

2019 Highlights

University of Montana's Flathead Lake Bio Station



OUR MISSION

To serve the Flathead region, the state of Montana, the nation, and world by advancing a cutting-edge research, education, and outreach platform for limnology, ecology, and environmental science in the Flathead Watershed.

We fulfill our mission in three ways:

- advanced **research**,
- sustained **monitoring**,
- and **education** at all levels.

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Closing Out Another Amazing Decade at FLBS

As a new decade begins, it's good to look back on the past year for all that 2019 brought to us. This report features some highlights of how everyone here at the Flathead Lake Biological Station (FLBS) has worked to advance our mission and benefit the waters and students of Montana and beyond (more inside).

We continue to advance ambitious research to improve our understanding of how aquatic ecosystems work and how human activities might affect them. For example, FLBS distinguished professor Bob Hall and his group lead the world in developing new ways of studying the metabolism of rivers and streams, using our long-term research site on the Nyack flood plain of the Middle Fork Flathead River. You may recall the outstanding river science that former FLBS professors Jack Stanford, Ric Hauer, and many others completed at the Nyack over the previous 30 years. It is exciting to see how that research legacy moves in new directions under Bob's leadership.

We also have numerous research projects on water when it slows down in the world's lakes and oceans. This work extends from our doorstep in Yellow Bay to the furthest reaches of our planet in Antarctica, where FLBS assistant research professor Shawn Devlin studies lakes, or in the deepest ocean of the central Pacific, where FLBS professor Matt Church and his team research the microbial community and nutrient cycling.

Our growing education programs enlivened the Bio Station campus with students at all levels, including those involved in our K-12 FLARE program as well as a new cohort of college-level students and interns discovering the wonders of western Montana through our summer class program.

Our Flathead Lake Monitoring Program (FMP), working with citizen scientist partners, recorded one of the highest water transparency events in more than a decade. This is great news for our beloved lake. FMP has also extended its operations with the addition of a new long-term monitoring site in the south basin of the lake. We continue to remain on alert for new Aquatic Invasive Species – which were not detected in 2019!

It was an especially big year for FLBS-led workshops and conferences, with visitors from around the world coming to the Flathead and converging on FLBS to share information and plan new research on diverse themes. Some of these themes included winter limnology, transboundary mining pollution, ecological stoichiometry, sensor networks and conservation genomics. The Bio Station was also honored in 2019 to host, for the first (but not the last) time, the annual summer Flathead UM Alumni and Friends event.

Our year was also brightened by the presence of a new type of visitor to FLBS, a series of artists-in-residence who came and went during spring, summer, and fall. Finally, we will remember 2019 as another year in which the Flathead community engaged enthusiastically with the Bio Station. For that support, we are so very grateful! With our community's generous support, we look forward to another exciting and productive year in 2020.



Jim Elser
Director



Tom Bansak
Assistant Director



Notable 2019 Workshops & Conferences



Transboundary Mining Impact Workshop

An international workshop focused on advancing the scientific knowledge of mining impacts on watersheds that span the border between U.S. and Canada

Montana Aquatic Research Colloquium (MARC)

A gathering of Montana water scientists and researchers who are dedicated to collaborating and advancing aquatic research

China Cryosphere Workshop

A United States-China cooperative workshop focused on the ways that loss of ice is changing temperatures and the balance of chemicals in mountain lakes and streams.

Woodstoich Conference

A product-focused event aimed at creating a diverse community of early career scientists to invigorate ecology and evolution by improving and expanding the use of stoichiometric theory

Chapman Conference on Winter Limnology

A meeting focused on accelerating the progress of the study of freshwaters in winter by addressing hypotheses associated with specific climate-based topics



STREAMS OF KNOWLEDGE

Bob Hall Connects Research with Future Scientists

The Nyack field research site just south of Glacier National Park is treasure trove of information for world-renowned FLBS Stream Ecologist Bob Hall. There, among the babbling streams, the avid cyclist and Grand Master beer judge has a hand in several research projects that aim to unlock the mysteries of mountain rivers and streams.

