The Flathead Lake Biological Station (FLBS) has monitored water quality in Flathead Lake continuously since 1977 and reports findings to the Flathead Basin Commission and Montana Department of Environmental Quality (MDEQ).

Each year an annual report is completed to summarize the research conducted and assess the conditions in the lake for the previous water year. The report: “Monitoring Water Quality in Flathead Lake: 2008 Progress Report” summarizes Flathead Lake water quality and monitoring efforts during the 2007 Water Year (October 1, 2006–Sept 30, 2007). The report also assesses the interim Total Maximum Daily Load (TMDL) targets established by the Flathead Basin Commission to manage nutrient inputs to the Lake for the protection of water quality.

Monitoring Sites, Sampling Schedule  
Midlake Deep (110 meter depth) is approximately one mile west of Yellow Bay Point in a pelagic (open water) area of Flathead Lake. At Midlake Deep, water chemistry (nitrogen, phosphorus, oxygen), suspended algae (phytoplankton), chlorophyll a (photosynthetic pigment in algae), primary production and zooplankton are sampled 15 times each year.

Ross Deep (35 meter depth) is approximately 1 mile southwest of Wildhorse Island in Big Arm Bay. Since the discovery of declining oxygen in bottom waters at Ross Deep in 1992, water column profiles of dissolved oxygen are measured during late summer and early fall (but not all years due to funding).

“B” Beach and Horseshoe Island are long-term shoreline periphyton biomass (algae attached to submerged substrata) monitoring sites. “B” Beach is located at the Biological Station on the west side of Cape Montana. Horseshoe Island also has (Continued on page 2)
a westerly aspect and is located between Bird Island and Finley Point. Since 1999, periphyton has been sampled at these sites during August from rocks collected at 5 m depth.

Water Year 2007 Adopted Water Quality (TMDL) Targets

Target 1) No increase in the biomass of lakeshore periphyton.

Results: Periphyton biomass appears to have increased in Flathead Lake since the late 1980s. Periphyton biomass in 2007 was statistically significantly higher than in 1987 (the earliest periphyton biomass data, see Baumann M.S. Thesis 1988). However, the slight increasing trend observed in the continuous 8-year monitoring record (1999–2007) was not statistically significant due to high interannual variation.

Discussion: In 2007, mean periphyton biomass (measured as chlorophyll a per unit area) was the highest ever measured at both “B” Beach and Horseshoe Island. Although regression analysis showed a slight increasing trend in periphyton biomass from 1999 to 2007, it was not statistically significant. But 1987 data from Baumann on periphyton biomass at “B” beach compared to 2007 data indicates significantly higher biomass in 2007. Given the large increase in periphyton biomass from 1987 to 2007, continued monitoring is warranted.

From 1999 to 2007, periphyton chlorophyll a content at “B” Beach averaged five times the content measured at Horseshoe Island (Fig. 1). This suggests access to nutrients is greater at the “B” Beach site.

One possibility is that upwelling currents on the east shore of the Lake bring higher nutrient concentrations from the hypolimnion (bottom layer) to upper waters during the growing season. It is also possible that ground waters, which are typically higher in nutrients, are influent in the area of the “B” Beach. Increased nutrient pollution on the east shore is also a potential cause and concern.

Target 2) No measurable blooms of *Anabaena flos-aquae* (or other pollution algae).

Results: No visual evidence of an algal bloom was detected in the summer and fall of 2007.

Discussion: In WY 2007, no algal blooms were visually apparent at Midlake Deep or reported from anywhere else on Flathead Lake. Enumeration of archived surface samples (counting algal cells) will be required to confirm absence of an algal bloom in the Lake.

Unfortunately, lack of funding since the TMDL targets were established has resulted in limited information concerning this particular target. Subsequently, the Biological Station has not been able to examine the physical, chemical or food web factors that cause the toxic blue-green *Anabaena* (and other algae) to flourish in certain years.

Target 3) No declining trend in oxygen concentrations in the hypolimnion (bottom layer of water).

Results: This dissolved oxygen target was not met: a decline in oxygen was observed, although not as much as in past years.

