KBS K-12 Partnership

Spring Newsletter

Issue 15 Ecological Literacy in K-12 Classrooms April 2014

Inside

From the Directors

Dear KBS K-12 Partners,

After a long, cold winter the signs of spring are appearing! The buds on the trees are preparing to unfurl and the tulip tips are emerging from the soil. We have all had a slow start to the second half of the school year, but our partnership continues to grow! We are excited to share with you the activities of the GK-12 fellows in the classrooms and the events we have planned for the spring and summer in the following pages.

As always, we would love to hear from you. Contact the leadership team with any questions you may have and don't forget to visit our KBS GK-12 website at kbsgk12project.kbs.msu.edu for current news, event announcements, and lesson plans.

Until next time,

Tom Getty, Andy Anderson,
Phil Robertson & Sarah Bodbyl

GK12 Bioenergy Sustainability Project

http://kbsgk12project.kbs.msu.edu

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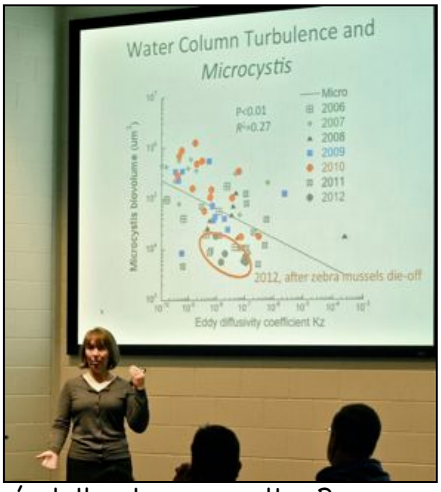
November Workshop Review



Our first workshop of the 2013-2014 year, titled: Water Cycling and Ecosystems, was a big hit! Fifty four teachers from all 15 of our K-12 partner districts attended and rated the workshop as one of our best yet!

Our plenary speaker was Zoology and Kellogg Biological Station professor Dr. Elena Litchman. Dr. Litchman gave a fantastic talk on her aquatic ecology research, sharing results from her studies of local Gull Lake all the way to the exotic Lake Baikal in Russia. She told us some great stories about both the 'good' and 'bad' phytoplankton she studies and how human induced environmental change (e.g. fertilizer run-off in Gull Lake or climate change at Lake Baikal) can affect the community composition of these miniscule critters. Workshop attendees particularly enjoyed learning about the robotic fish Dr. Litchman uses to sample aquatic ecosystems and watching video of the adorable Nerpa, the endemic and tubby Lake Baikal seals. For links to content from Dr. Litchman's talk, please see the Resources tab of the GK-12 website.

As usual, our crew of workshop presenters gave a super series of concurrent sessions. The GK-12 fellow sessions covered diverse water-related topics including: the effects of human contaminants on aquatic organisms, how weather drives food web dynamics in the Serengeti, and how wetlands provide indispensable ecosystem services. Teacher educator (MSP) presenters Miller and Anderson gave an informative session on tools to help students understand global carbon cycling. Coordinator Syswerda (at her last official workshop) and teacher Wininger gave a lesson on watershed dynamics of the Kalamazoo River. Special guests Greenler and Nye, from the Great Lakes Bioenergy Research Center (GLBRC), talked about research advances in cellulosic biofuels production.

A big thanks to all of those who attended and presented at the workshop, we hope to see you all at the next one in April!

Upcoming Events

April

4/22: Free admission to the Kellogg Bird Sanctuary for Earth Day. Contact: (269) 671-2510 or birdsanctuary@kbs.msu.edu

4/23: KBS K-12 Partnership Workshop. STEM: Environmental Engineering for Sustainability. RSVP with Sarah at bodbyl@msu.edu.

May

5/11: Mother's Day Brunch. KBS Manor House. 11AM and 1 PM. To reserve a table, please call (269) 671-2400 or email: manorhouse@kbs.msu.edu.

5/14: Dessert with Discussion, featuring Dr. Elena Litchman, "Microalgae in Lakes and Oceans: The Good, the Bad, and the Ugly." 7:30-8:30 PM, KBS Auditorium. Open to the public.

