






Greetings from FLBS: Celebrating Another Exciting Year in all Dimensions of our Mission

Our Mission

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

We fulfill our mission in three ways:

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

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This year brought the Bio Station a lot of excitement. Our microbial ecologist **Matt Church** has settled into life in the Flathead, advancing his innovative ocean research while building our understanding of how microbes affect Flathead Lake (see inside). Stream ecologist **Bob Hall** completed his move to Montana and initiated a program on the foundation of past work on the Middle Fork of the Flathead River. Our project on groundwater stoneflies is making big discoveries and connects many of our faculty, old and new, including **Gordon Luikart**, **Brian Hand**, and former director **Jack Stanford**, with major contributions by postdoctoral scholar **Rachel Malison**. **Shawn Devlin** had his first field season “on the ice” in Antarctica while keeping our Flathead Monitoring Program humming (see inside). Meanwhile, Director **Jim Elser** is involved with two projects on the lakes of Glacier National Park. One is his continued exploration of “new lakes” following glacial recession. The other, conducted with Shawn Devlin and **Clint Muhlfeld**, examines ecosystem-level effects of the removal of non-native lake trout. If you get the chance, ask Jim about his close encounter with bear spray!

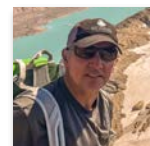
A big source of excitement at the Bio Station is students. Our graduate student cohort is growing, with projects ranging from salmonid genomics to impacts of livestock overgrazing on China’s largest lake. Our summer session continues to expand – with another increase in enrollment in 2018, including our first students from China (see inside).

But the real excitement for all of us occurs on mornings when the grade school kids file past our windows on their way to the Lakeside building to learn about Flathead Lake and its inhabitants (more inside).

We are very pleased that our sampling did not show any sign of zebra / quagga mussels in the Flathead basin. Our trip to Lake Mead was super exciting, as **Cody Youngbull’s** DNA Tracker mapped invasive mussel DNA in the field in real time. We also know more about the potential for economic disaster should invasive mussels reach Flathead Lake and Montana due to a comprehensive economic study that **Nanette Nelson** has been developing all year.

We saw a record level of philanthropic giving to the Bio Station in 2018, an accomplishment spearheaded by Assistant Director **Tom Bansak**. With the public launch of the University of Montana’s capital campaign, we look forward to seeing how much higher we can go. Such support from our community is essential for FLBS to meet its mission. Thank you.

Finally, we are especially excited to see what 2019 will bring and to meet you all, so please come by to see for yourself what all the excitement is about!



Jim Elser
Director



Tom Bansak
Assistant Director

Meet the Church Lab Team



Matt Church
Associate Professor
Aquatic Microbial Ecologist



Kate Evans
Graduate Student



John Ranieri
Research Associate



Trista Vick-Majors
Postdoctoral Research Associate



Emma Wear
Postdoctoral Research Associate



The Church Lab: An Ocean of Innovation at FLBS

In the world of ecology, most researchers investigating water bodies are divided into one of two camps: You either study lakes or you study oceans. There's little crossover.

At FLBS, researchers in the Church Lab for Microbial Biogeochemistry and Ecology are working to break down that barrier. Led by world-renowned researcher **Matt Church**, the Church Lab is bringing knowledge and techniques learned while conducting research on the open ocean to Flathead Lake.

Their research focuses on microbes, the ancient and microscopic creatures that thrive in all of the world's environments and are responsible for making Earth a place that can sustain life.

But while their subjects are small, the aims of these Church Lab scientists are not. Currently, the scientists are overseeing two long-term microbe monitoring projects. The first is near Hawaii, at a location called Station ALOHA. The second is right here on Flathead Lake. Both projects are focused on assembling genetic data that will over time provide information to help us better understand these microbial foundations of life and the roles they play in our aquatic ecosystems.

Church Lab scientists are using innovative techniques, conducting research from the deepest waters of the Pacific Ocean to the ice-covered lakes

in the Antarctic, and ultimately bringing these tools and understandings to the waters of Flathead Lake.

Locally, the Church Lab is currently looking at how the microbial communities in the lake work. Soon researchers will begin using metagenomics, which examines the complete genetic profile of an ecosystem to delineate the ecological functions that all of the microorganisms might be performing.

For up-to-date information about the Church Lab's research and innovation, visit our website at flbs.umt.edu.



“Participating in the Secchi Dip-In was a really fun way for us to do something significant for such a beautiful place.”

Melinda Withrow - Polson, MT
Director, Big Sports Academy Track and Field Camp

Citizen Science: Community and Collaboration at Flathead Lake

Flathead Lake is the largest natural freshwater lake west of the Mississippi, which is why FLBS relies on dedicated Citizen Scientists to help us monitor Flathead Lake and its watershed. For examples of how effective our Citizen Scientists can be, one need look no further than the Swim Guide Project and the first annual Flathead Secchi Dip-In.

