



OUR MISSION

To serve the Flathead region, state of Montana, 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.

THIS ISSUE

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For the Future of Our Waters

Winter is upon us again as we reflect on the passing of another successful but very challenging year at the Flathead Lake Biological Station. We continued to adapt to an evolving coronavirus pandemic and a changing climate that is increasing the presence of fire and smoke in our daily lives. Through it all, we remained committed to our mission, serving the community by advancing cutting-edge research, sustaining our long-term monitoring, and delivering high quality education about lake and river ecosystems. This year's newsletter highlights some of the achievements of FLBS staff and students as they carried on through the second year of COVID-19.

One thing we can celebrate: Another year has passed without detection of invasive mussels in the Flathead Watershed, and invasive mussels have not been re-detected anywhere in Montana since their first alarming discovery several years ago.

This success is the result of extensive cooperation among many partners including the state of Montana and the Confederated Salish and Kootenai Tribes' invasive species programs, as well as the contributions of FLBS scientists who work alongside them. A special acknowledgement goes to FLBS scientist **Phil Matson**, who leads our efforts to detect invasive mussels using eDNA methods pioneered by FLBS professor **Gordon Luikart**.

Unfortunately, not all efforts to contain non-native species succeed. Lake trout, for example, have spread widely in lakes west of the Continental Divide, and have massive impacts on the fabric of lake food webs and native species, such as westslope cutthroat and bull trout. FLBS graduate student **Charles Wainwright** published a landmark study on these effects in the prestigious journal *Proceedings of the National Academy of Sciences*, which you can learn more about in this newsletter.

Fire was a big part of our 2021 story. Our hearts go out to those who lost property during the Boulder 2700 Fire near Polson. We also give a big thanks to those on the firelines, including FLBS' own volunteer firefighters **Reggie Heiser, Shawn Devlin, Tyler Tappenbeck, and Eric Anderson**. The fire shut down power, internet, sanitation, and water for nearly a week at FLBS, forcing us to evacuate our resident students to Missoula to finish courses and internships. This was an ironic development, as the main course that had to relocate was Forest and Fire Ecology. We are very grateful to University of Montana main campus staff at housing and food services who accommodated our students on short notice.

While we expect that the Boulder 2700 Fire will have only minor effects on Flathead Lake water quality, fires are increasing in frequency and severity and are moving to higher elevations as climate change unfolds. These fires and their effects on our iconic lakes and rivers will be an increasing focus of FLBS monitoring and research efforts, including the developing PhD studies of FLBS graduate student **Brooke Bannerman**, who will be working in Glacier National Park.

Ultimately, 2021 was another year of perseverance at FLBS. With the availability of vaccines, we were thrilled to welcome back our summer session students and successfully deliver six courses. We also had a large crop of talented interns who completed diverse projects. Our Flathead Monitoring Program didn't skip a beat, FLBS assistant research professor **Rachel Malison** prevailed in establishing the new Monitoring Montana Waters program, and our FLARE K-12 educators welcomed young students to Yellow Bay again.

We hope you enjoy reading about a few of our successes at FLBS, where we carry on, in spite of the challenges, caring for our incredible Flathead Watershed.