June

6/10: Pasture Dairy Open House, 4 - 8 PM. Open to the public. Contact: (269) 671-2402

6/23 - 6/25: KBS K-12 Partnership Summer Institute. RSVP with Sarah at bodbyl@msu.edu

KBS K-12 Partnership

Gobles and Vicksburg

By GK-12 Fellow Dustin Kincaid

I think it's fair to say this winter has challenged even the heartiest of us to question why it is we haven't established residency in a more southern locale. But with each crocus bloom and renewed frog chorus, we're reminded that the transition from winter to spring brings renewed hope and a bit of magic into our lives. Though, as the middle school students at Gobles can tell you, it's not magic, it's physics and chemistry!

The 7th and 8th graders at Gobles Middle School have been working through their biology and earth science curricula this winter. A couple of weeks ago, we took a break from the normal schedule to investigate how frogs can freeze entirely during the winter and return to life each spring. The premise of the lab was to examine how different solutions (tap water, sugar water, and salt water) affect the freezing point of water and the process of osmosis. The students learned that while both salt and sugar can lower the freezing point of water, sugar seems to work best when preserving tissues that make up a frog's organs.

Meanwhile at Vicksburg High School (VHS), the freshman biology classes have been learning how different genes determine behaviors and traits in living things and how these are inherited by their offspring. And as the students can (hopefully) tell you, it's once again not magic; it's all biochemistry (e.g., DNA and protein synthesis), biology (e.g., cell division), and evolution (e.g., inheriting genes from surviving parents).

In addition to working with the biology students at VHS, I've been working with the Environmental Club there to plan a canoe excursion on the Kalamazoo River in the spring. The goal of the trip will be to learn about the ecology of the river, the 2010 oil spill and cleanup, and how scientists study the river. My advisor, Dr. Steve Hamilton, will join us as our expert scientist. This should be a great experience for all (assuming winter comes to an end).

While many of you likely believe fellow Michigander Smokey Robinson's beloved tune "You've Really Got a Hold on Me" was written about an unhealthy relationship of the human variety, I'm inclined to think he may have written it to describe his relationship with a Michigan winter. And accordingly, I think it best we end this update with a bit of group therapy. Sing it loud.

I don't like you, but I love you
Seems that I'm always thinkin' of you
You treat me badly, I love you madly
You've really got a hold on me
(You really got a hold on me)

Despite my affiliation with the Zoology department, you won't find me observing the behavior of animals or crossing lines of fruit flies; you're actually much more likely to find me hip deep in mud in an overlooked wetland. These places are home to really interesting microbes that actively process and transform the materials (e.g., organic matter and nutrients, like nitrogen and phosphorus) that flow through and over our landscape. While I don't study these microbes directly, I do study the processes they mediate, like decomposing organic matter and removing nitrogen from the landscape.

Lucky for me, wetlands, streams, and shallow lakes are very abundant throughout southwestern Michigan. And because of their position in the landscape, a lot of materials pass through them en route to larger rivers, lakes, and eventually the ocean. The microbes and other decomposers that thrive on these materials do so in unique ways because of the oxygen dynamics in shallow waters. For example, because there tends to be very little or no oxygen available in the mud and sediments, microbes can use compounds like nitrogen, iron, and sulfur instead of oxygen to process their food. Therefore, I'm investigating how these processes affect water quality so that we can better manage and conserve these important features in our watersheds.

Parchment and Lawton

By GK-12 Fellow Susan Magnoli

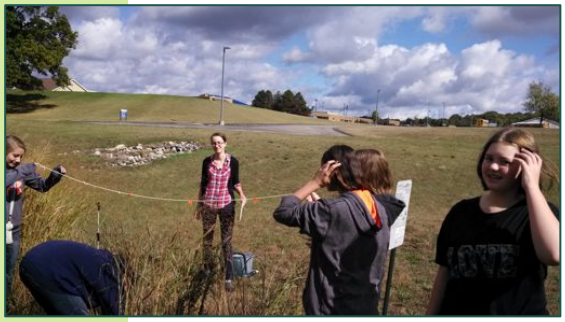
I study how plant species establish in new habitats. Understanding the environmental factors that influence species establishment is particularly important for understanding restorations and biological invasions. A basic question underlying restorations is 'how do we get this species to establish here?' Whereas with invasions the question is 'why is this species so good at establishing here?' The questions are different, but the explanations could be very similar. I'm particularly interested in how multiple introductions of the same species can affect establishment.

