



USRWA NEWS

JANUARY 2013

FISH SOUNDS, DEEP SOUNDS: STURGEON THUNDER

*Submitted by Chris Bocast, Ph.D. student
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Though most people today are aware of the many sounds produced by marine mammals, ranging from the cheerful chirping of dolphins to the haunting cries of humpback whales echoing off the sea floor, many are still surprised to learn that fish also have a wide repertoire of sonic ability. That might be expected - for most of us, our experience of lakes, rivers, and the sea comes from outside the water, or from swimming and splashing through it. Our ears have evolved to perceive vibrations in the atmosphere - even if you paused underwater to listen, you'd be at a real disadvantage to perceive fish sounds. Also, in the 1960's, the television show Flipper introduced dolphins and their squeaks to many Americans, while advances in recording technology enabled the wide dissemination of whale songs. Indeed one of the most significant early contributions of bioacoustic research to the environmental debate was the commercial publication of recordings of moving whale sounds by Roger Payne in 1967, which brought a humane perspective and emotional intensity to the efforts to preserve cetaceans. Sounds produced by fish, however, remain a somewhat arcane research area reserved for specialists. Yet there is a mysterious sound made by fish that can sometimes be heard on the banks of quiet rivers of Wisconsin during springtime, and that has led to some intriguing recent research.

That fish make sounds has been known for centuries. Aristotle first noted that drum fish and sea-robins generated noises in the fourth century B.C.E., but it wasn't until the mid-1800's that ground-breaking scientists such as Johannes Peter Müller (who mentored Hermann von Helmholtz) first began to systematically investigate this phenomenon. He and his associates identified a number of fish, mostly from marine families, that emitted sounds, and termed them *pisces vocales* or vocal fish. *Continued on page 2...*

In this Issue:

- Page 1, 2, 3 - Fish Sounds, Deep Sounds: Sturgeon Thunder
- Page 3, 4 - The Land Ethic Continued - Annual Meeting 2013
- Page 5 - A Picture's Worth...A Year of Photos on the Sugar River
- Page 6 - All Aboard: Paddle & Pig-Out 2012
- Page 7 - Paddle & Pig-Out 2012, One "Sweet" Deal: Bruce Co. Sells Riverfront Property to Dane Co.
- Page 8 - New Board Member Spotlight: Welcome Wade & Steve!

As ichthyology and fisheries science matured in the twentieth century, the phrase “fish vocalizations” would continue to be used by some specialists as traditional terminology, though some may find this use problematic, as we shall see. With the introduction of sonar in the 1930’s, the varieties of sounds emanating from the depths became apparent, and the challenges of comprehending underwater acoustics became a military priority in World War II. Much of what was learned about marine bioacoustics was actually classified military information until the 1950’s; the United States Navy still maintains an extremely sophisticated network of underwater listening stations, and while these have at times contributed greatly to research tracking whales, often the most precise of these measurements cannot be published for security reasons. Still by the 1970’s, a small but dedicated community of scientists began to steadily advance knowledge of sound production and communication in fish, and this research continues today.



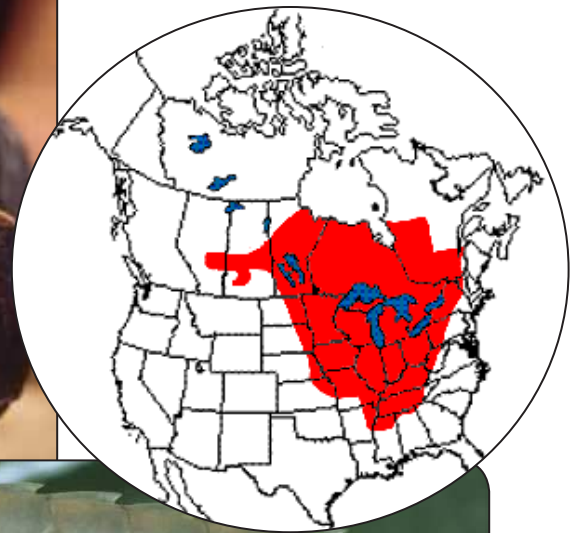
Left: Lake sturgeon spawning event on the Wolf River in Wisconsin.



Right: Chris Bocast (left) and DNR biologist Ron Bruch (right) pose with a lake sturgeon.

