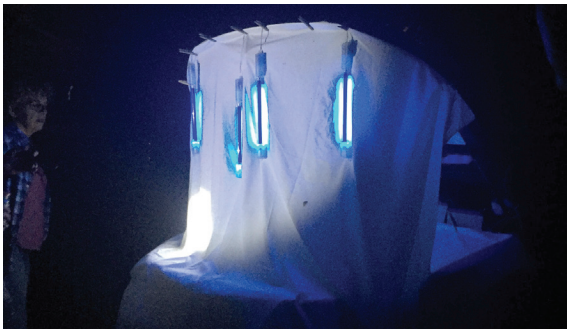
HURON MOUNTAIN WILDLIFE FOUNDATION

December 2016

Dear Huron Mountain Wildlife Foundation Friend:

We have arrived at yet another year end letter from the Huron Mountain Wildlife Foundation and have concluded another year of fascinating and meaningful research. The Huron Mountain Wildlife Foundation continues to attract exceptional investigators from across the country and world and thanks to our brilliant director and one of a kind laboratory we continue to produce exciting and intriguing information about this ever-rarer ecosystem. We thank you for all your past support and urge you to continue to generously support what is becoming increasingly recognized as a world-class research facility. Thank you in advance for supporting the work of the Foundation and for providing the opportunity for discovery at the Huron Mountains.

Thanks to your support, last year we were able to sponsor 25 projects, and 15 of those were enabled by grants from Huron Mountain Wildlife Foundation. This year has already seen several inquiries and exploratory visits from researchers considering applying for support next year. Some of these new projects include studies of lichen populations on the cliffs on the north side of Ives Lake and follow-up studies on the unusual "humper" lake trout of Rush Lake.



One of Werner and Bess's moth attracting tents

This year your contributions have funded work such as Nyeema Harris' new study of mesocarnivores. Nyeema is a professor at the University of Michigan who in addition to her research in Michigan conducts research in Burkina Faso, in West Africa. She and her students deployed 94 cameras, each costing $600 or $1,200, in May and collected them in October. The Huron Mountains are her most remote and unaltered site, providing comparison with two other lower Michigan sites. Data from an ecosystem with top predators (wolves) and extensive old-growth habitat provides a critical baseline for her study. While her study specifically targets mesocarnivore populations (coyotes, fishers, martens, skunks, bobcats, lynx, etc.) she was surprised and pleased that bear were photographed at two thirds of the camera locations. More results will follow. This study is designed to last for at least three years and your contributions are critical to allowing its full implementation.

Your contributions also continued funding for insect researchers Thomas Werner and Jim Bess from Michigan Tech. These projects, together, in their first two years, added over 500 species of moths (many regionally rare or previously unknown) to the Huron Mountains all-taxa list, along with dozens of species from other insect groups, and the 2016 work promises many more additions. These enthusiastic researchers shared their study techniques with a group of interested foundation supporters. They attracted moths using mixtures of mashed, fermented bananas and other fruit applied to tree trunks overnight, and by using UV lights behind sheets.

The dramatic diversity of habitat protected on Huron Mt. Club land supports remarkable diversity in many groups, and sustained support for new studies promises to reveal comparable depths of undocumented diversity in other insects, spiders, and beyond.

This year's annual meeting attracted a record turnout with the Presentation by Chad Wittkop (Minnesota State University-Mankato) on the ancient mysteries hidden at the bottom of Canyon Lake (Jill Riddell HMWF newsletter 2016). We look forward to learning more as this research unfolds.

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**

67 Vernetti Road, Red Lodge, MT 59068 | **www.hmwf.org**

The Huron Mountain Wildlife Foundation board welcomes Buffie Finkel and Dan Oneglia and would like to thank outgoing board member Carol Davis, and president Tim Brown for his many years of hard work and dedication to the Foundation.

Have a great Holiday Season.

Sincerely,
Henry Dykema

Foundation News From the Director of Research, Kerry Woods

Annual Meeting

The Foundation's annual meeting at the Huron Mountain Club once again saw a full house, and attendees were once again treated to new insights about the unique ecosystems of the Huron Mountains from one of the Foundation researchers supported by contributions to the Foundation. Dr. Chad Wittkop of Minnesota State University – Mankato. Wittkop leads a team of researchers from Iowa State and two campuses of the University of Minnesota in an ongoing study of Canyon Lake. Canyon is a "meromictic" lake – an unusual class of lakes in which the deepest layer of water never mixes with upper layers – and Wittkop's team has found evidence that it may belong in an even rarer category; "ferruginous" lakes have distinctive chemical environments in their deepest waters which may mimic conditions of the oceans during the earliest development of life on earth. Only a handful of ferruginous lakes are known. Wittkop's work was also featured in our summer 2016 newsletter, and his talk in August brought us an update on results to date as well as research plans. These include characterization microbial communities that may include very poorly understood organisms that appear to use methane and iron oxides, in the absence of oxygen, to fuel their metabolism.

