Water Quality of Whitefish River
by Scott Relyea, Principal Investigator

Whitefish River is currently on Montana’s 303(d) list as threatened for partial support for aquatic life and cold water fishery – trout. Probable causes listed are metals, nitrogen, nutrients, oil and grease, PCBs, priority organics and thermal modifications. Probable sources are noted as industrial point sources, silviculture, construction-land development and urban runoff/storm sewers.

The river’s source is Whitefish Lake, a 13.2 km² oligotrophic lake. Its only major tributary, Haskill Creek, drains Big Mountain located at the southern tip of the Whitefish Range. The first three kilometers of the Whitefish River are within the city limits of Whitefish, but most of its course is over agricultural land in Flathead County. The final four kilometers flow through light industrial and residential developments north of Kalispell.

In the past decade, Flathead County has experienced a 26% growth rate (Flathead Basin Stewardship Index 2002). The cities of Whitefish and Kalispell continue to annex land for development. Big Sky Ski Resort at the headwaters of Haskill Creek also continues to expand. Without careful management, this growth could increase the degradation of water quality in Whitefish River significantly.

As rivers flow from their source to their mouth, inputs (e.g., tributaries, ground water, storm water drainage and point source discharges) alter water quality and in-stream biological and chemical changes occur as the water flows downstream. The magnitude and extent of these changes depends on season, weather and channel characteristics, as well as floodplain development and connectivity. Synoptic measurements capture this temporal and spatial variance.

Synoptic sampling of the Whitefish River was conducted in 2003–2004 by Flathead Lake Biological Station (FLBS) on behalf of the Montana Department of Environmental Quality (MDEQ). Findings were compiled in the report “A Synoptic Study of the Water Quality of Whitefish River.”

In the final report, annual nutrient and sediment loads are estimated; probable causes and sources listed as reasons for including this water body on the 303(d) list are assessed; and remediation measures and a monitoring program are offered.

Whitefish River is a lake outlet, lowland river. Algal and periphyton productivity is phosphorus limited and nutrient concentrations are generally low. The dampening effect of Whitefish Lake on discharge from the upper basin and the low gradient of the valley make the river susceptible to impacts from increased sediment loading.

The river lacks a natural extensive flood plain, which limits the degree of solute transformation as the river flows downstream. The river course

(Continued on page 2)
is through real estate with high probability for housing and commercial development. Water quality declines downstream from the lake in relation to increasing development.

A beneficial use designation for the Whitefish River is cold water fishery – trout. However, findings suggest the designation is better described as a cool water fishery due to the effect of Whitefish Lake on the thermal budget of the river. Warm surface water from the lake makes up over 85% of the discharge in the river during the summer months when temperatures routinely exceed 20°C (68°F) (Fig. 1). Little in the way of local anthropogenic (caused by humans) influence is at play.

Two probable causes for the partial support listing were nitrogen and nutrients. Both nitrate and total persulfate nitrogen concentrations in the Whitefish River reach levels higher than those found in any other large river in the Flathead Basin. Since productivity is phosphorus limited and the nitrogen levels are relatively high, impacts of increased phosphorus loading are amplified. Nuisance algal blooms and oxygen depletion from decomposition could result if phosphorus levels increase.

Metals should also remain as a probable cause. Lead was the only metal found to exceed State water quality criteria and only for chronic exposure. Until further sampling is done and samples analyzed at lower detection levels, metals should remain as a probable cause for inclusion on the 303d list.

While oil and grease were not included in the scope of this study, substantial oil deposits were detected in the river sediments at JP Road. Kelly Schmitt, Brownsfield Coordinator, MDEQ, notes a number of such deposits exist in the river sediments and shoreline soils.

Sediment should be added to the list of probable causes for impairment. Dense macrophyte beds, which provide quality habitat for a host of macroinvertebrates, cover up to two-thirds of the river bottom and are easily visible around the Highway 40 bridge. Sediment deposition smothers these macrophyte beds, replacing a highly productive macrophyte/soft bottom habitat with sand, which has the lowest productivity of any other type of river bottom habitat.

It is suspected entrained sediment from City Beach in Whitefish is reaching the river. This sediment along with construction site and road sanding inputs have smothered macrophyte beds to well below JP Road changing the riverbed from a soft to sand bottom. An even more striking impact is due to sediment loads from Haskill Creek. Negative impacts to macrophyte beds are apparent from the confluence to over a kilometer downstream. The hydraulic power of the river is insufficient to remove most of this sediment making these changes permanent.

The Whitefish River has two major point sources of pollution: Whitefish Sewage Treatment Plant effluent and Haskill Creek.

