

Spring 2013

SP TLIGHT

MSU Fisheries & Wildlife

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

Conserving Michigan Wildlife in Harvested Forests

Economic Benefits of Publicly-Accessible Land for Hunters

Tracking Sea Lamprey with Acoustic Telemetry

Outreach Across the Generations: Welcome to Grandparents University!



ALSO INSIDE: Diversifying representation in natural resources, Demmer Scholars at work in Washington, D.C., Fulbright: Beyond funding, Bridges between FW Club and FW GSO, A dinosaur fish back from the brink, What to consider when buying fish, & 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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Special thanks to our contributing authors for their submissions and the Department of Fisheries & Wildlife for financial assistance provided toward printing this magazine.

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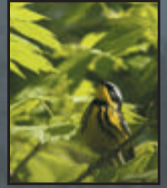


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Darin (DJ) McNeil's cover photo of a magnolia warbler was chosen by popular vote in a voluntary poll of Department of Fisheries & Wildlife faculty, staff, and students.



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Outreach in Action! Exploration and Engagement Across Generations at the MSU Ponds

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U.S. Fish and Wildlife Service biologists set a gill net to track the status of Gulf sturgeon. See page 28 for more information on this "dinosaur" fish. (photo: Paul A. Lang/USFWS)

Letter from Dr. Mike Jones:

Welcome to the ninth issue of FW SPOTLIGHT. One of my great pleasures during each academic year is when the editor of SPOTLIGHT sends me a pre-publication set of proofs for the magazine and I get to find out, before anyone else, what we're going to be reading about in the next issue. SPOTLIGHT magazine continues to be one of FW's signature products and, as always, the graduate students involved deserve HUGE credit for their efforts to produce an outstanding publication.

Fittingly, the headline article for Issue 9 of SPOTLIGHT is about wildlife. Issue 8 was referred to as a "Special Aquatic Issue," so it's only fair that the landlubbers get their turn. But, if you prefer waders to hiking boots, a mask and snorkel to binoculars, or a fly rod to a shotgun, there is still plenty for you in here.

In the headline article, recent Ph.D. graduate **Clint Otto** describes his dissertation research on the role of "retained structures" in providing suitable habitat for songbirds and salamanders in areas affected by clear-cut logging. His findings shed important light on the degree to which these small

patches of less-disturbed habitat mitigate against the negative effects of logging on wildlife. Retaining structures do not appear to provide a perfect solution, and **Clint's** work helps us to reconcile needs of wildlife and timber industry: practical advice for forest managers based on sound science.

In the pages to follow, you'll also learn about how acoustic telemetry is rapidly becoming for fish ecologists what radio telemetry is for wildlife ecologists. **Trevor Meckley** and **Chris Holbrook** describe how they are using this technology to learn about movements of the sea lamprey in lakes and rivers – their findings should help the Great Lakes Fishery Commission to develop more effective ways to control this destructive invasive species.

Back on the wildlife side, **Scott Knoche** explains how he is using an economic valuation method called the "travel cost model" to estimate the economic value of publicly held lands for hunters as part of his dissertation research. His results suggest that these lands provide nearly \$100 million in economic benefits for user groups – valuable information for making decisions regarding the uses of public lands.

Together with these articles about exciting research being conducted by our graduate students you can read about our many fellowship recipients: **Marisa Rinkus, Abby Lynch, Kara Stevens, Darren Thornbrugh, Hanna Kruckman, and Jason Smith**. Marisa describes her remarkable experiences in Brazil



as a Fulbright Fellow and the articles written by Abby and Kara that garnered them Patullo Fellowships are printed here for your enjoyment. *Congratulations to all of these outstanding students!*

Rounding out this issue is the recurring lab profile – this time around you get to meet Dan Kramer's lab; an introduction to four graduate students from Puerto Rico who joined our department in 2011 as part of a developing partnership with the University of Puerto Rico; a visit from two FW alumni who are currently Knauss Fellows in Washington, D.C.; our first undergrad-grad co-authored piece about collaborations between our undergraduate FW Club and our graduate student organization (GSO); a brief report on the Demmer Scholars Program, a summer internship program based in Washington, D.C. that provides amazing experiential learning opportunities for our undergraduates, and in 2012, for three of our graduate students; and last, but far from least, a great story about three of our graduate students reaching out to the local community with "Grandparents University."

So, pour a coffee or some other favorite beverage, sit back in your favorite chair, and *enjoy yet another great issue of SPOTLIGHT!*



Spotlight on Student Awards



-Compiled by
Jodi Kreuser

Andrea Bowling, Emi Fergus, Diana Guzmán Colón, Jodi Kreuser, Abby Lynch, Kyle Molton, Bob Montgomery, Pablo Reeb, Marisa Rinkus, Sara Smith, Darren Thornbrugh, and Wu Yang received travel grant awards. Sources of travel support include: Animal Studies Program, College of Agriculture and Natural Resources, Council of Graduate Students, Department of Fisheries & Wildlife, Ecological Society of America, Ecology, Evolutionary Biology, and Behavior Program, Environmental Science and Policy Program, FW Graduate Student Organization, Great Lakes Fishery Commission, International Lake Environmental Committee Foundation, International Studies and Programs, Michigan Chapter of the American Fisheries Society, Michigan State University, National Science Foundation, Office of the Associate Provost for University Outreach and Engagement, Red Cedar Fly Fishers, Society of Environmental Toxicology and Chemistry, The Graduate School, The Wildlife Society, and U.S. Department of Agriculture.

Andrea Bowling, Emi Fergus, Corey Jager, Kate Julian, Abby Lynch, and Brendan Shirkey received Special Recognition Fellowships from the Department of Fisheries & Wildlife for their contributions to the department.

Steven Chang, Kyle Enger, Wei Liu, Andrea Miehls, and Clint Otto received College of Agriculture and Natural Resources Dissertation Completion Fellowships for summer 2012.

Kari Dammerman was awarded Best Oral Presentation (*Retrospective*) at the 2012 Fisheries & Wildlife Graduate Student Organization Research Symposium.

Angela Deardorff received a Center for Integrative Toxicology and Integrative Toxicological Sciences (EITS) award to enhance her graduate education in the EITS program at MSU. She also received the Graduate Women in Science Rachel Carson Award for environmental excellence.

Diana Guzmán Colón was selected to participate in the Rachel Carson exhibit "Echoes of Silent Spring: 50 Years of Environmental Awareness," at the MSU Museum.

Madison Hall was awarded an internship with U.S. Fish and Wildlife Service in the Office of International Affairs, Arlington, VA and Summer Study Fellowship funding from the Department of Fisheries & Wildlife and College of Agriculture and Natural Resources.

Seth Herbst was awarded the Don L. Brumbaugh Memorial Scholarship from Sontronics.

Lindsay Hunt was awarded a Kellogg Biological Station Research Scholarship for research and tuition support.

Corey Jager received an Academic Achievement Graduate Assistantship for research and tuition support.

Corey Jager and **Jodi Kreuser** were awarded Michigan Bird Conservation Initiative Student Scholarships.

Jodi Kreuser received a Grant-in-aid of Research from the George J. Wallace and Martha C. Wallace Scholarship Fund and the MSU Department of Zoology.

Isis Kuczaj received an Oral Presentation Award at the 2012 4th Annual Graduate Academic Conference, sponsored by the MSU Council of Graduate Students.

Tom Loch received the Best Student Presentation award at the 37th Annual Fish Health Workshop.

Michelle Lute received the Theodore (Teddy) Roosevelt Leadership Award for support in professional development, a Schottheofer Memorial Award from Safari Club International, and an Emerging Leader

Fellowship awarded by the Great Lakes Leadership Academy. She was also the recipient of the 2012 Jane Goodall Fellowship from the American Sociological Association.

Abby Lynch received a Clark Hubbs Research Assistance Award from the American Institute of Fishery Research Biologists and a Graduate Fellowship in Fisheries Management from the Red Cedar Fly Fishers.

Abby Lynch and **Emily Norton** received Future Academic Scholars in Teaching (FAST) Fellowships, awarded by Center for the Integration of Research, Teaching and Learning (CIRTL) and MSU Graduate School.

Abby Lynch and **Kara Stevens** received 2012-2013 Ambrose Pattullo Fund for Environmental Issues Graduate Fellowships. This award recognizes outstanding graduate students in the College of Agriculture and Natural Resources for their literary works on issues related to the environment.

Ayman Mabrouk was awarded Best Oral Presentation (*Prospective*) at the 2012 Fisheries & Wildlife Graduate Student Organization Research Symposium.

Sherry Martin and **Kyle Molton** received Hazard Awards from the Michigan Chapter of the American Fisheries Society for best thesis or dissertation.

Andrea Miehls was the 2012 recipient of the College of Agriculture and Natural Resources Excellence in Teaching: Graduate Student Award.

Anna Mitterling was awarded a Safari Club International Scholarship and a Michigan Branch Quality Deer Management Association Award.

Julia Novak received a Foreign Language and Area Studies Fellowship from the Asian Studies Center for Tamil language study. Fellowships are awarded to students enrolled in programs that combine study of a modern foreign language with advanced training and research in international development studies.

Genevieve Pang received a National Science Foundation Graduate Research Fellowship and was awarded Best Poster at the 2012 Fisheries & Wildlife Graduate Student Organization Research Symposium.

Lisa Peterson was awarded a William E. Ricker Distinguished Fellowship in Quantitative Fisheries Sciences and the 2012-2013 Janice Lee Fenske Excellence in Fisheries Management Fellowship.

Brent Rudolph received the 2012 Safari Club International Biologist of the Year Award.

Kelsey Schlee received a 2012-2013 Taylor International Engagement Fellowship.

Jason Smith received the 2012-2013 Robert C. Ball and Betty A. Ball Fisheries and Wildlife Fellowship.

Sarah Smith received an Oral Presentation Award at the 2012 4th Annual Graduate Academic Conference, sponsored by the MSU Council of Graduate Students.

Kara Stevens received a Fulbright award from the U.S. State Department for community-based fisheries research in Nicaragua.

Darren Thornbrugh was awarded the 2012-2013 Dr. Howard A. Tanner Fisheries Excellence Fellowship.

Chiara Zuccarino-Crowe was awarded Best Student Paper Presentation at the 2012 joint Michigan/Wisconsin Chapter meeting of the American Fisheries Society.

From the University of Puerto Rico to Michigan State University: Diversifying representation in natural resources



De la Universidad de Puerto Rico a la Universidad Estatal de Michigan: Diversificando la representación en el campo de recursos naturales

Trading the warm days of Puerto Rico for the cold winters of Michigan was not an easy decision, but the opportunity was worth it. We aspire to Gandhi's words, "be the change you want to see in the world," and seek to become role models and motivate other minorities to participate in natural resource fields. So, we packed our bags with our few winter clothes to move north and become the first cohort of students in the Michigan State University/North Carolina State University/University of Puerto Rico partnership. Our master's degrees, and all the experiences we can pack into them, will be what we take home.

Intercambiar los días cálidos de Puerto Rico por los inviernos fríos de Michigan no fue una decisión fácil, pero la oportunidad merecía el cambio. Inspiradas por las palabras de Gandhi, "se el cambio que quieres ver en el mundo," buscamos convertimos en modelos ejemplares y motivar a otras minorías a participar en el campo de recursos naturales. Así fue como empacamos nuestra poca ropa de invierno para mudamos al norte y convertimos en el primer cohorte de estudiantes del programa colaborativo entre la Universidad Estatal de Michigan, Universidad Estatal de Carolina del Norte, y la Universidad de Puerto Rico (MSU, NCSU, y UPR, por sus siglas en inglés). Nuestros grados de maestría y todas la experiencias que podamos empacar en ellas será lo que llevaremos a casa.

What is the MSU/NCSU/UPR partnership?

The main goal of the MSU/NCSU/UPR partnership is to increase the number of underrepresented students in graduate school, and ultimately the workforce, in the field of natural resources within the U.S. This

collaboration has been made possible thanks to the efforts of the United States Department of Agriculture, Dr. Stacy Nelson, Dr. William Taylor, Mark Rey, Emma Suarez, Dr. Elvia Meléndez-Ackerman, and the Commonwealth of Puerto Rico. To participate in the partnership, students from any UPR campus apply, interview, and are selected by faculty members from all of the participating universities. Admitted students are matched with faculty advisors from their host university (NCSU or MSU).

Our common goal is to use our research findings to help tackle the different challenges facing Puerto Rico's natural resources. In addition, we hope to promote awareness, encourage conservation on the island, and showcase our pride for our home. As Puerto Ricans, we share a passion and commitment to return home and conduct research, while inspiring other students to follow similar paths.

Puerto Rico, a beautiful island located in the Caribbean, is commonly known as the Island of Enchantment. (photo: W. Alcobas)

¿Qué es colaboración entre MSU/NCSU/UPR?

