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Ward Freeman

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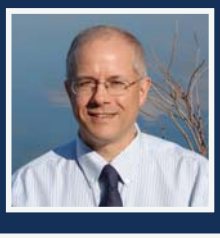


New York Water Science Center News Volume 19, October 2014

U.S. Geological Survey, New York Water Science Center Newsletter

Floods of 2011 in New York | NYS Canals Flood Warning System | Flood Innundation Mapping Pratsville | Hurricane Irene's Effect on Fish | Hydrologic Conditions

EXCERPT FROM NEW REPORT: Floods of 2011 in New York

Storm and Floods of April 26–May 9, 2011

The wet spring of 2011 that produced 5 in. of rain during late April in parts of upstate New York, combined with a rapidly melting snowpack from above-normal temperatures, caused widespread flooding of streams throughout northern New York and in other parts of the State. The resulting floods caused many road closures and 23 counties to be declared as Federal disaster areas and generated $60 million in damages. In northern and parts of central New York, record flows were recorded at 17 active streamgages, and record stage was recorded at five lake/reservoir gages during late April to early May. Peak discharges equaled or exceeded the 1-percent AEP [Annual Exceedance Probability] discharge at 11 streamgages.

The USGS New York Water Science Center operates two gages on Lake Champlain, one at the south end of the lake just north of Whitehall (04279085) and the other at the north end near the outlet of the lake at Rouses Point (04295000). The maximum lake stage (103.20 ft relative to NGVD 29) recorded at the Rouses Point gage on May 6 was the highest in 141 years of record (normal for May 6 is 98.8 ft) and the highest documented stage since at least 1827 (previous maximum stage was 102.1 ft in 1869). The daily mean lake stages at Rouses Point were above 100 ft from April 13 to June 17, 2011, (normally about 98.2 ft) and above 102 ft from April 28 to June 4, 2011 (normally at 98.3 ft).

Lumia, Richard, Firda, G.D., and Smith, T.L., 2014, Floods of 2011 in New York: U.S. Geological Survey Scientific Investigations Report 2014-5058, 236 p.

Storm and Floods of August 28–29, 2011 (Tropical Storm Irene)

On August 28, Tropical Storm Irene moved inland and north through New York bringing torrential rains, which resulted in catastrophic flooding and damage to many areas of eastern New York. Record storm rainfall totals were reported at several NWS stations in the Catskill Mountains area. Record stream stages and discharges were recorded at 62 streamgages throughout eastern New York, and peak discharges at 25 of the streamgages exceeded the 1-percent AEP [Annual Exceedance Probability] discharge with 6 sites in the Schoharie Creek Basin exceeding the 0.2-percent AEP discharge. Reservoir inflow, outflow, and stage data in and around the Catskill Mountains area indicate that some floodwaters were stored, but most reservoir water elevations exceeded those of their spillways on August 28.

Storm and Floods of September 7–11, 2011 (Tropical Storm Lee)

Remnants of Tropical Storm Lee reached south-central New York on September 7, 2011. The heaviest rains were centered over the already saturated Susquehanna River Basin in south-central New York with over 12 in. recorded in some areas during September 7–9 (and most falling on September 8). Flooding in the lower reaches of the Susquehanna River exceeded the record levels of 2006 by more than 4 ft (Tioga County). Ten streamgages in the Susquehanna River Basin recorded new maximum discharges and elevations on September 8, each greater than the 1-percent AEP discharge.

A Message From the Director

"Federal fiscal year 2014 (October 1, 2013 to September 30, 2014) is coming to a close. That means that it's been over three years since Tropical Storms Irene and Lee impacted the Northeast. These two storms —along with the substantial flooding due to snowmelt in upstate New York in April of the same year— resulted in loss of life, over a billion dollars' worth of damage, and a substantial effort —in terms of both manpower and resources— by Federal, State, and Local agencies for recovery, resiliency, and research. This newsletter will focus on the role that the USGS New York Water Science Center had in documenting the impacts from these three significant floods in a single year.