The Swim Guide Project monitors public swimming areas all around the lake, and is a collaborative effort between FLBS, the Flathead Lake Open Water Swimmers, the Confederated Salish and Kootenai Tribes' Natural Resource Department, and the Greater Polson Community Foundation. Testing was conducted by volunteers this summer at Riverside Park, Salish Point and Boettcher Park, as well as the tribal swimming beaches at Elmo, Wolf Point and Blue Bay Campground. Of the 60-plus tests conducted by the **FLBS Freshwater Research Lab (FRL)**, Flathead Lake beaches passed with a 100 percent success rate and were “clear for swimming” throughout the summer.

We also were fortunate to kick off the first annual Flathead Lake Secchi Dip-In, which, thanks to additional support from the Polson Community

Foundation and private donors, exceeded all expectations. FLBS and the Flathead Lakers partnered to register twenty-five community members and groups for the event. Taking water clarity measurements and collecting water samples (processed at FRL) from all over Flathead Lake, these Citizen Scientists harvested data that will help FLBS researchers put together a more holistic view of water clarity around Flathead Lake and better understand the overall health of the ecosystem.

FLBS Citizen Science efforts expanded greatly in 2018, but this year was only the beginning. Plans for the 2019 Flathead Lake Secchi Dip-In are already in the works, and the number of testing sites for the Swim Guide Project, including sites in Bigfork, is expected to increase by the start of summer. We love nothing more than working with community members who are passionate about protecting Flathead Lake.



Freshwater Research Lab (FRL)

The **Freshwater Research Lab (FRL)** is an analytical facility providing grant, contract, and fee-based services for researchers from FLBS and around the world. It offers analyses on water, soil, air, biological, and radiochemical samples. It also uses state-of-the-art equipment to implement accepted methodologies and develop new analytical techniques. Adhering to a strict quality assurance plan and participating in federal and international auditing programs to ensure only high quality data to its stakeholders, FRL is a world-class research laboratory housed right here at Yellow Bay. For more information, visit flbs.umt.edu/newflbs/services/freshwater-analyses



Significant FRL Developments in 2018

• Opening of the Molecular Ecology Laboratory

FRL now offers two distinct laboratory spaces that are dedicated to the preparation, handling, and quantification of sensitive DNA samples. This will play a significant role in our ability to provide early detection of invasive mussels in Montana.

• Upgrade of the lab-wide water deionization system

Thanks to the generous gift from a local family, FRL was able to upgrade its aging and failing deionization system. The new state-of-the-art water purification system will be the heartbeat of the laboratory, ensuring FRL's ability to provide the highest level of analytical support to our world-class researchers at FLBS, UM, and beyond.

• Implementation of new key instruments

Over the last year, FRL introduced a (1) Picarro Cavity Ringdown Spectrometer for the analysis of isotopic carbon dioxide and methane; and (2) a Bay Instruments Membrane Inlet Mass Spectrometer for the analysis of dissolved gases directly from water samples. Additional new instruments are also on the way!

2018 Flathead Lake Sampling Contributors

Maggie Burnham

BSWC / FLBS Intern

Charlene Charlo

CSKT

Tyrel Fenner

SKC Intern

Heidi Fleury

LCCD

Jessie Finley

LCCD

Eliza Kelski

SKC / FLBS Intern

Erin Lee

FLBS Volunteer

Melanie McMillan

FLBS Volunteer

Dulaney Miller

MCGL

Lauren Odom

BSWC / LCCD

Evan Smith

CSKT

Paula Webster

CSKT

Jared Young

SKC Intern



Aquatic Invasive Species: Working Together to Protect

Under the guidance of FLBS researcher **Phil Matson**, our Aquatic Invasive Species (AIS) sampling program analyzed over a thousand samples from over 40 bodies of water around western Montana. As a result, we are happy to report that **we detected no sign of invasive mussels in the entire watershed!** We continue to integrate DNA-based mussel detection methods into our monitoring activities, and have ramped up our outreach efforts to increase AIS awareness and understanding around the state.

To assist us in these efforts, we've made it a priority to build and maintain as many collaborative relationships as possible. Using a sampling protocol standardized across the Western U.S. and Columbia River Basin by Federal and State agencies, the 2018 October sampling marked the start of our third year working directly with the Confederated Salish and Kootenai Tribes (CSKT) to monitor Flathead Lake for invasive mussels. Our Big Sky Watershed Corps (BSWC) member worked alongside many others from CKST staff, Salish Kootenai College (SKC) student interns, FLBS student interns, the BSWC and the Lake County Conservation District (LCCD), to conduct important sampling that contributed to FLBS receiving a 2018 Flathead Service Award for our AIS monitoring efforts. We greatly appreciate access granted to us by local private marinas, including Marina Cay and Saddlehorn Marina in Bigfork.

