HURON MOUNTAIN WILDLIFE FOUNDATION

Summer 2012 Newsletter

Life on the Salmon Trout: Understanding Impacts of Sand



A Michigan Tech graduate student keeps an eye on the gas-tight recirculating chambers used to measure productivity and respiration of microorganisms

By Jill Riddell

When we think of sand, our imaginings tend toward the pleasant: warm beaches, sand castles, or the combed cool sands of zen gardens. Even sand tracked into a cabin at the end of a summer day is treated by most of us with benign tolerance, if not outright affection. But for the living things in a stream in the Huron Mountains, sand can be a terrible menace. When there is a sudden influx, the sand flows into and fills up the spaces between rocks, diminishing habitat for fish and other organisms.

Understanding the effects of sand in the Salmon Trout River is at the heart of a new survey currently being conducted by Casey Huckins and Amy Marcarelli, two aquatic ecologists at Michigan Tech.

Huckins has been studying the Salmon Trout River since 2000, when he began a coaster brook trout survey funded by HMWF. Around 2005, he noticed that the amount of sediment in the river seemed to be increasing. "We'd set up a weir to study coasters, always in the same area of the river. In the early years, we would anchor it in place by using rocks from the stream," says Huckins. "Then one year, we realized we couldn't do that anymore—we couldn't find

any rocks. They were all buried under thick sand."

This year, using funding from the National Fish and Wildlife Foundation, Huckins and Marcarelli are installing a sand collector for the Huron Mountain Club. The sand collector will contain sediment flowing into the Salmon Trout River which should help restore the spawning habitat for coaster brook trout. The National Fish and Wildlife Foundation is also funding research to monitor the results of this restoration effort for coasters. In a separate study funded by HMWF, Huckins, Marcarelli and their respective graduate students will study effects of changes in sedimentation on the overall ecosystem of the river.

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5 GREAT THINGS TO FIND ON THE SALMON TROUT RIVER

Casey Huckins's List of Recommendations

When someone has spent twelve enviable summers working steadily on the Salmon Trout River, he's bound to know a thing or two about it. We asked researcher Casey Huckins for his favorite lunch spot, but he seldom pauses for lunch—"Our research team is always in a hurry, so we just eat on the fly wherever we are." But Huckins did offer up five recommendations for things anglers and hikers might notice along the river. (He qualifies this list by saying that these things are his favorites "other than coasters, of course.")

1) Jewelwing damselflies. (Calopteryx)

"Beautifully graceful, brightly-colored damselflies. We often see the males perched on vegetation or wood along the stream bank. Then they take off, and bob about."

2) White-throated sparrows.

"We hear them sing throughout the day along the riverbanks."

3) Stoneflies. (Pteronarcys)

"If you actually get into the river and root around, you'll find stonefly larvae, a sign of good water quality. They're an important 'shredder,' which means they chew up leaves and big organic matter. They don't like sediments much; they're affected negatively by sand and silt."

4) Garter snakes.

"The area around the Salmon Trout has the greatest population of garter snakes I've ever seen. Often they're basking along the trails or even up in some old decaying trees."

5) Mink

"I've had a lot of nice views of mink and otter. Once I watched a little mink trying to catch a big spawning coaster. The coaster must have outweighed the mink fourfold, but the mink kept jumping in the pool and chasing the coasters, then hopping back out—it tried and tried. Finally, it came up from the pool, and I guess it must have given up. It had a little sculpin, so it just ate that."



A mink on the Salmon Trout River, giving up after trying to catch a coaster brook trout. *Photograph by Casey Huckins*.



Three scientists from Michigan Tech conduct a survey of the Salmon Trout River's fish populations. It was this long-term fish project that led the same team to conduct the study currently funded by HMWF on the river's overall ecosystem.

THE PERIL OF SAND

"Excess sand is detrimental to all the organisms in a river," says Marcarelli. "A natural river bottom consists of medium to large sized rocks with space in between. This is where coaster brook trout spawn. In those spaces insects live, algae grows; pools form where the fish can get out of the strong flow and hang out. They can avoid predators there, or wait to lay their eggs."

