

MSU Fisheries & Wildlife

SPOTLIGHT

2016

Produced by Graduate Students in the Department of Fisheries & Wildlife at Michigan State University

Bridging the Growing Gap between People and Nature

Furthering the Future of
Fisheries Management

Aquaculture is Global.
But is it Right for Michigan?

A Call to Your “Young”
Scientist

ALSO INSIDE: Emerging Leaders Empowered to Make Change,
Spotlight on Technology: Otolith Micro-What Now?
MSU Alums in the USGS, Lab Profile: Aquatic Landscape Ecology, & MORE!

FW Spotlight is a magazine written, edited, and designed by graduate students in the Department of Fisheries & Wildlife at Michigan State University.

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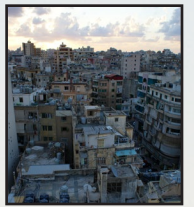
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**Interested in being a part of *Spotlight*?
Contact Lisa Peterson (peter710@msu.edu)**

(photo: FW photo contest honorable mention C. Devault)

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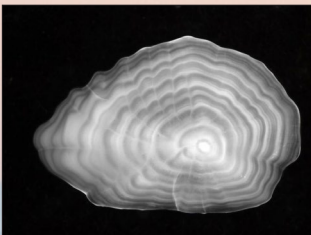
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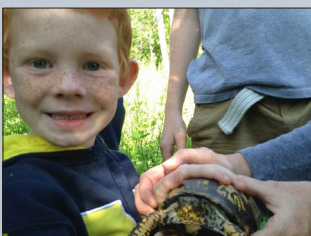
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A Call to Your "Young" Scientist: Your Duty to Inspire the Natural Resource Professionals of 2030

Tracy Swem

Letter from Dr. Scott Winterstein

It is my pleasure to introduce the 2016 edition of the Department of Fisheries and Wildlife Graduate Students' *Spotlight* magazine. This is the twelfth issue and like the previous issues, the quality of the magazine is a testament to the quality and dedication of the FW graduate students. Everyone involved in putting it together, take a well-deserved bow. Particular recognition goes out to **Lisa Peterson** (Coordinator), **Kathryn Frens** (Copy Editor), and **Yang Li** (Design Director).

The multidisciplinary nature of the FW research program and multifaceted talents of the FW graduate students are on display in *Spotlight* this year. This issue is loaded with great articles and scads of information.

Remington Moll, the Pattullo Fellowship awardee, examines the growing gap between people and nature. **Betsy Riley** and **Darrin McCullough** discuss the pros and cons of expanding the aquaculture industry in Michigan. **Alexander Maguffee** gives you a crash course in otolith microchemistry, including step-by-step instructions on preparing otoliths for analysis. **Zach Curtis**, **Kathryn Frens**, **Molly Good**, and **Lisa Peterson** reflect on their involvement with the Emerging Leader Program of the Great Lakes Leadership Academy.

You can find the FW Photo Contest Winners on the back two pages. You should feel free skip straight to the photos, but I

encourage you to read the *Spotlight* from cover to cover. That way you won't miss **Tracy Swem's** "A call to your 'young' scientist". In this issue you will also find an overview of the awards won and papers published by FW graduate students and a profile of the departmental fellowship awardees, including a report by **Molly Good** (and her mentors Bill Taylor and Bob Lambe) on her 2014 – 2015 Fenske Fellowship project Furthering the Future of Fisheries Management in the Great Lakes Basin. Congratulations to all the award and fellowship recipients.

In the alumni corner, you will find a double interview with **Abby Lynch** (Ph.D. 2013) and **Clint Otto** (Ph.D. 2012). Abby and Clint each now work for the USGS,

albeit in rather different environments. Abby is in Reston, Virginia while Clint is in Jamestown, North Dakota. This issue's Lab Profile looks at **Dr. Dana Infante's A.L.E. lab**. By the way, - that's the Aquatic Landscape Ecology lab, not a laboratory devoted to brewing with top-fermenting yeast.

Enjoy this issue of *Spotlight*. After you have read it and reread it, pass it on to a friend or a stranger. It is extremely well-written and the photographs are fantastic! As the chair of the department, one of my favorite pastimes is bragging about the accomplishments of the FW graduate students – the *Spotlight* magazine and FWGSO Research Symposium are always at the top of my list.



- Scott Winterstein

Spotlight on



Awards & Research

Brandon Armstrong received a graduate fellowship from the Institute for Integrative Toxicology's Environmental and Integrative Toxicological Sciences Graduate Program, travel awards from the Society of Environmental Toxicology and Chemistry and the Environmental and Integrative Toxicological Sciences, and a professional development grant from the COGS.

Rebecca Cain received the Joseph G. Schotthoefer Memorial Student Award from Safari Club International Michigan Involvement Committee, and was appointed as an Official Measurer for the Boone and Crockett Club's Records of North American Big Game.

Andrew Carlson received a University Distinguished Fellowship, the Janice Lee Fenske Excellence in Fisheries Management Fellowship, and the William A. Demmer Scholar distinction from MSU. He was awarded the Best Student Paper Award from the Minnesota Chapter American Fisheries Society annual meeting and the Sander Award from the Walleye Technical Committee of the AFS North Central Division.

Sonja Christensen was awarded the Hal and Jean Glassen Conservation Medicine Fellowship.

Andy Crosby received the Graduate School Writing Fellowship from the MSU Graduate School.

Andrew Dennhardt received a Graduate Fellowship from the FW Department and travel grants from the Graduate School, College of Agriculture and Natural Resources, FW Department, and FW GSO.

Anna Herzberger received the William W. and Evelyn M. Taylor Endowed Fellowship for International Engagement in Coupled Human and Natural Systems and two Foreign Language and Area Studies fellowships.

Corrine Higley received the Future Academic Scholars in Teaching Fellowship.

Remington Moll received best presentation awards from the 21st Annual Wildlife Society Conference and the FW GSO Research Symposium, the Ambrose Pattullo Fund for Environmental Issues Graduate Fellowship, and the Vera M. Wallach Fellowship for Arctic research.

Lisa Peterson received the John Robertson-Theodore (Teddy) Roosevelt Conservation and Environmental Leadership Fellowship.

Isaac Standish received the Best Student Presentation Award at the 40th Annual Eastern Fish Health Workshop.

So-Jung Youn received the Clark Hubbs Research Assistance Award from the American Institute of Fishery Research Biologists, a Travel Award from the Equal Opportunity Section of the American Fisheries Society, and a Best Student Presentation Honorable Mention in Socioeconomics from the Socioeconomics Section and Missouri Chapter for the American Fisheries Society Weithman Award.

Brandon Armstrong published "Reproductive effects in fathead minnows (*Pimephales promelas*) following a 21 d exposure to 17 α -ethinylestradiol" with J. Lazorchak, K. Jensen, H. Haring, M. Smith, R. Flick, D. Bencic, and A. Biales in *Chemosphere*. This paper is important because it indicates that the previously reported no observable adverse effect concentration (NOAEC) for the active ingredient in birth control, EE2, on fathead minnow egg production may be too high at 1.0 ng/L. This study showed significantly reduced fathead minnow egg production with an estimated NOAEC of 0.24 ng/L.

Andrew Carlson published "Synthesis of ecology and human dimensions for predictive management of bighead and silver carp in the United States" with B. Vondracek in *Reviews in Fisheries Science and Aquaculture*. Andrew also collaborated with members of the American Fisheries Society Student Subsection of the Education Section to publish "How to establish a student subunit," "How to navigate fisheries education and employment," and "Purpose, history, and importance of the student angle" in *Fisheries*.

Sonja Christensen published "Reproduction and nutrition of desert mule deer with and without predation" with R. Carrera, W. B. Ballard, P. R. Krausman, J. Devos Jr., M. C. Wallace, S. Cunningham, and O. J. Alcumbrac in *The Southwest Naturalist*.

Andy Crosby published "Looking beyond rare species as umbrella species: Northern Bobwhites (*Colinus virginianus*) and conservation of grassland and shrubland birds" with R. Dwayne Elmore, D.M. Leslie Jr., and R.E. Will in *Biological Conservation*. This paper is important because it shows how habitat restoration for a popular game bird can have a positive impact on a number of declining grassland and shrubland bird species, thus showing that the umbrella species concept could be used opportunistically to further broad biological diversity and conservation goals.

Andrew Dennhardt had two publications with A. Duerr, D. Brandes, and T. Katzner. One was "Integrating citizen-science data

with movement models to estimate the size of a migratory golden eagle population," in *Biological Conservation*. This article describes a new method for estimating population size of raptor species using migration models as well as citizen-science monitoring data. Another was "Modeling autumn migration of a rare soaring raptor identifies new movement corridors in central Appalachia," in *Ecological Modelling*. This article summarizes the construction and application of migration models toward identifying sites used by migratory raptors for population-level conservation and monitoring efforts. He published a third article this year, "Accounting for raptors beyond our sight: modeling migration and hawk-count data to estimate the golden eagle population in eastern North America," as the sole author, in *Hawk Migration Studies*. In this article, he applied citizen-science data in models of eagle migration to estimate population size for golden eagles in eastern North America.

Anna Herzberger published the article "Plant-microbe interactions change along a tallgrass prairie restoration chronosequence" with S. Meiners, J.B. Towey, P. Butts, and D. Armstrong in *Restoration Ecology*. This article evaluates how different stages of restoration affect plant growth, and how the soil's microbial make-up affects that. Anna also published the article "Bouncing Back: Plant-Associated Soil Microbes Respond Rapidly to Prairie Establishment" with R. Jackson and D. Duncan in *PLOS ONE*. This research explores microbial community composition shifts in early restoration efforts from historically agricultural soils.