Discussion: Low oxygen conditions in the hypolimnion can result in the release of large amounts of nutrients (particularly P) from the sediments. This has been a concern in Flathead Lake since oxygen sags were observed in the early 1990s. In 2007, percent oxygen saturation was 78% and 78.9% near the bottom at Midlake Deep and Ross Deep, respectively. Recent analyses have shown a statistically significant trend of decreasing percent saturation of dissolved oxygen in bottom waters of the lake after *Mysis* became established in the 1980s. Funding is

![Figure 1. Mean periphyton biomass as chlorophyll a (µg cm⁻²) ± 1 standard deviation at 5 m depth in August of each year at the two long-term monitoring sites on Flathead Lake.](image-url)
needed to obtain continuous measures of that variable at both sites via sensors deployed on buoys.

Target 4) Average annual concentrations in the photic zone (water depth penetrated by sunlight) of the Midlake Deep site in Flathead Lake will not exceed the values indicated: primary production – 80 g C m\(^{-2}\) yr\(^{-1}\) (80 grams carbon per square meter per year) and chlorophyll \(\alpha\) - 1.0 \(\mu\)g/L (1 microgram per liter).

Results: Primary production at Midlake Deep exceeded the target value by 24%, but there is no statistically significant trend post-Mysis establishment. The mean chlorophyll \(\alpha\) concentration at Midlake Deep in WY 2007 was relatively average: just below the target value.

Discussion: The annual mean primary production for WY 2007 exceeded the TMDL target by 19 g C m\(^{-2}\) yr\(^{-1}\), which is essentially the same as WY 2006 (Fig. 2). Since 1994, annual primary productivity in Flathead Lake has been at least 10% greater than the target set by the FBC and in 1998, exceeded the target by 65%. While there is a significant increasing trend for the entire record, there is not a statistically significant trend in primary productivity during the post-Mysis time frame. The increase for the entire record is best described as a step increase that occurred during the 1986–1987 Mysis upheaval as indicated by Bayesian probabilities (B. Ellis Dissertation 2006).

This target variable requires understanding of food web dynamics and cannot be interpreted independent of those dynamics. Dramatic alteration of the composition of at least three trophic levels (i.e., fish, zooplankton and algae) of the lake food web occurred during the establishment of *Mysis relicta* in the mid to late 1980s (B. Ellis Dissertation 2006). This essentially resulted in a lake with a different biological community, which has likely altered nutrient cycling. Additional funding will be actively pursued to model the changes that have occurred in the food web and its effect on the TMDL target parameters.

Recommended Targets (but not adopted targets): Average annual concentrations of the following variables in the photic zone of the Midlake Deep site in Flathead Lake will not exceed the values indicated: soluble reactive phosphorus (SRP) - <0.5 \(\mu\)g/L; total phosphorus (TP) - 5.0 \(\mu\)g/L; total nitrogen (TPN) - 95 \(\mu\)g/L; ammonium (NH\(_3\)) - <5.0 \(\mu\)g/L; nitrate + nitrite (NO\(_{2}/3\)) - 30 \(\mu\)g/L. Results: All five nutrient variables recommended by the FBC TMDL Technical Committee as targets were measured and found equal to or greater than the target values; in particular, mean soluble reactive phosphorus was twice the target concentration.

Discussion: Water Year 2007 appeared to be relatively average in terms of mean NH\(_3\) and TP concentrations and above average (but within the range previously reported) for TPN, NO\(_{2}/3\) and SRP concentrations. None of these nutrient variables were below the recommended concentrations.

Soluble reactive phosphorus (SRP) was nearly double the recommended TMDL target. Mean SRP concentration in 2007 was identical to that in 2005 and was the highest annual average ever recorded for the Midlake Deep photic zone (0 to 30 meters).

The Future

The importance of maintaining an in-depth long-term record of water quality cannot be overstated. Inclusion of food web analyses (zooplankton and phytoplankton) early in our monitoring protocol design provided us with critical information used to evaluate changes in primary production.

On the horizon is the added influence of climate change that will require more detailed monitoring of temperature to assess the potential impacts. Recently, MDEQ reduced water quality monitoring funding forcing cutbacks on sampling tributaries of Flathead Lake for WY 2009.

Citizens interested in contributing to the Lake Monitoring Fund can help support efforts to reinstate monitoring of Ashley and Stoner Creeks and the Stillwater and Whitefish Rivers. Other goals are to purchase and deploy a buoy at Midlake with temperature, oxygen, conductivity, chlorophyll and other sensors to improve our time-series record of these important variables.

Continued vigilance is key to maintaining water quality in one of our most magnificent State resources and you can be a part of that effort.
LAKE MONITORING

(Continued from page 1)

pollution and help keep Flathead Lake one of the cleanest in the US (The Daily InterLake 14 July 1968).