Jim Elser
Director



Tom Bansak
Associate Director



Keaton Martin
MMW Program
2021



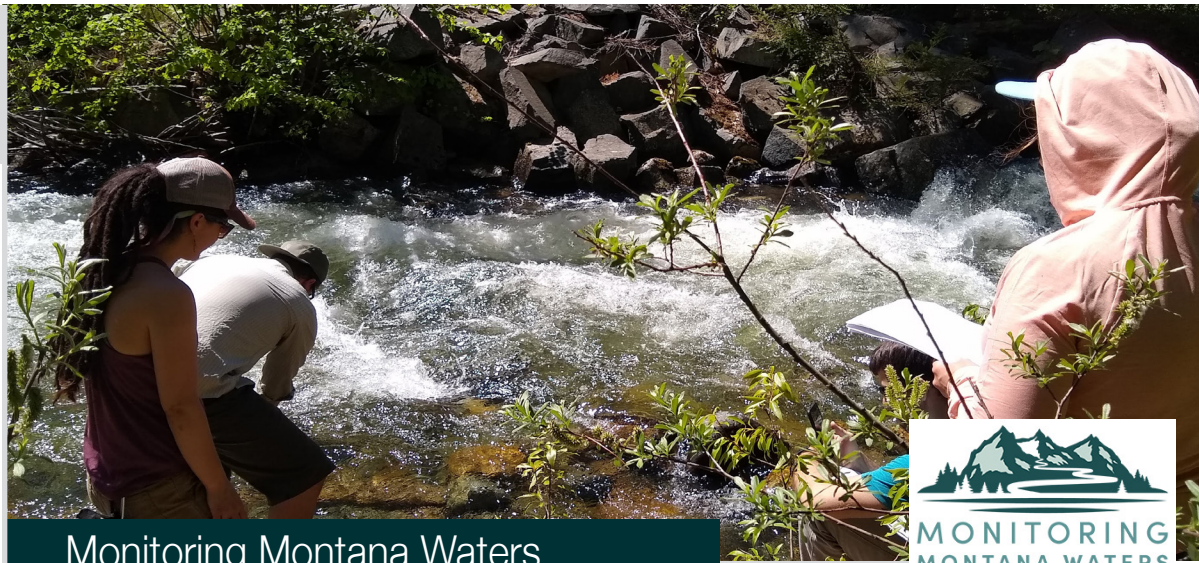
Abby Schmeichel
K-12 Education
2020



Natalie Poremba
AIS Outreach
2019



Maggie Burnham
AIS Monitoring
2018



Monitoring Montana Waters

During 2021, FLBS launched a new program called **Monitoring Montana Waters (MMW)**. Developed and led by FLBS assistant research professor **Rachel Malison**, the program provides scientific expertise, guidance, and funding to citizen-led watershed groups in Montana to build capacity for freshwater monitoring and ensure the use of scientifically sound methodologies. Even in its inaugural year, MMW already made a positive impact on water quality monitoring in Big Sky Country.

With Malison at the helm and Big Sky Watershed Corps Member **Keaton Martin** on board, MMW provided financial, logistical, and scientific support to seven watershed groups in 2021. These partnerships resulted in over 1000 water samples collected from streams and lakes throughout western Montana. Once collected, the samples were sent to the FLBS Freshwater Research Lab to be analyzed for nutrient content, water clarity, and pollutants such as *E. Coli* bacteria.

But the engagement of MMW didn't stop there. The program visited all but one citizen-led group in their respective watersheds. Malison and Martin also took part in three community outreach events, and gave presentations to the Montana Watershed Coordination Council, Flathead Basin Commission, American Water Resources Association, and Montana Association of Conservation Districts.

With so many achievements in the books, it seems likely that MMW would be ready to settle in for a relaxing winter, but the 2022 sampling season is just around the corner. All citizen-led watershed groups interested in MMW support must have sample analysis plans and standardized operation procedures to be considered for funding, equipment, or services. For more information, visit the MMW website at fbs.umt.edu/newfbs/outreach/mmw/monitoring-montana-waters

Strengthening Partnership with Purpose

For the past four years, **Big Sky Watershed Corps (BSWC)** Members have partnered with Flathead Lake Biological Station researchers and educators to conduct meaningful work in the areas of watershed research, education, and outreach. These yearlong collaborations have helped BSWC Members gain first hand skills and real-world experience, and FLBS research, monitoring, and education programs have all made significant strides as a direct result of our partnership with the BSWC program. We are proud to introduce our growing list of BSWC Members who continue to better the world around them at FLBS and beyond!





The Impact of Invasive Lake Trout

Invasive species cause biodiversity loss and about \$120 billion in annual damages in the U.S. alone. Despite plentiful evidence showing that invasive species can change food webs, how invaders disrupt food webs and native species through time has remained unclear.

Now, thanks to a collaborative study conducted by researchers representing FLBS, U.S. Geological Survey (USGS), and Montana Fish, Wildlife & Parks, there is new insight into how invasive species progressively affect native food webs. Recently published in the prestigious journal *Proceedings of the National Academy of Sciences*, the study used long-term fisheries monitoring records in ten northwestern Montana lakes to determine the timing and extent of invasion by predatory non-native lake trout, and also analyzed food webs from those lakes to determine how they changed and impacted native communities as the invasions progressed.