Julia Novak published "Multi-level fisheries governance and their impact on fishermen's adaptation strategies in Tamil Nadu, India" with M. Axelrod in *Environmental Policy & Governance*. This paper analyzes how fishermen decide to change their fishing practices in the face of conflicting fisheries management rules.

Darrin McCullough and coauthors from the USGS Great Lakes Science Center published "Evidence of the St. Clair-Detroit River System as a dispersal corridor and nursery habitat for transient larval burbot" in *Hydrobiologia*. As part of a collaborative assessment of habitat restoration efforts within the Huron-Erie-Corridor (HEC), they determined that this important connecting channel between the upper and lower Great Lakes provides a suitable migratory pathway and critical early life habitat for burbot. Burbot is a key indicator of overall system health throughout its distribution, and evidence of its recruitment and survival within the HEC provides baseline knowledge for current and future habitat restoration efforts.

The 2014-2015 Fenske Fellowship

Furthering the Future of Fisheries Management in the Great Lakes Basin



Molly Good (center) with her two Fenske mentors, Dr. Bill Taylor (left) and Bob Lambe (right, photo: T. Lawrence).

What does the future have in store for the Great Lakes Basin, and are we ready for it?

This is a critical question to consider, especially in regard to emerging issues and potential threats that could affect the Great Lakes and its abundant aquatic and fisheries resources.

The Great Lakes Basin comprises 20% of the world's surface freshwater and is home to immense biological diversity, including more than 150 native fish species. The basin also provides extensive and economically significant tribal, commercial, and recreational fisheries, all worth more than \$7 billion annually. However, cultural and anthropogenic influences including overexploitation of fish stocks, climate change, pollution, land use changes, potential introductions of new invasive species such as the Asian carp, and even international border control threaten the Great Lakes. Though we cannot use a crystal ball to foresee the Great Lakes Basin environment decades from now, it is possible, and recommended, that fisheries researchers, managers, and other stakeholders discuss potential changes in the environment and whether the management structure within the Great Lakes Basin is best equipped to address these changes.

After a successful application process, I was awarded the 2014-2015 Fenske Fellowship for a project proposal that was related to my dissertation research and addressed the importance of these types of discussions. Through the Fenske Fellowship, I have been fortunate to work closely with my professional mentor, Bob Lambe, my graduate advisor at Michigan State University, Dr. Bill Taylor, and other members of the Great Lakes Fishery Commission (GLFC) to accomplish two main goals. First, I wanted to gain a better understanding of the GLFC's complex, bi-national governance and management structure. Second, I hoped to become involved in the manner in which the GLFC fulfills its responsibilities to acquire knowledge about and facilitate implementation of management decisions for aquatic and fisheries resources in the Great Lakes Basin – both now and for the future. As a Fenske Fellow, I feel poised to use my new understanding of the GLFC, coupled with some high-level management and decision-making experience, to positively impact the future of our Great Lakes through my personal and professional endeavors.

The Great Lakes Fishery Commission

The Great Lakes Basin is a complex system of management, due mainly to its geography, size, associated values, and its many governing bodies. These governing bodies include two countries – the United States and Canada – eight U.S. states, the province of Ontario, a number of federal agencies, federal programs, intertribal agencies, and numerous local and county governments. Amazingly, all of these governing bodies come together and work within the Joint Strategic Plan for the Management of Great Lakes Fisheries (JSP), which is facilitated by the GLFC.

The GLFC's mandate is determined by the Convention on Great Lakes Fisheries, signed in 1954 (to learn more about the Convention, please visit: www.glfc.org/pubs/conv.htm). The aquatic and fishery resources within the Great Lakes Basin do not recognize geographical and political boundaries; thus, the GLFC facilitates bi-national, multi-jurisdictional cooperation to improve, manage, and sustain these resources.

The GLFC is comprised of four Canadian Commissioners appointed by the Privy Council of Canada and four U.S. Commissioners appointed by the President of the United States; the United States also appoints an "Alternate Commissioner" to serve in the absence of one of its four commissioners. Michigan State University's own Dr. Bill Taylor has served as the U.S. Commissioner (Alt.) since 2002! A primary mission of the GLFC is to provide for



The GLFC gathers for their Annual Meeting's plenary session. In the front row, left to right, are Commissioners Tom Melius (U.S.), Trevor Swerdfager (Canada), Bill Taylor (U.S.), Don Pereira (U.S.), Robert Hecky (Canada), Tracey Mill (Canada), Doug Stang (U.S.), and James McKane (Canada). Commissioner David Ullrich (Canada) is not pictured. (photo: T. Lawrence)

the control of sea lamprey, a destructive aquatic invasive species that has seriously impacted the sustainability of Great Lakes fisheries. As a result of GLFC efforts, the sea lamprey is the only non-native Great Lakes species that is controlled basin-wide and at an ecosystem scale. The GLFC also facilitates fisheries research and management throughout the basin for fish species of common concern including shiners, bass, lake trout, and walleye.

Ensuring Fish for the Future

Building on its past success, the GLFC continues to assess how it can respond to emerging issues or potential threats to the Great Lakes fisheries. As part of my Fenske Fellowship, I assisted the GLFC in the development and execution of a two-day retreat held early in 2015 to discuss these issues and gain a better understanding of the GLFC's responsibilities and roles. The retreat provided excellent fodder for discussion

and revealed key perspectives of the Convention on Great Lakes Fisheries and the GLFC among retreat participants. First, Commissioners and staff confirmed that their organization is critical, and successful, in facilitating multi-jurisdictional research and collaboration throughout the Great Lakes Basin. Second, they concluded that the Convention on Great Lakes Fisheries enables the GLFC to engage in emerging issues or potential threats to the basin. I believe this particular conclusion is especially insightful, as it indicates the GLFC possesses the flexibility to adapt to new issues and engage in future actions not necessarily spelled out in the Convention.

I shared this material and our conclusions with other GLFC staff at their Annual Meeting in June 2015. There, we confirmed that the GLFC remains ready and generally able to play its part in protecting and sustaining the Great Lakes Basin's aquatic and fisheries resources for the foreseeable future.

Managing Fish Means Managing People

As the GLFC concluded during the two-day retreat this spring, I have also learned that fisheries managers manage more than fish. Collaboration and partnerships between states, tribes, federal agencies, and even stakeholders, policy-makers, researchers, and others are necessary aspects of effective fisheries management. Preparing for the future management of resources in the Great Lakes Basin will be a continuing challenge due to the plethora of individuals, agencies, and

organizations that share a vested interest in the sustainability of these resources and must work together to provide for effective management of them. Fortunately, in my opinion, the GLFC stands at the helm of enabling collaboration and successfully facilitating partnerships with other agencies and organizations. With its proven track record, the GLFC is uniquely positioned to promote future cooperation toward the sustainability of Great Lakes fishery resources in the Basin and their environments.

By beginning these discussions about the future with the GLFC,

I am learning how to best prepare organizations to be able to address potential changes in the Great Lakes environment. I am grateful to Michigan State University and the Fenske Fellowship Committee, and for Bob Lambe and Dr. Bill Taylor in particular, for providing me with abundant experiences to work closely with the GLFC Commissioners and staff. Most importantly, I am thankful for the opportunity to become immersed in a management and decision-making process that has and will continue to effectively protect the fishery resources of our magnificent Great Lakes.

What is the Fenske Fellowship?

Fellowship History and Description

Jan Fenske was the first female fisheries biologist of the Fisheries Division of the Michigan Department of Natural Resources. For 27 years, Jan worked passionately to protect and conserve the state's aquatic and fisheries resources. As an advocate for equality, Jan served as a mentor to many future professionals in the field of fisheries science and management. The Janice Lee Fenske Excellence in Fisheries Management Fellowship honors her and her significant legacy. The fellowship program is in its ninth year and has supported eleven students. For more information about the Fenske Fellowship, please contact Dr. Dana Infante (infante@msu.edu) or visit: http://www.fw.msu.edu/graduate/graduate_fellowship_opportunities



Jan Fenske

Molly's Motivation to Apply

I was inspired to apply for this fellowship because I greatly admire Janice Lee Fenske's passion for the sustainability of aquatic and fisheries resources she displayed during her lifetime. I was eager to find an opportunity that would enable me, like Janice, to make my own impact on fisheries sustainability in the Great Lakes Basin.

Molly's Fenske Project

In addition to helping the GLFC conduct an evaluation of the organization's future (covered in this article), I was also tasked with establishing a working relationship with members of the GLFC Law Enforcement Committee. One outcome of this relationship included a half-day symposium on fisheries sustainability, crime, and enforcement held at the 2015 American Fisheries Society meeting in Portland, OR.

Molly's Lessons Learned

I can proudly say that I finally understand the basic structure and function of the GLFC. I also learned that effective decision-making is a huge challenge, especially with so many stakeholders at the table. Through the many meetings and seminars I have attended with the GLFC, I have learned that relationships and partnerships are the key ingredients to a successful decision-making and management process.

Molly's Application beyond the Fellowship

This fellowship provided me with opportunities that have enabled me to grow as a graduate student and future professional in the field of fisheries science and management. I am more confident to pursue a permanent position with a state, federal, or even provincial management agency, and I know better how to become an effective fisheries manager capable of making positive change.