The NY WSC recently published "Floods of 2011 in New York, by Richard Lumia, Gary D. Firda, and Travis L. Smith" (http://pubs.usgs.gov/sir/2014/5058/pdf/sir2014-5058.pdf). This report includes the climate and flood data associated with the 2011 flooding and represents a herculean effort by my staff to document the historic flooding. The information presented in the form of maps, graphs, and tables will help emergency managers, planners, transportation, and others improve flood resilience of communities prone to flooding, as well as, help environmental-resource managers understand the effects flooding has on the local environment. As an indication of how significant these three floods were, there were 93 streamgages in New York that documented new record high streamflows and elevations. Lake Champlain with record dating back to 1863 had a new record high water surface elevation and was above flood stage for a month. The streamgage on the Schoharie Creek at Prattsville, with 109-years of record, was 5 feet higher than its previous record in 1996.

The USGS is in the process of installing and/or reactivating 22 streamgages in support of Governor Cuomo's "Upstate New York Flood-Warning System" (http://www.governor.ny.gov/press/10312013-upstate-flood-warning-system) Data from these streamgages will improve flood predictions, serve dynamic flood-inundation maps, and drive the operation of flood-control structures. We're also in the process of creating flood-inundation maps for the Schoharie Creek at Prattsville, NY. These maps can be used to help emergency managers respond to a flooding event or by city planners to enhance a community's resiliency to future events -- by visually showing the extent and magnitude (depth) of flood waters. The public can see how a forecast flood will impact their home because all the maps and forecast information will be available to the public on the USGS Flood-Inundation Mapper (http://wimcloud.usgs.gov/apps/FIM/FloodInundationMapper.html).These maps are driven by the data collected by a nearby USGS streamgage and forecasts from the National Weather Service.

USGS scientists are also studying the effects of flooding on fish —in particular trout. Preliminary results show that the timing of flooding in relation to spawning is critical. This could be critical as climate change appears to be shifting the timing of spring snowmelt in northern states. For more information about these products and projects please visit the New York Water Science Center website (ny.water.usgs.gov). And, don't hesitate to email me or my staff for more information."

New Streamgages to Enhance New York Flood-Warning System

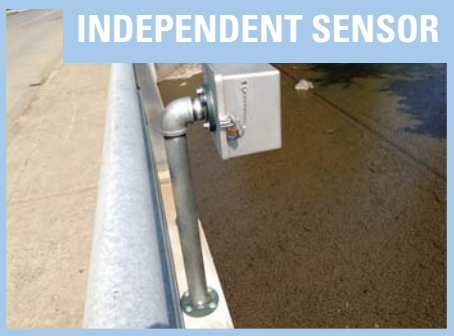
Since 2006, several separate flooding events (summer 2006,Tropical Storm Irene/Tropical Storm Lee in 2011, and the recent 2013 storms) have resulted in damages to private property and public infrastructure in Upstate New York estimated to be in the billions of dollars. Particularly hit hard were upwards of 27 upstate counties in the Oswego River, Mohawk River, and Upper Hudson River Basins.

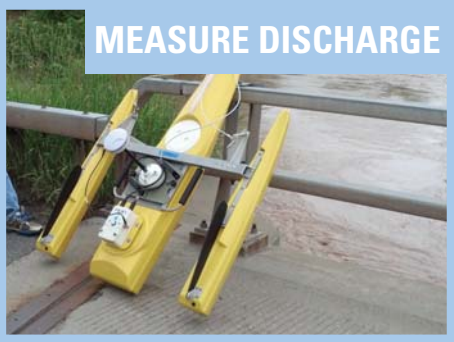
On October 13,2013, Governor Andrew M. Cuomo announced the establishment of a new Upstate New York Flood Warning System, which will substantially improve the forecasting frequency, accuracy, and modeling and mapping for any potential flooding throughout the Oswego River, Mohawk River, and Upper Hudson River Basins —"An advanced early warning system can reduce flood-induced property loss by upwards of 15 percent, with even more important benefits to human life and health."