This summer I will be conducting several experiments to examine both the ecological and evolutionary effects of multiple introductions. I'm doing this with the annual native prairie plant, Partridge Pea, which is commonly used in restorations. I have 8 populations of Partridge Pea from across the Midwest and East Coast, which I will plant out into field plots. My experiments will allow me to test whether introducing plants from more than one population into a restoration site will make establishment more likely, and whether this is due to ecological or evolutionary factors.

Hi, my name is Susan Magnoli and I'm a first-year GK-12 fellow and a third year PhD student at KBS. This year I am working with Marcia Angle at Lawton Middle School and Jodie Lugar-McManus at Parchment High School.

This year has been very exciting so far! I've been working with Mrs. Lugar-McManus's Biology II class at Parchment High, helping students design and implement greenhouse experiments. At the beginning of the trimester, we talked about how to ask good scientific questions, come up with hypotheses, and design experiments to test these hypotheses. Each student came up with an ecologically-relevant question that they could test in the Parchment greenhouse (such as 'how does acid rain affect bean plants?'). Students set up their experiments and maintained them all trimester, while collecting data. Although not everything grew as we planned (it turns out that it's hard to get plants to grow in January when there are a million snow days), each student ended up with enough data to address their questions. I taught a lesson on data analysis and graphing, and the students generated some really nice-looking graphs. At the end of the trimester, each student put together a poster about their whole experiment and presented their results to the class. The students did a wonderful job, and I hope they had as much fun with their experiments as I did. Mrs. Lugar-McManus and I are now doing this whole project again with a new class this trimester.

At Lawton Middle School Mrs. Angle and I have been doing lessons that incorporate biological data and graphing exercises with her 7th and 8th graders. For one lesson, we had students ask a scientific question that they could answer with Lawton's BEST plot data that we collected last fall. Students had to come up with hypotheses, predictions, and identify all of their variables. They then graphed their data to see if their predictions were correct. I think this lesson was a great way for students to become more invested in the BEST plots, because it showed them how we can actually use all the data they collect to answer scientific questions. And it was great graphing practice!



I have had a great time as a gk-12 fellow this year, and I feel that I've learned as much as I've taught. I look forward to doing it again next year!

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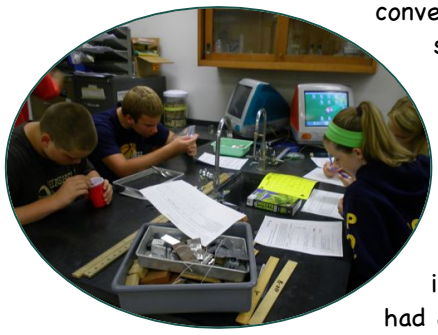
Hastings

By GK-12 Fellow Dani Fegan

My first year as a GK-12 fellow has turned out to be an interesting one. I didn't expect snow days to have such an impact on me during my third year of graduate school! Despite almost three school weeks of school closings, the Honors Biology students at Hastings High School are pushing forward.

In Mr. Buehler's class, much of the focus early in the semester was on body systems and disease. While the students were busy working on individual assignments to study a disease or virus and present it to the class, I took the opportunity to share a disease that has puzzled scientists "down under" – Devil Facial Tumour Disease, one of only a few cancers that can be passed from animal to animal and is decimating populations of Tasmanian devils in the wild. This spurred some interesting conversation and was a great opportunity to share a real-life example of the types of problems that conservation biologists are rapidly working to address.



After some time spent on homeostasis, body systems, and disease, the Honors Biology class has more recently delved into cell and DNA replication. Once they had a grasp of how mitosis works normally, we discussed what happens when mitosis "goes wrong." Leading up to a discussion of what causes cancer, I shared the story of Henrietta Lacks, and the HeLa cell line that scientists still use today to study cancer. We talked about how mutations to certain groups of genes can cause cancer and how mitosis of healthy cells differs from that of cancerous cells. The questions and observations the students made were excellent!