AQUACULTURE IS GLOBAL. BUT IS IT RIGHT FOR MICHIGAN?

Betsy Riley &
Darrin McCullough

Despite having access to two oceans, the Gulf of Mexico, and the Great Lakes, Americans are importing our seafood at an alarming rate. The United States imports nearly 85% of its seafood from international producers, feeding an \$11 billion a year trade deficit. To Michiganders, the proud stewards of four of the five Great Lakes, this has recently raised an important question for our state decision makers: is it possible for us to produce sustainable, healthy, and environmentally

“The United States imports nearly 85% of its seafood from international producers”

friendly seafood right here at home? This question has moral implications as well as economic ones. While it is easy to argue that certain countries can produce seafood more cheaply than the U.S., this low price is often the result of unsustainable practices, poor environmental laws, and nonexistent enforcement.

Through our purchase of cheap imported fish, Americans are contributing to the pollution and degradation of these distant ecosystems. The current movement to support local business calls for embracing a locally productive fish industry, and several aquaculture companies have proposed an expansion of fish farming in the region to meet these demands. In the next few years, a policy response will be required.

So, What Is Aquaculture?

At its core, aquaculture is simple. It is the practice of farming aquatic organisms for consumption, sale, or release. In other words, fish farming. Modern fish farms (*examples above and below from NOAA and the USDA*) in the Great Lakes region range from small scale inland flow-through systems or pond rearing facilities to large scale off-shore net-pen operations in the Canadian waters of Lake Huron. Aquaculture has already been happening in Michigan for over 100 years in the form of supplementing wild fish populations through stocking. Expanding this system to include food production is a logical next step, but Michigan trails far behind other Great Lakes states and Canada in aquaculture development. Currently, Michigan is only capturing about \$5 million a year in a region with the potential to sustainably produce around \$1 billion.

Is Aquaculture Green?

Like many forms of agriculture, fish farming can be done in a sustainable, healthy, and environmentally-friendly manner if sound management practices are enforced. Fish farming will be particularly valuable to our growing population as fish can be more

sustainable to produce than other meats, requiring two pounds of feed to produce one pound of marketable fish (compared to 8:1 for beef and 4:1 for pork). Wise policies can also make aquaculture products a safer, healthier form of protein by controlling water quality and the food that fish eat, thereby reducing or eliminating the usually-high levels of heavy metals and PCBs found in wild fish.

Reward vs. Risk

This is not to say that aquaculture does not pose any risks. On the contrary, raising a high concentration of fish in a relatively small space raises the same questions as with any large-scale livestock operation. These include an increased risk of disease as well as potential nutrient contamination of the surrounding environment if poor waste management practices are allowed. In the case of aquaculture, the proximity of cage operations to the natural environment and wild species could pose additional risks, such as the introduction of invasive species or genetic contamination of wild counterparts if an aquaculture fish escapes. Additionally, large scale aquaculture operations, if not properly sited, may be put in waters already occupied by recreational or commercial fisheries. Ultimately, there is widespread concern that improperly sited or managed installations pose threats to our Great Lakes ecosystem. Both the potential reward and inherent risk of aquaculture in Michigan require careful consideration.

Next Steps?

Unfortunately, it is not yet clear exactly how risky each of these possible advantages and disadvantages is, as very little research is being done in this area in Michigan. What sorts of installations are the safest? Will the general public accept farmed fish over wild? What policy processes can be put in place to prevent issues such as invasive species? Michigan aquaculture holds a great deal of promise— the ability to feed a growing population, to take pressure off wild stocks, to produce a less contaminated supply of fish, and to reduce our consumption and global transport of unsustainably produced seafood. These are big promises from a little industry, and yet with the world's population ever expanding, these are the sorts of promises that warrant attention. It is unlikely that Michigan's industry will go unchanged, and it should be Michigan's people who decide what form this change takes. Decisions addressing Michigan's moral dilemma will not wait. Our state's world-renowned universities must step up to meet these questions with good science, reliable methods, and an unbiased scientific eye. Policy makers are scrambling for good science on which to base their decisions, but if we do not provide them the data they need, the decisions will be made without it.

“...it should be Michigan's people who decide what form this change takes.”



Department Fellowship Awards

Hal and Jean Glassen Conservation Medicine Fellowship: The purpose of this award is to recognize a student committed to the study of Fish and Wildlife Disease Ecology and Conservation Medicine.



Sonja Christensen

Graduate Program: Fisheries and Wildlife, Ph.D.

Advisors: Dr. William Porter and Dr. David Williams

Graduate Research: I am interested in how disease affects wildlife populations and their management across varying spatial scales. Specifically, my research addresses management challenges posed by sudden and severe mortality events in white-tailed deer populations, such as those caused by outbreaks of epizootic hemorrhagic disease (EHD). By understanding the forces driving EHD emergence in deer across spatial and temporal gradients, we will gain insight for future deer populations experiencing severe disease mortality.

Motivation to Apply: I was interested in expanding my research scope to include a blood serum survey for EHD in harvested white-tailed deer from Michigan.

Benefits of the Fellowship: This fellowship will allow the implementation of this blood serum survey into my research. Results from this survey will allow us to infer infection history of deer from EHD virus serotypes.

The support afforded by this fellowship is critical for addressing the role of emerging disease risks on wildlife populations.

Dr. Howard A. Tanner Fisheries Excellence Fellowship: This recognizes students who are committed to fisheries research related to the Great Lakes, connecting waterways, or tributary stream research.



Erin Jarvie

Graduate Program: Fisheries and Wildlife, M.S.

Advisor: Dr. Heather Triezenberg

Graduate Research: My research investigates stakeholder risk perceptions of fish diseases, in particular, viral hemorrhagic septicemia (VHS) and the efficacy of risk communications. Results could be used to improve future outreach efforts, including addressing perceived disease risks and equipping stakeholders to be well-informed.

Motivation to Apply: I applied to this fellowship because of its support of Great Lakes research. Born and raised in the eastern Upper Peninsula of Michigan, I grew up close to Lakes Michigan, Huron, and Superior and developed a deep appreciation for the Great Lakes at an early age. I felt that my thesis research and personal feelings about the Great Lakes complemented the purpose of this fellowship award.

Benefits of the Fellowship: My goal entering my graduate studies at MSU was to be able to contribute to Great Lakes conservation, and this fellowship supports this goal by funding my thesis research. I am very happy to be a part of the legacy of this fellowship and work to support its mission of expanding Great Lakes research.

Robert C. Ball and Betty A. Ball Fisheries and Wildlife Fellowship: This was established to provide deserving graduate students with the opportunity to study fisheries, limnology, or water research.



Darrin McCullough

Graduate Program: Fisheries and Wildlife, M.S.

Advisor: Dr. Daniel Hayes

Graduate Research: My thesis research focuses on the response of early-life predator-prey dynamics of larval yellow perch and their zooplankton prey to changing ecosystems throughout nearshore areas of the Great Lakes and Michigan's largest inland water bodies.

Motivation to Apply: Dr. Robert C. Ball helped lead the way for our department to become a leader in limnology, water quality, and fisheries research. His legacy is tremendous and his passion for our aquatic resources assisted society to choose to conserve, protect, and restore the waters of our Great Lakes. I intend to honor this legacy by doing the same.

Benefits of the Fellowship: As a non-traditional student, the challenges of attending graduate school while supporting my family are many. This award allows me to continue with my educational journey and focus my attention on research of aquatic and fisheries resource integrity within the Great Lakes basin.

Information on graduate student fellowship opportunities from the Department of Fisheries and Wildlife can be found at http://www.fw.msu.edu/graduate/graduate_fellowship_opportunities

USGS National Climate Change and Wildlife Science Center (NCCWSC) Science to Action Fellowship: Recipients work with a NCCWSC mentor and spend a summer in the USGS headquarters outside Washington D.C. The intent is to expose students to the NCCWSC and support them in developing a policy-relevant product related to the impacts of climate change.



Tracy Swem

Graduate Program: Fisheries and Wildlife, M.S./Ph.D.
Advisors: Dr. Gary Roloff and Dr. Phoebe Zarnetske
NCCWSC Mentor: Dr. Laura Thompson
Motivation to Apply: The scientists at the NCCWSC use applied science to tackle the most pressing environmental challenges resulting from climate and land-use change. This fellowship is a tremendous opportunity to work directly with talented research professionals on cutting-edge research.

Proposed Project: A meta-analysis of climate adaptation strategies, literature review of case studies, and nation-wide analysis of climate change and wildlife adaptation strategy by organism, ecosystem, and climate stressor.

Anticipated Skill Development: Working directly with Dr. Thompson will allow me to learn new methodologies in meta-analysis. I will also come away with knowledge of what natural resource managers are doing to adapt to the effects of climate change.

Application beyond Fellowship: Being able to see the ongoing research methodology, research priorities, and discussions at the NCCWSC will put climate change issues and strategies in context and provide valuable guidance for my future career.



Ralph Tingley

Graduate Program: Fisheries and Wildlife, Ph.D.
Advisor: Dr. Dana Infante
NCCWSC Mentor: Dr. Shawn Carter
Motivation to Apply: My interests in the Science to Action Fellowship stem from the desire to link my current and future research to management objectives and directly influence conservation actions. My current research on stream conservation in the context of climate change fit well with fellowship goals.
Proposed Project: The goal of my project

is to incorporate a recently completed classification of Hawaiian streams into management, ultimately enhancing adaptive climate change planning. In addition, I hope to use this project as a template for landscape-scale stream conservation research that directly incorporates stakeholder input in data-limited regions.