El objetivo principal de este programa es aumentar el número de estudiantes con poca representación en las escuelas de posgrado y posteriormente en la fuerza laboral dentro del campo de los recursos naturales en los EE.UU. Esta colaboración ha

sido posible gracias a los esfuerzos del Departamento de Agricultura de los Estados Unidos, el Dr. Stacy Nelson, el Dr. William Taylor, Mark Rey, Emma Suárez, la Dra. Elvia Meléndez-Ackerman, y el Estado Libre Asociado de Puerto Rico. Para participar en el programa, los estudiantes solicitantes de los recintos de la UPR son entrevistados y luego seleccionados por los miembros de la facultad que representan Las Universidades. Los estudiantes admitidos luego son pareados con miembros de la facultad de la universidad anfitriona (ya sea NCSU o MSU).

Nuestra meta común es utilizar los resultados de las investigaciones para ayudar a abordar los diferentes retos que enfrentan los recursos naturales de Puerto Rico. Además proponemos la concienciación, conservación en la isla y mostrar nuestro orgullo por nuestro hogar. Como puertorriqueñas, compartimos la pasión y el compromiso de regresar a nuestra casa y llevar a cabo investigaciones, mientras inspiramos otros estudiantes a seguir caminos parecidos.

Puerto Rico, una hermosa isla ubicada en el Caribe, que comúnmente se conoce como la Isla del Encanto. (foto: W. Alcobas)



The first cohort of MSU/NCSU/UPR partnership students with their advisors. El primer cohorte de la colaboración MSU/NCSU/UPR con sus mentores: (from left to right/de izquierda a derecha) Esther Morales Vega, Dr. Scott Winterstein, Mark Rey, Miriam Toro Rosario, Marielle Peschiera Rivera, Dr. William Taylor, Diana K. Guzmán Colón, and Dr. Gary Roloff.

I am starting the second year of my master's degree under the supervision of Dr. Gary Roloff. I have an appointment in the U.S. Forest Service under the Student Temporary Employment Program (STEP). I am conducting my thesis research with a great research team from El Yunque National Forest in Puerto Rico. My goal is to map the population distribution of mongoose, an invasive species (and also a rabies vector), to contribute to the management plan for this species. My professional goal is to continue conducting research, while my passion is sharing knowledge and working closely with nonscientists. I enjoy helping them understand the ecosystem, as well as encouraging students to pursue degrees in science.



Diana K. Guzmán Colón

Recién empiezo mi segundo año de maestría bajo la supervisión del Dr. Gary Roloff. A la vez trabajo como interna en el Servicio Forestal de los EE.UU. bajo el programa de empleo temporal para estudiantes (STEP, por sus siglas en inglés). Estoy realizando mi investigación con la ayuda de un gran equipo del Bosque Nacional El Yunque en Puerto Rico. Mi objetivo es obtener información sobre la distribución poblacional de la mangosta, una especie invasora (y también un vector de rabia), para contribuir al plan de manejo de la especie. Mi objetivo profesional es continuar realizando investigación, mientras que mi pasión es compartir el conocimiento y mantener estrecha colaboración con el público no-científico. Me gusta ayudar a entender el ecosistema, así como alentar a los estudiantes a cursar estudios en el campo de la ciencia.

I was born in Humacao, Puerto Rico. In 2010, I obtained my bachelor's degree in Wildlife Management at the University of Puerto Rico, Humacao Campus. I started my master's degree in 2011 with Dr. Scott Winterstein. For my thesis, I am creating a species composition baseline to assess the short-term impacts of habitat restoration on avian biodiversity and breeding ecology in the Jobos Bay National Estuarine Research Reserve, located in the southern coastal area of Puerto Rico. My professional goals are to become a biology professor and study population ecology to help advance wildlife conservation efforts in Puerto Rico.



Esther Morales Vega

Nací en Humacao, Puerto Rico. En el 2010, obtuve mi bachillerato en Manejo de Vida Silvestre de la Universidad de Puerto Rico, Recinto de Humacao. En el 2011 empecé mi maestría con el Dr. Scott Winterstein. Mi tesis trabaja con la creación de una base de datos que servirá de referencia para evaluar el impacto a corto tiempo de la restauración de hábitat en la biodiversidad y ecología reproductiva de las aves en la Reserva Nacional de Investigación Estuarina de Bahía de Jobos, localizada en la costa sur de Puerto Rico. Mis objetivos profesionales son convertirme en profesora de biología y estudiar ecología poblacional con el fin de ayudar a avanzar los esfuerzos de conservación de vida silvestre en Puerto Rico.

I was born in Lima, Peru and raised in Carolina, Puerto Rico. In 2010, I finished my bachelor's degree in Wildlife Management at the University of Puerto Rico, Humacao Campus. I am a master's student in the Center for Systems Integration and Sustainability at Michigan State University under the mentorship of Dr. Taylor. For my master's research, I am examining how human-landscape relationships, in terms of values, perceptions, and behaviors, can influence and affect water quality and coral reef health in certain coastal watersheds in Puerto Rico. My professional goal is to work with underserved communities around the world, managing and conserving the natural resources upon which they depend.



Marielle Peschiera Rivera

Nací en Lima, Perú y fui criada en Carolina, Puerto Rico. En el 2010, terminé mi bachillerato en Manejo de Vida Silvestre de la Universidad de Puerto Rico, Recinto de Humacao. Soy estudiante de maestría en el Centro de Integración de Sistemas y Sustentabilidad de la Universidad Estatal de Michigan bajo la mentoría del Dr. Taylor. Mi investigación de maestría consiste en estudiar cómo las relaciones humano-paisajistas, en términos de valores, percepciones y conductas pueden influenciar e impactar la calidad del agua y salud de los arrecifes de coral en determinadas cuencas costeras en Puerto Rico. Mi meta profesional es trabajar con las comunidades marginadas alrededor del mundo y contribuir con el manejo y la conservación de los recursos naturales de los cuales dependen.

I was born in Santurce, Puerto Rico. In 2011, I finished my bachelor's degree in the Environmental Science program at the University of Puerto Rico, Río Piedras Campus. Under the mentorship of Mark Rey, I am pursuing a master's degree specializing in environmental public policy of tropical karst systems. Some of my professional goals include contributing to public policy-making processes and developing educational material pertaining to caves and karst resources with politicians, scientists, students, and the general public.



Miriam Toro Rosario

Nací en Santurce, Puerto Rico. En 2011, terminé mi bachillerato en el programa de Ciencias Ambientales de la Universidad de Puerto Rico, Recinto de Río Piedras. Actualmente completo mi maestría especializada en política pública ambiental de los sistemas kársticos tropicales bajo la mentoría de Mark Rey. Algunas de mis metas profesionales son contribuir por medio de la investigación y participación a los procesos de toma de decisiones de políticas públicas y el desarrollo de material educativo referente a las cuevas y recursos kársticos con políticos, científicos, estudiantes y público en general.

CONSERVING WILDLIFE IN MICHIGAN'S HARVESTED FORESTS

BY CLINT OTTO

The forests of northern Michigan once again grow quiet as I flip the kill switch on my ATV. I just spent the last 20 minutes of a cold, damp dawn driving down a flooded logging road toward one of my study sites located in Michigan's northern Lower Peninsula. I turn my attention to the young forest stand in front of me and witness a vast thicket of innumerable aspen and thorny blackberry bushes, intermixed with patches of mature white oak and red maple. Most of the aspen here are 10 feet tall: new growth that followed an extensive logging operation five years ago.

The timber products industry has been an important component of northern Michigan's economy for the past 160 years and will continue to shape the landscape for the foreseeable future. Harvested trees from northern Michigan provide the raw materials for a variety of products including houses, furniture, paper, and now, renewable biofuels. But, because logging significantly alters forest habitat, it has been implicated in the decline of numerous species of wildlife. Developing strategies to minimize the impacts of timber harvest on wildlife is a major concern for resource managers. To address this concern, and to enhance the sustainability of the timber products industry, the Michigan Department of Natural Resources (Michigan DNR) has adopted new operational standards for timber harvests occurring on state-owned lands. For example, under previous standards, clear-cuts, with no habitat retention, were common. Now, new forest management guidelines proposed by the Michigan DNR require that structural elements of the forest stand be left untouched during logging operations. Newly harvested forest stands will maintain patches of green-trees, standing dead trees, and coarse woody debris (horizontal dead trees) for wildlife habitat refugia. The Michigan DNR recommends that 3-10% of a forest stand be left untouched. The harvested forest stand before me is no exception: There are multiple patches of mature white oak and red maple that tower over the regenerating aspen, and large, dead logs are scattered throughout the forest floor.

As part of my dissertation, I investigated the effectiveness of the Michigan DNR's structural retention guidelines for conserving songbirds and salamanders in harvested

forest stands (see *Why Study Salamanders and Songbirds?*). Specifically, I determined whether areas with greater structural retention (i.e., more patches of green-trees or coarse woody debris) were used more often by forest-dwelling wildlife than areas with less structural retention. I also investigated how early-successional songbirds respond to structural retention. These species, including many warblers and sparrows, typically require young forest stands with thick understory vegetation. My last project was an in-depth investigation to determine if structural retention reduces red-backed salamander mortality in recently-harvested forest stands during the hot summer months. These salamanders need protective cover to shelter them from desiccating in summer heat, and it is unknown if structural retention can provide adequate microhabitat for reducing mortality. Overall, I hoped to determine if the Michigan DNR's retention guidelines are effective in promoting habitat for songbirds and salamanders following timber harvesting.

My field crew and I spent the spring and summer from 2009-2011 in the northern Lower Peninsula of Michigan collecting data on songbirds and salamanders in aspen stands that were harvested between 1-15 years ago. Most study sites were between 20 and 80 acres in size. Over three field seasons, we visited 275 sites with varying degrees of structural retention. During a typical day, we conducted bird surveys in the early morning and salamander surveys in the afternoon. Detecting songbirds in regenerating aspen stands required a well-trained ear and a good pair of binoculars, while detecting salamanders required a strong back and healthy knees for rolling large logs. At some study sites, we marked salamanders with individual tags which allowed us to relate salamander mortality rates to the quantity of structural retention.

My research has shown that green-tree retention may not increase habitat use of forest-dwelling songbirds, at least in aspen stands less than 15 years old. Only one species I studied,

Facing (from left): A Baltimore oriole perches in a northern Michigan forest (D. McNeil). Clint conducts a bird point-count in thick aspen (R. Thames). A regenerating clear-cut in northern Michigan (C. Otto). Rachael Thames holds two red-backed salamanders prior to their release into an enclosure (C. Otto). After one month, Shayna Wierferich begins searching for the same salamanders (C. Otto).

Why Study Salamanders and Songbirds?



Red-backed salamanders (*left*) are terrestrial, lung-less salamanders that are

distributed in woodlands throughout northeastern North America. They are critical components of forested ecosystems because they are an apex predator in forest-floor food webs and are often the most abundant vertebrate within the forest. Furthermore, many researchers consider salamanders to be good indicators of environmental disturbance or “canaries in a coalmine.” As a result, red-backed salamanders are an ideal candidate for studying wildlife response to timber harvesting.



Many migratory songbirds are affected by timber harvesting, but the

response has not always been negative. For example, golden-winged warblers (*above*) often benefit from timber harvesting because harvest events create young forest conditions preferred for nesting. Still, many migratory songbirds, such as scarlet tanagers and wood thrushes, are negatively impacted by timber harvesting. Studying songbird species that require different habitat characteristics allow researchers to assess the overall benefit of structural retention for conserving a diverse community of migratory forest birds.





David Burt and DJ McNeil mark salamanders with visual implant elastomer, a fluorescent, biocompatible material. (photos: C. Otto)

the red-eyed vireo, showed a preference for sites with high levels of green-tree retention. Counter to what I predicted, many young forest songbirds seemed to preferentially select sites based on the age (i.e., years since harvest) of the habitat rather than the availability of structural retention. For example, golden-winged warblers used sites that were harvested 1-7 years ago about 200% more than sites harvested over 7 years ago, which was consistent among many species of warblers. Other species, such as rose-breasted grosbeaks, were found more often in the 10-15 year-old forests, but again, their occurrence was not related to the availability of structural retention. My research highlights the importance of having a variety of ages among forest stands within a landscape. My findings also indicate that clear-cutting with limited structural retention is a viable management tool for promoting habitat of early-successional songbirds.

Looking at the red-backed salamander, I observed that salamander mortality was effectively zero at some patches with high levels of structural retention. Patches with no retention (i.e., clear-cuts) had 70–75% mortality. Other studies have shown that red-backed salamanders require cool and moist microhabitat to prevent desiccation and physiological stress, but until my research, it was unknown if leaving structure within harvested forest stands provided adequate microhabitat for reducing mortality. Despite the impact on survival, salamanders were just as likely to occur at sites with low retention as they were at sites with high retention. These results indicate that structural retention can effectively reduce salamander mortality within small patches of habitat in harvested forest stands. However, the relative effect of structural retention is conditional on whether we are referring to salamander mortality or salamander

occupancy (i.e., presence or absence) within a site.

