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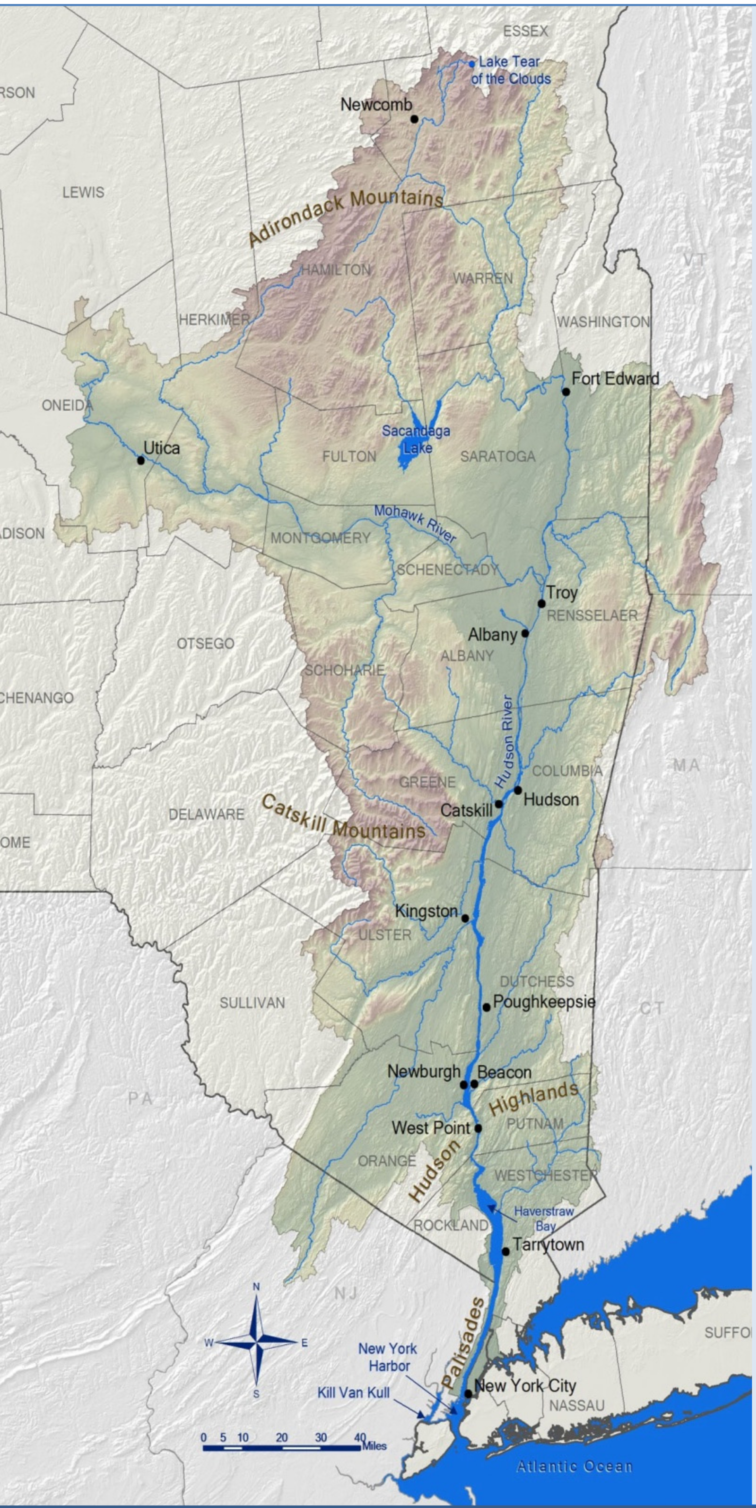

2015

Hudson River Symposium: *Seeing the Hudson River in the 21st Century*

Wednesday May 6th, 2015

Student Union Building
SUNY at New Paltz
New Paltz, New York

Speakers & Workshops 9:00-4:00
Reception and Poster Session 4:00-5:30

Symposium Speakers:

Stuart Findlay, Cary IES
Dewayne Fox, U. of Delaware
Nickitas Georgas, Stevens Inst. Of Tech.
Scott Ireland, Hudson River Pilots Assoc.
Josh Kohut, Rutgers U.
Steve Stanne, Hudson River Estuary Program/DEC/Cornell U.
Timothy Sugrue, Beacon Inst. of Rivers and Estuaries
Margie Turrin, Lamont Doherty Earth Observatory/Columbia U.
Gary Wall, US Geological Survey

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2015 Hudson River Symposium:
Observing Systems & Networks of the Hudson River and Estuary:
"Seeing the Hudson River in the 21st Century"
State University of New York at New Paltz, Student Union Building
Wednesday May 6, 2015
8:00AM - 5:30PM
Talks start at 9:00 AM – Poster Session at 4:00 PM

Advancements in the reliability and accuracy of environmental monitoring equipment have provided an ability to measure the environmental conditions of coastal waters, estuaries, and rivers at a continuum and frequency never before possible. This symposium will focus on the various observing systems being used to monitor the environmental conditions in the Hudson River watershed and estuary and New York Bight, including: the Hudson River Environmental Conditions Observing System (HRECOS), New York Harbor Observing and Prediction System (NYHOPS), Rivers and Estuary Observing Network (REON), the Mohawk River Ice Jam Monitoring Network, the Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS), and a fish tracking network in the Hudson River estuary. Paper presentations will be followed by mini-workshops allowing participants to learn how to use the data being collected both in their own research and in their teaching. The afternoon will end with a reception and poster session, featuring posters devoted to a variety of topics related to the river and its environs.