By 1968, Gaufin, then Assistant Director of the Biological Station, reported pesticide residues had made their way into Flathead Lake. Related to this news, Flathead and Lake County officials made a decision to participate in continuing pollution studies (The Daily InterLake 28 November 1968).

Art Gaufin, Biological Station Assistant Director (right) with Ben Foote (left), visiting Kent State faculty (circa 1971)

Many additional issues—detergent phosphates, wastewater treatment, toxic substance pollution, dredging, lakeshore development setbacks, stormwater runoff, logging and construction related sediments, and shoreline erosion—have garnered the attention of Flathead citizens. These issues have elevated the urgency of preserving Flathead Lake water quality. One topic that galvanized the mood of Flathead citizens in the 1970s was the proposed massive open pit coal mines in the Cabin Creek drainage, North Fork of the Flathead River. The impending threat of pollution made many people recognize the need to collect additional data on baseline water quality in the Flathead Basin including Flathead Lake. Urged on by the scientific community, Max Baucus (then U.S. Representative) secured federal appropriations for the 5-year Flathead River Basin Environmental Impact Study (EIS) in 1977. The Biological Station was involved from inception on this very important research.

In 1983 after completion of the study, the State of Montana established the Flathead Basin Commission (FBC) “to protect the existing high quality of the Flathead Lake aquatic environment; the waters that flow into, out of, or are tributary to the lake; and the natural resources and environment of the Flathead Basin.”

Dr. Richard Hauer, FLBS Professor of Limnology, notes “The Flathead River Basin EIS Steering Committee proved to be a successful approach to managing the EIS study effort. Recognizing the value and leadership of this group and the need for ongoing stewardship of the Flathead Basin, the Montana Legislature established the Flathead Basin Commission, which in many ways resembled the Flathead River Basin EIS Steering Committee.”

An important achievement of the FBC is the implementation of Total Maximum Daily Load (TMDL) interim targets for monitoring Flathead Lake water quality. Another is continued support of water quality monitoring in area lakes.

Today, routine monitoring of Flathead Lake is funded by the Montana Department of Environmental Quality and the Montana Legislature. The work is executed by the Biological Station under the direction of Dr. Bonnie Ellis. Routine monitoring, along with other studies, has resulted in a detailed record of Flathead Lake water quality from 1977 through the present.

Volunteer Monitoring Program (VMP)

In the early 1990s, many citizens became interested in monitoring other lakes in the area surrounding Kalispell, MT. Spurred on by this interest, the FBC organized a volunteer monitoring program for selected area lakes in 1992.

The Biological Station participates in this program. Station researchers developed a cost effective monitoring strategy for the program and along with FBC staff provide training in proper sampling protocol to the volunteers. The Station also provides chemical analysis in the Freshwater Research Lab.

The goal of the program is to gather baseline data on the trophic status of lakes in the Flathead Basin. The ongoing objective is to track variables that enable resource managers to detect water quality impairment.

Lakes were selected by the FBC based upon citizen concern and commitment to continue monitoring them over several years. Lakes range in size from very small (surface area of 8 acres) to very large (122,319 acres).

Rogers Lake and Lake Five have been sampled nearly every year from 1993 to 2007, others have only been sampled once during that time. In all, 43 lakes have been included in the monitoring effort.

With a little extra funding this year, researchers at the Biological Station were able to conduct a more extensive analysis of the long-term data base. This analysis was prepared by Dr. Bonnie Ellis and Jim Craft. It is titled “Trophic Status and Trends in Water Quality for Volunteer Monitoring Program Lakes in Northwestern Montana, 1993–2007.”

Individual citizens contribute their time and resources to the program. In many cases, volunteer-generated data is the only water quality information available for many small lakes.

Volunteers find this is a personally rewarding learning experience and feel a sense of accomplishment in proactively protecting the natural resources that makes this region a great place to live.