Overall, it appears that structural retention harvest can reduce the negative impacts of clear-cutting on terrestrial salamanders by lowering mortality rates. However, it is less clear if structural retention promotes large-scale occurrence of songbirds or salamanders within harvested forest stands across northern Michigan. Therefore, protecting usable habitat for wildlife in forests can likely not be accomplished by simply retaining structure within individual forest stands. Rather, successful management of forest-dwelling wildlife will likely require conservation of entire stands of late-successional forests in northern Michigan. Timber harvesting will continue to be a dominant force in the global biodiversity and sustainability crisis for the foreseeable future. Hence, developing strategies to minimize the impact of timber harvesting on wildlife and the environment should be of paramount concern to individuals who utilize forest resources.

Having completed my bird survey work for the morning, I begin the long walk back to my ATV. Although it was a sunny morning, my field gear is sopping wet from the condensation on the surrounding aspen leaves. I reflect on how these early morning walks in dense aspen thickets are seldom without surprises: Often my crew and I have stumbled upon nesting warblers, fledgling grouse, porcupines, and even an occasional black bear. To me, these encounters serve as evidence of successful conservation efforts within northern Michigan's forests. There is still much to be learned, but steps are being taken to protect our forested ecosystems. I jump back onto the ATV and the sounds of the forest dissipate as I rev the engine. I press onward to the next forest stand.



Clint Otto received his doctorate degrees from the Department of Fisheries & Wildlife and the Ecology, Evolutionary Biology, and Behavior Program at Michigan State University in 2012, under the guidance of Dr. Gary Roloff.

He is currently a research ecologist for the United States Geological Survey at the Northern Prairie Wildlife Research Center in Jamestown, North Dakota. Clint's research interests include investigating the impacts of land-use change on wildlife population dynamics and applying novel, empirical models to improve our understanding of wildlife-habitat linkages. (photo: R. Thames)

Interview with 2011 M.S. Alumni Eric MacMillan & Kyle Molton



Spotlight: *What is a John A. Knauss Marine Policy Fellowship and what motivated you to apply for it?*

Eric MacMillan (EM): The Knauss Fellowship is a Sea Grant sponsored program that matches graduate students with host offices in the legislative and executive branches of the Federal government to work on marine policy issues. Positions vary greatly from working on broad environmental issues for a congressman as a legislative fellow to working on specific issues for a federal agency as an executive fellow. I applied for an executive position because I wanted to learn how science does (or often does not) translate into on-the-ground action for natural resources.

Kyle Molton (KM): The biggest motivation to apply for a legislative position was that I wanted to see the inner workings of the policy process and explore a variety of topics over the course of any day, and that has definitely been the case! The fellowship is a great opportunity to get a broader perspective on natural resource policy.

Spotlight: *What is your fellowship position?*

KM: I work in the office of Congresswoman Chellie Pingree, who represents the 1st District of Maine, including Portland and the coast and islands from the New Hampshire border to Penobscot Bay. In the office, I work as a legislative assistant with an emphasis on fisheries, forestry, and energy issues. In a typical day, I discuss benefits and concerns of legislation, take meetings with NGOs and businesses, communicate with folks in federal and state agencies, and sometimes even accompany the Congresswoman to the House floor when she speaks on environmental issues.

EM: I work for the NOAA Restoration Center which is part of the National Marine

Fisheries Service. My office provides funding and technical guidance for coastal habitat restoration efforts across the country. I review grant proposals, participate in grant review panels, and work with the groups who implement habitat restoration projects to ensure federal conservation dollars are spent in the most effective way possible.

Spotlight: *What is most rewarding about working at the science-policy interface?*

EM: Seeing results on the ground. In some ways, life in grad school can be more theory than actual application. In my office, our goal is to do work that can directly benefit fisheries and ecosystems.

KM: Being able to make sure that voices of the folks in our district, like fishermen and foresters, are heard in national policy discussions. It's amazing how much insight the people who work with the resources bring to the table.

Spotlight: *What at MSU best prepared you for your fellowship?*

KM: The focus on applied research and learning how natural resources decisions can impact communities. Learning to explain my own research to stakeholders and policy makers was really important. It is particularly useful to me now, as I often have to summarize complicated research and other information vital to decision-making in a way that is clear to a lay audience.

EM: My work at MSU allowed me to work hand in hand with natural resource managers and stakeholders. This interaction gave me a sense of everything – and it's not just science – that must be considered when managing a fishery or making other decisions in natural resource management. I learned that things can get very complicated quickly – nothing is black and white.

Spotlight: *What do you wish you had done at MSU that would have assisted you with your current position?*

EM: GIS courses would have been valuable. GIS software is often used to prioritize habitat restoration projects and our office takes this information into account when determining how to use funds.

KM: A communications course would have been useful because I spend a lot of my time in meetings and on the phone.

Spotlight: *Do you have any advice for FW students who might wish to follow in your professional footsteps?*

KM: Take the opportunities that are presented to you; volunteer on someone else's project; take a trip for a class. These experiences are important when you try to relate to folks from different backgrounds.

EM: Ask applied research questions and choose a project that will allow you to interact with a range of people involved with natural resources. Being able to work with a wide range of people from different backgrounds will be particularly important for working in natural resource management.

Spotlight: *Anything that you'd recommend as a MUST to students new to East Lansing?*

EM: Tailgate.

KM: The river trail; a bike ride or walk along the Red Cedar is a great way to relax!

Spotlight: *Is it tough to be a Spartan fan in D.C.?*

EM: Spartans are everywhere so it is not tough to find somewhere to watch a game among fans. I do miss tailgate, though.

KM: Agreed. But, I hope to get back to MSU for a football game soon. It's hard to beat a cool, fall day in Spartan Stadium.

-Interview conducted by Abigail Lynch

Eric (right) assisted with oyster restoration in Chesapeake Bay. (photo: A. Hammond)



Kyle (center) toured a Maine lake infested with invasive milfoil. (photo: C.A. Doucette)



Tracking Sea Lamprey with Acoustic Telemetry in Lake Huron

By: Trevor Meckley & Christopher Holbrook

Photo by: H. Muir

Sea Lamprey

The sea lamprey is an invasive species that parasitizes other fishes in the Great Lakes. Extensive efforts to control the species have been in place since the 1950s. Like salmon, sea lampreys must migrate between streams (where they spawn and grow) and open-water habitats (where they feed on fish) to complete their life cycle. Unlike salmon, adult sea lampreys do not return to their natal streams to spawn, but instead use odors released in rivers by newly developing sea lamprey larvae to guide the adults into good spawning sites. Currently, the most effective control strategies for sea lamprey involve killing larvae in streams with chemical lampricide, stopping adults at barriers during their spawning migration, and capturing them in traps. These strategies are based on a good understanding of sea lamprey migration during the larval and spawning phases, but little is known about migration between the parasitic and spawning phases. To better understand this migration, new knowledge of habitat use and patterns of movement by sea lampreys at each life stage is needed. Two important questions include: 1) How do sea lamprey migrate from open water back to rivers? and 2) How do sea lamprey migrate and spawn in large rivers that produce large numbers of sea lamprey? New understanding will hopefully lead to development of improved sea lamprey control strategies.

Acoustic Telemetry

Remote telemetry allows scientists to track animals in environments and at scales not previously possible and includes GPS transmitter collars, radio telemetry, and acoustic telemetry. GPS and radio telemetry both rely on signals that are carried by radio waves that pass readily through air, but not water. In contrast, acoustic telemetry uses sound waves that are much better at moving through water. An acoustic telemetry system consists of transmitters (electronic tags that “ping”) and receivers (hydrophones) that detect pulses of sound from nearby tagged animals. Receivers typically store the detection data on an internal computer. One type of data collected is proximity, or presence, of tagged animals at a given site. In constrained environments (e.g., rivers and narrow bays), proximity data can be used to examine passage of individuals. In open environments (e.g., lakes and oceans), proximity data may be used to examine habitat use of individuals. Another type of data collected is two or three dimensional positions of animals. Positional studies are completed through either active (mobile tracking) or passive tracking methods (fixed receiver array).

Lampreys in a Larger River: *An example of proximity-type data*

Lampricide application is currently the most effective method for suppressing sea lamprey populations in small rivers and streams. However, in large rivers, lampricide is less effective because of the large volumes of water, and traps are not always adequate because they can only be fished at a few specific locations (usually at dams and other barriers) in each river. In places like the St. Marys River (see **map**), with traps at barriers about 75 km upstream from Lake Huron, this issue is particularly concerning because the river is one of the largest producers of sea lamprey in the Great Lakes. We used acoustic telemetry to examine how to improve current removal techniques for sea lamprey from this important source.

During 2010-2012, we surgically implanted 300 to 400 lampreys with acoustic tags and released them back into the lower river. We placed stationary acoustic telemetry receivers at 20 key locations and recorded the presence of tagged fish, documenting the passage of animals through specific river channels and arrival at barriers. We used this information to provide

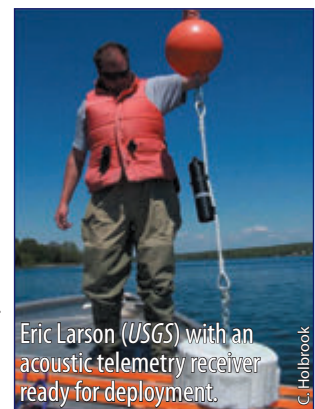


a detailed movement history for each tagged fish during the spawning run.

Our first goal was to determine the effectiveness of the existing traps by

examining the proportion of the lampreys removed from the population. We found that existing traps captured a very small fraction (about 4%) of the total population. Therefore, existing traps in the St. Marys River provide very little population control.

Our next goal was to determine if the low capture rates were caused by trap performance or trap locations. Only about 8% of the lampreys that reached traps were actually caught, suggesting that population control may be increased if traps can be modified to catch more lampreys in their vicinity. However, we also found that only about half of the lamprey in this system reached the upper-river traps each year. Other lampreys ceased their migration farther downstream or ascended tributaries, and possibly spawned in these locations. Therefore, at best, the traps could only remove half of the lamprey population. Our findings suggest that upper-river trapping on its own is not a viable control strategy and that others are needed to control the population of lampreys in the St. Marys River. The next step is to combine these results with existing knowledge of capture technologies and migration behavior to predict the feasibility of expanded or enhanced trapping.



Eric Larson (USGS) with an acoustic telemetry receiver ready for deployment.

C. Holbrook

3-D Active Positioning: *An example of manual tracking*

Little is known about how sea lampreys migrate along coasts and choose rivers for spawning. We used acoustic telemetry to manually track sea lampreys and examine how they moved in a river plume, in a lake, and in a river. To increase the effectiveness of traps in rivers, we attempted to attract sea lamprey into specific rivers by releasing a suspected attractant (larval odor).

At night, we released one sea lamprey implanted with an acoustic tag along the coast. We followed and recorded the positions of the lamprey every 5 to 10 minutes for up to 12 hours. We followed some lamprey for over 20 kilometers in a single night along the coast and up rivers. Using this technique, we were able to describe some general movement patterns of lamprey that were previously not possible. We found that lamprey released into the river plume after the addition of larval odor were 36% more likely to stay in the river plume. However,

our number of subjects was low ($n=20$) because manually tracking lamprey was time consuming and the research season is short. Therefore, we could not determine if the attractant affected migration behavior of lampreys.



Tyler Buchinger (left) and Trevor Meckley (right) use a computer that connects to a hydrophone and interprets sounds transmitted by tags at specific frequencies and coded intervals.

J. Yarkin

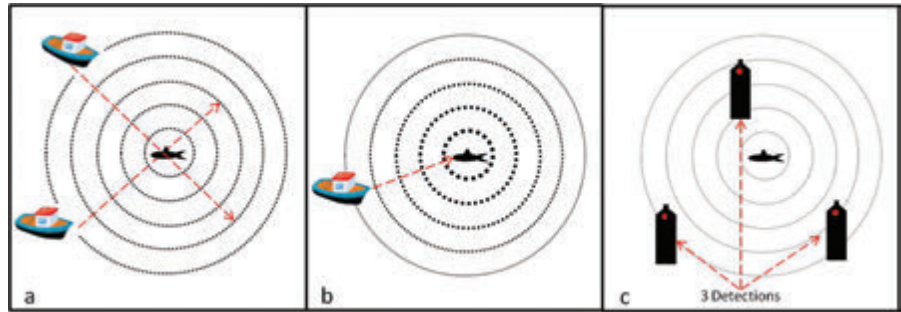


A. Masters

Meckley used an autonomous underwater vehicle (AUV) to map the river plume using variables such as dissolved oxygen, conductivity, temperature, and pH.