We also participated in an AIS Rapid Response Training exercise—an event co-led by officials from the Confederated Salish and Kootenai Tribes and Montana Fish, Wildlife & Parks—and worked to engage local fishermen, boaters, students, businesses, and the general public during monitoring events to educate them on important issues and ways to ensure the protection of Flathead Lake.

Still, imminent threats remain. Aquatic invasive species are constantly on the horizon, and declines in water quality are always of great concern. To address these challenges we look to **SensorSpace**, our innovative and exciting technology lab that operates under the leadership of FLBS Technologist **Cody Youngbull**. Earlier this fall, Youngbull and FLBS Lake Ecologist **Shawn Devlin** conducted a field test with our DNA Tracker at Whitefish City Beach. The test marked the first time ever that a continuous flow, digital droplet PCR machine was used in an attempt to detect and quantify aquatic mussel DNA at a boat inspection station.

Moving forward, we will continue to collect and analyze DNA samples from numerous sites in Flathead Lake, in addition to 40+ lakes around western Montana. With a mindset focused on early detection, prevention of AIS remains our number one goal. **Working together, we can keep our waters mussel free!**





The Sentinel on Watch Flathead Lake Monitoring Program (FMP)

With another year in the books for our **Flathead Lake Monitoring Program (FMP)**, we are happy to announce that Flathead Lake remains extremely clean and clear. Monitoring data also suggests that last year's nutrient concentrations were typical and low. We have increased our analyses of Mysis shrimp abundance and size structure to a monthly basis and are poised to gain valuable insights to their growth and their role in Flathead Lake's food web. This information will add to our long-term dataset, which acts as a safeguard against degradation in Flathead Lake.

Recently, FMP officially joined the Global Lake Ecological Observatory Network (GLEON). This affiliation has already led to three new international collaborations focusing on how lakes are changing

around the world. Additionally, with the help of a private donation, SensorSpace is in the process of installing the infrastructure for a new environmental sensor Low Range Wide Area Network (LoRaWAN) on Flathead Lake. Once operational, this network will provide the most comprehensive real-time data on the lake to date.

Thanks to philanthropic support, FMP is more robust than ever. We will continue to be a strong steward and keen observer of the Flathead Lake ecosystem. With more exciting developments waiting on the horizon, we couldn't be more excited about the future of FMP. Thanks to everyone for supporting our monitoring program and helping us to **KEEP IT BLUE!**

Meet the FMP Team



Jim Craft
*Research Scientist
Limnology*



Shawn Devlin
*Assistant Research Professor
Aquatic Ecology*



Tyler Tappenbeck
Research Scientist

FLBS Receives Stewardship Award

On July 25, the Flathead Lakers awarded FLBS with their 2018 Stewardship Award. The award recognizes the Bio Station's continuous and dedicated contributions to the monitoring and protection of Flathead Lake and its watershed. It also serves as another defining link in the long partnership between the Flathead Lakers and FLBS.



Pictured from left to right: FLBS Assistant Director **Tom Bansak**, Flathead Lakers President **Steve Rosso**, FLBS Director **Jim Elser**, and former FLBS Director **Dick Solberg**

The Cost of Life Without Flathead Lake

FLBS Environmental Economist Nanette Nelson knows what's at stake when it comes to keeping invasive mussels out of Montana waters. In a report commissioned by the Montana Invasive Species Council (MISC), Nelson determined that invasive mussels could cost Montana over \$230 million in mitigation costs and revenue losses each year. Nelson identifies three key economic sectors in her report—recreation, infrastructure, and irrigation. These areas face the greatest potential loss from an established mussel infestation. To find out more about Nelson's work and findings, visit our website at flbs.umt.edu.





Summer Undergraduate Internships

For eight weeks each summer, we offer interdisciplinary and experience-driven internship opportunities to college students from all over the world. Interns in our program are surrounded by top-tier scientists and facilities, where they gain valuable hands-on experience. We are especially proud of the wide variety of our internships. Not only do we offer positions in ecological areas, philanthropic support now gives us the chance to offer internships in:

- Analytical Chemistry
- Aquatic Field Ecology
- Bioanalytics
- Computer Science
- Ecological Modeling
- Education/Outreach
- Environmental Journalism
- Environmental Law
- Microbial Ecology
- Stream Ecology
- Web Application Programming/GIS

Summer of Learning: Life-Changing Experiences on the Shores of Yellow Bay

We continue to enjoy a rise in the popularity of our summer classes. Summer class student credit hours have increased 350% since 2015. On average, 40% of those students receive philanthropic assistance from one of our 16 named scholarships. From their first day at FLBS, our students from around the world explore pristine wilderness and crystal-clear mountain lakes. They investigate area streams and rivers, and take extensive field trips to Flathead Basin sites, including Glacier National Park.

