

PROCEEDINGS



DELAWARE ESTUARY SCIENCE & ENVIRONMENTAL SUMMIT 2013

**“Weathering Change – Shifting Environments,
Shifting Policies, Shifting Needs”**

January 27 – 30, 2013
Cape May, New Jersey

For more information visit www.DelawareEstuary.org

**Partnership for the Delaware Estuary
PDE Report No. 13-01
March 2013**

For more information, please see the conference website at:
http://delawareestuary.org/Science_Environmental

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Delaware Estuary Science and Environmental Summit Overview and Goals

Since early 2005, the Partnership for the Delaware Estuary: a National Estuary Program (PDE), has convened the Delaware Estuary Science and Environmental Summit every two years as a forum to bring together researchers, resource managers, environmental practitioners and educators in a retreat-like atmosphere to share their latest research findings and experiences regarding the Delaware Estuary and River Basin Ecosystem. The event spans 3 days and typically draws more than 250 participants. By gathering experts from diverse science, restoration, resource management and outreach sectors, the Summit helps to bridge the gaps among these sectors and areas of the watershed, thereby facilitating ecosystem-based management and awareness.

Following the first conference in 2005, PDE and partners used the conference proceedings to craft a “White Paper on the Status and Needs of Science in the Delaware Estuary”. The White Paper was then used as a guidance document, capturing top actions and needs. Building on the successful 2005 conference, the Summit was held again in 2007, 2009, 2011 and 2013. In each, more than 100 presentations were given in various types of sessions such as:

- Regular science and management sessions for the presentation of any type of scientific topic relevant to the region;
- Special sessions that address matters of contemporary importance to the region’s scientific and management community;
- Outreach and training sessions on effect science communication
- Thematic sessions and panels that pertain to the central theme of each biennial meeting.

For each summit, a theme was chosen that captured contemporary interests and needs. The following is a list of the themes of past summits:

2005: The State of Science in the Delaware Estuary

2007: Linking Science, Management, and Policy

2009: Planning for Tomorrow's Delaware Estuary

2011: Connections - Land to Sea, Shore to Shore, Science to Outreach

2013: *Weathering Change - Shifting Environments, Shifting Policies, Shifting Needs*

This document consists of the program schedule, abstracts, and notable awards for the 2013 Summit. Proceedings of the 2005, 2007, 2009 and 2011 Summits are available from the PDE website at:

http://delawareestuary.org/Science_Environmental

2013 Statistics

More than 130 presentations were given at the 2013 Delaware Estuary Science and Environmental summit, which breaks down to 81 contributed talks, 7 invited talks and panel presenters, 44 posters, and 20 student presenters.

Abstracts are included here. In addition, in cases where presenters approved sharing of actual oral and poster presentations, these are also furnished as PDF files via the PDE website at http://delawareestuary.org/Science_Environmental.

By all accounts, the 2013 Summit was regarded as a huge success. The quality of the presentations was stellar, and many participants seem to be now saving some of their best work for rollout at this conference instead of other outlets such as national forums. We are grateful to the many participants and sponsors of the 2013 meeting. Contingent of future support, we anticipate convening the 7th Delaware Estuary Science and Environmental Summit in January 2015. Preliminary planning has already begun, including a possible "10 years later" repeat of the 2005 needs assessment that led to the 2006 White Paper.

John Kraeuter - 2013 Recipient of the Delaware Estuary Jonathan Sharp Lifetime Achievement Award

John Kraeuter received the Delaware Estuary Jonathan Sharp Lifetime Achievement Award on January 28th 2013. Serving as the Associate Director at the Haskin Shellfish Research Laboratory, John is well-respected for his work on shellfish, particularly hard clams and this is best embodied in the book he co-edited with Mike Castagna: *Biology of the Hard Clam*. His research has always bent towards the applied side, often directly supporting fisheries and aquaculture. He has served on countless committees locally, regionally and nationally; on which he is particularly known for (1) his reliability (if he says he'll do it, you will rarely have to remind him) and (2) his penchant to play the devil's advocate or to point out the obvious when academics stray from dealing with the problem at hand – "I mean come on folks...". John has served on the PDE Science and Technical Advisory Committee for many years. He has worked tirelessly with the Delaware Estuary and numerous science reports, including the most recent 2012 Technical Report for the Delaware Estuary & Basin, Marine Bivalve Shellfish Conservation Priorities, and Climate Change and the Delaware Estuary.



Delaware Estuary Science & Environmental Summit 2013 Student Presentation Awards

The Partnership for the Delaware Estuary (PDE) thanks all the undergraduate and graduate students who journeyed to Cape May to present their original research findings at the Fifth Delaware Estuary Science & Environmental Summit. Working with our Science and Technical Advisory Committee and the many others who helped to judge student presentations, PDE is pleased to announce the recipients of the student presentation awards. This competition recognizes the important contributions that students make to the environmental sector in our watershed.

Twenty-three students presented (12 oral, 11 posters) this year. Our intent is to select the most outstanding oral presentation and the most outstanding poster presentation. The judges had their work cut out for them as the overall quality of the student talks and posters was high. This year, we had a tie in the scoring for the best oral presentation. Therefore, three students will be given certificates acknowledging their awards and will be invited to contribute articles on their research to [Estuary News](#). ***All students should be commended for their outstanding contributions and presentations!***

Best Student Talk Award (a tie)

Elanor Stevens, University of Maryland

Does the Macroinvertebrate Community of a Restored Delmarva Bay Mimic a Natural Bay?

Co-authors: Lauren E. Culler, Alan Leslie, Robert F. Smith

Daniel Tomaso, Penn State University

Estimates of Net Community Production in the Upper Delaware Estuary.

Co-author: Raymond G. Najjar

Best Student Poster Award

Michael Lang, Villanova University

Denitrification and Nitrous Oxide Production in Tidal Marshes Along the Salinity Gradient in the Delaware River Estuary: Implications of Salt Water Intrusion for an Important Ecosystem Service

Co-author: Nathaniel B. Weston

The Best Oral and Poster winners are receiving:

- A Certificate of Excellence from the Estuary Program (nice for resumes),
- An invitation to contribute a feature article on their research to a future issue of *Estuary News*, which has a circulation in the thousands and can be referenced as a non-peer reviewed publication (great exposure), and
- Acknowledgement in the forthcoming conference proceedings report and website.

We anticipate that the 6th Delaware Estuary Science and Environmental Summit will be held in two years (January 2015.) We look forward to another strong showing from students then.

Thank you to everyone for your support of students at this meeting, and every day!

Danielle Kreeger, PDE Science Director

Angela Padeletti, PDE Science Coordinator

Delaware Estuary Science & Environmental Summit 2013

Weathering Change – Shifting Environments, Shifting Policies, Shifting Needs

Program & Abstract Corrections

Monday, January 28th

- Page 4 Agenda at a Glance – Monday, January 28th, Dinner begins at 7:00 p.m.
- Page 6 New poster aligned with Session 2 – Donald B. Boesch, “MADE CLEAR: Maryland and Delaware Climate Change Education Assessment and Research”
- Page 8 Richard Greene is a 2nd author of the talk by William Burton
- Page 9 Sessions 5 – 4:15 p.m., Sari Rothrock is the only author/speaker
- Page 9 Session 4 – Dee Durham has withdrawn poster #30 from the Summit
- Page 9 New poster aligned with Session 4 – Mingshun Jiang, “Development of a Hydrodynamic and Water Quality Model in the Delaware River and Bay system”

Tuesday, January 29th

- Page 10 Session 7 – 10:00 a.m., Jill Lipoti, Ph.D., Director, Division of Water Monitoring and Standards, New Jersey Department of Environmental Protection is speaking in place of Michele Siekerka
The full session description is: Extreme weather events highlight the dynamic, changing environmental conditions in the Delaware Estuary and River Basin. Yet the traditional management paradigm is to manage and restore in the context of historical conditions. A panel of some of the Delaware Estuary’s leading environmental officials will present and discuss their agencies’ strategies for adapting to shifting environments, policies, and needs.
- Page 12 New poster aligned with Session 10 – Angela Padeletti, “Comparative analysis of coastal wetland health in the Delaware Estuary assessed using rapid methods”
- Page 13 Session 12 –4:45 p.m., Gerald Bright is speaking in the place of Doug Janiec with the talk “Does Stream Restoration Really Create Habitat? – Quantifying Instream Habitat Using Two-dimensional Hydrodynamic Analysis”

Wednesday, January 30th

- Page 16 Session 17 – 11:45 a.m., Doug Janiec is speaking in the place of Gerald Bright with the talk “Fight or Flee: The Sea Level Rise Scenario – An Alternative is Adaptation”

Note: Some formatting was lost in the abstract importation process. These included issues with italics, subscripts/superscripts, and special characters. We attempted to identify and correct these format errors, but we apologize for any remaining issues.

Great Memories from the 2011 Delaware Estuary Summit



Welcome to the Delaware Estuary Science and Environmental Summit!

On behalf of the Partnership for the Delaware Estuary (PDE), welcome to Cape May and the 5th biennial Delaware Estuary Science & Environmental Summit!

So much has happened since our last Summit in 2011, making “Weathering Change” a particularly appropriate theme. There are volumes of great new scientific information to share, like information on over 50 indicators that are part of the *Technical Report on the Estuary and Basin* and from new wetland monitoring and assessment work just starting to produce results. There are also new examples of innovative tools and tactics to help make the science more applicable to people and communities, like the WeTable, volunteer mussel survey training, and living shorelines.

Our first Summit in 2005 was held on the heels of the Athos II oil spill – the biggest man-made disaster in the Estuary in recent times. This year’s summit comes on the heels of perhaps the worst natural disaster in the Mid-Atlantic in recent times. Hurricane Sandy, following on two years of extraordinarily warm and wet weather, reminds us of the challenges ahead, and that climate change may be the defining issue of our time. Appropriately, an entire session in the Summit program is devoted to “Changing Conditions and Shifting Baselines” with additional related talks peppered throughout the program.

This year’s program is full of experts sharing work across our region, as well as a number of guest speakers sharing work and lessons learned from other places and sectors – ranging from market research on climate change, to estuary functions and fisheries in the Chesapeake Bay. The Summit also serves important arena for us to share and discuss PDE’s priorities for the future. This year, in a special live-polling session, we will preview elements of a new 5-year Strategic Plan for PDE for your feedback.

We look forward to sharing our work, learning about your work, and having all of the discussion and exchange that makes the Summit so unique and valuable!



Jennifer Adkins
Executive Director
Partnership for the Delaware Estuary



Jennifer Adkins is the executive director at the Partnership for the Delaware Estuary, A National Estuary Program, where she leads a team of science and outreach professionals devoted to improving the health of the tidal Delaware River and Bay and its tributaries.

Jen has been active in conservation planning and collaboration in the Mid-Atlantic region for nearly 20 years, working for The Nature Conservancy in Delaware, the Land Trust Alliance, and the Brandywine Conservancy, before joining the Partnership in 2005.

She is a graduate of the University of Delaware with a Master of Public Administration degree specializing in environmental and energy management, and a Bachelor of Science degree in economics.

Notes

5th Biennial Delaware Estuary Science & Environmental Summit

Weathering Change – Shifting Environments, Shifting Policies, Shifting Needs

The Grand Hotel
Cape May, New Jersey
January 27th – 30th, 2013

Sponsors

- Benefactor**
- New Jersey Department of Environmental Protection
- Patron**
- Delaware Department of Natural Resources and Environmental Control
 - DuPont
 - PSEG Nuclear, LLC
 - U.S. Fish and Wildlife Service
- Contributor**
- Delaware Coastal Programs
 - National Oceanic and Atmospheric Administration
 - Pennsylvania Department of Environmental Protection, Coastal Resources Management Program
 - Rutgers Institute of Marine and Coastal Sciences
- Friend**
- The Academy of Natural Sciences of Drexel University
 - Cardno ENTRIX
 - Citizens United to Protect the Maurice River and its Tributaries
 - Hach Hydromet
 - Matrix New World Engineering, Inc.
 - McCabe & Associates
 - Pennsylvania Sea Grant
 - Philadelphia International Airport
 - Philadelphia Water Department
 - University of Delaware Sea Grant
 - YSI

Agenda at a Glance

Sunday, January 27

5:00 – 8:00 p.m. Registration - *5th Floor*
Networking – *Hemingway’s at the Grand Hotel*

Monday, January 28

8:00 a.m. Registration -*5th Floor*
Continental Breakfast* – *Atrium 1st Floor*

9:00 a.m. Welcome: Jennifer Adkins
Keynote Address: Dr. Victor Kennedy. Shifting Baselines in Mid-Atlantic Estuaries
– *Grand Ballroom 1st Floor*

10:30 a.m. Break

10:45 a.m. Session 1 – The State of the Delaware Estuary and River Basin – *Grand Ballroom 1st Floor*

12:00 p.m. Lunch & Presentation: Clay Sutton. Raptors, Waterfowl, Shorebirds and Water Birds on the Maurice River - *Penthouse Ballroom 5th Floor*

1:30 p.m. Concurrent Sessions
Session 2 – Changing Conditions, Shifting Baselines -*Grand Ballroom A 1st Floor*
Session 3 – Urban Environmental Education -*Grand Ballroom B 1st Floor*

3:00 p.m. Break

3:15 p.m. Concurrent Sessions
Session 4 – Water Quality and Quantity -*Grand Ballroom A 1st Floor*
Session 5 - Community Based Education: Planning for the Future -*Grand Ballroom B 1st Floor*

5:15 p.m. Session 6 - Posters & Networking - *Penthouse Ballroom 5th Floor*

6:30 p.m. Dinner – *Penthouse Ballroom 5th Floor*

7:30 p.m. Special Session: Charting the Course for an Evolving Partnership for the Delaware Estuary (Interactive Polling Activity) - *Penthouse Ballroom 5th Floor*

Tuesday, January 29

8:00 a.m. Registration -*5th Floor*
Continental Breakfast* – *Atrium 1st Floor*

9:00 a.m. Plenary: Jim Uphoff. Managing Land Use, Fish Habitat, and Fisheries in a Large and Diverse Estuary – *Grand Ballroom 1st Floor*

10:00 a.m. Session 7 – Panel: Managing Shifting Environments in the Context of Shifting Policies & Shifting Needs - *Grand Ballroom 1st Floor*

10:45 a.m. Break

11:00 a.m. Concurrent Sessions
Session 8 – Living Resources - *Grand Ballroom A 1st Floor*
Session 9 – Monitoring & Assessment - *Grand Ballroom B 1st Floor*

12:15 p.m. Lunch & Presentation: Eric Eckl. Taking Their Temperature: What Market Research Says About “Climate Change” and Related Terms- *Penthouse Ballroom 5th Floor*

1:30 p.m. Concurrent Sessions
Session 10 – Wetlands & Other Habitats -*Grand Ballroom A 1st Floor*
Session 11 – Water (and Weather) Words that Work (Part 1) - *Grand Ballroom B 1st Floor*

3:15 p.m. Break

3:30 p.m. Concurrent Sessions
Session 12 – Restoration, Enhancement & Conservation -*Grand Ballroom A 1st Floor*
Session 13 – Water (and Weather) Words that Work (Part 2) -*Grand Ballroom B 1st Floor*

5:15 p.m. Session 14 - Posters & Networking - *Penthouse Ballroom 5th Floor*

7:00 p.m. Dinner (on your own)

Wednesday, January 30

- 8:00 a.m. Registration -5th Floor
Continental Breakfast* – Atrium 1st Floor
- 9:00 a.m. Concurrent Sessions
Session 15 – What’s Mud Got to Do With It? - Grand Ballroom A 1st Floor
Session 16 – Ecological Linkages - Grand Ballroom B 1st Floor
- 10:30 a.m. Break
- 10:45 a.m. Concurrent Sessions
Session 17 – Physical Processes -Grand Ballroom A 1st Floor
Session 18 – Collaboration and Communication -Grand Ballroom B 1st Floor
- 12:30 p.m. Lunch - Penthouse Ballroom 5th Floor
- 1:45 p.m. Concurrent Sessions
Session 19 – Innovative Outreach -Grand Ballroom B 1st Floor
Session 20 – Hot Topics -Grand Ballroom A 1st Floor
- 3:00 p.m. Announcements, Awards, and Closing Remarks – Grand Ballroom 1st Floor

**Continental breakfast is provided daily, beginning at 8:00 a.m., in the Atrium outside of the 1st floor Ballroom. If you would like a more substantial breakfast, one can be purchased at Hemingway’s Restaurant at the front of the Grand Hotel. Hemingway’s opens daily at 6:30 a.m.*

Abstracts are available at the registration table and online at: www.DelawareEstuary.org



Detailed Agenda

Sunday, January 27

5:00 p.m. - 8:00 p.m. **Registration - Penthouse Ballroom 5th Floor & Networking - Hemingway's at the Grand Hotel**

Monday, January 28

8:00 a.m. **Registration - 5th Floor & Continental Breakfast – Atrium 1st Floor**

9:00 a.m. **Welcome & Keynote Address**
Grand Ballroom 1st Floor

Jennifer Adkins, Partnership for the Delaware Estuary

Keynote: Dr. Victor Kennedy, University of Maryland
Shifting Baselines in Mid-Atlantic Estuaries

10:30 a.m. **Break**

Session 1 - The State of the Delaware Estuary and River Basin
Moderators: Susan Kilham (Drexel University) and Priscilla Cole (PDE)
Grand Ballroom 1st Floor

Session 1	10:45	Danielle Kreeger, Susan Kilham, Jennifer Adkins, Priscilla Cole	Key Findings from the 2012 Technical Report for the Delaware Estuary and Basin (TREB) and Next Steps	
	11:00	Raymond Najjar, Andrew Ross, Danielle Kreeger, Susan Kilham	Historical Climate Change and Variability in the Delaware River Basin	
	11:15	Desmond Kahn, Russell Allen, Daryl Pierce, Dave Arnold, Jerry Mohler	A Positive Assessment of the Status of the Delaware River American Shad Stock and its Fisheries	
	10:45 a.m.	11:30	John Yagecic, David Sayers	Assessment of Water Quantity and Quality Indicators in the 2012 TREB
	11:45	Lisa Wool, Elizabeth Horsey	From "Sediment" to "What's Mud Got to Do With It": Methods to Make Technical Reports Public Friendly	

Associated Posters:

Kimberly Cole, Charles Bishop, Jennifer Holmes, Michael Mensinger, Kate Marvel, Christina Pinkerton, Robert Scarborough, Drexel Siok, Kenneth Smith, Kelly Valencik, James Wicks. *Delaware National Estuarine Research Reserve: 20 Years Advancing Coastal and Estuarine Conservation, Research and Education* (25)

Justin Schulte, Raymond Najjar. *The Variability of Delaware River Streamflow and its Relationship to Dominant Modes of Climate Variability* (80)

Ron Smith, Rosy Tucker. *Investigating Changes in Land Cover, Habitat and Bird Biodiversity in a Lower Delaware Watershed Town; Haddonfield, NJ from the late 1800s to 2012* (85)

12:00 p.m. **Lunch - Penthouse Ballroom 5th Floor**
Speaker: Clay Sutton, Citizens United to Protect the Maurice River
Raptors, Waterfowl, Shorebirds and Water Birds on the Maurice River

Session 2 - Changing Conditions, Shifting Baselines

Moderators: **Gerald Kauffman** (University of Delaware) and **Jeff Fischer** (USGS)

Grand Ballroom A - 1st Floor

1:30 p.m.
Concurrent Sessions 2 & 3

1:30	Gerhard Kuska	Toward Enhanced Forecasting of Extreme Weather Events in the Mid-Atlantic to Improve Preparation, Response, and Resiliency
1:45	Jim Eisenhardt, Mike Powell, Tony Pratt, Steve Eberbach, Rob Koehert	Coastal Resiliency - Economics for Changing Environment
2:00	George Hall, David Hill	A High-Resolution Study of Tidal Range Changes in the Delaware Bay: Past Conditions and Future Scenarios
2:15	Susan Love, Carl Yetter, Tricia Arndt, Sarah Cooksey, Robert Scarborough, Kelly Valencik	Challenging Tides: Results of Delaware's Sea Level Rise Vulnerability Assessment
2:30	Robert Scarborough, Michael Mensinger, Drexel Siok, Christina Pinkerton, Kenneth Smith, Susan Guiteras, Annabella Larsen, Fred Wurster	Prime Hook NWR - Providing Science for Management
2:45	Andrew Ross, Raymond Najjar	Influences on Subtidal Salinity Variability and Change in the Delaware Estuary

Associated Posters:

Robert Scarborough, Christina Pinkerton, Michael Mensinger, Drexel Siok, Kenneth Smith, Kelly Valencik. *Delaware National Estuarine Research Reserve – Becoming A Sentinel Site for Climate Change Research, Monitoring and Education* (75)

Beth Njiru. *Diminishing Water and Shifting Livelihood Systems Among the Pastoral Communities of Kenya* (69)



Pennsylvania Coast Day is held annually at Penn's Landing in Philadelphia.

Session 3 – Urban Environmental Education <i>Grand Ballroom B - 1st Floor</i>		
1:30	Tom Davidock	Moving Watershed Outreach Upstream: Success Stories in Replicating Innovative Philadelphia Watershed Projects in Upstream Communities
2:00	Demetrius Marlowe, Jim Cummings, Julia VanderWoude	Discovering Our Urban Waterways
2:30	Maryann Helferty	Uniting Artists and Urban Residents for Green Infrastructure Actions
Associated Posters: Joy Best. <i>Environmental Awareness Festival</i> (5) Jeannette Rea-Keywood. <i>4-H Environmental Ambassador Program</i> (74)		
3:00 p.m.	Break	
Session 4 – Water Quality and Quantity <i>Moderators: Tom Fikslin (DRBC) and Tom Belton (NJDEP)</i> <i>Grand Ballroom A - 1st Floor</i>		
3:15	Anthony Aufdenkampe, William J. Ullman	A Novel Approach to Estimating Monthly Salt Marsh Contributions to Oxygen Deficit in the Murderkill Estuary from Hourly Sensor Data
3:30	William Burton, Gregory M DeCowsky	Pilot Study of Polycyclic Aromatic Hydrocarbons in Delaware Estuary Using Passive Diffusion Sampling Technology
3:45	Anastasia Chirnside, Robert Jorgensen, Alison Kiliszek	Assessment of the Impact of Best Management Practices on Surface Water Quality Within a Small Agricultural Watershed
4:00	Robert Hughes, Michael Hewitt	Underground 3D Mine Pool Mapping in the Anthracite Region's Upper Schuylkill River Watershed
4:15	Molly Julian, Altje Hoekstra, Mary Neutz, Amanda Tolino, Gary Schwetz	Clean Waterways in Wilmington – Green Infrastructure Planning and Implementation to Improve Water Quality and Support Public Space
4:30	John Yagecic	Temporally Dynamic Representations of Delaware Basin Continuous Data Sets
4:45	Jeff Fischer, Richard B. Moore	A Spatially Detailed Assessment of Total Nitrogen Loads in the Delaware River Basin
5:00	Gregory Cavallo, Thomas Fikslin, Namsoo Suk, Ronald MacGillivray, Douglas Haltmeier	Assessment of Metals in Estuarine Waters
3:15 p.m.	Concurrent Sessions 4 & 5	

Associated Posters:

Gregory Cavallo, Thomas Fikslin, Namsoo Suk. *Clean Hands Metals Sampling Techniques* (18)

Anastasia Chirnside, Alison Kiliszek. *Demonstration of the Kiliszek Water Quality Indices (Kwqi) Model: Kwqi Calculation Utilizing Water Quality Data from a Small Agricultural Watershed* (24)

Jeffrey Eker, Julia Gross, Jared Novak, Ron Smith. *A Suburban Assessment of Storm Drains; Implications for Non-point Source Pollution, Neighborhood Initiatives and the Education Imperative* (34)

William Ullman, William Gagne-Maynard, Sarah J. Fischer, Yoana G. Voynova. *The Kent County Land Ocean Biogeochemical Observatory: Real-time Hourly Determination of Water Quality in the Delaware Bay Ecosystem* (94)

Jeffery M. Fischer, Ward O. Freeman. *WaterSMART Water-use Studies in the Delaware River Basin* (114)

Mike Haberland, Chasity Williams, Craig McGee. *Naturalizing Dry Detention Basins to Create Water Quality and Pollinator Habitat Benefits* (42)

David Walsh, Josef Kardos, Phil Duzinski, Ramona Stammermann, David Velinsky, Jeff Cornwell, Mike Owens. *Long-term Measurements of Hydrology, Meteorology, and Sediment Oxygen Demand in the Delaware Estuary* (119)

Dee Durham. *Eliminating Plastic Bags & Other Plastics in the Mid-Atlantic* (30)

Luc Claessens, Gerald Kauffman. *Hydro-ecological investigation of legacies in urban stormwater management: towards a holistic strategy for improving water quality* (121)

Session 5 – Community Based Education: Planning for the Future

Grand Ballroom B - 1st Floor

3:15	Ed Lewandowski, Bryan Hall, Carol Bason, Nicole Minni	The weTable: A Tool for Participatory Geospatial Planning
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4:15	Sari Rothrock, Danielle Kreeger, Jennifer Adkins, Laura Whalen, Lisa Wool, David Bushek, Josh Moody	Weathering Change with Communities
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5:15 p.m. **Session 6 – Posters & Networking**
Penthouse Ballroom 5th Floor

7:00 p.m. **Dinner** – *Penthouse Ballroom 5th Floor*

7:30 p.m. **Special Session - Charting the Course for an Evolving Partnership for the Delaware Estuary**
An Interactive Polling Activity
Moderators: Jennifer Adkins (PDE) and James Falk (Delaware Sea Grant)
Penthouse Ballroom 5th Floor

Over the course of the last year, the Partnership has worked with its Board, partners, and staff on the development of a new strategic plan, and to assess the needs for updating the Comprehensive Conservation Management Plan for the Delaware Estuary. Feedback on some of the key results from this work will be sought from Summit participants at this interactive session.