The Whitefish STP is a tertiary treatment plant and land application of effluent during the summer is the only practical improvement over current practice. The flashy nature of Haskill Creek coupled with poor land management practices upstream has made it a serious threat to Whitefish River water quality and ecosystem function. Better education of landowners about buffer vegetation and the impact of livestock grazing through watershed advisory groups could be a start to improving management practices.

Removal of ponds and well-developed riparia due to land development would result in a loss of the sediment and nutrient retention they provide. Thus, preserving and increasing what retention there is in the last kilometer of Haskill Creek is critical.

Major nonpoint sources of pollution are effluents from septic system drain fields, fertilizer leachate, animal wastes, and sediment from agricultural land, construction sites and Whitefish City Beach. These reach the river through overland flow during spring and storm event runoff or through groundwater inputs.

Mitigation and control include increasing riparian buffer zones to a minimum 100 feet, sewering of all new developments with tertiary treatment of wastes and building a jetty between City Beach and the Whitefish Lake outlet. The most important management tool is denying river alterations such as riprap, levees, dikes and especially channelization.

Water quality monitoring needs to be done as close to the confluence with the Stillwater River as possible to assess impacts from land development. Addi-

**Definitions**

- **macrophyte** – Rooted and floating aquatic plants, larger than the phytoplankton.
- **oligotrophic** – Lakes characterized by low concentrations of nutrients and algae and resulting good water transparency.
- **phosphorus limited** – Level of dissolved phosphorus that limits algae growth.
- **periphyton** – Community of algae, bacteria, fungi and protists and organic matter attached to submerged surfaces, such as rocks, in streams and lakes.
- **synoptic sampling** – Use of multiple sites along a river or about a lake that are sampled at nearly the same time to give a spatially-detailed snapshot of water quality.
- **tertiary treatment** – Additional treatment to remove suspended or dissolved substances remaining after conventional secondary wastewater treatment processes.
tionally, synoptic sampling should be performed during spring runoff and late fall baseflow at least once every five years and should include the main sites sampled in this study (Fig. 2). Data collected would be instrumental in assessing sources of degradation. This monitoring would be used to assess impacts to Whitefish River and for understanding future impacts from development on other Flathead Basin rivers.

All data collected during this study can be found in the State of Montana’s Department of Environmental Quality STORET database.

FLBS staff and two visiting researchers from Spain assisted with sampling and analysis. A special thanks goes out to Mr. and Mrs. Charles Abell for access to the Whitefish Lake Outlet site and gracious permission to use their canoe.

In the recent geologic past, natural processes in the Crown of the Continent Ecosystem (Crown) were largely unimpeded by human interactions, but now the region is succumbing to increasingly greater human disturbance. Added to the known stresses of resource extraction and landscape fragmentation are the unpredictable consequences of climate change, irrefutably evident in the relentless recession of the ecoregion’s icefields, which provide source waters for 19 important rivers that flow towards three oceans.

The Crown covers approximately 16,000 square miles (44,000 square kilometers) and includes Glacier National Park, the Bob Marshall Wilderness and Waterton Lakes National Park in Alberta. Despite fragmented jurisdictions within this vast ecosystem, the region remains largely ecologically intact.

Portions of the Crown have completely intact food webs that are continental gems as well as biodiversity hotspots. These natural systems and ecosystem services, highly valued and relatively rare, are deemed so valuable that Waterton Lakes National Park and Glacier National Park have been designated World Heritage Sites.

The Crown landscape encompasses short grass prairie, limber pine savannahs, lush coniferous forests, intermountain prairies and low passes to the plains. Native peoples like the Blackfeet, Salish, Kootenai and others plied these lands for centuries.

Today, the Crown provides vital natural services, especially water, to natural and human systems throughout the vastness of Canada’s Prairies, the Great Plains of the U.S. and the Columbia Basin. As the water tower for much of western North America, the widespread and unknown cumulative impacts of human activity and climate change on water quality, quantity and seasonality are of urgent international concern.

Now policy makers on both sides of the border are facing serious challenges. How do you provide access to a priceless resource without compromising the very thing, its pristine attributes, that makes it so valuable? What is needed to protect the natural environment yet facilitate economic prosperity?

To answer these questions, a solid scientific and socioeconomic context is needed to inform resource managers and policy makers. While there is a great deal of information distin-

(Continued on page 7)
Natural Treasure at GNP
(Continued from page 1)

The report is summarized herein.

**Background**—The Rocky Mountain capshell limpet, *Acroloxus coloradensis* (Henderson), was collected in Lost Lake in the mid-1960s by Richard Russell and Royal Bruce Brunson. The status of *A. coloradensis* in Lost Lake has not been examined since the species was discovered some 40 years ago. Lost Lake is a roughly oval shaped basin contained in a shallow glacial cirque located on the north side of the “Going-to-the-Sun Road”, the main road bisecting Glacier National Park.