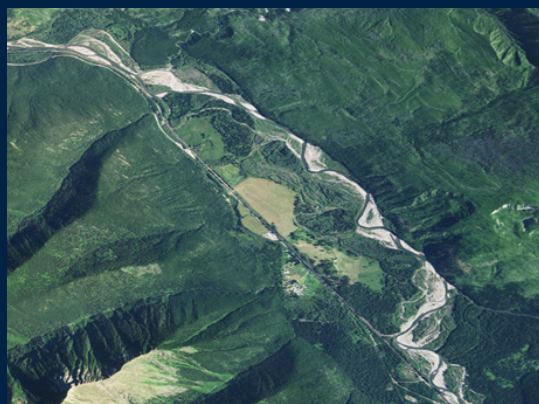
Hall is known as a pioneer for the way he conducts his stream and river research. He views streams as analogous to living organisms with metabolisms, and analyzes the way streams “consume” carbon and “exhale” carbon dioxide. Utilizing this innovative and impactful approach, Hall’s work has not only earned him international acclaim and made him an award-winning scientist, but also provided a steady flow of significant discovery in 2019.

In the past year, Hall worked alongside Michelle Baker from Utah State University and Erin Hotchkiss from Virginia Tech University to measure the flow of river-transported dissolved organic carbon into the carbon dioxide pool. A largely technical achievement, the research will allow Hall and his team to answer more complex questions in the future.

Additionally, Hall collaborated on a paper that showed controls of stream water-air gas exchange occur in both bubble and non-bubble exchanges, and penned his own long review on the controls of gas exchange in rivers.

Though he is often busy working on projects funded by the National Science Foundation, Hall also engages in and supports the research of his students. He spent 2019 working with Joanna Blaszcak, a postdoctoral associate who created explanatory mathematical models for river metabolism, and he is currently overseeing two PhD students: Laurel Genzoli, who is investigating the recovery of Klamath River processes in relation to forthcoming dam removal, and Pavel Garcia, who is researching the ecology of shredder insects in Guatemalan streams. Hall also spent 2019 working directly with Madison Foster, an undergraduate student from the University of Kansas who developed a method to estimate denitrification rates from bacteria associated with stoneflies of the Nyack floodplain.

With research project proposals in the pipeline, 2020 is shaping up to be another busy year for the Bio Station’s resident stream and river expert. For more information on Bob Hall and his research, visit the FLBS website at <https://flbs.umt.edu>.



Since the 1980s, Bio Station researchers have been investigating the Nyack flood plain along the Middle Fork Flathead River. As a result, the decades of consistent study in this remote area advanced the scientific understanding of how rivers function and made the Nyack one of the most studied floodplains in the world.

EXPANDING OUR WATCH

Working Together to Keep Our Waters Blue

As we venture into the sixth decade of our Flathead Lake Monitoring Program (FMP), we are excited to announce that Flathead Lake remains clean and blue! This is certainly outstanding news, and it is made all the more exciting due to the roles that Citizen Scientists, our partners, and funding from the Flathead Lake Protection Association's Keep It Blue license plates played in the data collection and growth of our FMP in 2019.

With the endorsement and permission of the Confederated Salish and Kootenai Tribes, and thanks to a financial leadership grant from the Flathead Lakers, FLBS started sampling at a second long-term sampling site in the south basin of Flathead Lake called the Polson Bay Monitoring Site.

The development of this additional monitoring site was spurred by spatial data gathered by Citizen Scientists during the FLBS and Flathead Lakers'

inaugural event, the 2018 Flathead Lake Secchi Dip-In. Immediate benefits from the new site will include the enhancement of our already-robust monitoring datasets while increasing our ability to detect any changes to the lake's water quality or biological community as early as possible.

Additionally, measurements taken during the 2019 Flathead Lake Secchi Dip-In revealed that Flathead Lake was the clearest it has been since 2004, while volunteers and the Whitefish Lake Institute contributed nearly 1000 hours towards monitoring 41 lakes in the Northwest Montana Lakes Volunteer Monitoring Network.