The research team showed that lake trout disrupted food webs by forcing native fishes to feed on suboptimal food sources in different habitats, eventually causing the loss of the native bull trout, which remains a threatened species protected under the Endangered Species Act.

The study's results stress the importance of protecting entire watersheds and landscapes from biological invasions. The use of innovative biosurveillance monitoring techniques, like environmental DNA, are also critical to increase the likelihood of detecting invaders before they become established. For ecosystems that have already been invaded, this study's findings can be used to inform control efforts during the early stages of invasion to avoid food web disruptions that may be difficult or impossible to reverse.

The study was led by FLBS graduate student **Charles Wainright**, now a fisheries biologist with the U.S. Fish and Wildlife Service, and was co-authored by **Clint Muhlfeld** of USGS and FLBS, FLBS Director **Jim Elser**, FLBS assistant research professor **Shawn Devlin**, and Samuel Bourret of Montana Fish, Wildlife & Parks. The study was supported by the USGS Biological Threats Program, FLBS and philanthropic gifts. The complete study is available on the *Proceedings of the National Academy of Sciences* website.

[Above: USGS researcher Vin D'Angelo holds nonnative lake trout caught in Glacier National Park. Photo provided by Joe Giersch and the United States Geological Survey.]

Did you know...

...Aquatic Invasive Species (AIS) like zebra and quagga mussels (pictured left) remain one of the greatest threats to Montana's freshwater ecosystems. Learn more at flbs.umt.edu.



Melting Glaciers May Create New Pacific Salmon Habitat



For decades, climate change has had detrimental impacts on Pacific salmon populations. But in a new study, FLBS research scientist **Diane Whited** and an international team of scientists have discovered that warming trends may offer one silver lining for salmon populations, if only for a while.

Recently published in *Nature Communications*, the study revealed that the retreat of glaciers in the mountains of western North America could potentially produce more than 6,000 km of new Pacific salmon habitat by the year 2100. That's a distance nearly equal to the length of the Mississippi River.

The researchers caution that while the newly created habitat may be a ray of light for salmon in some locations, overall climate change poses grave challenges for salmon populations. If current warming trends continue, the salmon habitats would eventually overheat and ultimately disappear. For more on this and other FLBS research publications, visit our website at flbs.umt.edu.