Manierre Award

Another high point of the annual meeting is the presentation of the Manierre Award. Honoring the long-term and generous support of the Foundation by the Manierre family and named for Dr. William and Anne Manierre – distinguished naturalists in their own right – the award recognizes a recent, peer-reviewed publication resulting from HMWF-sponsored research. This year's award recognizes the work of Dr. Evelyn Williams of the Chicago Botanic Garden, and her recent publication on the evolution of *Botrychium,* or rattlesnake ferns (see the citation below). This paper, along with two other recent publications, springs from her long-term studies, originally undertaken for her Ph.D. dissertation at University of Wisconsin – Madison, of these ferns at Huron Mountain. The paper shows that these odd little ferns present a much more complex genetic and evolutionary picture than was previously recognized. Selection of Manierre Award winners is a particularly pleasing, if challenging, task because it emphasizes the strength and productivity of the Foundation's research program; in this case, the pleasure was enhanced by the fact that, while the Manierre's were on intimate terms with the entire flora of the Huron Mountains, they were particularly fond of the *Botrychium* ferns.

Left to right: Anne Sheret, Evelyn Williams, and Bill Manierre.

Research Update

In 2006, Dr. Mara Zimmerman from the Great Lakes Fisheries Commission began a study of the lake trout (or lake charr) in another of the Huron Mountains' unusual lakes, Rush Lake. Rush Lake is extremely deep for its size, and it has been known since at least the 1920s that it holds two forms of the species; the wide-spread typical form *(Salvelina namaycush)* and a deep-water form distinctive enough to have been regarded as a distinct species (named *Salvelina huronicus* by distinguished ichthyologist Carl Hubbs). The deep-water form is now generally seen as a form or subspecies of the common species – *"S. namaycush huronicus."* Similar polymorphic populations are known elsewhere only in lakes vastly larger than Rush. But not much more was known about the situation. Just how distinct were the two forms ecologically and genetically? Dr. Zimmerman set out to more fully document behavioral and ecological differences, to establish their genetic and taxonomic status, and to assess the significance of their occurrence in a comparatively very small lake.

Ten years later, just before writing these notes, I received a paper, newly published in the prestigious *Biological Journal of the Linnean Society* (see citation below), reporting the results of what grew to be a much more extensive study. The study integrates multiple data

sets – ecological, behavioral, morphometric, and genetic – resulting from several expeditions to Rush Lake and the work of multiple researchers (the paper has ten authors). The findings are complex. Researchers determined that the two forms are distinct in form and ecological habits, but are not very different genetically and are probably subject to ongoing "gene flow" (interbreeding) between the two populations. These two findings are somewhat challenging to reconcile; how is the distinctness maintained without strong genetic isolation? The researchers see these findings from a small lake challenging regarding ideas about the evolution of distinct morphs in other, large lakes. They also suggest the possibility that, in the absence of strong genetic barriers, ecological change – specifically, the apparently recent introduction of rainbow smelt to Rush Lake – may lead to the two forms merging as feeding habits change and become more similar.

This paper is a satisfying culmination of a long-term (and continuing) study that makes use of one of the many unique ecological research opportunities at the Huron Mountains. I expect it will have a high profile. But it is also just one piece of a continuing stream of research publications springing from HMWF-supported research; I tally about 35 peer-reviewed research publications over the last five years (you can find a full listing at www.hmwf.org under "Research Reports"), and, like the Rush Lake project, many spring from multi-year field studies that are possible only with the sort of security and support provided by the Foundation.

These peer-reviewed publications are the most visible, valuable, and lasting "product" of the Foundations' work (and of the contributions on which the Foundation depends). They are the substance of scientific advances, and the Foundation's reputation and visibility are increasing accordingly. Here is a list of publications since the last newsletter listing, along with some presentations of Foundation-sponsored research at major scientific conferences (which suggest publications likely to appear in the near future). They will give you a since of the impressive scope of HMWF-sponsored research.

Illustrations of lean and huronicus lake charr morphs sampled from Rush Lake within the present study. Illustrations by P. Vecsei.