We at the Biological Station extend our thanks and gratitude to all volunteers. We also want to recognize the dedicated Biological Station personnel, Dr. Bonnie Ellis, Jim Craft and lab chemists, for their hard work and commitment to lake monitoring. Indeed, the work begun by Dr. Arden Gaufin continues. Raising awareness of the relationship between land management practices and protecting and improving water quality of Flathead Lake and other area lakes is one of the Station’s important goals.
TROPHIC STATUS OF 43 FLATHEAD BASIN LAKES

BY MARIE KOHLER

Last November, Dr. Bonnie Ellis, Research Assistant Professor at the Biological Station, gave a talk to volunteers and coordinators of the Volunteer Monitoring Program. Dr. Ellis discussed trophic status of the lakes (a system of classifying lakes), trends in water quality and the results of the analysis of 43 lakes.

At first, a single water sample was taken for each lake each year. Samples were analyzed for total phosphorus and chlorophyll a concentrations. In 2005, a small increase in program funding allowed for the addition of total nitrogen analysis.

Dr. Ellis notes, “This change was very important because it helps us understand the natural range of nitrogen in this region. It also allows us to calculate the ratio of nitrogen to phosphorus that we use to determine which nutrient is in the lowest supply, thus limiting the production of algae.” Addition of a limiting nutrient to a lake will stimulate the production of algae.

By studying the nitrogen/phosphorus ratio from the VMP data collected, Dr. Ellis and Jim Craft determined that the majority of lakes in the Flathead region should be phosphorus limited. Phosphorus is the nutrient most likely to stimulate the production of algae in area lakes so a positive trend in phosphorus concentration warrants attention.

Of the 43 lakes, some lakes exhibited statistically significant increasing trends in total phosphorus and/or chlorophyll a: Bailey Lake, Lake Blaine, Lake Five, Glen Lake, Rogers Lake and 3 bays or areas of Flathead Lake (Crescent Bay, Indian Bay and Mack Alley). Of these, Bailey Lake, Lake Five and Rogers Lake are of particular concern as they were monitored for 10 years or more and showed significant, increasing trends in one or both of the variables.

Data collected on Lake Blaine, Glen Lake and Crescent Bay in Flathead Lake was inconclusive due to a short period of record. The period of record was a bit longer at 6 years for Indian Bay and Mack Alley in Flathead Lake.

Other lakes exhibiting very large spikes in nutrients and/or chlorophyll should be closely monitored. The spike in total phosphorus in Lake Mary Ronan was 3.5 times the next highest value. In Jette Lake, the spike was 6 times the next highest measure of a lake in its size class. Chlorophyll a was orders of magnitude higher in Jette Lake—at 4 times the next highest value of a lake in its size class on the same date in 1998.

Other smaller peaks in monitoring criteria were observed in Loon Lake, McCaffery Lake, Lower Stillwater Lake, Lake Blaine, Ashley Lake and Lake Five. Results of the monitoring efforts show some warning signs are evident and should not be ignored.

Dr. Ellis commented about routine data collection and emphasized, “It is very important that a continuous record of these water quality criteria be maintained so that interannual variation in the criteria is monitored as well. It is difficult to monitor trends when data are collected sporadically or collection is suspended.” Water samples should be collected as near to the same time every year—from late July to early August.

The volunteers and Flathead Basin Commission staff should be applauded for their efforts. At very minimal costs, baseline data have now been generated for 43 lakes in northwestern Montana.

Additional funding should be sought to add a seasonal component and to enhance quality control. Ellis pointed out that “seasonal monitoring would provide a more statistically sound basis for trend analysis and reference data for EPA’s development of defensible water quality criteria that are protective of designated uses.”

Water may be the State’s most valuable resource and protecting it should be everyone’s concern.


EXCESSIVE NUTRIENTS IN LAKES
BY BONNIE ELLIS

What’s the problem with excessive nutrients in lakes or why does my lake look like green paint?

The US Environmental Protection Agency (EPA) reported that excessive nutrients—nitrogen and phosphorus—were the leading cause of impairment in lakes in the USEPA National Water Quality Inventory in 1996 and the second leading cause of impairments reported by the States in their 1998 list of impaired water bodies.

Excessive nutrients can result in overgrowth by algae and/or aquatic plants, low dissolved oxygen, fish kills, increased sediment accumulation rates and shifts in species composition of both plants and animals. High nutrient loading in the worst case scenario can result in the growth of harmful algal blooms with potential human health risks.

Harmful algal blooms have been reported from lakes and reservoirs in Montana (e.g., Hebgen Lake, Canyon Ferry Reservoir), some of which resulted in the death of cattle.

The monitoring criteria recommended by the US EPA for assessing potential water quality impairment when funds are limited are total phosphorus, total nitrogen, chlorophyll a and turbidity (e.g., Secchi depth). Other indicators like dissolved oxygen and aquatic plant growth or species determinations are also deemed useful.