In contrast to coarser rock, sand grains are so fine they allow little air in between the grains. So in a river bed with a sandy bottom, insects may decide not to live there or lay their eggs; the ones that do risk getting buried and suffocated by the sand. The coasters can't spawn on a sandy stream floor. "Sand also moves a lot," says Marcarelli. "It's constantly moving downstream, so algae, bacteria, fish eggs—they all have high mortality in sand."

Insects, bacteria, algae, small fish: these are the important building blocks at the bottom of the food chain. If they suffer, everything higher up the food chain suffers, too, including coaster brook trout. And sand is a problem not just in the Huron Mountains—it's a nation-wide issue. "Sediments are the most widely reported pollutant in streams," says Marcarelli. "It's so serious that sediment is treated by U.S. EPA just like heavy metals."

The drivers of sedimentation are the human land uses in the watershed. Road building, logging when it's not conducted responsibly, and mining are three examples of contributing activities.

HOW THE SURVEY WORKS

The teams working with Marcarelli and Huckins are studying the bottom of the food chain, the microorganisms. Studying bacteria and algae is essential for understanding ecosystems because microorganisms are by far the most abundant organisms. Their activity dominates the flows of energy and nutrients through those ecosystems and also controls the food and resources available for more complex organisms like insects and fish. Marcarelli explains how their work is done: "We take core samples of sediments and take them back with us to the lab to measure levels of extracted chlorophyll. This is the pigment algae use to photosynthesize, the same one that trees use. This measures their biomass."

To measure their input and output—photosynthesis and respiration—the researchers place sediments in gas-tight chambers and return them to the river. Oxygen concentrations are measured before the material is put in the chamber and then again an hour or two later. With no other oxygen entering from outside, the chambers give an accurate measure of what is produced and consumed by the small organisms within.

"We normally work from sun up to sun down," says Marcarelli. "We do our chamber runs between ten o'clock and two o'clock when the sun is high. Then once we are off the river, back at the Stone House, we measure what we collected, sometimes late into the night. The Stone House is a fabulous resource—it makes the Salmon Trout one of the best places to conduct research."

This HMWF-funded project on the river's ecosystem will continue next year, and by then, some results should also be available on how the sand collector has affected fish populations. The two surveys working in tandem, one at the bottom of the food chain and the other at the top, should provide a clearer picture of this important river.



Graduate student Tony Matthes checks on the temperature logger. Located in the water, the logger records real-time water temperatures with computer chips; temperatures are recorded every half-hour.



Welcome to the 2012 Research Season

Dear Friends,

The 2012 research season is in full swing with several returning projects as well as some interesting new ones, such as an analysis of fossilized sand dunes, use of ground-based laser technology to assess old growth forest canopy structure, and a study of the massive production of cones and seeds of the white spruce—to name a few.

Director of Research Kerry Woods continues the engaging work of soliciting and reviewing projects that deepen scientific understanding of the Huron Mountains. One metric of success is the number of peer-reviewed published research papers that stem from Foundation-sponsored projects. This year a record number of papers featuring Foundation projects have been published so far: 11 peer-reviewed scientific papers, six conference presentations, and three thesis papers.

All of this research has generated important data about Huron Mountain. We continue to integrate this data in a GIS system and are considering different ways to provide it to the Huron Mountain community in ways that are useful and interesting.

ANNUAL MEETING

Tuesday, July 31, 2012 4:00 p.m., Playhouse

Learn more about HMWF's current research, and find out who wins this year's Manierre Award. Discover how the Huron Mountains' water features and rock formations came to be the way they are in geologist James Bockheim's keynote address. All are welcome—come and enjoy the afternoon with us. To learn more, please come join us at the annual meeting on July 28. Our featured speaker will be Professor James Bockheim, who has spent some years doing research in the Huron Mountains. Most recently, he's been mapping the geology of the Club properties and reconstructing the history of local deglaciation. His talk will be "Catastrophic Flooding in the Huron Mountains: Club Member Richard A. Rice Had It Right."