Distribution of *A. coloradensis* is highly disjunct and limited to 17 North American localities including Lost Lake. The finding of fossil limpets in recent Ice Age glacial outwash and sediments resulted in this species being called a glacial relict species.

Owing to its disjunct distribution and relict status, scientists considered the Rocky Mountain capshell to be a rare and possibly endangered species. Historically fishedless, Lost Lake has a long legacy of trout (Salmonidae) stocking and heavy use by recreationists for fishing, wading and swimming. The lake is small and shallow and the capshells are rather fragile, epilithic organisms (living on rocks) with vulnerability to waders and swimmers. Moreover in a preliminary study, Marnell (unpubl.) found capshells in trout guts.

The field study conducted during 2001 and 2002 quantified the distribution and abundance of capshells in Lost Lake in relation to a detailed limnological analysis of the lake. Data was considered in a conservation context.

**Lost Lake Limnology**—Lost Lake has a maximum depth of 8.2 m (27 feet) and a surface area of 0.8 hectares (1.98 acres) and lies at the base of Goat Mountain below a forested (subalpine fir) headwall. The lake is situated near the north shore of the much larger St. Mary Lake at an elevation of 1418 m MSL (4652 feet); thus, it is in the transition zone between the coniferous valley bottom and the subalpine.

Lost Lake is a part of the Hudsonian drainage, but very little surface flow reached the lake during this study. Seeps were evident at the base of the talus slope on the north shore from June through August, but were mostly dry by September. In June of both years, the outlet into St. Mary Lake consisted of only a trickle. Water flux was mainly via groundwater pathways, but the terrain indicates greater discharge occurred via the outlet in the past.

The lake is ice covered from about early December to May and light extended to the bottom of the lake during all ice-free months of the study.

The shoreline was almost entirely ringed by bushy vegetation. Surrounding slopes had a patchy forest of lodgepole pine mixed with Douglas fir and subalpine fir at the higher elevations.

The Lake is surprisingly productive, owing probably to its nature as a seepage lake. Groundwater seeps into the lake are high in nitrate nitrogen and total phosphorus, but both nutrients are rapidly assimilated by lake biota. The trophic status of Lost Lake may best be characterized as mesotrophic (moderately productive), though the net primary production was in the range observed for eutrophic (very productive) lakes. The lake is dimictic (two stratifications and two mixing cycles a year) and oxygen is reduced below 4 m as soon as temperature stratification of the water column begins, with near 0% dissolved oxygen saturation on the bottom by August.

Given the high nutrient concentrations and phytoplankton (suspended algae) biomass, the relatively high zooplankton abundance in Lost Lake was expected. Hydrophytic macrophytes (plants with roots submerged in water) were present in Lost Lake and profuse growths of benthic algae occurred in localized areas of the shoreline.

Cladocera (water fleas), Ostracoda (seed shrimp), and Diptera (flies and midges) were the most abundant benthic invertebrates. An unknown species of leech (Hirudinea) was collected during shore surveys.

Organisms found in Lost Lake deep-water benthos must be adapted to the low oxygen concentrations that were observed in Lost Lake, even if only for a short period should they move in and out of the region.

**Capshells**—Limpets are mollusks with a single cone-shaped shell (valve), a suction cup like foot and well developed eyes and tentacles. A ribbon-like radula covered in rasps scrapes algae and detritus off the rocks on which it makes its home.

Lost Lake *Acroloxus coloradensis* specimens have a distinct black narrow ring of melanin around the periphery of the mantle just slightly in from the edge. The rest of the mantle is very light in color and clearly visible through the translucent shell of shiny golden-brown. The shell of *A. coloradensis* may best be described as a low, flat cone. Specimen size (average of 3.5 mm in length) was within the range reported for the Colorado population by Bryce in 1970 and the Quebec lakes by Clarke in 1970, but none reached the upper limit of 5 mm in length described by Burch.

Although thin shells appear to be a common feature for this species, specimens from Lost Lake possessed very thin, delicate shells. The low alkalinity and calcium concentrations may account, in part, for the very thin shells observed.

Rocky Mountain capshell limpets remain fairly abundant in Lost Lake.
Acroloxus coloradensis occurred primarily in the eastern and southern regions of Lost Lake (Fig. 1). The preferred habitat of the limpet was the underside of flat rocks (~5 cm diameter) in relatively shallow water (~<1 m depth). Densities were highest where layers of flat rocks were numerous and the area was not utilized by people for wading and swimming. Densities averaged 164/m² (range = 0 to 574/m²).