VMP volunteers collect water samples for total phosphorus, total nitrogen and chlorophyll a analysis, and measure Secchi depth. They also make field measurements of temperature and dissolved oxygen throughout the water column.

NEW CRUSTACEAN IN WESTERN MONTANA
BY ROBERT NEWELL

The scientific order Bathynellacea is a little known group of microscopic crustaceans found in wells, subterranean waters, artesian systems and interstitial waters of streams. The animals are very small—about the size of a grain of sugar.

Bathynellids are blind and wormlike in shape. Living in ground waters in river flood plains, they are well-adapted to subsurface water contained in pore spaces between the grains of rock and sediments. The Bathynellids have been thoroughly studied in Europe, but they were not discovered in the United States until 1974. Four species are known in the United States.

These crustaceans have been commonly encountered in the Flathead Valley near Kalispell, the Nyack area near Glacier National Park, and the Jocko River valley near Ravalli in collections from wells that were installed by Flathead Lake Biological Station researchers. The study of this group of crustaceans is complicated by their small size, unusual habitat in ground water and lack of scientific information.

Only one expert could be found who is studying this group. She is a researcher working in Spain, Dr. Ana Camacho Pérez. Dr. Camacho agreed to examine the Bathynellids collected from western Montana wells. She has completed her examination and has decided that some specimens collected from groundwater wells near Kalispell and in the Jocko Valley are a genus new to science. She has named this new genus Montanabathynella.

FAIRY AND TADPOLE SHRIMP SURVEY
BY ROBERT NEWELL

The FLBS is assisting a U.S. Geological Survey (USGS) biologist, Blake Hossack, with a biodiversity survey of wetlands in Glacier National Park (GNP). The USGS has been monitoring amphibians in GNP each summer since 1999, noting habitat, diversity, ecology and distribution. In an attempt to increase the scope of surveys, other aquatic organisms are also being collected and identified. Robert Newell is working with Blake Hossack and Christopher Rogers of EcoAnalysts, an expert taxonomist, to survey an often overlooked group of crustaceans in Glacier National Park, the fairy shrimp (Order Anostraca) and tadpole shrimp (Order Notostraca).
RAGING WINDS HAMMER FLBS

BY JACK STANFORD

A winter storm rolled across northwestern Montana on Saturday, December 13, 2008, hammering 80 acres of old growth forest at The University of Montana’s Flathead Lake Biological Station. Many ancient ponderosa pines that gave the Station grounds its character were blown down.

Station director, Professor Jack Stanford said, “It is very sad. We lost 30 or more of our biggest p-pines, and about a third of the larger grand and Douglas firs on the entire grounds went down. We have thousands of board feet of solid old timber on the ground.”

Stanford who has taught ecology among those trees for nearly 40 years notes, “Some of these trees were over 400 years old and I thought their greatest danger was bugs, not wind.”

Most of the trees were uprooted rather than snapped off—perhaps because the ground was very dry and not frozen. Stanford pointed out, “Certainly there is no record of a windstorm causing this kind of damage in the 110-year history of the station. We have seen wind like this many times in the past without trees coming down.”

The storm blew in before dawn, knocking trees down along Highway 35 north and south of the Station. A motorist was killed when a tree hit his car before daylight on the highway at Yellow Bay. Eric Anderson, a FLBS caretaker and Finley Point volunteer firefighter, responded to the accident but before he could get out to the highway with the fire truck, he had to cut and move several trees.

The power of the storm increased through the morning as the temperature dropped toward zero. At about 11 a.m., the wind velocity increased dramatically in a sudden burst, devastating the FLBS forest.

Stanford said, “Maintenance supervisor Mark Potter, Anderson and I had just sawed out the entrance road and got the fire truck back under cover when we looked back up the road and saw the trees coming down like dominos. It took the rest of the day to get the entrance road open again.”

Highway 35 was closed most of the day as personnel from the highway department and Mission Valley Power cleared trees and began to put downed power lines back in order.

The Station was without power for about 19 hours, but backup generators kept essential functions operational. The storm abated about 8 p.m.

“Fortunately none of our buildings were seriously damaged by falling trees,” Stanford said. “Roofing of the Freshwater Research Lab was blown off and two cabins got direct hits from trees, otherwise we are in pretty good shape. We were thankful that our power lines are underground, owing to a grant from the National Science Foundation a few years ago.”