Tuesday, January 29

8:00 a.m.	Registration - 5th Floor & Continental Breakfast – Atrium 1st Floor		
9:00 a.m.	Tuesday Plenary <i>Grand Ballroom 1st Floor</i>		
	Plenary Speaker: Jim Uphoff , Maryland Department of Natural Resources Managing Land Use, Fish Habitat, and Fisheries in a Large and Diverse Estuary		
10:00 a.m.	Session 7 – Panel Managing Shifting Environments: Is a Paradigm Shift Needed? <i>Moderator: Jennifer Adkins (PDE)</i> <i>Grand Ballroom 1st Floor</i>		
	Panel Members: Carol Collier (DRBC), Sarah W. Cooksey (DNREC, Delaware Coastal Program), Shawn M. Garvin (US EPA, Region 3), Kelly Heffner (PA DEP), Michele N. Siekerka, Esq. (NJ DEP). Extreme weather events highlight the dynamic, changing environmental conditions in the Delaware Estuary and River Basin. Yet the traditional management paradigm is to manage and restore in the context of historical conditions.		
10:45 a.m.	Break		
11:00 a.m.	Session 8 – Living Resources <i>Moderators: Greg Breese (USFWS) and David Bushek (Rutgers)</i> <i>Grand Ballroom A - 1st Floor</i>		
	11:00	David Bushek, Daphne Munroe	Oyster Mortality and Disease in Delaware Bay: Impact and Recovery Following Hurricane Irene and TS Lee
	11:15	Jeffrey C. Cole, Kelly O. Maloney	Improving Ecological Flow Science in the Main Stem Delaware River: The Decision Support System in the Delaware River
	11:30	Danielle Kreeger, Melanie Mills, Lance Butler, Roger Thomas, Priscilla Cole	Importance of Freshwater Mussels for Water Quality in the Tidal Delaware River: Preliminary Findings from Quantitative Surveys in 2012
	11:45	Sixto Portilla	Juvenile hard clam survival in response to different dietary fatty acids during seasonal temperature decline
Concurrent Sessions 8 & 9	Associated Posters: Eleanor Bochenek, Michael DeLuca, Steven Carnahan, Lisa Calvo, Brenda J. Landau. <i>The Horseshoe Crab (<i>Limulus polyphemus</i>) Enhancement Initiative</i> (8) Steven Pearson, Harold Avery, James Spotila. <i>Competition Between Red-bellied Turtles (<i>Pseudemys rubriventris</i>) and Invasive Red-eared Slider Turtles (<i>Trachemys scripta elegans</i>)</i> (109) Roger Thomas, Melanie Mills, Danielle Kreeger, Priscilla Cole, Lance Butler. <i>Distribution of Freshwater Mussels (<i>Unionidae</i>) in Relation to Depth in the Tidal Delaware River</i> (112) Dave Jones, Brenda Landau, Matt Neuman. <i>Commercial Production of Ribbed Mussels</i> (122)		

Session 9 – Monitoring & Assessment

Moderators: *Jessica Sanchez (DRBC) and Jim Eisenhardt (CardnoENTRIX)*

Grand Ballroom B - 1st Floor

11:00	John Callahan, Kevin R. Brinson, Daniel J. Leathers, Linden S. Wolf	The Delaware Coastal Flood Monitoring System
11:15	Christina Callahan	The Delaware Monitoring and Analysis Center
11:30	Rachel Edelstein	A View from the Cloud: A Cloud-based GIS Tool Simplifying Site Analysis for PHI
11:45	Helen Pang, Trish Ingelido, Barbara Hirst, Ariane Giudicelli, Jill Lipoti	Synoptic Water Quality and Quantity Monitoring in the Barnegat Bay Watershed
12:00	Charles Shorten	Ten Years of Classroom Examinations of Water Quality in the East Branch Brandywine Creek, Pennsylvania: 2002-2012

Associated Posters:

Kathryn Goddard, Adam DiCaprio, Rachael Vietheer. *Index of Biotic Integrity Study Above and Below a Dam to be Removed on the Darby Creek, Drexel Hill, PA* (39)

Anne Harvey, Ivanna Szpilczak. *Using the Flowcam for Algae Monitoring: One Year's Worth of Data and What it Reveals* (44)

Jonathan Sharp, Yoana Voynova, Eric Yoder. *Cape May Lewes Ferry Monitoring – a Developing Community Resource* (82)

John Callahan. *The Delaware Geologic Information Resource (DGIR)* (15)

Lunch - Penthouse Ballroom 5th Floor

Speaker: Eric Eckl, Water Words that Work

Taking Their Temperature: What Market Research Says About “Climate Change” and Related Terms

Tuesday
12:15 p.m.

Join us for a journey through climate insights from social scientists and market researchers. The findings are sometimes heartening, sometimes frustrating — but always fascinating! You'll learn what polls, surveys, focus groups, and other research tools teach us (and how they mislead us) about the public's attitudes towards weather, water -- and the people working to protect them.



Left: Partnership for the Delaware Estuary proudly received the Governor's declaration for April 20th, 2012 as Wilmington Earth Day! Right: Partnership staff assists with freshwater mussel tagging. These lucky mussels will bring us vital information about water quality in the Delaware Estuary.

Session 10 – Wetlands & Other Habitats Moderators: <i>Tracy Quirk (Academy of Natural Sciences of Drexel University) and Ken Strait (PSEG)</i> Grand Ballroom A - 1 st Floor			
1:30 p.m.	1:30	Mark Biddle, Andrew Howard, Alison Rogerson, Rebecca Rothweiler	A Closer Look at Delaware Wetland Trends 1992-2007
	1:45	Tracy Elsey-Quirk, David Velinsky, Danielle Kreeger, Angela Padeletti, Martha Maxwell-Doyle	Site-specific Intensive Monitoring of Wetlands of the Delaware River Estuary and Barnegat Bay
	2:00	Andy Howard, Alison Rogerson	The Condition of Wetlands in the Murderkill Watershed, Delaware
	2:15	Drexel Siok, Bartholomew Wilson, Robert W. Scarborough, David B. Carter	Marsh Vulnerability Index: Assessing the Health of Delaware's Marshes
	2:30	Viktoria Unger, Susan Kilham, Tracy Quirk, Chris Sommerfield, David Velinsky	The Relationship Between Carbon Burial and Sediment Deposition in Salt Marshes: A Comparison of a Coastal Lagoon and Coastal Plain Estuary in the Mid-Atlantic U.S.
	2:45	Renee Searfoss, Sherilyn Morgan	Extent and Distribution of Submerged Aquatic Vegetation (SAV) in the Delaware Estuary
Concurrent Sessions 10 & 11	Associated Posters: Wes Bickford, Dorina Frizzera. <i>Assessing the Impacts of Boater Activity on Mass Transfer of Shorelines of the Barnegat Bay, NJ</i> (6) Melanie Mills, Tracy Elsey-Quirk, David Velinsky, Danielle Kreeger, Angela Padeletti, Martha Maxwell-Doyle. <i>Above- and Below-ground Biomass Densities at Salt Marsh Sites in Delaware and Barnegat Bays</i> (64) Michael Lang, Nathaniel B. Weston. <i>Denitrification and Nitrous Oxide Production in Tidal Marshes Along the Salinity Gradient in the Delaware River Estuary: Implications of Salt Water Intrusion for an Important Ecosystem Service</i> (108) Kurt Phil. <i>Sediment Accretion and Marsh Elevation in Estuary Enhancement Program Sites</i> (118)		
	Session 11 – Water (and Weather) Words that Work (Part 1) Grand Ballroom B - 1 st Floor Speaker: Eric Eckl , Water Words that Work Market and social research consistently finds that floods, droughts, and other water related issues are the most salient aspects of climate change for everyday citizens. In this hands-on workshop, you'll learn to frame your climate messages to maximize your connection to the public's daily concerns.		
3:15 p.m.	Break		

Session 12 - Restoration, Enhancement & Conservation Moderators: Gerald Bright (Philadelphia Water Department) and Doug Janiec (CardnoENTRIX) Grand Ballroom A - 1 st Floor			
3:30 p.m. Concurrent Sessions 12 & 13	3:30	Kenneth Strait	Fish Production and Habitat Use in a Large-scale Wetlands Restoration Project
	3:45	Jennifer Cass, Tim Schueler, Chris Roubas	From Stream to Tap: Protecting Drinking Water through Stream Restoration
	4:00	Lance Butler, Joseph Perillo	Quantifying the Success of the Fairmount Fishway Restoration Project: A Key to Sustainable Migratory Fish Populations in the Schuylkill River
	4:15	Susan Myerov, Drew Shaw	Updating the Riparian Buffer Assessment Mapping for Southeastern Pennsylvania Streams
	4:30	Elanor Stevens, Lauren E. Culler, Alan Leslie, Robert F. Smith, William O. Lamp	Does the Macroinvertebrate Community of a Restored Delmarva Bay Mimic a Natural Bay?
	4:45	Douglas Janiec	Fight or Flee: The Sea Level Rise Scenario - An Alternative ID Adaptation
	5:00	Ralph Spagnolo, Dominique Lueckenhoff, Mike Hoffman, Carolyn Steinberg, Ellen Bryson	The Watershed Resources Registry: An Integrated Approach to Watershed Management
Associated Posters: Lawrence Malizzi, Leslie Carrere, PJ Marshall, Marv Marshall, Margo Moss, Alan Parsons. <i>The Effectiveness of Using the Gulf Savers® Bag for Spartina alterniflora in Marsh Restoration at Popcorn Beach, Pass a Loutre WMA, Venice, Louisiana</i> (60) Joshua Moody, Laura Whalen, Danielle Kreeger, David Bushek. <i>The Delaware Estuary Living Shoreline Initiative (DELSI): Field Reconnaissance and Living Shoreline Conceptual Planning</i> (65) Yared Beyene Kidanemariam. <i>Conservation of Biodiversity</i> (54) Matthew Sarver, Bill Stewart, Joe Sebastiani. <i>The Power of Partnerships: Meaningful Conservation Progress by an All-volunteer Non-profit</i> (78)			
Session 13 – Water (and Weather) Words That Work (Part 2) Grand Ballroom B 1 st Floor			
Speaker: Eric Eckl , Water Words that Work Market and social research consistently finds that floods, droughts, and other water related issues are the most salient aspects of climate change for everyday citizens. In this hands-on workshop, you'll learn to frame your climate messages to maximize your connection to the public's daily concerns.			
5:15 p.m.	Session 14 - Posters & Networking Penthouse Ballroom 5 th Floor		
7:00 p.m.	Dinner (on your own)		

Wednesday, January 30

8:00 a.m. **Registration -5th Floor & Continental Breakfast – Atrium 1st Floor**

Session 15 – What’s Mud Got to Do With It?

Moderators: *Elizabeth Sikes (Rutgers) and Jeff Gebert (USACE)*

Grand Ballroom A - 1st Floor

9:00 a.m. Concurrent Sessions 15 & 16	9:00	Nathaniel Weston	What’s Mud Got to Do with Sea Level Rise? Sediment Supply and Marsh Vulnerability to Climate Change in the Delaware Estuary
	9:15	Brandon Boyd, Christopher K. Sommerfield	Comparison of Sediment Accumulation and Accretion in Impounded and Unimpounded Marshes of the Delaware Estuary
	9:30	Anna Hermes, Elisabeth L. Sikes	Insights Into Seasonal Organic Carbon Cycling in the Delaware Estuary from N-alkane Biomarker and Stable Carbon Isotopes
	9:45	Jeff Gebert	Regional Sediment Management - Sediment Dynamics/Quantity
	10:00	Joel Pecchioli, Scott Douglas, John Yagecic, Dave Burke	Regional Sediment Management - Sediment Quality
	10:15	J. Bailey Smith	Regional Sediment Management - Overview

Associated Posters:

Molly Haggerty, Nathaniel B. Weston. *The Role of Sediment Deposition in Predicting Marsh Response to Sea-Level Rise* (106)

Kenneth Goldberg. *Emergency Dredging - Delaware River Philadelphia to Trenton* (41)



Session 16 – Ecological Linkages*Moderators: Danielle Kreeger (PDE) and Dorina Frizzera (NJDEP)**Grand Ballroom B - 1st Floor*

9:00	Daniel Tomaso, Raymond G. Najjar	Estimates of Net Community Production in the Upper Delaware Estuary
9:15	Yoana Voynova, Jonathan H. Sharp	What Controls the Lower Delaware Bay Primary Production in the Summer: Wind-Driven Coastal Upwelling or Discharge Variability?
9:30	Lance Butler, Jim D’Agostino, Danielle Kreeger, Roger Thomas, Melanie Mills, Priscilla Cole	Spatial Relationships Between Sediment Composition and Freshwater Mussel Distribution in the Tidal Delaware River: Preliminary Findings
9:45	Daphne Munroe, John M. Klinck, Eileen E. Hofmann, Eric N. Powell	Collaborative Shellfish Modeling Fosters Better Shellfishery Management
10:00	Thomas Belton, Gary Buchanan, Joseph Bilinski, Bruce Ruppel, Robert Hazen, Lee Lippincott	Environmental and Ecological Research in Barnegat Bay, New Jersey (2012 – 2014)
10:15	Zhiren (Joseph) Wang, Dale Haidvogel, John Wilkin, David Bushek, Susan Ford, Eric Powell, Eileen Hofmann	Circulation and Water Properties and Their Relationship to the Oyster Disease MSX in Delaware Bay

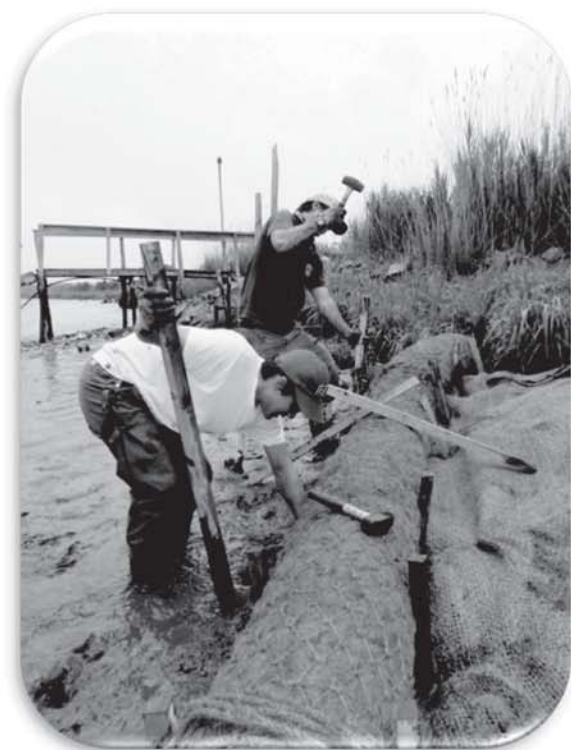
Associated Posters:Bingran Cheng, Megan Nogan, Jennifer Biddle. *Archaeal Populations in Local Delaware Sediments* (22)Sarah Fischer, William Gagne-Maynard, William Ullman, Joanna York. *Seasonal Patterns of $\delta^{15}N$ and $\delta^{18}O$ of NO_3^- in the Murderkill River Watershed and Estuary, DE* (36)Eileen Hofmann, David Bushek, Susan Ford, Ximing Guo, Daphne Munroe, Eric Powell, Dale Haidvogel, John Wilkin, Julia Levin, John Klinck. *Development of a Theoretical Basis for Modeling Disease Processes in Marine Invertebrates* (47)

10:30 a.m.

Break

Session 17 - Physical Processes <i>Moderators: Bob Chant (Rutgers) and Daphne Munroe (Rutgers)</i> <i>Grand Ballroom A - 1st Floor</i>			
10:45 a.m.	10:45	Maria Aristizabal, Robert Chant	Salt dispersion in Delaware Bay Estuary
	11:00	Robert Chant, Maria Aristizabal	A Numerical Study of Salt Fluxes in Delaware Bay Estuary
	11:15	Hadley McIntosh, J.E. Bauer, E.A. Canuel	Sources and Composition of Dissolved and Particulate Organic Matter in the Delaware Estuary
	11:30	Ramona Stammermann, Michael Piasecki	High Resolution Numerical Models of Tidal Marshes in the Delaware Bay
	11:45	Gerald Bright	Does Stream Restoration Really Create Habitat? - Quantifying Instream Habitat Using Two-dimensional Hydrodynamic Analysis
	12:00	Peng Cheng, Ming Li, Raymond Najjar	The Response of Delaware Bay to Changes in Climate Forcing
Concurrent Sessions 17 & 18	Associated Posters:		
	Jacqueline McSweeney, Robert J. Chant. <i>Sediment Dynamics in the Delaware Estuary</i> (63) Linden Wolf, Kevin Brinson, Daniel Leathers, John Callahan, Weihan Chan, Alison Hayes. <i>Evaluation of Water Level Forecasts from Hydrodynamic Models in Delaware Bay</i> (101)		
Session 18 – Collaboration and Communication <i>Grand Ballroom B 1st Floor</i>			
	10:45	Laura Bishop	The Rosetta Stone for Science
	11:30	Brenna Goggin	In this Together: Building Lasting Coalitions
	11:50	Dina DiSantis	Watershed Monitoring, Training and Educational Programs in the Andes-Amazon Basin of Peru and How to Make This a Sustainable Effort
	12:10	Cristina Frank	Avian Protection Program of a Power Delivery Company
12:30 p.m.	Lunch - <i>Penthouse Ballroom 5th Floor</i>		
Session 19 – Innovative Outreach <i>Grand Ballroom B - 1st Floor</i>			
1:45 p.m.	1:45	Chris Petrone	Engaging K-12 Audiences Through Hands-on Experiences and Data-based Activities
	2:05	Cheryl Jackson, Arthur Holst	Doggie Pageants and Poo-lution Prevention
	2:25	Deanne Ross	"Got Mussels?" Partnership for the Delaware Estuary Volunteer Mussel Survey Program
Concurrent Sessions 19 & 20			

Session 20 – Hot Topics Moderators: <i>Desmond Kahn (DNREC) and Renee Searfoss (EPA)</i> Grand Ballroom A - 1 st Floor		
1:45	Ronald MacGillivray, Thomas Fikslin, John Jackson, David Funk, Christopher Nally	Toxicity Testing in Ambient Water Quality Assessment
2:00	Gerald Kauffman	Benefit-Cost Analysis of Improved Water Quality in the Christina Basin of Delaware and Pennsylvania
2:15	Calvin M. Davenger	Moving Land for Air Travel
2:30	Steve Eberbach, Michael Powell, Jim Eisenhardt, Mark Osler, Michael Baker Jr., Rob Koechert	Evaluating Coastal Hazard Management Alternatives Under Changing Environmental Conditions for Seven Delaware Bay Communities
2:45	Jerry Conrad	Sector Delaware Bay Area Contingency Plan – Status, Changes, Updates
Associated Posters: Joni Baumgarten, Dr. John Dighton. <i>Soil Nutrient Drain of Biofuel Crop Panicum virgatum (Switchgrass)</i> (3)		
3:00 p.m.	Announcements, Outstanding Student Presenter Awards, and Closing Remarks Grand Ballroom 1 st Floor	



Left: Graduate students Josh Moody and Kurt Cheng install a living shoreline at Matts Landing in New Jersey. Above: Students in Philadelphia help plant a rain garden on their school property to reduce storm water runoff.