3-D Passive Positioning: *An example of fixed receiver arrays*

Manual tracking with acoustic telemetry provided us information about the large-scale movement patterns, but failed to reveal fine-scale patterns that occurred within the river plume, or provide a large enough sample size to evaluate the effect of larval odor on behavior. To address these concerns, we used a fixed acoustic array that was composed of 39 receivers that covered a 2 km area in front of a river entrance to estimate 3-D positions of lamprey and 7 receivers in the river to monitor passage of lamprey that entered and moved upstream. We released 3 fish each night. In year 1, we monitored the movements of 78 lampreys in front of the river with few larvae. In year 2, we added larval odor and monitored the movements of 100 lampreys. We are still processing the data necessary to address both objectives but have successfully positioned the fish and are already seeing movement patterns that we did not previously capture with manual tracking.



Tracking a sea lamprey with manual telemetry is more accurate with two boats because signal strength is not important (a). Tracking with a single boat is possible by using the direction and the signal strength (b). Fixed acoustics triangulates fish based on at least 3 positions (c). The array (below) is composed of 36 receivers (yellow) covering approximately 2 square kilometers of lake. The 9 acoustic tags (orange) keep the array synchronized. To track with fixed acoustics, Meckley released one lamprey from each of three locations (white), 600 meters from the river mouth.



Conclusions

Acoustic telemetry has made it possible to observe sea lamprey migration for the first time in areas larger than small rivers. With new knowledge on how lampreys behave in large lakes and rivers, managers may be able to adapt current strategies for the Great Lakes region and tributaries to more effectively remove lampreys.

Check out the Great Lakes Acoustic Telemetry Observation System at: <http://data.glos.us/glatos>



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ECONOMIC BENEFITS

PUBLICLY-ACCESSIBLE LAND FOR DEER AND RUFFED GROUSE HUNTERS IN MICHIGAN

BY: SCOTT KNOCHE

It's October 1,

and the alarm goes off at 5:00 a.m. I would ordinarily keep sleeping, but unlike many weekdays, no snooze button is necessary, and I spring out of bed. Soon after, I am sipping a coffee in the kitchen, nervously and excitedly going over my itinerary. Later, as I drive past my normal exit for work, I smile. Not today. An hour later, still before first light, I am 17 feet above the ground in the Waterloo Recreation Area, sitting patiently in my treestand. As I wait for the minutes to pass and archery deer-hunting season to begin, my thoughts begin to drift. In another six weeks, I will be moving this same treestand more than 500 miles away to the Porcupine Mountains Wilderness State Park, on a six-day Western Upper Peninsula hunting trip with two college friends. Now, what an adventure that will be!

Hunters in Michigan are able to choose from a myriad of different hunting locations on public land from wilderness hunting experiences on federally-owned land in the Upper Peninsula to state-owned land in southern Michigan that is within close proximity to major urban areas. In total, Michigan hunters can choose from roughly 7.4 million acres of state- or federally-owned hunting land. A third option is the 2.2 million acres of privately-owned land that is publicly-accessible through Michigan's Commercial Forest Act (CFA) program.

All these publicly-accessible hunting lands are heavily utilized by deer and grouse hunters in Michigan, with about 60% of deer hunters and 80% of ruffed grouse hunters spending at least one day hunting on publicly-accessible land during their respective hunting seasons.

As economists, we have tools at our disposal that enable us to translate the importance of these public lands into the monetary benefits realized by hunters from the existence of these lands. Though the statistical methods used to estimate the economic benefits are complex, the idea is simple: the trade-offs hunters make between the travel costs associated with a hunting trip and the attributes available at potential hunting locations (such as game animal harvest rate and the amount of public land) provide insight into the economic benefits hunters receive from these attributes.

We focused our research efforts on estimating the economic benefits of publicly-accessible hunting land in Michigan, finding that the combined annual economic benefits of state-owned, federally-owned, and privately-owned, publicly-accessible CFA land to deer and ruffed grouse hunters in Michigan is about \$97 million.

Above: Two Michigan hunters walk with their dog in search of ruffed grouse. (photo: J. Simoes)

There's no such thing as a free lunch!

While hunters enjoy inexpensive (and often free) access to millions of acres of public land in Michigan, the expenses associated with the maintenance and general oversight of these lands must be paid. There is no such thing as a free lunch!

During difficult economic times, these costs may result in a reduction of public access opportunities. For example, in Spring 2011, the Michigan Department of Natural Resources (DNR) proposed to close 23 state forest campgrounds due to a reduced budget. Keeping tracts of land available for hunting can mean foregoing possible income from extractive uses of natural resources, such as mining, logging, and oil and gas extraction.

Furthermore, a state seeking to balance its budget could sell publicly-owned land for commercial/private interests. With our research, we seek to provide information on the economic benefits of publicly-accessible hunting land that can be contrasted with land management costs and the costs associated with foregone alternative uses of the land.

What is "economic benefit"?

Economic benefit to an individual (also known by the technical term, *consumer surplus*) is the difference between the maximum amount an individual would be willing to pay for a product, and the amount actually paid. As an example, when buying a pizza, if I was willing to pay \$15, but the pizza costs \$10, then I received \$5 in economic benefits from the transaction. The maximum amount I would be willing to pay for a pizza may be a function of product attributes (say, quality of ingredients) as well as possible product substitutes (e.g., whether there is a burrito shop down the road).

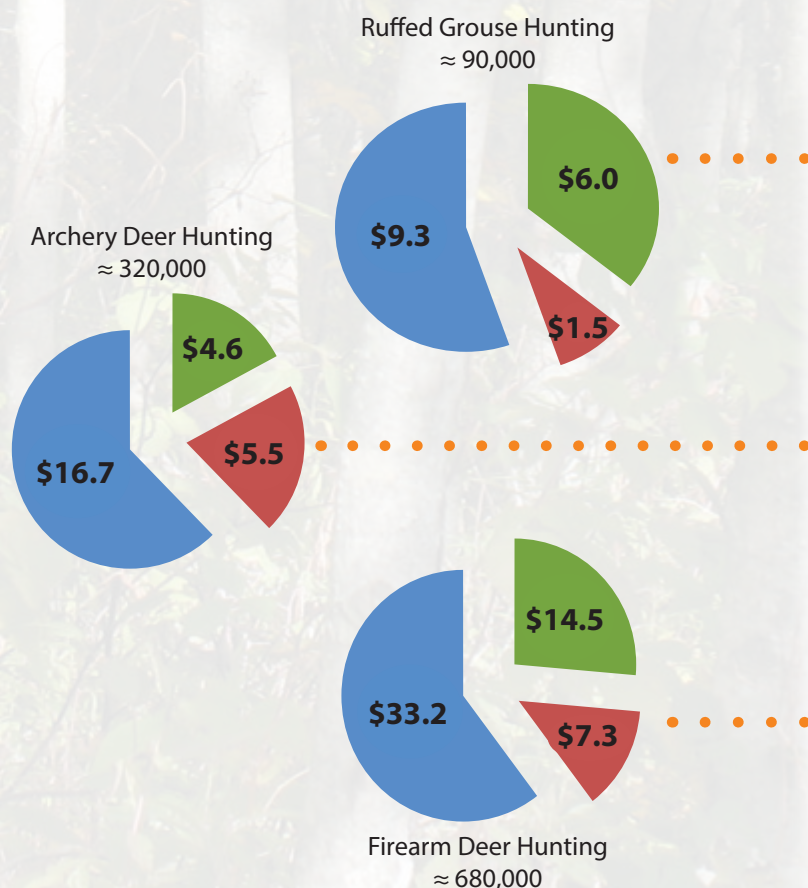
While people don't typically buy hunting trips in the marketplace, the logic is similar. With hunting, an individual purchases a trip by incurring travel expenses necessary to hunt in a given location.

The average hunter would likely be willing to pay more (via greater travel costs) to hunt an area with higher levels of attributes we hypothesize to be desirable (such as amount of public hunting land). Ultimately, this tradeoff between trip cost and hunting site attributes allows us to estimate the economic benefit associated with these attributes.

Estimating...

To estimate the economic benefits of publicly-accessible hunting land, we used the travel cost method. This method examines the tradeoffs individuals make between the cost of traveling to the recreation site and the attributes of that site. A survey of Michigan hunters provided us information on the number of hunting trips each hunter took to each county. Key attributes we thought might influence, either positively or negatively, the likelihood of a hunter choosing a particular county to hunt (from the set of 83 counties in Michigan) included: round-trip travel costs, acres of federally-owned land, acres of state-owned land, acres of CFA land, harvest rate of game animals, and size of county.

The round-trip driving distance between each hunter's residence and the zip code at the center of each county was multiplied by the per-mile driving cost rate published by the American Automobile Association (AAA) to obtain an estimate of round-trip travel costs. The Michigan Department of Natural Resources provided us with data on hunting site



economic benefits

attributes such as the acres of publicly-accessible hunting land in each county and the average harvest rate of game animals.

We examined the influence of hunting site attributes on hunter site selection and generated economic benefits to hunters for three different types of hunting experiences: firearm deer hunting, archery deer hunting, and ruffed grouse hunting. For all three types of hunting, we found that hunters tended to choose hunting sites that were associated with lower travel costs, greater availability of public land, and higher game animal harvest rates. In total, the annual economic benefits of publicly-accessible hunting land for deer and ruffed grouse hunters in Michigan is nearly \$100 million, with state-owned land having the highest total economic benefits for each type of hunting (see **pie charts**). On a per-hunter basis, public access for ruffed grouse hunters provided the greatest economic benefits. One possible reason for this could be ruffed grouse hunters preferring to hunt on a lot of ground (often with dogs) in an attempt to flush grouse, while smaller parcels of private land are a relatively more preferred option for deer hunters.



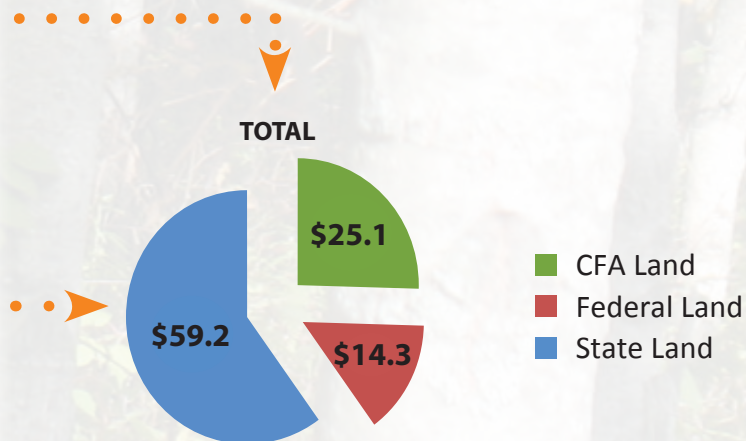
Deer hunting from a tree stand in Michigan.

Policy implications

Individuals and interest groups promoting the privatization and development of public land in Michigan often emphasize the expected economic impacts such as job creation and/or tax revenues. Often, the economic benefits associated with outdoor recreation on those lands are not considered. We show that a small segment of users of public land in Michigan - deer and grouse hunters - derive nearly \$100 million annually in economic benefits from the existence of this land. Thus, we argue it is critical that policy analysts recognize the substantial economic benefits generated from recreational uses of public lands when evaluating land management and ownership alternatives.



Scott Knoche is a PhD student in the Department of Fisheries & Wildlife. He is advised by Dr. Frank Lupi and his research focuses on the economics of hunting and fishing in Michigan.



Estimated annual economic benefits (in \$ millions) for deer and grouse hunters from three types of publicly-accessible hunting land in Michigan. CFA land refers to privately owned land that is made to be publicly-accessible through Michigan's Commercial Forest Act.

Training in Natural Resources Policy: Demmer Scholars in Washington, D.C.

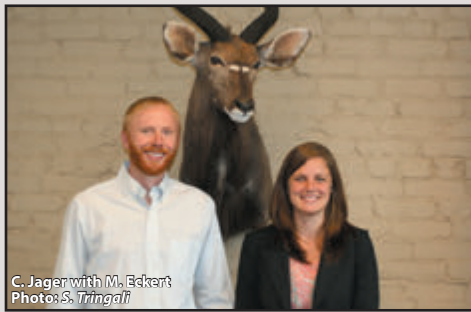
The William A. Demmer Scholars Program is a summer course and internship in Washington, D.C. for upper-level undergraduates and graduate students in natural resource policy. The 12-week program is a paid full-time position with a government or non-government organization involved in natural resource policy making. The course provides lecture and discussion sessions, as well as weekly field trips for hands-on experience, for an insider's perspective on national policy making. Mark Rey, executive in residence in the Center for Systems Integration and Sustainability, has led the program since its inception in 2009. According to Rey, the course reviews and evaluates how each branch of the federal government, as well as non-governmental groups – including the media – affect the development and implementation of federal government policy in the natural resources area. To date, 87 students have participated in the program.