Anticipated Skill Development: Through this experience, I hope to strengthen my communication skills and ability to work with managers and stakeholders.

Application beyond Fellowship: Besides the skills developed through the fellowship, the experiences during my visit to the NCCWSC in Reston, Virginia will help me identify critical needs and new directions in climate-related conservation initiatives.

Vera M. Wallach Fellowship - Awarded to students who are studying wildlife management, ecology, or natural resource management or conducting Arctic and Antarctic research with emphasis on the protection and preservation of wildlife in those regions.



Remington Moll

Graduate Program: Fisheries and Wildlife, Ph.D.
Advisor: Dr. Robert Montgomery
Graduate Research: I study carnivores and ungulates (hoofed mammals) in a variety of systems ranging from the southern tip of Africa to Scandinavia. I also conduct cross-disciplinary research in the field of philosophy of science.
Motivation to Apply: Like many ecologists, I am highly concerned about the effects a changing climate will have on wildlife. I hope my work

helps us understand, prepare for, and mitigate the effects of climate change on wildlife in Arctic regions. I was thrilled when this new fellowship became available to Fisheries and Wildlife students working on Arctic wildlife!

Benefits of the Fellowship: I am grateful for the Vera M. Wallach Fellowship because it is enabling me to collaborate with researchers in Norway to study how rising temperatures are affecting moose in Scandinavia.



Amber Goguen

Graduate Program: Fisheries and Wildlife, Ph.D.
Advisor: Dr. Shawn Riley
Graduate Research: My graduate research focuses on how the traditional use of natural resources, in particular wild harvested meat, brings together human and natural systems.
Motivation to Apply: Wildlife conservation in the Arctic involves not only understanding the unique natural systems that create this landscape but also the people who rely on and alter

this environment for the ecosystem services it provides. My dissertation research in Sweden focuses on identifying the ecosystem services provided by the sharing and consumption of wild harvested meat.

Benefits of the Fellowship: It was an honor to be selected for this fellowship. It helped support my research during a year abroad in Sweden at the Swedish University of Agricultural Sciences (SLU).

Bridging the Growing Gap between People and Nature

Overcoming Urbanization and Videophilia

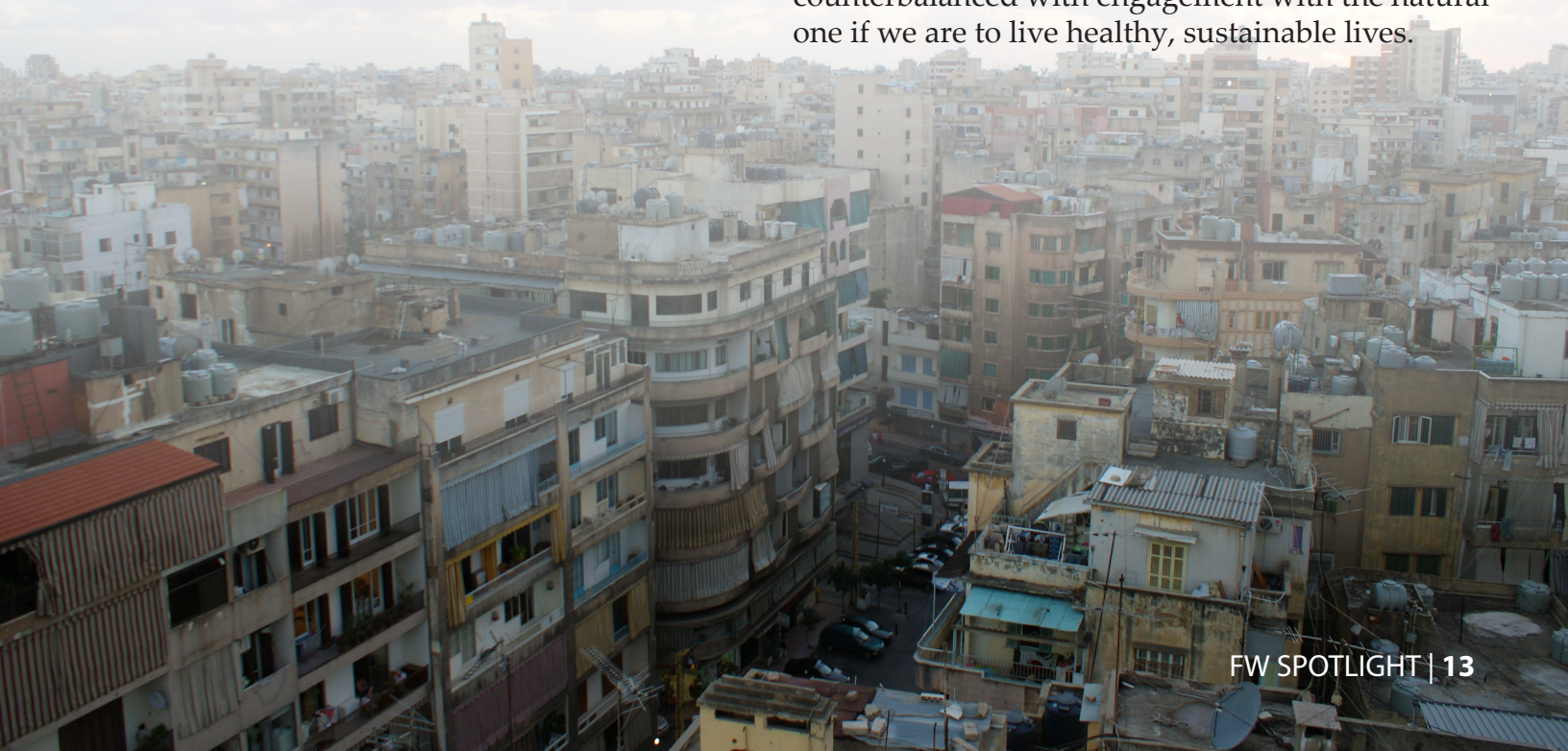
Remington Moll

I spent four years living and working in Beirut, Lebanon, a noisy, people-packed, cement jungle of a city that sprawls lazy and never-ending along the Mediterranean coast. Beirut's population density is roughly twice that of New York City, and it has a mere 8.6 square feet of green space per resident. When I first moved to Beirut with my family, I did not realize what effect living in such a green-starved environment would have on me. As I spent the days and weeks navigating life in the humming metro, my stress levels slowly but steadily rose. Even when I would retreat with my family to the pine-forested mountains of Lebanon for vacation, my enjoyment of the outdoors was overshadowed by a desire to consistently connect with nature, not just visit it on holidays. Moreover, while teaching high school biology in Beirut, I was shocked to find that the only formal exposure most of my Lebanese students had to the natural resource sciences was a single, month-long unit they had been given in the third grade.

*"We grieve only for what we know."
Aldo Leopold*

On a global scale, experiences like these are becoming more common due to an accelerating trend in urbanization. Today, for the first time in history, the majority of people live in cities. By the year 2050, approximately two-thirds of all humans worldwide will be city-dwellers. Research has shown that people's baseline perception of the environment is formed in early childhood and persists into adulthood. Thus, the increase in urbanization is creating a situation where humans are at risk of losing the ability to appreciate nature. When the city is all you know, the wildlands beyond its boundaries hold little allure.

In addition, the recent rise of videophilia – an attachment to electronic media and technology – has been linked to lower rates of outdoor recreation and a weaker connection with nature. Although it's unquestionable that technological advances have improved the quality of our lives, research suggests that a lack of interaction with the natural world has many health effects, from increased stress levels to hindered recovery from emotional trauma. Research also shows that individuals who are the least connected to nature tend to have the most unsustainable consumption habits and are the least likely to support conservation initiatives. It seems our immersion in the virtual world must be counterbalanced with engagement with the natural one if we are to live healthy, sustainable lives.

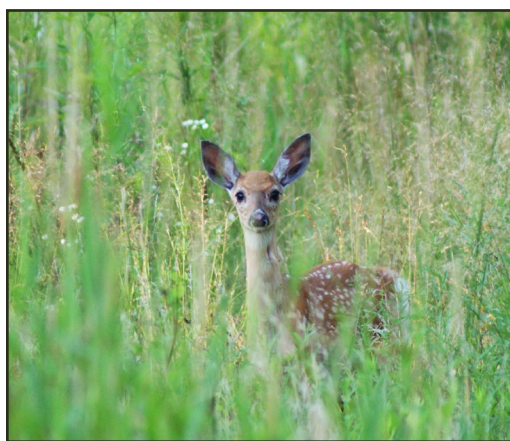




Despite my passion for nature, I am no exception to the trend of videophilia. In the last year I've spent hundreds of hours behind a computer, trying to decipher patterns from information collected by GPS collars attached to African lions in hopes of mapping their distribution and learning how they interact with their prey. I've also recently purchased my first smartphone, which now wakes me up, maintains my schedule, directs me to the store, tracks my budget, logs my notes, takes my pictures – in short, manages a good part of my life. Moreover, it is not uncommon to end a long day by putting my kids to bed early and catching up on a Netflix series with my wife on the couch. These factors, in combination with my experiences in Beirut, have led me to adopt two strategies to maintain my connection with nature as a city-dweller and a technology-user.