The Honors Biology students in both Mr. Buehler's and Mrs. Withey's classes are currently busy working to come up with individual research projects, which they will be working on over the next few weeks. I enjoyed the opportunity to talk with Mr. Buehler's students about the ways that my own research questions have changed and continue to change as I become a better scientist. As somebody that plans on working in science as a career, it was interesting to listen to the students ideas and discuss some of the reasons why understanding how science is carried out is important for everyone, not just those who want to do scientific research in the future. In Mrs. Withey's class, the students shared their research project ideas with the class and were able to get some helpful feedback from their peers. They had some great ideas and I'm interested to hear about their findings in the future!

I am excited to say that I am currently in the process of getting ready for another summer field season in South Carolina. As part of a collaborative group of scientists working in a large-scale restoration experiment in longleaf pine woodlands, I will continue studying seed dispersal. Broadly, I am interested in whether human land use changes are affecting the ability of plants to move. Specifically, I am studying how restoration treatments, such as thinning of overstory trees and prescribed burning in this case, affect seed dispersal of wind-dispersed understory plant species. Wind-dispersed species comprise a large proportion of the species in my study ecosystem and are often of conservation interest in grassland ecosystems around the world. Over the next year, I will be carrying out a project to determine if restored and control landscapes produce different amounts of wind-dispersed seeds, if the plants in the two types of landscapes differ in important traits related to seed dispersal (e.g., plant height), or if the two different landscape types change the dispersal patterns of the wind-dispersed species due to effects of forest stand density on wind within the landscape. I am looking forward to getting back to the field after a long, cold winter spent mostly indoors.

I'm interested in the biological basis of individual and sex differences in aggressive behavior. Males of most mammalian species are more aggressive than their female counterparts. For instance, men commit more violent crimes than women worldwide, and males of other mammal species often fight with higher intensity than females. Individuals also vary greatly in aggression, with some members of both sexes showing particularly high or low levels of aggression. Aggression can be essential to an individual's survival, but can also be detrimental, causing physical and mental stress for both the aggressor and recipient. Therefore, it is important to understand the biological basis of aggression and why males might be more prone to it than females.

My research focuses on an unusual mammal – the spotted hyena. Females are much more aggressive than males in this species. I am trying to untangle the biological causes of this sex role reversal. For instance, brain chemicals such as serotonin and hormones such as testosterone help determine aggression levels in individuals and sexes across mammalian species. I am examining whether differences in such molecules can explain individual and sex differences in hyena aggression. This year, I've discovered that lower serotonin levels are connected with high social dominance in hyena social groups; this is likely because more dominant individuals engage in more aggressive behavior.

Harper Creek

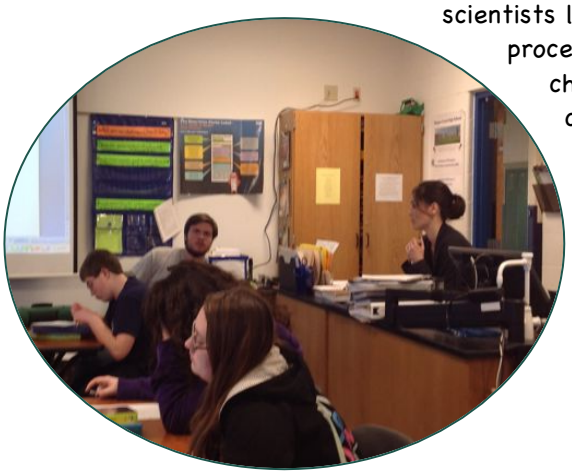
By GK-12 Fellow Sarah Jones

Hi, I'm Sarah Jones and I'm a first year fellow. I'm working with Sandy Erwin at Harper Creek this year, helping teach high school students in her chemistry classes. This semester, Sandy and I have been focusing on science writing and bringing recent, relevant scientific research into the classroom.

For our first writing activity, students chose an article in Discovery magazine that details a recent advancement in science. They then wrote a synopsis of the article for a teenage audience, explaining the research and why it is relevant to their generation. The students seemed to like the freedom that choosing their own article gave them, so open ended assignments like this might work well in the future.

Now Sandy and I are working on a project on global climate change. The students are writing essays which discuss (1) what evidence scientists have found that indicate the earth is warming rapidly and (2) how climate change is affecting a particular country/region of the world and what impacts it will have on the people living there. This is a difficult project, partly because of the scope of the topic and partly because the students are doing their own research to write their essays. Sandy and I have given them a list of resources to start with, and the librarian, Ms Jeri Sutton, has come in and discussed how to utilize online databases. Later, the students will do short multimedia presentations to the rest of the class, focusing on how climate change will impact their assigned country.