The maximum densities reported for Lost Lake exceed all published estimates for the species. Reduced densities of limpets were observed where people commonly walked out into the lake to swim (Fig. 1, shaded area), as they can be easily crushed between the successive layers of rock from simply walking on the substrate. Persons accessing the lake on the northern and western shores, primarily to fish, would have little impact on the limpet population, as the substrate is not optimum for the limpets.

The presence of another limpet, Ferrissia fragilis, in Lost Lake is of interest as it was not reported by Russell and Brunson (1967). Whether this species was missed in the original investigation or whether it is a newcomer is not known, but it appears it shares similar habitat with that of A. coloradensis. If competition is occurring between these two limpets, it does not appear to have reduced the density of A. coloradensis since estimates were made by Clarke (1993).

Fish are limited to nonnative brook trout that feed on an array of zooplankton and benthos. Although the capshells do not appear to be very sensitive to fish predation in summer and fall, it is possible that brook trout are more aggressive in bottom feeding during winter when surface organisms and zooplankton populations are reduced.

Nonetheless, managers faced with protection of this important population should consider returning Lost Lake to its historical fishless condition by intensive gill netting of nonnative trout and carefully managing or eliminating wading and swimming by recreationists.

DNA analysis indicated that the sister-group relationship of the rare North American A. coloradensis and the Lake Baikal acroloxid species flock is significant. Hitherto, the widespread European A. lacustris was assumed to be the sister-species of A. coloradensis. The biogeographic connection of the Lake Baikal region and the Rocky Mountains is not easily explained but might be elucidated with the genetic study of specimens from the Russian Far East.

A. coloradensis was also collected from Trout Lake (west of the divide) in Glacier National Park and from Lake No. 1 in Jasper National Park during this study. Both the Lost Lake (east of divide) and Trout Lake (west of divide) populations showed completely identical COI haplotypes indicating the distribution and genetic diversity of A. coloradensis is not noticeably affected by the Continental Divide. Moreover, the Jasper National Park populations (just east of the divide) differ both from the Trout Lake and Lost Lake populations by one mutation. It is therefore likely this small genetic difference is not due to processes related to the Continental Divide but simply a matter of geographic distance.

**Future Studies**—Although the abundance of Acroloxus coloradensis in Lost Lake appears quite good, the discovery of a potential competitor, the limpet Ferrissia fragilis, certainly warrants additional investigation if the conservation of Acroloxus is a primary goal. A detailed food web study would be helpful in predicting complex interactions between these limpets and their food resources and a more thorough understanding of the biology of the species is needed. Perhaps differences in the life history of these two limpets will allow them to coexist or perhaps they utilize different habitats and food resources, though our initial studies suggest they do not.

It would be interesting to see if either limpet in Lost Lake would shift to using the upper surface of rocks if brook trout were removed, or if their selection of the bottom of rocks has more to do with type of algae and/or detritus present or some other physical parameter (e.g., light). Whether brook trout prey on limpets during winter months could also be determined with a gill net set in winter (with some effort!).
Summer 2005 REU Program

Summer is a busy time at the Station. Students, visiting researchers and various groups are here throughout the summer going about their studies, field/lab work and meetings while enjoying the amazing location. What is unique this summer is the Research Experiences for Undergraduates (REU) program, which is resuming after a 1-year hiatus. Over 85 good to excellent applicants competed and 10 were selected based on “goodness of the fit” to ongoing Station projects.

As the selection team read through the applications, they could not help but feel very positive about the future of science—there are so many solid students the team would love to have working on Station projects.

The REU program consists of a week-long overview phase of the ongoing research programs, a conceptual development and planning phase of 2 to 3 weeks with a mentor scientist, and a personal research phase of 6 to 7 weeks. The program concludes with individual presentations at an REU Symposium and archiving of the individual REU reports in a web-accessible form.

Students are immersed in the collaborative science environment of FLBS with many opportunities to consult with other researchers as they design and complete their independent research projects. REU students are assigned to a mentor scientist and research project based on their professed interests and become full members of a research team.

May through October Field Research

From May through October, many of the Station’s graduate students, research staff and volunteer researchers are heading out to various locations as part of the SaRON project. These individuals will be part of four field crews working on the Kitlope and Skeena (BC), the Kwethluk (AK), the Kol (Kamchatka) and the Utkholok (Kamchatka) Rivers.

The Salmonid Rivers Observatory Network (SaRON) research focuses on salmonid habitat requirements that appear to vary with life history stage and in relation to population structure. A multidisciplinary project team was assembled to document salmonid biodiversity and productivity, as controlled by natural and cultural processes, of a suite of pristine Pacific salmon river ecosystems (observatories).

One aspect of this project team is the matrix relationships where key personnel from many diverse groups meld their skills and contribute toward common goals of 1) quantifying biophysical processes producing the Shifting Habitat Mosaic (SHM) and associated biodiversity in the observatory rivers, in context of influences on salmonid population structure and productivity and 2) devising and promoting a new conservation and management protocol for wild salmon rivers that is based on the SHM model.