While the methods used to create sound by cetaceans are comparable to other mammals, sound generation in fishes is, well, a whole other kettle of fish. Though the classifications are far from settled, there are three basic types of sounds – stridulatory, swimbladder, and hydrodynamic sounds. Stridulatory sounds are created by friction in skeletal elements of the animals such as fins, teeth, vertebrae or other bony structures, and even plucking of stretched tendons. Fish obtain oxygen from water flowing through their gills; the only place they actually retain air is in their swim bladders, and so many fish create sounds through the expulsion of air through small ducts from the swim bladder or the intestine. As the name suggests, hydrodynamic sounds are generated by the movement of fins and body of the fish in the water. It is important to remember that sound travels about five times as fast through water as it does through air; given the often murky or completely dark context of many underwater environments, the importance of sound to numerous aquatic organisms cannot be over-stated. This is why many biologists and bio-acousticians are so interested in unraveling the complexities of sonic behaviors in fish. And despite the many technical and interpretive challenges of these studies, it is becoming clear that the level of cognition in fish is far more sophisticated than what has been previously thought.

Further complicating acoustic studies, and yet another insight gained from the study of cetaceans, was the realization the range of what is emitted and perceived by aquatic organisms vastly exceeds the limits of human hearing. Orcas and dolphins produce echo-location sounds at cycles far above what we can hear (ultrasonic), while many whales produce sounds at extremely low frequencies (infrasonic). These very deep sounds can carry for hundreds of miles, bouncing off the ocean floor, and are critical for whales finding each other in the vast sea. As the wavelengths of such infrasonic sounds are very long, several meters, it was not believed that fish in shallow waters would utilize sounds in this range. And this leads us back to the rivers of Wisconsin.



Top left: Juvenile lake sturgeon (photo by WDNR).
Top right: Lake sturgeon distribution in N. America.
Bottom right: Lake sturgeon have “scutes” instead of scales. These bony plates cover the fish’s body. Native Americans used to utilize the scutes of sturgeon for arrowheads and other piercing tools. As the fish ages, the rows of spine-tipped scutes smooth out and have a smooth appearance.

Every spring, lake sturgeon travel miles up Wisconsin rivers to spawn. They gather on the shallow banks at favorite spots, in sometimes frenzied groups, vigorously mating for a few short days. Biologists studying sturgeon have long known of a deep sound they could sometimes faintly hear at these times, a low, rapid drumming they termed “sturgeon thunder”. As an acoustic ecologist studying at the Nelson Institute, I was able to work with these biologists to obtain recordings of this sturgeon thunder. To our surprise, the fundamental frequencies of their drummings lie squarely in the infrasonic range; what can be heard on the riverbanks (and I have heard the thunder there as well as through my hydrophones) are the top harmonics of the drumming, breaking through the surface of the water. We believe now that this drumming, a classic swimbladder-type sound, functions as an advertisement and timing mechanism for gamete release and fertilization by the sturgeon. The infrasonic thunder likely operates as a shock wave to the sturgeon rather than a discrete sound; it is possible that their perception of these sonic events is a combination of sensation through the lateral line, which is essentially nervous skin sensors along the sides of the fish, and their ears, in a way that perhaps does not have any direct analog to human sensory experience. Other sounds made by the sturgeon were discovered as well, and the final write-up on the fieldwork is currently being finished.

One issue emerged though. As the study progressed I found myself unable to describe the sturgeon sounds as “fish vocalizations”. Thoughts of Mr. Limpit aside, fish do not have vocal cords, nor do they generally use their throat for sound production. To avoid this tradition yet not rigorous terminology, I chose to use the terms pisciphony, piscisonic, and the tremendously fun to say, if not to spell, ichthyophony, to describe sonic behavior in fish. I’ll let the reader decide and leave this thought. We know that the water temperature has to be just right for the sturgeon to initiate spawning activity; could it be that the river has to “sound right” to the sturgeon too? Rivers produce a background level of low frequency sound that sturgeon are apparently capable of perceiving. Was Aldo Leopold anticipating something sixty years ago we are only beginning to glimpse?

“That the good life on any river may likewise depend on their perception of its music, and the preservation of some music to perceive, is a form of doubt not yet entertained by science.”

The “Land Ethic” in Action: USRWA’s 2013 Annual Meeting & Open House Set for Feb. 24

Submitted by Megan Phillips, Executive Director

Every year the Upper Sugar River Watershed Association holds an open house event to showcase our work and programs of the previous year and generate excitement about the projects we will undertake in the year ahead. Last year we were fortunate to work with former USRWA Executive Director Marcia Hartwig to acquire the rights to host screening of the film “Green Fire: Aldo Leopold and a Land Ethic for Our Time.” The film spurred a lively community discussion about how we can define a land ethic for the Upper Sugar River Watershed.

This year, we are bringing the land ethic concept to life by hosting a community read of the book “Nature’s Second Chance,” written by renowned ecologist Steven Apfelbaum. The book has been described as the 21st century sequel to Leopold’s “A Sand County Almanac.” Apfelbaum’s story recounts how he and his partner nursed their eighty-acre farm, which had been degraded due to years of corn farming, into a diverse ecologically sound landscape. The moving story offers insight into the process of ecological restoration and how humans can implement Leopold’s land ethic in their own backyards.