Through projects such as this, I hope to help the students see how scientists learn about large scale processes such as global climate change, and how such science connects to their lives. I also hope this project will also help them learn to sort through the vast amounts of information available to them online in order to better understand a complex issue.



Harper Creek and Olivet

By GK-12 Fellow Amanda Charbonneau

Hello again! It's been a long, cold winter here in Michigan, which means I've been stuck in the lab, and we haven't seen the BEST plots for quite a while. We've still been busy in the high school classrooms though!

I've been moving around at bit at Harper Creek High School, and have been helping with a variety of classes. One of my new courses is Forensic Science. This class is super fun, but requires a lot of clean up. We're constantly spreading (fake) blood all over the room to see how different splatter patterns are formed, or covering objects in powder to search for fingerprints. I've also started sitting in on a statistics class, where I've been helping to explain how math applies to daily life, and just what all those little Greek squiggles mean. In Biology, we've been learning about genetics: meiosis, mitosis, Mendel and his peas, and all sorts of other fun things. My PhD will be in genetics, so I'm always excited to share my deep love of Punnett squares with the world.

At Olivet High School, our Tuesday "Science Lunch" is coming along well. We've done all sorts of experiments and exploration projects during the year. For a few weeks we focused on how the brain works, and looked at a lot of illusions. One of my favorites is the Colour Changing Card Trick, which you can see, along with lots of others, on the Quirkology channel on YouTube. We've also done some more hands-on activities, like observing the behavior of fruit flies with and without a predator present. Most recently, we're learning about plant physiology by growing radish plants under lots of different conditions. Each student brought in a different substrate to grow their seeds on: milk, rotting radishes, water from various sources, etc, and we're going to see which seeds grow the best.

So, even though winter has tried it's hardest to keep us inside and away from class, we've had a great spring semester at both my schools. We've been having a lot of fun learning together, and I'm sure the rest of the year will be just as exciting. I've got lots of ideas for fun, outdoor experiments for us to work on as soon as Spring finally arrives, and I think all of us are ready to go spend some quality time outside.

My PhD research is to figure out how weeds can cope with new environments by studying the evolution of weedy radish. Around here, weedy radish grows mostly on wheat farms, or in other small grains, so it's hard to study when there's a foot of snow on the ground.

Instead, I've been processing samples that I collected over the summer. Last year, I grew more than 500 weedy, crop and native radish plants at my field site at MSU. My undergraduate research assistant, Josh, and I tracked the growth of each plant, and recorded the dates that they hit important plant milestones. For instance, we recorded how long the seeds took to germinate, and then how long those plants needed to flower and set seed. We also took lots and lots of pictures of them, so we know exactly how they looked at different parts of the summer. In addition to all recording all of that data, we also took leaves from each plant, and saved them in the freezer. Most of what I've been doing lately is crushing up the leaves to extract their DNA and send it off for sequencing. Then it's time for the real work to begin: analyzing all the data.

My graduate research focuses on the need for our society to begin transitioning to alternative fuel sources if we are to continue living out the lives we have developed into. I focus specifically on how we can better grow vast amounts of algae in large outdoor ponds that can be turned into biodiesel. As an ecologist, I am applying our basic knowledge of how the natural world works in an attempt to generate more algae and higher amounts of biodiesel. In my lab, we are tapping into the biodiversity of algae and investigating how we can grow multiple species of algae together to achieve higher biodiesel outputs than if we grew only a single species of algae.

Reflecting on my brief two years as a GK-12 Fellows, it is safe to say that I have learned more about what it is to be a "scientist" and science educator than I could have possibly imagined. I joined the program under the assumption that I would develop some communication skills, and put together some fun lessons for students, but I did not realize how much this would impact the way I approach and perceive "science." The experiences of working alongside such talented Fellows, science educators, and enthusiastic students have helped me develop the skills necessary to become a more effective science communicator, educator and researcher. My deepest thanks to everyone who has helped along the way.