First, I have learned to nourish my personal connection with nature through outdoor exercise. I grew up in a large city and knew nothing of hunting, fishing, farming, or camping. Rather, my interaction with the outdoors came from running cross country: I developed a connection with nature by

training on forested trails in urban parks. It was this connection that led me to major in Fisheries and Wildlife Science at the University of Missouri as a student-athlete. It was also running that facilitated my bond with nature within the Beirut metroplex. When I realized I was at risk of losing this connection, I began exercising daily in Beirut's only city park, despite the fact that I had to cover several miles on foot, weaving in and out of traffic jams and enduring many perplexed stares, to reach it. Over time, the park became a refuge from the frenetic pace of the city and a reminder of the greener world.



As a full-time student, researcher, and parent of two young children, I recognize that prioritizing outdoor exercise runs counter to the busy modern lifestyle. For this

reason, nearby urban parks have become a crucial resource for me. Fortunately, the Lansing area has several hidden gems of natural beauty that afford a break from the city and the screen. A personal favorite is Crego Park on the south side of town. Crego reopened as Lansing's largest city park in 2014 after 25 years of closure following industrial contaminant clean-up. Now, this 205-acre park has a running path that originates on the banks of a beautiful lake and snakes its way through maple-dominated forest and deer-filled fields. Crego is a prime example of how, even in an urban setting, a forgotten, polluted space can be transformed into a conduit for connection to the natural world. Quite often I have cleared my head after a long day at the computer by heading out for a run through Crego and onto the Lansing River Trail.

Second, I have taken to heart the recent emphasis in my field on reaching and engaging underrepresented groups, especially youth, in the natural sciences. Such groups are often concentrated in highly urbanized landscapes where they face a dual challenge to connecting with nature: limited contact with natural resources

and extensive access to electronic media. Given the global trend towards urbanization, it is important to recruit youth from underrepresented groups to enter the field of natural resources. As the future leaders in our profession, they hold vast influence over the way the next generation will interact with nature. In response, I have recently decided to modify my Ph.D. research to include a focus on urban ecosystems and engaging inner-city students in citizen science projects. Our proposed project will map the plant, mammal, and bird species

throughout an extensive urban park system in Cleveland, Ohio – all through the help of citizen scientists and park volunteers. Although it is unreasonable to suggest that all researchers in my field adopt the same focus, I believe that partnership with underrepresented groups should continue to be a priority for all of us who seek to impact our diverse and highly urbanized world.

Cities and technology are here to stay. Integrating them with the natural world is a formidable challenge, for each of us personally and for our

society as a whole. I believe that we who are passionate about the natural world all have a unique role to play to ensure the recent trends towards urbanization and videophilia do not sever the connection between humans and nature. Others' responses to these challenges will look different than mine, perhaps dramatically so. It is my hope that the experiences and strategies I've shared here will inspire others who hold a similar passion for nature to work in their own way to ensure our critical connection to the earth is not lost.

Pattullo Award Winner!



Remington Moll is a Ph.D. student in the Department of Fisheries and Wildlife at MSU. He is advised by Dr. Robert Montgomery. (all photos: R. Moll)

Ambrose Pattullo Fund for Environmental Issues Graduate Fellowship for Literary Work

– The purpose of this award is to recognize students who are interested in current environmental issues and who have written about these issues for possible publication in a literary outlet. The focus of the essay must be to raise public awareness of a current environmental issue.

Rem's Motivation to Apply – I have been profoundly influenced by environmental writers such as Barry Lopez and Aldo Leopold. I think that raising awareness about environmental issues through literary outlets both encourages the sustainable use of our natural resources and inspires others to consider a career in the environmental sciences. The Ambrose Pattullo Fellowship was the perfect opportunity to do both of those things.

Benefits of the Fellowship – As a parent of two young children, I am especially grateful for the financial support provided by this fellowship, as it enables me to pursue my dream of becoming both a research scientist and a voice for environmental issues. The opportunity to publish an essay in *Spotlight* magazine is also invaluable because it allows me to communicate with an audience outside the scientific community.

For more information, see [//www.fw.msu.edu/graduate/graduate_fellowship_opportunities](http://www.fw.msu.edu/graduate/graduate_fellowship_opportunities)

Abby Lynch & Clint Otto

1. Tell me about what you did when you were at MSU.

AL: My dissertation research examined the implications for climate change on Lake Whitefish recruitment in the 1836 Treaty Waters of Lakes Huron, Michigan, and Superior. However, one of the many things I learned from my advisor, Bill Taylor, was to make my dissertation just one component of my education at MSU. Between 2009 and 2013, I tried to take advantage of many other opportunities at MSU including the Environmental Science and Policy Program, the Ecology, Evolutionary Biology, and Behavior Program, and the Future Academic Scholars in Teaching Program.

CO: During my time at MSU, 2008-2012, I studied the effects of structural retention on wildlife populations in Michigan's harvested forests. Essentially, I wanted to know if leaving patches of habitat, such as green tree islands or coarse woody debris, in forest clear-cuts benefited wildlife. Gary Roloff was my academic advisor and the Michigan Department of Natural Resources (MI DNR) was our primary partner in this research.

2. Where are you now? What is your position?

AL: I am now a Research Fisheries Biologist with the U.S. Geological Survey's (USGS) National Climate Change and Wildlife Science Center in Reston, Virginia.

CO: I am a Research Ecologist with the USGS at Northern Prairie Wildlife Research Center in Jamestown, ND.

3. What motivated you to apply to the USGS?

AL: The chief of my current research center was on my advisory committee at MSU. Though this can't be the case with every job, there's a great advantage for a potential employee as well as an employer to be familiar with each other before applying for a job.

CO: While still at MSU, I saw my current position listed on USAjobs.gov. The principal duty of the advertised position was to understand how biofuel crop production affects ecosystem services and wildlife habitat in the Prairie Pothole Region of the USA. I thought the position sounded interesting, so I decided to apply.

4. What does a typical day in your life look like?

AL: I think if I had a typical day, I would get bored with my job! Every day is different and that's what makes it fun and exciting. That being said, I am a research biologist in a national center, where larger-scale (national and global) synthesis is a focus. So, I am in front of a computer most days working on large-scale questions about fish and topics like global change and global food security.

CO: As I write this, I am traveling with my research team to a study area in western Minnesota. Over the next two weeks we will be assessing the health of our honey bee research colonies in three different states. Then it is back to the office. In a few weeks, I will present at The Wildlife Society meeting in Winnipeg. I guess it is hard to define a typical day, which keeps the job fresh.

5. What at MSU do you think best prepared you for your position now?

AL: I think the combination of activities that I was involved with at MSU, from classes to research to community engagement activities

(like working for *Spotlight!*) helped prepare me for juggling many tasks at once. At MSU, I took advantage of opportunities to learn new things and try new activities to build a broad skill set that I can use for a range of responsibilities in my current position.

CO: Having the freedom to develop a research project and run with it; fail, learn, improve, repeat. My advisor, Gary Roloff, knew when to be a strong mentor and when to give me space to learn on my own. Gary had some broad project goals in mind, but it was my job to hone our research questions, develop the study designs, and implement them.



6. Do you have any advice for FW students who might wish to follow in your professional footsteps?

AL: Consider applying for the USGS National Climate Change and Wildlife Science Center Science to Action Fellowship! This fellowship gives students the opportunity to share their research with a broader community of decision makers through an engagement project mentored by one of our staff scientists.

CO: You will greatly improve your odds of landing a professional research position if you have a proven track record of completing scientific studies in a timely manner. Once your thesis or dissertation proposal is completed, make routine progress on science products. Take time every work day to write or analyze data, and hold this time sacred.

7. Anything that you'd recommend as a MUST to students new to East Lansing?

AL: Adventure beyond the campus bubble! You can go as close as Lansing to enjoy a Lugnuts game or pancakes at the Soup Spoon (yum!) or as far as the Upper Peninsula for great hikes and a total change of scenery. Michigan is a beautiful and diverse state that's worth exploring!

CO: Well, I heard Bonnies Bar is closed for business so I can't recommend two-for-one burgers on Monday nights. But Grand Traverse Pie Company will not disappoint. You used to be able to burn off the excess calories by playing FW football on Sunday mornings (see Ace Sarnelle, FW, to join the tradition).

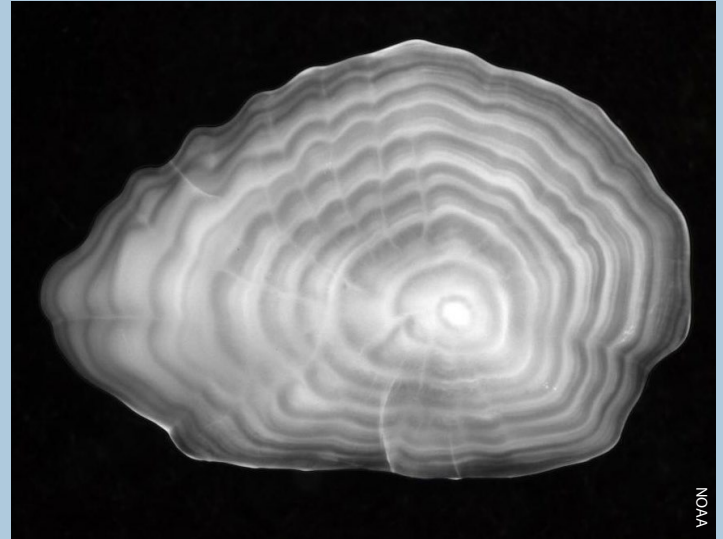
If you do adventure beyond the bubble as Abby suggests, do not be alarmed if a person from the Upper Peninsula calls you a "troll." All Michiganders who live south of the Mackinac Bridge are affectionately called "trolls" by Yoopers.