Cooperator organizations involved in SaRON are the Wild Salmon Center, Moscow State University, Na’na’kila Institute, U.S. Geological Survey, Wild Salmonid Genetics Laboratory of The University of Montana, Alaska Department Fish and Game, U.S. Fish and Wildlife Service, Alcan Corporation and Flathead Lake Biological Station. This work is funded by the Gordon and Betty Moore Foundation as a part of its Wild Salmon Ecosystems Initiative.

Summer Session 2005 Courses

The following courses are being offered at the Biological Station in 2005: Ecology, Landscape Ecology, River Ecology, Lake Ecology, Conservation Ecology, Alpine Ecology and Ecology of Mammals. These courses, available for either undergraduate or graduate credit, involve hands-on field study and an excellent student to instructor ratio. Additionally, many generous scholarships are awarded to students interested in studying at the Station.

This year in addition to our regular web posting about Summer Session, our webmaster, Jeremy Nigon, created an audio and visual presentation for prospective students enabling a person to easily and quickly absorb information about the academic program (see http://www.umt.edu/flbs/Education/Summersession.htm).
Among the 17 Canadian and 20 American participants, a clear consensus was drawn—the region is a globally unique nexus of converging ecosystems and biodiversity. It was through this forum to review what is known about the Crown that an absence of detailed ecological mapping and modeling, especially in the Canadian portion of the ecosystem, became a recurring theme. “The Rockies’ biological hotspots, its wetlands and flood plains remain unmapped and undervalued in both British Columbia and Alberta,” according to University of Alberta biologist Dr. Suzanne Bayley.

This lack of information is even more significant in the face of exploding rural residential sprawl and landscape-scale energy extraction. “Southern Alberta is one of the driest regions in North America,” noted Schindler. “The only water they have to work with comes from the glaciers and snow packs of the Rockies.”

Information deficiencies about resources, landscapes, water and wildlife were articulated and compiled during the summit. The chairperson’s summit report is forthcoming, but an initial list from the summit follows:

- Impact of shrinkage of alpine climate on high-altitude species such as goats and sheep
- Impact of warming climate on fire frequency and intensity
- Baseline stream water quantity and quality
- Cumulative impacts on stream systems of factors such as fire, pine beetle and coal mining
- Impact of Calgary's growth on nearby mountain playgrounds
- Accounting of goods and services provided by the ecosystem to human economy and society
- Fish and wildlife migration patterns
- Role of linear disturbances such as roads and seismic lines in spread of alien species
- Impact of gas field activity on transboundary airshed
- Identification and mitigation of barriers to wildlife movement
- Identification of unsecured landscapes that have special social and ecological importance

An institutional framework for collecting and sharing ecological information about the Crown of the Continent, which is divided into five often-conflicting national, state and provincial jurisdictions, is needed. Stanford concluded, “There needs to be some kind of cross-cutting scientific committee, commission or coalition to address this situation before the integrity of the region is permanently compromised.”

A paradigm of collaboration and cooperation is essential. “The stream network is the blood supply of the whole system,” said Stanford. “River flood plains are the most endangered landscapes on the Earth.”

Visit the Flathead Lake Biological Station website for job postings, workshops and other Station news at http://www.umt.edu/flbs/
Captivated by the Kitlope River Ecosystem, British Columbia

By Rachel Wilkinson, Volunteer Research Assistant

After Summer Session in 2004, I participated in a 6-week field expedition based in Terrace, British Columbia. It was an amazing experience observing salmon on the Kitlope River, a river that is part of the world’s largest uncut temperate coastal rainforest.

While having the privilege of attending Flathead Lake Biological Station (FLBS) summer courses on scholarships in 2003 and 2004, I came to know about this project and lined up a position as a volunteer research assistant with FLBS principal investigator and professor, Dr. Jack Stanford.

After graduating from The University of Montana last summer, I made my way to Terrace, BC to do field research on the Kitlope. The field research is part of a larger program called the Salmonid Rivers Observatory Network (SaRON). SaRON is a collaboration of the Flathead Lake Biological Station of The University of Montana with the Wild Salmon Center (WSC), Moscow State University (MGU) and others that have assembled a multidisciplinary team of scientists to document salmonid biodiversity and productivity in a suite of pristine Pacific salmon river ecosystems (observatories).

In 2004, the FLBS began partnerships with the Yukon Delta National Wildlife Refuge of the US Fish and Wildlife Service for work on the Kewthluk River in Alaska and the Na'na'kila Institute and Kitamaat Village Council for work on the Kitlope River in British Columbia, Canada.

The Kitlope was put under environmental protection 10 years ago by a dedicated group of people. It is now the Kitlope Heritage Conservancy Protected Area.

Arriving in mid August, I was fortunate to set foot in the beautiful Kitlope wilderness in time to partake in the Celebration, a gathering to mark 10 years of protection for the Kitlope. Many key people involved in preserving this wilderness attended including many Haisla, a First Nations denomination native to the Kitlope.

The Celebration was an incredible cultural experience. I will always remember sitting at the edge of Kitlope Lake in the dark, around a fire with a Haisla elder and others who have helped conserve this wilderness. An eagle feather was passed around the circle and as each person held the feather, they spoke about their feelings of the Kitlope. I had only been in the Kitlope for a few days, but the place had already touched me, and I was very thankful for all the hard work of the people sitting around me.

Inspired by this exchange and through the work, I learned a great deal about research methods and the study area. To reach the study area, we traveled about 100 miles by jet boat, a trip that took around 4 hours. Once we were there, we traveled everywhere by jet boat and after learning how to operate one, the sampling trips, already an adventure, had an added element of excitement.

We stayed in the Kitlope between 4 and 15 days at a time, so we didn’t make many of those long 4 hours trips. We collected different samples each day, ranging from algae and plant samples to collecting juvenile and adult salmon.

In our field forays, we spotted bald eagles everywhere; we saw many black bears and a few grizzlies. And the glaciers, which would be spectacular in any hue, were brilliant blue.

This wonderful opportunity provided me with the necessary experience to be accepted into a good graduate program. I am currently enrolled in the graduate program at Idaho State University, Department of Biological Sciences. My major professor is Dr. Colden Baxter, formerly one of Dr. Hauer’s graduate students at FLBS.

Rachel Wilkinson in BC, Canada

Graduate Student News

Presenting Dr. Samantha Chilcote

Samantha Chilcote was hooded by her major professor and mentor Dr. Jack Stanford during graduation ceremonies on May 14, 2005 at UM; a triumphant moment not to be forgotten, at least until Sam gets swept away by another science mystery begging for her time. When Sam first arrived at the Station, she was reluctant to take on the advice of her advisor. Stanford said, “Study ponds.” She was determined instead to study human impacts of dams and regulated rivers as this surely was a way to help mitigate negative impacts.

But as Sam began to execute the work on ponds, which at first blush seemed mundane, a slow but steady affection bloomed into outright passion and respect. As it turned out, there was plenty of drama and complexity at pond scale. And the epiphany of
the importance of pond/river interactions chipping away at what ecologists do not know made Sam realize her work had solid intellectual impetus.

It has become increasingly necessary that we understand the complex functioning of unregulated river ecosystems not only for its role in basic life-sustaining processes, such as photosynthesis and respiration, but also for the goods and services provided by watersheds, ranging from wildlife and fish production to migration corridors to water filtration. Sam’s study exclusively addressed the paraluvial form of floodplain ponds and results of this study will allow another component of the shifting habitat mosaic of flood plains to be integrated into a holistic framework of understanding. This will not only aid professionals in management decisions, but will also allow a more accurate valuation of lateral floodplain habitat resources.

Currently, Sam is submitting three papers for publication from her dissertation, “Ecology of Parafluvial Ponds.” She spent the past three months across the Straits of Magellan in Chile, conducting a rapid assessment of fish community structure and habitat use for the Wildlife Conservation Society. The ultimate goal of this study was to evaluate the potential for a sustainable sport fishery focusing on exotic sea-run brown and steelhead trout in order to generate income for conservation objectives.

Sam may soon be off to Russia to study a river in the Primorsky Region on the mainland close to the North Korean border. So before she gets whisked away for more field work, we want to say…

Congratulations, Dr. Chilcote!

Aaron Hill and the Kitlope

At 800,000 acres, the pristine Kitlope watershed is one of the largest, coastal temperate-rainforest watersheds on Earth. Located about 150 miles south of Terrace, British Columbia, the Kitlope is stunning in its grandeur, and renowned for its towering mountains, sheer granite cliffs, waterfalls, glaciers and old growth forests. In 1994, the Haisla First Nation and conservationists from around the world succeeded in convincing the BC government and the West Fraser Timber Company to set it aside as a protected area.

This primordial wilderness is very close to Aaron Hill’s home town of Terrace. Aaron is working on his M.S. at the Bio Station under the mentorship of Dr. Jack Stanford.

Aaron's father, Bruce Hill, was one of the conservationists involved in the struggle to protect the Kitlope, and later started Kitlope Ecotours in partnership with Gerald Amos, a former Haisla First Nation Chief.

After repeated trips on the Kitlope River, Aaron wanted to learn more about the ecology of the place. So, when Aaron began looking for potential mentors for graduate studies, he was really looking for someone who could facilitate his desire to study in the Kitlope.

Word got around that a world-renowned American scientist named Jack Stanford was being funded to set up a network of observatory biostations on salmon rivers around the Pacific Rim. The Kitlope was one of the rivers Jack had his eye on. When Dr. Stanford went to Vancouver to meet with Bruce and Gerald to discuss operating in the Kitlope, Aaron was there too.

After hearing more about Jack’s research program and the Flathead Lake Biological Station, Aaron was convinced this was something he really wanted to do. And Jack was looking for someone who knew the area, so Aaron applied and was accepted to The University of Montana for graduate studies.

The research program is called the Salmonid Rivers Observatory Network (SaRON). It spans two continents and is funded by the Gordon and Betty Moore Foundation. FLBS and various co-operators have assembled a multidisciplinary team of scientists to document salmonid biodiversity and productivity of pristine Pacific salmon river ecosystems (observatories). The Middle Fork of the Flathead River serves as a reference site, thus building upon the FLBS research funded by the National Science Foundation.

The 2004 Kitlope crew included Candice Wilson, a Haisla representative and an undergraduate in the Environmental Sciences program at the

(Continued on page 10)
Aaron Hill and the Kitlope
(Continued from page 9)

University of Northern British Columbia and Rachel Wilkinson, a UM
graduate.

SaRON’s first season in the Kitlope went remarkably well, considering the logistical and bureaucratic challenges inherent in beginning an operation in a remote wilderness area in another country. But with some help from local individuals, organizations and agencies, Aaron and his various helpers were able to collect enough data to begin making the requisite cross-site comparisons to other rivers in the observatory network.

The SaRON jet boat—a 17’ welded aluminum skiff—was put to the test running the full gamut of conditions one should expect on BC’s wild, wet coast, ranging from 6-foot waves on the 4-hour saltwater ride from Kitimaat Village to the mouth of the Kitlope River, to high-stakes maneuvers in the river through boulder fields and around massive log jams. Along the way, the crew observed mountain goats, grizzly and black bears, beavers, otters, harbor seals, moose, deer, whales, porpoises, bald eagles, falcons and, of course, plenty of salmon.

At the end of last field season, Aaron came away with a slightly beserk disdain for mice, although Aaron claims he knows nothing about mouse cuisine—leaving that to famous Canadian story-teller, Farley Mowat (in “Never Cry Wolf”).

Far outweighing his contempt for the little animal was the gratifying experience from spring to fall in one of his favorite places in the world, the Kitlope, where he will be through October 2005 doing his research.

With this field season already in progress, Aaron is beginning his thesis project. Aaron will be attempting to reconstruct historic salmon abundance and lake productivity in Kitlope Lake over the last 200 years by analyzing lake sediment cores.

Essentially, freshwater systems are fertilized by nutrients from the spawned-out carcasses of salmon that have returned from the ocean to spawn in their natal streams. It is thought that this sets up a positive feedback cycle, whereby the increased productivity in the lake creates an increased forage base that benefits the next generation of juvenile salmon.

These marine-derived nutrients have distinct chemical signatures which show up in sediments that settle to the bottom of the lake year after year. Looking at how the levels of these and other distinct chemical signatures change in the lake sediments over time tells how the numbers of salmon returning to the system have changed over time, as well as how this has affected the productivity of the lake, and how this has all been affected by climate change over the years.

By looking at how these factors have played out over the past 200 years, Aaron is hoping he can get an idea of how the salmon populations in coastal rivers like the Kitlope will respond to commercial harvest and climate change.

Aaron began his academic career working towards a liberal arts degree in Geography at the University of Victoria in Victoria, BC, with a focus on resource management. Later, he switched to a science program and tacked on a minor in Biology. Aaron’s honors project dealt with the use of satellite imagery to examine the effects of hypernutrification from salmon farms on coastal water quality.

Beyond academia, Aaron spent several bug-infested seasons on some of BC’s finest clearcuts, planting trees and mowing down their competition with various powersaws. Aaron also complemented his academic pursuits by working extensively as a fisheries observer on the Skeena River and on the wild west coast. And before joining the FLBS program, he spent time as a ‘sustainable aquaculture researcher’ for the Sierra Club of BC.

In his rapidly dwindling spare time, Aaron fancies himself an amateur snowboarder, surfer, diver, fisherman, musician, mechanic and conspiracy theorist.

The Flathead Lake Journal is published throughout the year by the Flathead Lake Biological Station (FLBS) and Friends of the FLBS, Inc. This issue was co-edited by Marie Kohler and Sue Gillespie.

Views expressed in the Flathead Lake Journal do not necessarily represent the official position of the Flathead Lake Biological Station, The University of Montana or Friends of the FLBS. Editors and publishers disclaim any responsibility or liability for such material.

Welcome to
Kenna Renee
Born May 25, 2005–2:30 am
Second child of Eric and Michelle Anderson

Subscription Rates: Individual $15/yr—Family $20/yr
Larger donations are gratefully accepted.
Subscription renewal month is January; subscriptions are retro-active to beginning of the calendar year and are tax deductible. To subscribe, send check payable to Friends of the Flathead Lake Biological Station:
Friends of the FLBS, Inc.
c/o Bonnie Ellis, Treasurer
311 Bio Station Lane
POLSON, MT 59860-9659
Mother’s Day Mayhem: Eagles vs. Bear

Each year, bald eagles return to nest in this tree on the Station grounds at Yellow Bay. In the early afternoon of May 8, Vic and Chris Schroeder observed this black bear in the nest and their quick action snared this one of a kind photo. Just moments before the photo was taken, Chris noted, “The bear (red arrow) had just turned completely around in the nest to face the eagle in the tree.” Since the bear incident, Station resident Bonnie Ellis noted the eagles (blue arrows) have been seen a few times hunting in the bay, but no longer appear to be using the nest.

Scott Relyea
FLBS Research Coordinator

During the spring of 2002, Scott was working at Idaho State University in the Center for Ecological Research and Education’s Analytical Laboratory while finishing his Master’s Thesis. A couple of friends showed him a job opening at the Flathead Lake Biological Station. The job description matched his experience and education in Aquatic Ecology and Analytical Chemistry so he decided to apply. Soon afterwards, Scott was hired as the Research Coordinator and began work in June 2002.

Scott orchestrates field sampling on the Station’s Nyack Flood Plain study of the Middle Fork of the Flathead River, oversees the Freshwater Research Laboratory’s quality assurance/quality control program and serves as a liaison with local government agencies and public interest groups. He also conducts many other shorter duration studies.

Scott’s wife, Christina, is finishing her Ph.D. in Stream Ecology at Idaho State University. The Relyeas’ completed their move from Pocatello, ID to a home south of Bigfork in October, 2003, when they finally sold their house in “Pokey”.

Scott and Christina, now expecting their first child, continue to explore this region with its many trails, lakes and rivers by foot, ski and canoe.

Joann Wallenburn
Data Management Specialist

Joann Wallenburn started working at the Station in July 2004 as a Data Management Specialist, assisting the Data Manager with organization and storage of research data and the design and development of tools to enter, validate and retrieve data.

After working as a Medical Technologist for 15 years and specializing in blood banking, Joann returned to school at North Carolina State University to pursue a degree in Computer Science and received an M.S. in Computer Science in 1990.

Taking her combined background of laboratory and computer science into environmental and pharmaceutical labs, Joann designed and developed network, data-reduction, management and reporting systems for ten years prior to moving to Montana.

Joann married her long-time friend, David, in 2001 and they soon started realizing their dream of living in the Rockies by purchasing property in nearby Seeley Lake. David and Joann moved to Montana in April, 2004 after David was hired to fly the Alert II airplane for a local, regional hospital. Joann’s daughter, Rachel, attends the University of North Carolina-Wilmington in pursuit of a business degree.

Joann and David enjoy aviation, astronomy, orienteering, canoeing, downhill skiing, snowshoeing, cross-country skiing and snowmobiling in their new home state.

Scott Relyea in the field
FLBS Open House and Seminar

The public is invited to a free open house at the Flathead Lake Biological Station located on the East Shore of Flathead Lake (Highway 35), 17.5 miles north of Polson or 14 miles south of Bigfork. The open house is scheduled for July 20, 2005 from 2:00 PM to 6:30 PM. Join our students, professors and staff in facility tours, guided nature walks and boat trips/demonstrations on the research vessel, Jessie B, or spend time browsing research project displays and posters.

A free seminar, open to the public, is offered on Thursday, June 30, 2005 at 7:00 PM. The topic is “Conservation research on a New Zealand treasure, the tuatara.” The presenter is Dr. Nicky Nelson, Coordinator of the Masters in Conservation Biology program at the Victoria University of Wellington in New Zealand.

The tuatara (Sphenodon) is a reptile native to New Zealand and is considered a living fossil. Its closest relatives are a group of reptiles that vanished 100 million years ago. Dr. Nelson is currently working on a case study to find out how the tuatara (Sphenodon spp.) will cope with global warming related to their temperature-dependent sex determination (TSD). Also, Dr. Nelson is working with the New Zealand Department of Conservation and the Māori to translocate tuataras to a new island location, Whakaterepapanui, as part of an ecological restoration program.

For more information and other announcements about Flathead Lake Biological Station, see the web page at www.umt.edu/flbs.