Olivet and KAMSC

By GK-12 Fellow Jake Nalley

A winter break that seemed to go by far too quickly yielded a January month that answered every student's wishes, around 15 snow days! This led to some interesting school visits, planning lessons that might not every see the light of a classroom, or finally getting a day in the school only to have the students still reeling from the long 6 day "weekend" they just had. But despite the blistering winter months, the spring thaw is coming and with that some successful school lessons.

KAMSC: Working with Chris Chopp at the Kalamazoo Math and Science Center, I had an opportunity to discuss experimental design with his AP Biology students as they began developing their semester long independent research projects. Some students have picked some excellent questions to investigate; one group has even decided to work with algae! I also had an opportunity to meet up with Cheryl Hach's AP Environmental Science class and help them sample Augusta Creek in the Kellogg Forest. Students collected a number of water quality measurements, and investigated how the macroinvertebrate communities differed in fast and slow moving areas in the river.

Olivet: I continued to work closely with Russ Stolberg's 8th Grade Earth Science class. I developed a lesson to illustrate underwater volcanic eruptions using hot candle wax (magma), silt (ocean floor), and water that led to some amazing lava tubes and wax formations. We also got to create our own weather events, making our own clouds in bottles and simulating thunderstorm formation through flying, flaming tea bags! The big project this semester was a month long algae experiment. Each group of students grew their own flask of algae that received different combinations of nutrients. There were four treatments, Full (all the nutrients present), -N (limited nitrogen), -P (limited phosphorus), and -NP (limited nitrogen and phosphorus). Over the course of the four weeks, students performed weekly sampling events to determine how much algae was in their flask, and then performed a dilution, pouring some algae out and replacing it with fresh "nutrient" water. Next we are going to conduct some data analysis to determine which nutrients are necessary for the algae to live and reproduce through graphing the data and making scientific conclusions. Coming up at Olivet, we have a trip to the Kellogg Biological Station to tour the grounds and sites, a salmon release in the Red Cedar, the 4th and 5th Grade Science Fair and river quality testing at Olivet. If only it would warm up...

KBS K-12 Partnership

Plainwell

By GK-12 Fellow Sara Garnett

I'm glad to be back for another year as a GK-12 Fellow! I'm still in Plainwell, but this year I've moved to the middle school, where I'm working with Marty Green and Lisa Wininger.

The eighth-grade classes have spent the beginning of the school year reviewing in preparation for MEAP testing. This has also given me the opportunity to revisit many topics in science that don't necessarily apply directly to my research. I have helped out in the classroom while students reviewed topics like groundwater and photosynthesis. I also took a more active role in helping students review the metric system and genetics and Punnett squares (using the Toothpick Fish lesson), and put together some worksheets for students to review cell structure and function. I hope that these review activities stick with the eighth-graders as they take the MEAP exams, and I'm looking forward to working with them as we get more into Earth Science!

So far, most of my time with the sixth-graders has been while they work through the Systems and Scale unit of CarbonTIME. On my first visit to the classroom, they discussed combustion and started thinking about what might make some materials burn, while others do not. They also got to see me burn some ethanol. Students also watched a demonstration involving burning ethanol and a chemical called bromothymol blue, which changed color as carbon atoms left the ethanol during the combustion reaction. This helped them think about the idea that atoms are forever, and atoms that leave the ethanol must go somewhere. We also talked about the difference between organic and inorganic molecules. They also did a lab to look at how the mass of an item and the height from which it is dropped influence its potential and kinetic energy. They have been very excited to do these activities, and I hope to continue encouraging their enthusiasm for science throughout the school year!

I'm very happy to be at Plainwell Middle School, and I'm looking forward to the rest of the year with these classes!

Like most people with siblings, I am familiar with the potential for conflict in family relationships. Despite frequent competition with brothers and sisters for toys, parental attention, and access to the remote, you still love them and want them to succeed. This pattern is not unique to human families; seeking a balance between cooperation and competition happens in a wide variety of animals. We're used to thinking about nature as a competitive place, where only intense fighting for shelter, food, and mates will bring success, but we see individuals put themselves at greater risk to predators or compete less intensely for food or mates when relatives are involved. Because relatives share at least some of the same genes, behaving in ways that help relatives survive and reproduce can be an effective strategy for an individual to pass its genes on to the next generation. This raises questions about when it is best for an individual to focus on itself vs. its relatives, as well as the strategies animals use to maintain this balance.