Poster Presentations

Joni Baumgarten, Dr. John Dighton. *Soil Nutrient Drain of Biofuel Crop Panicum virgatum (Switchgrass)* (3)

Joy Best. *Environmental Awareness Festival* (5)

Wes Bickford, Dorina Frizzera. *Assessing the Impacts of Boater Activity on Mass Transfer of Shorelines of the Barnegat Bay, NJ* (6)

Eleanor Bochenek, Michael DeLuca, Steven Carnahan, Lisa Calvo, Brenda J. Landau. *The Horseshoe Crab (Limulus polyphemus) Enhancement Initiative* (8)

John Callahan. *The Delaware Geologic Information Resource (DGIR)* (15)

Gregory Cavallo, Thomas Fikslin, Namsoo Suk. *Clean Hands Metals Sampling Techniques* (18)

Bingran Cheng, Megan Nogan, Jennifer Biddle. *Archaeal Populations in Local Delaware Sediments* (22)

Anastasia Chirnside, Alison Kiliszek. *Demonstration of the Kiliszek Water Quality Indices (Kwqi) Model: Kwqi Calculation Utilizing Water Quality Data from a Small Agricultural Watershed* (24)

Luc Claessens, Gerald Kauffman. *Hydro-ecological investigation of legacies in urban stormwater management: towards a holistic strategy for improving water quality* (121)

Kimberly Cole, Charles Bishop, Jennifer Holmes, Michael Mensinger, Kate Marvel, Christina Pinkerton, Robert Scarborough, Drexel Siok, Kenneth Smith, Kelly Valencik, James Wicks. *Delaware National Estuarine Research Reserve: 20 Years Advancing Coastal and Estuarine Conservation, Research and Education* (25)

Dee Durham. *Eliminating Plastic Bags & Other Plastics in the Mid-Atlantic* (30)

Jeffrey Eker, Julia Gross, Jared Novak, Ron Smith. *A Suburban Assessment of Storm Drains; Implications for Non-point Source Pollution, Neighborhood Initiatives and the Education Imperative* (34)

Jeffery M. Fischer, Ward O. Freeman. *WaterSMART Water-use Studies in the Delaware River Basin* (114)

Sarah Fischer, William Gagne-Maynard, William Ullman, Joanna York. *Seasonal Patterns of $\delta^{15}N$ and $\delta^{18}O$ of NO_3^- in the Murderkill River Watershed and Estuary, DE* (36)

Kathryn Goddard, Adam DiCaprio, Rachael Vietheer. *Index of Biotic Integrity Study Above and Below a Dam to be Removed on the Darby Creek, Drexel Hill, PA* (39)

Kenneth Goldberg. *Emergency Dredging - Delaware River Philadelphia to Trenton* (41)

Mike Haberland, Chasity Williams, Craig McGee. *Naturalizing Dry Detention Basins to Create Water Quality and Pollinator Habitat Benefits* (42)

Molly Haggerty, Nathaniel B. Weston. *The Role of Sediment Deposition in Predicting Marsh Response to Sea-Level Rise* (106)

Anne Harvey, Ivanna Szpilczak. *Using the Flowcam for Algae Monitoring: One Year's Worth of Data and What it Reveals* (44)

Eileen Hofmann, David Bushek, Susan Ford, Ximing Guo, Daphne Munroe, Eric Powell, Dale Haidvogel, John Wilkin, Julia Levin, John Klinck. *Development of a Theoretical Basis for Modeling Disease Processes in Marine Invertebrates* (47)

Dave Jones, Brenda Landau, Matt Neuman. *Commercial Production of Ribbed Mussels* (122)

Jeannette Rea-Keywood. *4-H Environmental Ambassador Program* (74)

Yared Beyene Kidanemariam. *Conservation of Biodiversity* (54)

Michael Lang, Nathaniel B. Weston. *Denitrification and Nitrous Oxide Production in Tidal Marshes Along the Salinity Gradient in the Delaware River Estuary: Implications of Salt Water Intrusion for an Important Ecosystem Service* (108)

Lawrence Malizzi, Leslie Carrere, PJ Marshall, Marv Marshall, Margo Moss, Alan Parsons. *The Effectiveness of Using the Gulf Savers® Bag for Spartina alterniflora in Marsh Restoration at Popcorn Beach, Pass a Loutre WMA, Venice, Louisiana* (60)

Jacqueline McSweeney, Robert J. Chant. *Sediment Dynamics in the Delaware Estuary* (63)

Melanie Mills, Tracy Eley-Quirk, David Velinsky, Danielle Kreeger, Angela Padeletti, Martha Maxwell-Doyle. *Above- and Below-ground Biomass Densities at Salt Marsh Sites in Delaware and Barnegat Bays* (64)

Joshua Moody, Laura Whalen, Danielle Kreeger, David Bushek. *The Delaware Estuary Living Shoreline Initiative (DELSI): Field Reconnaissance and Living Shoreline Conceptual Planning* (65)

Beth Njiru. *Diminishing Water and Shifting Livelihood Systems Among the Pastoral Communities of Kenya* (69)

Steven Pearson, Harold Avery, James Spotila. *Competition Between Red-bellied Turtles (Pseudemys rubriventris) and Invasive Red-eared Slider Turtles (Trachemys scripta elegans)* (109)

Kurt Phil. *Sediment Accretion and Marsh Elevation in Estuary Enhance Program Sites* (118)

Matthew Sarver, Bill Stewart, Joe Sebastiani. *The Power of Partnerships: Meaningful Conservation Progress by an All-volunteer Non-profit* (78)

Robert Scarborough, Christina Pinkerton, Michael Mensinger, Drexel Siok, Kenneth Smith, Kelly Valencik. *Delaware National Estuarine Research Reserve – Becoming A Sentinel Site for Climate Change Research, Monitoring and Education* (75)

Justin Schulte, Raymond Najjar. *The Variability of Delaware River Streamflow and its Relationship to Dominant Modes of Climate Variability* (80)

Jonathan Sharp, Yoana Voynova, Eric Yoder. *Cape May Lewes Ferry Monitoring – a Developing Community Resource* (82)

Ron Smith, Rosy Tucker. *Investigating Changes in Land Cover, Habitat and Bird Biodiversity in a Lower Delaware Watershed Town; Haddonfield, NJ from the late 1800s to 2012* (85)

Roger Thomas, Melanie Mills, Danielle Kreeger, Priscilla Cole, Lance Butler. *Distribution of Freshwater Mussels (Unionidae) in Relation to Depth in the Tidal Delaware River* (112)

William Ullman, William Gagne-Maynard, Sarah J. Fischer, Yoana G. Voynova. *The Kent County Land Ocean Biogeochemical Observatory: Real-time Hourly Determination of Water Quality in the Delaware Bay Ecosystem* (94)

David Walsh, Josef Kardos, Phil Duzinski, Ramona Stammermann, David Velinsky, Jeff Cornwell, Mike Owens. *Long-term Measurements of Hydrology, Meteorology, and Sediment Oxygen Demand in the Delaware Estuary* (119)

Linden Wolf, Kevin Brinson, Daniel Leathers, John Callahan, Weihan Chan, Alison Hayes. *Evaluation of Water Level Forecasts from Hydrodynamic Models in Delaware Bay* (101)



Featured Speakers

Carol Collier

Delaware River Basin Commission

Ms. Collier was appointed Executive Director of the Delaware River Basin Commission (DRBC) on August 31, 1998. The DRBC is an interstate/federal commission that provides a unified approach to water resource management without regard to political boundaries. Before joining DRBC, Ms. Collier was Executive Director of Pennsylvania's 21st Century Environment Commission.

Prior to PADEP, Ms. Collier served 19 years with BCM Environmental Engineers, Inc., Plymouth Meeting, PA, beginning as a student intern and ultimately becoming Vice President of Environmental Planning, Science and Risk.

Ms. Collier has a B.A. in Biology from Smith College and a Masters in Regional Planning from the University of Pennsylvania. She is a Professional Planner licensed in the State of New Jersey, a member of the American Institute of Certified Planners (AICP) and a Certified Senior Ecologist. In 1997 she was presented the Touchstone Award from the Society of Women Environmental Professionals and in 1998 the Woman of Distinction Award from the Philadelphia Business Journal. In 2007 the American Water Resources Association (AWRA) presented her with the Mary H. Marsh Medal for exemplary contributions to the protection and wise use of the nation's water resources.



Sarah Cooksey

Delaware Department of Natural Resources and Environmental Control, Delaware Coastal Program



Sarah Cooksey is currently the Administrator of the Delaware Coastal Programs where she is responsible for both the coastal zone management program and the Delaware National Estuarine Research Reserve. She coordinates with federal, state and local governments on coastal resource issues such as tidal and freshwater wetlands, energy policy, non-point source pollution, coastal hazards, essential fish habitat, ocean planning, biodiversity, sustainable development, and dredging issues.

Recent accomplishments include developing environmental indicators for the health of the coastal zone, and expanding public facilities and land holdings at the Reserve. Ms. Cooksey is on the executive council of the Coastal States Organization (CSO). CSO represents the Governors of thirty-five coastal states, island and

territories on national, regional and local coastal management issues, particularly coastal legislation. She is past President of the Coastal States Stewardship Foundation, a 501(3) (c) formed to assist state governments with pressing coastal management issues and Chair of Management Board of MARCO – the Mid-Atlantic Regional Council of the Ocean – a five state initiative to focus on offshore issues related to renewable energy, water quality, habitat protection and climate change adaptation. Prior to her work in the State of Delaware she spent several years in EPA's Office of Water in Washington DC working with states on water issues. Sarah has a Master of Science degree in Biology and enjoys spending time at the beach with her husband and two sons, bird watching and gardening.

Eric Eckl

Water Words That Work, LLC

Eric Eckl's role models include Aldo Leopold, Martin Luther King, Maxmillian Berlitz, and P.T. Barnum.

Eric loves campaigns and would run for office if he could give the job to somebody else after winning. Instead, he helps people like you with your pollution prevention, fundraising, and issue advocacy campaigns.

Eric founded Water Words That Work LLC as a marketing and public relations firm for nature protection and pollution control organizations. Since 2009, the company has assisted more than 50 conservation organizations, including the National Park Service, the Alliance for the Chesapeake Bay, the Southwest Florida Water Management District, the Minnesota Association of Watershed Districts, the Ogeechee Riverkeeper, and many others.



Before launching Water Words That Work, Eric managed fundraising, media relations, and publishing activities for many conservation organizations. His past employers include Beaconfire Consulting, American Rivers, the U.S. Fish and Wildlife Service, and the White House Council on Environmental Quality. Eric has appeared in countless media stories, including CNN and the New York Times. He is a frequent speaker at environmental, marketing, and technology conferences.

Shawn M. Garvin

U.S. Environmental Protection Agency, Region 3

Shawn M. Garvin was named Regional Administrator on November 5, 2009. Shawn's career in intergovernmental affairs spans more than 20 years at the federal and local levels. In his most recent position as Senior State and Congressional Liaison for EPA Region 3, he provided counsel to agency leadership, environmental program managers, press officers and others involved in complex and controversial public health and environmental matters.

Shawn's contributions to high-profile environmental litigation cases, emergency response clean-ups, contaminant investigations, and public health crises have earned him numerous EPA gold, silver and bronze medals. He's worked closely with Congressional Delegations, Governors, state and local elected leaders, environmental agencies and citizen advocacy groups. Early in his career at EPA, he served as special assistant to the Regional Administrator. Prior experience includes working as an aide to then-Senator Joe Biden, D-Del., and working on the staff of former New Castle County (Del.) Executive Dennis Greenhouse. Shawn is a native Delawarean and graduate of the University of Delaware. He lives in Wilmington with his wife and their son.



Kelly Heffner

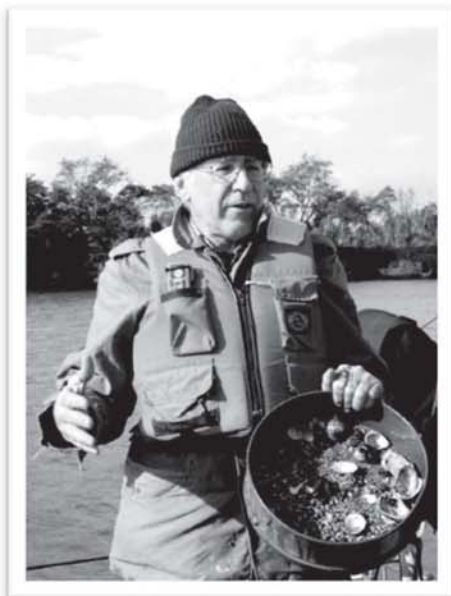
Pennsylvania Department of Environmental Protection

Kelly has served most recently as Acting Deputy Secretary for Field Operations from March 2010 to March 2011. Prior to that, she served as Policy Director for DEP and has served as the DEP's American Reinvestment and Recovery Act (ARRA) Coordinator. Other previous positions held by Kelly include Executive Policy Specialist in the DEP Policy Office where she has developed policy, regulations, and guidance. In particular, she has functioned as the policy liaison for all water related policy matters and has provided input to legislative committees regarding the interpretation of policy recommendations; Chief of the Permitting Section in the Division of Waterways, Wetlands and Storm Water Management where she supervised professional staff who were responsible for the development of program guidance, policies, regulations, that supported the permitting processes. She began her career at DEP as a Water Pollution Biologist in the Northeast Regional Office and later in Central Office where she provided technical expertise to central and regional office staff and served as an expert on wetlands matters.



Before joining DEP, Kelly also worked for five years in the private sector as a Project Manager and Biologist for RMC Environmental Services in Pottstown.

Kelly holds a Bachelor of Science degree in Environmental Science from East Stroudsburg University.



Victor Kennedy

University of Maryland

Dr. Kennedy is a Professor in the University of Maryland Center for Environmental Science's Horn Point Laboratory in Cambridge. There he performs ecological research in Chesapeake Bay and teaches graduate students. He has published numerous scientific papers in peer-reviewed journals on invertebrate biology and is currently cooperating in a study of the transport of microscopic oyster larvae by water movements within Chesapeake Bay. He was a co-editor of a book summarizing our extensive knowledge of oysters and another dealing with blue crabs. He and a colleague are beginning to co-edit a book on Diamondback Terrapins. His recent research interests involve understanding and describing the environmental history of Chesapeake Bay, building on papers he published earlier on the history of the oyster and blue crab fisheries.

Michele N. Siekerka, Esq.

New Jersey Department of Environmental Protection

Michele N. Siekerka, Esq. joined the New Jersey Department of Environmental Protection (NJDEP) in 2010 and has most recently taken on the critical position of Assistant Commissioner for Water Resource Management. Siekerka is charged with overseeing the execution of strategies for comprehensive water management including water supply, water quality and water monitoring. This position follows her role as the Department's first Assistant Commissioner for Economic Growth and Green Energy (EGGE), now named Sustainability and Green Energy (SAGE). Building on her work with sustainability and green energy, Siekerka brings to the Division of Water Resource Management a deep understanding of the key roles of green infrastructure, waste minimization and appropriate water reclamation for beneficial reuse. Having served as a steering committee member for the State Strategic Plan, Siekerka is also the Department's liaison for the Plan's implementation.



Siekerka's background includes serving as the president and CEO of the Mercer Regional Chamber of Commerce, senior legal counsel and vice president of human resources with the Automobile Association of America, and as a law partner in a Mercer County law practice. As an alumni of the Ford Foundation Fellowship for Regional Sustainable Development, Michele worked with Chamber of Commerce, government and business leaders from across the nation to develop regional action plans. She also served on Governor Chris Christie's Red Tape Review Group.

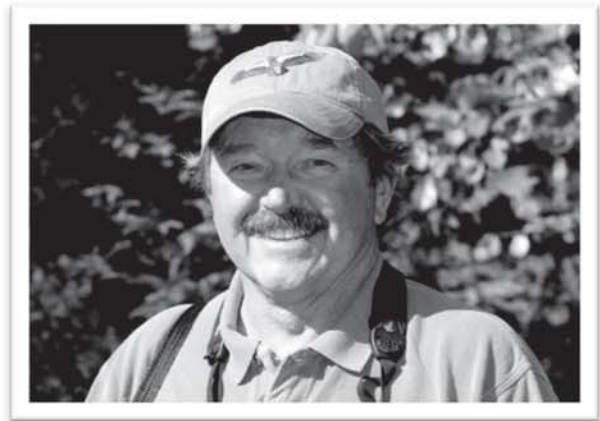
A Robbinsville resident, Siekerka earned a BA in Political Science and German from Rutgers University and a JD from Temple University School of Law.

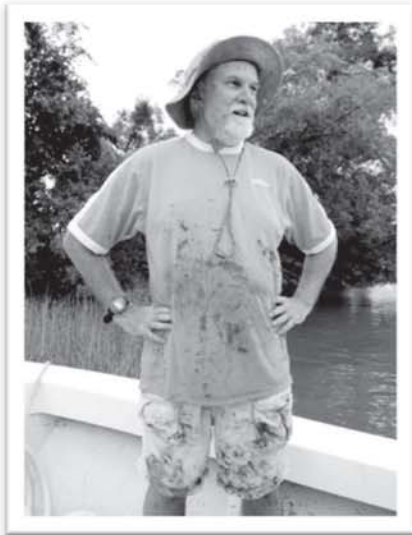
Clay Sutton

Citizens United to Protect the Maurice River

Clay Sutton is a life-long resident of Cape May, where he has worked as an environmental planner, environmental program administrator, vice-president of an environmental consulting firm specializing in threatened and endangered species, and for the past decade as a self-employed environmental consultant, naturalist and field biologist.

Clay is a writer, lecturer, tour leader, and was a long-time instructor for the American Birding Association's Institute for Field Ornithology. Clay is a co-author, with Pete Dunne and David Sibley, of the classic *Hawks in Flight* (Houghton Mifflin Harcourt, 1988; 2nd Edition 2012), and Clay and his wife Pat have co-authored *How to Spot Butterflies* (1999), *How to Spot Hawks & Eagles* (1996), and *How to Spot an Owl* (1994), all published by Houghton Mifflin Harcourt. Their latest book, *Birds and Birding at Cape May* (Stackpole Books, 2006, 568 pages), is the in-depth result of their efforts over many years documenting and protecting the migration and the Cape May area that they so love. This landmark book is a complete guide to birds and birding for the Cape May region, covering what to see, when, where, and how to go, as well as the storied ornithological history of the Cape.





Jim Uphoff
Maryland Department of Natural Resources

Jim Uphoff is a native Marylander who received his B.S. at the University of Maryland, College Park in 1976. He started with Maryland's Department of Natural Resources in 1973 as a summer assistant and began his professional career there in 1978. During his career, he has sampled and analyzed most everything that moves in Chesapeake Bay and a few things that don't. He is currently the Fish Habitat and Ecosystem Assessment Program Chief. This program is working to develop ecosystem-based fisheries management approaches for Fisheries Service.

**Thank you for attending the
2013 Delaware Estuary Science and Environmental Summit.**

The Partnership for the Delaware Estuary is a nonprofit organization established in 1996 to take a leadership role in protecting and enhancing the Delaware Estuary, where fresh water from the Delaware River mixes with salt water from the Atlantic Ocean. It is one of 28 congressionally designated National Estuary Programs throughout the coastal United States working to improve the environmental health of the nation's estuaries. Its staff works with partners in three states to increase awareness, understanding, and scientific knowledge about the Delaware Estuary, the region's most important cultural, economic, and recreational resource.

Staff List – Partnership for the Delaware Estuary

<p>Jennifer Adkins, <i>Executive Director</i> jadkins@DelawareEstuary.org Ext. 102</p> <p>Shaun Bailey, <i>Marketing & Communications Coordinator</i> sbailey@DelawareEstuary.org Ext. 113</p> <p>Kurt Cheng, <i>Drexel University Fellow</i> kcheng@DelawareEstuary.org</p> <p>Priscilla Cole, <i>Data & Information Specialist</i> pcole@DelawareEstuary.org Ext. 115</p> <p>Tom Davidock, <i>Schuylkill Action Network Coordinator</i> tdavidock@DelawareEstuary.org Ext. 109</p> <p>Karen Johnson Forst, <i>Director of Development</i> kforst@DelawareEstuary.org Ext. 101</p> <p>Beth Haas, <i>Business Manager</i> omanager@DelawareEstuary.org Ext. 100</p> <p>Elizabeth Horsey, <i>Development Specialist II</i> ehorsey@DelawareEstuary.org Ext. 114</p> <p>Cheryl Jackson, <i>Program Specialist II</i> cjackson@DelawareEstuary.org Ext. 112</p>	<p>Danielle Kreeger, <i>Science Director</i> dkreeger@DelawareEstuary.org Ext. 104</p> <p>Josh Moody, <i>Drexel University Fellow</i> jmoody@DelawareEstuary.org</p> <p>Angela Padeletti, <i>Science Specialist</i> apadeletti@DelawareEstuary.org Ext. 103</p> <p>Dee Ross, <i>Watershed Program Coordinator</i> dross@DelawareEstuary.org Ext. 106</p> <p>Sari Rothrock, <i>Science & Policy Fellow</i> srothrock@DelawareEstuary.org Ext.108</p> <p>Laura Whalen, <i>Restoration Specialist</i> lwhalen@DelawareEstuary.org Ext. 107</p> <p>Gus Wolfe, <i>Director of Finance and Operations</i> gwolfe@DelawareEstuary.org Ext. 111</p> <p>Lisa Wool, <i>Program Director</i> lwool@DelawareEstuary.org Ext. 105</p>
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Partnership for the Delaware Estuary

110 South Poplar Street, Suite 202
 Wilmington, DE 19801
 (800) 445-4935 or (302) 655-4990

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Notes

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Abstracts

Salt Dispersion in Delaware Bay Estuary

Maria Aristizabal, Rutgers University, 21 Roosevelt Ct, Metuchen, NJ 08840, mariaimcs@gmail.com; Robert Chant, Rutgers University.

Dispersion processes in an estuary determine the residence time of materials such as sediments, pollutants, nutrients and salt. In particular salt dispersion determines the salt intrusion length, which is directly related with the availability of water for human consumption. It is therefore important to understand the physical processes that set the different dispersion rates in an estuary.

In this work we focus on the dispersion of salt and for this we calculate the salt fluxes in this system using velocity and salinity data from a mooring array in the middle reach of the bay and two tidal surveys in the same location of the array. Additionally we compare our observational results with previous results from a three dimensional model of Delaware Bay.

The salt fluxes are decomposed into three different components: a seaward salt flux due to the river output and two landward salt fluxes due to the estuarine exchange flow and tidal flows. The results show that the tidal salt flux and estuarine exchange salt flux are comparable in magnitude and both fluxes are strongly landward during neap tide and weaken during spring tide. As a consequence this system gains salt during neap tide and loses salt during spring tide. Results also show that the salt fluxes are mostly confined to the main channel and this indicates that changes in its area, for instance through dredging, could enhance the landward salt fluxes and therefore increase the length of the salt intrusion in this system.

A Novel Approach to Estimating Monthly Salt Marsh Contributions to Oxygen Deficit in the Murderkill Estuary from Hourly Sensor Data

Anthony Aufdenkampe, Stroud Water Research Center, 970 Spencer Road, Avondale, Pennsylvania 19311-9514, aufdenkampe@stroudcenter.org; William J. Ullman, Oceanography Program, College of Marine and Earth Studies, University of Delaware, Lewes, DE 19958.

An important hole in our understanding of the controls on oxygen levels in a salt marsh dominated estuary is whether salt marshes release or remove carbon and nutrient species associated with oxygen demand from estuarine waters during tidal exchange. To determine whether salt marshes are a source or sink of nutrient species contributing to the oxygen demand of the Murderkill River Estuary (Kent County, Delaware), we measured water, salt, and dissolved and particulate nutrient (N, P, C, Si) balances in and out of a constrained section of polyhaline salt-marsh at Webb's Slough near South Bowers during five 40-hour periods to capture different seasons. These intensive studies of net fluxes out of the salt marsh led to the understanding that the most important species contributing to estuarine oxygen deficit were the low oxygen discharge water directly and also dissolved organic carbon (DOC), which together were more than an order of magnitude more important than total net nitrogen and phosphorus fluxes. Furthermore, it is possible to calculate net dissolved oxygen and DOC fluxes for every tidal cycle over a year or more by applying a novel tidal flux anomaly approach to continuous hourly sensor data.

This research is part of a larger study of the causes of the anoxic “dead zone” that occurs every August near the mouth of the Murderkill river. The results of this study have been used to directly verify and calibrate a hydrodynamic/water quality model for the Murderkill River Estuary.

Environmental and Ecological Research in Barnegat Bay, New Jersey (2012 – 2014)

Thomas Belton, New Jersey Department of Environmental Protection - Office of Science, 430 - 428 East State St., Trenton, New Jersey 8625, thomas.belton@dep.state.nj.us; Gary Buchanan; Joseph Bilinski; Bruce Ruppel; Robert Hazen; Lee Lippincott, NJDEP Office of Science, Trenton, NJ.

The New Jersey Department of Environmental Protection funded a multiple year research initiative for Barnegat Bay (2012 - 2014) as a means to assess and improve water quality, evaluate the impacts from a once-through nuclear power plant slated for closure, advance habitat restoration, and establish baseline physical and biological conditions for inclusion in an ecosystem-based management. The technical approach and results to date for the ten research projects being performed at various academic and research institutions in and around New Jersey will be discussed and the regulatory objectives reviewed. These ten projects include:

1. Benthic Invertebrate Community Monitoring and Indicator Development for the Barnegat Bay-Little Egg Harbor Estuary
2. Barnegat Bay Diatom Nutrient Inference Model
3. Benthic-Pelagic Coupling: Hard Clams as Indicators of Suspended Particulates in the Barnegat Bay
4. Assessment of Fishes and Crabs Responses to Human Alteration of Barnegat Bay
5. Assessment of the Distribution and Abundance of Stinging Sea Nettles (Jellyfishes) in Barnegat Bay
6. Baseline Characterization of Phytoplankton and Harmful Algal Blooms
7. Baseline Characterization of Zooplankton in Barnegat Bay
8. Multi-Trophic Level Modeling of Barnegat Bay
9. Tidal Freshwater and Salt Marsh Wetland Studies of Changing Ecological Function and Adaptation Strategies
10. Ecological Evaluation of Sedge Island Marine Conservation Area in Barnegat Bay

A Closer Look at Delaware Wetland Trends 1992-2007

Mark Biddle, DNREC, 820 Silver Lake Blvd. Suite 220, Dover, DE 19904, mark.biddle@state.de.us; Andrew Howard, DNREC; Alison Rogerson, DNREC; Rebecca Rothweiler, DNREC.

Delaware’s wetland maps were last updated in 1992. Using 2007 aerial photography, DNREC recently updated state wetland maps and produced the 2011 status and trends report. DNREC will use the results of this report and other information in cooperation with partner agencies to improve wetland protection statewide. Report results showed that Delaware lost nearly 3,900 acres of vegetated wetlands statewide from 1992 to 2007 (15 years) and gained over 700 acres. This presentation will detail what types of wetlands have been vulnerable to conversion, the leading causes for wetland losses and discuss patterns by county and basin. Also included will be how wetland gains occurred and how they relate to replacing lost wetlands. We will also discuss follow-up research regarding the mechanisms that allowed wetland conversion and how DNREC has countered losses with land protection and acquisition.

The Rosetta Stone for Science

Laura Bishop, Laura Bishop Communications LLC, P.O. Box 45, Cedar Brook, NJ 08018, laura@laura-bishop.com.

