) in derived bioethanol; whereas application of fertilizers and other chemicals in production and fuel conversion stage caused acidification potential high.

A NEW MODEL FOR INVASIVE SPECIES: URINALMINTUS. Walter J. Berry (berry.walter@epa.gov) U.S. EPA, Atlantic Ecology Division, Narragansett, RI 02882.

Invasive species are a big problem, (I mean come on, they are invading.) so we need to find ways of understanding them. The trouble is that we often don't know much about them. (After all, they are new here.) A popular way of getting funding in situations in which we are theory-rich and data-poor is to construct models. There are several kinds of models. All of them are wrong, but some are useful. In this study we explore the use of the common urinal deodorizing tablet, *Urinalmintus spp.* as a model for the spread of invasive species. Data on the life history of *Urinalmintus,* and several years of data on the species composition of *Urinalmintus* at the EPA laboratory in Narragansett, RI, showed that *Urinalmintus* is a pretty stinky model for invasive species.

SESSION V: ENVIRONMENTAL TOXICOLOGY

(student) **TOXICITY OF DEICING SALT COMPONENTS ON EARLY AMPHIBIAN LIFE STAGES.** S. E. J. Collins (sara.collins@smu.ca) and R. W. Russell, Saint Mary's University, Halifax, Nova Scotia, Canada.

Chemical contamination has been identified as an important factor contributing to worldwide amphibian declines. Road salt is a major pollutant producing elevated chloride concentrations in freshwater systems. Additionally, ferrocyanide anti-caking agents are released from road salt and effects on the environment are poorly understood. Amphibians exhibit low tolerance to salt. Lethal concentrations have been previously determined, but consequences of sub-lethal exposure are unclear. Our purpose is to investigate chronic, sub-lethal NaCl exposure on early developmental amphibian stages as well as determine acute toxicity of cyanide. Chronic toxicity experiments at environmentally significant salt concentrations were conducted on larvae of three species and embryos of five species in the laboratory. Species tested were spotted salamanders, American toads, spring peepers, green frogs and wood frogs. Cyanide acute toxicity experiments were performed on the five species. Chronic salt exposure reduced hatching, increased mortality, and induced developmental and behavioural anomalies. Median lethal concentration values were calculated from cyanide acute toxicity experiments. Results indicate that the chronic effects can inflict detrimental consequences to amphibian populations.

BEYOND THE HAZARD QUOTIENT: CASE STUDY OF RISK ASSESSMENT FOR PENINSULA HARBOUR FISH EXPOSED TO MERCURY. R. Osborn (rosborn@environcorp.com), M.H. Henning, M. Bock, ENVIRON International Corporation, Portland, ME.

The operations of a pulp mill on the shores of Jellicoe Cove in Peninsula Harbour on the north shore of Lake Superior led to the 1985 designation of the harbour as an Area of Concern under the Great Lakes Water Quality Initiative. Elevated levels of mercury in sediment are a primary concern and ecological risk assessment in the harbour suggests that mercury may pose a risk to fish. Comparisons of tissue concentrations to a literature-derived toxicity reference value suggest that reproduction may be impaired in sportfish and bottom-dwelling fish. Hazard quotient analysis predicts that the potential for adverse effects is greatest in the longnose sucker, where

reproductive impairment may propagate to population level impacts. Individual lake trout, walleye and lake whitefish are also predicted to be adversely affected. To better understand the effects on the fish community, we evaluated reproductive and fitness metrics for fish collected from Jellicoe Cove, Peninsula Harbour and Lake Superior as part of Ontario's Sportfish Contaminant Monitoring Program. Male mortality, skewed sex ratios, and decreased fitness have been identified as potential effects endpoints for mercury toxicity in fish. The sex ratios and fitness endpoints were tested for significant correlations with mercury concentrations in fish tissue, as well as for significant differences across locations. The application of multiple lines of evidence, in addition to a simple hazard quotient, reduces the uncertainty of the risk analysis, leading to more appropriate management decisions.