My research examines these questions using American toad tadpoles. They prefer to swim near siblings rather than non-siblings in their birth ponds, using chemicals in the water to tell them apart. I am investigating whether these chemicals might provide information that influence how quickly tadpoles grow and develop, or how intensely they compete for food. In particular, I am interested in whether they respond differently to siblings than non-relatives in different environments. By looking at how these factors influence tadpole growth, I can get an idea of how tadpoles improve the chance that they (and their siblings) will make it out of the pond in a variety of environmental conditions.

Plainwell and Comstock

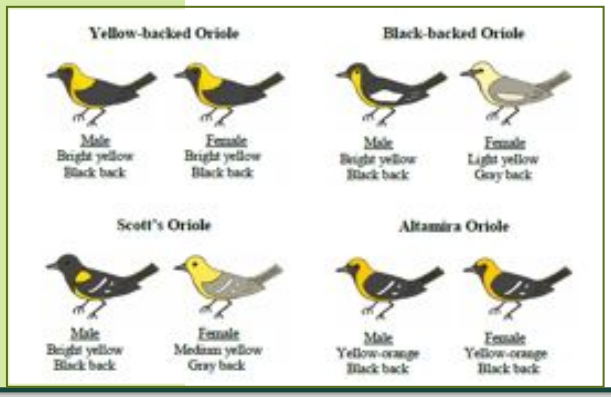
By GK-12 Fellow Cara Krieg

My name is Cara Krieg and I've been the fellow for the Comstock STEM Academy and Plainwell High School this past year. As part of my second year as a GK-12 fellow, I've enjoyed all the opportunities I've had to use my own research to teach big ideas in evolution, ecology, and behavior.

In Comstock the 5th graders learned about the types of birds they can find in their backyards. Although the world might have seemed like a harsh polar-vortex tundra this winter, many native birds stay here in Michigan. I taught Mary Grintals' students how to identify the different Michigan birds common during the winter. The class was so excited about this lesson that they were identifying birds outside the classroom window the next day! Students also learned that their observations can contribute in important ways to citizen science efforts around the country. Citizen scientists are an incredible resource for scientists that study birds. Every year thousands of citizen scientists contribute birds counts to the Audubon Christmas Bird Count, the Great Backyard Bird Count, the North American Breeding Bird Survey, and the Cornell run monitoring program eBird. These long term records can be used by scientists to tell which bird populations are growing or shrinking and how they are responding to changes in the environment. Later this semester the 5th graders used some data from these citizen scientist efforts to practice their graphing skills on the computer. Students looked at how the population of Cooper's Hawk, a common bird predator, has changed over the last 50 years in Kalamazoo. As a final project the Comstock students will be putting up nest boxes around the school and taking data on which birds comes to build their nest.

With Sandy Breitenbach's AP students I've been using recent scientific data to help them understand concepts in evolution and behavior. Earlier in the semester the students learned how scientists use evolutionary trees. Students took a "colorful" example- the different colors in females in the blackbird family- and asked which came first: colorful females, or dull females? Students competed together in groups to see how could come up with the best trees. Later in the semester the students learned how evolution, the environment, and the brain are all needed to understand animal behavior. Students learned why prairie voles "fall in love" and why dogs are man's best friend and were excited to learn how studying behavior in animals can teach us things about ourselves and our favorite animal companions.

I am fascinated by animal behavior and I love understanding why animals do the things they do. I study sex differences in the behavior of house wrens. Have you ever heard someone say "men are from Mars and women are from Venus"? How much of this is a product of biology and how much is a result of culture? In nature males are typically the aggressive sex. However, females are often aggressive too! Female aggression has not received much attention from scientists. Working with house wrens, I study aggression in males and females to understand how and why their fighting styles differ. I use recorded songs and a model wren to mimic an intruder and I record the aggressive response by male and female birds. I've already discovered female house wrens become more aggressive if they are more likely to lose their territories. This summer I was surprised to find that more aggressive females actually had bigger babies. This was exactly opposite of what I expected find! This summer I'll be trying to figure out what makes aggressive females super moms. Are they better at finding nutritious food, or do they lay eggs with chemicals that make their babies grow faster?