Peer-reviewed journal publications:

Chavarie, L., Muir, A.M., Zimmerman, M.S. (7 others). 2016. Challenge to the model of lake charr evolution: shallow- and deep-water morphs exist within a small postglacial lake. *Biological Journal of the Linnaean Society in press.*

Coble, A.A., Marcarelli, A.M., Kane, E.S., Stottlemyer, J.R., Toczydlowski, D. 2016. Temporal patterns of dissolved organic matter biodegradability are similar across three rivers of varying size. *Journal of Geophysical Research - Biogeosciences* 121. DOI:10.1002/2015JG003218

Coble, A.A., Marcarelli, A.M., Kane, E.S., Huckins, C.J. In press. Uptake of ammonium and soluble reactive phosphorus in forested streams: influence of dissolved organic matter composition. *Biogeochemistry.*

Costello, D.M., and Burton, G.A. 2014. Functional and community response to sediment metals in stream ecosystems: context-dependent responses and variation among endpoints. *Elementa: Science of the Anthropocene* 2: 000030.

Feringa, M., Huckins, C., Mattes, W., Baker, E., Zorne, T., Littlefield, J., Scribner, K. 2016. Genetic and phenotypic evidence for splake presence in brook trout and lake trout spawning habitats. *Journal of Great Lakes Research* 42 (2016) 738–742

Gailing, O., and J. Riehl. 2016. Hybridization and adaptive divergence in oaks. International Oaks: the *Journal of the International Oak Society.* 27:91-98

Marcarelli, A.M., Huckins, C.J., Eggert, S.L. 2015. Sand aggradation alters biofilm standing crop and metabolism in a low-gradient Lake Superior tributary. *Journal of Great Lakes Research* 41:1052-1059. DOI:10.1016/j.jglr.2015.09.

Williams, E.W., D.R. Farrar, and D. Henson. 2016. Cryptic species and confusing morphological variation in the *Botrychium matricariifolium (Ophioglossaceae)* complex. *American Journal of Botany* 103:740-753.

Botrychium ferns

Theses:

Hill, L.A. 2015. *Habitat use by spruce grouse in a fragmented ecosystem.* M.S. Thesis, Northern Michigan University.

Knoll, Kayla M. 2015. *The effect of isolation by waterfalls and dams on stream fish morphology.* M.S. Thesis, Northern Michigan University.

Conference Presentations:

Fitzgibbon, A.S.* and Costello, D.M. 2016. Micron-scale spatial and diel variation in oxygen at the biofilm–sediment interface. Annual Meeting of the Society for Freshwater Science, Sacramento, CA.

Jol, H.M., Loope, W.L., Fisher, T.G., Morrison, S., Johnston, J.W., Moore, L.J., and Smith, D.G. 2016. Ground penetrating radar studies along the present and past coastlines of the Great Lakes: An Overview. Geological Society of America North-Central Section, 50th Annual Meeting, April 18-19, Champaign, IL, doi: 10.1130/abs/2016NC-275681.

Messick, Emily. and Scott D. Tiegs. 2016. Evaluating Spatial and Temporal Variation of Organic-matter Decomposition to Assess Stream "Health." Midwest Ecology and Evolution Conference. Oxford, OH, USA.

Muzika, R.M. and Carson, W. 2016. Using boulders to evaluate the effects of overbrowsing in eastern deciduous forests. Northeast Natural History Conference.

Swanner, E., Wittkop, C., Lambrecth, N., and Katsev, S. 2016. Establishment of early ocean analogs in Midwestern ferruginous lakes: keys to the evolution of biogeochmical (iron) cycling. Annual Meeting, Geological Society of America annual meeting (invited).

Wetzel, M.J., Reynolds, J.W., Morgon, M.A. 2016.) The earthworms *(Annelida, Clitellata)* of the Huron Mountain Club, Upper Peninsula, Michigan, USA. *AND.* The aquatic and semiaquatic oligochaetes *(Annelida, Clitellata)* of the Huron Mountain Club, Upper Peninsula, Michigan, USA. Annual meeting of the Florida Association of Benthologists.

Wittkop, C., Swanner, E., Lambrecht, N., Torgeson, J. 2016. Dissolved inorganic carbon isotope signatures in ferruginous lakes: new insights into ancient carbonate isotope excursion. American Geophysical Union, fall meeting.

Wysocki, A.D., Aken, T.J., Jol, H.M., Loope, W.L., Morrison, S.M., and Morin, A., 2016. Ground penetrating radar imaging of a strandplain along Lake Superior, Huron Mountains, Michigan, USA. Association of American Geographers, 111th Annual Meeting, San Francisco, CA, March 29 - April 2.

DONATIONS WELCOME

You can make a donation using your credit card on the website, or mail a check made out to "Huron Mountain Wildlife Foundation" to: Treasurer, Huron Mt. Wildlife Foundation, 1088 Park Avenue Apt 10E, New York, NY 10128. The Huron Mountain Wildlife Foundation is a 501(C)(3) organization and donations are fully deductible.