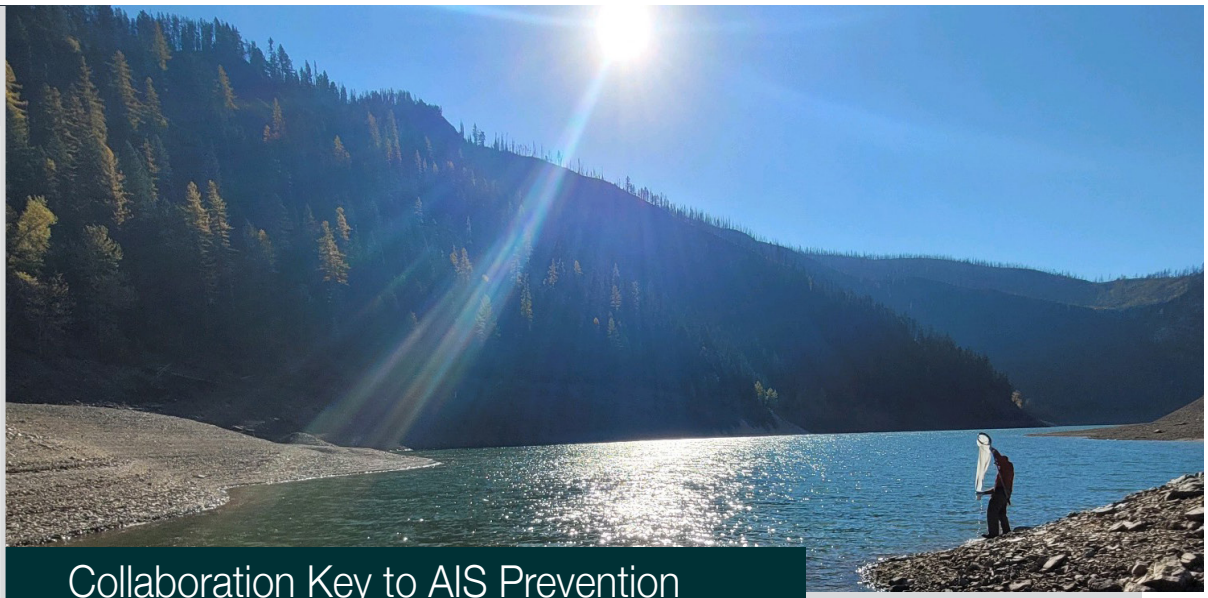
2021 AIS Sampling Participants

- 14 University of Montana Incoming Freshmen
- 7 Big Sky Watershed Corps Members
- 4 FLBS Summer Interns
- 2 Salish Kootenai College Students
- 2 FLBS Staff Members
- 1 CSKT Staff Member
- 1 High School Student

AIS Collaborative Partners

(listed alphabetically)

- CSKT Natural Resources Department
- Flathead Basin Commission
- Flathead Lakers
- Montana Department of Environmental Quality
- Montana Fish, Wildlife & Parks
- Montana Department of Natural Resources and Conservation
- Montana State Parks
- North American Invasive Species Association
- Upper Columbia Conservation Commission
- Western Regional Panel on Aquatic Nuisance Species
- Whitefish Lake Institute



Collaboration Key to AIS Prevention

This was another massive year for Aquatic Invasive Species (AIS) prevention in Montana, and FLBS scientist **Phil Matson** and his AIS monitoring team were busy assisting a rigorous and collaborative statewide early detection survey of our waters. Funded by grants from Montana Department of Natural Resources and Conservation (DNRC) and philanthropic contributions, Matson's team completed three rounds of sampling on Flathead Lake and two rounds of sampling on Tiber Reservoir. The Tiber sampling also included the use of an underwater rover, which allowed for sampling in areas that Montana Fish, Wildlife & Parks (FWP) SCUBA divers couldn't safely reach.

Flathead Lake and Tiber Reservoir samples were sent to the state lab Helena for microscopy analysis and to the FLBS Montana Conservation Genomics Laboratory in Missoula for PCR analysis. Tiber samples were also sent to the Bureau of Reclamation DNA lab for PCR analysis. None of these samples tested positive for invasive mussel larvae nor for mussel DNA.

In addition to sampling, Matson continues to work closely with the Confederated Salish and Kootenai Tribes (CSKT) and Montana FWP, and also benefits from an incredible team of volunteers. This year, volunteers included Big Sky Watershed Corps Members, FLBS interns, UM and Salish Kootenai College students, and more. Matson

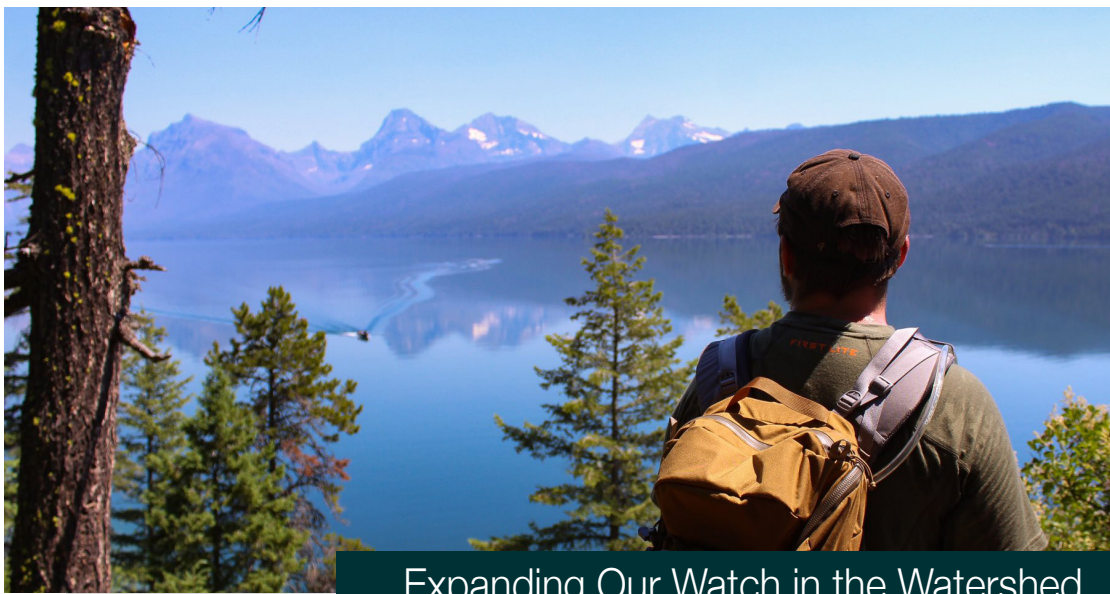
also participated in important outreach efforts like the Mussel Walk for local middle school students, which FLBS co-hosts annually alongside CSKT educators, the Flathead Lakers, and Montana State Parks.