At the end of last year the Red House renovation was finally completed. Without missing a beat, attention turned to the Stone

House, which was starting to look a little faded on the first floor, and the porch over looking Ives Lake that had began to sag. We allocated Foundation funds to repair the porch, and the extended McMillan family made an extremely generous donation in honor of William and Anne Manierre to renovate the first floor of the Stone House. Wayne Thorpe and Cynthia Pryor have been working tirelessly to restore and repaint the walls and ceilings and refinish the floors. They have also installed a library with custom made bookshelves. New furniture will be purchased, along with some additional equipment.

The Stone House renovation is a fitting memorial to the Manierres who were such important supporters of the Foundation and who, in their own right, were contributors to science at Huron Mountain. We are lucky to have a great research facility that is generously supported by the Huron Mountain community and so well cared for by Wayne and Cynthia. Please come out to Ives Lake to see the new and improved facilities and visit the scientists to learn what they are discovering in the North Woods.

Sincerely, Tim Brown President 2012 HMWF Project Summary

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By Kerry Woods, Director of Research

The 2012 research season is off to a good start. The facilities at lves Lake will host a number of researchers representing a broad spectrum of subject areas this year, and the Stone House, the now-fully-operational Red House, and the management skills of Wayne Thorpe and Cynthia Pryor will be put to good use. Thanks to the generous contributions of Foundation supporters (and the hugely successful silent auction at last summer's annual meeting), we were able to approve all of the proposals that we judged scientifically legitimate and appropriate to the Foundation's mission.

Here is a brief synopsis of the projects. A more detailed summary is available in the Huron Mountain Club office.

Earth and Atmosphere

Our research program has long been dominated by the biological sciences, but the Huron Mountains offer equally great opportunity for research in the earth sciences. That will be exploited by two long-term projects - Jim Bockheim's (Univ. of Wisconsin) mapping of surface geology and a wealth of interesting glacial geomorphological features, and Fritz Nelson's (Univ. of Delaware) and Ken Hinkel's (Univ. of Cincinnati) microclimate monitoring network. (See the list of publications in this newsletter for a recent product of that effort). In addition, Walter Loope (USGS) and collaborators initiated a study analyzing 'fossil' sand dunes to reconstruct paleoclimate; in particular, they are dating materials from a stabilized dune system SW of lves Lake to assess suspected severe droughts about 9000 years ago. In another exploration of potential effects of long-term droughts, Ben Duval (USDA Ag Research Service) is beginning an experiment to assess whether lake sediments exposed to air act as sources or sinks of greenhouse gasses.

Ecosystem Function

Ecosystem studies sit at the interface between the biological and earth sciences, examining the effects of physical system properties on biological processes and vice versa. Four projects continue studies of ecosystem dynamics in aquatic systems; all of these focus on potential for environmental changes or events to cause

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HMWF DASHBOARD: A SUMMARY OF 2012 RESEARCH STATISTICS

Number of HMWF-sponsored research projects active this summer: 21

Number of projects that look at the ecology of lakes and streams: 7

Number of projects that primarily concern earth and atmospheric science: 3

Number of projects that take place mostly in terrestrial ecosystems: 10

Number of projects that focus on the ecology or taxonomy of a particular species or group: 6

Number of projects that look at ecosystem-level dynamics: 4

Number of projects concerned with species interactions and community dynamics: 5

Number of projects that are long-term, and that have already accumulated five or more years of data: 6

Number of projects totally new this year: 7

Number of projects enabled partly or entirely by small grants from HMWF: 15

Percentage of states in the United States of America that have at least one researcher conducting an HMWF project: 20