2012 Placements

Advisory Council on Historic Preservation
Association of Fish and Wildlife Agencies
Executive Office of the President, Council on Environmental Quality
Executive Office of the President, Domestic Policy Council
Foundation for Political, Economic, and Social Research
National Science Foundation
Safari Club International
Society of American Foresters
The Aluminum Association
The Clean Water America Alliance
The National Fish and Wildlife Foundation
The Nature Conservancy
Thermostat Recycling Corporation, National Electrical Manufacturers Association
Trout Unlimited
U.S. Department of Agriculture, Foreign Agricultural Service
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Department of the Interior, Office of the Secretary
U.S. Fish and Wildlife Service
U.S. Forest Service, Division of Recreation, Heritage, and Volunteer Resources
U.S. Forest Service, Division of Watershed, Fish, Wildlife, Air, and Rare Plants
U.S. Forest Service, National Partnership Office
U.S. Forest Service, Office of International Programs
U.S. Forest Service, Office of Legislative Affairs
U.S. Senate Committee on Appropriations
U.S. Senate Committee on Agriculture, Nutrition & Forestry



The 2012 Demmer Scholars gathered with Mark Rey (left photo, far right) in Milford, Pennsylvania at Pinchot Falls, located near the former home of Gifford Pinchot, the first chief of the U.S. Forest Service and twice Governor of Pennsylvania. The estate, known as Grey Towers, is now a national historic site. There, the scholars also enjoyed dinner at the estate's unique outdoor dining room, the Finger Bowl (right photo). Not pictured: S. Craddock and H. Kruckman.



C. Jager with M. Eckert
Photo: S. Tringali

Corey Jager
Safari Club International



As an intern with Safari Club International (SCI) and its affiliate, the SCI Foundation, my responsibilities ranged from attending hearings on Capitol Hill to sharing updates about wildlife conservation projects with SCI members. The primary mission of SCI is to protect the freedom to hunt and to promote wildlife conservation worldwide; the separate, yet complementary mission of the SCI Foundation is to fund and manage worldwide programs dedicated to wildlife conservation, outdoor education, and humanitarian services. This internship provided a new perspective on how natural resource policies are developed and how hunting, in particular, plays a key role in how we manage wildlife for current and future generations. I feel fortunate to have worked for an organization with diverse roles in wildlife management and to have learned how non-governmental organizations fit into larger political frameworks. The Demmer Scholars Program complimented this internship by providing a basic understanding of natural resource policy making and government. Overall, this internship provided me with the aptitude to become a leader in the field of conservation.



H. Kruckman
Photo: L. VanAlstyne

Hanna Kruckman
U.S. Fish & Wildlife Service



I worked for the U.S Fish & Wildlife Service as a Student Career Experience Program employee in the Wildlife and Sport Fish Restoration (WSFR) program. The WSFR program is responsible for distributing money from excise taxes on hunting and fishing equipment. The money goes to state fish and wildlife agencies for implementing projects to conserve and manage fish, wildlife, and their habitats. Funding for these projects is allocated through a wide variety of mandatory and competitive grants. Most of my duties involved working with these grants and learning about the application process and legislation that supports these programs. I experienced first-hand the intricacies of policy making and developed a greater appreciation for the behind-the-scenes work that makes many conservation projects possible. My participation in the Demmer Scholars Program also provided insight on the inner workings of the federal government and helped me see how my work was connected to a variety of agencies. The combination of the internship and course work broadened my perspective on government processes and policy making and will serve as an instrumental experience as I continue my education in natural resources conservation.



M. Toro Rosario with M. Rey and T. Tidwell
Photo: E. Loubert

Miriam Toro Rosario
U.S. Forest Service



My experience in the Legislative Affairs office in the Washington Office of the U.S. Forest Service was full of new names, contacts, acronyms, and lovely people willing to help develop my academic interests in the professional world. Washington, D.C. is the center of decision making for the nation and sometimes for the world. Many look to D.C. for leadership and direction on political and business issues facing the country. Because of this, my internship provided first-hand experiences of how government, citizens, and corporations interact. Being an intern entailed attending staff meetings and hearings, working under deadlines, collaborating with colleagues, being exposed to various opportunities at professional and personal levels, and riding a bike all over the city! Through this internship, I increased my understanding of how public policy is implemented and communicated within and outside the U.S. Forest Service. Some of the decisions my colleagues and I were involved with included: 1) the National Airtankers Contracts; 2) State Facts Sheets distributed on the Hill; and 3) the HR 5544 bill to authorize an exchange of 86,295 acres of trust land in Minnesota for equivalent lands owned by the United States and managed by the U.S. Forest Service.



S. Crandall

Please visit:
<http://csis.msu.edu/education/demmer>
and contact Dr. Kelly Millenbah at
517.353.4802/millenba@msu.edu
for more information about the
Demmer Scholars Program.

Fulbright: More than just research funding

-Marisa Rinkus

In February 2011, I left a snowy Michigan winter and headed south into the warm Brazilian summer to begin my doctoral research examining community participation and sea turtle conservation. As the recipient of a Fulbright fellowship to Brazil, I not only received financial support, but amazing opportunities for personal and professional development in an international setting.

Fulbright is an international educational exchange program sending U.S. scholars all over the world and bringing foreign scholars to the U.S. for study, research, and teaching. The fellowship covers round-trip travel to the designated country, modest living expenses, and research-related travel. Unlike other grants or fellowships that target particular disciplines, Fulbright welcomes diverse applications to meet its mission of “promotion of international goodwill through the exchange of students in the fields of education, culture, and science.”

The purpose of my research was to understand how to engage local communities in sea turtle conservation by examining motivations for participation in non-conservation related activities (for example, attending church or participating in a youth group) and conservation related activities hosted by the



sea turtle conservation project (for example, release of turtle hatchlings or beach clean-up events). Sea turtles are primarily threatened by human activities such as incidental bycatch, direct killing, taking of eggs, coastal development, floating debris, and climate change. Therefore, increasing community support is an imperative, yet not always easy, task. My research provides a framework that can be used to improve the design and targeting of conservation programs. All of this research benefited greatly

from the support, guidance, and assistance of the diverse people I met through my Fulbright experience—some of whom have become close

colleagues and friends.

Securing an in-country affiliation is a requirement for the Fulbright application. Through the wonders of the internet, I stumbled upon a professor and graduate program that mirrored my research interests. Dr. Sônia Seixas and the graduate program in ‘Society and Environment’ at the State University of Campinas (Universidade Estadual de Campinas – UNICAMP) provided feedback on my research and helped me navigate the processes for human subjects review and general permission to conduct research as a foreign researcher in Brazil. Through this connection, I was also able to present my

The Fulbright Program

- Created in 1945 by Arkansas Senator J. William Fulbright
- There are 310,000 Fulbrighters to date
- Approximately 8,000 grants are awarded annually
- Fulbright operates in 155 countries worldwide
- **MSU is one of the top five Fulbright earning schools**
- Notable recipients include: Joseph Stiglitz (economist), John Lithgow (actor), Renee Fleming (opera singer), and Melissa Block (NPR)

For more information:

- <http://www.isp.msu.edu/funding/fulbright.htm>
- <http://us.fulbrightonline.org/home.html>



Marisa Rinkus (pictured above with Dr. Sônia Seixas and at left at her goodbye churrasco with Projecto TAMAR staff) completed her 2010-2011 Fulbright Fellowship in Brazil.



Marisa's research assistants (center photo, from left to right), Jordana, Emanuel, and Kercia, interviewed residents in coastal communities.



research to faculty and students, access library collections, and get a feel for "Brazilian college life." And though I am no longer in Brazil, today's technology makes frequent and affordable communication possible, facilitating our continued collaboration.

To research how to help conservation managers better engage local communities, I partnered with biologists and staff at a monitoring station in northeastern Brazil, managed by the national sea turtle conservation program, Projeto TAMAR. They gave me access to documents, opportunities to observe their work, and transportation to neighboring communities to collect data. In exchange, I taught basic English to staff and volunteered

at events. The TAMAR staff was extremely hospitable, from helping me find a place to live to allowing me to use their internet. While my research would not have been possible without their assistance, what I will miss most is the camaraderie. I will always have fond memories of last minute *churrascos* (BBQs) and good conversation.

To assist in data collection, I hired and trained three local residents. Together, we surveyed 341 households in four communities and conducted five focus groups over a four-month period (a great feat!). We gathered information on knowledge, attitudes, and perceptions regarding sea turtle conservation as well as how and why people are motivated to participate in their communities. My assistants were key to helping me understand local culture and what was acceptable to ask, do, and say. I am forever grateful for all of their hard work and patience with my many "rules" about how research needs to be done. I hope that they learned as much as I did and that the experience benefits them in their future endeavors.

From sharing my research with Brazilian university professors, students, and conservation managers to forging new friendships with *Fulbrighters* from all over the U.S., my time as a Fulbright Fellow was definitely more than just funding for my dissertation research. Fulbright was an experience that has made the world just a little bit smaller and my horizons a little bit broader.



While monitoring the beach with the TAMAR staff (page 20, top), Marisa and Kercia, spotted a loggerhead turtle about to lay her eggs.

Marisa Rinkus was a 2010-2011 Fulbright Fellow to Brazil where she conducted her dissertation research on the relationship between community-level social capital and sea turtle conservation in northeastern Brazil. Stay tuned for more on her research in future issues of *Spotlight*. Her advisor is Dr. Tracy Dobson.

I have been at MSU since 2005 and have a joint appointment between James Madison College and the Department of Fisheries & Wildlife. I am lucky to have colleagues and graduate students that continually push and pull me in various directions. At Madison, I have recently partnered with political scientists to explore how the ecological concepts of diversity, modularity, and resilience provide insights into the field of international relations. In the Department of Fisheries & Wildlife, I have worked closely with members of the limnology lab looking at land and water interactions. My work at MSU thus far has centered around three broad themes: 1) the conservation of biodiversity, 2) water resources, and 3) global change science, particularly the effects of globalization on remote communities. These themes and my love for interdisciplinary work are reflected in the research of my graduate students. *Welcome to the Kramer lab!*

Contact Dr. Kramer at: dbk@msu.edu



The Kramer Lab



Chris Jordan is a Ph.D. candidate researching terrestrial biodiversity and traditional environmental knowledge along the Caribbean coast of Nicaragua. One of the primary objectives of his research is to determine the impacts of socioeconomic development on wildlife occupancy and the retention of traditional environmental knowledge.

Contact Chris at: jordan41@msu.edu



Shylene Mata is a Ph.D. student who holds a master's degree in Public Administration with concentration in International Development and a B.S. in Natural Resources from Cornell University. Her research looks at social networks of migrants to the agricultural frontier in Caribbean Nicaragua. Her research interests include community-based management and participatory action research.

Contact Shylene at: matashyl@msu.edu



Shikha Singh is a Ph.D. candidate trying to map the different types of policies and strategies used by local governments in Michigan to protect freshwater resources using GIS. She received a master's degree under Dr. Rose studying fecal indicator bacteria in the Grand River (MI) and a B.Sc. in Biology from the University of Western Ontario. Her current research is focused on determining if there is evidence of policy fragmentation within watersheds and to what extent policies are influenced by population demographics and land use/land cover.

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Kara Stevens is a Ph.D. candidate studying the social and ecological dynamics of small-scale fisheries on the Caribbean coast of Nicaragua. She is studying the impact of fishing on a multi-species estuarine fishery as well as the role of social networks in driving an individual fisherman's change in harvest and management behavior. She is broadly interested in understanding how rapid social or environmental changes affect communal management of natural resources and the resulting impact on biodiversity.

Contact Kara at: steve492@msu.edu



Anna Mitterling is a master's student studying social networks within organized deer hunting cooperatives on private properties in southern Michigan. She received her B.A. at Spring Arbor University in Recreation and Natural Resources. Her current research evaluates the influence of deer cooperatives on individual behavior and satisfaction with hunting and management experience.

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BUILDING BRIDGES

UNDERGRADS AND GRADS WORKING TOGETHER

BY : MARCO SANCHEZ AND RYAN MACWILLIAMS

The Fisheries and Wildlife Club (FW Club) has been a Student Chapter of The Wildlife Society since 1950 and has recently become a Student Subunit of the American Fisheries Society. As a reflection of the organizational missions of The Wildlife Society and American Fisheries Society, the FW Club aims to provide opportunities for professional development and education through regular meetings and events.

The majority of FW Club efforts center around four standing committees: Wildlife Research Committee; Fisheries Research Committee; Outreach Committee; and the Habitat Management Committee. This is where students gain experience in leadership, planning and organizing events, and professional interaction.