TOXICOLOGICAL IMPLICATIONS OF OCEAN ACIDIFICATION ON MARINE BIVALVES, BASED ON FREE METAL ION ACTIVITY MODELING. William E. Robinson (William.Robinson@umb.edu) and Marianna Nappi, University of Massachusetts Boston, Environmental, Earth and Ocean Sciences Department, Boston MA 02125-3393

Increasing atmospheric pCO_2 has gradually lowered the pH of seawater from 8.2 in preindustrial times to 8.1 today. Seawater pH could reach < 7.8 by 2100. These pH drops represent a 26 % increase in hydrogen ion concentration [H^+] since preindustrial times, and a 151 % increase by 2100. Biological consequences have primarily focused on reduced biocalcification (corals, pteropods, urchins and bivalves). However, an even more fundamental impact has received little attention – changes in metal speciation, uptake, and blood transport. The equilibrium speciation program MINTEQA2 was used to calculate changes in seawater free ion activity for a number of divalent metals (e.g. Ca, Cd, Cu, Ni, Zn) under a range of pH values (8.2 to 7.8). While some metals exhibited increases in free ion activity (e.g. Cu^{2+}, Zn^{2+}), metals that are already predominantly present as free metal ion (e.g. Ca^{2+}) or that are complexed by chlorides (e.g. Cd^{2+} or Ni^{2+}) showed little change. The facilitated uptake of these latter metals by marine bivalves is therefore unlikely to change. However, acid-base imbalance may increase the concentration of free metal ions in bivalve hemolymph, and reduce the concentrations of metals bound to the major metal transport protein, Histidine-rich Glycoprotein. Preliminary Cd titrations of *Mytilus edulis* blood plasma support this prediction.

EVOLUTION OF THE TOXIC RESPONSE. Emily Monosson (emonosson@verizon.net) PO Box 329, Montague MA 01351

Toxicology has deep evolutionary roots. However practitioners seldom pause to consider the evolutionary origins. Even as ecologists, immunologists, medical scientists and others now benefit from more deeply understanding their sciences – toxicologists are just beginning unravel the origins of the toxic response. Currently, evolutionary toxicology is focused on micro- or rapid-evolution in response to high, local concentrations of contaminants. Yet by gathering the work of toxicologists who have begun to use genomics and proteomics to trace toxic response mechanisms from complex metabolic detoxification systems (e.g. DNA repair, antioxidants, CYPs, metal binding proteins) to the blood brain barrier and integrating their findings with relevant work by geologists, biochemists, microbiologists, physiologists, evolutionary biologists and others, we might better understand the evolutionary history of toxicology which in turn may provide insight into current and future problems in toxicology. Using ultraviolet B (UVB) as an example, this presentation will trace the evolution in light of UVB.

SESSION VI: OTHER TOPICS IN ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY

POPULATION-LEVEL EXPERIMENTS FOR POPULATION-LEVEL RISK ASSESSMENT: AN EXAMPLE USING THE OPOSSUM SHRIMP *AMERICAMYSIS BAHIA*. J.S. Grear (grear.jason@epa.gov), D. Borsay Horowitz and R. Gutjahr-Gobell, U.S. EPA, Atlantic Ecology Division, Narragansett, RI 02882.

Most observations of stressor effects on marine crustaceans are made on individuals or even-aged cohorts. Results of these studies are difficult to translate into ecological predictions,

either because life cycle models are incomplete, or because stressor effects on mixed age populations may differ from those observed in cohort studies. This problem is evident in several important environmental applications of population ecology, including ecological risk assessment of chemicals and futures analyses of ocean acidification. In particular, investigators have acknowledged the need for life cycle approaches in predicting adaptive responses to changing environments. To address this need, we developed an observational scheme that allows estimation of stage-specific vital rates (e.g., juvenile survival, adult survival, fecundity) from observations of mixed age *Americamysis bahia* populations. We used this system to examine life cycle responses to four levels of resource limitation (i.e., feeding rates), which is an oft-cited complication in applied population ecology. Based on our analysis, more than 95% of the treatment effect on population growth rate was due to changes in adult survival. However, we also detected complex compensatory responses, such that impairments in one part of the life cycle were partially offset by improvements in other vital rates. This contrasts with our cohort-based results, where resource effects on each vital rate were always positive. Our study suggests that emphasis in stressor-response studies on early life stages and even-aged cohorts may miss important demographic responses and should be augmented by observations of intact populations, especially as methods such as ours become more available.