Our class offerings are also growing. In 2017, **Matt Church** launched a course in Aquatic Microbiology. That same year, FLBS scientist **Diane Whited** began an Unmanned Aerial Vehicle Remote Sensing course for freshwater ecology. In 2018, **Cody Youngbull** launched an Environmental Sensors course, which offers students the chance to design, build, and deploy sensors out in the environment. For 2019, a new course on animal behavior has been added.

Whether undergraduates, graduate students, or professionals looking to upgrade their basic training, those who attend our summer courses gain real field experience in a research-intensive environment. Not only does this experience make students more competitive candidates for graduate school or when pursuing a professional career, our students also have a blast chasing academic adventure in the Crown of the Continent in Northwest Montana.



"I cannot fully express how grateful I am to be immersed in this learning environment in one of the most beautiful places in the country."

Jamela - Field Ecology Student and Restoration Ecologist





A Big Year for FLARE K-12: Building a Future of Freshwater Stewards

The Flathead Lake Aquatic Research and Education K-12 Program (FLARE K-12) continued to flourish this year, thanks in large part to the generosity of our supporters and the devoted work of FLBS education leaders **Monica Elser** and **Holly Church**. FLARE K-12 is an education program specifically designed to deliver innovative and engaging hands-on aquatic ecology research activities to K-12 students and teachers.

In 2018, the program brought in over 850 K-12 students to FLBS through class field trips, connected with over 1000 K-12 students through classroom visits, and hosted over 100 educators through various teacher training programs. FLARE K-12 also engaged over 2100 students through various Powwows, public library programs, family science nights, and other community events.

Working in collaboration with Confederated Salish and Kootenai Tribes and Montana Fish, Wildlife & Parks, FLARE K-12 provided five educational stations during the annual Flathead Lake Honoring Day. It also played a significant role in several undergraduate visits to FLBS, including hosting the University of Montana College of Humanities and Sciences "Success in Science" program for incoming freshmen interested in STEM majors.

With field trips and teacher training opportunities already scheduled well into 2019, the future of our FLARE K-12 program couldn't be brighter. We look forward to another incredible year inspiring future freshwater stewards on the shores of Flathead Lake.

Quenching the Thirst for Knowledge at Science on Tap



What could be better than science and beer?

Held the first Tuesday of every month, Science on Tap is our partnership with the Flathead Lakers to bring science to our community at a local brewery. In 2018, scientists from the region presented a broad range of topics from loons to river metabolism. Held primarily at the Flathead Lake Brewing Company in Bigfork, Science on Tap has become one of our most popular events.

For more information or to learn how you can reserve a seat at the next event, visit www.scienceontapflathead.org.

Mark Your Calendars

Open House August 9, 2019



Over 400 people visited FLBS during our 2018 Open House. Riding on the *Jessie B* is always a hit, especially when Monte is along for the ride. Mussel-sniffing dog demonstrations, plankton viewing experiences, engaging scientific talks, and our Nyack floodplain display kept all ages busy and informed about the lake and our important work.

Research Cruise July 9, 2019



Great food, drinks, music, and science combined to make our 2018 Research Cruise a success. This year, in addition to listening to presentations by our scientists and viewing samples collected on the *Jessie B*, passengers were able to meet our undergraduate interns. These students helped to make the event run smoothly and shared first-hand experiences of doing diverse research at the Bio Station.

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

Our public events

- **Open House**

Every August, come and see our beautiful facilities, do some “hands-on” science activities, meet our faculty, staff, and students, and get an update on the state of the lake and the Bio Station. Come early, and get a boat ride on the *Jessie B*!

- **The Research Cruise**

In July, we embark from Lakeside on the *Far West* for a cruise that features great food, refreshing beverages, live music, and a good dose of science. Come along to learn from our scientific staff and students as we rendezvous with the *Jessie B* and discuss how to **Keep Flathead Lake Blue**.

- **Science On Tap Flathead**

On the first Tuesday of every month, we partner with the Flathead Lakers to host an informal science presentation at a local pub. Topics range from osprey to oil trains to oxygen metabolism. Join us!

- **Data and Donuts**

During the first four Mondays of our summer session, 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!

Contact us at events@flbs.umt.edu for more information about our events and to sign up for our e-newsletter.