FW Club students come together for a variety of social activities including presentations from fisheries and wildlife professionals, camping trips, canoeing, hiking, bonfires, movie nights, and intramural sports. Additionally, with help from fundraising events and financial support from the Department of Fisheries & Wildlife, FW Club members have the opportunity to attend the annual conferences of The Wildlife Society and The American Fisheries Society. As a student chapter in The Wildlife Society's North Central Section, members also interact with students from other schools at an annual mini-conference, providing valuable networking experiences and chances to be exposed to the vast array of research currently being conducted.

The FW Club provides a variety of experiences for students, but perhaps the biggest reason students stay involved is the personal connections they build. This is important because fisheries and wildlife professionals must consider numerous opinions and stakeholders when contending with complex issues such as climate change, habitat destruction, or the threat of species

extinctions. Fisheries and wildlife professionals must always consider human communities and attitudes as key components of conservation. "When we see land as a community to which we belong, we may begin to use it with love and respect" (Aldo Leopold – *A Sand County Almanac*). The FW Club provides undergraduates with the tools needed to make these essential connections with others and create this "community of conservation" that Aldo Leopold references. This has become an integral part of the FW Club mission.

Like the Fisheries and Wildlife Club, the **Fisheries & Wildlife Graduate Student Organization (GSO)** serves a similar role for graduate students, providing opportunities for leadership, professional growth, and representation within the department, College of Agriculture and Natural Resources, and across the university.

GSO committee representatives participate in meetings at undergraduate, graduate, and faculty levels; serving as a voice for Fisheries & Wildlife graduate students and reporting back to the GSO on pertinent issues. Furthermore, GSO committees organize outreach activities, special events, seminars, distribute grants, and work in other capacities to meet the mission of the GSO. By bringing graduate students together, the GSO facilitates sharing ideas and research projects. This ensures that FW graduate students feel part of a greater community, and not just a specific lab.

Skill builders: FW Club member, Austin Messing, learns prescribed fire techniques at the Michigan Audubon Society's Otis Farm Bird Sanctuary. (photo: A. Adams)



McAllen

Outreach opportunities (left): GSO member, Andrea Bowling, engages young campers at the 4-H Great Lakes and Natural Resources Camp in Presque Isle, Michigan. Andrea discusses live trapping techniques to educate aspiring scientists about the process of wildlife research.

GSO and FW Club Collaboration

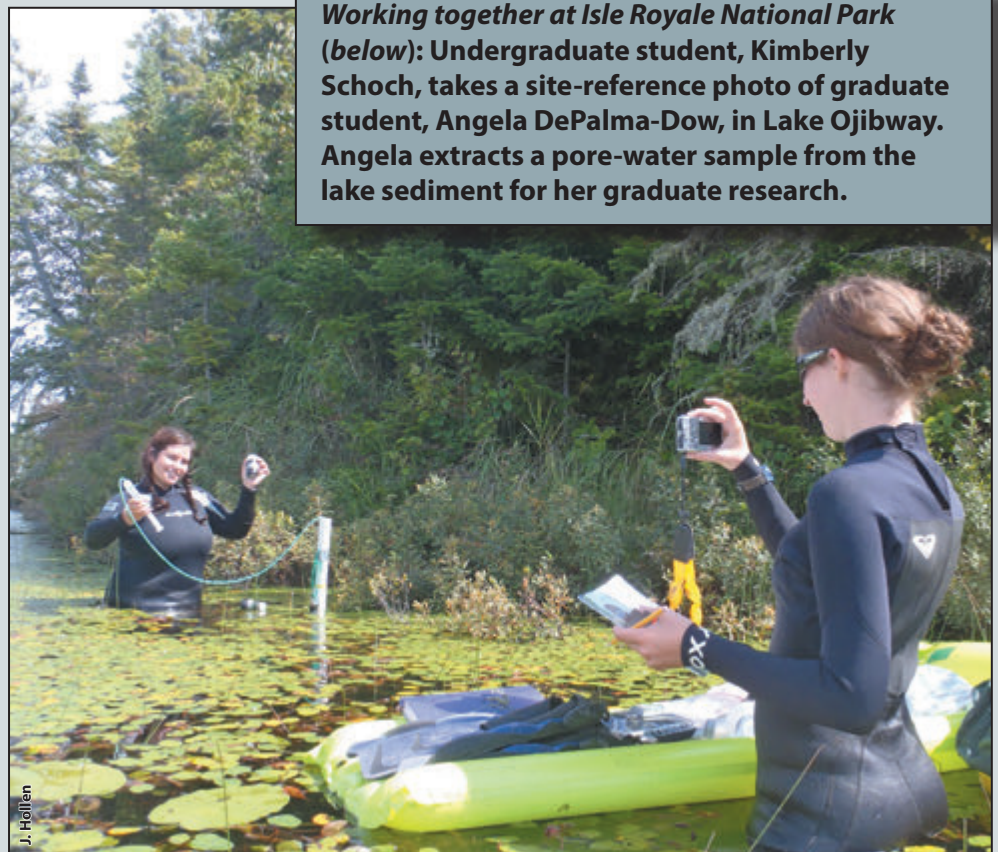
To increase interaction between Fisheries & Wildlife undergraduate and graduate students, a GSO “Fisheries & Wildlife Club Representative” attends weekly FW Club meetings. The role of this representative includes: 1) assisting interested undergraduates in locating research opportunities within the department, 2) providing mentorship for undergraduates interested in graduate school, and 3) facilitating cooperation between both FW Club and the GSO.

Perhaps the most exciting part of strengthening ties between FW club and the GSO is a new program that matches eager FW Club members with graduate students in need of assistance with their projects. The program provides the opportunity for undergraduates to become more familiar with the process of conducting science in a field or laboratory setting. Volunteer opportunities can range from a single day to multiple occasions, with many undergraduates dedicating at least 3-5 hours a week. This program also benefits graduate students that need research technicians for long-term help and would like to mentor enthusiastic undergraduates. As graduate students become aware of this GSO/FW Club collaboration, number and diversity of volunteer opportunities will hopefully increase and become available to a larger group of undergraduates.

Saving Sara

A second year graduate student, Sara Smith, was overwhelmed with a freezer full of hundreds of thousands of lake trout eggs that had to be counted, weighed, and measured for length. Sara was faced with a quandary that all graduate students must encounter at some point: *How am I ever going to get this done in time?* Luckily for Sara, the GSO/FW Club volunteer program was recently instated and provided her with the help of several eager FW Club volunteers.

Sara was able to take a task that may have taken a semester to complete alone and finish it in a fraction of the time. In addition, Sara’s volunteers benefitted greatly from the experience gained while working on the project. With the continued participation of GSO and FW club members, dire situations such as Sara’s can be flipped to provide beneficial experiences for both undergraduates and graduates alike.



J. Hollen

Working together at Isle Royale National Park (below): Undergraduate student, Kimberly Schoch, takes a site-reference photo of graduate student, Angela DePalma-Dow, in Lake Ojibway. Angela extracts a pore-water sample from the lake sediment for her graduate research.



Mr. Sanchez

For the betterment of all (above): FW Club members, GSO members, and other MSU students work together for the semi-annual Red Cedar River Cleanup on campus, autumn 2011. Over 100 students participated.

Marco Sanchez and Ryan MacWilliams co-authored this article to highlight some of the activities and achievements of the Fisheries and Wildlife Club and the Graduate Student Organization, along with new research and professional development opportunities created through increased collaboration between the FW Club and the GSO.

To get involved in the GSO/FW Club Volunteer Program, graduate students are encouraged to email Ryan MacWilliams with a short description of their project including when and where volunteers are needed. *It's that simple!*

For more information, visit:

FW Club: msu.edu/~fwclub/
 FW GSO: fw.msu.edu/~gso/organization.php



Marco Sanchez (msanchez@pecva.org) served as president of the FW Club during 2010 and 2011. He is a recent graduate of the Department of Fisheries & Wildlife and is currently employed by the Piedmont Environmental Council in northern Virginia as a Communications Specialist.



Ryan MacWilliams (macwill2@msu.edu) serves as the FW GSO Secretary and the FW Club Representative. He is a second-year masters student in the Department of Fisheries & Wildlife. His research focuses on the ontogenetic dynamics of Walleye.



C. Koleski

New experiences (above): Former FW Club member, Craig Sherwood, assists a MDNR biologist in checking a wood duck box at the Rose Lake Research Station.

Department of Fisheries & Wildlife 2012-2013 fellowship awards

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 aimed at non-scientists, including the general public.



Name: Kara Stevens

Graduate program: Fisheries and Wildlife, Ph.D.

Advisors: Drs. Dan Kramer and Gerald Urquhart

Graduate research: Social and ecological dynamics of small-scale fisheries along Nicaragua's Caribbean coast

Motivation to apply: I wanted to share my passion for fish conservation with a larger audience by writing something that makes a connection between the fish we eat and their environment. The Pattullo Fellowship is unique in that it gives an opportunity to have your work published, providing incentive and training to translate complex ideas into a format that is readable to reach that larger audience.

Literary work: "Five Things to Know Before Buying Fish." See pages 30-31.



Name: Abigail Lynch

Graduate program: Fisheries and Wildlife, EEBB, ESPP; Ph.D.

Advisor: Dr. Bill Taylor

Graduate research: Decision support for harvest management of Great Lakes lake whitefish for a changing climate

Motivation to apply: Communication with policy makers, stakeholders, students, and the public is vitally important to ensure informed decision making and environmental awareness. Translating science into this arena is an imperative, but often undervalued, task. I appreciate that the Departments of Fisheries & Wildlife and Community, Agriculture, Recreation, and Resource Studies highlight the importance of environmental communication through this award.

Literary work: "A Dinosaur Fish Back from the Brink." See pages 28-29.

The Annual Robert C. Ball and Betty A. Ball Fisheries and Wildlife Fellowship

Dr. Robert C. Ball, a well-known and respected limnologist and the Director of the Institute for Water Research, was one of the first members of the faculty in the Department of Fisheries & Wildlife. Dr. Ball and his wife, Mrs. Betty A. Ball, established this fellowship as a means of providing deserving graduate students with the opportunity to study fisheries, limnology, or water research.



Name: Jason Smith

Graduate program: Fisheries and Wildlife, M.S.

Advisors: Drs. Mary Tate Bremigan and Daniel Hayes

Graduate research: Sportfishing regulations are one of the tools most commonly used by fisheries managers. We will be using a model to investigate the sensitivity of various Michigan fisheries to size, bag, and seasonal limits. Regulatory effectiveness requires a myriad of trade-offs; simple, statewide regulations versus more complex fishery-tailored regulations; biological needs of the fishery versus the sociological needs of the angling

public; and tentative versus risk-accepting management practices. We hope our research lends insight into the efficacy of current and proposed sportfishing regulations.

Motivation to apply: All things fishy have fascinated me since I first picked up a rod more than thirty years ago. This research and the Ball Fellowship have given me a chance to give back to the Michigan fisheries that have given to me all these years.

Benefits of the fellowship: As a non-traditional student, I needed to find a master's program within commuting distance of my family and home in Tecumseh. The Ball Fellowship, TA support from the FW department, and the help of Drs. Bremigan and Hayes has allowed me to continue my education at MSU. I am most thankful to all who have made this possible.

Dr. Howard A. Tanner Fisheries Excellence Fellowship

Dr. Howard Tanner, former Chief of the Fisheries Division, Director of the Michigan Department of Natural Resources (DNR), and Director of Natural Resources for the College of Agriculture and Natural Resources at MSU, earned his Ph.D. within the Department of Fisheries & Wildlife under the direction of Dr. Robert Ball. Dr. Howard Tanner has been a long time supporter of Great Lakes related issues and this fellowship recognizes students who are committed to fisheries research related to the Great Lakes, connecting waterways, or tributary streams research.



Name: Darren J. Thornbrugh

Graduate Program: Fisheries and Wildlife, Ph.D.

Advisor: Dr. Dana M. Infante

Graduate research: Regional influence of landscape features and processes on the nation's fluvial fish assemblages. Recent work has suggested that specific landscape influences on fish assemblages vary regionally and across spatial scales. Understanding these differences is critical for managing

and protecting systems from large-scale stressors like changes in land use and climate.

Motivation to apply: I saw that my research has direct implications for helping to improve the management of Michigan's fishery resources in tributaries and connected streams of the Great Lakes.

Benefits of the fellowship: The Tanner fellowship will provide me with support for the completion of my dissertation research and travel support to more broadly disseminate my research findings to colleagues at local, national, and international conferences.

Janice Lee Fenske Excellence in Fisheries Management Fellowship

This fellowship honors the legacy of Jan Fenske, the first female Fisheries Biologist in the history of the Michigan DNR's Fisheries Division. It is designed to facilitate interactions for a FW graduate student with professionals from a sponsoring agency through the implementation of a fisheries research or management project of mutual interest to the agency and student. For more information, please visit: fenskefellow.wordpress.com.