ECOSYSTEM SERVICES – AN EMERGING DIRECTION FOR THE U.S. EPA. Walter J. Berry (berry.walter@epa.gov) and W.R. Munns, Jr., U.S. EPA, Atlantic Ecology Division, Narragansett, RI 02882

Forty years ago the United States Environmental Protection Agency (U.S.EPA) was formed to “protect human health and the environment”. In those days the environment was being severely, and obviously, degraded by any number of pollution inputs, and it was clear that a healthy environment was essential to our survival. Today many of the stressors on the environment are not so obvious, and there is a call for more explicit accounting of the benefits and costs of environmental protection. In recognition of this new reality many governmental and non-governmental agencies have shifted emphasis from environmental protection for its own sake, to environmental protection to maintain the services which the environment provides. These are referred to as ecosystem services. One of the programs in the U.S.EPA that has adopted the ecosystem services paradigm is the Ecosystem Services Research Program (ESRP). The vision of the ESRP is to transform the way we understand and respond to environmental issues by making clear the ways in which our choices affect the type, quality, and magnitude of the services we receive from ecosystems – such as clean air, clean water, productive soils and generation of food and fiber. The ESRP is reaching for this vision with a three-pronged approach, emphasizing specific pollutants, certain ecosystem types, and place-based scenarios as case studies.

POSTER SESSION ABSTRACTS

(student) **A VISUAL DOCUMENTATION OF ACUTE TOXICITY IN ZOOPLANKTON.** K. Cushing, Kathryn Frazier (kafrazier@assumption.edu), and J. Hauri, Assumption College, Worcester, MA 01609.

Ceriodaphnia dubia and *Daphnia magna* are common aquatic zooplankton, which have been used extensively in toxicity testing of water samples. Typical toxicity methods provide information on whether a sample displays acute and chronic toxicity, but do not specify which contaminant caused the toxicity. Additional procedures such as toxicity identification evaluation (TIE) can be performed to determine the class of contaminant responsible for toxicity, but at the cost of additional time and resources. Our study investigates whether visual changes in zooplankton during acute toxicity tests can indicate the type of contaminant that is responsible for the zooplankton mortality. Acute toxicity tests were run on both *C. dubia* and *D. magna* exposed to various contaminants, including metals (lead, chromium, zinc, silver) organics (acetone, benzene, toluene, dichloromethane), pesticides (Irgasan, Imazapyr), ionic liquids (Et_2ImBr^-, and EtMeI), sodium chloride, and methanol each within a 48-hour period. Physical changes to the zooplankton from the contaminant exposure were visually documented. Physical changes to the zooplankton could be seen when the mechanism of action for the contaminants disrupted the cell membrane, molting process or caused dehydration of the cells. *Ceriodaphnia dubia* was more reliable than *Daphnia magna* for determining type of contaminant in toxic water samples, however more research is needed to determine whether visual documentation of acute toxicity in zooplankton could replace standard toxicity identification evaluations for determining the type of contaminant responsible for toxicity.

(student) **USING FISH SCALES AS NON-LETHAL BIOSENSORS OF SURFACE WATER CONTAMINANTS.** Daniel G. Skall (Daniel.Skall@umit.maine.edu), University of Maine, Orono, ME 04469; and A.A. Elskus, U.S. Geological Survey, Aquatic Toxicology Section, Orono, ME.