Symposium Speakers:

Dr. Stuart Findlay, Cary Institute of Ecosystem Studies
Dr. Dewayne Fox, University of Delaware
Dr. Nickitas Georgas, Stevens Institute of Technology
Capt. Scott Ireland, Hudson River Pilots Association
Dr. Josh Kohut, Rutgers University
Mr. Steve Stanne, NYS DEC Hudson River Estuary Program
Dr. Timothy Sugrue, Beacon Institute of Rivers and Estuaries
Ms. Margie Turrin, Lamont Doherty Earth Observatory, Columbia U
Dr. Gary Wall, US Geological Survey

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HUDSON RIVER ENVIRONMENTAL SOCIETY

2015 Hudson River Symposium:
Seeing the Hudson River in the 21st Century

State University of New York at New Paltz, Student Union Building
May 6, 2015 8:00AM -5:30 PM

Agenda

8:00 – 8:45: Registration and Light Breakfast
8:45 – 9:00: Introductions & Announcements: CRREO & HRES

Observing Networks: Essential to Understand Coastal and Estuarine Processes (9:30 to 10:30)

9:00 – 9:45: The United States Integrated Ocean Observing System: A national-regional partnership working to provide new tools, observations, and forecasts to understand, manage, and protect our coastal environment. *Dr. Josh Kohut, Institute of Marine and Coastal Science, Rutgers University*

9:45-10:15: Hudson River Environmental Conditions Observing System – Science and Surprises on the Hudson River Estuary. *Dr. Stuart Findlay, Cary Institute of Ecosystem Studies*

10:15 – 10:45 Break

Developing the Tools for Science, Navigation and Emergency Response (10:45 – 12:15)

Mohawk River Ice Jam Monitoring Network. *Dr. Gary Wall, US Geological Survey, Troy, NY*

New York Harbor Observing & Prediction System (NYHOPS). *Dr. Nickitas Georgas, Urban Ocean Observatory at Davidson Laboratory, Stevens Institute of Technology*

Rivers and Estuary Observing Network (REON) II. *Dr. Timothy Sugrue, Beacon Institute for Rivers and Estuaries*

12:15 -1:00 – Lunch

Observing Networks: Essential for Resource Management, Navigation & Environmental Education (1:00 - 2:30)

A Collaborative Fish Tracking Network in the Tidal Hudson River.
Dr. Dewayne Fox, Delaware State University

A Marine User's Perspective: "This is great data, but what am I looking at?"
Capt. Scott Ireland, Hudson River Pilots Association

Teaching with HRECOS: Using Remotely Sensed Data to Frame Estuary Inquiry.
Ms. Margie Turrin, Lamont Doherty Earth Observatory of Columbia University & Mr. Steve Stanne, New York State DEC Hudson River Estuary Program/NYS Water Resources Institute at Cornell University

Mini-Workshops (2:45 – 4:00) (2 session: 3:00-3:25 & 3:35-4:00)

Environmental Science in the Classroom: Getting Your Hands wet with HRECOS Data –
Ms. Margie Turrin & Mr. Steve Stanne

YSI Observing Equipment: Ensuring Data Quality - *Mr. Michael Lizotte & Mr. Benjamin Clarke, Xylem-YSI*

HRECOS Data and Equipment – *Dr. Stuart Findlay & Mr. Gavin Lemley*

Track pollutants and plumes based on New York Harbor Observation and Prediction System (NYHOPS) forecasts in NOAA GNOME– *Dr. Nickitas Georgas, Mr. Benjamin Ganon*

4:00 PM – 5:30 PM – **Poster Session & Reception**

SPEAKER ABSTRACTS

Hudson River Environmental Conditions Observing System – Science and Surprises on the Hudson River Estuary

Stuart Findlay
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Cary Institute of Ecosystem Studies

The Hudson River Environmental Conditions Observing System (HRECOS) was initiated by a grass-roots effort to better understand the Hudson and increase access to timely information. HRECOS has been in operation for nearly a decade and has established strong ties to several user groups as well as achieving many of its original objectives. This talk will highlight some of the science results, linking these back to the original motivation for creation of HRECOS. Observing conditions in the Hudson during storms and other difficult conditions was one of the original drivers and the system performed well during Irene and Lee revealing consequences of these storms for several aspects of the river. Some patterns were predictable such as the large increase in turbidity while others such as increased dissolved oxygen were not anticipated. HRECOS, through its high-frequency observations has also confirmed some general attributes of the Hudson that were strongly suspected but harder to confirm in general. Frequent tidal resuspension of bottom sediments is now known to be a normal occurrence rather than some special event contingent on a set of other conditions. Some of the observations derived from HRECOS remain enigmatic (I'm saving these) but the system has also helped show us things we don't understand well and can't always explain. From the science perspective HRECOS has worked well, supporting various research efforts by providing environmental context as well as revealing processes worthy of further study.