Normal operations resumed on Monday for most faculty and staff, although Stanford notes, “The Biological Station has a vastly different look with all the big trees down.”

See additional photos at: http://www.umt.edu/flbs/Photos/Photos.htm
RADIATION BIOLOGY AT FLBS

BY RICHARD SCOTT

Last year alumnus Richard Scott stopped in to visit. He talked about how things have changed at Yellow Bay but also stayed the same. Here are Richard’s recollections of the summer of 1961.

Back in the late 1950s, I had just launched my teaching career in Bushnell, Illinois and was going to graduate school during the summers.

Then it happened. Russia launched the tiny satellite, Sputnik, on October 4, 1957. The United States knew it was behind in space exploration, science education and mathematics. Responding to this issue, the National Science Foundation began recruiting teachers in 1959 for summer institutes in mathematics and science. This is how I ended up attending classes at the Biological Station.

In 1961, I enrolled in the NSF Radiation Biology Summer Institute at the Yellow Bay Biological Station (now Flathead Lake Biological Station). This was the same year President Kennedy made his famous pledge to send men to the moon.

Besides signing up for Radiation Biology, participants were required to select an additional class, so I signed up for the invertebrate biology course.

At the Biological Station, students were assigned four to a cabin—a tad more crowded than two per cabin today. Accommodations were austere but served us very well.

We ate our meals on picnic tables in front of the cookhouse, but now there is a full food service line in the Prescott Center with indoor and outdoor dining.

Each Radiation Biology student received a binary scaler, a cloud chamber, a black light, a stop watch, a Fiberglass work tray, a lab apron and X-ray film holders. Participants took this equipment with them after completion of the course work for teaching purposes.

The Radiation Biology class consisted of lectures and laboratory sessions. The professors, Dr. Hardin B. Jones (Biology) and Dr. Charles A. Sondhaus (Radiation Physics), both from the University of California at Berkeley, were top quality and widely respected within their fields.

The subject matter was difficult for many of the students, but the students gave it their best.

The invertebrate biology course was a course mainly taught in the field. Our instructor, Professor Royal Brunson, led us on trips to collect living specimens that we later identified in the laboratory.

One memorable field trip was to Glacier National Park. It was around the 20th of June and the snow at Logan Pass was three times higher than an automobile.

We slept in tents on mattresses trucked to the Park. I recall a close encounter with a black bear who was sniffing inches away from my mattress with only the tent as a divider.

After summer session was over, I returned to western Illinois and continued teaching biology. What I learned at Yellow Bay went directly into my course material.

On October 14, 1962, a U-2 airplane flying over western Cuba discovered missile sites—so began the Cuban missile crisis. People were building bomb shelters in their homes, and much was being written about the effects of radiation on humans.

Because of the excellent training from my course, I was able to teach students about radioactive fallout from atomic bomb tests. Volunteer students collected matter from the tops of cars in junk yards and fuel tanks on farms. I would reduce the samples to small amounts of ash in a crucible and use the binary scaler to detect radioactivity in the ash.

Some of these samples would yield several thousand counts of radiation per minute. By graphing the results, the students could estimate the "half-life" of the radioactive isotopes.

In one experiment, we added radioactive isotopes to water in a small aquarium containing a goldfish. After 3 days, we placed the goldfish in a film holder in close contact with 4 x 5 inch X-ray film for twelve hours.

The film was developed and hot spots could be seen from various parts of the skeleton and organs where radiation had become concentrated.

This helped students understand how radioactive fallout from bomb testing would fall to the ground, be taken up with grass by cattle and find its way into milk consumed by humans. The radioactive isotope would be incorporated into human bones possibly increasing cancer risk.

I believe the summer institute at the Station was a very successful NSF program. I know it enabled me to bring improvements in teaching science to my students. Perhaps it is time to introduce programs like this again to improve math and science knowledge and expertise in the US.

For some of us, Richard’s story dredges up memories of sirens piercing the night and duck and cover drills. For others it’s a nostalgic peek into the past. We thank Richard for this great contribution to the Flathead Lake Journal.
When Zach isn’t living on the Kwethluk, he is climbing, backpacking and raising his daughters, Jaela and Kira, with wife Krista. He is keen on traveling to wild places and seeing the diversity of life across the globe.