The event will be held in the Delphi Room of the Andromeda Building at Epic Systems’ campus in Verona (exit 76 off of Highway 18/151) from 1:00-4:00pm on Sunday, February 24. We encourage participants to arrive early to register and renew their membership if it has lapsed, as well as socialize with other members and the USRWA Board of Directors. Light refreshments and coffee will be served.



Steve Apfelbaum

The first 40 individuals to RSVP to the event will receive a free copy of Apfelbaum’s book. Additional copies will be available for purchase at the event, and Apfelbaum will be available to sign copies after the program. To RSVP, you can send an e-mail to Megan at usrwa@usrwa.org indicating your name, phone number and address, or call 437-7707 and leave this information in a message. Someone from the Board will deliver a book to your house within several days.



Event Agenda at a Glance

- 12:30-1:00pm: Registration & refreshments
- 1:00-1:15pm: Presentation by USRWA Executive Director, Megan Phillips
- 1:15pm-1:25pm: Overview of joint membership campaign with the River Alliance of Wisconsin
- 1:25pm-1:40pm: Board of Directors introductions & election
- 1:40-1:55pm: Candle on the Water Award presentation

BREAK - Turn in ballots

- 2:00pm-3:30pm: Presentation by Steve Apfelbaum and community discussion of “Nature’s Second Chance”
- 3:30pm: Announce election results
- 3:35pm: Book signing and sales
- 3:50pm: Event feedback and close

“A Picture’s Worth...” A Year in Photos on the Sugar River



From top, left to right: Dave Marshall hands out “carp kisses” at the Belleville Lake Fest. A caddisfly found in Fryes Feeder emerges from its house. Steve Falter mans the pole saw on a river clean up day. Volunteers remove a giant piece of corrugated pipe from the Sugar River. Bill Keen retrieves an underwater datalogger on the Badger Mill Creek. A sample red swamp crayfish specimen from June’s invasive species training. Josh Sulman regards his curlyleaf pondweed specimen with disdain (found in Lake Belle View).

ALL ABOARD: PADDLE AND PIG OUT 2012



Annual Pig-Out volunteer Cal Hageman enjoys his pig roast lunch in the park.



The "Fashion a Fish" activity let kids design their own Sugar River specimens.



NessAlla Kombucha came by to offer a free kombucha tasting to participants!

The 2012 Paddle & Pig-Out in Paoli event was attended by 88 members of the community. We made a few changes this year, the first of which being that we hired Bob's BBQ Emporium to join us at Paoli Park and roast a pig! Members received a free pig roast lunch, and non-members could join in for \$10/meal. USRWA was ecstatic to introduce its new canoe fleet at the event, which was purchased from Sugar River Sports (Belleville) via a grant from the Dane County Environmental Council and a generous donation from Payne & Dolan. Volunteers Bill and Lisa Keen built a trailer to haul our new canoes and single kayak -- a million thanks to the duo for their hard work, and to the Bradt family for housing our boats over the winter. Due to this purchase, we will now be able to host more river clean-up days than ever in the summer of 2013! We are also planning semi-regular paddling outings during the week. Visit our website (usrwa.org) or Facebook page for up to date details about summer paddling and the status of the river trail. We also hosted our annual raffle at the event, and gave away a kayak and a rain garden design as the major prizes. Congratulations to Steve Gavin for winning both! (Someone must have bought quite a few raffle tickets, eh?!). The Paddle & Pig-Out is our favorite event of the year, and it wouldn't be possible without the gracious donations from local businesses (see the following page) and time spent by volunteers.

Thank you for your continued support, and we'll see you on the river in 2013!



USRWA's brand new canoe fleet in progress!



Wrapping up the paddle at the Mill Park.



Rodd Wangen gave casting demos for those interested in fly fishing.

ALL ABOARD: PADDLE AND PIG OUT 2012

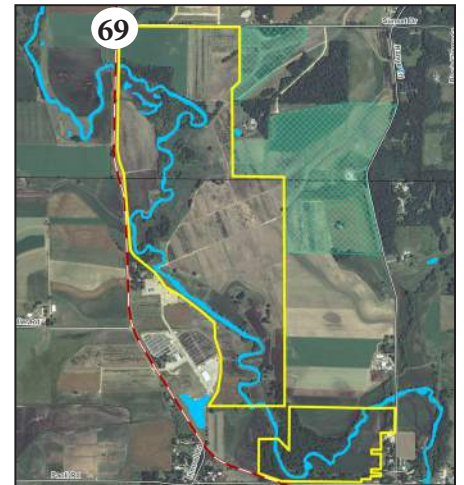
Thank you to these local businesses for making the Pig-Out possible!