As part of this effort the USGS New York Water Science Center (NY WSC) will be installing (and operating and maintaining) 22 near-real time streamgages, including:

- SCRIBA CREEK NEAR CONSTANTIA (04245840)
- KEUKA LAKE OUTLET AT DRESDEN (04232482)
- SKANEATELES CREEK NEAR SKANEATELES JUNCTION
- CHITTENANGO CREEK NEAR CHITTENANGO (04244000)
- COWASELON CREEK
- SENECA RIVER NEAR BALDWINSVILLE (04237496)
- SENECA RIVER AT CAYUGA LAKE OUTLET
- GARNARGUA CREEK
- FISH CREEK AT OSWEGO ROAD BLOSSVALE
- EAST CANADA CREEK AT EAST CREEK (01348000)
- OTSQUAGO CREEK AT FORT PLAIN (01349000)
- FULMER CREEK NEAR MOHAWK (01342743)
- MOHAWK RIVER NEAR UTICA (01342602)
- SAUQUOIT CREEK AT WHITESBORO (01339060)
- ORISKANY CREEK NEAR ORISKANY (01338000)
- HUDSON RIVER AT THOMSON (01328770)
- MOHAWK RIVER (AMSTERDAM AREA)
- MOHAWK R ABOVE STATE HIGHWAY 30A AT FONDA (01349527)
- MOYER CREEK NEAR FRANKFORT (01342682)
- GLENS FALLS FEEDER AT DUNHAM BASIN (01327500)
- STEELE CREEK AT ILION (01342730)
- BLACK CREEK NEAR GRAY (01343403)

These streamgages will provide the data needed by the proposed flood-warning system. Data will also be available on the NY WSC's Web Page (ny.water.usgs.gov).





Photos showing selected steps necessary to install and operate a USGS streamgage as part of the USGS Streamgaging Network. The USGS Streamgage Network, which consists of over 8,000 streamgages, has redundant satellite telemetry downlinks and mirrored internet gateways across the Nation. When the flood waters come USGS teams are deployed to measure the impact, make sure the streamgages are operating correctly, and work closely with the National Weather Service to provide for flood warning at any of their flood forecast points. The USGS has the infrastructure to be able to draw from neighboring offices when needed. For these reasons (and more) USGS streamgages are perfectly suited to be the backbone of any flood-warning system.

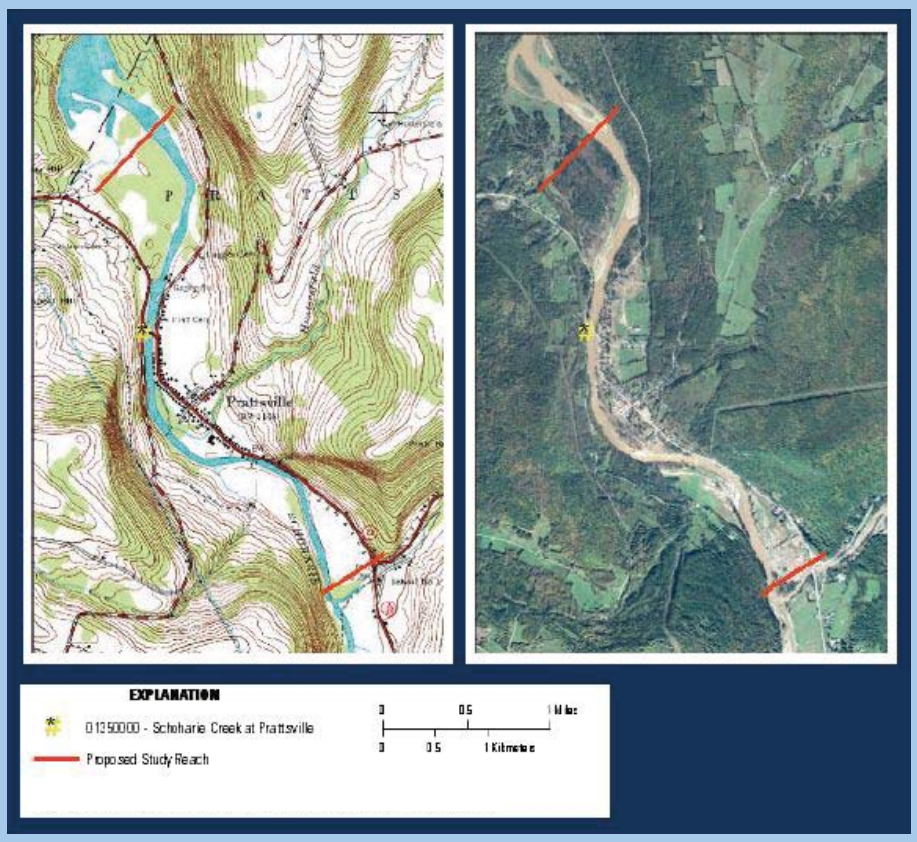
Flood-Inundation Maps for the Schoharie Creek at Prattsville, New York