There is great need for non-lethal, biologically relevant screening tools for assessing the effects of surface water contaminants on threatened or endangered fish species. Typical screening procedures are highly invasive or lethal to the fish. Recent studies show that fish scales biochemically respond to a range of contaminants. I hypothesize that fish scales can serve as non-lethal, biologically relevant, rapid biosensors of fish response to contaminants. In preliminary experiments, I determined that the pollutant biomarker, cytochrome P4501A (CYP1A)) is 1) inducible in scales of Atlantic salmon (*Salmo salar*) parr aqueously exposed to polychlorinated biphenyls and polynuclear aromatic hydrocarbons, and 2) is expressed in the epidermal covering of these scales, demonstrating that a fish scale biosensor is feasible. My next step is to establish quantitative (real-time) reverse-transcriptase polymerase chain reaction (qRT-PCR) assays to detect fish scale response to three contaminant classes: metals (mercury), endocrine disruptors (ethinyl-estradiol), and pharmaceuticals (fluoxetine) using scale metallothionein (MT) mRNA, estrogen receptor (ER) mRNA, and CYP1A mRNA, respectively, as endpoints. A non-lethal fish biosensor would allow researchers and managers to determine if endangered fish species are being exposed to contaminants, in what part of their geographic range, and, for diadromous fishes, whether exposure is occurring during migration to-, or return from-, the sea. Support: USGS and the Senator George J. Mitchell Center for Environmental and Watershed Research 06HQGR0089

(student) **SYNERGISM AND ANTAGONISM IN TOXICITY OF MIXTURES OF PHARMACEUTICALS TO *DAPHNIA MAGNA*.** Pooja Shakya (pooja.shakya@trincoll.edu), Richard S. Kim and Alison J. Draper, Environmental Science Program, Trinity College, Hartford, CT 06106.

Pharmaceuticals escape wastewater treatment and contaminate aquatic environments; there is increasing concern about the exposure of aquatic organisms and the combined toxicity of this complex mixture of chemicals. Four human pharmaceuticals were chosen for this study: all are water-soluble and thus, complications of solvent effects are eliminated, and all are commonly

used in the U.S. and have been detected in the aquatic environment. A 48-hour motility assay of <24 hour-old *Daphnia magna* neonates was used to examine the effects of a mixture of commonly-used pharmaceuticals. LC_{50} and NOAEL concentrations of propranolol, metoprolol, terbualine, and metformin were estimated. *Daphnia* were then exposed to all possible combinations of these drugs, all at their NOAEL concentration. Synergy and antagonism were observed in these mixtures. Metformin and metoprolol together (but not separately) were synergistic with propranolol, additionally, terbutaline and propranolol were synergistic, but the addition of either metformin or metoprolol to the mixture antagonized the combined toxicity of the terbutaline/propranolol mix. None of these relationships would be predicted by the drugs' mechanism of action in humans. Frequent use of pharmaceuticals by consumers coupled with imperfect methods of wastewater treatment will likely increase pharmaceutical residue in the aquatic environment. Future experiments will be aimed at determining the mechanism of drug interactions observed in this study.

U.S. EPA WILDLIFE DATABASE: A PUBLIC RESOURCE FOR ENVIRONMENTAL QUALITY INFORMATION. Melissa Hughes[a] (hughes.melissa@epa.gov), David Bender[a], Jane Copeland[b], Marguerite Pelletier[c], Anne Kuhn[c], and Diane Nacci[c]. [a]Raytheon Corporation and [b]SRA International, on contract to US EPA, Narragansett, RI 02882; [c]U.S. Environmental Protection Agency, Narragansett, RI, 02882.

U.S. EPA Office of Research and Development (ORD) is conducting research on the risks of mercury (Hg) to top level predators, such as fish-eating birds and mammals. Related research supported by ORD, EPA Region 1, and the U.S. Geological Service supports the development of the MERGANSER (Mercury Geospatial Assessments for the New England Region) model, which links atmospheric Hg deposition and ecosystem features to predict Hg in freshwater fish consumed by wildlife and humans. Common goals for these projects require comprehensive information on environmental characteristics and quality. To address these needs ORD has developed a publically accessible 'Wildlife Database' (http://oaspub.epa.gov/aed/wildlife.search), containing data integrated from national, regional and state-sponsored environmental monitoring programs, academic and conservation organization researchers in the northeastern United States, Wisconsin and Canada. Almost 8800 sites from these various sources have been linked via lake name and location with watershed and lake characteristics, water and sediment chemistry data, and fish contaminant concentration data, to facilitate their integration into geographic information systems for analysis and display. EPA's Wildlife database provides an important and unique resource to support research and the communication of research results with state, regional, and national decision makers about contaminants, such as Hg, and their risks to ecosystems and human health.