New York Harbor Observing & Prediction System (NYHOPS).

Nickitas Georgas
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Urban Ocean Observatory at Davidson Laboratory, Stevens Institute of Technology

The New York Harbor Observing and Prediction System (NYHOPS) is a comprehensive, completely automated, operational, 72-hr forecasting system for the New York / New Jersey Harbor and surrounding tidal waters that include the Hudson River from Manhattan to the Troy dam. NYHOPS was built and maintained at Stevens Institute of Technology over the past 10 years. The automation of the NYHOPS numerical system is based around a continuously-updating hydrodynamic model, sECOM, forced with, and validated against, real-time observations collected and integrated within an expert central modeling framework. Real-time field observations of weather and water conditions come from a variety of sources, including the Hudson River Environmental Conditions Observing System (HRECOS), the United States Geological Survey (USGS), the

National Ocean Service (NOS), National Weather Service (NWS), and other partners to the Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS), the regional representative to the NOAA IOOS program. The central NYHOPS forecast framework, in turn, feeds external user-focused products developed for the maritime, emergency response, and coastal and environmental engineering communities. For example, the NYHOPS hydrodynamic forecasts feed into the Stevens Storm Surge Warning System, one of the first completely Internet-based, real-time coastal ocean observing and warning systems in the United States (SSWS, www.stevens.edu/SSWS). The Emergency Response Division of the National Oceanic and Atmospheric Administration's Office of Response and Restoration (NOAA/OR&R/ERD) and the United States Coast Guard Office of Search & Rescue (USCG/SAR) have been using the NYHOPS forecasts for drift simulations in support of pollutant tracking and Search and Rescue planning, respectively, since 2006 (www.stevens.edu/TRACES). Through the NOAA Hudson River Sustainable Shorelines project, and using HRECOS data, the NYHOPS modeling framework was used to calculate climatological conditions for engineering planning in the Hudson's waters, and new tidal datums for the Hudson; these datasets are available now through the NYSDEC GIS Clearinghouse. Support for the continuous development and maintenance of the system and its products has been provided by these and a variety of other leveraged research projects. This talk will showcase NYHOPS and its more recent applications. A workshop on the TRACES service is also scheduled.

The United States Integrated Ocean Observing System: A national-regional partnership working to provide new tools, observations, and forecasts to understand, manage, and protect our coastal environment.

Josh Kohut
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Rutgers University and MARACOOS

Chris Kinkade
U.S. Integrated Ocean Observing System Program Office

Coastal ecosystems span from watersheds to the deep sea and are extremely complex. This complexity drives multi-disciplinary approaches to better understand the coupled mechanisms that define ocean ecology. The rapid evolution of the Integrated Ocean Observation System (IOOS) made possible through developing technology, interdisciplinary partnerships, and networked data sharing captures coastal ocean hydrography and hydrodynamics at fine scales in space and time over regional spatial extents. The networks are enabled by advances in technology, from satellites in space to robots below the ocean surface. These systems are built to support both basic research and the practical needs of society, from offshore resource management to the economy. U.S. IOOS delivers the data and information needed, so that decision-makers can take action to improve safety, enhance the economy, and protect the environment. Themes addressed across the observing network include Marine Ops, Coastal Hazards, Climate, Ecosystems & water quality and Observation Data in Classrooms. At the regional level, U.S. IOOS is comprised of eleven Regional Associations (RAs), which guide development of and stakeholder input specific to regional observing activities. In the Mid-Atlantic, The Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS) develops and maintains products in support of maritime safety, ecological decision support, water quality, inundation, and renewable energy. This presentation will introduce the technologies and products of IOOS at the national and regional scales. Particular attention will be placed on storm inundation and fisheries.

Teaching with HRECOS: Using Remotely Sensed Data to Frame Estuary Inquiry.

Steve Stanne
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Estuary Education Coordinator, Hudson River Estuary Program/NYS Water Resources Institute, Cornell University

Margie Turrin
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Education Coordinator, Lamont-Doherty Earth Observatory of Columbia University,

In bygone days, river 'students' learned about Earth systems first hand – using winds to sail, navigating to take advantage of tides and currents, and accounting for density differences between salt and fresh water when loading a ship. Today, most students lack such opportunities, though they may have more formal, at-a-distance exposure to river subjects. HRECOS can bridge this gap, bringing the river into the classroom for students to study first hand. They can follow a tide as it moves up the river, watch the effect of a rain event on salinity, see insolation drive photosynthesis, and watch any number of other processes unfold in the data. Engagement with the network expands the understandings gained through field trips, revealing processes and connections that unfold over time or that might be invisible below the water's surface. Use of HRECOS promotes place-based learning, systems thinking, and STEM skills; it is an incredible resource for inquiry-driven exploration of the Hudson ecosystem.

River and Estuary Observatory Network (REON) II

Timothy F. Sugrue, Ph.D.
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Beacon Institute for Rivers and Estuaries, Clarkson University

Real-time data as applied to critical water challenges has the potential to revolutionize environmental monitoring by providing insights into contaminant behaviors, restoring habitats for endangered species, securing sound policy decisions, assisting homeland security practices, among other uses. Until now, financial infeasibility has limited efforts to put this sensor-based technology to work in the real world. We will discuss the evolution of the REON II network and promising next steps towards protecting our valuable water resources through "affordable adequacy."