Today, the phrase Rosetta Stone commonly is associated with language-learning software based on the idea that "learning language should be fun, easy and effective." But the original Rosetta Stone is celebrated for providing the first clue to decipher Egyptian hieroglyphics.

The Rosetta Stone for Science workshop will give scientists and environmentalists tips and tools to communicate complicated scientific and technical information using approaches and language that is both accurate and engaging. Participants will learn ways to communicate more effectively with non-technical audiences, including funders, legislators, media and community members - stakeholders who, despite their lack of technical expertise, may hold the key to your success.

We'll use case studies of effective and not-so-effective communication initiatives and materials related to site remediation, grant awards media events and reports, to name a few, to demonstrate the best approaches.

Comparison of Sediment Accumulation and Accretion in Impounded and Unimpounded Marshes of the Delaware Estuary

Brandon Boyd, School of Marine Science and Policy - UDel, 700 Pilottown Road, Lewes, DE 19958, boydb@udel.edu; Christopher K. Sommerfield.

In the state of Delaware, coastal managers are concerned about the fate of impounded wetland marshes and are considering what actions (if any) can be taken to adapt to rising sea level. Accretion, or vertical growth of the marsh platform by accumulation of mineral and organic material, is an important part of marsh elevation change through time. This study compares impounded and unimpounded tidal marshes of coastal Delaware to examine 1) the relative accretionary status of selected managed and natural marshlands, 2) the relative influences of mineral and organic solids accumulation on rates of accretion. Accretion and accumulation rates were calculated for 44 cores from eleven sites along the western coast of the Delaware Estuary using activity-depth profiles of ^{137}Cs and excess ^{210}Pb , using the 1964 reference horizon and the Constant Initial Concentration model, respectively.

Accretion rates for unimpounded marshes averaged 0.57 cm y^{-1} and, for unimpounded marshes, 0.28 cm y^{-1} . Impounded marshes investigated exhibited lower accretion rates and lower mineral sediment inventories than the unimpounded marshes. Impounded and unimpounded marshes were found to have a similar direct relationship between accretion rates and accumulated mass. However, accretion was more sensitive to organic accumulation than mineral sediment accumulation. In the case of impounded marshes, accretion rates appear to be limited by mineral sediment accumulation.

Accretion rates determined for the impounded marshes fell at or below the rate of relative sea-level rise for middle Delaware Estuary. Where the rate of marsh accretion is deficient, coastal flooding and inundation related to future sea-level rise will be most pronounced. Coastal managers should consider sediment management among the various adaptation strategies implemented by the state of Delaware to mitigate effects of rising sea level on the impounded marshlands.

Does Stream Restoration Really Create Habitat? - Quantifying Instream Habitat Using Two-dimensional Hydrodynamic Analysis

Gerald Bright, Philadelphia Water Department-Office of Watersheds, Aramark Tower, 4th Floor, 1101 Market Street, Philadelphia, PA 19107, gerald.bright@phila.gov.

The science of stream restoration has progressed steadily in its application from pure stream bank stabilization to the placement of large instream structures and diversions and into the current paradigm of Natural Stream Channel Design. Despite the progression observed in the application of stream restoration concepts, little progress has been made in the application of post-construction monitoring techniques, specifically techniques capable of quantitatively assessing the success or failure of a project. Most stream restoration projects list goals of ecological uplift or achieving dynamic equilibrium with watershed processes; however, the success or failure of a project has typically been determined using qualitative techniques such as photo monitoring or rapid bioassessment protocols. Given the considerable investment required to design and construct traditional stream restoration and natural stream channel design projects as well as an economy driven by fiscal accountability, the elements of successful projects need to be gleaned from quantitative analysis of the physical changes associated with channel modifications, realignment, reconfiguration and the placement of instream structures.

The Philadelphia Water Department has taken an active role in physical, biological and chemical monitoring within the stream networks of Philadelphia. Physical monitoring has been consistent with traditional fluvialgeomorphic assessment schemes such as analysis of permanent cross-sections; however, the increased use and application of two-dimensional hydrodynamic models has prompted changes in the PWD physical assessment protocol.

The program River2D was used to model both the pre-restoration and post-restoration channel and floodplain bathymetries of an approximately 3,000 LF urban stream reach in Tacony Creek, Philadelphia. . Instream hydraulic parameters and habitat (Weighted Usable Area) for three fish guilds were then compared between the two model domains in order to determine quantitatively, if stream restoration created a net uplift in terms of habitat and resilience to watershed processes.

Pilot Study of Polycyclic Aromatic Hydrocarbons in Delaware Estuary Using Passive Diffusion Sampling Technology

William Burton, Versar, Inc., 9200 Rumsey Road, Columbia, Maryland 21045, wburton@versar.com; Richard Greene, Department of Natural Resources & Environmental Control, Dover, DE; Gregory M. DeCowsky, Delaware Department of Natural Resources and Environmental Control, Site Investigation and Restoration Section, New Castle, DE.

Polycyclic Aromatic Hydrocarbons (PAHs) are a major pollutant in the Delaware Estuary due to extensive crude oil tanker traffic, the high concentration of petrochemical processing facilities, and frequent oil spills. While traditional grab sampling for sediment and water often results in non-detections, PAHs may be present in low concentrations that will accumulate in biotic tissues potentially causing sub-lethal effects. There is also a need to develop an estuary-wide baseline of PAH concentrations and distributions through which oil-spill-related natural resource damage assessments can be conducted. This study assessed the effectiveness of Semipermeable Membrane Devices (SPMDs), a type of passive diffusion sampler, deployed over a month long time frame at six stations with suspected concentration gradients

from high to low PAHs. SPMDs contain ribbon-like semipermeable membrane tubes filled with a lipid gel that accumulate PAHs over time, much like fatty tissues in biota but without metabolism affecting the concentrations. The samplers are PAH traps which can measure otherwise non-detectable concentrations when deployed for long time periods. SPMDs were deployed on six mooring systems for a period of one month such that water column and sediment concentrations were simultaneously assessed. Grab samples of sediments half way through the deployment period and low resolution PAH testing was also conducted. The effectiveness of the technology and its potential for use in an estuary-wide study will be discussed.

Oyster Mortality and Disease in Delaware Bay: Impact and Recovery Following Hurricane Irene and TS Lee

David Bushek, Rutgers, The State University of NJ, 6959 Miller Avenue, Port Norris, NJ 08349, bushek@hsrl.rutgers.edu;
Daphne Munroe, Haskin Shellfish Research Laboratory, Rutgers, Port Norris, NJ.

The distribution of oysters and their parasitic pathogens is dependent upon salinity. Both thrive in intermediate salinity, but oysters have a greater ability to survive in lower salinity. Dermo and MSX are major oyster pathogens that have devastating impacts on oyster populations. After 30 years of devastatingly high levels of mortality from MSX, the native population developed a relatively strong resistance to MSX disease. The MSX parasite is still prevalent in the Bay and quickly attacks naïve oysters whereas native oysters resist attacks. In contrast, Dermo has been entrenched in Delaware Bay for just over two decades and remains a major cause of oyster mortality. Refugia from both diseases exist in the upper portion of the Bay and are correlated with salinity, creating a spatial pattern that fluctuates with riverine inputs, runoff and drought conditions. Hurricane Irene and Tropical Storm Lee dumped record levels of precipitation into the Delaware Bay watershed in late summer 2011, dropping salinity for a prolonged period across the natural oyster beds. The reduced salinity pushed the oyster pathogens down bay, reducing their impact, but the prolonged low salinity caused extensive mortality on the upper beds. Recent developments in modeling capabilities for the Delaware Bay oyster population suggest a minimum of ten years will be required for the upper bay oyster population to recover. Prior to these storms, this region of the bay comprised about 34% of the oyster population that is managed as part of New Jersey's commercial fishery. Mortality on some beds exceeded 70% by spring of 2012 as many oysters were not strong enough to survive the winter. This talk will describe the impacts on the population, the fishery and the local economy, review the recovery during 2012, and outline efforts to expedite the recovery.

Quantifying the Success of the Fairmount Fishway Restoration Project: A Key to Sustainable Migratory Fish Populations in the Schuylkill River Drainage

Lance Butler, Philadelphia Water Department, 1101 Market Street, Philadelphia, PA 19107, Lance.Butler@phila.gov;
Joseph Perillo, Philadelphia Water Department, 1500 East Hunting Park Avenue, Philadelphia, PA, 19124.

As the most downstream passageway, the Fairmount Dam Fishway plays a critical role in the overall success of restoring migratory fish runs in the Schuylkill River Watershed. Therefore, all planned upstream fish passage projects will be affected by the success or failure of the Fairmount Dam fishway at passing migratory species during spawning runs. Moreover, successful colonization of resident species is highly contingent upon minimizing the effects of fish barriers on movement. Between 2002 and 2012, the Philadelphia Water Department (PWD) has maintained a robust monitoring program, quantifying the resurgence of key migratory species (e.g., American shad), assessing the relative health and

abundance of both resident and migratory fish, and evaluating the efficacy of restoration activities within the Fairmount Dam Fishway. Temporal variation of resident and migratory fish assemblages inhabiting the tidal portions of the Schuylkill River were assessed through standardized electrofishing techniques, conducted three to four times per month from April 1st to July 1st. Similarly, a video monitoring program was established in 2003 to assess fish passage at the fishway. Pre- and post-restoration monitoring below the Fairmount Dam and within the fishway has shown marked increases in both migratory and resident numbers. Of the forty-six species of fish that have been identified in the tidal portion of the Schuylkill River, thirty-one of these species have been observed utilizing the fishway in various densities. Moreover, post-restoration monitoring of relative abundance and total passage of American shad has shown discernible increases. While these numbers are promising, it is the intentions of PWD to continue its monitoring program until a healthy and sustainable migratory fisheries population has been established.

Spatial Relationships Between Sediment Composition and Freshwater Mussel Distribution in the Tidal Delaware River: Preliminary Findings.

Lance Butler, Philadelphia Water Department, 1101 Market Street, Philadelphia, PA 19107, Lance.Butler@phila.gov; **Jim D'Agostino**, Philadelphia Water Department, 1101 Market Street, Philadelphia, PA, 19107; **Danielle Kreeger**, Partnership for the Delaware Estuary, 110 South Poplar St, Wilmington, DE 19810; **Roger Thomas**, Academy of Natural Sciences of Drexel University.

The global decline in freshwater mussel assemblages is garnering growing interest among scientists and wildlife managers alike. However unlike their marine counterparts, studies concerning life-history traits and species-specific habitat preferences (i.e., habitat optima) of freshwater mussels have been sparse and weakly integrated with management paradigms. Nowhere is this more apparent than in the freshwater tidal Delaware River, where mussel species and populations have been undersampled compared to other faunal assemblages and to other basins along the eastern continental slope. Recent studies in this region have uncovered an apparent robust and diverse assemblage of freshwater mussels inhabiting the urban corridor between Trenton and Philadelphia; however, the demographics, range, and habitat preferences of these vestigial mussel beds remain poorly understood. As an initial step in identifying the critical habitat needs of these freshwater tidal populations, we examined relationships between physical and chemical substrate conditions and the community structure and density of freshwater unionoids. Quantitative mussel and substrate surveys were performed along representative sublittoral shorelines at four spatially discrete locations in the tidal Delaware River (see presentations by Kreeger, Thomas). Substrate composition, sediment size distribution, submerged aquatic vegetation density and elemental analyses were performed in each of many sampling quadrats that were arranged along transects spanning depths of 0.5-2 m below mean low water. Preliminary analysis of substrate composition has shown significant spatial variability in sediment size and vegetative density among different depths and survey locations. These findings may be an important component in determining key habitat constituents that define the patchy nature of freshwater mussel assemblages and may provide guidance for future restorative initiatives in the tidal Delaware River.

The Delaware Monitoring and Analysis Center

Christina Callahan, University of Delaware, 125 Academy St Rm 212A, Newark, Delaware 19716, tina.callahan@udel.edu.

Through the combined efforts of federal agencies, state agencies, and a number of University of Delaware research centers, Delaware has become densely equipped with instruments that monitor air, land, and sea. With the addition of a real-time satellite receiving station located on the University of Delaware's Main Campus, Delaware could arguably be branded the country's "Best Monitored State". With this significant monitoring of the environment occurring across the State and the resulting volumes of data, it is important to have mechanisms for ingesting, organizing, archiving, and disseminating data from these initiatives in a meaningful way.

The recently established Delaware Environmental Monitoring and Analysis Center (DEMAC) is aiming to provide holistic approaches to visualizing these monitoring efforts for the benefits of both research and lay communities. DEMAC is working closely with agencies like the Delaware Environmental Observing System (DEOS), the Office of the Delaware State Climatologist (ODSC), the Delaware Geological Survey (DGS), and the UD Center for Remote Sensing to identify ongoing environmental research projects throughout the state, catalyze new research efforts, invigorate growth in environmental sciences in K-12, and promote a more environmentally-aware state. Through this collaborative approach, DEMAC is building value-added environmental web applications that aggregate currently disparate data to help model and monitor Delaware's fragile ecosystems. An example DEMAC application system will be discussed during this presentation.

The Delaware Coastal Flood Monitoring System

John Callahan, Delaware Geological Survey, 257 Academy St., Newark, Delaware 19716, john.callahan@udel.edu; Kevin R. Brinson, University of Delaware, Newark, DE; Daniel J. Leathers, University of Delaware; Linden S. Wolf, University of Delaware.

In the last two decades storms such as Hurricanes Katrina and Ike along the Gulf of Mexico and Floyd and Isabel along the Atlantic Coast of the United States have resulted in significant loss of life, injuries and property damages reaching well over \$100 billion, much of it due to severe coastal flooding.. The Delaware coastline is extremely vulnerable to such events and has been affected by many great storms in its history, particularly the Ash Wednesday storm in March of 1962 and the Mother's Day storm on May 12, 2008, which severely affected the communities along the Delaware Bay. The added concern of sea-level rise and its effect on the frequency and intensity of coastal flooding events, have further emphasized the need for a modern, dependable coastal flood monitoring and warning system for Delaware's coastal communities.

The Delaware Coastal Flood Monitoring System (CFMS) has been developed, jointly by the Delaware Geological Survey and the Delaware Environmental Observing System at the University of Delaware, to achieve such a goal. A prototype of the system was released in the summer of 2011 for a limited number of Kent County communities along the Delaware Bay but has since expanded to include coastal areas from the City of New Castle southward to the City of Lewes. The CFMS serves three primary objectives: 1) to send out warning alerts, via text or email, to community members in advance of potential flood conditions, 2) to provide access to real-time meteorological and hydrologic conditions, and 3)

to provide a web-based portal displaying tidal+surge predictions, potential flood inundation maps, and road elevation profiles. The targeted audience for the CFMS is state, county, and local emergency management personnel, researchers, planners, and others involved in the preparation and planning for severe flooding events.

From Stream to Tap: Protecting Drinking Water through Stream Restoration

Jennifer Cass, Hazen and Sawyer, 498 Seventh Avenue, New York, NY 10018, jcass@hazenandsawyer.com; Tim Schueler, Hazen and Sawyer; Chris Roubas, Hazen and Sawyer.

The New York City Department of Environmental Protection (NYCDEP) Catskill-Delaware Watersheds cover 1,600 square miles in Upstate NY. This system encompasses streams that serve as trout-breeding habitat and deliver runoff to the City's Reservoirs, which supply unfiltered drinking water to approximately 8.1 million residents.

Within these watersheds, NYCDEP operates several aging sanitary sewer systems. In Grahamsville, Tannersville, and Pine Hill, NY, variable terrain necessitated sewers construction under streambeds in several locations. These sewers were originally concrete encased and/or overlaid with massive stone blocks. However, at 12 locations the once-buried crossings have arrested the upstream progression of natural headcuts, leading to erosion exposing the sewer pipes, and the crossings now acting as fish passage barriers. This condition, left unmitigated, has the potential to breach the sewer's integrity and discharge untreated sewage into streams, jeopardizing natural resources and public drinking water.

To remedy this situation, Hazen and Sawyer has designed vertical grade control structures at two sewer crossings in Chestnut Creek in Grahamsville. We determined that installation of rock cross vanes and riffle grade controls downstream of the crossings will allow the Creek to deposit natural bedload over the sewers, thereby covering and protecting the revetments and removing fish barriers. By this action, complete removal and re-installation of the sewers will not be necessary, minimizing site disturbance and duration.

The remaining 10 sewer crossings will be remediated by lining the sewer with a trenchless cured-in-place pipe and/or by restoring concrete encasement. These techniques will minimize the time spent performing construction and therefore maintain vitality of local stream-dwelling flora and fauna. In addition, during construction, measures will be taken to protect the sites' natural resources.

By restoring and protecting these aging sewers within NYC Watershed's streams, we will protect the quality of this important drinking water source, and the vital habitat surrounding it.

Assessment of Metals in Estuarine Waters

Gregory Cavallo, Delaware River Basin Commission, 25 State Police Drive P.O. Box 7360, West Trenton, NJ 8628, gregory.cavallo@drbc.state.nj.us; Thomas Fikslin, Delaware River Basin Commission, West Trenton, NJ; Namsoo Suk, Delaware River Basin Commission, West Trenton, NJ; Ronald MacGillivray, Delaware River Basin Commission, West Trenton, NJ; Douglas Haltmeier NJ Department of Health &

Assessment of metals in the estuarine waters of the Delaware River is complicated by field sampling and analytical issues with contamination, detection limits associated with routine analytical procedures, the applicability of freshwater or marine criteria, and the influence of other water quality attributes that influence the partitioning and toxicity of metals. In Zone 5 of the Delaware River, copper concentrations continue to be near water quality criteria with several apparent exceedances of the marine criteria in the vicinity of Pea Patch Island (RM 60.6) in recent water quality assessments. The DRBC performed additional data collection for copper, zinc and nickel using enhanced analytical methods, modified collection procedures and changes in the spatial scale of sampling in this segment of the Delaware River. Surface and near bottom water samples were collected at 11 sites from Reedy Island to Marcus Hook. Three sampling events were conducted in November 2011, April and July 2012. All surveys utilized Clean Hands/Dirty Hands techniques to reduce contamination associated with sample collection. The surveys utilized high resolution analytical techniques (ICP/MS) and clean lab procedures to reduce analytical contamination. Detection limits achieved for copper, nickel and zinc were 0.02, 0.02 and 0.08 ppb, respectively using ICP-MS methodology. Equipment rinsate blanks were less than 0.2 ppb for copper and nickel and less than 0.53 ppb for zinc. These levels are significantly less than those obtained with routine sampling and analysis procedures. Exceedances of the marine criteria were observed in surface and bottom samples below the Delaware Memorial Bridge in the April survey. Supplemental assessment of the data is planned using the biotic ligand model (BLM) in freshwater (<1 ppt salinity), and regression-based DOC models in brackish conditions. Future sampling efforts should include Clean Hands/Dirty Hands techniques and clean metals analytical procedures to insure greater accuracy. Coordination among basin states and agencies should continue to ensure the use of the most appropriate methods and procedures for the conduct of monitoring studies in the Basin, and the harmonization of water quality criteria and assessment methodologies.

A Numerical Study of Salt Fluxes in Delaware Bay Estuary

Robert Chant, Rutgers, 71 Dudley Road, New Brunswick, New Jersey 08901, chant@marine.rutgers.edu; Maria Aristizabal, Rutgers University, 71 Dudley Road, New Brunswick, NJ 08901.

The results of a numerical study of Delaware Bay using ROMS are presented. The simulations are run over a range of steady river inputs and used M2 and S2 tidal components to capture the spring-neap variability. Results provide a description of the spatial and temporal structure of the estuarine exchange flow, the salinity field as well the along-channel salt flux in the estuary. The along-channel salt flux is decomposed into an advective term associated with the river flow, a steady shear dispersion (F_e) associated with the estuarine exchange flow and a tidal oscillatory salt flux (F_t). Time series of F_e and F_t show that both are larger during neap tide than during spring. This time variability of F_t , which is contrary to existing scalings, is caused by the lateral flows that bring velocity and salinity out of quadrature and the stronger stratification during neap tide causes F_t to be enhanced relative to spring tide. A fit for the salt intrusion length L with river discharge Q for a number of isohalines is performed. The functional dependences of L with Q are significantly weaker than $Q^{-1/3}$ scaling. It is concluded that the response of the salt field with river discharge is due to

the dependence of F_e and F_t with Q and the relative importance of F_t to the total upstream salt flux: as river discharge increases F_e becomes the dominant mechanism. Once F_e dominates, the salt field stiffens due to a reduction of the vertical eddy viscosity with increasing Q .

The Response of Delaware Bay to Changes in Climate Forcing

Peng Cheng, Horn Point Laboratory, University of Maryland Center for Environmental Science, 2020 Horns Point Road, Cambridge, Maryland 21613, pcheng@umces.edu; Ming Li, Horn Point Laboratory, University of Maryland Center for Environmental Science, Cambridge, Maryland; Raymond Najjar, Department of Meteorology, Pennsylvania State University, University Park, Pennsylvania.

Estuaries are vulnerable to climate change. To investigate the impacts of climate change on the Delaware Bay, we have developed an unstructured-grid model using the Finite Volume Coastal Ocean Model (FVCOM). The model domain covers the Delaware Bay, Chesapeake Bay and part of the Atlantic Ocean. The tidal simulation for 2010 has been completed with 7 tidal harmonic constituents forced at the open boundary and river discharge specified at the Delaware River and the Schuylkill River. The results showed accurate prediction of tides and reliable subtidal salinity structure and currents.

On the basis of the 2010 simulation, a series of sensitivity experiments were conducted to examine the effects of sea-level rise and changing river flows. In the first set of numerical experiments, we ran the model with sea level at -0.5, 0, 0.5, 1 and 1.5 m relative to the current mean sea level. It showed that sea-level rise leads to salt intrusion into the Bay, increasing estuarine length and stratification. Sea level also produces higher tides due to reduction in the bottom friction. It appears that tidal mixing has kept in pace with salt intrusion to maintain well mixed condition in most parts of the Bay at high mean sea levels.

In the second set of numerical experiments, we conducted 5 additional numerical experiments with the river discharge at 0.5 to 2.5 times of the annual averages. Higher river flows transport the freshwater further seaward arresting the landward salt intrusion, and produce stronger stratification in the Bay. The salt intrusion length varies as $Q^{-0.23}$ and the average stratification varies as $Q^{0.22}$ in the Bay. Understanding the physics behind the different power-law dependence is a focus of our current modeling effort.

Assessment of the Impact of Best Management Practices on Surface Water Quality Within a Small Agricultural Watershed

Anastasia Chirnside, University of Delaware, 531 S. College Ave, Newark, Delaware 19716-2140, aemc@udel.edu; Robert Jorgensen and Alison Kiliszek, Bioresources Engineering, University of Delaware, Newark, DE 19716-2140.

Surface water quality within the Cool Run Experimental Watershed (UDEW) was monitored for nutrients, metals, and bacteria. The monitoring sites were located in the head waters of the Cool Run. These head waters are critical to watershed health and have been classified as impaired with nutrients, bacteria, sediments and other water quality stressors originating from urban, industrial and agricultural nonpoint pollution. In 2004, a Comprehensive Land Use Plan

was developed for the farm which resulted in The Cool Run Wetland Restoration Project that designed and implemented improved nonpoint source BMPs to protect and restore water quality of the Cool Run and reduce total pollutant loads. By installing these BMPs and potentially additional management practices, the UD Farm expected to see an increase in overall stream health within the sub-watershed over time. Six monitoring sites were sampled monthly during base flow conditions. Storm samples were taken from 3 different locations several times during each season. The samples were monitored for 20 different parameters

The goals of this project were to assess the changes in water quality after the implementation of the conservation practices within the sub-watershed; and to compare surface water quality of the tributaries draining institutional and residential land use to those draining agricultural land uses. Statistical analysis of the data using SPSS was achieved in order to summarize the data, explore the relationships between the variables and to test the significance of the differences among the variables both temporally and spatially.

Improving Ecological Flow Science in the Mainstem Delaware River: the Decision Support System in the Delaware River

Jeffrey C. Cole, Northern Appalachian Research Laboratory, USGS Leetown Science Center, Wellsboro, PA, jccole@usgs.gov; Kelly O. Maloney.

