

CONFLUENCE

Spring 2019

HANCOCK BIOLOGICAL STATION



600TH LAKE MONITORING CRUISE

July 22, 1988, marked the beginning of a new era for the scientific study of Kentucky Lake. On that date, three faculty and staff from Murray State University's Hancock Biological Station boarded a pontoon boat early in the morning and began regular monitoring of one of the largest reservoirs in the eastern United States.

Now, more than 30 years later, this effort has reached a significant landmark with the occurrence of the 600th monitoring cruise on March 12, 2019. Throughout the duration of the program, more than 260 faculty, students, and staff from Murray State's departments of Biological Sciences, Chemistry, and Earth and Environmental Sciences have participated in the Kentucky Lake monitoring program.

Monitoring efforts have focused on measuring long-term water quality and biological changes in Kentucky Lake. The resulting data are housed and maintained at Hancock Biological Station. The data are used by government agencies, university researchers, corporations, and the general public. Such large data sets are rare but vital for the evaluation of environmental change including the effects of invasive species such as Silver carp and Zebra mussels.

The Biological Station's boats remain central

to the monitoring program, but other technology has been incorporated. Satellite imagery of Kentucky Lake has been used throughout the study period, and real time, continuous measurements of water temperature, oxygen levels, and other water quality indicators were added over a decade ago.

For access to the real-time data and more information about the Kentucky Lake monitoring program, visit murraystate.edu/hbs.



Cruise participants (left to right): Dr. David White, Clark Hendrix, Dr. Sarah Princiotta, and Dr. Susan Hendricks

FOUR RIVERS WATERSHED SUSTAINABILITY FESTIVAL

Running from April 2-6, the Third Annual Four Rivers Watershed Sustainability Festival will be a week-long celebration of our local water resources and the efforts being made to maintain them.

The event began as a one-day educational summit in 2017 with just three sponsors – the Jackson Purchase Foundation, the Watershed Studies Institute and the City of Murray – with some growth in 2018. However, in 2019 the festival will be larger than ever, with a week's worth of events planned thanks to numerous sponsors and partners.

Festivities will kick off with a Family Day on Tuesday, April 2, at the Murray State University Arboretum from 10 a.m. to 3 p.m. This day will feature interactive activities for children such as Animal Tales with the Calloway County Public Library and Hooked on Science with Jason Lindsey, as well as engaging educational material for adults. Visitors can look forward to various giveaways including free trees from the Calloway County Conservation District (while supplies last).

A Summit featuring speakers from across the region will be open to the public on Wednesday, April 3, at the Murray State University Curris Center Large Ballroom. Sessions will focus on invasive Asian carp and wetland restoration and will include time for questions from the audience. Throughout

the day, a display of student posters will highlight University research.

Other events planned for the week including a special Cinema International film on Asian Carp in the Murray State Curris Center theater (Thursday, Friday, and Saturday evenings), a Project Aquatic WILD workshop on Thursday, and a trash clean up activity on Saturday. The week will end with a Beast Feast, sponsored by Murray State's Wildlife and Fisheries Society.

“Through this event, we hope to encourage our community to celebrate our abundant water resources and learn about local projects that aim to improve and protect these resources,” said Four Rivers Basin Coordinator Maggie Morgan.

The Western Kentucky region has a wealth of water resources that supply invaluable benefits for our local economy and communities. These resources also provide a foundation for unique educational opportunities and conservation efforts. The Four Rivers Watershed Sustainability Festival grew from the need for continued engagement in protecting our water resources and will set the precedent for future endeavors in the area.

For a full list of times and events, visit the Four Rivers Watershed Sustainability Festival Facebook page.

EVENT ANNOUNCEMENTS:

- + Four Rivers Watershed Sustainability Festival (see above): April 2-6
- + 600th Cruise Celebration @ Hancock Biological Station: Friday, April 12, from 2:30-4 p.m.
- + Murray State University Spring Commencement @ CFSB: Saturday, May 11 at 9 a.m. and 2 p.m.
- + Hancock Biological Station Reunion (details forthcoming): Friday, October 18

GRANT UPDATES

+ *Inventory of Amphibians and Reptiles* - With the guidance of project directors Dr. Michael Flinn and Dr. Howard Whiteman, funds under this award will be used to generate a comprehensive baseline inventory of amphibians and reptiles, with a focus on state-threatened or at-risk species and a rare forest type (i.e. exo-hydric flatwoods) within Clarks River National Wildlife Refuge.

+ *Wetland Restoration Project Grant* - This grant allows for monitoring of water and soil quality to understand physical and chemical changes over time and monitor biological parameters within and surrounding wetlands. The Wetlands Reserve Program Monitoring Team includes: Murray State members Dr. Whiteman, Dr. Michael Flinn, Jane Benson, and Christy Soldo, The Nature Conservancy members Shelly Morris and Danna Baxley, and National Resource Conservation Service member Reed Cripps.

+ *NASA Kentucky Space Grant Fellowship*: Recipient Jacob Pease, a current master's student, will be mapping the restoration of the American Chestnut as part of his graduate research.