But the impact of our Citizen Scientists doesn't end there. Organized by Flathead Lake Open Water Swimmers Mark and Dana Johnston, the Swim Guide Project currently monitors twelve public swimming locations around Flathead Lake for water quality and safety, and sample testing by the Bio Station's Freshwater Research Lab has given Flathead Lake the highest public swimming water quality grades provided by the Swim Guide app standards.

We are proud to be able to collaborate and take part in these Citizen Science projects and grateful for any opportunity to work alongside our amazing partners. For more information about the FMP or our Citizen Science collaborations, visit our website at <https://flbs.umt.edu>.



Director Elser Elected to National Academy of Sciences



Back in April of 2019, Flathead Lake Biological Station Director and Bierman Professor of Ecology Jim Elser was elected to the National Academy of Sciences (NAS) in recognition of his distinguished and continuing achievements in scientific research.

Elser was elected to NAS by current members of the Academy, and will join them as they serve as advisers to the nation on matters relating to science, engineering, and medicine. The National Academy of Sciences is a private, nonprofit institution that was first established under a congressional charter signed by President Abraham Lincoln in 1863.

This is the highest honor an American scientist can receive, outside of the Nobel Prize. Elser is the only active National Academy of Sciences member from the University of Montana and only the second in the state. Elser will officially be inducted during a ceremony in Washington D.C. in April 2020.

2019 AIS Sampling Contributors

 **Confederated Salish and Kootenai Tribes**

 **Salish Kootenai College**

 **MT Department of Natural Resources and Conservation**

 **MT Fish, Wildlife & Parks**

 **Whitefish Lake Institute**

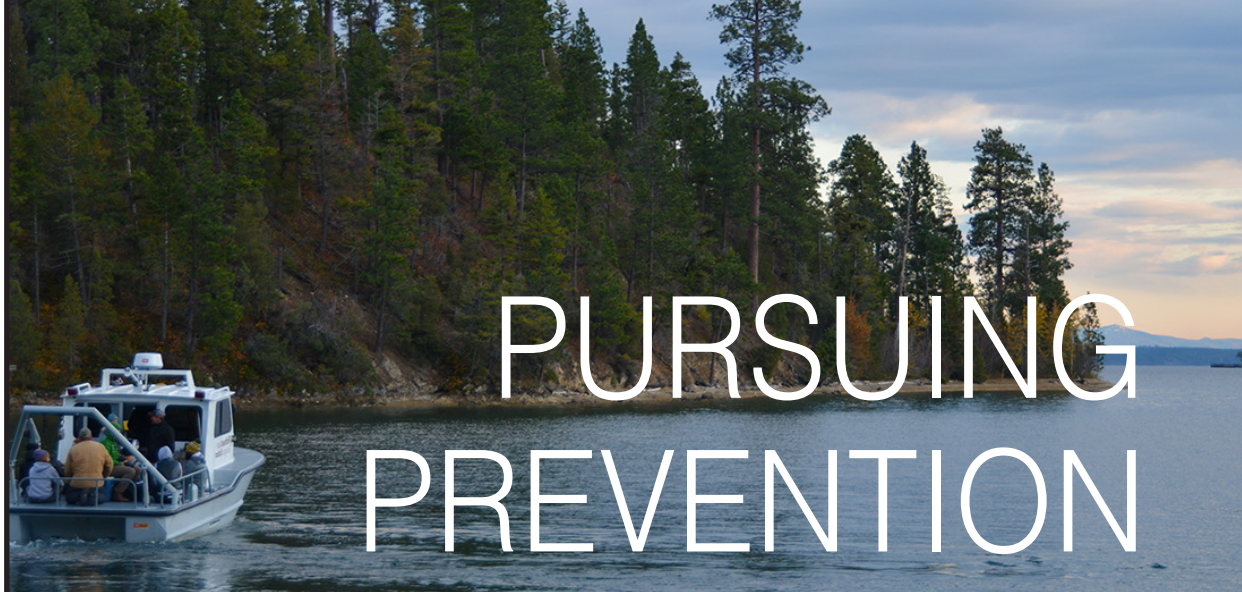
 **Big Sky Watershed Corps**

2019 Summer Artist-in-Residence Debby Kaspari



Over the summer, we welcomed Debby Kaspari as our first summer Artist-in-Residence at the Bio Station.