Number of different universities and institutions sending researchers: 18

significant system-level changes. **Amy Marcarelli** and **Casey Huckins** (Michigan Tech) will continue focusing on analyses of ecosystem-level effects of sand accumulation in the Salmon Trout River, exploring the possibility that it can trigger substantial system changes (a 'tipping point' phenomenon) in the river. **Jay Lennon** and **Mario Muscurella** (Michigan State Univ.) examine the effects on microbial ecosystems of freshwater 'browning' (increased runoff of dissolved organics due to climate warming), and **David Costello** and **Allen Burton** (Univ. of Michigan) look at the effects of metal contamination on 'biofilms' – microbial ecosystems on stream sediment surfaces. **Scott Tiegs** (Oakland Univ.) and **Donna Kashian** (Wayne State Univ.) will continue regional studies of the effects of surrounding landscape properties on stream ecosystem function. On land, **Peter Curtis** (Ohio State Univ.) will be exploring the potential for research at the Hurons Mountains using ground-based LiDAR (a portable laser ranging system) to assess forest canopy structure and carbon storage in old-growth forests.

Forest Community Patterns and Processes

Paralleling the Curtis group's focus on the influence of canopy structure on ecosystem processes, **Bob Fahey** (Morton Arboretum) will be using LiDAR as well to further grapple with how forest dynamics – changes in species composition and size distributions – are related to canopy structure in old-growth forests. Both of these studies will be particularly enabled by the existence of long-term permanent study plots in the old-growth stands at Huron Mts. **Rose-Marie Muzika** (Univ. of Missouri), who, several years ago, studied fire history in pine stands at Huron Mts will return with **Walter Carson** (Pittsburgh Univ.) to initiate a study examining whether tops of large boulders and rock outcroppings serve as natural refuges for plant species that are particularly vulnerable to deer browse. **Dennis Riege** (Univ. of Maryland), as part of a regional study, will continue monitoring dynamics of white pine populations in mixed pine-hemlock-hardwood old-growth stands (see the Winter 2011 for a product of this study), with a particular focus this year on understanding seedling dynamics of hemlock and white pine. Dennis is also collaborating with **Donald Waller** (Univ. of Wisconsin) in monitoring a large deer exclosure – an experiment that will more definitively assess the long-suspected negative effects of deer browsing on forest regeneration and diversity.

Population and Biodiversity Studies

These studies are as diverse in approach as the organisms on which they're focused. Studies focusing on plants include **Jalene LaMontagne's** (DePaul Univ.) study of 'mast-seeding' (production of cones and seeds in massive quantities at intervals of several years) in white spruce; **Evelyn Williams'** (Chicago Botanical Garden) continued study of populations of the tiny, odd, and poorly understood Botrychium ferns (see publications listing elsewhere); and analyses of the genetics and taxonomic of oak populations by **Oliver Gailing** (Michigan Technical Univ.) and **Erik Lilleskov** (US Forest Service). **Dana Richter** (Michigan Technical Univ.) continues his long-term documentation of fungal communities in red pine stands. We will see further contributions to understanding of invertebrate diversity by **Ron Priest's** (Michigan State Univ.) ongoing studies of leaf-mining insects, **Mark Wetzel's** (Illinois Natural History Survey) work with aquatic oligochaete worms, and, in a new project undertaken by **Patrick Gorring** and **Brian Farrell** (Harvard Univ.), work with pine sawyer beetles. **Casey Huckins'** (Michigan Technological Univ.) long-term studies of the 'coaster' brook trout population in the Salmon Trout River will continue but, as the project becomes more focused on habitat and population management, it will be sponsored and overseen by the Huron Mt. Club rather than the Foundation (but the research team will still be working out of Ives Lake).

Thoughts on Change

by Kerry Woods

I'd like take a moment to reflect on the loss, over the last two years, of some formative figures in the history of the Huron Mt. Wildlife Foundation. Theodore McGraw, Dr. William Manierre, and Charles Haffner were all former Presidents of the Foundation. These were people whose support of and service to the Foundation were critical to its becoming a significant regional and national research organization. It was a personal privilege to have been acquainted with them, and I'm confident that I speak for the large and growing community of Wildlife Foundation researchers in expressing my gratitude for their work.