To help evaluate alternate management scenarios on ecological flow requirements for the Delaware River, Bovee et al. (2007) developed a Decision Support System (DSS) for the upper portion of the Delaware. The existing DSS includes sites within the East and West Branches as well as the mainstem Delaware River (3 sites – near Hankins, Lordsville, and Callicoon, NY), and two of its tributaries: the Neversink and the Flatbrook. However, over the past several years stakeholders have suggested several needed improvements, including a more user-friendly interface, improving transparency, testing the water temperature model, improving the current habitat suitability curves (HSC) for existing species as well as adding additional species of interest, and extending the meteorological and hydrological data used in the model. Current USGS research, funded through the WaterSMART program, is aimed at fulfilling these needs as well as possibly extending the DSS to a larger portion of the Delaware River. To date, the new DSS platform, which is in early beta version and inclusive of the Upper Delaware only, is a GUI window interface that is easy to use, includes updated HSC for mussels, and is transferable to other systems. Future plans include using remote sensing techniques to generate more extensive bed files needed to extend coverage of the DSS. Multiple climate weather stations will also be utilized to extend the meteorological database (both geographically and temporally), both of which are required for improved temperature predictions. At its current geographic extent, the updated DSS will enable managers to simultaneously assess alternative management scenarios on instream flows in a user-friendly venue with extended hydrological and updated HSC. Ongoing improvements will be discussed with stakeholders, and will possibly include extending the geographic extent to Trenton, N.J.

Sector Delaware Bay Area Contingency Plan – Status, Changes, Updates

Jerry Conrad, United States Coast Guard - Sector Delaware Bay, One Washington Avenue, Philadelphia, PA 19147, gerald.a.conrad@uscg.mil.

The ability to effectively respond to spills of oil and hazardous substances in the coastal and marine environment is of paramount importance, given the potential for adverse impacts to economic and natural resources. Effective incident response is facilitated by the Area Contingency Plan (ACP), a regional planning document designed to provide for orderly and effective implementation of response actions to protect the people, natural resources, and property of coastal and inland zones from the impacts of oil or hazardous substances spills. The ACP promotes coordination of stakeholders, describes strategies for a unified and coordinated response by involved parties, and serves as a guideline for spill response actions to ensure consistency. The United States Coast Guard (USCG) requires Area Committees to review and revise their ACPs on an annual basis to include newly available data and biological information on environmentally sensitive areas of the Delaware River and Delaware Bay. In the wake of the Deepwater Horizon oil spill in the Gulf of Mexico, many interested parties throughout the United States want to know how they can be more involved in preparation and response activities to maximize response effectiveness to and minimize impacts from spills in their areas of concern. Parties concerned with sensitive areas in the Delaware Estuary can actively engage with the Philadelphia Area Committee to provide input to and stay abreast of planning activities. This presentation provides an overview of the Philadelphia ACP and describes recent updates to ensure effective and expedient response to spills in the Delaware Estuary.

Moving Land for Air Travel

Calvin M. Davenger, Jr., Philadelphia International Airport, Terminal D, 3rd Floor, Philadelphia, PA 19153, calvin.davenger@phl.org.

This proposed presentation will help attendees gain perspective concerning the history of land alteration, occupying submerged lands, and the evolution of the area that is now known as Philadelphia International Airport (PHL). Since 1925 when the land was first used as an airfield by pilots in the Pennsylvania Air National Guard, Philadelphia Airport has continued with a series of expansion plans where land manipulation and maintaining the integrity of the Delaware River has been a reoccurring topic. Focus has remained on the careful management of dredging and soil disposal in order to avoid adverse effects on navigation, flood flow capacity, public interest, and environmental quality. Attendees will understand planning for dredging and fill projects as well as PHL's path of perpetual permitting and mitigation requirements, the stakeholders and agencies involved, and the transformation from non-regulation to intense regulation, including submerged lands licensing.

The Capacity Enhancement Program, which includes a new runway, two runway extensions, new terminals, new cargo facilities and an automated people mover system, is once again is anticipated to result in the alteration of the Delaware River shoreline. Expansion plans include dredging and a loss of wetlands within the Coastal Zone, including tidal wetlands associated with the Delaware River. Mitigation includes enhancing and creating coastal wetlands in order to maintain benefits for wildlife habitat, flood control, water quality, water flow stabilization, and biodiversity.

In addition, the presentation will detail the organizations/agencies involved in the Airport's expansion plans of navigating land management, which include NOAA, USACE, FAA, Delaware County Coastal Task Force, Delaware River Basin Commission, Pennsylvania Coastal Zone Management Program, PA DEP, NJ DEP, and others.

Moving Watershed Outreach Upstream: Success Stories in Replicating Innovative Philadelphia Watershed Projects in Upstream Communities

Tom Davidock, Partnership for the Delaware Estuary, 110 S Poplar St, Wilmington, DE 19801, tdavidock@DelawareEstuary.org.

The Schuylkill Action Network (SAN) has been working with a diverse group of partners to protect and restore the water resources of the Schuylkill Watershed for the past 10 years. During this time, one of its most important responsibilities has been to help facilitate the sharing of information, resources, and expertise throughout the watershed community. One aspect of this has been to identify projects and initiatives that have proven to be successful and finding the resources to transfer this knowledge to others.

Some of the most progressive efforts aimed at creating a healthy land-water connection are occurring in the city of Philadelphia. The Philadelphia Water Department (PWD) has implemented an aggressive Source Water Protection initiative and is reinventing the way urban areas manage stormwater through their Green Cities Clean Water program. The PWD has also piloted a unique pharmaceutical disposal outreach campaign, engaged schools as hubs of green activities, and has been spearheading the development of new partnership and stakeholder groups. In seeing the benefit of these activities, the SAN has been partnering with the PWD to acquire the resources to move them beyond Philadelphia and replicate them in upstream communities.

This presentation will focus on the recent efforts of the SAN to spread these innovative programs into other communities. Using examples and case studies of successful projects, it will explore the benefits of partnerships, methods of replicating projects in different communities, challenges in transitioning between urban and suburban communities, and tools and techniques for achieving success. The specific project areas that will be explored include stormwater education and outreach using the recently created Green Guide for Large Property Owners, green-infrastructure implementation with schools, pharmaceutical disposal outreach, and partnership/coalition building activities.

Watershed Monitoring, Training and Educational Programs in the Andes-Amazon Basin of Peru and How to Make this a Sustainable Effort.

Dina DiSantis, West Chester University and Downingtown High School West Campus, 40 Sonoma Lane, Birdsboro, Pennsylvania 19508, ddisantis@dasd.org.

This paper presents my findings on how watershed monitoring, training and educational programs are being implemented in the Andes-Amazon Basin and on the feasibility of international collaboration involving watershed studies. In addition, a discussion of the importance of watershed sustainability worldwide is also presented. I traveled from the United States to Peru this summer as a participant in the ACEER Foundation's Institute for Emerging

Sustainability Leaders. While traveling in the Andes-Amazon region of Peru, I set out to answer questions I had concerning water quality studies and training as well as the feasibility of a collaborative effort between the two countries. My goal was to investigate if past and current water monitoring and educational programs conducted in Peru by organizations from the United States have resulted in the implementation of local watershed stewardship programs by the Peruvian people living in the region. What I found was that in order to continue a sustainable effort from those living in the region it is important to have individuals from the local area with a vested interest in the local issues be involved in the training and monitoring process. Ways to accomplish this task is to offer watershed education to students in local schools, build partnerships with schools internationally using technology as a tool to share data, and involve local villagers in the training, monitoring, decision making process with the dissemination of information being conducted by local residents. Changing the behavior of individuals with a connection to the region, can occur through the education and training implemented by people living in the community who have a stake in the future of where they live. Individuals are more likely to understand the issues and develop responsible attitudes if trained by other local residents. Research shows that well-educated citizens become stewards of the environment. Having individuals exposed to environmental education early on can best help them make the complex conceptual connections among environmental protection, economic prosperity, benefits to society, and their own well-being.

Evaluating Coastal Hazard Management Alternatives Under Changing Environmental Conditions for Seven Delaware Bay Communities

Steve Eberbach, Michael Baker Jr., Inc., 8000 Regency Parkway, Suite 600, Cary, NC 27518, seberbach@mbakercorp.com; Michael Powell, Delaware Department of Natural Resources & Environmental Control; Jim Eisenhardt, Cardno Entrix; Mark Osler, Michael Baker Jr., Inc.; Rob Koechert, Johnson, Mirmiran, & Thompson.

The Delaware Department of Natural Resources and Environmental Control is completing a comprehensive economic evaluation of management alternatives which address flooding, coastal erosion, and sea level rise hazards for seven communities along the Delaware Bay. These communities include Broadkill Beach, Prime Hook Beach, Slaughter Beach, South Bowers, Bowers Beach, Pickering Beach, and Kitts Hummock. The study analyzes the expected net benefits associated with four management alternatives including beach re-nourishment and planned retreat. Within each community and for each of the four alternatives, the key components of the evaluation include an assessment of expected flood damages, changes in recreational values, shifts in financial or tax revenue flows, and transfer or loss of housing services. Projections account for changing environmental conditions such as anticipated coastal erosion and sea level rise over a thirty year planning horizon. Results are being used to develop a comprehensive benefit-cost summary that will guide the State of Delaware in development of policies which most effectively reduce community vulnerability.

A View from the Cloud: A Cloud-Based GIS Tool Simplifying Site Analysis for PHI

Rachel Edelstein, Pepco Holdings, Inc., 30 U Rose Rita Terrace, Hammonton, NJ 08037, rachel.edelstein@pepcoholdings.com.

Environmental impact analysis is a crucial component to the success of electric power projects that affect the approximate 2 million customers of Pepco Holdings, Inc. (PHI). PHI, one of the Mid-Atlantic region's largest energy delivery companies, distributes electricity throughout New Jersey, Delaware, Maryland, and the District of Columbia. To

fulfill PHI's mission to provide safe and reliable power while minimizing impacts to the environment, a comprehensive cloud-based geographic information system (GIS) was developed with the help of Photo Science, Inc. PHI's Environmental Geospatial Resource and Engineering Tool, or EGRET, allows engineers and scientists to aerially analyze potential impacts to natural resources to avoid environmentally sensitive areas early in the planning process. Prior to the development of EGRET in spring 2011, environmental analysis was typically completed using traditional paper maps and various public GIS mapping sources. Approximately 400 data layers provide PHI with the means to review potential concerns on one central website to make preliminary determinations of required permits and licenses to comply with federal, state, and local laws and regulations. The cloud-based structure of EGRET allows PHI to share project files by saving layers, import field survey data, outsource for maintenance and data layer updates, and regularly make enhancements. EGRET, which contains various mapping tools, provides PHI with a means of conducting a desktop review of natural resources to identify areas of concern and efficiently move forward with projects. This unique tool used throughout project planning has both expedited the environmental permitting and licensing process, and has led to a more thorough environmental analysis to protect natural resources throughout the PHI service territory. This presentation will include an introduction to EGRET, demonstrating a unique way of fulfilling the responsibility of providing safe and reliable power to customers while avoiding and minimizing environmental impacts to the maximum extent practical.

Coastal Resiliency - Economics for Changing Environment

Jim Eisenhardt, Cardno ENTRIX, Corporate Circle, New Castle, DE 19720, jim.eisenhardt@cardno.com.

Site-specific Intensive Monitoring of Wetlands of the Delaware River Estuary and Barnegat Bay

Tracy Elsey-Quirk, Academy of Natural Sciences of Drexel University, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19123, quirk@ansp.org; David Velinsky, ANS Drexel University; Danielle Kreeger and Angela Padeletti, PDE; Martha Maxwell-Doyle, BBP, NJ.

Climate change, sea-level rise, and coastal development are only a few of the factors affecting tidal wetlands. How wetlands will change in area, composition, and function over time in response to the interactive influences of these factors is relatively unknown. A scarcity of long-term wetland monitoring data limits our ability to assess changes over time and predict future adaptation or loss of area and function. To assess physical, chemical, and biological changes over time, we have established six wetland monitoring stations in the Delaware Estuary and three in Barnegat Bay. Beginning in 2010, changes in surface elevation, elevation relative to sea level, soil and water chemistry, surface chl a, plant biomass, plant communities are being monitored at each of the fixed stations. The network of monitoring sites includes tidal freshwater, brackish, and salt water wetlands and sites that span nutrient gradients. The initial rate of surface elevation increase in the tidal freshwater wetlands averaged over 30 mm/yr with the rate of relative sea level rise at Philadelphia, PA averaging 2.8 mm/yr over the last century. Surface elevation change in salt marshes ranged from -3 to 4 mm/yr with local rates of sea level rise ranging from 3 to 4 mm/yr. Elevations (NAVD88), aboveground and belowground plant biomass, soil and water nutrients varied among sites during the first two years of monitoring. Long-term data are expected to result in a better understanding of the interactions of elevation, sedimentation, vegetation, and nutrients in these wetlands over time.

A Spatially Detailed Assessment of Total Nitrogen Loads in the Delaware River Basin

Jeff Fischer, U.S. Geological Survey, New Jersey Water Science Center, NJ , fischer@usgs.gov; Richard B Moore, U.S. Geological Survey, New Hampshire Water Science Center, rmoore@usgs.gov, 603-226-7825.

SPATIally Referenced Regressions On Watershed attributes (SPARROW) is a modeling technique that was developed by the U.S. Geological Survey to relate contaminant sources and losses to stream water-quality measurements. SPARROW provides estimates of contaminant loads for all unmonitored streams as well as contributions from different sources. SPARROW was originally designed for application at the national level, but smaller scale models have recently been developed for other regions of the country.

One such SPARROW model was developed to assess nitrogen loading in the Northeastern United States to represent source conditions for the year 2002. The model results for nitrogen sources and transport to receiving waters provide spatially detailed information that aids water-resources managers in understanding eutrophication processes and developing nutrient management strategies.

For the Delaware River Basin the model estimates that the total nitrogen load to the Delaware Estuary above the bay is close to 46 million kilograms per year (MKg/yr). Nearly half (45 percent) of the total load was attributed to point source discharges, about half of which discharge directly to the estuary. Other sources of nitrogen included agricultural fertilizer and manure applications (29%), undifferentiated urban sources (13%), and atmospheric deposition (12%). Contributions from the three largest tributaries to the estuary, the Delaware, Schuylkill, and Christina Rivers, were estimated to be 11, 13, and 3 MKg/yr respectively. The largest sources of nitrogen were different for each river: the largest source on the Schuylkill was point-source dischargers (46%), on the Christina it was agricultural runoff (78%), and on the Delaware River urban, agricultural, and atmospheric sources of nitrogen were all close to 30 percent. Model results are available on the web (<http://cida.usgs.gov/sparrow/>), and similar calculations can be made for many streams throughout the Delaware Basin using the web based tool.

Avian Protection Program of a Power Delivery Company (PHI)

Cristina Frank, Pepco Holdings, Inc., PO Box 9239, 79NC64, Newark, DE 19714-9239, cristina.frank@pepcoholdings.com.

Avian protection is a critical issue for electric power lines. When birds interact with electric utility infrastructure, the result can be bird fatalities and power outages due to damage to electrical facilities. These risks increase in the Delaware Estuary where large raptors and other breeding and migratory birds concentrate. While utility poles can benefit birds by providing perching and nesting opportunities where few natural perches or nest sites exist, utility structures can also pose a threat to birds through electrocutions or collisions. In order to minimize avian electrocution and collision hazards from its overhead infrastructure, Pepco Holdings, Inc. (PHI), a power delivery company serving two million customers in NJ, DE, MD, VA and DC (Atlantic City Electric, Delmarva Power & Light and Pepco subsidiaries), developed a multi-faceted Avian Protection Program. The goal of the program is to ensure compliance with federal and state regulatory requirements protecting birds, while improving system reliability and reducing the effects of bird interactions with power lines. As part of the Avian Protection Program, PHI maintains and implements comprehensive Avian Protection Plans, utility-specific documents that provide a strategic roadmap to address avian issues into the changing future. They provide management and field personnel with a tool to protect and manage for bird interactions and address regulatory

compliance procedures, training programs for utility personnel, retrofits for identified risk throughout the service territory and avian-friendly construction design standards. PHI's Avian Protection Program is collaborative in nature, pulling together government agencies, conservation partners and community leaders to focus on protection and restoration projects for the benefit of birds, other wildlife and local communities. We will present about the strategies, initiatives and accomplishments of PHI's Avian Protection Program, demonstrating the company's commitment to balancing avian protection with its primary responsibility of providing safe, reliable, and affordable energy to its customers.

RSM Sediment Dynamics/Quantity

Jeff Gebert, USACE, Philadelphia District, Philadelphia, PA 19107, jeffrey.A.gebert@usace.army.mil; Christopher K. Sommerfield, School of Marine Science and Policy, University of Delaware, Lewes, DE 19958-1208; David R. Walsh, Woods Hole Group Inc., 81 Technology Park Dr., East Falmouth, MA 02536.

This talk summarizes a study to identify and quantify sources and sinks of fine-grained sediment in the Delaware Estuary, and develop a sediment budget for the river-estuary system. The results provide a framework for managing sediment resources in the estuary, in support of the regional sediment management plan (RSM) developed by the US Army Corps of Engineers (USACE), Philadelphia District and other regional agency and NGO partners.

The principal tasks in this investigation evaluated the following sediment budget components:

- input of sediment from rivers discharging to the estuary
- resident suspended load of the estuary
- removal of sediment through dredging
- sediment accumulation/erosion in subtidal zones
- sediment mass contributed by eroding wetlands
- sediment mass accumulating in tidal marshlands

These components were then integrated to develop a sediment mass budget averaged over the period 1950–2001. The budget includes three sediment source terms (subtidal erosion, river input, and shore erosion) and three sinks (maintenance dredging, marsh accumulation, and subtidal accumulation) with respective totals of $3.8 \pm 0.9 \times 10^6$ mt/yr and $3.3 \pm 0.6 \times 10^6$ mt/yr. Although there is near-equality between sources and sinks, this balance is artificial as it includes maintenance dredging, which permanently removes sediment from the estuarine system. The natural sediment balance of Delaware has been extensively modified by human activities, principally after 1909. The influence of maintenance dredging and other waterway engineering practices on the sedimentary system must be taken into account when developing strategies for regional sediment management in the Delaware Estuary.

In This Together: Building Lasting Coalitions

Brenna Goggin, Delaware Nature Society, 3511 Barley Mill Road (PO Box 700), Hockessin, Delaware 19805, brenna@delawarenaturesociety.org.

Creating an open dialogue amongst fellow organizations and stakeholder groups is an important first step in building any coalition and/or implementing an outreach campaign. However, obtaining buy-in and agreement among a diversity of individuals can be a challenge. For several years, multiple attempts have been made in Delaware to create an environmental coalition or at least provide opportunities for the environmental community to speak with one voice. Due to a variety of circumstances, these attempts failed to find a common cause or a rallying point for groups to grasp onto. Over the past year, the Delaware Nature Society brought the leading state environmental organizations together to once again attempt to create a working environmental coalition. Through countless meetings, e-mail discussions, and phone calls, these organizations have taken the first steps to developing a Delaware Environmental Working Group. The Working Group has developed guidelines and rules to help focus the group's efforts, voted on priorities for the coming year, and made substantive progress to meet on our objectives. Lessons learned through this process include but are certainly not limited to communication, trust building, and collective decision making.

A High-Resolution Study of Tidal Range Changes in the Delaware Bay: Past Conditions and Future Scenarios

George Hall, Oregon State University, 220 Owen Hall, Corvallis, OR 97330, david.hill@oregonstate.edu; David Hill, Associate Professor of Civil Engineering, Oregon State University.

Tides in the Delaware Bay (USA) have been modeled from 10,000 years before present (10 ka) to present day and for selected future sea-level rise scenarios (100 years, 300 years). Historic bathymetries were constructed through use of glacial isostatic adjustment (GIA) models and a very high spatial resolution (< 100 m) was used at the shoreline. Future bathymetries were obtained by extrapolating these GIA models and applying an additional eustatic sea-level rise. It was found that tides in the lower bay have remained fairly constant through time but that tides in the upper bay have increased steadily from about 4 ka to present day; a nearly 100% increase in total. The future runs demonstrated spatially complex behavior with tidal-range changes of up to 10%.

Uniting Artists and Urban Residents for Green Infrastructure Actions

Maryann Helferty, US EPA Mid-Atlantic Region, 1650 Arch St., Philadelphia, PA 19103, helferty.maryann@epa.gov.

Community Art projects harness unique power to transform public perception of water issues, especially in today's crowded media context. Artists are adept at provoking curiosity among audiences not reached by traditional outreach methods. Their well crafted process of engaging community members to envision a common future and transform their neighborhood lends itself to promoting green infrastructure. This presentation will provide stunning visual examples of public art themed on water stewardship and relay good practices in partnering with the cultural community. Types of outreach include:

Site-specific, temporary public art installations: A pop up project that celebrates water resources can bring public attention to often ignored water resources. The Manayunk neighborhood was transformed by “Escaped Infrastructure”, a kinematic structure celebrating the legacy of the Tow Canal winding into the Schuylkill River.

Arts & Music Festivals: Many residents of Philadelphia live in neighborhoods far from the major open water such as the Delaware and Schuylkill Rivers. Programs like the East Falls Art on the River Festival bring out the public and stimulate new conservation behaviors.

Mural Arts Installations: Philadelphia’s Mural Arts program is world-renowned for the transformative effect of large-scale murals on social issues. By targeting community organizations and engaging residents in painting projects, arts organizations build awareness about the legacy, present and future of water resources. The story of their Twin Bridges Public Art Project will tell how to create an artistic focus on an urban waterfront.

Engaging Business Districts: Many business districts perceive value in celebrating urban waterfronts or water resources as a way to brand their location and draw in foot traffic. Concepts will be shared about how to partner in promoting green infrastructure measures like rain barrels, green roofs and rain gardens while helping them beautify their commercial corridors.

Insights into seasonal organic carbon cycling in the Delaware estuary from N-alkane biomarker and stable carbon isotopes

Anna Hermes, Rutgers University, 71 Dudley Rd, New Brunswick, New Jersey 08901, sikes@marine.rutgers.edu;
Elisabeth L. Sikes, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ.

Estuaries are the classic site for the meeting and mixing of marine and terrestrial influxes for many components. Our understanding of organic carbon pathways in estuaries remain poorly quantified. Mixing across biogeochemical gradients in estuaries controls the geochemical reactivity and partitioning of marine and terrestrial organic carbon (OC). In the Delaware Estuary, urbanization and wetland sources of carbon further complicate OC pathways. Here, we show bulk isotope, biomarker, and compound-specific carbon isotope analysis (CSIA) results for water column particulate OC and sediments from two seasonal transects through the estuary (2010-2011).

In spring, multi proxy analyses indicate surface water OC primarily reflect productivity both upriver and in the estuary, however, bottom water and sediments sources of OC are dominated by wetland and terrestrial inputs. This suggests that substantial burial of terrestrial-derived OC in the upper-estuary has potential for subsequent resuspension in the estuarine turbidity maximum, or has implications for the impact of dredging on OC cycling through the estuary. Additionally, it appears that a greater proportion of marsh sourced OC partitions into sediments surrounding the estuarine turbidity maximum, reinforcing its role as a biogeochemical filter.

In contrast, during fall with low river discharge, the sediments have much less overall OC than in spring and the character of the particulate and sedimentary OC is much more homogenous. In-estuary productivity was also low at this time in early autumn. Our compound-specific isotope data suggests substantial marsh and wetland sources of OC relative to spring throughout the estuary. Thus, wetland OC appears to be important both geochemically and quantitatively for OC processing in the Delaware and other estuaries.

The Condition of Wetlands in the Murderkill Watershed, Delaware

Andy Howard, DNREC, 820 Silver Lake Blvd., STE 220, Dover, DE 19904, andrew.howard@state.de.us; Alison Rogerson, Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Delaware's Wetland Monitoring and Assessment Program is systematically assessing the condition of wetlands throughout the state on a watershed scale. Wetlands within the Nanticoke, Inland Bays, St. Jones, Murderkill, Broadkill, and Christina watersheds have been assessed. In the Murderkill watershed 116 sites were sampled in 2008 and 2009 to determine the health of the watershed's wetlands. Results indicated that over 60 percent of wetlands in the watershed were moderately or severely stressed by alterations to hydrology, habitat or buffer features. Invasive plant species and ditching were predominate stressors as invasive species were found at 87 percent of riverine sites and ditches were present in 60 percent of tidal fringe sites. Assessment results from riverine, flat, depressionnal, and tidal fringe wetland classes will be highlighted. Changes in wetland acreage over the last 15 years will be discussed as well as watershed specific management recommendations and how the wetland program plans to use this new information.