SENSING AND EDUCATING THE NEXUS TO SUSTAIN ECOSYSTEMS (SENSE)

Written By: Dr. Susan Hendricks

SENSE is a \$3.85 million, four-year National Science Foundation grant to Murray State's Hancock Biological Station (HBS) to study the environmental factors that lead to toxic blue-green algal blooms. It is the largest single research grant ever awarded to MSU. The overall project is led by PI David White. Co-PIs are Susan Hendricks (HBS Research Scientist), Jimmy Fox and Bill Ford (University of Kentucky), as well as Mindy Armstead (Marshall University). More than 40 other faculty, staff, and students are participating in research and education components, including West Liberty University and Eastern Kentucky University. HBS staff Clark Hendrix, Xulong Peng, and Angie Hayden are providing expertise in aquatic sensors, databases, and water chemistry. Sarah Princiotta is a post-doctoral researcher working on trophic interactions between planktonic grazers and toxic algal cells.

Toxic blue-green (Cyanobacteria) harmful algal blooms (CyanoHABs) are a water quality issue held in common between Kentucky and West Virginia water bodies such as the Ohio River, Kentucky Lake, and smaller agricultural tributaries. Excessive nutrient runoff (nitrogen and phosphorus) and temperature are the most common factors leading to CyanoHAB development. Marshall is focusing on the Ohio River near Huntington, WV. UK is looking at processes in small streams in Kentucky and West Virginia, and we at Murray State are concentrat-

ing on Kentucky Lake. All three groups use in situ sensors that have advantages over traditional sample collection and analysis. Advantages include high temporal resolution capacity, development of smart sensing platforms to streamline sampling in near real-time, and minimization of errors induced by common sampling and preservation methods.

Sensor arrays have been deployed at three sites in Kentucky Lake, one in the main lake at Highland Light, Ledbetter Bay (an agricultural/rural watershed), Panther Bay (a forested watershed in LBL). Data are collected every 15 minutes and streamed via cell phone or radio to the HBS server system. Basic parameters include pH, dissolved oxygen, temperature, conductivity, and turbidity. The densities of algae are measured by chlorophyll sensors. A phycocyanin sensor gives us a direct measure of the amount of blue-green-cyanobacteria present. Newly developed nitrate and phosphate sensors keep track of nutrient levels in the lake. Parallel arrays of sensors have been deployed in the Ohio River by Marshall University in collaboration with the Army Corps of Engineers and the US Geological Survey. Similar sensors have been installed by UK in two small agriculturally impacted streams to measure not only what is coming off the landscape but also what is stored in the streambed. To corroborate what the algal pigment sensors are telling us, we identify and count phytoplankton in KLMP water samples for all cruise dates.

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Sounds easy and straight forward... not exactly! Flash flooding, particularly in UK's small streams, can bury their equipment in mud. Their nitrogen and phosphorus sensors have been overwhelmed by the high concentrations of these two nutrients coming off the landscape. The Kentucky Lake equipment has proven to be a great substrate for attached algae and a variety of small animals biofouling the sensors. Sometimes the systems just stop sending data for one reason or another such as lightning strikes, floods that cause buoy wandering off site, detachment of equipment from the buoys, and loss of cell phone service, to name a few. Calibration is a regular maintenance concern, too. Ensuring that good data have been collected can be pretty intensive.

Educational opportunities for students also are available through an annual Research Experiences for Undergraduates (REU) workshop as part of the grant. Up to ten students begin the workshop at Marshall University by visiting research sites on the Ohio River and small streams in WV, then travel to UK to work on agricultural streams, ending at HBS to work on Kentucky Lake. All three legs of the workshop emphasize hands-on experiences with sensors in the field and laboratory. The 2019 REU workshop will be held Aug. 10-18.

The data resulting from the research associated with this grant at HBS in conjunction with the KLMP data have been reported most recently at the annual symposium of the North American Lake Management Society last November, 2018, in Cincinnati, Ohio, by White and Hendricks, and by Princiotta at the February 2019 annual meeting of the Society of Limnology and Oceanography in Puerto Rico.

We are a little more than half way through the grant period and expect to have everything wrapped up by the end of 2020.



*Biofouling of a YSI unit /
Photo Credit: Susan Hendricks*



*Biofouling of nutrient sensors /
Photo Credit: Susan Hendricks*

IS THERE CONTENT YOU WOULD LIKE TO SEE IN OUR NEXT NEWSLETTER?

ANY SUGGESTIONS FOR THE EDITOR?

FOR QUESTIONS, COMMENTS OR POTENTIAL SUBMISSION OF CONTENT,

CONTACT US AT:

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PHOTO HIGHLIGHTS



@HancockBiologicalStation



Hancock Biological Station
Watershed Studies Institute

Follow us on
social media to keep
tabs on the hard work
put in by our
faculty, students, and
staff!