Prattsville has experienced severe flooding along the Schoharie Creek, most notably during August 2011 following Tropical Storm Irene, which severely damaged or destroyed large areas of the town, and caused several million dollars in damages. Before and during a flood, forewarning and emergency response are critical. The rescue efforts of emergency

Flooding damage caused by Tropical Storm Irene

responders are often hampered by lack of information on where flooding is occurring at any given moment, but also where flooding is likely to occur in the near future. Emergency responders would benefit from a library of flood-inundation maps that are referenced to the stages recorded at the U.S. Geological Survey (USGS) streamgage in Prattsville. By referring to the appropriate map, emergency responders can discern the severity of existing and forecast flooding (depth of water and aerial extent), identify roads that are or will soon be flooded, and make plans for notification or evacuation of residents that are in harm's way.

Digital flood-inundation maps for a 2.6 mile reach of the Schoharie Creek at Prattsville, New York will be created by the USGS in cooperation with the New York State Department of Environmental Conservation. Flood profiles will be computed for the stream reach by means of a one-dimensional step-backwater model; this model will be based on existing models where available, but will be updated to reflect current ground conditions following the August 2011 flood. This hydraulic model will be used to compute 17 water-surface profiles for flood stages at 1-foot intervals referenced to the USGS streamgage, Schoharie Creek at Prattsville, N.Y. (station number 01350000), for stages 9 to 25 feet, which exceeds the estimated 0.2-percent annual-exceedance-probability flood, or 500-year recurrence interval flood. The simulated water-surface profiles will be combined with a geographic information system (GIS) digital elevation model derived from Light Detection and Ranging (lidar) data to delineate the area flooded at each water level and to map the estimated depth of water. These flood maps will be overlaid on high-resolution, georeferenced, aerial imagery of the study area in the form of static maps, and will also be available on the USGS Flood Inundation Mapper website: (http://wim.usgs.gov/FIMI/FloodInundati onMapper.html) which displays current USGS and forecast (from the National Weather Service Advanced Hydrologic Prediction Service) stages, has a variety of basemaps, and allows users to interact with model results and inundation scenarios.



Approximate study reach for flood-inundation mapping, Prattsville, NY.

Effect of Flooding from Tropical Storm Irene on Fish Assemblages in the Upper Esopus Creek Basin

The Esopus Creek, a popular trout-fishing and recreational stream in the heart of the Catskill Mountains, received historic flooding from Tropical Storm Irene on August 28, 2011. Streamflows approached or surpassed the 1 percent annual exceedance probability (>100 year) discharge at several USGS streamgages in this basin. Short-term flood impacts on biological assemblages have been assessed in several studies, but longer-term effects, recovery, and analysis of factors affecting ecosystem resiliency have rarely been investigated.

Upper Esopus Creek (A) Before Hurricane Irene and (B) After Hurricane Irene.

The U. S. Geological Survey (USGS), New York City Department of Environmental Protection (NYCDEP), and Cornell Cooperative Extension of Ulster County (CCEUC) collaborated on an earlier study of fish communities at 18 sites from 2009-2011 (prior to the flood). The pre-flood data at these sites provided an opportunity to quantify the impacts of Irene on stream fish assemblages and to assess the relations between landscape and channel features that limit the level of disturbance and hasten recovery.