Mohawk River Ice Jam Monitoring Network

Gary R. Wall
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U.S. Geological Survey, NY Water Science Center, Troy, NY

In cooperation with the New York State Department of Environmental Conservation, the New York State Power Authority, Brookfield Renewable Power, and Union College, USGS has developed a web-based monitoring system to assist emergency managers assess river conditions and the potential for ice jam flooding near Schenectady, NY. Ice jam floods are a threat to lives and property in low-lying areas along the Mohawk River, particularly in the vicinity of the Stockade District in Schenectady. Lederer and Garver (2001) estimated that 80% of historic Mohawk River floods in Schenectady are a result of winter snowmelt and ice floes. Backwater from an ice jam can cause flooding upstream of the jam and the abrupt release of backwater from a jam break-up can pose a threat to lives and property downstream. The monitoring system web page provides graphs of river elevation from four stream gages along a 10.7 mile river reach as well as graphs that show the amount of backwater from ice at three of the four gages. A web camera installed in the Stockade District provides emergency managers with a view of river and ice conditions without having to send police or other emergency officials to the river. USGS WaterAlert subscriptions are available for all the parameters displayed on the web page. WaterAlert is a free service that allows users to subscribe to receive email or text messages when observed parameters exceed a user defined threshold.
(*see*, http://ny.water.usgs.gov/flood/MohawkIce/)

WORKSHOP ABSTRACTS

YSI Observing Equipment

Ben Clarke
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Xylem/YSI Northeast Sales Rep

Mike Lizotte
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Xylem/YSI Senior Applications Specialist

This workshop will focus on the steps needed to ensure that your long term water quality data is of the highest accuracy possible.

Topics we will discuss

- Choosing the Right Sensor Technology
- Establishing a QA/QC Program
- Instrument Preparation
- Calibrations
- Site Selection and Design
- Fouling Protection
- Field Documentation

Your first dip into HRECOS – seeing the Hudson remotely

Dr. Stuart Findlay,
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Aquatic Ecologist/HRECOS Manager, Cary Institute of Ecosystem Studies

Gavin Lemley,
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HRECOS Coordinator, NY State Dept. of Environmental Conservation

Environmental monitoring technology has made remarkable strides in recent years. We can now remotely observe and characterize our waterways with precision and speed, providing for a new and unique way of connecting residents, scientists, educators and others with the surrounding environment.. The Hudson River Environmental Conditions Observing System (HRECOS) is a network of water and weather monitoring stations along the Hudson and Mohawk Rivers that utilizes this technology, displaying real-time data to the public through a web interface accessible by novice users and experts alike. The applications of HRECOS are wide-reaching, with the most significant user groups being: research, education, resource management, navigation, and emergency management. This workshop will provide attendees a general understanding of HRECOS capabilities, the available data and products, and will also demonstrate some unique applications of HRECOS.

Checking a River's Vital Signs: Using HRECOS Data in the Classroom

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Education Coordinator, Lamont-Doherty Earth Observatory of Columbia University,

Forgot your boat? Come navigate the river anyway! Join us to explore the Hudson River, using your fingertips to navigate through remotely sensed data. Such data is an outstanding resource for promoting systems thinking, STEM skills, using data to pose and answer questions, and stepping from local real time data to broader Big Data sets. Coupled to field experiences, this data can put student-collected results in a larger system context. Where field trips are being eliminated, HRECOS can provide a virtual alternative. This hands-on workshop will present tangible ways to explore HRECOS data with students in order to build their understanding of the Hudson River estuary while simultaneously supporting them in becoming more data literate. Starting with "mystery data-sets," we will demonstrate how presenting small data puzzles can create lively discussion and generate student-centered inquiry while at the same time digging into the complexities of our estuary. Building from small bits of data we will move to open ended data inquiry, comparing different parameters for correlation or causation, uncovering expected and unexpected relationships. Then launch into different locations in the estuary, letting HRECOS move you through variations in salinity, tidal cycles, etc. For this trip, no life jacket is needed.

POSTER ABSTRACTS

Hudson River Eel Project: Migration monitoring for both conservation and constituency-building

Chris Bowser
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Katie Friedman
NYS Department of Environmental Conservation, Norrie Point Environmental Center

As a catadromous species, the American Eel (*Anguilla rostrata*) migrates from the Sargasso Sea to spend the majority of its life in coastal freshwater or estuarine environments. Many eel populations have declined worldwide in recent decades, and in 2014, the IUCN declared the American Eel as an endangered species. To address both conservation and stewardship goals, researchers work with trained citizen scientists at twelve sites spanning 132 miles of the tidal Hudson River Estuary to monitor juvenile eel migration according to the Atlantic States Marine Fisheries Commission (ASMFC) protocol. The project employs fyke nets, "eel mops", and trap-and-pass ramps as collection gear placed along urban shorelines, tributary mouths, and below dams. Study sites are sampled for juvenile eels almost every day of the spring season. Since the project began in 2008, volunteers have caught, counted, and released over 2,500 juvenile eels per season, mostly above upstream barriers to migration. On average, individual sites have collected as few as less than one juvenile eel per day, while others have collected over 900 juvenile eels per day throughout a single sampling season. Through partnerships with public schools, colleges, watershed alliances, and various community groups, the project successfully communicates the importance of ecological conservation to broad audiences. The result has been a richer picture of both temporal and spatial eel migration along the tidal Hudson as well as significant public attention to eels, effectively combining migration data collection with public awareness and stewardship.