(student) **MERCURY ACCUMULATION IN BRAIN AND MUSCLE TISSUES OF BLUEFISH (*POMATOMUS SALTATRIX*) AND TAUTOG (*TAUTOGA ONITIS*).** Nichole L. Ares and David L. Taylor (dtaylor@rwu.edu), Roger Williams University, Department of Marine Biology, Bristol RI 02809.

Mercury (Hg) is a toxic environmental contaminant that negatively affects human health, and exposure occurs mainly through fish consumption. Previous research has been dedicated to measuring Hg levels in muscle filets of edible fish, including the bluefish (*Pomatomus saltatrix*) and tautog (*Tautoga onitis*). While Hg contamination in the muscle tissue of these species has been reported, there is little information on Hg concentrations in other tissues, e.g., brain and liver. The objectives of this investigation were to: (1) examine Hg bioaccumulation in brain and muscle of bluefish and tautog, and (2) evaluate the relationship between Hg levels in the two tissue types. From June to August 2007-2009, target fish were collected from the Narragansett Bay (RI, USA), and total Hg was measured in excised muscle and brain tissue using combustion atomic-absorption spectroscopy (ppm dry wt). For both species, muscle and brain Hg concentrations were positively correlated with fish length (Blue: R^2=0.110, n=7; Taut: R^2=0.256, n=17), indicating that the Hg bioaccumulates in both tissues. There was also a positive correlation between muscle and brain Hg concentrations for both target fish (Blue: R^2=0.868, n=7; Taut: R^2=0.468, n=17). Among these relationships, tautog experienced elevated brain Hg concentrations relative to bluefish, which can be attributed to this species greater age-at-catch;

hence tautog had a protracted period in which they accumulated Hg. Future research will include the analysis of target fish livers, as well as the possible role of selenium in mitigating the toxic effects of Hg.

CYTOCHROME P450 2AA GENES IN ZEBRAFISH (DANIO RERIO): EXPRESSION OF CYP2AA1 AND CYP2AA2 IN RESPONSE TO PHENOBARBITAL-TYPE INDUCERS. Akira Kubota (akubota@whoi.edu)[1], ACD Bainy[1,2], BR Woodin[1], JV Goldstone[1], JJ Stegeman[1], [1]Biology Department, Woods Hole Oceanographic Institution, Woods Hole, MA, 02543; and [2]Departamento de Bioquímica, Universidade Federal de Santa Catarina, Florianopolis, SC, 88040-900, Brazil.

Understanding the roles of cytochrome P450s (CYP) in zebrafish is important to the use of this non-mammalian model in toxicological, pharmacological and carcinogenesis research. The CYP2 gene family is the largest and most diverse in zebrafish. Cloning new genes based on partial sequence similarity to mammalian CYP2Bs identified a new subfamily, CYP2AA. Expression of CYP2AA1 and CYP2AA2 was examined in different tissues of adult fish treated with phenobarbital (PB) and 5-pregnen-3β-ol-20-one (pregnenolone), activators of mammalian pregnane-X-receptors (PXR), and 1,4-bis-[2-(3,5-dichloropyridyloxy)]-benzene (TCPOBOP), an activator of mammalian constitutive androstane receptor. Zebrafish Cyp2aa1 mRNA is highly expressed in kidney, while Cyp2aa2 is expressed in liver, kidney, spleen, ovary and intestine, suggesting differing roles in biotransformation of exogenous and/or endogenous compounds. CYP2AA1 expression was increased by pregnenolone in liver and intestine, and also by TCPOBOP in intestine. CYP2AA2 was induced by pregnenolone and TCPOBOP in both liver and intestine, and also by PB in intestine. The induction of CYP2 genes is the first concrete evidence for a PB-type response in fish, and as zebrafish lacks the constitutive androstane receptor, suggests involvement of PXR. We have uncovered 10 CYP2AA genes in zebrafish implying multiple functions of this subfamily. (NIH grants R01-ES015912 and Superfund Research Program 5-P42-ES007381)

(student) **OCCURRENCE AND TRANSPORT OF PBDE, TRICLOSAN, AND ALKYLPHENOLS IN AN URBAN ESTUARY DETERMINED USING PE PASSIVE SAMPLERS.** Victoria P. Sacks (vpsacks@gso.uri.edu) and R. Lohmann. University of Rhode Island Graduate School of Oceanography, Narragansett, RI 02882.