The main objective of the present study is to increase our understanding of the response (short- and long-term impacts) and recovery of fish assemblages to extreme hydrologic events and to determine how landscape and channel features affect this process. More specific goals are to document the impacts, recovery, and apparent resilience of brown and rainbow trout populations and entire fish communities in the Upper Esopus Creek basin.

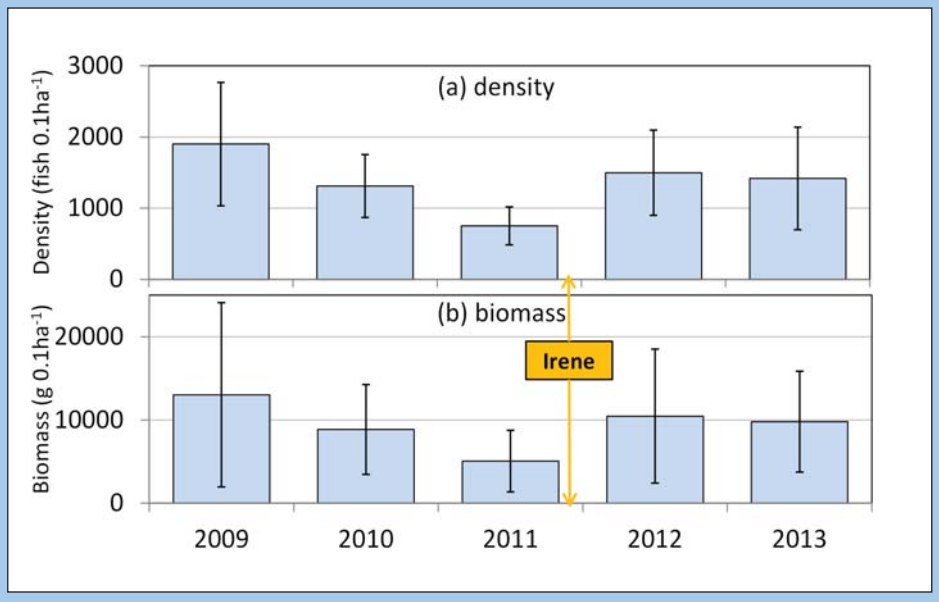
Additional funding by CCEUC, New York State Energy Research and Development Authority (NYSERDA) and the USGS allowed for resampling fish assemblages at 9 of the original sites during both 2012 and 2013. Data were complied, verified, and analyzed to test hypotheses that the floods would cause:

- Decreases in density and biomass of fish communities;
- Shifts in community structure, and;
- More severe impacts on species of small fish and early life stages of large species, especially young-of-the-year trout.

Results of this study are submitted for publication in Journal of Freshwater Biology and generally indicate that:

- The overall fish community across the basin was minimally affected by the flooding;
- Fish assemblages at individual sites responded differently, and the impact and recovery of brown, and rainbow trout populations differed
- Brown trout had an enormous 2012 year class following the flood and population age structure shifted toward younger (age 0+ and 1+) fish;
- Rainbow trout populations, already declining from 2009-2011, continued to decline in 2012 and 2013;
- Observed increases in density and biomass during the post-flood years (2012, 2013) may be attributed more to the poor pre-flood (2011) condition of the fish community than to direct effects of the flood;
- The sampling interval was critical to correct interpretation of species and community impacts;
- Local fish communities are fairly resilient to extreme hydrologic disturbance; and,
- Continued surveys at these 9 sites in 2014 will help assess and interpret longer-term impacts and recovery from extreme hydrologic events.

Reference: George, S.D., Baldigo, B.P., and Smith, A. J., in review. Effects of extreme hydrologic events on trout populations and fish communities in a Catskill Mountain river. Freshwater Biology.