Otolith micro-what now?

Alexander Maguffee

Otolith microchemistry. Rolls right off the tongue, doesn't it? Maybe it doesn't sound like something you'd like to learn—but don't discount it just yet. The use of otolith microchemistry, which looks at where fish were born and how they move, has grown in relevance over the past couple decades. While this method is primarily used in marine ecosystems, it has begun to be used in freshwater systems as well. In fact, projects in the Great Lakes involving Chinook salmon and steelhead have been met with large amounts of success.

As an example of this method's use, I'd like to introduce my project, which focuses on Chinook salmon in the Great Lakes. In the early 2000s, Lake Huron saw a collapse in its number of alewives, a non-native fish that is also the primary food source of Chinook salmon. Due to this decline, it is thought that Chinook from Lake Huron have been migrating to



Lake Michigan to feed. This movement has the potential to put more pressure on Lake Michigan's population of alewife. We can't prevent the movement, but being able to put a number on how many Chinook migrate could help managers determine fishing regulations and stocking decisions, which will help protect Chinook salmon. And, you guessed it, otolith microchemistry is the method I will use to help solve this problem.

But let's back up a bit. What is an otolith anyway? The otoliths of fish are their ear bones (*see above*), located just above their gills in a membrane called the otic sac. Fish actually have three pairs of otoliths, but typically only the largest pair, the sagittae, is used for analysis. Otoliths, like scales, can be used to age fish. However, the use of otolith microchemistry focuses on a much smaller scale.



The Visual Guide to Otolith Preparation

So that's what an otolith is, but what about the microchemistry part? While otoliths are primarily made up of calcium, they also contain concentrations of trace elements, such as strontium, magnesium, and lead. These elements enter the bloodstream through the gills or the gastrointestinal tract, and end up with the otoliths in the otic sac. Otoliths grow indefinitely as fish age, meaning that new layers are added on a consistent basis, and these layers contain whatever trace elements are in the otic sac at the time. To examine an otolith's microchemistry is to measure the concentrations of its trace elements; these concentrations can be compared between different layers of the otolith, and even with the otoliths of other fish.

Because otoliths incorporate trace elements from the surrounding environment, one can hypothesize that the concentrations of these elements vary from location to location due to environmental differences. This assumption can be tested by collecting juvenile fish from different locations and examining the microchemistry of their otoliths. Collecting these fish involves the use of an electroshocker, a piece of equipment worn as a backpack that sends an electric pulse through the water, making fish easier to net. In the case of my project, I have collected Chinook salmon from multiple streams (*see map*) feeding into Lake Michigan and Lake Huron, and will examine the chemical differences between these streams.

Before this can be done, however, many steps are required to prepare these otoliths for analysis (*visual guide at right*).

"the otoliths are **extracted** from the fish"



"they are **encased** in epoxy"

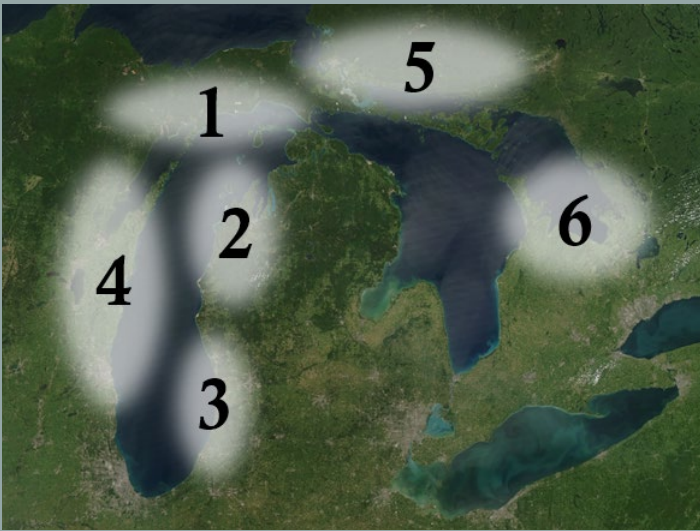


"then **cut** near the center"



"final step is **polishing**...grind the otolith down to its core"





All of the regions in which salmon were collected. Differences in chemical otolith structure will be calculated using this regional scale.

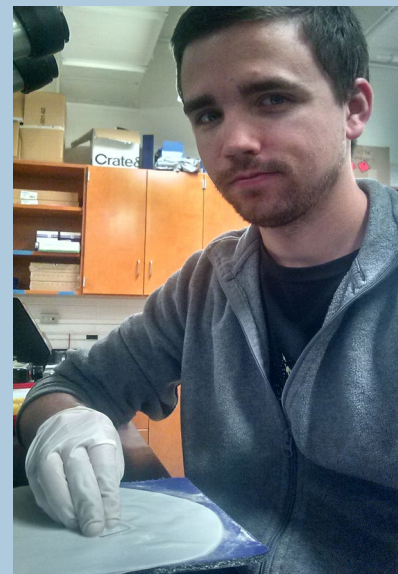
First, the otoliths are **extracted** from the fish; this is done by making a small cut near the fish's head and carefully picking them out with forceps. The otoliths are also cleaned to remove all of the wonderful fish innards attached to them. After the otoliths dry, they are **encased** in epoxy, which is a type of resin that hardens with time. The otoliths are then **cut** near the center using a saw with two blades spaced a small distance apart; in this way, we get small sections of the otoliths. The final step is **polishing**, which requires fine grit sandpaper to grind the otolith down to its core. Following this process, the otoliths are ready for analysis. Simple, right?

Analysis of the otoliths is done using a machine called LA-ICPMS, which is short for laser ablation inductively coupled plasma mass spectrometer. As you might expect, the explanation for how it works is a bit long-winded. At its most basic, however, it is a laser attached to a mass spectrometer. The laser removes material from the otolith and sends it to the mass spectrometer, which is used to identify

and measure the trace elements.

We can determine chemical differences between regions using various statistical methods. But it doesn't stop there; if differences exist, a computer model can be built that predicts a fish's stream of birth. And that's what I'll be doing—building a computer model to predict where Great Lakes Chinook salmon were born. The scope of this project is simply to build the model and test its efficiency using fish of known origin. In building this model, the hope is that we will be able to examine the otoliths of unknown-source fish and determine where and how far they have moved based on their birthplace and where they were caught. Future work may be done to use the model to determine movement from Lake Huron to Lake Michigan, helping managers better protect Chinook salmon in the Great Lakes for many generations to come.

And there you have it—otolith microchemistry in a nutshell!



Alex Maguffee is a master's student in the Quantitative Fisheries Center in the department of Fisheries and Wildlife. Alex's advisor is Dr. Mike Jones. Here he is polishing an otolith for his project. (all photos: A. Maguffee)



The A.L.E. Lab

Aquatic Landscape Ecology



To learn more about the ALE lab, visit: www.msu.edu/~infanted/

Dr. Dana Infante directs the Aquatic Landscape Ecology (ALE) lab and leads several graduate students and professional staff in research efforts that involve understanding landscape influences on aquatic ecosystems. Members of the ALE lab work with multiple agency stakeholders, and their collective work can be used to develop tools that aid in efforts to conserve aquatic resources and to support decision-making by managers. Dr. Infante is an Associate Professor and a Partnership for Ecosystem and Research Management (PERM) faculty member with the Michigan Department of Natural Resources (MDNR), Fisheries Division. Her research interests include effects of landscape-scale factors on physical and biological features of river systems, river catchment hydrology, and ecological assessment. She led a national effort to assess conditions of the nation's rivers in 2010 and again in 2015 for the National Fish Habitat Partnership, with recently released results available at: ecosystems.usgs.gov/fishhabitat. Assessment results, along with data compiled for this effort, are intended to support decision making on where and how to prioritize management actions related to conservation of stream fishes and their habitats in the conterminous United States, Alaska, and Hawaii.

Graduate Students



Janet Hsiao is a Master's student interested in the conservation of nearshore coastal habitats and how management strategies may differ when considering ecosystem linkages. Her research uses a landscape approach to investigate how landscape characteristics may affect the quality and condition of coastal habitats and the organisms they support. She will be testing relationships among anthropogenic and natural variables as a way to contribute to understanding the connectivity between inland and coastal ecosystems.

Linda Ortiz is a Master's student and is employed full-time by the US Department of Agriculture under the Natural Resources Conservation Service. Her research will include a comparison of the contaminants from farming operations versus from residential areas into streams. This would provide a better understanding of how aquatic habitats might be affected and which ones may need more aggressive conservation practices to reduce potential negative impacts to aquatic systems.



Ralph Tingley's Ph.D. research will help stream managers prioritize conservation actions in the face of climate change by helping to identify where and how to most effectively apply management actions. Ralph is classifying streams of the five main Hawaiian Islands based on landscape and climate characteristics in relation to native species assemblages in order to identify relationships between endemic stream organisms, stream flow regimes, and natural landscape factors, including climate. Along the North Hilo Coast of Hawaii Island, Ralph is also examining influences of different stream flow regimes on population structure, health, and habitat use of a culturally-important shrimp.

Research Associates



Dr. Wesley M. Daniel's post-doctoral research is focused on developing the National Fish Habitat Partnership's inland fish habitat assessment. This work assesses the current status of the nation's riverine fish habitats based on fish assemblage responses to anthropogenic landscape variables such as land use, dams, and mining. Wesley received his doctorate in biology and minor in fisheries management from Louisiana State University, where he worked with freshwater mussels. He has continued his work with threatened and endangered mussels by evaluating habitat suitability in Michigan and developing a multiagency regional conservation plan in Texas, Oklahoma, and Louisiana.