To help ensure the accuracy of sampling efforts, Matson secured an additional DNRC grant to examine plankton tow net decontamination effectiveness and sample preservation techniques from early detection protocols currently used throughout the western United States. This study will help minimize the potential for false results and wasted resources, and provide insights into the ways sampling protocols can impact the sensitivity for detecting AIS, especially when using the plankton tow net sampling approach.

Presented at the North American Invasive Species Management Association's annual conference, the study's results will improve early detection of invasive mussels and other AIS threatening Montana's waters.

“By providing scientific expertise, we're able to help develop recommendations for policy, protocol, and best management practices moving forward.”

- FLBS AIS Specialist Phil Matson



Expanding Our Watch in the Watershed

It was a challenging wildfire year in Montana and around the west. Unfortunately one fire, the Boulder 2700 Fire near Polson, MT, warranted the evacuation of hundreds of people along Flathead Lake's east shore and destroyed more than 30 structures. Though greatly disrupting FLBS operations, the fire was unable to stop FLBS scientists from continuing to research and monitor the Flathead Watershed.

Even as fire crews bravely fought the Boulder 2700 Fire, FLBS researchers were out on the lake collecting their regular suite of data and samples. Additionally, FLBS Director **Jim Elser** collected both ashy water from the freshly fallen ash, while FLBS Lake Ecologist **Shawn Devlin** began preliminary assessments on short and long-term impacts of the Boulder 2700 Fire on Flathead Lake temperatures, clarity, and ecology.

Today, we're pleased to report that—in spite of the intense fire season—FLBS monitoring and research still show that Flathead, Whitefish, and Swan Lakes all remain clean, clear, and blue. While these results are encouraging, they also serve as further proof that we need to be more vigilant than ever as our climate continues to change and our region's popularity continues to grow.

Looking ahead, we have much to be excited about for our Flathead Monitoring Program. A renewed partnership with Glacier National Park will support the expansion of FLBS water quality monitoring into Glacier's iconic Lake McDonald, and FLBS graduate student **Brooke Bannerman** has launched a new research project exploring the impacts of wildfires on lakes.

The Bio Station's Growing Business Community



The growing FLBS Business Community has played a crucial role supporting FLBS research, monitoring, and education programs. Thanks to generous partnerships with businesses like **Wear Your Roots Clothing (WYR)** and **My Real Montana**, that support has taken an eye-catching step forward! When you purchase FLBS items, you're not only bringing the Flathead Watershed closer to your heart and home, but also the knowledge that all proceeds support our ability to watch over and protect our beloved Flathead Watershed. With limited items available, and new items coming in 2022, visit the FLBS website at flbs.umt.edu and place an order today!

Boulder 2700 Fire Impacts FLBS 2021 Summer Programs



On July 31, the Boulder 2700 Fire started in the Mission Mountains about eight miles northeast of Polson. The fire rapidly swelled to more than 1,000 acres. Residents along a 10 mile stretch of Highway 35 were forced to evacuate. At FLBS, the fire forced summer internships and academic courses to relocate to the UM's main campus in Missoula. But our science and commitment to community in the Flathead Watershed carried on as strongly as ever.