Ted McGraw was President of the Foundation when, as a grad student, I first applied to do research at the Huron Mts in 1977; I still have the letter in which he responded directly (and positively) to my request. I became acquainted with Charlie Haffner after becoming Director of Research; as an Honorary Director, he was a reliable presence at all Foundation meetings and events, and a valued advisor. I benefited immensely from the generosity with which Will and Anne Manierre shared their intimate knowledge and deep love of the Huron Mountain landscape, and I've received numerous communications from other researchers indicating that this was a widely shared experience. I was able to visit the Manierres at their home in Marquette last August and, despite their frail health, they were both deeply interested in what was happening at lves Lake. We will miss their wisdom and their company.

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RECENT PUBLICATIONS AND PRESENTATIONS

The time from initiation of field-work to publication can seem long for field-based research in seasonal climates, but this last year the longterm growth of the HMWF research program has caught up with us and we've seen a minor explosion of publications and presentations emerging from HMWF-sponsored research.

THESES

- Evelyn Williams. 2012. "Exploring Cryptic species in *Botrychium* S.S. ferns using genetics, morphology, and demography." Ph.D. Thesis, University of Wisconsin – Madison.
- Schliemann, Sarah. 2011. "Effects of treefall gap size and age on carbon and nitrogen biogeochemical cycling in northern hardwood-hemlock forests. Ph.D. Thesis, University of Wisconsin – Madison.

Igleski, Matthew. 2011. "What environmental factors affect

Batrachochytrium dendrobatidis infection of green frogs (Lithobates clamitans) in Michigan?" M.S. Thesis, Central Michigan University.

PEER-REVIEWED RESEARCH PUBLICATIONS

- Anderson-Carpenter, L., J.S. McLachlan, S.T. Jackson, M. Kuch, C. Lumibao, and H. Poinar. 2011. Ancient DNA from lake sediments: Bridging the gap between paleoecology and genetics. *BMC Evolutionary Biology* 11:30-44.
- Fahey, R.T., C.G. Lorimer, D.J. Mladenoff. 2012. Habitat heterogeneity and lifehistory traits influence presettlement distributions of earlysuccessional tree species in a late-successional, hemlock-hardwood landscape. Landscape Ecology. DOI 10.1007/s10980-012-9754-z.
- Gailing, O., J. Lind, and E. Lilleskov. 2012. Leaf morphological and genetic differentiation between *Quercus rubra L*. and *Q. ellipsoidalis* E.J. Hill populations in contrasting environments. Plant Systematics and Evolution 298: on-line as of June 2012.
- Hinkel, K.M. and F.E. Nelson. 2012. Spatial and temporal aspects of the lake effect on the southern shore of Lake Superior. Theoretical and Applied Climatology. DOI 10.1007/s00704-012-0585-2.
- Pypker, TG, CS Tarasoff and H-S Koh. 2012. Assessing the Efficacy of Two Indirect Methods for Quantifying Canopy Variables Associated with the Interception Loss of Rainfall in Temperate Hardwood Forests. Open Journal of Modern Hydrology 2, 29-40.
- Ransom, T.S. 2012. Behavioral responses of a native salamander to native and invasive earthworms. Biological Invasions. DOI 10.1007/s10530-012-0255-4.
- Richter, D. 2012. The sugar maple sapstreak fungus (*Ceratocystis virescens* (Davidson) Moreau, Ascomycota) IN THE Huron Mountains, Marquette, County, Michigan. The Michigan Botanist (in press).
- Scribner, K., Huckins, C. J., Baker, E., Kanefsky, J. 2012. Genetic relationships and gene flow between resident and migratory brook trout in the Salmon Trout River. Journal of Great Lakes Research. 38:152–158.