Underground 3D Mine Pool Mapping in the Anthracite Region's Upper Schuylkill River Watershed

Robert Hughes, Eastern PA Coalition for Abandoned Mine Reclamation, 101 S. Main Street, Ashley, PA 18706, rhughes@epcamr.org; Michael Hewitt, Eastern PA Coalition for Abandoned Mine Reclamation-Program Manager.

EPCAMR and a team of experts from the Pennsylvania Department of Environmental Protection-Pottsville District Mining Office, the PA DEP Bureau of Abandoned Mine Reclamation (BAMR), U.S. Geological Survey (USGS) Pennsylvania Water Science Center, and the Office of Surface Mining (OSM) Appalachian Regional Office have completed a 4 year study of water quantity, quality, and potential usage from underground mines in the Anthracite region.

The objective of this project was to determine the immediate and long-term availability (water quantity and water quality) of mine-water resources in the Western Middle and Southern Anthracite Fields of Eastern Pennsylvania, including the Upper Schuylkill River Basin and the Susquehanna River Basin.

The project involved the compilation, evaluation, and synthesis of data on the hydrogeology of flooded underground mines. Information maintained in paper files by State and Federal authorities was digitized and combined with other available data to develop a comprehensive geographic information system (GIS) database containing the locations, topographic elevations, water-level elevations, flow rates, and water quality in wells, boreholes, abandoned mine drainage (AMD) sources, and associated stream reaches throughout the region. Additional data on the locations of coal outcrops, barrier pillars, and mine boundaries are included in the GIS database. These data were evaluated to delineate horizontal and vertical boundaries and to estimate corresponding current flooded volumes for the major mine pools, also know as multi-colliery hydrogeologic units. The associated recharge area(s) and primary discharge points for each of the major mine pools have been identified utilizing digital topographic, mine map, and aerial photography data.

The full report available for download below, explaining in detail the hydrogeological characteristics of each mine pools and the results of the GIS and ground-water resources analysis and have been displayed as maps in that identify the quantity and quality of the mine-pool water resources. The maps will be useful to guide land-use managers as well as public and private interests concerned with water availability and economic redevelopment in Pennsylvania's Southern and Western Middle Anthracite Region. EPCAMR is currently working on developing the 3D Mine Pool Maps for the Northern and Eastern Middle Anthracite Region.

Doggie Pageants and Poo-lution Prevention

Cheryl Jackson, Partnership for the Delaware Estuary, 110 South Poplar Street, Suite 202, Wilmington, DE 19801, cjackson@DelawareEstuary.org; Arthur Holst, Philadelphia Water Department, Philadelphia, PA.

For the past two years, Philadelphia Water Department (PWD) has partnered with Partnership for the Delaware Estuary (PDE) to organize an annual spokesdog contest. This contest is a creative program where the educational content is presented in a lighthearted, informal manner. Aspects of water poo-lution as well as social stigma (neighbors want to open their windows to fresh, clean smelling air!) are touched on.

Targeted Philadelphia neighborhoods are peppered with direct mailings, brochures, and free bags-on-board (biodegradable bags for picking up pet waste). Neighborhood Associations are engaged and their involvement is encouraged.

After finalists are determined, special guest judges choose the winning spokesdog at a neighborhood doggie pageant. This community event appeals to neighbors as a chance to socialize, visit with local dogs, and get free giveaways, all while learning about poo-lution.

Winning spokesdogs agree to participate in community events and are provided with literature and bags-on-board to help spread the word about the importance of picking up after your pet.

This program has driven a phenomenal amount of traffic to PWD and PDE websites, with over 10,000 visits being attributed to online voting for the spokesdog contest. In two years, nearly two-hundred dog owners have participated in the contest, and approximately one-thousand Philadelphia residents have been reached, including Philadelphia's Mayor Nutter.

Fight or Flee: The Sea Level Rise Scenario - An Alternative is Adaptation

Douglas Janiec, Cardno ENTRIX, 10 Corporate Circle, Suite 300, New Castle, DE 19720, doug.janiec@cardno.com.

We are on the front edge of a world-wide crisis: Sea Level Rise (SLR); the natural resource, economic, and commercial impacts are already beginning to be felt. One predominant management strategy has emerged relative to this condition: Fight or Flee (FoF). FoF refers to temporarily holding-back SLR with structural or nourishment related techniques, and/or retreating inland, surrendering tidal marsh, mud flat, SAV, and other related habitats to open water habitats. Under many current SLR projections, this strategy forfeits most of our existing tidal estuarine systems over the next century.

This presentation introduces the audience to the alternative strategy of SLR adaptation. Adaptation offers a means to: slow down the loss of desirable habitats; improve natural processes to better enable habitats to keep pace with SLR; and/or provide for conversion to other desirable habitats rather than an open water habitat. A key element of this strategy is recognizing that the restoration design needs to be tailored for a fluid normal circumstance, as such the design goals and target habitat(s) may change in response to the ever changing SLR condition. In many cases, these strategies provide for a more cost effective means to preserve important ecological functions and ecosystem services currently provided by our tidal systems.

Clean Waterways in Wilmington – Green Infrastructure Planning and Implementation to Improve Water Quality and Support Public Space

Molly Julian, Meliora Design, LLC, 100 North Bank Street, Phoenixville, PA 19460, mollyj@melioradesign.net; Altje Hoekstra, Meliora Design; Mary Neutz, City of Wilmington Department of Public Works; Amanda Tolino, City of Wilmington Department of Public Works; Gary Schwetz, Delaware Center for Horticulture.

The City of Wilmington has updated its Long Term Control Plan (LTCP) to include Green Infrastructure and runoff source control management, which will help improve the quality of impaired streams, enhance neighborhood aesthetics, mitigate urban heat island effects, and meet target goals for regulatory compliance. The City has undertaken a number of initiatives as a part of the Clean Waterways in Wilmington Program, which strives to create a safe, clean and sustainable water environment to support a thriving community in Wilmington.

A key component of Clean Waterways in Wilmington Program is to evaluate and pilot Green Infrastructure measures within their combined sewer overflow (CSO) hotspot areas, such as the CSO 4A sewershed. The GI Plan for CSO 4A proposes interventions that are specifically designed to reduce the volume of runoff entering the sewer during frequent precipitation events and will enhance water quality by managing the first 1.5-inches of runoff from over 30 acres of impervious surfaces in the sewershed. A critical component of this effort is identifying projects that can meet water capture goals while also improving public spaces or dovetailing with other proposed efforts.

This presentation will introduce the water quality challenges facing the City of Wilmington, define Green Infrastructure and discuss its need in the urban environment, propose a methodology for locating and implementing Green Infrastructure at a planning level, and discuss the balance of project benefits and costs. Also, several case studies of Green Infrastructure measures that have been designed and/or built in Wilmington in collaboration with the Delaware Center for Horticulture will be presented, including an ACME parking lot in downtown Wilmington retrofitted with GI technologies to capture existing parking lot runoff and a Stormwater Tree Trench designed as a pilot project in the CSO 4A sewershed.

A Positive Assessment of the Status of the Delaware River American Shad Stock and its Fisheries

Desmond Kahn, Delaware Division of Fish and Wildlife, 302-735-2969, Dover, DE , desmond.kahn@state.de.us; Russell Allen, New Jersey Division of Fish and Wildlife, Daryl Pierce, Pennsylvania Fish and Boat Commission; Dave Arnold, Pennsylvania Fish and Boat Commission; Jerry Mohler, U. S. Fish and Wildlife Service.

An assessment of the Delaware River American shad stock and its fisheries has just been concluded, producing a positive picture of the status of the stock. The assessment was conducted by a multi-state fish and wildlife cooperative organization focused on fishery resources of the Delaware River, the only undammed major river on the East Coast of the United States. American shad migrate up to 300 miles upriver from the mouth of Delaware Bay, into New York state waters. A critical question was whether the fisheries were having negative impacts on stock reproduction. Young-of-year production has been monitored annually since 1980, using two beach seine surveys. There is a statistically significant positive trend in YOY catch-per-haul, stemming largely from low indices in the earliest years. Adult abundance was low in mid-century due to annual anoxia below Philadelphia. Anoxia disappeared by 1987, and adult catch-per-haul in a commercial haul seine fishery in the non-tidal River in New Jersey, with data back to 1925, shows the index was low

during mid-century, then increased to peak levels in the 1980s and 1990s. Adult relative abundance declined in the 2000s, and has a highly significant negative correlation with relative abundance of striped bass in Delaware Bay and the tidal River since 1982. Plots of the young-of-year index as a function of the adult index show that reproductive output of this stock has been stable, even when adult run size declined to the lowest levels observed since 1980. This finding was a major influence on the assessment finding that the fishery level is sustainable.

Benefit-Cost Analysis of Improved Water Quality in the Christina Basin of Delaware and Pennsylvania

Gerald Kauffman, University of Delaware, DGS Annex Academy St., Newark, DE 19716, jerryk@udel.edu.

A watershed model is developed to conduct benefit-cost analysis of improved water quality in the Christina Basin in Delaware and Pennsylvania. The Christina/Brandywine River system is the 2nd largest tributary to the Delaware Estuary. The water quality model links costs of pollutant load reductions with the economic benefits of watershed restoration. Costs are estimated to reduce nitrogen loads by a median of 50% within confidence intervals of 25th to 75th percentile. Market and nonmarket benefits of improved water quality on water supply, recreation, and fishing uses are estimated. Marginal abatement cost curves are derived to estimate optimal costs of improved water quality in the Christina Basin.

Key Findings from the 2012 Technical Report for the Delaware Estuary and Basin (TREB) and Next Steps

Danielle Kreeger, Partnership for the Delaware Estuary, 110 South Poplar St., Suite 202, Wilmington, DE 19801, dkreeger@delawareestuary.org; Susan Kilham, Drexel University, PISB, 33rd and Chestnut Streets, Philadelphia, PA 19104; Jennifer Adkins, Partnership for the Delaware Estuary, 110 South Poplar St, Wilmington, DE 19810; Priscilla Cole, Partnership for the Delaware Estuary.

The Science and Technical Advisory Committee of the Partnership for the Delaware Estuary (PDE) led the development of the 2012 Technical Report on the Delaware Estuary and Basin (TREB), which provided the scientific footing for the 2012 State of the Estuary Report. This indicator-based technical report represented a significant expansion of previous efforts to assess status and trends in the health of the Delaware Estuary watershed system, with extensive information on more than 50 environmental indicators representing diverse facets of the natural ecosystem, such as water quality, living resources, habitats, and land cover. When considered together, this indicator-based report provides a comprehensive picture of the status and trends in environmental health of the Delaware Estuary and River Basin, showing that some indicator conditions appear to be improving, while others appear to be declining. Where appropriate, forecasts for future conditions will be provided as well. When taken all together, the contents of this report suggest that overall environmental conditions are fair, with some improvements since our last State of the Estuary Report in 2008, and some conditions apparently declining. Actions and needs were also discussed to help strengthen future watershed assessments. Input will be sought from Summit participants to guide next steps for how PDE and partners can best address these needs, fill vital data gaps, and respond to emerging challenges.

Importance of Freshwater Mussels for Water Quality in the Tidal Delaware River: Preliminary Findings from Quantitative Surveys in 2012.

Danielle Kreeger, Partnership for the Delaware Estuary, 110 South Poplar St., Suite 202, Wilmington, DE 19801, dkreeger@delawareestuary.org; Melanie Mills, Academy of Natural Sciences of Drexel University, 1900 Ben Franklin Parkway, Philadelphia, PA 19104; Lance Butler, Philadelphia Water Department, 1101 Market Street, 4th Floor, Philadelphia, PA 19107; Roger Thomas, Academy of Natural Sciences.

Native freshwater mussels continue to garner increasing attention for their declining populations, usefulness for biomonitoring, and ecological importance. To understand their current or potential water quality benefits, physiological data must be integrated with population abundance data. However, freshwater mussel surveys that generate quantitative data on mussel densities and demographics are onerous and rarely undertaken. Since 2009, large and diverse assemblages of native mussels have been discovered in the tidal Delaware River between Trenton, NJ, and Philadelphia, PA, including several rare species. As a first step to assessing their ecological importance, we surveyed four representative mussel beds using quantitative methods in the shallow, sublittoral zone of the river between June-September, 2012. The spatial extent, density and species richness of mussels varied widely among beds, across each bed, and with depth and substrate conditions (see presentations by Thomas, Butler, and Cole). Up to six species of mussels were found in a single 1-meter square quadrat. Densities ranged from zero to 81 mussels m^{-2} . One of the largest beds surveyed extended across several hectares and had a mean density of 30.2 mussels m^{-2} . Therefore, that bed likely contains at least 600,000 animals, and probably much more, because mussels were not surveyed in depths of more than 2 m below mean low water. Based on tissue biomass and physiological rate processing data, we estimate that this one bed contains at least one metric ton of mussel biomass (dry tissue weight) with the capacity to filter more than 30 million liters per day during spring to fall. Considering that many shallow water beds of mussels have been found in this river reach and deeper areas remain largely un-surveyed, we conclude that the extant population of native freshwater mussels is of sufficient size to furnish valuable ecosystem services of regional significance. Investments in mussel conservation and restoration should help address some water quality targets in the Delaware River Basin.

Toward Enhanced Forecasting of Extreme Weather Events in the Mid-Atlantic to Improve Preparation, Response, and Resiliency

Gerhard F. Kuska, Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS).

Coastal inundation has become a priority concern over the past several years, particularly as predictions for sea level rise combine with the increasing frequency of higher-intensity weather events in the Mid-Atlantic Bight, including in the Delaware Estuary. The weather community has made progress in storm track forecasts; but progress in hurricane intensity forecasting has remained illusive over the past 20 years. Particularly during Hurricane Irene (2011) and super storm Sandy (2012), coastal areas in the Mid-Atlantic received, in some cases, inadequate or incorrect information on the intensity of the storms and the resulting impacts, including storm surge. A major contributor to this shortfall is the lack of adequate and accurate sea-surface and sub-surface observations that characterize the driver of hurricane intensity in the North Atlantic---water temperature, as well as a lack of adequate, fully-coupled, ocean-atmospheric models at the regional scale to inform accurate and timely forecasts. With the expectation of increasing frequency in higher-intensity storms, an enhanced system for observing and forecasting is necessary and can be achieved through a coordinated system of regular, sub-surface monitoring as well as a suite of enhanced models and forecast delivery

methods that provide timely and accurate information to emergency managers, coastal managers, other decision makers, and the public. This will require a new level of coordination among a variety of partners, including among the many offshore-, near coastal-, and estuarine organizations engaged in observing, forecasting, and management.

The weTable: A Tool for Participatory Geospatial Planning

Ed Lewandowski, Sustainable Coastal Communities Initiative/University of Delaware, 700 Pilottown Road, Lewes, DE 19958, edlew@udel.edu; Bryan Hall, Circuit Rider Planner, Office of State Planning Coordination, State of Delaware; Carol Bason, Land Use Planner, CommunityViz®; Nicole Minni, Associate Policy Analyst, Institute for Public Administration, University of Delaware.

University of Delaware outreach and extension specialists have been assisting local stakeholders with geospatial planning efforts in a number of Delaware communities. Recently, our specialists have introduced a new technology that has enhanced citizen engagement in these public processes.

The weTable, which was developed by Texas Sea Grant in collaboration with Placematters Inc., transforms an ordinary tabletop into an interactive computer interface. This affordable participation tool allows groups to collaboratively explore and use computer-based data and programs in a workshop setting. Participants can easily use the interface with very little instruction, and it allows them to work with what matters most in a meeting- data, maps, and their fellow participants!

The weTable is an ideal tool for use in community projects where participants use data and maps to help define planning priorities and strategies. The setup is especially useful for exploring GIS data and as a participatory GIS tool. Rather than crowding around a computer screen or viewing presentations across a room, participants work together in a shared and open tabletop interface. The result is a dynamic tabletop workspace that helps participants engage in the issues more meaningfully. This setup of off-the-shelf technology represents a leap in the collaborative potential of public workshops and other meetings and its prospective uses are being realized by a number of planning agencies and groups around the state.

The use of “smartboard” technology for participatory GIS was pioneered by Placematters, a nonprofit spinoff of the Orton Family Foundation dedicated to improving decision making at the community level.

Challenging Tides: Results of Delaware's Sea Level Rise Vulnerability Assessment

Susan Love, DNREC - Delaware Coastal Programs, 5 East Reed St., Ste 201, Dover, DE 19901, susan.love@state.de.us; Carl Yetter, DNREC Delaware Coastal Programs; Tricia Arndt, DNREC Delaware Coastal Programs; Sarah Cooksey, DNREC Delaware Coastal Programs; Bob Scarborough, DNREC Delaware Coastal Programs; Kelly Valencik, DNREC Delaware Coastal Programs.

With the assistance of Delaware's Sea Level Rise Advisory Committee, the Delaware Coastal Programs completed an in-depth statewide sea level rise vulnerability assessment. Using a statewide bathtub model, 79 resources ranging from wetlands to historic sites to wells were analyzed for exposure to sea level rise and secondary social, economic and

environmental impacts. This assessment shows that sea level rise is an issue that will have far reaching effects to state residents and the regional economy and will serve as the basis for development of a sea level rise adaptation plan for the state. This presentation will review the methods utilized and highlight the results of the assessment as well as provide insights on use of this document in developing adaptation actions.

Toxicity Testing in Ambient Water Quality Assessment

Ronald MacGillivray, Delaware River Basin Commission, 25 State Police Drive, West Trenton, NJ 08628-0360, ronald.macgillivray@drbc.state.nj.us; Thomas Fikslin, Delaware River Basin Commission; John Jackson and David Funk, Stroud Water Research Center, Avondale, PA; Christopher Nally, American Aquatic Testing, Allentown, PA.

Based on existing federal and state water quality regulations, no adverse effects should be observed in toxicity tests with undiluted ambient water. Toxicity tests are an effective way to measure mixtures in receiving streams. Two areas of the Delaware River Basin that present challenges to standard toxicity testing include the tidal river segment of the estuary with salinity gradients between 0 to 15 ppt and the upper basin tributaries with soft water (< 30 mg/l hardness). In the estuary, freshwater locations from the main stem and from tributary sites were tested using standard EPA freshwater acute and chronic toxicity methods with fish (*Pimephales promelas*), invertebrates (*Ceriodaphnia dubia*) and an algae (*Pseudokirchneriella subcapitata*). Brackish water locations were tested using marine acute and chronic toxicity methods with fish (*Menidia beryllina*), mysids (*Americamysis bahia* after acclimating to lower salinities), and amphipods (*Hyalella azteca* in water-only tests). A wide range of salinity controls were included in the tests for survival, growth, and reproduction.

In the upper basin, tributary locations were tested using *P. promelas*, *C. dubia* and *P. subcapitata*, as well as with non-standard mayfly species (*Centroptilium triangulifer*, *Procladius rivulare* and *Pseudocloeon frondale*). All species were measured in acute and chronic toxicity tests with multiple controls using soft and moderately hard surface water as part of a baseline monitoring program designed to evaluate natural gas development in the Delaware River Basin. Mayflies were chosen as a test species as they occur in the region, are known to be relatively sensitive to changes in water quality, are ecologically important, and are commonly included in water quality assessment programs. A tiered approach to monitoring including ambient toxicity tests provides cost effective information for environmental management. Sites that exhibit toxicity can be targeted for additional evaluation using expensive chemical analysis, toxicity identification evaluation, and toxicity reduction evaluation.

Discovering Our Urban Waterways

Demetrius Marlowe, UrbanPromise Academy, 3700 Rudderow St., Pennsauken, NJ 8110, dmarlowe@urbanpromiseusa.org; Jim Cumming, UrbanPromise Academy; Julia VanderWoude, UrbanPromise Academy; UrbanPromise Academy Students.

UrbanPromise Academy utilizes experiential and expeditionary learning in order to engage students in environmental awareness, advocacy, and stewardship. This approach has supported and facilitated inquiry-based learning which serves as a guidepost for project-based service learning across the high school curriculum, including research about and restoration to urban waterways, specifically the tidal Cooper River. If accepted, our presentation will deliver the current

status of Camden's water supply system, sources of pollution, and current degradation. Students will share the value of the tidal Cooper River and its potential to serving the community as a course of recreation. They will discuss the action-oriented assignments that teach simple behavioral changes that students can teach to peers and other city residents to reduce negative environmental effects on and protection of Camden's waterways, watersheds, and ecological habitats. Water supply testing and watershed restoration will be the key focus of project-based their learning modules. Students will deliver evidence of their learning through enhanced ecological literacy, data collection and analysis, critical thinking, communication, and teamwork. As a result of their work UPA has influenced the county park;s department to build an access point for the canoes and kayaks UPA students have built through the BoatWorks Program.

Sources and Composition of Dissolved and Particulate Organic Matter in the Delaware Estuary

Hadley McIntosh, Virginia Institute of Marine Science, 1208 Greate Road, Gloucester Point, VA 23062, hamcintosh@vims.edu; J.E. Bauer, Ohio State University, Columbus, OH; E.A. Canuel, Virginia Institute of Marine Science, Gloucester Point, VA.

Estuaries are dynamic regions where organic matter (OM) is produced and reworked before being delivered to the coastal ocean. OM in these zones derives from a mixture of sources (e.g., terrestrial, anthropogenic, and marine) and is subject to modification by physical, biological, and chemical processes. In the Delaware River-Estuary system as well as other estuaries, these end-member sources of OM (terrestrial, anthropogenic, and marine primary production) change along the salinity gradient but the influence of changing sources and biogeochemical modifications on the age of OM remains unknown. Previous studies in the Delaware system have documented that the radiocarbon age of the lipid fraction (23,300 years before present (BP)) is considerably older than total organic carbon (TOC, both dissolved and particulate organic carbon, 120 years BP) and other biochemical classes. This suggests that the lipid fraction is either derived from an older source or the lipid fraction (or sub-fractions) is selectively preserved relative to other biochemical classes. We used the Delaware Estuary as a model system for studying the sources and dynamics of OM along the estuarine salinity gradient. Particulate organic matter (POM) and ultra-filtered dissolved organic matter (UDOM) were collected along the Delaware River and Estuary in August 2010, October 2010, March 2011, October 2011 and August 2012 to determine the composition of OM in the Delaware Estuary under different physical and biological conditions. Samplings took place during both low (August 2010) and high (October 2011) flow conditions. Differences in the sources of DOM and POM to the Delaware Estuary were evaluated using chlorophyll a, particulate C:N elemental ratios, particulate stable isotopes ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) and lipid biomarker compounds. Sources, transformations, and preferential preservation of OM was evaluated using a combination lipid biomarkers and radiocarbon age signatures.

Collaborative Shellfish Modeling Fosters Better Shellfishery Management

Daphne Munroe, Haskin Shellfish Research Laboratory, 6959 Miller Ave, Port Norris, NJ 8349, dmunroe@hsrl.rutgers.edu; John M. Klinck, Center for Coastal Physical Oceanography, Department of Ocean, Earth and Atmospheric Sciences, 4111 Monarch Way, 3rd Floor, Old Dominion University, Norfolk, VA; Eileen E. Hofmann, Center for Coastal Physical Oceanography.

How does disease resistance evolve?

What are the genetic consequences of fishery management options?

Can we forecast long-term ecological consequences of extreme weather events such as Hurricane Irene?

These are questions being addressed by an ongoing collaboration between Old Dominion and Rutgers Universities. An individual-based numerical model (DyPoGEn) was developed to simulate oyster metapopulation dynamics. The model tracks individual oysters genetics from spatially-explicit populations, and has been parameterized for Delaware Bay. By combining genetics, spatially-explicit population dynamics, and bio-physical larval dispersal, this model represents a tool useful for a wide range of questions, from theoretical ecology and evolution, to applied fisheries management and economic forecasts.

Evolution

DyPoGEn has been used to test mechanisms by which oysters in Delaware Bay evolve in response to disease. Oyster diseases can cause high mortality and cause reduction in fishery quota. A greater understanding of the ways oyster populations respond to disease will help create a more stable and sustainable fishery.