Polyethylene (PE) passive samplers are cheap, efficient tools used to detect organic contaminants and have been widely used to measure hydrophobic organic compounds (HOCs). Emerging contaminants such as triclosans, alkylphenols (APs), and polybrominated diphenyl ethers (PBDEs) are of increasing concern as they leach into the environment, and simple efficient ways to measure their occurrence is needed. In this study, PE-water partition coefficients were determined experimentally for triclosan (TCS), n-nonylphenol (n-NP), n-octylphenol (n-OP), t-octylphenol (t-OP), and BDEs- 28, 47, 49, 99, 100, 153, 154, 183 at a range of temperatures and salinities. For apolar HOCs, PE-water partition coefficients correlate with octanol-water partition coefficients. For polar contaminants (TCS, APs), this is not the case. Log-scale PE-water equilibrium partitioning coefficients (log K_{PEw}s) were determined: TCS (3.4), MTCS (3.9), n-NP (3.9), n-OP (3.7), t-OP (3.6). PBDEs will more strongly partition into PE and log K_{PEw} values closely relate to log K_{ow} values (BDE 28=5.94; 47=6.81; 99=7.32; 100=7.24; 153=7.90; 154=7.82; 183=8.27). In 2009, PE samplers were deployed in surface and bottom waters at eight locations in Narragansett Bay, RI (NB). Deuterated performance reference compounds were impregnated in PE samplers prior to deployment to assess uptake equilibrium. Preliminary results show low concentrations of TCS and APs in NB waters (< 3 ng/L), and of PBDEs (ng/L). Spatial trends as well as surface/bottom gradients will be presented.

(student) **FOOD CONTAMINATION: ANALYSIS FOR MERCURY AND COCKROACH ANTIGEN IN FOODS.** Richard S. Kim (richard.kim@trincoll.edu) and Alison J. Draper. Interdisciplinary Science Program, Trinity College, Hartford CT 06106

Three possible food contaminations were examined: mercury in tunafish, mercury in cereal bars and cockroach antigen in ground coffee. Mercury bioaccumulates in tuna and other large oily fish and because mercury is used as a catalyst in one method of high-fructose corn

syrup manufacture, there is concern that this mercury leaches into foods. The possibility of allergy to cockroach antigen in pre-ground coffee was raised in a recent interview of entomologist Doug Emlen on National Public Radio. Food products were purchased from Hartford-area stores representing three socioeconomic levels: Whole Foods, Stop & Shop, and Save-A-Lot. Mercury concentration in canned tuna and cereal bars was measured with a direct mercury analyzer, and a commercial ELISA kit was used to analyze a cockroach antigen in ground coffee. Mercury in tuna was consistent with published levels, and white albacore tuna, the most expensive variety, had the highest mercury concentration. Very low levels of mercury were found in the fruit filling of cereal bars. Cockroach antigen in all coffee samples was undetectable. Although the results of this study were unsurprising, food contamination continues to be a source of concern, especially for vulnerable populations such as children.

EVALUATION OF BIOGEOCHEMICAL VARIABLES AFFECTING DISTRIBUTIONS OF MULTIPLE METAL ION CONCENTRATIONS IN BOSTON HARBOR. Z.Dong (zdong@hsph.harvard.edu), C.G.Lewis, R.M.Burgess, B.Coull, J.P.Shine. Exposure, Epidemiology and Risk Program, Department of Environmental Health, Harvard School of Public Health, 401 Park Drive, Boston, MA 02215.