Happy Trails Papa Griz

Mike Piazza, custodian and loyal Griz football fan known by most as Papa Griz, retired last December.

Mike always had a good word for all of us at the Station and our visitors too.

When asked what he will do with all his free time, Mike said, “I’m going to kick back and enjoy what is very precious to me—Marylee, the love of my life, and my extended family. Mike and Marylee celebrated their 40th wedding anniversary on December 28, 2008.

Mike plans to spend more time with his two sons, Craig and Kevin, daughter-in-law Courtney and three grandchildren, Trinity-Faith, Justus and Michael. Mike and Marylee now have time to spend with Marylee’s mom who will be 90 this year.

Mike is proud of his sons, Craig and Kevin, who co-own and manage a thriving business. Like Craig who studied and performed opera at LSU, Mike loves music. We often found Mike swabbing down Elrod Hall in the mornings listening to a favorite aria and sometimes a little hip hop.

Mike logged years of service cleaning our offices, labs, classrooms, readying the cabins and dorms for guests, and delivering tidbits of advice, moral support and big bear hugs. We wish you and your family the best of luck—GO GRIZ!!

FLBS Staff Update

Zach Crete's integral love for aquatic ecosystems stems from childhood summers diving and fishing on a small lake in Helena. In 2003 after three months of fishing and hunting on the Missouri River, he felt compelled to pursue his Bachelor of Science degree in aquatic ecology at The University of Montana (UM).

While at UM, Zach learned about the Salmonid Rivers Observatory Network (SaRON) research at the Biological Station and was determined to work on this project. SaRON involves a multidisciplinary team of scientists who are investigating salmonid biodiversity and productivity in a suite of pristine Pacific salmon river ecosystems.

To demonstrate his resolve, acquire skills and meet the SaRON project director, Zach enrolled in Dr. Jack Stanford’s field ecology course. Then in 2007 and 2008, Zach worked on the Kwethluk River in Alaska as a SaRON summer field assistant. He earned his B.S. in May 2008 from UM.

The Kwethluk presents a unique opportunity to study a river ecosystem with no human-caused disturbance to the physical system. Each day in the field after completing his SaRON project work, Zach would spend time on his personal research project—not wasting a minute of an exceptional opportunity. For his personal project, Zach is studying the contribution of lateral aquatic habitat (parafluvial ponds) to juvenile salmon production and invertebrate diversity.

Zach wants to return to the Kwethluk to continue learning how natural rivers function. In the future, he plans to apply what he has learned restoring habitat and physical structure to rivers back at home.

Chemistry Students Visit

Mary Cloninger (Montana State University, Department of Chemistry and Biochemistry) and Michael Ceballos (The University of Montana Native American Research Lab) know the value of combining adventure and education. For three years, they have brought summer students from different regions and cultural backgrounds together to participate in a cross-disciplinary educational environment.

Cloninger and Ceballos chose the Biological Station as the site for a minisymposium in 2008. The Biological Station is an ideal location allowing informal outdoor activities to be interspersed with formal presentations.

During summer 2008, 22 students participated. The students were from many First Nations including Cree, Blackfeet, Cheyenne, Karuk, Tepehuane, Choctaw, Comanche and Navajo, and from other areas of the US.

During the minisymposium, students made oral presentations describing research projects. They also led discussions on their research and openly exchanged information about research opportunities at both universities.

Cloninger and Ceballos believe that interweaving science and extracurricular activities provides students with a positive perspective about their future studies and careers as scientists. It also allows students opportunities to build relationships in a social setting that can translate into future research contacts.
## ONGOING PROJECTS IN 2008

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Summer Session 2009

In 2009, the following courses are being offered at the Biological Station: Field Ecology, Stream Ecology, Lake Ecology, Alpine Ecology, Conservation Ecology, Undergraduate Thesis, Undergraduate Research Experience and Research in Ecology. These courses are available for undergraduate or graduate credit and involve hands-on field study with an excellent student to instructor ratio. A high percentage of applicants are awarded generous scholarships. This summer, twenty-four students are enrolled: 7 from UM, 6 from U of North Carolina, 6 from Colgate U with others from MSU, Bucknell, State U of New York and 1 Montana Fish, Wildlife and Parks employee. Eleven of the 24 students received scholarships totaling $36,700.

A little relaxation at the end of day complements rigorous summer courses!

Best Wishes From All of Us At the Station

Flathead Lake Biological Station 2008 Publication List


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