A chilly winter Cruise with (pictured left to right): Luke Zuklic, Clark Hendrix, and Jason Harris / Photo Credit: Sarah Princiotta



HBS dock after our recent rain / Photo Credit: Clark Hendrix



An overhead shot of Hancock Biological Station / Photo Credit: Jason Sealock



An outtake from the morning of the 600th Cruise / Photo Credit: Tyler Anderson



Dr. Sarah Princiotta hard at work / Photo Credit: Dr. Susan Hendricks

WORK PUBLISHED BY STUDENTS, FACULTY, AND STAFF

Kevin Takashita-Bynum:

Takashita-Bynum, K.K., 2017. *A snapshot of early Miocene primate activity in west Turkana, Kenya: Using geology and geochemistry to track the environmental preferences of our primate ancestors*, presented at the Sigma Xi Symposium on Atmospheric Chemistry, Climate, and Health, Raleigh, NC.

Liutkus-Pierce, C.M., Takashita-Bynum, K.K., Beane, L.A., Edwards, C.T., Burns, O.E., Mana, S., Hemming, S., Grossman, A., Wright, J.D., & Kirera, F.M. (2019). Reconstruction of the Early Miocene Critical Zone at Loperot, Southwestern Turkana, Kenya. *Frontiers in Ecology and Evolution*, 7(44), p 1-20

Dr. Gary Stinchcomb:

Munoz, S.E., Giosan, L., Blusztajn, J., Rankin, C. and Stinchcomb, G.E. (2019). *Radiogenic fingerprinting reveals anthropogenic and buffering controls on sediment dynamics of the Mississippi River system*. *Geology* 47(3), 271-274.

Beverly, E. J., Peppe, D. J., Driese, S. G., Blegen, N., Tryon, C. A., Stinchcomb, G. E. (2017).] *Reconstruction of Late Pleistocene paleoenvironments using bulk geochemistry of paleosols from the Lake Victoria region*. *Frontiers in Earth Science* 5 (93).

Dr. Howard Whiteman:

Krzton-Presson, A., B. Davis, K. Raper, K. Hitzl, C. Mecklin and H. Whiteman. 2018. *Effects of Phragmites management on the ecology of a protected wetland*. *Northeastern Naturalist* 25:418-436.

Boeckman, K. R. and H. H. Whiteman. 2017 *Predators lack complementarity in a degraded stream*. *Copeia* 105:745-754

Dr. Maeve McCarthy:

K. Renee Fister, Maeve McCarthy, Seth Oppenheimer, *Diffusing Wild Type and Sterile Mosquitoes in an Optimal Control Setting*, *Mathematical Biosciences* (2018) <https://doi.org/10.1016/j.mbs.2018.05.015>

M.L. McCarthy, D. Wallace, H. H. Whiteman, E. T. Rheingold, A. M. Dunham, O. Prosper, M. Chen and E. Hu-Wang, *Modeling the population dynamics and community impacts of *Ambystoma tigrinum*; a case study of phenotype plasticity*, *Mathematical Biosciences* 2017 June; 288: 35-45. <http://doi.org/10.1016/j.mbs.2017.02.011>

Dr. Bommanna Loganathan:

Loganathan, B.G., Sajwan, K. 2017. Spatial and Temporal Trends of POPs in Abiotic Compartments : An overview. *Organohalogen Compounds*. 79, 799-802.

Kodavanti, PRS., Loganathan, BG. 2019. *Polychlorinated biphenyls, polybrominated biphenyls, and brominated flame retardants*. In. *Biomarkers in Toxicology*, 2 nd Edn (Ed. R. Gupta). Elsevier Academic Press. London. 501-518pp.

GRADUATE STUDENT CONDUCTS RESEARCH IN ETHIOPIA

Written by: Tyler Anderson

Graduate student Kevin Bynum visited Ethiopia to conduct research concerning early human environmental conditions.

Bynum, along with Dr. Gary Stinchcomb, Bynum's graduate advisor, and undergraduate student Marie White, visited Gona, Ethiopia, and collected 146 soil samples. Said samples will provide various data concerning climate and environmental conditions for humans that once lived in what is known as the "cradle of humankind."

An established and thorough understanding of the area's wealth of natural records bolstered the group's hopes of collecting data that will benefit their research.

"Gona is an area... that contains one of the most established archaeological records in the world," Bynum said.

The group worked for nearly a month to gather soil and paleosols, or fossilized soil deposits. With these the group hopes to cultivate a better understanding of early human life and activity.

But for Bynum, this trip was both a professional and personal endeavor.

"I wanted to improve my own awareness and understanding of the beliefs and perspectives of people living a life much different from my own in an area completely unlike what I am used to," Bynum said.

Gona's environment, people, and culture are far removed from that of the local community; conducting research in a way that upholds high academic, professional, and personal standards was important to Bynum and his career path and personal growth.

"On my first day [there], I gave myself a goal: write a Master's thesis that is not only publishable but will provide a significant contribution to the pool of knowledge of this fascinating area," Bynum said. "[The] trip provided me with data and experience to realistically pursue this goal."

This research was made possible in part by the National Geographic Society (Grant EC-52923R-18), the Watershed Studies Institute, the Office of Research and Creative Activities at Murray State University, and Jones College of Science, Engineering and Technology. The full project will be completed by May 2020.

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