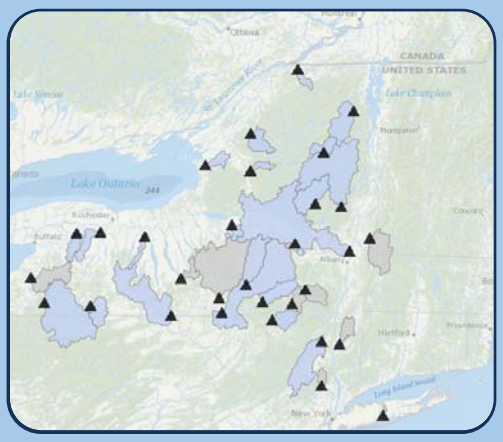


Mean community density and biomass, 2009-13. Error bars show 95% confidence intervals about the mean.

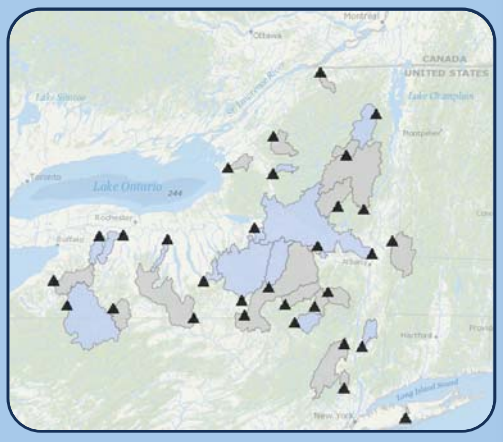
Surface Water and Groundwater Conditions in New York

Monthly and seasonally (shown below), hydrologists at the New York Water Science Center synthesize and summarize streamflows and groundwater levels for New York: Visual representation of the streamflow and groundwater conditions are shown on the NY WSC's Hydrologic Conditions Mapper. For spring and summer (2014) streamflow was in the wet or normal ranges at nearly all of the index stations. Groundwater levels at the observation wells varied from mostly in the normal range in April and May, mostly in the wet range in June and July, and mostly in the wet to normal ranges for August and September.

A. Streamflow

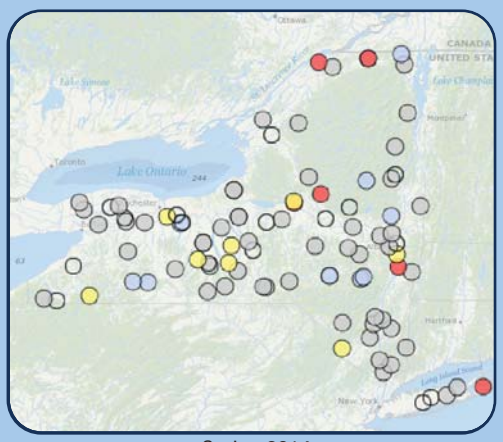


Spring 2014

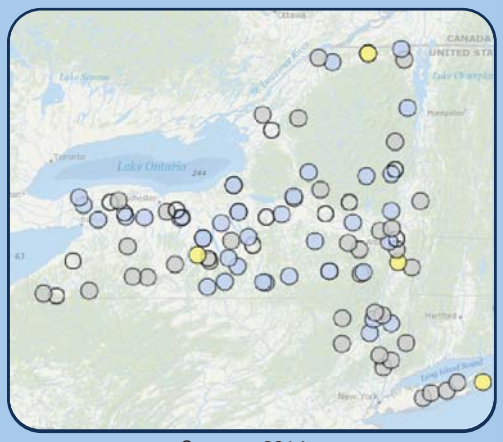


Summer 2014

B. Groundwater



Spring 2014



Summer 2014

EXPLANATION

Basin boundry — Streamgage ▲ — Groundwater well ●

Percentages of Monthly Means (Period of Record)

WET | NORMAL | DRY | VERY DRY

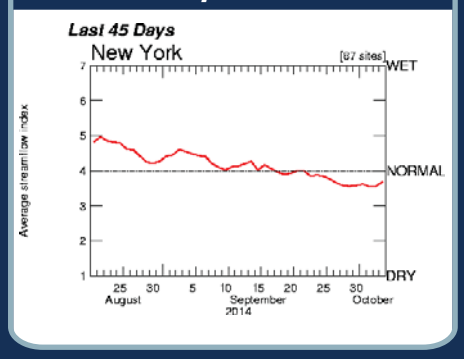
Seasonal conditions at selected (A) streamgages and (B) groundwater wells in New York. USGS maintains and operates most streamgages and groundwater wells in cooperation with various federal, state, and local agencies. Winter (January, February, March), Spring (April, May, June), Summer (July, August, September), Autumn (October, November, December).