Fishery Management

Oyster fishery management decisions such as fishing rates and size limits have important ecosystem implications. DyPoGEn is being used to study genetic connectivity under a range of management strategies. These simulations will generate greater understanding of the effects of management decisions.

Economic Projections

DyPoGEn has also been used to make predictions about recovery of oyster beds impacted by extreme weather in 2011, that caused high mortality in upstream oyster beds and had important consequences to the local fishery. Prediction of recovery timescales provides critical information for oyster industry economics.

Modeling tools like DyPoGEn are key to understanding complex ecological processes such as genetic connectivity. An understanding critical, not only in comprehension of natural ecosystems, but also for ecosystem interactions of human activities and for refining management strategies that ensure long-term sustainability of resources and the economies reliant on them.

Updating the Riparian Buffer Assessment Mapping for Southeastern Pa Streams

Susan Myerov, Heritage Conservancy, 85 Old Dublin Pike, Doylestown, PA 18901, smyerov@heritageconservancy.org;
Drew Shaw, AICP, Environmental Planning Section Chief, Montgomery County Planning Commission, P. O. Box 311, Norristown, PA 19404-0311, dshaw@montcopa.org.

Riparian forest buffers have been identified as one of the most effective means for controlling non-point source pollution from agricultural, urban and suburban lands. During 2000, Heritage Conservancy (HC) developed a Riparian Buffer Assessment (RBA) method to identify and map the extent of forested riparian buffers using high-level aerial photographs and video of helicopter flyovers. The study looked at buffers in four watersheds including the Neshaminy Creek Watershed, The Perkiomen Creek Watershed, and the Valley Creek Watershed. This assessment of the pilot watersheds was completed over ten years ago (2001 and 2002), and so HC in partnership with the Montgomery County Planning Commission (MCPC) has undertaken a re-assessment of six of the original watersheds studied to determine increases or decreases in riparian buffered stream miles over the last decade. Technological improvements over the past ten years have improved the accuracy and scope of the RBA.

The study will identify correlations between riparian buffer status and land use patterns and the extent to which the RBA mapping has facilitated on the ground restoration activities. Three of the six sub-watersheds re-assessed are within the Schuylkill Watershed including: the Lower Schuylkill River, Perkiomen, and Wissahickon watersheds. This session will review the methods and outcomes of the re-assessment, highlighting the changes to the riparian buffer over time. The project also identifies possible causes of the changes, and how municipalities and watershed groups may be able to use the data in such diverse ways as MS4 (NPDES Phase II) compliance and grant applications.

Historical Climate Change and Variability in the Delaware River Basin

Raymond Najjar, The Pennsylvania State University, Department of Meteorology, 503 Walker Building, University Park, Pennsylvania 16802-5013, rgn1@psu.edu; Andrew Ross, The Pennsylvania State University; Danielle Kreeger, Partnership for the Delaware Estuary; Susan Kilham, Drexel University.

An analysis has been conducted of changes in a wide variety of climate metrics in the Delaware River Basin between 1910 and 2009. It was found that the watershed is getting warmer and wetter, as expected given the observed increase in greenhouse gases. However, the magnitude and timing of the precipitation change is not consistent with climate model simulations and thus may be a result of natural variability. Some metrics of extreme temperature and precipitation are following changes in mean conditions. For example, decreases in ice-jam and frost-day frequency and an increase in the number of heavy precipitation days were found. However, some other metrics of extremes, including storminess (determined from sea-level pressure), do not show significant trends. Wind speeds have declined substantially but the causes are not well understood. Streamflow is generally on the increase and is consistent with the precipitation change. In summary, many aspects of the climate of the Delaware River Basin are undergoing change, and there is some understanding of these changes. A modeling framework that links the atmosphere to the watershed will not only help to improve understanding of past change but also allow for more robust future predictions.

Synoptic Water Quality and Quantity Monitoring in the Barnegat Bay Watershed

Helen Pang, NJDEP Water Monitoring and Standards, 401 East State Street, PO Box 420, Mail Code 401-041, Trenton, NJ 08625, helen.pang@dep.state.nj.us; Trish Ingelido, Barbara Hirst, Ariane Giudicelli, and Jill Lipoti, Division of Water Monitoring and Standard, New Jersey Dept of Environmental Protection.

Water quality condition has been declining throughout the Barnegat Bay estuary since the early 1990s. In order to determine the locations and extent of water quality impairments and to calibrate and validate modeling tools that can be used to direct water quality restoration of the bay, comprehensive ambient monitoring started in June 2011, measuring synoptically both water quality & quantity in both Bay & major tributaries, and is planned to continue until the summer of 2013. A total of 15 in-bay stations and 12 tributary stations are sampled for the water quality analysis weekly over the growing season and bi-weekly for the rest of the year. Besides in-situ parameters, parameters being analyzed by the lab include N series, P series, carbon, silica, chlorophyll a, CBOD/BOD, turbidity and alkalinity. Among 27 stations, continuous monitoring of various parameters is also conducted at 6 locations (5 in bay and 1 on the tributary). Flow and velocity measurement from 6 tributary gages, three in-bay stations and three inlet/outlet stations provides the hydrodynamic information to characterize the circulation within the bay and to quantify the load coming into the bay

from the tributary or the ocean. Data collected through this unprecedented monitoring effort provide the extremely valuable information to have a good understanding of the problems that the Bay is facing, to construct and populate the model simulating the processes in the Bay and to direct the restoration plan.

RSM - Sediment Quality

Joel Pecchioli, NJDEP, State Street, Trenton, New Jersey 8625, joel.pecchioli@dep.state.nj.us; David Burke, PADEP; Barbara Conlin, USACE-Philadelphia District; W. Scott Douglas, Office of Maritime Resources, NJDOT; John Yagecic, Delaware River Basin Commission.

Sediment quality was one of several key factors considered during the development of a Regional Sediment Management Plan for the Delaware Estuary. The data from over 900 sediment samples collected since 1990 were compiled into a database for the following contaminants of concern: arsenic, cadmium, cobalt, copper, lead, mercury, total chlordane, dieldrin, 4,4'-DDT/DDD/DDE, benzo(a)pyrene, total PCBs, and total dioxin/furan TEQ. The data were used to evaluate the potential suitability of dredged material from the estuary for aquatic habitat restoration projects (by comparison to established sediment quality guidelines) and upland beneficial uses (by comparison with State regulatory criteria for the placement of soil/fill at upland sites). These planning-level analyses indicated that approximately 98% of the sediment samples are of suitable quality for some type of upland beneficial use, with 69% of the samples potentially suitable for use in aquatic habitat restoration projects. Project-specific evaluations of sediment quality will be needed before dredged material can be beneficially used at upland sites or in aquatic habitat restoration projects. Finally, a number of contaminated sediment "hot spots" in the Delaware River and its tributaries were also tentatively identified; additional sampling and testing of these areas is recommended.

Engaging K-12 Audiences Through Hands-on Experiences and Data-based Activities

Christopher Petrone, Delaware Sea Grant / UD, 700 Pilottown Road, Lewes, DE 19958, petrone@udel.edu.

Teaching scientific concepts using real data has never been easier, thanks to real-time data streaming to the internet 24 hours a day, 7 days a week. Throughout the country's streams, rivers, lakes, and coastal ocean, scientists are deploying gauges, buoys and autonomous underwater vehicles packed with sensors that measure various biotic and abiotic data.

Through the use of the Internet, scientists, emergency managers, the commercial shipping industry, teachers and the general public can access these data with just a few clicks of the mouse. Because these data are real and easily accessible, they serve as a powerful teaching tool for classroom and informal educators. Working with experienced educators, scientists can develop classroom-ready activities that use their data to investigate science concepts and improve science literacy.

Participants will be introduced to an inquiry-based, classroom-tested activity that uses Delaware Environmental Observing System (DEOS) and NOAA National Ocean Service buoy data to investigate the concept of heat capacity and its effects on our climate and our daily lives.

Juvenile Hard Clam Survival in Response to Different Dietary Fatty Acids During Seasonal Temperature Decline

Sixto Portilla, Center for Estuarine, Environmental and Coastal Oceans Monitoring at Dowling College AND The Graduate Center of the City University of New York, 150 Idle Hour Blvd., Oakdale, New York 11769, portills@dowling.edu.

Hard clam aquaculture in temperate regions has historically been plagued with anomalous overwinter mortality, sometimes incurring losses of 100%, (Gionet et al. 2008). In an effort to shed light on what is considered the “principle obstacle for the development of aquaculture of this species,” (Bricelj 2007), we monitored the response of juvenile hard clams to different dietary fatty acids considered important in maintaining membrane fluidity as temperatures decline. During the fall of 2011 four groups of juvenile hard clams, *Mercenaria mercenaria*, were given diets with varying amounts of docosahexanoic acid, DHA, and eicosapentanoic acid, EPA, as environmental temperatures dropped between 18°C and 6°C. Their fatty acid profiles were measured biweekly by gas chromatography (GC) in an effort to determine the role of each fatty acid in survival. Two additional groups fed from the local estuarine waters were established in parallel to track how they would perform under otherwise similar environmental conditions to the experimental groups. A major mortality event that occurred following a 7.0°C decline over 5 days revealed a trend that suggests prolific biosynthesis of 22 carbon non-methylene interrupted (NMI) dienoic fatty acids (22:2 Δ 7,13 and 22:2 Δ 7,15) as a notable component of the pool of survivors. Although 22:2 NMI biosynthesis begins with palmitic acid, (16:0), found abundantly in all diets, its activation seems to have a distinct association with the presence of DHA, which varied greatly among the diets. DHA is an essential fatty acid found in large quantities in natural plankton assemblages at lower temperatures whose availability may be subject to a changing local ecology.

Influences on Subtidal Salinity Variability and Change in the Delaware Estuary

Andrew Ross, The Pennsylvania State University, 406 Walker Building, University Park, PA 16802, acr5155@psu.edu; Raymond Najjar, The Pennsylvania State University, University Park, PA.

On subtidal time scales, the salinity of an estuary can be influenced by a number of factors including streamflow, sea level, oceanic salinity, and wind stress. By changing the means and variabilities of these influences, climate change and other effects have the potential to significantly alter the salinity and the environment of the estuary. We have analyzed long-term records of salinity in the Delaware Estuary to determine which variables have a significant influence on salinity variability and whether the mean salinity is changing. Our primary focus is on several locations in the upper estuary, where the United States Geological Survey has measured salinity with automated sensors since the 1960s. Statistical models are applied to compare the salinity records with streamflow, sea level, wind, and other data. The relationships between these variables are also compared with predictions from theory and results from model simulations.

“Got Mussels?” Partnership for the Delaware Estuary Volunteer Mussel Survey Program

Deanne Ross, Partnership for the Delaware Estuary, 110 S. Poplar Street-Suite 202, Wilmington, DE 19801, dross@delawareestuary.org.

In the streams of PA, NJ, DE, and just about anywhere else in the U.S., the answer is “probably not.” Freshwater mussels are the most imperilled of all species in North America. Historically home to robust beds of a dozen different species, the waterways of the Delaware Estuary now contain only sporadic numbers of very few mussel varieties. Reasons for the decline are numerous, but include dams that block fish passage, and water quality and quantity issues.

In ecosystem services, freshwater mussels are virtual powerhouses. Each adult mussel can filter 5-15 gallons of water in warmer months. Healthy populations in creeks and rivers serve as water filtration plants, straining out sediment and other pollutants simply by feeding. Mussel beds also strengthen stream bottoms by holding soils in place to reduce erosion.

Since 2007, PDE scientists and partners have been searching for these now elusive bivalves. The unexpected 2011 discovery of several rare mussel species in the Delaware River inspired the creation of the Volunteer Mussel Survey Program (VMSP). With limited funding and very few scientists searching for mussels, more bodies were needed to cover the many stream miles of the estuary. Launched in 2012, the VMSP led the way for volunteer groups to learn about the important ecosystem services of freshwater mussels, as well as how to search for them in their local headwater streams. Data and photos collected by these “citizen-scientists” are uploaded via web portal, and then analyzed by PDE science staff. Stream miles covered by the volunteers are mapped, and the reported presence or absence of mussels therein helps to determine locations of potential brood stock for the mussel hatchery, as well as the possibility of re-introduction of mussels to qualified stream locations in future project phases.

Weathering Change With Communities

Sari Rothrock, Partnership for the Delaware Estuary, 110 S. Poplar St., Suite 202, Wilmington, DE 19801, SRothrock@DelawareEstuary.org.

In this interactive presentation, participants will learn about the Partnership for the Delaware Estuary’s Weathering Change initiative, why climate adaptation is central to the PDE mission, and why it’s important to start communicating complex problems (like the interaction of climate change impacts with existing environmental, social, and built infrastructures) in new and different ways. Following the presentation, participants will aid in addressing a hypothetical case study where they will be asked to physically model a town based on realistic parameters. Scientists, outreach specialists, teachers, planners, and all other conference participants with an interest in the future of coastal towns are encouraged to attend. No special skills aside from imagination and willingness to try something new are necessary for this session.

The Partnership for the Delaware Estuary (PDE)’s Weathering Change Initiative includes an outreach booklet and accompanying ‘sign on’ statement. The Weathering Change booklet uses inclusive language to help municipal officials understand how they can harness the power of natural infrastructure to adapt to the impacts of climate change. The ‘Take Action for Weathering Change’ statement walks municipalities through the first steps of thinking about climate

change adaptation planning. In addition to the Weathering Change Initiative, PDE is working with communities on climate change adaptation through several other projects. Partners in these projects include Pennsylvania Sea Grant, Delaware Sea Grant, and the Natural Lands Trust. By working together to create inclusive and creative solutions to local-scaled problems, we have the potential to make positive impacts on communities and resources Estuary-wide.

Prime Hook NWR - Providing Science for Management

Robert Scarborough, Delaware NERR, 818 Kitts Hummock Road, Dover, DE 19901, bob.scarborough@state.de.us; Michael Mensinger, DNERR, Dover, DE; Drexel Siok, DNERR, Dover, DE; Christina Pinkerton, DNERR, Dover, DE; Kenneth Smith, DNERR, Dover DE; Susan Guiteras, USFWS, Bombay Hook NWR, DE; Annabella Larsen, USFWS, Prime Hook NWR, DE; Fred Wurster.

Over the last 3 years Prime Hook National Wildlife Refuge has experienced a rapid transformation of their impoundment and wetland habitat due to coastal dune breaches along the Delaware Bay. The resulting consequences of these breaches and the implications to the mission of the Refuge have raised many management concerns. To make informed management decisions based on the best available science and information, the Refuge staff asked DNREC's Coastal Programs for technical assistance. Through cooperative efforts, over the last 2 years, data has been collected on water quality trends, salinity movement and impacts, marsh surface elevation changes, historic accretion rates, hydrology, and impoundment bathymetry. The Coastal Programs have also assisted in workshops with wetland expert and providing information for public outreach. This presentation will review the data collected to document the transformation and discuss the options for habitat management of the Refuge in the future.

Extent and Distribution of Submerged Aquatic Vegetation (SAV) in the Delaware Estuary

Renee Searfoss, U.S. EPA Region 3, 1650 Arch St., Philadelphia, PA 19103, searfoss.renee@epa.gov; Sherilyn Morgan, U.S. EPA Region 3.

Submerged aquatic vegetation (SAV) is an important indicator of estuarine health as it provides a number of benefits to the ecosystem, such as shelter for juvenile fauna, sediment stabilizer, and nutrient filter. While the Chesapeake Bay is known for supporting a variety of SAV, very little is known about the type, existence, and extent of SAV in the Delaware Estuary. Initial field attempts to locate SAV began in August of 2011. SAV were observed visually during low tide. During high tide, a depth finder was employed that identified signatures unique to SAV. The type of SAV was then confirmed using a three-prong rake. The location, depth, salinity, dissolved oxygen concentration, turbidity and sediment type were also recorded. To date, three species of SAV were identified in Pennsylvania, New Jersey and Delaware in both freshwater and brackish water environments: *Vallisneria Americana* (Wild Celery), *Zostera marina* (Eelgrass), and *Hydrilla verticillata* (Hydrilla). Stands of SAV were typically found in depths of two to four feet during slack and low tide, extending approximately 10-20 meters from the bank.

Ten Years of Classroom Examinations of Water Quality in the East Branch Brandywine Creek, Pennsylvania: 2002-2012

Charles Shorten, West Chester University, Environmental Health Program, Dept. of Health, West Chester, PA 19383, cshorten@wcupa.edu.

The East Branch of the Brandywine Creek in Chester County, PA is an important tributary of the Christina River. As it meanders from its headwaters adjacent to Lancaster County near Honeybrook, PA to its confluence with the West Branch below West Chester, PA it traverses upland agricultural regions, light industrial, suburban and urban land use areas. The East Branch provides drinking water to Downingtown and West Chester, PA. Each summer since 2002, Environmental Health students at WCU have conducted an examination of water quality in the East Branch that includes measurement of DO, temperature, pH, conductivity, alkalinity, NO₃-N, ortho-PO₄-P, total coliforms and (for some years) various metals. Physical/biological observations for the stream basin have included flow, presence/absence of various streambed characteristics and organisms, weather and descriptions of potential contamination sources. Results have shown moderately good stream health over the 10-year period of observation despite rapid population growth and development of the surrounding watershed; most nutrient values have been consistently below target maximums. Coliform levels have been highly variable, dependent primarily on the frequency and magnitude of storms. Tabulated results will be presented that incorporate a GIS-based database to illustrate temporal and spatial variability of the findings. While these data are derived from student-generated values obtained during field and laboratory class sessions, the general results are nonetheless significant both for educational and watershed planning purposes.

Marsh Vulnerability Index: Assessing the Health of Delaware's Marshes

Drexel Siok, DNREC / Coastal Program, 5 E Reed Street Suite 201, Dover, DE 19901, drexel.siok@state.de.us; Bartholomew Wilson, P.G., Center for the Inland Bays, 39375 Inlet Rd, Rehoboth Beach, DE 19971, science@inlandbays.org; Robert W. Scarborough, Ph.D., DNREC-Delaware Coastal Program, 89 Kings Hwy, Dover, DE 19901, Bob.Scarborough@state.de.us; and David B.

A growth index has been developed to allow the assessment of the short-term condition and long-term viability of Delaware's *Spartina alterniflora* marshes. The Marsh Vulnerability Index (MVI) for short-form *Spartina alterniflora* was developed upon the positive correlation between mean tidal range, productivity and the elevational growth range. Above- and below-ground vegetative biomass sampling serves as a proxy to quantify productivity in assessing marsh health. Integrating the elevation of the marsh platforms to a common datum, and the elevations relative to MHW and MLW at each site has yielded interesting correlations to below ground biomass production in short form *Spartina alterniflora*.

The determination of the preferred growth range for *Spartina alterniflora* is being used to determine the evolutionary trends in tidal wetlands. The MVI classifies marshes as healthy, degrading or severely degrading. Degraded and severely threatened marshes are more prone to catastrophic losses due to sea-level rise and storm events. The MVI will be essential for evaluating wetland vulnerability on a watershed and/or statewide basis. These classifications will be combined with existing digital elevation models (DEM) and locally derived tidal regimes to identify marshes that are at risk from sea level. Once these areas are identified pro-active measures may be implemented to protect the wetland habitat.

Regional Sediment Management Plan – Overview

J. Bailey Smith, USACE, Philadelphia District, 100 Penn Square East, Philadelphia, PA 19107, J.B.Smith@usace.army.mil.

This presentation will explore the opportunities and challenges associated with Regional Sediment Management (RSM) planning for the Delaware Estuary. The US Army Corps of Engineers received Federal appropriations to develop a RSM Plan for the Delaware Estuary. RSM is a federal initiative that is gaining momentum nationally. RSM approaches/plans have been initiated across the country, in particular in the coastal areas. Examples include Coastal California, the Columbia River, and more locally the New York/New Jersey Harbor.

RSM is an initiative that considers sediment as a resource along our coastlines and in our watersheds, rivers, and wetlands. A RSM Plan to manage sediment in the Delaware Estuary has been developed so that policy makers and funding agents can collaborate to meet multiple objectives within the Estuary. Recommendations from the Plan will then be implemented to achieve broader goals. RSM inherently requires multi-discipline technical input, programmatic input, regulatory input, and creative/ collaborative partnerships to achieve goals.

The RSM Plan was developed by the Delaware Estuary RSM Workgroup comprised of several federal agencies, each of the states within the basin (DE, PA, NJ), non-profit organizations and major municipalities. The RSM Workgroup has conducted a number of technical sessions to understand the dynamics, needs, and opportunities of the estuary.

The purpose of this presentation is to overview the development and future implementation of the RSM Plan including the identification of opportunities. An overview of the RSM process with specific consideration of the Delaware Estuary will be presented.

The Watershed Resources Registry: An Integrated Approach to Watershed Management

Ralph Spagnolo, Environmental Protection Agency, 1650 Arch Street, Philadelphia, PA 19103, spagnolo.ralph@epa.gov; Dominique Lueckenhoff, Ralph Spagnolo, Mike Hoffman, and Carolyn Steinberg, U.S. EPA, Region 3, Water Protection Division, Philadelphia, PA, USA; and Ellen Bryson, U.S. Army Corps of Engineers, Baltimore, MD, USA.

The U.S. Environmental Protection Agency (EPA) Region III office has partnered with the Army Corps of Engineers, Fish and Wildlife Service, Maryland's Department of the Environment, Department of Natural Resources, State Highway Administration, Federal Highway Administration, and Charles and Prince Georges' Counties to develop the Watershed Resources Registry (WRR) in the state of Maryland. Using Maryland as a pilot area, the overarching objectives were to construct a nationally transferable framework for integrated watershed management and an interactive mapping tool to increase potential for achieving multiple watershed benefits with a single ecological or programmatic action.

The mapping tool contains a set of suitability analyses developed with sound science and the best professional judgment of regional experts that will be used as a screening tool to target opportunity sites for the protection of high quality resources, restoration of impaired resources, and improvement of stormwater management. The analyses will specifically identify areas for: upland preservation, upland restoration, wetland preservation, wetland restoration, riparian preservation, riparian restoration, preservation of natural hydrologic systems and restoration to natural hydrologic systems.

By forging a collaboration where both regulatory and non-regulatory stakeholders agree up-front to develop and base decisions from the WRR, ultimate outcomes of the project include enhanced program integration and efficiency via the disintegration of “stovepipe” decision making processes, and streamlined regulatory and non regulatory processes ensuring maximum environmental results. An online interactive tool and user website have been developed, and can be viewed at <http://www.watershedresourcesregistry.org/outreach/outreach/home.html>.

High Resolution Numerical Models of Tidal Marshes in the Delaware Bay

Ramona Stammermann, Drexel University, 3141 Chestnut St, Curtis Hall R 251, Philadelphia, PA 19104, rs487@drexel.edu; Michael Piasecki, Dept. of Civil Engineering, City College New York, New York City, NY.

Physical, chemical, and biological processes in marshes are complex, highly intertwined, and still not entirely understood. A better understanding is essential for the management of marshes and the assessment of impacts due to future changes. These processes can be studied in detail by using a high resolution numerical model.

In this study we present two-dimensional, high resolution hydro- and morphodynamic models of marshes in the Blackbird Creek Reserve and the Bombay Hook National Wildlife Refuge in Delaware. We focus on sediment transport including the influence of vegetation on flow and sedimentation patterns. The marsh systems of interest span a wide area for which only a limited amount of data exist. LiDAR data were used that include high vertical errors above densely vegetated areas and no information about the bathymetry of tidal channels. Correct topographical heights and depths are essential to produce an accurate representation of the hydrodynamics. Hence, methods were developed to determine the correct ground elevation and to define a bathymetry based on a limited number of cross sectional measurements. These methods also include allowing the model to swing in morphodynamically, to account for errors in the initial bathymetry. The model was sensitive to conditions that differed too much from reality, leading to excessive erosion. This shows the difficulty to generate stable initial conditions based on a limited amount of data.

We will present results of sensitivity studies concerning the influence of sediment availability and vegetation on the dynamics of sediment fluxes in and out of the marshes under different weather scenarios. Additionally, an application for changing system geometries will be shown for the Bombay Hook marsh. A channel that possibly transports sediment out of the system will be filled in, and the resulting differences in sediment transport patterns analyzed.

Does the Macroinvertebrate Community of a Restored Delmarva Bay Mimic a Natural Bay?