Name: Hanna Kruckman

Graduate program: Fisheries and Wildlife, M.S.

Fenske mentors: Sarah LeSage, Aquatic Invasive Species (AIS) Coordinator, Michigan Department of Environmental Quality (DEQ),

and Jessica Mistak, Northern Lake Michigan Supervisor, Fisheries Division, Michigan DNR

Graduate research: I am analyzing the compensatory mechanisms of lake whitefish in northern Lakes Huron and Michigan relative to changes in sea lamprey abundance.

Motivation to apply: Fisheries management in the Great Lakes supports an important commercial, recreational, and cultural fishery whose success depends on the cooperation of a variety of different stakeholders. Working with the DEQ and DNR on invasive species seemed like an ideal way to look at fisheries management through a wider lens. I was also excited about the opportunity to establish relationships with mentors to gain both professional and personal insight and advice.

Fenske project: My project involves evaluating and summarizing various AIS risk assessment models to determine their potential use by natural resource managers in Michigan. During my project, legislation changes were implemented that mandated Michigan establishes an AIS Advisory Council. My project will be used to fulfill some of the council's reporting requirements.

Lessons learned: Fisheries management is a dynamic process that must quickly adapt to new circumstances whether it is the invasion of a new species or changes in legislation. Communication and partnerships are imperative to achieving common goals and ensuring that objectives are completed efficiently.

Application beyond fellowship: Being a part of Janice Lee Fenske's legacy has been both an inspirational and tremendous learning experience. Attending various meetings and conferences has allowed me to see management and policy-making processes that I may not have been exposed to otherwise. Much of this project's success can be accredited to the constant guidance and support I received from my mentors. This fellowship has been a collaborative effort with each contributing something valuable and all gaining from the experience.

For more info about these fellowships and to apply, visit fw.msu.edu/fellowships.htm.

Applications due January 20, 2013.

A Dinosaur Fish Back from the Brink: Saving the Gulf Sturgeon with Interjurisdictional Rehabilitation

By: Abigail Lynch

Out on the Yellow River along the Florida panhandle, you might not expect to see a dinosaur. But, that's exactly what Frank Parauka, a fishery biologist with the U.S. Fish & Wildlife Service's Panama City Fish and Wildlife Conservation Office (FWCO), is on the hunt for. He is out on a multi-month annual survey for Gulf sturgeon (*Acipenser oxyrinchus desotoi*). These fish are, in fact, a "living dinosaur." Sturgeon first appeared in the fossil record *before* the reign of the dinosaurs, approximately 225 million years ago, and have, remarkably, changed little since that time. While they have persisted all these millions of years, they are now on the brink of extinction because of overfishing and habitat degradation. Parauka's job, along with numerous partners and volunteers, is to ensure that rehabilitation, not extinction, is the future for this majestic fish.

Gulf sturgeon grow to over 8 feet, weigh over 200 pounds, and live to at least 30 years. They have a large snout, with a vacuum-like mouth, and their bodies are covered in five rows of bony scutes (modified scales that act as a body armor). And, if that is not an intimidating enough picture, imagine one jumping up next to your 15 foot fishing boat! In Florida's Suwannee River, there have been 10 collisions between Gulf sturgeon and boaters in this year alone. These sturgeon are famous for jumping, but scientists have yet to discover why. Some researchers hypothesize that jumping is a form of sturgeon-to-sturgeon communication because the jumping has a characteristic sound pattern. "There are too many questions to answer about these fun fish," says Parauka. "They sure keep you guessing."

The most southern of the sturgeons, Gulf sturgeon, are a subspecies of Atlantic sturgeon that were separated by the Florida peninsula (approximately 350,000 years ago). They've since adapted to the warmer waters of the Gulf of Mexico. Historically, Gulf sturgeon ranged from the Mississippi River to Tampa Bay. The present range extends from Lake Pontchartrain, Louisiana and the Pearl River system, Mississippi east to the Suwannee River, Florida. As an anadromous species, they migrate between fresh and marine waters. They



feed nearshore in the Gulf of Mexico and in its estuaries during the winter, rarely straying more than a few miles from the coast. Gulf sturgeon have a very strong homing instinct and generally return to their own natal rivers in the spring to spawn. They spend the rest of the summer and fall months in freshwater where they fast, not eating for eight or nine months.

Initially, Gulf sturgeon supported a profitable fishery with the harvest of their eggs for caviar, their flesh for smoked fillets, and their swim bladders for isinglass (a semi-transparent gelatin used in jellies, wine and beer clarification, special cements, and glues). Because of their long life, slow growth, late maturity (females at 12-15 years and males at 7-10 years), and infrequent reproduction (females spawn every 3-5 years), Gulf sturgeon were easily overfished by the mid twentieth century. Concurrent with overfishing, habitat degradation also precipitated this decline. Dams limited migration to historical spawning grounds; groundwater extraction decreased flow into streams and restricted cool-water summer refuges; point and non-point pollution caused bioaccumulation of heavy metals and other toxicants; and dredging destroyed benthic feeding areas.

Management of Gulf sturgeon poses many challenges; first and foremost is that sturgeon migrate across state boundaries. Because these fish travel long distances, place-based management measures do not provide adequate protection and interjurisdictional management



Measuring standard life history characteristics, such as weight (above) and length (far left), help guide rehabilitation efforts for Gulf sturgeon. (photos and map: Paul A. Lang/USFWS)

is necessary. The subspecies was officially listed as threatened in 1991 and a recovery plan was implemented in 1995. The U.S. Fish & Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and Gulf States Marine Fisheries Commission were signatories to the plan with the following joint objectives to: “prevent further reduction of existing wild populations of Gulf sturgeon within the range of the subspecies,” “establish population levels that would allow delisting of the Gulf sturgeon by management units,” and “establish a self-sustaining population that could withstand directed fishing pressure within management units.”

Under the recovery plan, Gulf sturgeon are comanaged by the USFWS and NMFS but there are many other partners involved from state agencies, to the Army Corps of Engineers, the Air Force, and universities. Karen Herrington of the Panama City Ecological Services Office is the recovery lead for the USFWS. She and her NMFS counterpart are currently guiding the update of the recovery plan. “Since we’ve listed the subspecies,” says Herrington, “we’ve funded a lot of research and come a long way in what we know about this species. We can greatly improve upon the current plan because we have a better idea of how to achieve recovery.”

Currently, seven rivers are known to support four genetically distinct reproducing populations of Gulf sturgeon. The largest population in the Suwannee River may contain as

many as 14,000 individuals. Parauka and the USFWS Panama City FWCO have led annual monitoring efforts on one or more of the four Florida Panhandle rivers (Escambia, Yellow, Choctawhatchee, and Apalachicola) since the mid 1980s. The gill-net surveys measure standard life history characteristics, such as length and weight, and also tag individuals to track their movement patterns and habitat use. By the end of the year, close to 300 Gulf sturgeon will have acoustic transmitters. There are 140 receivers, from the mouth of the Suwannee River to the Louisiana coast, positioned 25km apart to record when the fish leave the rivers and where they go afterwards. Gulf sturgeon movement is still quite a mystery. “We don’t know what they’re going to do half the time,” says Parauka. The success of these surveys, according to Parauka, wouldn’t be possible without the “excellent working relationship” that USFWS has with partners (the states, NMFS, universities, and NGOs) and volunteers.

Interjurisdictional management at its best, Gulf sturgeon rehabilitation will never be simple. Though everyone has common goals, wrangling geographically dispersed partners can be difficult. “Little things can be big challenges,” according to Herrington. “Permitting and getting all the partners to use the same conservation measures while sampling, for example, can be tough.” But, the returns from working together are even greater. “To see these charismatic fish recover,” says Herrington, “what a reward!”



This article is a reprint from the Spring 2012 issue of *Eddies*, the U.S. Fish & Wildlife Service's Fisheries Program outreach magazine. For more information, please visit: fws.gov/eddies.

Five Things to Know Before Buying Fish

By: Kara Stevens

Burger King Big Fish. McDonald's Filet-O-Fish. Van de Kamp's Frozen Fish Sticks. If you purchase these things, you might wonder what exactly you are eating. Is it hake from the cold North Atlantic, catfish from the warm waters of the Gulf of Mexico, tilapia from a fish farm in Central America or Vietnam? Was it caught by hook and line, a bottom trawler, scooped from a tank or caught in a gill net? Consumers are increasingly conscious of the origin of their food and want to know how it was raised, what it consumed, and how it was captured. No other group of wild animals sustains more people economically or nutritionally than fish. While we call it seafood, it is in fact, wildlife, and the increase in fish consumption over the last five decades has resulted in fishermen, scientists, and policy makers questioning how much longer we can continue to rely on our oceans as a source of food.

Of the global supply, as much fish comes from large industrial boats on the high seas as from individual fishermen in small boats working coastal areas within eyesight of their homes. Many of these individual fishermen are in developing countries. A fish's journey to your dinner plate may have started in a dugout canoe, caught by a fisherman who lives

in a corrugated zinc house on the water's edge and who uses income from fishing to buy the day's supply of rice, oil, and sugar. On the other hand, your fish may have been dumped onto the deck of a 50-foot commercial trawler and sorted by multiple deckhands who separated marketable products from the piles of crabs, sponges, and other fish that came up with the nets. Day to day, the lives of consumers in the U.S. are vastly different from fishermen overseas. However, the thread that connects us is the food we consume and the market that delivers that food.

The U.S. is the number two importer of fishery products worldwide, and eighty percent of our total seafood consumed is imported. Americans spend about \$80 billion a year on fish products. When we purchase fish, we send a signal about what species we prefer to eat, how we want the species captured, and where we want it to come from. These everyday grocery store decisions affect the lives of tens of thousands of fishermen all over the globe.

With improved consumer education tools, increasing awareness through films like the *End of the Line*, and mobile-phone-accessible assessment programs like *FishPhone* and *Seafood Watch*, people are able to make

better decisions about seafood consumption. Here, we will explore in more detail some of the misconceptions about buying and eating fish.

Myth: I need to eat a lot of fish to get omega-3s and have a healthy heart.

Omega-3 fatty acids describe a general group of fats found in a variety of foods that are important for cardiovascular health. They are not found in all species of fish, and are most abundant in cold-water species. Fish do not synthesize these fats; they accumulate the fats from the food they consume, such as algae and krill. The amount of omega-3 in fish varies based on the fish's diet, how it is prepared, and whether it is wild or farm-raised (usually wild has more, but not always). Recent evidence indicates that the health benefits of consuming fish may not be worth the risk for children and women of childbearing age, due to potential exposure to mercury. This is not without controversy, as omega-3 fatty acids are considered necessary for cognitive development in children. While research in this area continues, it is important to remember that there are other sources of omega-3, such as flaxseed, algae, walnuts, and soybeans, among others.



Photos: A. Lynch

Myth: Aquaculture is the solution to fishery declines.

In the past two decades, aquaculture has expanded to meet increasing global demands for seafood. Many fish raised in aquaculture grow by consuming wild-caught forage fish such as herring and menhaden. These small fish are a food source for a wide assortment of aquatic species. Farming can be highly inefficient when it relies on a wild-caught food source. It can take three pounds of wild fish to produce one pound of farmed fish meat. The exceptions are tilapia and catfish raised in the U.S. because they are fed a vegetarian diet. These species can be a good option when purchasing seafood, as well as farmed shellfish such as clams, oysters, and mussels. They are filter feeders, do not require wild-caught food, and have relatively minimal impacts on the environment.

Myth: If I order a red snapper, I will get a red snapper.

Recent studies have shown that almost 40% of fish are mislabeled. Most often a common, inexpensive fish is labeled as a more expensive species, and it can happen at any point along the supply chain. If

you buy snapper, grouper, or cod, you may, in fact, be eating tilapia. Fortunately, it has become much cheaper and quicker to identify fish with DNA barcoding. There are exciting opportunities for DNA barcoding to reduce fraud in fish labeling, and it is beginning to be widely applied by government regulatory agencies and private companies with an interest in ensuring the integrity of their products.

Myth: Sustainable seafood costs more and I can't afford it.

Grocery stores typically carry 10-15 different seafood options. Armed with the right information, consumers can purchase sustainable seafood without spending more than on alternatives. Assessment programs like Blue Ocean Institute's *FishPhone* and Monterey Bay Aquarium's *Seafood ID* card make choosing sustainable fish easier in grocery stores and restaurants. Greenpeace's *Carting Away the Oceans* report ranks grocers nationwide on their commitment to offering sustainable seafood. Local results may be surprising: Of twenty grocers evaluated, Meijer is last on this list. However, Kroger, Target, and Sam's Club all received a passing grade (Target ranked second) and most provide in-store information or offer products from third-party certification programs

like the Marine Stewardship Council to help wade through the choices.

Myth: Fish are often given new names so I never know what I am eating.