For a month, Debby stayed with us on-site at Yellow Bay, where she engaged with our scientists and integrated our research into her incredible artwork, which was unveiled during the Bio Station's Open House. Her residency was generously funded by Bio Station supporters who are Yellow Bay neighbors and want to foster art at FLBS.



Always on Watch in the Flathead Watershed

For more good news about the Flathead Watershed, look no further than our Aquatic Invasive Species (AIS) monitoring program. After collecting over 770 samples in 2019, Bio Station researchers found no sign invasive mussels anywhere in the Flathead Watershed.

But that isn't the only exciting news regarding our AIS monitoring. Fall 2019 marked the start of our 4th year partnering with CSKT. Not only has this strengthened our ties with tribal researchers, but it also sparked collaborative ideas and increased our outreach ability by leaps and bounds. In fact, our AIS sampling has allowed us to connect with over 35 individuals in 2019, including SKC students and interns; CSKT staff; legislators; school groups; Big Sky Watershed Corps members; State Park employees; public marina owners; and even Miss Flathead Lake!

Thanks to our research, monitoring, and outreach efforts, FLBS has contributed to the overall acceptance of eDNA technology at a state level as an effective part of the tool box for the early detection of aquatic invasive species. Additionally, Bio Station researchers had the chance to deploy the DNA Tracker and collect eDNA samples at Tiber Reservoir and to participate in

agency panels discussing DNA topics.

FLBS personnel also conducted AIS monitoring training workshops in collaboration with the Whitefish Lake Institute through a grant from the Bureau of Reclamation and in partnership with Montana Fish, Wildlife & Parks. The workshops engaged watershed groups and trained them in AIS monitoring protocol. As a result of these workshops, the FLBS AIS program expanded its own capacity to identify and monitor for aquatic invasive species throughout the Flathead Watershed.

It takes a massive team effort to confront the challenges facing our freshwater resources. Fortunately for us, our team is fantastic. For more information about our AIS monitoring program, visit our website at <https://flbs.umt.edu>.



INVESTING IN OUR FUTURE

Inspiring the Next Generation of Scientists

Thanks to the generosity of our supporters and collaborative partners, FLBS education leaders Monica Elser and Holly Church have continued to advance our flourishing Flathead Lake Aquatic Research and Education (FLARE) K-12 Program.

An education program that delivers innovative and hands-on aquatic ecology research activities to K-12 students and educators, FLARE K-12 brought in over 1,000 K-12 students to FLBS through class field trips in 2019. It also connected with over 1,900 K-12 students through classroom visits, hosted nearly 50 educators through various teacher training programs, and engaged over 1,450 K-12 students through Powwows, science festivals, and other community events.

One particularly exciting highlight was FLARE K-12's development of three new "Be AIS Aware" teaching trunks, which were designed at the request of the state, specifically for middle schools in Montana. FLBS educators have already worked directly with the Flathead Lakers to create and pilot these Aquatic Invasive Species lessons in seven schools in the Mission

and Flathead Valleys, and it remains a major priority to get the Be AIS Aware lessons into every middle school in the Flathead Watershed by the end of next year.

Another notable highpoint has been FLARE K-12's role in an innovative professional development program for K-12 teachers in the Flathead Watershed. Named "Flathead Watershed through the Seasons," the yearlong workshop is a joint effort put together by members of the Flathead Community of Resource Educators and engages teachers directly with natural resource experts, professionals, and settings. We welcomed the inaugural group of teachers for the September training session of the workshop, which is planned to run again in 2020.

Thanks to the continued support of the Heffernan family and others, FLARE K-12 will enter the next decade with plenty of momentum. The program truly demonstrates the impact philanthropic giving can have on our ability to connect eager young learners with science and the natural world.