USGS Water Watch & Groundwater Watch

WaterWatch is a USGS World Wide Web site that displays maps, graphs, and tables describing real-time, recent, and past streamflow conditions for the Nation. Real-time streamflow information (stage and flow) generally is updated on an hourly basis. WaterWatch provides maps that show the location of more than 3,000 long-term (30 years or more) USGS streamgages.

Groundwater Watch is a USGS World Wide Web site that displays maps, graphs, and tables describing groundwater level data from wells currently in a regular measurement program. Three types of water-level data are displayed, including periodic, continuous data that are periodically retrieved, and real-time data generally updated on an hourly basis. Groundwater Watch contains water levels and well information from more than 20,000 wells that have been measured by the USGS or USGS cooperators at least once within the past 365 days.

45 Day Index Plot



Among other things, WaterWatch summarizes streamflow conditions in a region (state or hydrologic unit) in terms of the long-term typical condition at streamgages in the region. For example, this plot shows that streamflow over the last 45 days was at or below normal conditions for New York.

FEATURED ARTICLE

The Importance of USGS Continuous Water-Quality Monitoring to Coastal Marine Research on Long Island, NY.

Recent data from a USGS continuous water-quality monitoring station on the Long Island Sound embayment of Flax Pond in Old Field, N.Y., were fundamental to the publication of two new journal articles related to ocean acidification and its effect on coastal marine organisms. Diel, seasonal, and interannual variability of dissolved oxygen and pH from Flax Pond during 2008 to 2012 were quantified and used in conjunction with short-term, simultaneous pCO_2 measurements. Findings suggest that coastal marine organisms are adapted to a wide range of environmental conditions and may tolerate long-term increases in anthropogenic CO_2 (Baumann and others, 2014). These adaptations were explored in the laboratory using wild fish populations of the Atlantic silverside Menidia menidia (Murray and others, 2014). The long-term, high-frequency pH data for Flax Pond were used to help demonstrate that these species adapt to natural seasonal fluctuations in pH and CO_2 by preconditioning their offspring to rapidly changing environmental conditions. The 2008-12 USGS data were collected in cooperation with the New York State Department of Environmental Conservation and The Nature Conservancy; presently (2014), these data are being collected in cooperation with the Suffolk County Department of Economic Development and Planning. Hannes Baumann, a researcher in both studies, emphasized the importance and usefulness of USGS monitoring. "Our research demonstrated that high-resolution time series, like the one from Flax Pond, comprise highly valuable tools to further understand the dynamics and future changes of coastal ecosystems (Hannes Baumann, written commun., 2014)."

Baumann, H., Wallace, R.B., Tagliaferri, T., and Gobler, C.J., 2014, Large natural pH, CO_2, and O_2 fluctuation in a temperate tidal salt marsh on diel, seasonal, and interannual time scales, Estuaries and Coasts (published online 3/2014). http://dx.doi.org/10.1007/s12237-014-9800-y

Murray, C.S., Malvezzi, A., Gobler, C.J., and Baumann, H., 2014, Offspring sensitivity to ocean acidification changes seasonally in a coastal marine fish, Marine Ecology Progress Series 504: 1-11.

SELECT NYWSC PUBLICATIONS

Kreitinger, E.A., and Kappel, W.M., 2014, Hydrogeology and water quality of the Nanticoke Creek stratified-drift aquifer, near Endicott, New York: U.S. Geological Survey Scientific Investigations Report 2014-5063, 19 p plus appendixes, http://dx.doi.org/10.3133/sir20145063

Misut, P.E., and Aphale, Omkar, 2014, Simulation of groundwater flow pathlines and freshwater/saltwater transition zone movement, Manhasset Neck, Nassau County, New York: U.S. Geological Survey Scientific Investigations Report 2013-5201, 44 p.