It is no secret that the not-so-delicious sounding Patagonian toothfish and slimehead were given more palatable names: Chilean seabass and orange roughy, respectively. Wholesalers or chefs, often successfully, rename fish to increase consumer interest and, thus, profit. However, consumers don't have to guess about fish names. The Food and Drug Administration publishes the Seafood List, which provides scientific, common, and vernacular names for a near-comprehensive list of seafood products. It is a useful tool to keep up with marketing ploys aimed at uninformed consumers.

If you do purchase seafood, ask where food providers source their fish and how it was caught. Consumer outrage changed the way meat was processed in the early 1900s and changed the way tuna was harvested to make it 'dolphin safe' in the 1990s. Sea turtles, sharks, fish, and all other sea creatures in the marine food web will depend on that same outrage in the coming decades.



Outreach in action!

Exploration and engagement across generations

at the MSU ponds

By: Jeffrey White, Emi Fergus,
and Emily Norton Henry

Van doors roll open and kids pour out with their grandparents, immediately drawn to the pond glistening in the afternoon sun. Amid the excited chatter, redwing blackbirds cackle in the reeds, and frogs plop into the water. The energy is palpable as we greet these soon-to-be aquatic ecologists for an afternoon of outreach and hands-on, exploratory science. Science outreach programs provide natural resources professionals with an opportunity to connect with the public in a relatively informal and interactive setting. This interaction, typically occurring outside the classroom, may be especially critical at a time when many K-12 and college students find science difficult or boring and have little interest in classroom-taught science. Part of this apparent disinterest could be related to the limited interactions many people have with their natural surroundings, something the fisheries and wildlife community is well-equipped to address through interactive, outdoor outreach programs. We had the opportunity to participate in an effective outreach experience to engage a diverse, multigenerational audience: Grandparents University. MSU provides outreach opportunities during this unique, annual, three-day summer program that brings about 900 alumni and their

grandchildren together on campus to take mini-classes and live as college students.

Learning through experience and discovery is one way to make science more engaging and enjoyable to a broad audience. We analyzed survey results from past participants of Grandparents University to determine what characteristics were desirable for a successful outreach experience. When we created a visualization of the responses to the open-ended question, "What was your

favorite class and why?," frequently mentioned attributes included "hands-on," "interesting," "fun," "interactive," "participation," and "informative" (see **word cloud** on page 34). We expected that future programs including these qualities would resonate with participants' interests and expectations.

Our Grandparents University class, which focuses on aquatic ecology, was developed to be hands-on, exploratory, educational, and fun. The class, *Looking Beneath the Surface*, is a 90-minute outdoor session designed for 20 participants and is one of dozens of diverse mini-courses offered by volunteer MSU faculty, graduate students, and staff during Grandparents University. Although the program presents an ideal opportunity for us, as natural resources professionals, to showcase our discipline and expose a diverse audience to natural resources topics, it poses formidable challenges for the instructors to connect with diverse age groups,

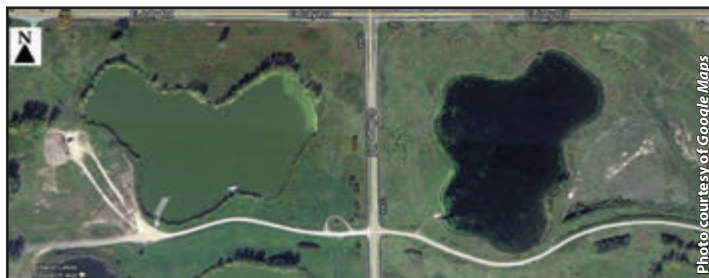


Photo courtesy of Google Maps



J. White



Grandparents University

Grandparents University participants visited the MSU Inland Lakes Research Facility (aerial photo above), located south of main campus to explore differences between two ponds (above and on facing page).

grandparents and their 8-12 year-old grandchildren.

Our session revolves around one central scientific question: Why are two MSU campus ponds ecologically different? Indeed, the two ponds look strikingly different (*see image on left*). The short answer is that one pond contains fish and the other is fishless, which leads to a domino effect in each pond resulting in algae blooms and murky water in the former and clear water in the latter. But, rather than simply tell the participants the answer, we guide them through an examination of the ponds using common aquatic ecology field techniques to find the answer themselves. Through exploration, participants develop their own ideas to explain the differences between the two ponds.


We first engage the class by asking the participants about their personal experiences interacting with aquatic ecosystems and their understanding of the scientific process. We pose questions which help gauge prior knowledge, such as: “Who can tell me something that a scientist does?” and “What organisms might we find today in the ponds?” By welcoming two-way discussion and the input of the participants, we create a comfortable atmosphere conducive to active learning, critical thinking, and reflection on personal experiences.

Following a brief introduction of sampling gear, the focus of the class turns to observing the physical and

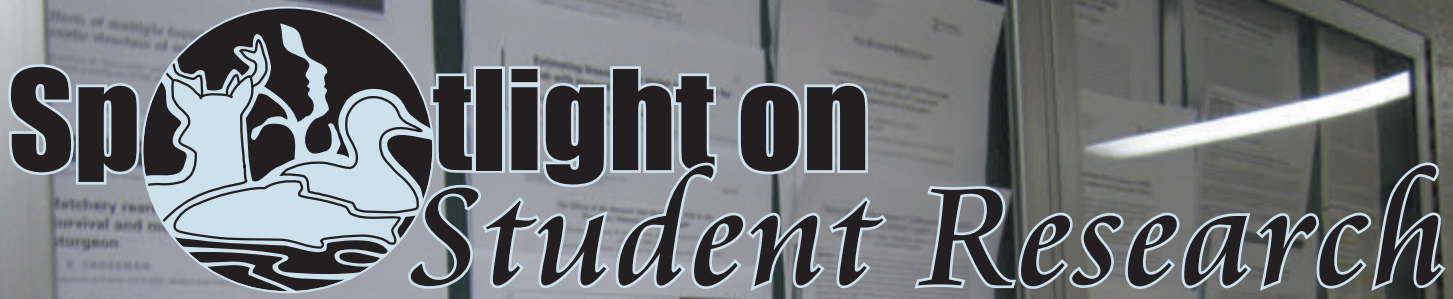
biological characteristics of the ponds using common lake sampling techniques. Participants are invited to net macroinvertebrates (aquatic insects), tow for zooplankton (tiny animals in the water column), collect water samples, and measure the clarity of the water with a Secchi disk. The children crowd around and peer intently as the black-and-white disk is slowly lowered into the water. “I still see it!” one child exclaims. “Me, too!” another confirms. The disk is lowered a little more. “Can you still see it?” “Yes!” “How about now?” “It’s gone! It’s gone!” The grandparents are equally engaged in the activities, assisting their grandchildren in pond sampling and recording data in a field notebook we provide.

Participants are fascinated by the microscopic zooplankton collected from one of the ponds that teem around in a jar. They get up close and personal with bullfrog tadpoles, mayflies, backswimmers, water striders, leeches, and damselflies. Some participants, young and old, learn for the first time that these animals occur in aquatic habitats.

When we cross the street to the second pond, participants immediately observe striking and intriguing differences between the two. The second pond is covered with a green scum of algae; its clarity is a fraction of the first. Unlike at the first pond, the fish traps here are full of minnows and sunfish. The kids are ecstatic



Participants use field-sampling gear to capture fish and invertebrates within the MSU Ponds. The class, called *Looking Beneath the Surface*, is offered through Grandparents University. (photo: Grandparents University)



Spotlight on Student Research

-Compiled by Jodi Kreuser

Check out the brag board in the basement of the Natural Resources Building to see recent publications from our students, faculty, and staff.

Brandon Armstrong published "Determining the effects of ammonia on fathead minnow, *Pimephales promelas*, reproduction" with Jim Lazorchak, Cheryl Murphy, Herman Haring, Kathleen Jensen, and Mark Smith in *Science of The Total Environment*. This paper reevaluates ammonia toxicity on *P. promelas* using a short-term 20-day fecundity method. The lowest un-ionized ammonia concentration tested during this study resulted in a decrease in cumulative fecundity. We estimated the no observable effect concentration (concentration that will not harm the species involved) for *P. promelas* reproduction to be lower than previously reported.

Andrea C. Bowling published "The effect of change in habitat conditions on the movement of juvenile snail kites *Rostrhamus sociabilis*" with Julien Martin and Wiley M. Kitchens in *Ibis*. This paper shows that juvenile snail kites have a higher probability of movement across their range than previously recorded, potentially indicating an additional source of stress and mortality for the endangered bird. The higher rate of movement is likely attributed to a change in habitat conditions across the Everglades ecosystem.

Neil H. Carter published "Coexistence between wildlife and humans at fine spatial scales" with Binoj K. Shrestha, Jhamak B. Karki, Narendra M.B. Pradhan, and Jianguo Liu, in *Proceedings of the National Academy of Sciences*.

Neil H. Carter published "Utility of a psychological framework for carnivore conservation" with Shawn J. Riley and Jianguo Liu in *Oryx*.

Shauna Hanisch published "Promoting wildlife health or fighting wildlife disease: insights from history, philosophy, and science" with Shawn Riley and Michael Nelson in *Wildlife Society Bulletin*. This paper argues for a clearer conceptualization of

the term "wildlife health" and provides the basis on which a common understanding of wildlife health can be achieved. The authors review the history and evolution of wildlife health management, reveal the philosophical basis of health, and share research findings about how wildlife health experts define the term.

Marta A. Jarzyna published "Effects of landscape-scale forest change on the range contraction of ruffed grouse in New York State, USA" with William Porter in the journal *Wildlife Society Bulletin*. This paper investigates how habitat quality and quantity have contributed to range contraction of the ruffed grouse in New York State. Factors affecting grouse populations appear to act at broader spatial scales than are typically considered in habitat evaluation. The authors' findings have implications for how public forest lands might be managed to encourage continued persistence or re-expansion of grouse populations.

Marta A. Jarzyna published "Climate change implications for wildlife conservation and management" with co-authors Benjamin Zuckerberg and William Porter in *Wildlife Management: Contemporary Principles and Practices* (Johns Hopkins University Press). The textbook was endorsed and written by The Wildlife Society professionals and was designed for university students in wildlife management courses. The climate change chapter was designed to provide the basic information on the implications of climate for wildlife, as well as information on how wildlife resources can be managed in the face of climate change.

Scott Knoche published "The economic value of publicly accessible deer hunting land" with Frank Lupi in *Journal of Wildlife Management*. This is the first paper to estimate the economic benefits accruing to hunters from the existence of publicly accessible hunting land.

Abby Lynch published *Great Lakes Fisheries Policy and Management: A Binational Perspective* (Second Edition; MSU Press) with co-editors William Taylor and Nancy Leonard. This book offers an informed look at Great Lakes fisheries, their ecosystem, and policy implications and is a valuable reference tool for students, researchers, policy makers, and managers alike.

Wu Yang published "Water sustainability for China and beyond" with Jianguo (Jack) Liu in *Science*. This paper outlines China's water crisis and recent leapfrog investment in water conservancy and suggests how to address complex human-nature interactions for long-term water supply and quality both for China and the rest of world.

8th Annual Graduate Student Research Symposium

Friday, February 22, 2013

Learn about the diverse research being conducted by graduate students in the Department of Fisheries & Wildlife.

Student Talks:
9 am to 5 pm



Keynote Address: 5 pm
Dr. Adrian Treves, UW-Madison,
Associate Professor of Environmental Studies

To register, please visit:
<http://fw.msu.edu/~gso/gsosymp/>



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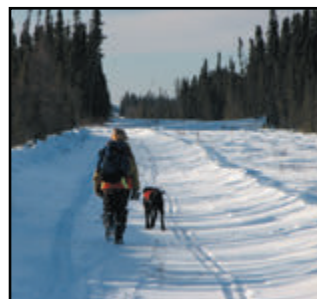


FIRST PLACE (clockwise, from left):

SCENERY - An inlet stream to Redfish Lake in the Sawtooth Mountains, Idaho (*Bryan Stevens*).

FIELD WORK - A southern red-backed vole (*Myodes gapperi*) quenches his thirst on Gatorade during a hot day in western Wisconsin (*Isis Kuczaj*).

FLORA AND FAUNA - A snowy plover (*Charadrius nivosus*) and chick rest on the beach of Sanibel Island, Florida (*Heather Porter*).



SECOND PLACE (from left):

SCENERY - Sunset over Hidden Lake, Glacier National Park (*Bryan Stevens*).

FIELD WORK - Tucker and his handler searching for wolf (*Canis lupus*) scat in Alberta (*Andy Crosby*).

FLORA AND FAUNA - Rocky Mountain bighorn sheep (*Ovis canadensis*) at Logan Pass, Glacier National Park (*Bryan Stevens*).

SPOTLIGHT online: www.fw.msu.edu/~gso/spotlight.php