Free metal ion concentrations ([Me^{2+}]) have been shown to be better predictors of bioavailability to aquatic organisms than total dissolved metal concentrations. Additionally, interactions among multiple metals can affect speciation due to metal-metal competition for binding sites on organic and inorganic ligands. These competition effects are poorly understood in part due to a lack of appropriate techniques for measuring [Me^{2+}]. In this work, we explored the interrelations among free metal ion concentrations for five metals (i.e., Cu, Zn, Cd, Pb, and Ni), measured biweekly for ten months at five inshore locations in Boston Harbor using an in-situ equilibrium-based multi-metal free ion sampler, the 'Gellyfish'. In addition, we examined the effects of biogeochemical variables (including pH, antecedent rainfall, organic carbon, total dissolved metal) on spatial and temporal variability in speciation, stratified by season. The results revealed highly significant correlations between [Cu^{2+}] and [Zn^{2+}] in the summer, and among [Zn^{2+}], [Ni^{2+}], [Pb^{2+}] and [Cd^{2+}] in other seasons. This work demonstrates the ability of the Gellyfish sampler to generate large [Me^{2+}] datasets, showing the spatial and temporal distribution of bioavailable metals and providing the capability to model the effects of biogeochemical parameters on [Me^{2+}] of multiple metals.

INDUCTION OF *CYP1* GENES AND EFFECTS OF AHR AGONISTS IN *XENOPUS TROPICALIS* TADPOLES. Maria Jönsson (maria.jonsson@ebc.uu.se), Cecilia Berg, Environmental Toxicology, Uppsala University, Uppsala, Sweden; Jared Goldstone, John Stegeman, Biology Department, Woods Hole Oceanographic Institution, Woods Hole, MA.

Four cytochrome P450 1 (CYP1) subfamilies occur in vertebrates: CYP1A, CYP1B, CYP1C, and CYP1D. Many mammals express only CYP1A and CYP1B genes, while fish generally express genes in all four subfamilies. Examination of the *Xenopus tropicalis* genome revealed one gene in each subfamily. We cloned the four CYP1 cDNAs and subsequently examined expression of the genes in tadpoles exposed to waterborne PCB126, βNF, or indigo. We also examined effects of PCB126 on expression of PCNA, thyroid system, and stress response genes. PCB126 induced CYP1A, CYP1B1, and CYP1C1 while CYP1D1 induction was unclear; βNF induced CYP1A and CYP1C1, and indigo tended to induce only CYP1A. CYP1 induction by PCB126 was positively correlated with the number of putative DREs in the promoters (0-20 kb upstream). Tadpoles exposed to 1-1000 nM PCB126 showed no morphological defects, but the highest concentration up-regulated PCNA, transthyretin, HSC70, Cu-Zn SOD, and cyclooxygenase 2. This first study of the full suite of CYP1 genes in frogs reveals a CYP1 induction pattern that is similar to that in fish. However, PCB126 seems to cause a weaker CYP1 gene response and a considerably lower toxicity in *Xenopus tropicalis* tadpoles than in fish larvae. (Funding: Carl Trygger's stiftelse, The Swedish Research Council Formas, NIH R01-ES015912, and The Superfund Research Program at Boston University 5-P42-ES007381.)

SETAC NORTH AMERICA 32ND ANNUAL MEETING, BOSTON, MA, NOVEMBER, 2011. Diane Nacci (nacci.diane@epa.gov), U.S. Environmental Protection Agency, Narragansett, RI, 02882, and Erin Bennett, Bioengineering Group.

The Society of Environmental Toxicology and Chemistry North America will hold the 32nd Annual Meeting at the Hynes Convention Center, Boston, MA, USA,13-17 November 2011. As the hosting chapter, we encourage members of the North Atlantic Chapter of SETAC to participate in planning a most excellent meeting.

THE ENCYCLOPEDIA OF EARTH (EoE). Emily Monosson (emonosson@verizon.net)
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The Encyclopedia of Earth (EoE) is an electronic reference about the Earth, its ecosystems, and their interaction with society. It is designed for use by students, educators, scholars and the general public, with content spanning the physical, biological, economic and social aspects of environmental topics. The EoE is an international collaboration that reaches a global audience, providing easy access to authoritative information on environmental issues, the underlying science, and the possible solutions. We have several collections, ebooks and classic articles and "course" readers, including the Environmental Toxicology Reader. One of our goals is to expand EoE coverage of Environmental Toxicology in general. Finally, because we are committed to fostering science communication, we recently developed the Student Science Communication Project for upper level undergraduates and graduate students - which provides an opportunity for students to learn how to write about science for a more general audience.