- Sessa, E., E.A. Zimmer, and T.J. Givnish. 2012a. Phylogeny, divergence times, and historical biogeography of New World *Dryopteris* (Dryopteridaceae). American Journal of Botany 99: 730–750.
- Sessa, E., E.A. Zimmer, and T.J. Givnish. 2012b. Reticulate evolution on a global scale: A nuclear phylogeny for New World *Dryopteris* (Dryopteridaceae). Molecular Phylogenetics and Evolution 64(3).
- Sessa, E., E.A. Zimmer, and T.J. Givnish. 2012c. Unraveling reticulate evolution in North American *Dryopteris* (Dryopteridaceae). BMC Evolutionary Biology. In press.
- Williams, E.W. and D.M. Waller. 2012. Phylogenetic placement of species within the genus *Botrychium* S.S. (Ophiglossaceae) on the basis of plastid sequences, amplified fragment length polymorphisms, and flow cytometry. International Journal of Plant Sciences 173: 516-531. DOI: 10.1086/664711.

CONFERENCE PRESENTATIONS

- Marcarelli, A., S. Eggert, and C. Huckins, "Changes in organic matter production, storage and processing associated with sand accumulation in the Salmon Trout River, Michigan." North American Benthological Society Meeting, Providence, RI. May 2011.
- Eggert, S., C. Huckins, and A. Marcarelli, "Effects of sand accumulation on invertebrate communities of the Salmon Trout River, Michigan." North American Benthological Society Meeting, Providence, RI. May 2011.
- Huckins, C., A. Marcarelli, S. Eggert, and T. Matthys: "Multi-scale variation in salmonid abundance in the Salmon Trout River, Michigan and associations with sand accumulation." North American Benthological Society Meeting, Providence, RI. May 2011.
- Eggert, S., A. Marcarelli, C. Huckins, N. King, J. Ebel, A. Matthys, and R. Kolka. "Effects of sand accumulation on food webs of a coaster brook trout tributary to Lake Superior." 9th Annual Forestry, Wildlife and Natural Resources Research Review, Cloquet, MN. January 2012.
- Huckins, C. J, Baker, E. A., Matthys, T., Marcarelli, A., "Habitat degradation from sedimentation may limit coaster brook trout Salvelinus fontinalis in the Salmon Trout River, Marquette County" Upper Peninsula Brook Trout Symposium. February 2012.
- King, N., S. Eggert, A. Marcarelli, C. Huckins, J. Ebel, A. Matthys, and R. Kolka: "Detrital breakdown and macroinvertebrate communities affected by sedimentation in a low-gradient tributary to Lake Superior." North American Benthological Society Meeting, Louisville, KY. May 2012.
- Wetzel, M. J. "The aquatic oligochaetes (Annelida, Clitellata) of the Huron Mountain Club area, upper peninsula Michigan, USA - Year Two," Florida Association of Benthologists, Tampa, Florida, 25 October 2011.



Chicago, Illinois 60615 4730 South Kimbark Avenue

This year, for the first time, researcher Dennis Reige from the University of Maryland noticed a dozen pink lady's slippers-also known locally as moccasin flowers-in bloom within an exclosure set up to exclude deer. The exclosure is a rectangle of light-weight plastic fencing that keeps the animals out of a small, closely-monitored area near Fisher Creek. The exclosure study plot was established by Prof. Don Waller of the University of Wisconsin in collaboration with Riege, who has been studying white pine regeneration and population dynamics in neighboring forests for several years. Photo by Kerry Woods.

Pink lady's slipper orchids (Cyprepedium acaule) are attractive to more than just our eyes-deer love them, too. And while hikers linger over the flower's beauty for a few minutes and then pass on, white-tailed deer express their ardor for the orchids by eating them.



Director of Research Kerry Woods Timothy H. Brown

About the Huron Mountain Wildlife Foundation: Since 1955, the Huron Mountain Wildlife Foundation has supported original research in a wide variety of scientific fields. The research takes place in the Upper Peninsula of Michigan. More information on the Foundation can be found at: www.hmwf.org

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