Evaluating greenhouse gas efflux across a rural-urban estuarine gradient: assessing the impact of incomplete wastewater treatment on the Hudson River

Brian Brigham
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Angel Montero, Jeffrey Bird, Gregory O'Mullan
Queens College, Earth and Environmental Science

The tidal Hudson River Estuary (HRE) receives significant inputs of readily dissolvable carbon (C) and nitrogen (N) from incomplete wastewater treatment and sewer overflow associated with New York City (NYC) and other urban centers. These sewage inputs intensify during storm events, delivering large concentrated pulses of C and N to the estuary, which may alter the natural C cycle and significantly enhance greenhouse gas (GHG) emissions. We hypothesize that increased sewage inputs will enhance GHG

production in close proximity to urban centers resulting in increased GHG efflux from the rural to urban gradient found in the HRE. To test this hypothesis, carbon dioxide (CO2) and methane (CH4) efflux rates were quantified over ten research cruises from HRE surface waters in combination with direct sewage input measurements following precipitation events. The Hudson River was found to be both a CO2 and CH4 source under all conditions. The greatest GHG effluxes (37 - 289 mg C m-2 day-1) were quantified at mid-channel sites in close proximity to NYC and other urban centers. Conversely, the lowest GHG effluxes (14.3 - 140 mg C m-2 day-1) were quantified at mid-channel sites in relatively underdeveloped regions. Increased CH4 efflux was also observed from urban tributaries and near-shore sites that routinely receive wastewater input. Further, increased GHG concentrations were also measured directly from sewage input compared to baseline waters. Overall, these data indicate that anthropogenic C additions associated with sewage input have the potential to significantly increase GHG emissions from the HRE.

Exploring the origins of antibiotic resistant bacteria in American Crows in Newburgh, NY

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Douglas Robinson
Division of Natural Sciences, Mount Saint Mary College

Antibiotic resistant bacteria have recently raised a high level of concern, particularly to the medical community, due to the potential risks they pose to human health management. Evidence suggests that bacteria with antibiotic resistance can travel through the food web, with organisms living in close association with humans potentially acting as reservoirs and vectors of antibiotic resistant bacteria. Our study aimed to identify a possible connection between environmental bacteria and bacteria found within American Crow (*Corvus brachyrhynchos*) nestlings, as well as to identify the prevalence of antibiotic resistance within environmental and nestling flora. In residential neighborhoods of Newburgh, NY, we collected cloacal bacteria from pre-fledgling American Crow nestlings and collected soil and potential invertebrate prey from foraging sites. *Enterobacteriaceae* collected from the cloaca and the environmental were tested for antibiotic resistance to 12 commonly used human antibiotics with Kirby-Bauer disk diffusion assay. All isolated bacteria (n=60) were resistant to Vancomycin, with 78% of bacteria resistant to at least one other antibiotic. More than 70% of nestlings (n=15 from 3 broods) had bacteria that were resistant to at least one antibiotic; 83% and 76% of foraging site and control site, respectively, were resistant to at least one antibiotic besides Vancomycin. Our results do not suggest conclusive trends between environmental bacteria and crow bacteria antibiotic resistance; however, current research is being done to determine the identity of all bacteria collected and assayed to learn the degree of overlap between the two bacterial floras.

Influence of Sewage and Sewage Infrastructure on the Microbial Aerosol Ecology of the Lower Hudson River Estuary

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S. Kamal: New School
R. Reichert, A. Montero, M. Kausch, G. O'Mullan: Queens College, CUNY

Previous research has highlighted microbial connections between the terrestrial and aquatic environments and air quality at the local scale. Understanding the ecological and public health implications of this local connection remains an understudied frontier in the emerging field of atmospheric biology. The air and water quality connection, specifically as it relates to the aerosolization of sewage-associated bacteria in contaminated urban environments, is particularly understudied. Processes including wind-wave interactions, wave-shore interactions, industrial and recreational boating, and mechanical aeration result in the creation of aerosols from contaminated water surfaces that are moved to the terrestrial urban environment with onshore winds. To better understand the role of sewage releases and urban sewage infrastructure in determining microbial aerosol content, we used a combination of culture-based and culture-independent microbiological approaches to sample air and water microbial communities in contaminated urban waterways and adjacent public spaces. We found that microbial aerosols above Lower Hudson River Estuary waterways were diverse, with similar microbial communities found in waterways and adjacent air masses. Wind direction and wind speed modulated the importance of sewage-associated bacteria. Bacterial aerosols detected using culture-based approaches were also evident in culture-independent (454 pyrosequencing) libraries, but culture-independent methods yielded much more diverse bacterial libraries. 454 pyrosequencing libraries revealed a large number of sewage-associated bacteria present in both aerosols and water (e.g. Acinetobacter, Arcobacter, Trichococcus, Faecalibacterium, Blautia, and Lachnospiraceae,), including potentially pathogenic bacterial genera. Similarities between water and aerosol bacterial assemblages suggest an important aquatic influence on air quality in the urban environment.