Dr. William (Willie) Fetzer's research addresses spatial and temporal food web dynamics in response to anthropogenic perturbations, such as climate change, invasive species, and eutrophication. His previous research focused on predator-prey interactions, population dynamics, and carbon sources supporting fish production through the use of multiple long-term datasets. Recently, he has been collaborating with the Michigan DNR to quantify nearshore fish community dynamics in the Great Lakes and with the International Joint Commission to assess data availability and calculate ecological and human health indicators for the Great Lakes basin. He will be joining the Wisconsin DNR as the Great Lakes Fisheries Management Coordinator.



Dr. Rafaela Schinegger is a senior scientist and lecturer from the University of Natural Resources and Life Sciences, Institute of Hydrobiology and Aquatic Ecosystem Management in Vienna, Austria. She coordinates research projects on fish ecology, sustainable hydropower use, and ecosystem services across Europe. Her work includes developing methods to link freshwater ecological status to the impact of different human pressures and estimating how much pressures should be reduced for freshwater ecosystems to reach desired ecological status, with results supporting the European Water Framework Directive (see www.mars-project.eu). At MSU, she is a Fulbright scholar in the Department of Fisheries and Wildlife working with Dr. Infante and her team to conduct a cross-continental comparison on the influence of human pressures on riverine fish assemblages.



Professional Staff



Arthur Cooper's current work assesses the influence of dams in fragmenting river systems and altering fish assemblages at both national and regional scales. In general, he specializes in quantifying human disturbances to riverine landscapes using spatial information generated through GIS. Arthur also supports research initiatives for the Michigan DNR's Institute for Fisheries Research, developing distribution models and conservation planning for aquatic species of greatest conservation need.

Kyle Herreman is the GIS specialist and database manager for the ALE lab. He is responsible for preparing, analyzing, and mapping spatial data used in various projects focused on landscape effects on stream habitat for fishes. He is also responsible for delivering processed data to stakeholders and collaborators.



Recent Lab Members:

- Dr. Yin-Phan Tsang**, Assistant Professor, University of Hawaii, Manoa
- Dr. Darren Thornbrugh**, Post-doctoral researcher, EPA
- Jared Ross**, The Nature Conservancy
- Daniel Wieferich**, United States Geological Survey

New Lab Members:

- Elizabeth Throckmorton**, Research Technician
- Paul Gibson**, Undergraduate Research Technician



Emerging Leaders Empowered to Make Change

**Kathryn Frens, Lisa Peterson,
Zach Curtis, and Molly Good**

“Promote positive change, economic vitality, resource conservation, and enhance the quality of life in Michigan by encouraging leadership for the common good.” That is the mission of the Great Lakes Leadership Academy (GLLA) conducted by the MSU College of Agriculture and Natural Resources. Through two programs, the Emerging Leader Program (ELP) and the Leadership Advancement Program (LAP), the GLLA brings together current and potential leaders from a variety of sectors to broaden their conservation perspectives and teach them the necessary skills to tackle the multitude of environmental, social, and cultural issues Michigan (and the world) face today. Since 2004, the GLLA has developed bold leaders capable of envisioning and implementing solutions for the common good.



Great Lakes Leadership Academy



In April 2015, twenty-four eager participants came together in Hastings, Michigan for their first of three sessions of the ELP. The ELP included participants representing diverse employers such as state and federal agencies, non-profit organizations, tribal groups, MSU Extension groups, and MSU graduate students, which provided us with an opportunity to network with individuals from many sectors. As anticipated, we did learn tips and tricks for planning a productive meeting, designing an agenda, facilitating discussions, and other classic leadership skills, but the GLLA pushed us further than that. Our GLLA cohort delved into complex and challenging topics, such as emotional resiliency and recognizing behavioral traits in ourselves and the people around us, diversity and the difference between equality and equity, and what it means to lead for the common good. Through difficult conversations and often emotionally draining days, these twenty-four once-eager participants transformed into a supportive and strongly bonded group of leaders. To give you a snapshot of our GLLA experience, four MSU graduate students discuss their perspectives on lessons learned from the 2015 GLLA.





Kathryn Frens

Ph.D. Student
Fisheries & Wildlife

'Leadership for the common good' is a GLLA catchphrase, and we spent quite a bit of time reflecting on and talking about what this phrase means and how it looks when applied in real life. As you might expect, we were unable to articulate a single definition of "common good," but we still found ways to engage with the idea in several different settings. The first was a group project in which we identified a person who leads for the common good, and then interviewed that person about their work and leadership style. My group found ourselves implicitly defining "common good" while narrowing down our list of possible interviewees, and ended up interviewing a policy advisor and long-time public servant. Other groups ended up with different implicit definitions: while I was adamant that the head of a for-profit company could not be said to be working for the common good, another group interviewed a CEO, and made an excellent case for his inclusion.

This concept was also woven into our many discussions of values and dealing with differences in the workplace. A person's concept of the common good is shaped by what they value, which is influenced by their community of origin and experiences in life, giving rise to disparate ideas on what to do when the common good is your goal. During the third session, we spent most of an afternoon coming up with consensus-based policy proposals that would advance the common good in areas like food, public land, and transportation, which quickly brought up differences not only in strategy, but also in conception of what advancing the common good means. To finish the project, we had to understand the origin of these conflicts and find points of commonality.

"I never would have guessed how quickly our cohort would bond, or how strong those bonds would become over a relatively short time together. The relationships I formed will enhance my professional network, no doubt, but more importantly I gained lifelong friends. Sharing this once-in-a-lifetime experience truly formed us into a family, and I am grateful to be part of it."

- Julie Hinderer, GLFC, GLLA Participant



Lisa Peterson

Ph.D. Student
Fisheries & Wildlife

Diversity. One of the GLLA cornerstones, and in my opinion, an extremely uncomfortable topic of conversation. But a main take-away from our GLLA diversity training was that just because a conversation is uncomfortable doesn't mean it is not important to have. As a leader, we need to be aware of the systems of oppression in our workplace and in this country. Discrimination and oppression are not just present at the individual level; they are also present at the institutional and cultural levels. To combat that oppression, we need to acknowledge it and envision solutions from an inclusive and equitable perspective. But what is equity, as opposed to equality? This was another important topic of the GLLA. If we give everyone the same thing then everything should be fair, right? That's equality. But this assumes we are all starting in the same place, which we are not. We are all part of target and non-target groups, sometimes being helped by the system in place, sometimes being hindered. Equity acknowledges that. Equity means access, and recognizing the barriers in place and providing means to overcome them. Being an equitable leader means recognizing that people are different, and the way they are treated by the system and society is different, and it is working to meet people where they are.

The GLLA argues that including diversity and equity in our vision as leaders is about recognizing that people from different perspectives bring great value to the table, and that we need to combat the idea that this is not true. Power and privilege are, and may always be, present; but to be able to have open conversations with others about our differences, and come from a place of love, not of fear, is an important component of leading for the common good.



Molly Good

Ph.D. Student
Fisheries & Wildlife

Understanding YOU and Your Leadership Style -

The ELP challenges its participants early on with the difficult task of learning about themselves as individuals in both a professional and personal setting. To jumpstart this learning process, each participant receives their own DiSC profile, or personality and behavioral assessment. The letters in DiSC stand for: D = dominance, i = influence, S = steadiness, and C = conscientiousness. For instance, I received a D profile or a dominant personality and behavioral assessment. The DiSC profiles, though fairly general in their descriptions, helped me and other program participants quickly become more self-aware of our values, personality strengths and weaknesses, and our boldest behavioral traits – both in and out of the workplace.

During the year, we continued to return to our DiSC profiles to seek guidance on how to use our personality characteristics and behavioral traits to increase effectiveness in certain circumstances. This type of reflection was especially helpful to program participants during group activities, when we were requested to function together as a team. As part of our first team assignment, I was placed in a group composed of I's, S's, C's, and other D's. All eight of us spent time understanding our DiSC profiles and building trust within our team by recognizing our individual limitations and utilizing others' strengths. We learned that effective, strategic leadership is flexible leadership, in which we, as leaders, must adapt and adjust our style to others to achieve maximum success.

The ELP encouraged program participants to practice flexible leadership by providing us with additional tools and strategies. We learned about utilizing decision-making models, developing an agenda, and employing different facilitation techniques. Since the program wrapped, I have benefitted from flexing my own leadership style and experimenting with these tools and strategies in my graduate lab and at home.



Zach Curtis

Ph.D. Student
Environmental
Engineering

Emotional Wellness Skill Building-

At one of our first training sessions, we were asked to think of a leader for whom we had great respect, and to consider the sort of behaviors they exhibited that separated them from ineffective leaders. Thoughtfulness, optimism, patience, and resilience were some responses, and the link between emotional wellness and effective leadership quickly emerged in our discussion. But how do we maintain this sort of emotional stability given the large responsibilities and complex challenges we face as researchers, public professionals, or other leaders of the common good? Throughout the ELP, we practiced connecting with our emotional health to become more effective leaders in the face of adversity.