2019 Mussel Walks



Thanks to the Flathead Lakers, the Confederated Salish and Kootenai Tribes, Montana State Parks, and the Whitefish Lake Institute, the 2019 Mussel Walk series reached over 400 students from five middle schools in the Mission and Flathead Valleys.

Students took part in hands-on learning at educational stations where they practiced cleaning aquatic recreational items, inspected boats for evidence of invasive mussels, and gained a better understanding of how quickly invasive mussels can spread.

The 2019 Mussel Walks were a massive effort from all parties involved, and stand as the finest example of what we can accomplish when we all work together.

Are you interested in helping with FLARE K-12?

FLARE K-12 welcomes community volunteers to help with some of our educational events. You can also provide philanthropic support to help augment the costs of field equipment, classroom supplies, bus and substitute teacher fees for teachers, and staff funding. Please contact us for more information.



Solving an Ocean Mystery



Large regions of our oceans are filled with vast systems of rotating currents. These areas are known as subtropical gyres, and have long been considered remarkably stable biological deserts. In other words, they have little variation in their chemical makeup and lack the nutrients needed to sustain life.

In the North Pacific Subtropical Gyre ecosystem, there exists a strange anomaly that has puzzled scientists for years. In this region, there's a particularly noticeable fluctuation in the levels of phosphorus and iron, which affects the overall nutrient composition and ultimately impacts the development of life.

Now, with the help of FLBS Microbial Ecologist Matthew Church, researchers have tracked down the answer to the mystery of the North Pacific Subtropical Gyre ecosystem, and they found it on the Asian continent, in the form of airborne dust. In 2019, their research resulted in a paper that was published in the prestigious *Proceedings of the National Academy of Sciences of the United States of America*.



RESEARCH THAT MATTERS

FLBS Internships Provide Real World Experiences

We had a record number of interns who participated in our 2019 interdisciplinary and experience-driven summer internship program. This record-breaking summer included 14 paid summer interns (most of which were funded through philanthropic donations), one internship funded by NASA, and two volunteer interns in our SensorSpace lab. Additionally, thanks to support from the Kuhn family, we also now offer internship opportunities that are specifically open to local students from Flathead Valley Community College in Kalispell, MT.

Among other things, our interns deployed and tested crucial environmental sensors, engaged local communities, and assisted Citizen Science programs to monitor water quality. They also presented their summer work to FLBS staff, internship donors and the public during the last week of the internship program. The variety of these internship opportunities included

aquatic and field ecology (lakes and streams), data sciences (modeling and GIS), education and outreach, chemistry, laboratory analysis, engineering, journalism, and environmental law.

“By connecting the internship experience to a place like Flathead Lake and leveraging the passion that FLBS researchers have for their work, the FLBS Internship Program lands in a sweet spot that allows for a holistic educational and rewarding research experience for interns that directly benefits ongoing FLBS projects.”

FLBS Lake Ecologist Shawn Devlin



IN SEARCH OF DISCOVERY

Transformative Learning in the Flathead Watershed

Summer 2019 was once again a vibrant time for everyone at FLBS. Our campus was abuzz with excitement as students and scientists worked side-by-side to conduct important research and fieldwork, witnessing firsthand all the incredible mysteries of our Flathead Watershed. When they weren't gathering samples and analyzing data, our students collaborated in our lakeshore classrooms, kicked back in our on-site residential cabins, and ventured out for an overnight camping trip with a cohort of newly-found friends.

FLBS opportunities for university students from Montana, the country, and world are more abundant than ever. We hosted nearly 100 students and interns at the Bio Station in 2019, only one-third of which came to us from University of Montana. The rest arrived from all over the country and world, representing 30 universities, over 20 states and 3 countries. With summer class enrollments increasing 350% since 2015, we are proud to say that nearly half of our students continue to receive philanthropic support from our named scholarships. These opportunities, made possible thanks to the generous support of our Bio Station community, help deserving students gain real hands-on experience while building important