The Establishment of a NOAA National Water Level Observation Network (NWLON) Compliant Tide Station at Turkey Point (Hudson River Mile 98)

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Christopher Mitchell
Hudson River National Estuarine Research Reserve

Marissa Guercio, Christina Pacella
SUNY New Paltz

The Hudson River National Estuarine Research Reserve (HRNERR) has installed a long term water level monitoring station in the Hudson River Estuary at Turkey Point in partnership with NOAA with the goal of achieving compliance with their National Water Level Observing Network (NWLON) protocols. Currently the only permanent NOAA gage for the estuary is at the Battery. Turkey Point is a former US Coast Guard dock northwest of the Kingston Rhinecliff Bridge at Hudson River Mile 98. This station will help resolve water levels and tide stages for the estuary. Additionally, these data could be used to update the NOAA VDATUM model to calculate a more accurate tidal datum to apply to LiDAR maps. Accurate measures of water level will also support research on the vulnerability of tidal marshes to sea level rise; such research is currently being conducted by HRNERR at the Tivoli Bays, on the eastern shore of the Hudson directly opposite from Turkey Point.

Partial migration in juvenile white perch (*Morone americana*) within the Hudson River Estuary

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David H. Secor
Chesapeake Biological Laboratory, U. of Maryland Center for Environmental Sciences

Philip M. Piccoli
University of Maryland, Department of Geology

Partial migration, the presence of multiple migratory groups within the same population, is likely common in marine and estuarine fishes, but has not been extensively studied. Previous work in Chesapeake Bay has established white perch as a model species for evaluating the causes and consequences of partial migration, yet how white perch partial migration operates in other estuarine systems has not been investigated. The purpose of this study was to characterize migratory behavior in young-of-the-year (YOY) white perch in the Hudson River Estuary and compare larval size-at-age, hatch dates, and growth rates between resident and migratory groups (contingents). Fish were collected during the NY Department of Environmental Conservation fall seine survey in 2013, and were assigned to contingents based on otolith strontium:calcium (Sr:Ca) profiles. Analysis of otolith microstructure and growth back-calculation were employed to test whether migratory behaviors were associated with larval and juvenile growth rates. Otolith Sr:Ca profiles identified a resident contingent, which only utilized freshwater habitats, and a migratory contingent which spent early life in freshwater before dispersing to brackish habitats. Residents tended to originate from later hatch dates than migrants, while larval and juvenile growth rates differed between contingents, although growth differences were less pronounced in the larval period. Overall, results suggest that conditions during the larval period influence migratory behavior, which in turn affects subsequent juvenile growth rates. Thus, YOY white perch in the Hudson River generally conform to the pattern of partial migration observed in Chesapeake Bay.

Hudson Data Jam: Creatively Engaging Students in Understanding Large Data Sets

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Alan R. Berkowitz, Samantha Root
Cary Institute of Ecosystem Studies

We have found that teachers routinely struggle with integrating large data sets into their classrooms, and while students enjoy collecting their own data, they struggle to work with secondary data sets. By encouraging students to participate in the Data Jam, we are providing a motivation for engaging with secondary data while exploring a topic of interest. Modeled on the Desert Data Jam at the Asombro Institute, the Cary Institute is currently running the second Hudson Data Jam competition this spring. Using either provided data sets or data found online such as HRECOS, students are challenged to explain trends or comparisons through art, music, or theater, and then share their work with others. Integrating the arts into STEM has been shown to improve students' spatial-temporal reasoning, originality and abstract thought, and we are interested in understanding whether participating in a Data Jam improves students' scientific reasoning, data literacy skills, or increases their motivation working with secondary data. Based on results from 2014, most students participated in the competition because they wanted to work with data and be creative; receiving extra credit and prize money was not weighed as heavily. Students reported that their knowledge and interest in the Hudson River watershed increased significantly, but their confidence in working with data did not. We hope that our 2015 evaluation results will shed more light on student learning as a result of participating in this project.

Monitoring the Hudson and Beyond with HRECOS:
The Hudson River Environmental Conditions Observing System

Gavin M. Lemley
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Hudson River Estuary Program, NYS Dept. of Environmental Conservation