Time was spent identifying our own unique behavioral and physiological responses to stress, a necessary component of deciding when our "best self" is present to make effective decisions. We discussed various strategies for quickly finding our emotional health when we have been "triggered" by challenges in our life – from simple thinking and breathing exercises, to developing personal growth plans that strengthen our core values and make us more emotionally resilient. We outlined the dominant cultural "norms" that result in unfair expectations put upon ourselves and one another, and considered that, as leaders, we need to be aware of the negative impact that results from reinforcing unreasonable rules and expectations. To that end, we explored the power of self-empathy and empathy for others as a way to connect and build trust, which ultimately results in more successful leadership and wholehearted living.

Perhaps many of the ELP graduates were surprised to see emotional wellness training in a leadership curriculum – I know I was. I am confident, however, that many of us will agree that it was one of the most impactful aspects of the Emerging Leader Program experience.

Visit www.glla.msu.edu for more information about the GLLA. The GLLA accepts applications for the Emerging Leader Program and the Leadership Advancement Program during the fall before the program year.

A Call to Your “Young” Scientist

Your duty to inspire the natural resource professionals of 2030

Tracy Swem

NATURAL RESOURCE PROFESSIONALS have a secret: part of us, however big or small, has yet to grow up. Adulthood conceals our deeply-rooted altruism—molded since childhood—to care for places. We are a unique bunch, each with a story of how we were shaped by people or events that ultimately led us to dedicate our professional lives to the outdoors. I find this especially fascinating—you can ask any colleague what led him or her to this career, and usually the memory is recollected as if it were carefully planted and subsequently nurtured for years. From what I’ve gathered after many casual discussions, most of these memories seem to occur around 8, 9, or 10 years old. Mine was discovering my dad’s waders in the basement and walking in the lake near our house, surrounded by sunfish and thinking I was an astronaut (whatever, I was 10). I later thought I discovered a new species on the beach. Turns out they were sand fleas. Regardless, the path was laid, and I never really grew up.

When you think about it, your own outdoorsy memory had to be a powerful moment in your life. It guided you through many future trials and tests. It may have seen you through your parents’ passive aggressive predictions of their son being a 45-year-old bug collecting man-child living in their basement, or through watching your high school friends buy houses while you slept on a floor mattress

next to your black lab that was expertly trained to identify animal poop. Perhaps it saw you through months in the Nicaraguan rainforest, nearly dying from 600 ant bites one year, to surviving the greater ordeal of explaining what you do to extended family the next. Whatever it is, it has seen you through to wherever you are now, reading this article.

I have never met a natural resource professional who could not recollect a set of important, influential, career-setting memories. I have never met a non-natural resource professional who could.

Now that I have become an established graduate student—a real, bona fide, “sciency” career professional—I have noticed that people seem to take me seriously (usually by intensively asking me how to get rid of a problem animal). But I’ve especially noticed this in the “Tracys of 2030.” The youngsters who, upon hearing that I follow turtles around for a job, are now seeing their young professional dreams shaped into real possibility rather than perhaps being told to chase other, more reasonable pursuits. I’ve noticed these miniature revelations many times in my short career: during philosophical conversations with wee 6-year-olds at fishing camp, when explaining mark and recapture techniques to middle-schoolers as a DNR fisheries assistant, or when a family tagged along for some turtle



telemetry last summer. I've had kids hug me when they go home. I've had high school students get serious and ask me what they should do with their lives. I had an elementary student turn to me when finding a turtle and say, "I didn't think this was a real thing!" We high-fived. I realized, I had the same dilemma as a kid. I wanted to hang out in the woods all day; I just didn't know what to call it as a job. I also quickly realized most adults didn't get excited when I talked about it (luckily, my parents did...in fact, my mom drove me to a nature center every Monday. Thanks Mom).

So this is a call to your "young" scientist, behind all that adulthood.

Forget about becoming the next E.O. Wilson or Sylvia Earle for a second. How will you replace yourself with a better, more inspired, harder-working professional? If you've never thought about this, perhaps you are too busy, or too distracted. Maybe you're worried about a grant proposal, or thesis edit, or your latest Forest Inventory Analysis. Replacing yourself might be the most influential thing you do throughout your career. Not that you won't accomplish great things; I just think this is greater.

Think about all the kids you know who are at that critical stage in life. The 8-, 9-, or 10-year-olds who have not yet been told they can do anything – including studying turtles for a career. Most pre-teens have yet to be completely influenced by their

peers. They may be at a fleeting crossroad that appreciates profundity without dismissing the messenger. Most students are deciding their futures in high school and even middle school. How many students know that Fisheries and Wildlife is a thing? Only the few wee young future scientists who hold on to their curiosity of the natural world throughout the trials and tribulations of peer pressure, parent pressure, and the like. These life-changing decisions and



curiosities are dependent on that vital science-related experience. You could be this experience. You could be the facilitator of stories. As "sciency types", we are a K-selected species: we have to dedicate time and effort into the next generation in order for our very important profession to persist.

So invest in the people who you will someday be supervising. Volunteer at a local nature center. Participate in fishing camps. Help out with MSU's "Grandparents University," "Agriculture and

Natural Resources Week," or "Middle School Girls Math and Science Day." Coach a local Science Olympiad chapter. Convert a niece or nephew into a future scientist with an impromptu bug safari at your next family reunion. Take a bit of your life and convince a young person that this is the best thing to do with his or hers. Show young, impressionable future scientists what it is like to be you, to do telemetry or go electrofishing, do a bird survey, count acorns, or discover what's living under an old board. Tell them how monarch caterpillars become poisonous, how to make a frog fall asleep, how to communicate with lightning bugs, or raise some tadpoles. Divulge the mysteries of hairworms, pollination, bee dances, and flower phenology – develop a deeper connection between the young potential scientists of tomorrow and the inner-secrets of a world that works beyond the bounds of human fabrication. And then tell them they can study this stuff as a job.

And in the process, remember to keep yourself young. Cultivate the age when you stole your dad's waders and went discovering, when something inside you clicked and it wouldn't go away no matter what – and then, to ultimately close out your storied career, use it to replace yourself with someone better.

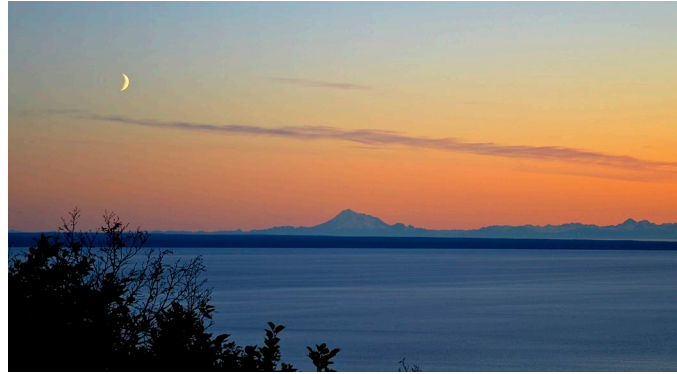
- Tracy Swem



FW Photo Contest

3rd Place and Honorable Mentions

Scenery



3rd (left): Star Trails by **David Dressel**

HM (top): Alaska Range at Sunset by **Cole Devault**

HM (right): Multnomah Falls, Oregon by **Brandon Armstrong**

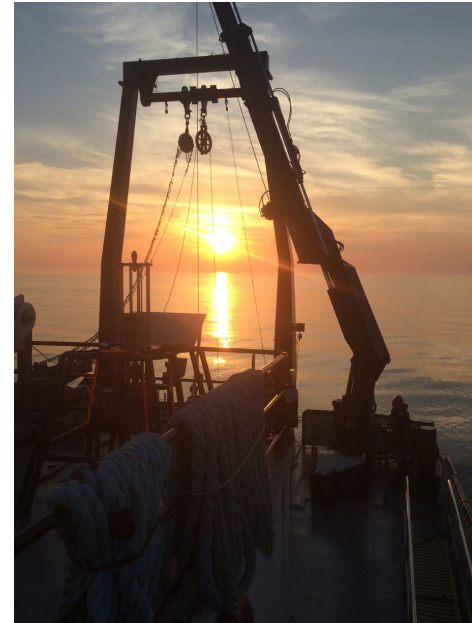
Field Work & Outreach



3rd (left): Boy and Blue Jay by **Dr. Jen Owen**

HM (center): Closer Look at Yellow-bellied Sap Sucker by **Kimberly Fake**

HM (right): Above Deck for Lake Michigan Sunset by **Devin Lang**

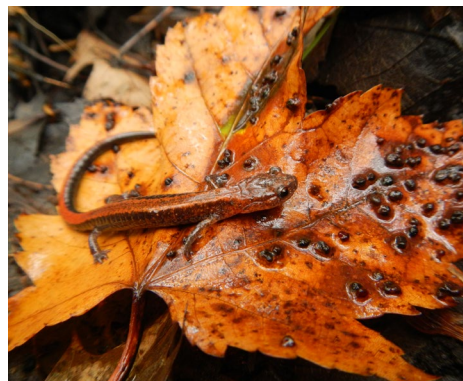


Flora & Fauna



3rd (left): Baby Sea Turtle by **Michelle VanCompernelle**

HM (right): Red-backed Salamander by **Tricia Brockman**





FW Photo Contest Winners



Scenery

1st (left): Long Chinstrap Penguin on Iceberg by **Dr. Jen Owen**

2nd (right): Mad Morning by **Molly Good**



Field Work & Outreach



1st (left): Girl with Red-eyed Vireo by **Dr. Jen Owen**

2nd (right): Ground Squirrel Leaving Tomahawk Trap by **Jen Smith**



Flora & Fauna



1st (left): Sandhill Crane in Wheat Field by **Dr. Jen Owen**

2nd (right): Winter Storm by **Shairah Abdul Razak**



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