Bodhi Yoga
Trillium Natural Foods
REI Madison Store
Willy St. Co-op
Cardno JFNew
Peg Ginsberg Gallery
Fisher King Winery
Michael's Frozen Custard
Just Nails
Miller & Sons Supermarket
Grumpy Troll Brew Pub
Friends of the UW Arboetum
Montgomery Associates: Resource Solutions
Firehouse Bar & Grill
New Paoli Cafe
Capitol Water Trails, Ltd.
Fontana Sports
Rutabaga Paddle Sports
Town of Montrose
Farm & Fleet
Culvers
Duluth Trading Co.
NessAlla Kombucha
Whole Foods



One "Sweet" Deal: Bruce Co. Sells Riverfront Property to Dane County

This week County Executive Joe Parisi announced that the County has reached an agreement with the Bruce Company to purchase over 400 acres of land adjacent to the Sugar River near Verona. This land includes 2.5 miles of riverfront property. The acquisition will improve recreational opportunities in the area, as well as provide easier river access for USRWA river clean-up days. "Whether it's paddling a canoe to Paoli, camping along the banks of the Sugar River or hiking with the family among tens of thousands of trees, this is truly a once in a generation opportunity to forever protect a true gem," Parisi said. "The options for outdoor recreation are endless and thanks to the stewardship of the Bruce Company, this will truly be a destination for families from Dane County and beyond." USRWA hopes to work with partners on projects to enhance this area and make the river easily accessible for all to enjoy. *Right: The land part of this purchase and permanent conservation easement stretches from the intersection of Highway 69 and Sunset Lane in the Town of Verona, south to Paoli and east to Range Trail.*



Board Member Spotlight: Welcome Steve and Wade!



Joined the Board in September, 2012

Occupation: GIS Consultant at the City of Verona Public Works Dept.,
President of the Yahra River Grocery Co-op

What's your favorite river memory?: "I remember going on the Crystal River Trip in Waupaca as a kid and being paired in a canoe with my brother Graham. The river was low that year and we crashed into numerous rocks along the way, lost our sandals in the river and argued most of the trip. It was my first real canoeing experience, and although it wasn't fun at the time, it's a pretty funny memory between my brother and I. To this day I think of that time whenever I get into a kayak or canoe."

How did you hear about us?: "After working on a mapping project for USRWA and attending the Paddle and Pig-Out, there was an opportunity to serve on the Board. I'm really impressed by the amount of work that the USRWA does on a limited budget and I'm happy to help out anyway I can."

What do you hope to accomplish during your service on the Board?: "I'd like to help increase awareness for the organization and enhance the benefits of becoming a member. Growing the organization is largely based on an active membership, so providing more avenues to get them involved is important. I would assume the majority of people that live in the watershed don't know about USRWA, so informing the public of the services we provide the community should be an ongoing goal."

Wade lives in Stoughton with his wife. He enjoys playing sports, cooking, traveling and being outside.



Joined the Board in December, 2012

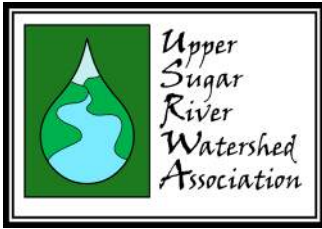
Occupation: Nuclear Medicine Technologist at St. Mary's Hospital

What's your favorite river memory?: "If pressed to pick the most memorable experience it would be a February paddle, which started in Paoli. At one point we came around a bend to see a great blue heron perched on the bank in the snow about 15 feet in front of the bow of our canoe. Later on that paddle going through a wooded area the sunlight and snow with the trees and the river made a breathtaking scene."

How did you hear about us?: "Quite a few years ago a friend got me out on a river clearing day with Capital Water Trails. However I had not given it much attention until attending the Annual Meeting last year. This led me into helping with river clearing and the Paddle and Pig-Out. Involvement in these activities led to an invitation to join the Board. Feeling growing appreciation of the watershed and that my background and experience could be beneficial, I decided to offer my services to the Board."

What do you hope to accomplish during your service on the Board?: "I hope for and want to help achieve a greater appreciation for watersheds in general and especially the Upper Sugar River Watershed. I would like to encourage greater understanding of the watershed geography, and the importance of maintaining a healthy watershed. I know that growth and development will continue in this area and want to see it come with a respect for the land and the water."

*Steve has lived in the City of Verona for 21 years with his family.
In his spare time he enjoys bicycling, hiking, paddling and photography.*



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SAVE THE DATE: USRWA's sister organization, the Lower Sugar River Watershed Association, will hold its first annual meeting & open house on Sunday, March 17. Location and details TBA.

USRWA memberships expire after one calendar year. To renew, please fill out the insert and place in the enclosed pre-addressed envelope. If you are unsure when your membership expires please call Megan at 437-7707 and she would happy to look it up for you. Thank you!