The Hudson River Environmental Conditions Observing System (HRECOS) is a robust environmental monitoring network operated and managed by a consortium of governmental, academic, and private institutions with shared interest in high-frequency monitoring in the Hudson River watershed. HRECOS monitoring stations are geographically distributed along the Hudson and Mohawk Rivers, and are equipped with sensors that continuously record a suite of water quality and weather parameters every 15 minutes, year-round. Remote telemetry at each station transmits real-time data for the public to freely view and download using an easily-accessible interface at our website, www.hrecos.org. HRECOS works to improve the capacity of regional river and estuary stakeholders to: understand the ecosystem and manage water resources, provide baseline monitoring data necessary for applied research and modeling, support the use of real-time data in educational settings, provide policy makers and emergency managers with data products to guide decision making, and provide information for safe and efficient commercial use and recreational activities. The HRECOS monitoring network brings together and develops upon long-standing monitoring programs of its partners, including the National Oceanic and Atmospheric Administration's National Estuarine Research Reserve System (NOAA; NERRS), New York State Department of Environmental Conservation's Rotating Integrated Basin Studies (NYS DEC; RIBS), U.S. Geological Survey monitoring, Stevens Institute of Technology's New York Harbor Observing and Prediction System (NYHOPS), and monitoring efforts of several other partner organizations. All HRECOS data collection and review procedures are subject to several levels of quality control as required by a Quality Assurance Project Plan, which is regularly renewed and approved by NYS DEC's Standards and Analytical Support Section - Division of Water, Bureau of Water Assessment and Management.

Comparison of Summer and Winter Protistan Plankton in the Lower Hudson River: A Metagenomic Analysis

M. Levandowsky
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American Museum of Natural History
Pace University
The River Project

E. Kim, A. Liberato, S. Scheinbach, B. Sprung, A. Yang
American Museum of Natural History

Metagenomic analyses were done using DNA extracted from samples of saline surface water of the lower Hudson River in June 21, 2013 and March 22, 2014. In both samples, two size fractions, 80 – 20 um and 20 – 0.2 um, were obtained by sequential filtration of a liter of river water. DNA was extracted and amplified by Polymerase Chain Reaction (PCR) using 2 primer sets for the 18S small subunit ribosomal gene regions, and then sequenced using the Illumina MiSeq platform. Hydrographic variables were also measured: salinity, temperature, DO, pH, NO_3- N, NH_3-N, P_i and Secchi depth. For comparison, plankton tows were also done using a 20 micron mesh size net and examined alive by phase microscopy. Taxonomic richness was far greater in Summer samples, though Winter samples had much greater plankton abundance. Winter samples also contained DNA from terrestrial species, reflecting runoff from rainfall and snowmelt.

Effects of antihistamine and salt on freshwater microbial community structure and function

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Rivers and streams receiving wastewater, such as the Hudson River, contain contaminants including pharmaceuticals and road salt. Ten out of 16 tested pharmaceuticals and drugs were detected among 6 sites along the Hudson River at concentrations ranging from 0.001 – 14 $\mu g\ L^{-1}$. An antihistamine (the active ingredient in Benadryl) was detected at a concentration of 4 $\mu g\ L^{-1}$ in the Kingston waste water treatment plant effluent. Pharmaceuticals are found in combination with other stressors, such as road salt, and these contaminants may interact and have complex consequences on ecosystem structure and function. We used artificial stream experiments to study the effects of the antihistamine (10 $\mu g\ L^{-1}$) and salt (205 μg Cl L^{-1} average final concentration) on algal and bacterial communities. Both contaminants, individually and as a mixture, suppressed gross primary production of biofilms after 3 weeks of chronic

exposure. Only the salt treatment suppressed community respiration. To understand how these changes in metabolism may be related to shifts in community composition, we examined composition of microbial communities exposed to contaminants using microscopic identification of algae and high-throughput sequencing of bacterial genes. The bacterial community exposed to antihistamine was distinct from the control group. The bacterial community exposed to both antihistamine and salt were more similar to the community exposed to only antihistamine, suggesting the antihistamine constrained bacterial community composition more than salt. Our results show the potential influence of contaminants on the structure and function of riverine ecosystems.

Ocean Glider Observations and Modeling of Sediment Resuspension in Hurricane Sandy

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Regional sediment resuspension and transport are examined as Hurricane Sandy made landfall on the Mid Atlantic Bight (MAB) in October of 2012. Teledyne-Webb Slocum glider RU23, equipped with a Nortek Aquadopp current profiler, was deployed on the continental shelf ahead of the storm, and is used to validate sediment transport routines coupled to the Regional Ocean Modeling System (ROMS). The glider was deployed on October 25th, 5 days before Sandy made landfall in southern New Jersey (NJ) and flew along the 40 m isobath south of the Hudson Shelf Valley. We used optical and acoustic backscatter to compare with two modeled size classes along the glider track, 0.1 and 0.4 mm sand respectively. Observations and modeling revealed full water column resuspension for both size classes for over 24 hours during peak waves and currents, with transport oriented along-shelf toward the southwest. Regional modeling showed over 3 cm of sediment was eroded on the northern portion of the NJ shelf where waves and currents were the highest. As the storm passed and winds reversed from onshore to offshore on the southern portion of the domain waves and subsequently orbital velocities necessary for resuspension were reduced leading to over 3 cm of deposition across the entire shelf, just north of Delaware Bay. This study highlights the utility of gliders as a new asset in support of the development and verification of regional sediment resuspension and transport models, particularly during large tropical and extra-tropical cyclones when *in situ* datasets are not readily available.