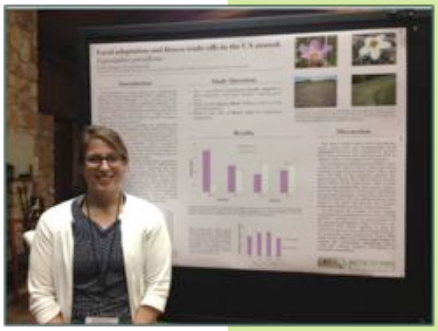
KBS K-12 Partnership

Thornapple Kellogg

By GK-12 Fellow Emily Dittmar

Despite all the snow days, I managed to get into the classroom this semester at Thornapple-Kellogg in between trips to my field site! I've been able to spend time discussing my field work and research with Jamie Bowman's 7th graders and have been thrilled with their enthusiasm. After my first trip, I showed the students some pictures of the site and described how I set up my field plots. They asked me many great questions about the logistics of traveling to CA for field work. During the next trip, I was able to get internet access out at my field site and Jamie got the classroom equipped to Skype with me while I was out there! It was fun to be able to show the students what my plots looked like and to answer their questions about the weather, survival rates, and how the recent rains had affected conditions in the field. We plan to continue Skyping through the season so the students can see how things progress in the field as the plants flower and set seed. The results will eventually become a data nugget so that students can experience the end product. Recently, the 7th graders learned about heredity and it was the perfect opportunity to discuss the genetics underlying the flower color differences in my plants. In my system, pink flower color is dominant to white and color is due to a single gene, therefore one can do Punnett Squares and predict the resulting genotypes and phenotypes of various cross types. As a result of the students' insightful questions, I found myself discussing some really complex aspects of my dissertation research and was amazed by how well they understood the concepts.

Most recently, Jamie and I had both the 7th and 8th grade students play the game that we made up for last summer's science institute. The game uses playing cards to represent different alleles of a gene and students mix up these alleles through a game of musical chairs. The game demonstrates how to calculate allele frequencies from genotype frequencies and how random events can cause changes in allele frequencies in a population. These are topics typically taught in college-level evolution classes, but the students all seemed to grasp them quickly. It has been a lot of fun to work with Jamie's students and I am grateful for the opportunity to learn how to communicate and teach science with such a gifted teacher!



My field season began in January and I planted 1800 seedlings at Jasper Ridge Biological Preserve in San Mateo County, CA. These seedlings originated from the natural populations from either serpentine or sandstone soils. I planted them in both soil types and hope to determine whether these populations, despite being in close proximity, are locally adapted to their home soil type. Local adaptation is occurring if the native population outperforms the other in its home environment. So far, this pattern is apparent on serpentine soil as the individuals from sandstone soil have almost completely died, while plants from serpentine are doing fine! Survival has been pretty high overall on sandstone soil, but the plants have just begun to flower, so I still have a lot more data to collect and performance can be measured not just on survival, but on how many seeds each individual plant produces.

In addition to unmanipulated plots, I planted both types in 'treatment' plots where I add supplemental water or weed the plot, or both. This will tell me how much drought or competition affects the performance of individuals from each population. It is exciting to get this field season underway, as it is a critical component of my dissertation!

Tom Getty, Co-Director
Tom is a Professor of Behavioral Ecology and the chair of the Department of Zoology at MSU. His research focuses on the role of information in various aspects of behavior, ecology, and evolution including: mate choice, aggression, cooperation, predator-prey interactions, and habitat choice.

Sarah Bodbyl, GK-12 Coordinator
Sarah has a PhD in Ecology and Evolutionary Biology at the University of Kansas. Her interests are in mating system evolution, particularly in plants and birds, restoration, conservation, and science education. Sarah meets with fellows, visits schools, supervises the K-12 Partnership, maintains web pages, and plans workshops.

Charles (Andy) Anderson, Co-Director
Andy is a Professor of Science Education in the Department of Teacher Education at MSU. His research centers on the classroom teaching and learning of science. He studies how students' prior knowledge, language, and social relationships affect their engagement in science learning and the development of environmental science literacy.

Phil Robertson, Co-Director
Phil is a University Distinguished Professor of Ecosystem Science in the Department of Crop and Soil Sciences at MSU. His research interests include the biogeochemistry and ecology of field crop ecosystems. He studies how nitrogen and carbon cycle in terrestrial systems and their impacts on crop yield, water quality, and atmospheric chemistry.

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