Zaugg, S.D., Phillips, P.J., and Smith, S.G., 2014, Analysis of pharmaceutical and other organic wastewater compounds in filtered and unfiltered water samples by gas chromotragraph/mass spectrometry: U.S. Geological Survey Open-File Report 2013-1297, 24 p.

Yager, R.M., and Heywood, C.E., 2014, Simulation of the effects of seasonally varying pumping on intraborehole flow and the vulnerability of public-supply wells to contamination: Groundwater, doi: 10.1111/gwat.12150

Misut, P.E., 2014, Simulation of zones of contribution to wells at site GM-38, Naval Weapons Industrial Reserve Plant, Bethpage, New York: U.S. Geological Survey Scientific Investigations Report 2014-5036, 58 p.

McHale, M.R., Siemion, Jason, Lawrence, G.B., and Mast, M.A., 2014, Long-term soil monitoring at U.S. Geological Survey reference watersheds: U.S. Geological Survey Fact Sheet 2014-3002, 2 p., ISSN 2327-6932 (online)

Scott, Tia-Marie, and Nystrom, E.A., 2014, Groundwater quality in the Upper Hudson River Basin, New York, 2012: U.S. Geological Survey Open-File Report 2014-1084, 21 p.

Kappel, W.M., 2014, The hydrogeology of the Tully Valley, Onondaga County, New York--an overview of research 1992-2012: U.S. Geological Survey Open-File Report 2014-1076, 28 pp., plus 3 appendixes

Bugliosi, E.F., Miller, T.S., and Reynolds, R.J., 2014, Hydrogeology and water quality of the stratified-drift aquifer in the Pony Hollow Creek Valley, Tompkins County, New York: U.S. Geological Survey Scientific Investigations Report 2014-5059, 23 p.

Baldigo, B.P., Phillips, P.J., Ernst, A.G., Gray, J.L., and Hemming, J.D.C., 2014, Spatiotemporal variations in estrogenicity, hormones, and endocrine-disrupting compounds in influents and effluents of selected wastewater-treatment plants and receiving streams in New York, 2008-09: U.S. Geological Survey Scientific Investigations Report 2014-5015, 32 p.

Lumia, Richard, Firda, G.D., and Smith, T.L., 2014, Floods of 2011 in New York: U.S. Geological Survey Scientific Investigations Report 2014-5058, 236 p.

Wall, G.R., Murray, P.M., Lumia, Richard, and Suro, T.P., 2014, Maximum known stages and discharges of New York streams and their annual exceedance probabilities through September 2011: U.S. Geological Survey Scientific Investigations Report 2014 5084, 16 p., http://dx.doi.org/10.3133/sir20145084.

Coon, W.F., 2014, Flood-indundation maps for the Mississinewa River at Marion, Indiana, 2013: U.S. Geological Survey Scientific Investigations Report 2014-5060, 13 p., http://dx.doi.org/10.3133/sir20145060

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The USGS Water Mission Area (WMA) has the principal responsibility within the Federal Government to provide the hydrologic information and interpretation needed by others to achieve the best use and management of the Nation's water resources. WMA actively promotes the use of its information products by decision makers to:

- Minimize loss of life and property as a result of water-related natural hazards, such as floods, droughts, and land movement.
- Effectively manage groundwater and surface-water resources for domestic, agricultural, commercial, industrial, recreational, and ecological uses.
- Protect and enhance water resources for human health, aquatic health, and environmental quality.
- Contribute to wise physical and economic development of the Nation's resources for the benefit of present and future generations.

If you have an environmental or resource-management issue in which you would like to partner with the USGS to investigate, please contact any of our senior management staff (listed below). Projects are supported primarily through the Cooperative Water Program. This is a program through which any State, County, or local agency may work with the USGS to fund and conduct a monitoring or investigation project

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