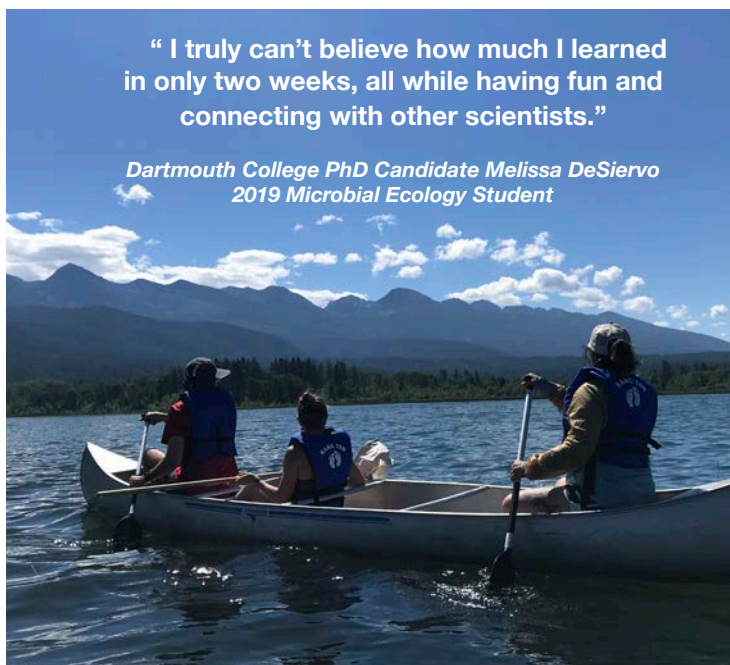
relationships in a research-intensive environment.

Whether undergraduates, graduate students, or professionals looking to upgrade their basic training, those who attend our summer courses are certainly given a leg up in the next phase of their education or professional careers. Equally important, our students are wide-ranging in their academic pursuits, majoring in everything from engineering to ecology to environmental journalism.

This diverse and interdisciplinary makeup of our student body is what makes our summer program so unique and memorable, and a big reason why our students often leave our program in the fall having formed friendships that will stay with them the rest of their lives. For more information about our summer college courses, visit <https://flbs.umt.edu>.

"I truly can't believe how much I learned in only two weeks, all while having fun and connecting with other scientists."

Dartmouth College PhD Candidate Melissa DeSiervo
2019 Microbial Ecology Student



OpenAIR MT Artists in Residence



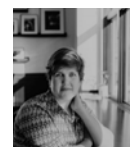
Tessa Heck
Visual Artist
Spring 2019



Zach George
Visual Artist
Spring 2019



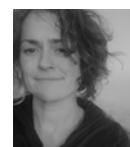
Anne Yoncha
Visual Artist
Spring 2019



Anne Holub
Poet
Spring 2019



Cecil Howell
Visual Artist
Fall 2019



Kailyn McCord
Writer
Fall 2019



Elizabeth Jean Younce
Visual Artist
Fall 2019

Science on Tap Flathead



Science on Tap is our partnership with the Flathead Lakers to bring science to our community at a local brewery. Hosted by the Flathead Lake Brewing Company, it has become one of our most popular events. For more information, visit

www.scienceontapflathead.org.



For up-to-date information on all things FLBS, visit our news blog at flbs.umt.edu

Our 2020 Public Events

- **Open House:** On August 7, we invite you to come to our beautiful facilities to engage in hands-on science activities; meet our faculty, staff, and students; and get an update on the State of the Lake and Bio Station. Come early and get a boat ride on the *Jessie B*!
- **Research Cruise:** Hop aboard the Far West on July 14 for a cruise that features great food, refreshing beverages, live music, and an ample dose of innovative science. You'll learn directly from our scientific staff and students as we discuss how to Keep Our Waters Blue.
- **Science on Tap Flathead:** At the start of each month, we partner with the Flathead Lakers to host an informal science presentation at the Flathead Lake Brewing Co. Join us for topics that range from osprey to oil trains to grizzly bears!
- **Data and Donuts:** During the first four Mondays of our summer program, scientists from FLBS, Montana, and around the world give a one-hour lecture on an exciting research topic. This is a great opportunity to learn while enjoying a tasty pastry or two!