Surface Elevation Tables (SETs) in the Tivoli Bays: Monitoring Marsh Surface Elevation Dynamics with Changing Water Levels

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To measure the relative elevation of sediments within the freshwater tidal marshes of the Tivoli Bays, Surface Elevation Tables (SETs) were installed. SET stations provide a nondestructive method for making highly accurate measurements of sediment elevation over long periods of time relative to a fixed elevation benchmark. The Tivoli Bays were divided into study segments including Outer Tivoli North (OTN), a reference site, Inner Tivoli North (ITN), a site of potential marsh migration, and Tivoli South Bay (TSB), a site impacted by invasive *Trapa natans*. Three SETs were installed in each study segment, for a total of nine SETs. SET data were collected every spring, summer and fall. SET pin heights have been measured seasonally since May 2012, feldspar marker horizons have been measured since April 2013, and rubber mats have been measured since May 2014. Data showed a high degree of seasonal variability and high standard deviations. Results across these various methods showed a range of sediment accretion rates from 5.01 to 31.4 mm/year. All results were higher than previous sediment accretion estimates of 3 mm/year. SET stations will continue to be monitored, and marsh elevation data will be compared with water level and inundation data calculated from the Turkey Point Tide Station.

Backyard Health Hazards: Fecal coliform contamination of the Fonteynkill creek in Poughkeepsie, NY

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Fecal pathogens, indicated by *Escherichia coli* and other fecal coliforms, are the dominant cause for impairment of 191,228 miles of rivers and streams in the United States. These bacteria and associated pathogens pose health risks to humans upon ingestion and contact. Contamination of recreational and residential waterways by sewage and storm water runoff poses a risk to suburban communities, such as those in the Casperkill Watershed, an 11 mile tributary of the Hudson River. Long term bacterial sampling of the Fonteynkill creek, a tributary of the Casperkill, revealed that concentrations of fecal coliforms far exceed the New York State Department of

Environmental Conservation levels for recreational contact and fishing. Total coliform geometric means have remained above the standard 200 colony forming units per 100 mL since sampling began in 2012, maintaining concentrations between 2000-4000 CFU's / 100 mL.

Historical Monthly Hudson River Salt Front Variations and Links to Large-scale Atmospheric and Oceanic Patterns

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Monthly Hudson River salt-front position variations from 1991-2013 were examined and linked to large-scale climate indices. A wavelet analysis determined that fluctuations in the monthly salt front position are stochastic with no preferred time scale. However, monthly salt front variations were found to be phase-locked to sea surface temperature (SST) anomalies in the Tropical North Atlantic (TNA) region at a period of 88 months. The relationship was found to be the result of concurrent fluctuations in precipitation across the Hudson River Watershed. An analysis of European Reanalysis SSTs and 300-hpa stream function fields from 1985-2013 determined that historical salt front variability at a period of 88 months may have resulted from Rossby wave trains emanating from the tropical Pacific.

Effects of Zebra Mussel (*Dreissena polymoprha*) on the Feeding Ecology of Early-Staged Striped Bass (*Morone Saxatilis*) in the Hudson River Estuary

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Invasion of zebra mussel (*Dreissena polymorpha*) in the Hudson River in the early 1990s sharply reduced phytoplankton biomass and markedly altered estuarine energy flow. Previous studies suggest that early-stage fishes of several species were negatively impacted by the invasion; one such species was the Striped Bass (*Morone Saxatilis*). While abundance, growth, and distribution of striped bass are well documented throughout the zebra mussel invasion, diet and feeding success has been unanalyzed. The objective of the present study is to assess feeding success indicated by condition index as well as diet composition of striped bass over multiple years, including pre and post

mussel invasion years. We hypothesized reduced feeding success and thus lower bodily condition in zebra mussel impacted years. We also hypothesized dietary shifts towards a more littoral based diet rather than a pelagic one. Analysis to test this hypothesis is possible thanks to 21 years of early-stage fish samples collected as part of the Hudson River Utilities' long-term monitoring program. We found that condition of bass varied among years, such that condition was relatively high in some pre-invasion years and relatively low in some post-invasion years. Diet composition did not differ between years nor were there clear shifts in littoral or pelagic prevalence. We are currently conducting multivariate analyses of gut fullness and diet composition.

Surveying and mapping campus trees for educational and sustainability benefits at SUNY New Paltz, NY.

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There is a growing interest on college campuses in promoting awareness of trees for their educational value and for connections to campus sustainability initiatives. As a first step toward more fully realizing the potential benefits of trees on the SUNY New Paltz campus, we conducted a campus tree survey and recorded species, size class, GPS coordinates, and a photograph for every campus tree. All data was compiled and a geographic database and online, user-searchable maps were created. 2514 individual trees were recorded, comprising 44 native and 26 non-native species. The three most abundant species were eastern white pine, sugar maple, and pin oak. The database and maps facilitate the use of campus as a "living lab" for educational purposes. For example, results of the survey were used to greatly improve a tree identification activity in our ecology course by designing a tour through campus highlighting important native species. In our plant ecophysiology course, the database was used in similar manner to locate important tree species for class phenology observations. Other potential future benefits of the survey include identifying and cataloguing "trees of special value" including notable specimens, for example particularly large or old trees, and informing decisions about future plantings on campus, in order to fill gaps in the campus collection of living trees, or to improve potential energy savings by improving the shading of buildings by trees in summer.

Notes: