



Science in the Crown

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Glacier's White Water Divers

By Melissa Sladek

Late summer sun shines through the car window as we drive along Upper McDonald Creek on the Going-to-the-Sun Road in Glacier National Park. Warren Hansen, a University of Montana graduate student, drives slowly, listening to a transmitter-receiver that is tracking harlequin ducks. A faint click and then a louder and stronger “blip, blip, blip,” emanates from the device. We inch our way along the road, hoping the beeps will increase in strength; soon the receiver is silent. Warren swings the car around and drives back down the road until the radio once more comes to life. Stopping where the signal is strongest, we pull over, gather our gear, and head out on foot toward the creek, eager to catch sight of the bird responsible for the receiver’s activity.

Harlequins are small sea ducks that spend their winters along the coastal waters of North America and migrate inland in the spring to breed alongside mountain streams. These showy birds with their rounded heads and stubby bills



Photo by Warren Hansen

One of Hansen's study birds, this female takes a break from the white water. Notice the transmitter attached to her back.

are white water experts. In the winter, they live along rocky coasts in the midst of rough surf waters. In the summer, these charismatic ducks make their home in the frothing white water found in fast moving mountain streams. Here, they dive under water to forage for aquatic insects and are also able to dabble, or walk, along the bottom of the creek searching for insect larvae attached to rocks.

It is these white water divers that I have come to see.

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SCIENCE IN THE CROWN

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Crown of the Continent
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CCRLC is part of a network of research learning centers that the National Park Service established to promote research and scientific understanding.

Director's Corner

By Tara Carolin



The larch needles are falling outside and paving the trails with gold while we wrap up another terrific season at the Crown of the Continent Research Learning Center. This year, we were fortunate to have the National Park Service's Youth in Parks program support two citizen science interns and one sustainability intern. Joe Porter and Abby Strom were great assets to our Citizen Science Program, helping with training and organizing our cadre of citizen scientists. It was also a delight to have Andrea Miller help us with a variety of media products on sustainability along with initial work on our dark skies lighting assessment. The summer seemed to pass in the blink of an eye this year, and already we miss the smiles and enthusiasm of our young interns and wish them well in their future endeavors.

Our second year of working with students in Flathead High School's International Baccalaureate program and a newly created curriculum led to a successful season for our Youth Exploring Science (YES!) program. In YES!, our student citizen scientists acquire experience with field data collection, hypothesis testing, and data analysis, providing them with real-world experience in scientific research. In addition, several college groups and some scout troops also contributed to our Citizen Science Program.

For those who are only in the park for a short time and are looking for citizen science opportunities, we

launched an on-line training for the Invasive Plant Citizen Science Project. Visitors can take the training and download information before leaving home, and be ready to hit the trails to collect data as soon as they arrive at the park. Additionally, we are indebted to over 100 citizen scientists who donated their time and energy to improve our knowledge about mountain goats, pikas, loons, invasive plants, golden eagles, and aquatic insects over the past year. Glacier National Park Fund continues to be our primary funding support for citizen science.

A few other 2012 highlights include several workshops we sponsored or assisted. We worked with the NPS National Climate Change Response Program to train staff and partners in climate change communication methods as well as teamed up with the National Parks Conservation Association to host a sustainable business workshop for neighboring businesses. Partnering with Glacier's Division of Interpretation and Partnerships, we held a social media workshop aimed at our park partners and organized a climate change workshop for teachers nationwide, funded by the National Park Foundation and co-hosted by the Glacier Institute.

Of course, none of these accomplishments would be possible without the hard work of our Citizen Science Coordinator, Jami Belt, our Science Communication Specialist, Melissa Sladek, our Librarian, Sheree West, and our Program Assistant, Terry Peterson. As in other years, we have enjoyed interfacing with numerous research scientists and graduate students conducting studies in the park and highlighting their research to the public. We look forward to learning about new scientific discoveries and sharing them with you in 2013.

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I follow Hansen and his assistant, Alaina Strehlow, across a bridge that crosses Upper McDonald Creek. We stop and scan for harlequins in the water. Seeing nothing, we move on, trying to follow the now softer and slower beeps of the receiver. As Warren leads us through the thick forest canopy alongside the creek, he explains that he and his crew of biologists, volunteers, and veterinarians have surgically attached radio transmitters to 12 female harlequins of breeding age. These transmitters track the birds' movements and identify each bird's territory, the area used by an individual to forage, mate, nest, and raise their young. By studying the quality of each territory, Warren hopes to identify how both environmental and human factors are affecting the harlequins reproductive success.

Although harlequin numbers are relatively stable throughout the West, this bird is listed as a species of concern in Montana. Harlequins are rare in Montana, with a statewide population estimate of 150-200 pairs, and their older breeding age (3+) and low fledgling success make them more susceptible to environmental and human disturbances. In Glacier, breeding harlequins are mainly found along a 10 mile (16 kilometer) stretch of Upper McDonald Creek. This section of stream holds the highest density of breeding harlequins in the state, comprising 25% of Montana's harlequin duck population.

Due to their colorful appearance and their ability to maneuver frothing whitewater rapids, many visitors to the park flock to Upper McDonald Creek in the spring to see the harlequins return. Park

biologists are also interested in watching these birds and since 1999 have monitored the numbers of breeding pairs and chicks reproduced each year. When no chicks were observed in 2010, they began to realize that to successfully manage harlequins, more research was needed on identifying the key factors that influence chick production and survival.

This is where Hansen's research comes in. His master's thesis is a three-year study that began in 2011. In a nutshell, Hansen is looking at two potential factors that might be associated with nesting success: stream flow variation and human disturbance.

The timing and fluctuation of stream flow is important to the harlequin's nesting success. Females build their nests close to the water, usually within one meter of the water's edge, in late May to early June. The ducks wait for stream levels to drop before laying their eggs and incubating them. Although timing and amount of spring run-off is variable from year to year, most streams experience a peak flow followed by a drop off. However, the flashiness of a stream, or how quickly a stream rises or falls in response to weather events, can be exacerbated by numerous factors, including climate change.

In recent years, Northwest Montana has been experiencing more extreme weather events. We are seeing rain falling on snow in winter, periods of heavy, erratic rainfall in summer, and changes to our normal avalanche regimes. These extreme weather events, thought to be the result of our rapidly warming climate, result in greater stream variation. For harlequins, this fluctuation in stream flow could be the loss of a nest. If Upper McDonald Creek

is affected by heavy rain or snow melt after reaching its peak flow, the rising water could wipe out the already nesting harlequins.

To determine whether or not stream flow variation shows a correlation with chick survival, Hansen is using 20 years of [Snowtel](#) data to design a model showing the average stream discharge of Upper McDonald Creek. He is calibrating this model using actual stream data taken from a gauge, located just above Lake McDonald, which measures the height of the creek. Measurements have been taken on a nearly daily basis during the study. Once Hansen has established an average stream discharge for Upper McDonald Creek, he can identify significantly high and low water discharge years, compare it with historical brood survey data, and determine if high stream flow during key nesting times affects harlequin chick survival.



NPS Photo

Hansen marks the location where harlequins are spotted using his GPS.

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Hansen's study is also looking at the potential effects of human disturbance on harlequin ducks. With an average of 2 million visitors a year, human presence is definitely a factor in Glacier National Park. But, it is not understood if our presence has an impact on the ducks. To determine this, Hansen is tracking his 12 study birds in order to map each bird's territory and identify if that territory is in a section of creek with high human activity. Using a device called an Automatic Receiving Unit (ARU), he is also recording how frequently harlequins are found in high-human use sections of the creek (pull-outs along the Going-to-the-Sun-Road) versus low use sections of Upper McDonald Creek.

In addition, Hansen is documenting the stress levels in his study group by taking blood at capture, sampling feces, and looking at stress hormones in feathers. This information will show the overall stress physiology of the bird. If there is a correlation between high stress levels in ducks whose territories experience high human use, it may be that human disturbance is associated with low reproductive success.

This information is important for resource managers because if humans are having a significant impact on harlequins, new management strategies could be put in place to protect them. But, if it's not people causing lower chick numbers, then it's important to understand what is. That is why Hansen's stream flow analysis is another critical piece of this research project. As Hansen explains, "It's important to be able to document environmental impacts, things that are critical in our understanding of harlequins. We can't change snowpack (amounts) or the weather, but



Photo by Warren Hansen

Harlequin chicks are able to navigate rapids found in fast-flowing streams right at birth. Females generally stay with their chicks until they fledge.

it would be great to understand it," and consequently how those impacts might affect the harlequin's ability to survive in the future.

Stepping out of the forest canopy into the bright sunlight, we perch on the side of a steep bank overlooking the creek. Hansen and Strehlow scan the creek. "Over there, two females!" Strehlow proclaims. Using his binoculars to look for leg bands, Hansen determines it's a female and a chick outside of his study group. Nearby, the researchers soon discover 'IG', one of Hansen's 12 banded birds and the cause of the transmitter's activity. As the scientists observe the birds and discuss their movements, I search in earnest to find these beautifully camouflaged brown-gray females. Seeing nothing, I interrupt Hansen and ask where he is looking. To my amazement, he informs me that the female and chick are just below a large boulder in the midst of a swirling rapid. I raise my binoculars once more and after a minute, see two small gray ducks bobbing up and down. Then, in an instant, they disappear, diving under the water.

The chick's ability to navigate these rough waters right from birth amazes me and I begin to think how incredible this bird is. It's clear why people come from near and far to see them. Perhaps it is the harlequin's uniqueness that draws us to them, and our passion is actually a detriment to the very thing we hope to see. Or perhaps their unique adaptations and particular habitat requirements cannot withstand even the slightest change. Whatever Hansen's research brings to light, I am comforted, for now, that Glacier's harlequin population is stable and am hopeful that in the future there will still be breath-taking opportunities to see these white water divers, even if our view is from a greater distance away.

Funding for this project provided by U.S. Federal Highways, Glacier National Park Fund, and CCRLC's Jerry O'Neal Fellowship.

A Forty-Year Love Affair with Ptarmigans

By Terry Peterson

On a cool brisk morning in July, I traveled with my fellow students up to Logan Pass in Glacier National Park (GNP). Our professor, the esteemed ornithologist Dr. Phillip Wright, was in charge of the expedition and our search for the white-tailed ptarmigan, the snowy white bird of the alpine. After parking the University's International Harvester Travelall, a classic SUV of the day, we huddled in the parking lot gathering our gear. I checked my day pack for a windbreaker, my water bottle, and the delicious looking peanut butter and jelly sandwich loaded with my mom's huckleberry jam. The year was 1972 and my excitement was building. Not only was I going to one of my favorite places on earth, my classmates and I had been given special permission to 'walk anywhere out there.' This was a rare opportunity granted to only a few as most people were directed to stay on the newly constructed boardwalk, which had been built to lessen visitor impact on the area's fragile alpine environment.

I sighed, closed my eyes to ingrain the day into my memory, and fell into line with my fellow students as we hiked up the boardwalk to the sun-filled alpine meadow. We passed by squeaking Columbia ground squirrels, colorful alpine flowers, and recent bear digs, and then fanned out along beautiful, chiming rivulets of water, on the lookout for ptarmigan. Thus began my love affair with high places and ptarmigan, the only bird that spends its entire life in the alpine.

Well-adapted to this environment, ptarmigans are found in higher elevations where temperatures are cooler. They are particularly

susceptible to high summer temperatures; above 70° F (21° C) can actually be detrimental to them, making it necessary for them to find suitable habitat that is cool and moist. David Benson, a professor at Marian University and a park naturalist at Glacier,

became interested in how this small alpine grouse was responding to climate and habitat changes and its potential to adapt in the future. He began studying ptarmigan in 1995, after visiting the park on his honeymoon and deciding that this was a perfect place to begin his Ph.D. project. If the park continues to warm, this little grouse, weighing around a pound and measuring a foot long, may need to move or adapt to survive or otherwise face local extinction.

Ptarmigan are closely tied to areas of snow and water in late summer, which create a cool microclimate for them. Unfortunately for ptarmigans, less snow and ice is available to them as temperatures rise. Higher elevations (above 6,000 feet/1,829 meters) in Glacier have experienced an average temperature increase of 1.6° C (2.9° F) over the last century; three times the global average. Glaciers and perennial snow cover have decreased and the number of glaciers has declined from 150 to 25 since the 1880s.



Photo by David Benson

Mottled brown and gray in the summer, ptarmigans change to white when the days get shorter and winter is on its way.

Unfortunately, Benson's study documents a decline in numbers of ptarmigan at Logan Pass. Past research from the 1950s documenting the numbers of ptarmigan that flock together in late summer, after the breeding season, shows an average of 55 birds at Logan Pass. Whereas, in the late 1990s, Benson documented only 26 birds. Additionally, over the last four years, he recorded an average of only 15 ptarmigans using Logan Pass in late summer. His findings have also shown a similar decline in breeding season numbers. According to Benson, this reduction in ptarmigan numbers may be caused by changes in habitat due to a changing climate at Logan Pass.

Looking back on that day in 1972, I am in awe of the numbers of ptarmigan broods I saw. Our professor explained that these little birds live on mountain tops, making one population isolated from another. 'Island populations' are well-adapted to their

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environment, but genetically vulnerable to change. Their resilience, the capacity to absorb disturbance, is strongly affected by their genetics. Benson's recent findings are showing this 'vulnerability to change.' His research indicates that ptarmigan flocks on Logan Pass have moved 335 meters upslope between the 1990s and 2009-2010. This is consistent with studies on other species such as butterflies that have changed habitat locations, shifting up in elevation. Benson explains that his study, "demonstrates that White-tailed ptarmigan in GNP have changed distribution, altered habitat preferences, and perhaps on a local scale, experienced declining population numbers in late summer. As climate changes, species distribution, habitat, and demography are being affected."

This past winter, while working as an educator and interpreter, I was one of the lucky ones asked to help with a new Logan Pass exhibit for children. Researching for this wayside not only rekindled my

affection for this hardy little bird, but reminded me of its uniqueness. Ptarmigans have feathers on their feet and enlarged feet that act like snowshoes. They also have feathers in their nose so when they dive into the snow to get warm in winter, they won't get snow up their nose. . .well not quite; it is really an adaptation so the air they breathe is warmed before it reaches the lungs, thus conserving energy. They are beautifully white in winter and mottled brown and gray in summer. The signal for a change in clothing (feather) color is primarily based on the amount of daylight, not temperature. As the snow comes later or melts earlier each year, they may be more vulnerable to predation. It is these amazing adaptations that allow this hardy bird to survive in the alpine, but it is this uniqueness that may also be its downfall as the climate warms.

This summer, like so many summers ago, I hiked around Logan Pass searching for and admiring these birds of the alpine. Unlike my earlier experience, I did

not have permission to 'fan out' and walk across the fragile alpine plants. But just the same, I scanned the area with binoculars, checking for scrapes, where vegetation forms a rim around a nest. I also looked for ptarmigan picking buds, stems, insects, flowers, and fruits for food. I didn't see nearly the numbers of birds I saw that day in 1972, but to be fair, I didn't spend all day looking. Still, I have a sinking feeling that Benson's study is accurate, and ptarmigan numbers are on the decline. Although I have noticed changes in my own life that I attribute to a changing climate, one thing has stayed the same. Just like that day in the past, I am still excited to be here, in Glacier National Park at Logan Pass, enjoying my peanut butter sandwich with my homemade huckleberry jam. Hopefully, there will always be ptarmigans close by to join me.

Climate Change Teacher Workshop

By Staff

This past summer, teachers from around the country came to Glacier National Park for a teacher workshop focused on climate change. Participants learned about climate change research in the park and current impacts our changing climate is having on Glacier and the surrounding area.

The four-day workshop included presentations from NPS staff, researchers from the United States Geological Survey (USGS), and [Glacier Institute](#) staff, our partner and host for the workshop. The days were chalk full of learning, exploring, and sharing and our

participating teachers were given a multitude of resources and ideas of how to teach climate change to middle and high school students.

As part of the Parks Climate Challenge (PCC), funded by the National Park Foundation, participating teachers designed and implemented a service learning project for their students during the 2012-2013 school year. Projects further enhance student understanding of climate change and will be posted on the [PCC website](#). Thanks to all of the talented and dedicated teachers who made this workshop a success!



NPS Photo

Teachers learn about aquatic insects found in clear, cold, connected streams.

New Citizen Science Highlights

By Terry Peterson

CRCRLC staff has been busy again this year managing Glacier's Citizen Science Program. Our High Country, Common Loon, and Invasive Plant Citizen Science Projects are still going strong with citizen scientists continuing to collect valuable data. But this year, we have also been hard at work finalizing new scientific articles and implementing new protocols and projects.

Two articles were published in professional publications this year. Jami Belt, Citizen Science Coordinator, and Dr. Paul Krausman, professor at the University of Montana, published **Evaluation Population Estimates of Mountain Goats Based on Citizen Science** in the *Wildlife Society Bulletin* (36(2):264-276; 2012). This peer-reviewed article demonstrates that Belt's research on multiple-observer surveys validates that citizen scientists can provide mountain goat population estimates that are statistically similar to those of biologists. In addition, data gathered by volunteers not only obtains needed information for the park,

but also gives those volunteers an opportunity to 'give back' to the park while inspiring them to learn more about these amazing animals.

Also, Lucas Moyer-Horner, a Ph.D. student from the University of Wisconsin, teamed up with Matthew Smith and Jami Belt to publish an article based on his dissertation data, entitled **Citizen Science and Observer Variability During American Pika Surveys** in *The Journal of Wildlife Management* (9999:1-8; 2012). In the article, Moyer-Horner et al. explain their research on observer variability during pika surveys. Their data suggests that sitting surveys conducted by volunteers can reliably detect pika site occupancy. However, data on population dynamics of pikas (e.g., density) should be collected by professionals.

After documenting that citizen scientists collect accurate data and volunteers can reliably detect pika presence, we joined the Pika Inventory and Monitoring (I&M) Program, a larger scientific study currently in place at seven other national parks. This program uses standardized survey protocols to assess pika population changes. We are the first park of the group that will exclusively use citizen scientists rather than paid biological science technicians to conduct the surveys. I&M biologists spent the summer establishing 47 randomly selected pika survey sites in Glacier for us to monitor and implemented the new survey protocols.

Volunteers begin their survey by locating a site marker, which defines an individual pika territory (a 24 square meter area). Then they conduct a five minute

observational survey followed by traversing the talus for 15 to 30 minutes and documenting the number of animals sighted as well as the presence of scat, haypiles, or calls. Pika scat and photographs of haypiles are collected. Ongoing presence of pikas is confirmed if citizen scientists see a pika, collect fresh scat, or observe a fresh haypile during a survey. Each site is surveyed up to three times, or until pika presence is confirmed. These new pika protocols have been put in place and explained to our enthusiastic citizen scientists. By joining such a large standardized study, our data will be useful to pika studies across the West.

Along with this new pika protocol, we introduced a citizen science project focused on collecting adult life stages of rare, aquatic insects in high elevation streams and seeps in the park. This effort is part of a larger United States Geological Survey (USGS) project that is researching the effects of climate change on the biodiversity of alpine streams. Many insects in these habitats are rarely encountered and have only been found in and around Glacier, with very little known about their biology. With the help of Joe Giersch, the aquatic entomologist at the Northern Rocky Mountain Science Center, we have established protocols for this project and our citizen scientists are now collecting insects that Joe can identify and record.

Thanks to all of our citizen scientists for making the Glacier Citizen Science Program a huge success. We graciously thank each of you for your dedication to Glacier National Park, this program, and our survey species. We look forward to seeing you next spring.



NPS Photo

Intern Joe Porter collects aquatic insects.

Intern Spotlight

By Andrea Miller

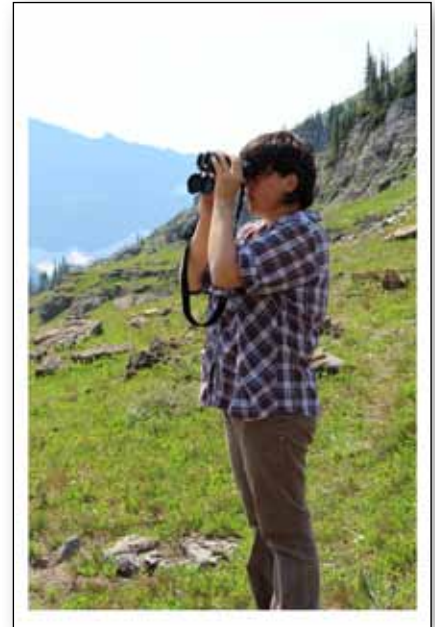
As a non-fiction writer quickly approaching graduation, I was delighted to be hired on as the Sustainability Communication Intern at the Crown of the Continent Research Learning Center (CCRLC) in Glacier National Park. This experience has been informative as well as fun and I enjoyed writing and researching for the various communication products I produced. In fact, working at Yellowstone last year and Glacier this year has been invaluable to me.

I feel the National Park Service (NPS) is on the leading forefront in implementing sustainable operations and in understanding how healthy ecosystems operate in diverse landscapes. I appreciate this and find it exciting to work at places where efficient and resourceful options are being pursued. It's also interesting to work with seasoned employees as well as others just beginning to explore NPS career opportunities. Not to mention, Glacier's astounding landscape has been awe-inspiring

and like Yellowstone, Glacier has stolen a piece of my soul.

I grew up in the Frank Church and Selway-Bitterroot Wilderness Areas so working in national parks with large tracts of protected land is a dream job and reminds me of home. Although my season was short-- three months is not a lot of time to get things done-- it's been a pleasure to see some of the projects I have worked on come to completion. I worked hard to create resource bulletins on mountain goats and loons and discovered pieces like these are edited and re-edited until all involved are satisfied with the end product. This causes me to smile because, as I know well, this is the life of a writer!

I also completed the layout for five new webpages on the topic of sustainability for Glacier's website as well as wrote informational blurbs for the CCRLC's new website. I ended my season piloting a lighting assessment project which will help the park in its efforts to become a [Dark Sky Park](#). Thanks much to the crew at the CCRLC for their many kindnesses and help throughout the season!



NPS Photo

Intern Andrea Miller scans a distant slope for mountain goats.

Crown of the Continent Research Learning Center

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Crown of the Continent Reseach Learning Center Goals and Mission:

- *Facilitate use of parks for scientific inquiry;*
- *Support science-informed decision-making;*
- *Communicate relevance and provide access to research knowledge; and,*
- *Promote resource stewardship through partnerships*

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