FLBS Facilities Technician and Volunteer Fireman **Reggie Heiser** played an important role protecting homes and structures in the fire's path. FLBS Media and Information Manager **Ian Withrow** helped coordinate temporary housing and warm meals to families displaced by the fire. Thanks to the incredible efforts and tireless work of the fire crews and first responders, the Boulder 2700 Fire was ultimately contained and extinguished.

But even as we create this annual report, fires continue to devour ecosystems, economies, and homes across Montana and the U.S. It's clear that fire and its impacts will continue to be a strong area of focus for FLBS research and education moving forward.

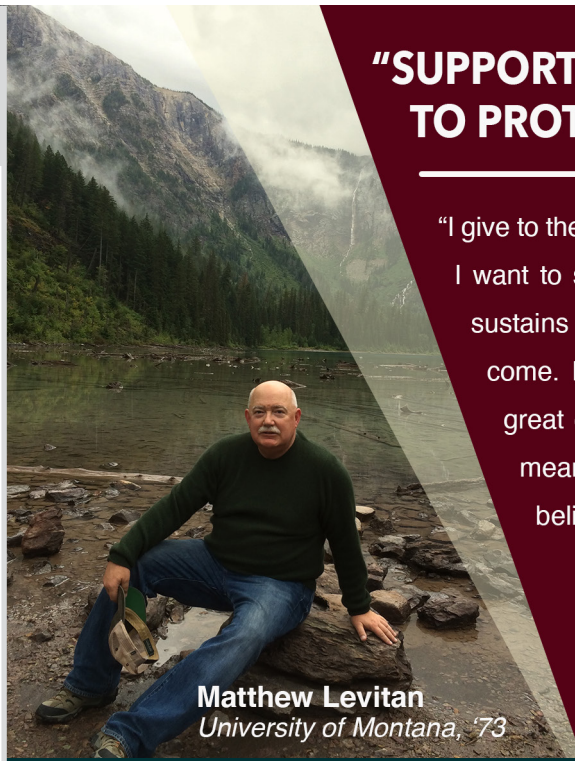
Banner Year for FLBS Internship Program



With sixteen interns representing nine different universities this past summer, FLBS hosted our largest cohort of interdisciplinary summer interns to date. These interns conducted impactful research, meaningful outreach, and important storytelling to help our scientists and staff advance all areas of our mission.

What makes this all the more impressive is that these accomplishments were completed even as our interns were forced to evacuate FLBS due to the Boulder 2700 Fire and to finish their internships at the University of Montana in Missoula. Nevertheless, our interns were still able to engage local communities, assist with monitoring water quality, and support meaningful research projects.

Offering an expansive interdisciplinary approach, our philanthropically funded internship program continues to provide life-changing experiences, and we look forward to expand our interdisciplinary opportunities in the years ahead.



Matthew Levitan
University of Montana, '73

"SUPPORTING THE BIO STATION TO PROTECT MONTANA'S WATERS."

"I give to the **Flathead Lake Biological Station** because I want to support students in a way that protects and sustains this very special place for generations to come. Money should never stand in the way of a great education, and a permanent gift is the most meaningful impact you can make. That's why I believe in the power of endowed scholarships."



**FLATHEAD LAKE
BIO STATION**

A Watershed Investment for Student Success

Matthew Levitan understands the important role a scholarship can play in a student's life. The now retired UBS PaineWebber executive was a scholarship recipient himself while a student at the University of Montana.

"So many scholarship recipients are truly grateful," Levitan says. "This is something I know personally, because a college education wouldn't have been possible for me if not for the financial assistance of a scholarship."

Levitan grew up hiking the Glacier National Park wilderness and fishing in the Flathead Watershed, investing in student scholarships means more than an opportunity to return the philanthropic favor to his alma mater. It's his way of preserving the Montana of his childhood, an endowment of ecological education to cultivate new generations of scientists that will someday help us better understand and manage our natural world.

Levitan established his first scholarship at FLBS in 1995. He has since added a scholarship in honor of each of his siblings and his mother. Today, thanks to the generosity of Levitan and others, FLBS offers over \$50,000 in scholarships each summer.