Elanor Stevens, University of Maryland, Department of Entomology, College Park, Maryland 20740, elanor.stevens@gmail.com; Lauren E. Culler, Dartmouth College, Hanover, NH; Alan Leslie, University of Maryland, College Park, MD; Robert F. Smith, Amherst College, Amherst, MA; William O. Lamp, University of Maryland, College Park, MD.

Maryland’s eastern shore is currently the focus for wetland restoration projects that aim to reestablish important wetland functions. Once restoration has been completed, it is necessary to have some measurement of its efficacy. Biomonitoring of aquatic macroinvertebrates is a popular tool because most macroinvertebrates indicate habitat quality. In this study we gauge restoration success by comparing the macroinvertebrate communities of a natural pool

and a restored pool in the Jackson Lane Wetland Preserve located in Caroline County, Maryland. Our research objectives were 1) to compare species composition and diversity between pools, 2) to measure the differences in habitat parameters based on abiotic factors, and 3) to determine if environmental data could explain patterns in community data. Analysis was performed on data collected from the 3rd, 4th, and 5th years (2005-2007) after the restoration and again in 2012. Results show that the macroinvertebrate community composition was significantly different, especially in terms of primary consumer taxa. Relative abundances of macroinvertebrate taxa do indicate groups that may be linked to restoration status and suggest differences in trophic structure between pools. Overall, environmental characteristics did not differ between sites, although water chemistry became more similar over the nine years during which this study was conducted. Continued monitoring of macroinvertebrates will provide further insights into the success of restoration in the restored pool and at the same time generate a better baseline for comparison in the natural pool.

Fish Production and Habitat Use in a Large-scale Wetlands Restoration Project

Kenneth Strait, PSEG Nuclear, P.O. Box 236, N33, Hancocks Bridge, New Jersey 08038, kenneth.strait@pseg.com.

PSEG has restored over 4,550 ha of formerly diked salt hay farms and degraded Phragmites-dominated marshes along the Delaware Estuary. Designed to expand and protect the habitat for fish and other aquatic species, these efforts have achieved unparalleled success. A comprehensive biological monitoring program was implemented to monitor progress and success, including measurement of the structural and functional characteristics of the fish assemblage present within the restoration sites.

The marsh fish monitoring program included intertidal (weir) and subtidal (otter trawl) sampling in both restored and reference marshes for a comparison of fish species composition, relative abundance, and habitat use to “natural marshes.” Monthly sampling at fixed stations within the diked salt hay farms and the adjacent reference marsh during 1996-2011 provided nearly 4,000 samples for analyses.

Fish species composition and abundance within the formerly-diked restoration sites responded quickly and dramatically. Within one to two years following the re-introduction of tidal flow, the assemblages and abundance of individual species on the marsh surface and in intertidal and subtidal creeks closely reflected the adjacent reference marsh

PSEG’s monitoring program on the formerly diked restoration sites has provided one of the most comprehensive evaluations of restored marsh function in North America. Data indicates that these restored marshes are structurally and functionally equivalent to “natural marshes” in the Delaware Estuary.

Raptors, Waterfowl, Shorebirds and Water Birds on the Maurice River, Cumberland County, New Jersey: The Findings of a Long-term Study

Clay Sutton, Citizens United to Protect the Maurice River and Its Tributaries, PO Box 474, Millville, NJ 8332, claysutton@comcast.net; James Dowdell, Cape May, NJ.

Under the auspices of Citizens United to Protect the Maurice River and its Tributaries, Inc., and with funding from the National Park Service, US Department of the Interior, and with goals of discovery, documentation, and conservation, raptors and waterfowl have been studied on Cumberland County, NJ's tidal Maurice River for 25 years. Over 476 days of field work have been carried out in this long term study. Initially implemented to document avian ecovalues in response to industrial barging and dredging proposals, core winter raptor and waterfowl point counts have been maintained every season since 1987-1988. Significant increases are shown for Bald Eagle, Black Vulture, Turkey Vulture and Canada Goose; substantial declines are seen for American Kestrel, Rough-legged Hawk, American Black Duck, Mallard, and Northern Pintail over the study period. Adjunct fall raptor migration counts have been conducted at East Point, NJ to monitor the hawk migration moving west around Delaware Bay; in 60 days of observation in 1990 over 9,000 migrant raptors were counted (35% of the number recorded at Cape May). In 2003, studies were expanded into year-round census efforts for all water birds, including focused surveys of spring migratory shorebird use of the Maurice River; a daily high count of over 45,000 shorebirds using the lower Maurice was attained in 2009. Studies have yielded significant data on status and trends, spacial and temporal distribution, and habitat change (with implications regarding sea level rise and climate change). Findings have been used in the RTE listing process, oil spill protection, prioritization of conservation purchases, testimony in land use proceedings, and in management decisions. These long-term and continuing studies have substantiated the tidal Maurice River as an important bird use area for the Delaware Estuary, New Jersey, and the entire Mid-Atlantic region by any and all standards and at all seasons.

Estimates of Net Community Production in the Upper Delaware Estuary

Daniel Tomaso, Penn State University, 203A Garban Hall, State College, PA 16801, dantomaso@psu.edu; Raymond G. Najjar, Penn State University, University Park, PA.

Rivers and estuaries play a critical role in the global carbon budget as a source of carbon to the ocean. A Delaware Estuary study will be completed using data from the USGS at Trenton, New Jersey, the Ben Franklin Bridge, Chester, Pennsylvania, and Reedy Island Jetty, Delaware. Daily, monthly, and annual climatologies have been completed for alkalinity, conductivity, dissolved oxygen, oxygen saturation, oxygen excess, pH, salinity, temperature, TCO₂ and pCO₂. Using the aforementioned data, plus a climatology of the Delaware River streamflow data at Trenton, and a climatology of the Schuylkill River streamflow data at Philadelphia, Pennsylvania, a dissolved oxygen budget and TCO₂ budget will be calculated. These budgets will be completed in two sections along the river from Trenton to the Ben Franklin Bridge and then the Ben Franklin Bridge to the Reedy Island Jetty. Two more sectional budgets along the river may be computed between the Ben Franklin Bridge and Chester and then from Chester to Reedy Island. There are data gaps every winter at the Chester location because data are not recorded during that time, so the budgets computed using the Chester data would not be complete for the entire year. The analysis of the dissolved oxygen and TCO₂ budgets will give us more knowledge of primary production and respiration in the Delaware River. In addition, the TCO₂ budget will provide more insight into the coastal ocean carbon budget that the Delaware Estuary is a part of.

The Relationship Between Carbon Burial and Sediment Deposition in Salt Marshes: A Comparison of a Coastal Lagoon and Coastal Plain Estuary in the Mid Atlantic U.S.

Viktorija Unger, Academy of Natural Sciences of Drexel University, 1130 Peevy RD, East Greenville, PA 18041, unger@ansp.org; Susan Kilham, Department of Biodiversity, Earth and Environmental Sciences of Drexel University, Philadelphia, PA; Tracy Quirk, Academy of Natural Sciences of Drexel University, Philadelphia, PA; Chris Sommerfield, University of Delaware.

Soil carbon (C) accumulation in salt marsh soils is a beneficial ecosystem service that occurs primarily through in situ macrophyte production and slow anaerobic decomposition. Research has increasingly illustrated that salt marshes are among the most efficient ecosystems in terms of C accumulation. Nonetheless, C accumulation may vary significantly both within and among salt marshes, and the factors influencing this variation are poorly understood. To examine differences in C accumulation in salt marshes and its potential governing factors, we collected three soil cores from close, middle and far range from the estuary from three salt marshes in each of two estuaries, Barnegat Bay (coastal lagoon) and Delaware Bay (coastal plain). Preliminary data suggest that accretion rates in Delaware Bay may be twice that of Barnegat Bay, and mineral sediment accumulation may differ within and among salt marshes within these estuaries. These differences may influence rates of C burial and the type of C that remains in the soil column. We measured both labile (easily decomposed) and refractory (relatively inert) C and belowground biomass in 2 cm depth sections along with radionuclide analyses to determine rates of accretion. Variations in the C burial rates and the type of C will be discussed.

What Controls the Lower Delaware Bay Primary Production in the Summer: Wind-Driven Coastal Upwelling or Discharge Variability?

Yoana Voynova, University of Delaware, 700 Pilottown Road, Lewes, DE 19958, yvoynova@udel.edu; Jonathan H. Sharp.

Despite large nutrient inputs from the urban region, the biogeochemistry of the lower region of the Delaware Estuary is generally nitrogen-limited in the summer and its biogeochemistry is controlled by river discharge, tidal flux and coastal upwelling. The lack of severe nitrogen limitation in the summer months, as expected in a typical low-nutrient environment, may be due to the presence of persistent coastal upwelling near the bay mouth. Discharge can also deliver higher nutrient concentrations further downstream than usual and into the lower bay, and thus can influence the lower bay biogeochemistry.

In the summers of 2010 and 2011, I used the Cape May-Lewes Ferry as a ship-of-opportunity to study the spatial and temporal variability of temperature, salinity, dissolved oxygen saturation and chlorophyll. Also, I collected discrete samples for nutrients, DOC/TDN and primary production incubation experiments, among other parameters. Discharge during 2010 was lower than the summer average, while in 2011 it varied from about average summer discharge in July to early August, to an extreme discharge period, after Tropical Storm Lee generated massive rainfall in the upper watershed.

When discharge was low, upwelling probably persistently delivered small amounts of nutrients that sustained a stable, moderately productive and low biomass ecosystem in the lower bay. The N:P ratio during this period was low and often

less than 1. When discharge increased, it became the dominant process to regulate the lower bay biogeochemistry, as nutrient influxes sustained higher chlorophyll biomass, increased primary production and surface waters were often supersaturated. When discharge increased (at or higher than spring levels), the N:P ratios also increased.

Circulation and Water properties and Their Relationship to the Oyster Disease MSX in Delaware Bay

Zhiren (Joseph) Wang, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ, 71 Dudley Road, New Brunswick, NJ 8901, zrwang@marine.rutgers.edu; Dale Haidvogel, and John Wilkin, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ; David Bushek, Susan Ford, and Eric Powell, Haskin Shellfish Research Laboratory, Rutgers University, Port Norris, NJ; Eileen Hofmann.

We apply a high-resolution hydro-dynamical model to investigate the role of physical factors influencing infection prevalence of *Haplosporidium nelsoni*, causative agent of MSX disease in the eastern oyster (*Crassostrea virginica*), in Delaware Bay, USA. Validation studies conducted for the years 2000 and 2010-2011 confirm that the model, based upon the Regional Ocean Modeling System, has significant skill in the recovery of observed water level, temperature, salinity, and velocity. Multi-year simulations are performed for periods representing temporal and spatial variations in *H. nelsoni* infection prevalence (1974-76, 1979-81, 1984-86, 1990-92, and 2006-09) to assess the degree to which the variations in water properties and transport are temporally and spatially correlated with infection prevalence variations. Results show statistically significant correlations between the observed prevalence of MSX and multiple physical factors including river flow and salinity (themselves highly correlated), as well as the co-occurrence of elevated temperature and salinity values. Observed occurrences of high *H. nelsoni* infection prevalence at up-bay locations correspond to periods of enhanced cross-bay and up-bay transport together with hospitable temperature and salinity conditions.

What's Mud Got to Do with Sea Level Rise? Sediment Supply and Marsh Vulnerability to Climate Change in the Delaware Estuary

Nathaniel Weston, Villanova University, 800 Lancaster Ave, Villanova, PA 19085, nathaniel.weston@villanova.edu.

Tidal marshes are dynamic ecosystems that are sensitive to changes in relative sea level. Climate change is accelerating the rate of global sea-level rise (SLR), and tidal marshes must keep pace or risk permanent inundation. The long-term stability of coastal wetlands is determined by interactions among sea level, plant production, and sediment accretion, and the availability of sediments ultimately determines the maximum rate of vertical accretion in most marshes. Changes in sediment supply to coastal wetlands have received relatively little attention outside of large river deltas. Deforestation, agriculture and development greatly increased sediment delivery over the past few centuries, but more recent afforestation and, especially, dam construction have resulted in declines in riverine suspended sediments in many U.S. East and Gulf Coast Rivers. In the Delaware River, sediment supply has declined by more than 80% from the 1950s and 1960s.

Patterns of sediment delivery to coastal marshes and the role of sediment in marsh resilience to future SLR in the upper Delaware Estuary is evaluated through a combination of field measurements and modeling. Spatial and temporal patterns of sediment deposition are examined using ^7Be as a tracer of recent sediment deposition on the marsh surface, surface elevation tables (SETs), marker horizons, and sediment traps. Watershed inputs appear to be the major source of

new sediment to these marshes, and sedimentation rates are greater in the tidal freshwater marshes than salt-marshes. In a more detailed study of a freshwater marsh, both elevation and distance from the sediment source were found to be important determinants of sedimentation. The Marsh Equilibrium Model (MEM) was used to explore the influence of suspended sediment concentrations on marsh stability over the next century, and preliminary work suggests that the combination of accelerating SLR and declining sediment supply place marshes in the Delaware Estuary at increasing risk.

From “Sediment” to ‘What’s Mud Got to Do With It’: Methods to Make Technical Reports Public Friendly

Lisa Wool, Partnership for the Delaware Estuary, 110 South Poplar St., Wilmington, DE 19801,
lwool@delawareestuary.org; Elizabeth Horsey, Partnership for the Delaware Estuary, Wilmington, DE.

In summer 2012 the Partnership for the Delaware Estuary published the 2012 State of the Estuary Report. This special issue of our Estuary News Newsletter was created from information from the Technical Report for the Estuary and Basin, which was written by the Science and Technical Advisory Committee and other leading scientists. Of the Technical Report’s 50+ indicators, a subset of 14 was selected for the public-friendly State of the Estuary Report. This indicator subset was chosen based on the following public-friendly criteria:

- a) A geographical mix (PA, NJ, and DE)
- b) Told a good, representative story of the Estuary's health
- c) Would interest varying members of the general public (fisherman, birders, coastal property owners, etc.)
- d) Has something that people can act upon to improve

For each Public Report indicator, one to three key, take-home messages were determined. From there, we worked backwards to provide background information and items of interest to make the indicator appealing and easily understood. Some key changes that were made to the information from the Technical Report were:

- a) Reduce and/or define jargon by using self descriptive words (i.e. increase canopy coverage = plant more trees)
- b) Select or create clear and attractive graphics that drive home key points
- c) Provide examples for technical concepts or terms
- d) Reiterate key definitions throughout the report, knowing that most people will not read it from front to back like a textbook.

We used Water Words that Work, a method of selecting words found by public surveys to be appealing and easily understood by people outside the environmental profession. The Fleischer Kincaid Reading Level function in Microsoft Word was also used to keep the report at a 9th grade reading level (same as most newspapers).

Assessment of Water Quantity and Quality Indicators in the 2012 Treb

John Yagecic, Delaware River Basin Commission, 25 State Police Dr., PO Box 7360, West Trenton, NJ 08628-0360, John.Yagecic@drbc.state.nj.us; David Sayers, Delaware River Basin Commission, West Trenton, NJ.

The Delaware River Basin Commission lead the development of the Water Quantity (Chapter 2) and Water Quality (Chapter 3) portions of the Technical Report for the Delaware Estuary & Basin (TREB) released in summer 2012. Water quantity indicators included withdrawals and water use by sector. Quality indicators included dissolved oxygen, temperature, and pH. This presentation will review the highlights of the findings of the water quantity and water quality reports, including current status and trends over time of key indicators. This presentation will also contrast the TREB with the Delaware River and Bay Water Quality Assessment Report, prepared concurrently, and review recommended actions for indicators and data collection.

Temporally Dynamic Representations of Delaware Basin Continuous Data Sets

John Yagecic, Delaware River Basin Commission, 25 State Police Dr., PO Box 7360, West Trenton, NJ 08628-0360, John.Yagecic@drbc.state.nj.us.

The proliferation of continuous real-time monitors across diverse monitoring organizations and web hosting platforms is making high frequency data widely available to water resource managers. The defining feature of the resultant data sets is a nearly continuous stream of observations at all times of day and under conditions that would be inaccessible to manned vessels. Traditional static representations seem incomplete and limiting when applied to these high density data streams.

The author has developed a method of cycling data sets in standard graphing applications, to exploit the temporal nature of continuous data. The resulting animated graphs provide an intuitive, information rich experience of the data, and allow for integration and synchronization of data sets from different sources to better understand estuary and basin processes being measured.

This presentation will highlight several applications including progression of the storm surge from Hurricane Irene into the estuary, development of terrestrial flooding in the non-tidal river, and dissolved oxygen fluctuations as a function of time-of-day and tidal cycle.

Charting the Course for an Evolving Partnership for the Delaware 2013 Delaware Estuary Science & Environmental Summit – Live Polling Session

Over the course of the last year, the Partnership for the Delaware Estuary (PDE) has been working on a new 5-year strategic plan to pick up where our previous Strategic Plan (2007-2012) ends.

Tonight's session has a dual purpose: to provide a preview of results of that planning effort so far, and to get feedback for fine-tuning and prioritizing those results for the final product – a PDE Strategic Plan for 2013-2017.

Warm-up Questions

1. (*Just for fun!*) Can you clearly define what an estuary is:
 - a. Yes – Why else would I be here?
 - b. Yes – But I had to look it up recently.
 - c. No – Is there a punishment for admitting this?
 - d. Maybe – But don't quote me.
 - e. Yes – What she said...

2. Which of the following best characterizes your affiliation:
 - a. Non-profit
 - b. Government
 - c. Private Sector
 - d. Academic/Research Institution
 - e. Other

3. What state is your state of residency or employment?
 - a. Delaware
 - b. Pennsylvania
 - c. New Jersey
 - d. New York
 - e. None of the above

- f. More than one of the above
4. What **best** characterizes the geographic scope of your work/interest:
- a. Delaware River Basin
 - b. Delaware Estuary
 - c. Statewide
 - d. Local (i.e. city, county, small watershed)
 - e. Other
5. What category **best** characterizes your work/interest:
- a. Research
 - b. Restoration/Protection
 - c. Natural Resource Management
 - d. Monitoring
 - e. Education/Outreach
 - f. Advocacy

Mission

The Partnership for the Delaware Estuary, a National Estuary Program, leads science-based and collaborative efforts to improve the tidal Delaware River and Bay, which spans Delaware, New Jersey, and Pennsylvania.

Vision

We envision everyone working together for clean drinking water, thriving fish and wildlife, and abundant recreational activities in and around the tidal Delaware River and Bay to support communities and a robust economy. To make this vision a reality, the Partnership for the Delaware Estuary will become:

- A model implementer of practical solutions and programs that fill critical gaps and engage people as stewards of the Estuary;
- The driver of attracting attention, and of joint problem solving for overcoming the challenges facing the Estuary; and
- The driver of attracting financial support and sustainable investment in the Estuary.

PDE values...

- **Science** – using science as an objective basis for decision-making and holistic action.
- **Collaboration** – working together across sectors and jurisdictions for common goals, shared responsibility, and powerful results.
- **Innovation** – combining science and forward-looking creativity to develop and implement new and better tools, projects, and programs.
- **Balance** – taking into account the many different values of the living and working river to maximize engagement and stewardship of a diversity of stakeholders with integrity and objectivity.
- **Strategic Investment** – identifying and pursuing opportunities with the greatest potential net impact.

Science & Restoration

PDE seeks continuous improvement of the health of the Estuary by sustaining the momentum of current successful science-based activities and undertaking new high-priority activities. To that end we've developed the following objectives and would like your feedback on their importance:

- Improve the health and sustainability of wetlands for current and future generations
- Restore shellfish (in fresh and salt waters) to improve the health and sustainability of the Estuary
- Facilitate partnerships and capacity-building to improve the health and sustainability of the Estuary's watersheds for current and future generations
- Coordinate and advance science activities for improvement management of the Estuary's resources

6. In your opinion, how important is it for PDE to work on improving the health and sustainability of wetlands for current and future generations:
 - a. Not important at all
 - b. Somewhat important

- c. Important
- d. Very important
- e. Extremely important
- f. I'm not sure

7. In your opinion, how important is it for PDE to work on restoring shellfish (in fresh and salt waters) to improve the health and sustainability of the Estuary.

- a. Not important at all
- b. Somewhat important
- c. Important
- d. Very important
- e. Extremely important
- f. I'm not sure

8. In your opinion, how important is it for PDE to facilitate partnerships and capacity-building to improve the health and sustainability of the Estuary's watersheds for current and future generations.

- a. Not important at all
- b. Somewhat important
- c. Important
- d. Very important
- e. Extremely important
- f. I'm not sure

9. In your opinion, how important is it for PDE to coordinate and advance science activities for improvement management of the Estuary's resource.

- a. Not important at all
- b. Somewhat important
- c. Important

- d. Very important
- e. Extremely important
- f. I'm not sure

Education & Outreach

PDE seeks to foster a public, communities, and key stakeholders highly engaged in improving the health of the Estuary and its tributaries. To that end we've developed the following objectives and would like your feedback on their importance:

- Increase the preparedness of coastal communities to adapt to climate change / sea level rise
- Encourage targeted behavior changes that can reduce pollution entering local waterways
- Build affinity for the tidal Delaware River and Bay and its major tributaries
- Facilitate collaborative problem solving on key issues and in key areas/subwatersheds

10. In your opinion, how important is it for PDE to work on increasing the preparedness of coastal communities to adapt to climate change / sea level rise.

- a. Not important at all
- b. Somewhat important
- c. Important
- d. Very important
- e. Extremely important
- f. I'm not sure

11. In your opinion, how important is it for PDE to encourage targeted behavior changes that can reduce pollution entering local waterways.

- a. Not important at all
- b. Somewhat important
- c. Important
- d. Very important
- e. Extremely important

f. I'm not sure

12. In your opinion, how important is it for PDE to work on building affinity for the tidal Delaware River and Bay and its major tributaries.

- a. Not important at all
- b. Somewhat important
- c. Important
- d. Very important
- e. Extremely important
- f. I'm not sure

13. In your opinion, how important is it for PDE to facilitate collaborative problem solving on key issues and in key area/subwatersheds.

- a. Not important at all
- b. Somewhat important
- c. Important
- d. Very important
- e. Extremely important
- f. I'm not sure

14. PDE seeks to generate more financial resources in order to have greater impact on improving the health of the Estuary – not just for our organization, but also for partners working to implement elements of the CCMP and the watershed as a whole. To that end how important is it for PDE to pursue the following (please rank):

- a. Joint grant-writing
- b. Promoting and supporting partner work through our Regional Restoration Initiative
- c. Advocacy for federal funding
- d. Exploring and pursuing feasible options to establish and fund a "Science and Restoration Trust" Other (please specify on the form provided)

15. PDE seeks heightened visibility, profile, and organizational capacity for improving the health of the Estuary. To that end how important is it for PDE to pursue the following (please rank):
- a. Enhancing marketing and communications, including building PDE's and the Estuary's brand
 - b. Increasing advocacy for the use of science in decision-making and for increased investment
 - c. Strengthening shared leadership and responsibility
 - d. Improving internal systems, personnel, and infrastructure to improve PDE capacity
 - e. Other (please specify on the form provided)
16. As part of the strategic planning process, PDE has been assessing the Comprehensive Conservation Management Plan (CCMP) for the Delaware Estuary and has identified a few actions as outdated. Are these actions still important enough that PDE and/or others should invest in them moving forward?
- a. Yes, invest in developing a Mascot for the Estuary
 - b. Yes, invest in establishing a Delaware Estuary Environmental Badge
 - c. Yes, invest in RIMS (Regional Information Management System)
 - d. Yes, invest in all of the above
 - e. No, invest in none of the above
 - f. Yes, invest in some combination of the above (please indicate which on the form provided)
17. In a sentence or two, tell us how you describe PDE to your co-workers and/or colleagues (on the form provided).

Thank you for your input! Please use the form provided for any additional comments you have regarding PDE strategic priorities for 2013-2017.



Partnership for the Delaware Estuary, Inc.

110 S. Poplar Street, Suite 202

Wilmington, DE 19801

1-800-445-4935

www.DelawareEstuary.org



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The Partnership for the Delaware Estuary, a National Estuary Program, leads collaborative and creative efforts to protect and enhance the Delaware Estuary and its tributaries for current and future generations.

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