These scholarships support more than 50% of the students attending the Bio Station's academic program each summer, which equates to just over 25% of the program's total costs. This is a remarkable achievement of private support, especially considering that the total enrollment in the Bio Station's summer courses has increased over 350% in recent years.

"That's the wonderful thing about the endowed scholarships," said Levitan. "They're a way to connect the past with the future, and they'll go on making a difference for students, the Bio Station, and Montana's natural resources for generations to come."

Did you know...

...the **Montana Endowment Tax Credit** may help you make a bigger impact on the Flathead Lake Biological Station than you thought possible.

In addition to receiving a federal income tax charitable deduction, Montana taxpayers who make a qualifying gift to support FLBS are eligible to receive a state tax credit of up to \$10,000 per individual or \$20,000 per couple.



Re-igniting the FLARE K-12 Program

In the wake of climate-related challenges, the importance of connecting the science of the Flathead Watershed with Montana’s future generations is more important than ever. While continuing to build upon the online curriculum and virtual field trip experiences created during the 2020-21 academic year, the Flathead Lake Aquatic Research and Education (FLARE) K-12 program educators **Monica Elser** and **Stephanie Hummel** were able to resume in-person field trips at FLBS, connecting Flathead Lake science with K-12 students, teachers, local camps, and organizations throughout western Montana.

Keeping the group sizes small and doing as many activities as possible outdoors to keep our local students and teachers safe and healthy, FLARE K-12 was still able to host over 500 students at the Bio Station this year. FLARE K-12 also worked alongside faculty and students from Salish Kootenai College to develop a “Daphnia Discovery” booklet, which kids from the Boys and Girls Club of the Flathead Reservation used to create their own take-home aquatic ecosystems

following their field trips to FLBS.

In addition to on-campus field trips, FLARE K-12 educators partnered with the Flathead Lakers, Confederated Salish and Kootenai Tribes, and Montana State Parks to conduct a successful return of the Mussel Walk at Wayfarers State Park in the spring. The program also led public educational events for the North Lake County Public Library and Montana State Parks. Our 2021 FLBS Summer Education Intern helped develop a Flathead Lake Art Activity for the Bigfork ACES program, which was held during the FLBS Open AIR Montana Art Exhibition at the Bigfork Art & Cultural Center at the end of the summer.

Finally, FLARE K-12 once again participated in the “Flathead Watershed Through The Seasons” teacher professional development workshops—a collaborative effort led by the Flathead Community of Resource Educators, and represents individuals from Glacier National Park, Flathead National Forest, The Glacier Institute, Montana Fish, Wildlife & Parks, Lone Pine State Park, Northwest Montana Educational Cooperative, and the Whitefish Center for Sustainability and Entrepreneurship.

This means that a \$10,000 tax credit saves you \$10,000 in taxes. Tax deductions lower your taxable income. Tax credits provide a dollar-for-dollar reduction of your state income tax liability. Contact the University of Montana Foundation at:

Alison Schultz

Director of Planned Giving

Univ. of Montana Foundation

406-243-5121 | alison.schultz@supportum.org



FLBS Co-hosts First Artist-in-Residence Art Exhibition



This past summer FLBS had the pleasure of co-hosting “Scene + Unseen: An Interwoven Tale of Art and Science from the Flathead Watershed” at the Bigfork Art & Cultural Center. This exhibition featured the works of nearly all FLBS Open AIR Artists-in-Residence, local professional and novice artists who participated in FLBS Plein Air Art Sessions, and historic drawings from FLBS scientists and students.

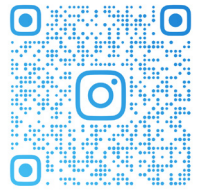
Connecting with Communities and Making a Difference



A special thank you to the **Greater Polson Community Foundation** for making it possible to purchase much-needed microscopes for our visiting FLARE K-12 classes, and for helping our educators better connect FLBS Flathead Watershed research with the curious young minds of our future generations.



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UMFLBS

Upcoming FLBS Events in 2022

- **Open House:** In early August, 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 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!

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

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