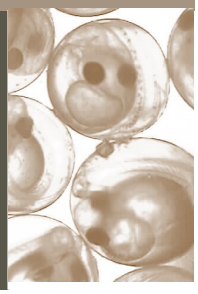
Volume 33, Issue: 3 December 20, 2015

in this issue >>>

Iowa Chapter of the American Fisheries Society

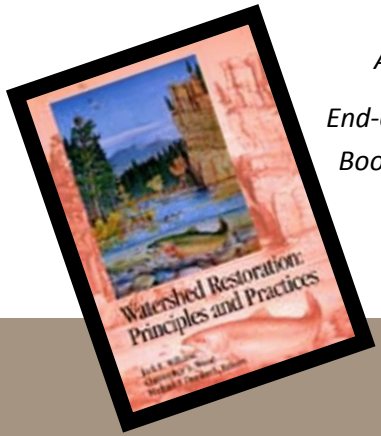
Lateral Lines



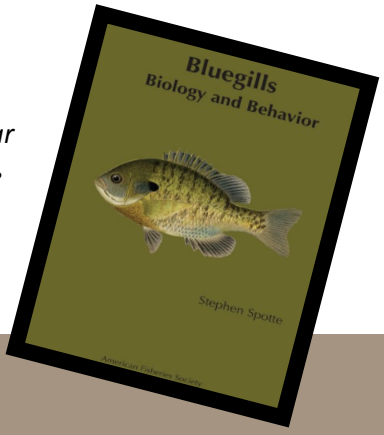
current topics >>>

Crystal Darter, Mississippi River

Page 6-9



AFS End-of-Year Book Sale



IN THE NEWS:

18 Foray into the Wilds of Iowa finds Northern Pearl Dace and Least Darter but not Northern Sunfish

24 Why Didn't the Fish Cross Under the Road?

26 Mountain Growth Helped Spawn Fish Diversity in New Zealand

Visit Iowa AFS on the web:

http://www.fisheriessociety.org/iowa/index.html

OFFICERS

PRESIDENT
Lewis Bruce
Cold Springs Station
57744 Lewis Rd
Lewis, IA 51544
(712)769-2587
Lewis.Bruce@dnr.iowa.gov

PRESIDENT-ELECT
Jeff Kopaska
Boone Research
1436 225th St
Boone, IA 50036
(515)432-2823
Jeff.Kopaska@dnr.iowa.gov

SECRETARY/TREASURER
Ryan Hupfeld
Rathbun Hatchery
15053 Hatchery Place
Moravia, IA 52531
(641)647-2406
Ryan.Hupfeld@dnr.iowa.gov

MEMBERSHIP CHAIR
D. Allen Pattillo
Fisheries Extension
339 Science II
Iowa State University
Ames, IA 50011
(515)294-8616
pattillo@iastate.edu

Our Mission:

To improve the conservation and sustainability of fishery resources and aquatic ecosystems by advancing fisheries and aquatic science and promoting the development of fisheries professionals.

COMMITTEE CHAIRS

Audit
Ben Dodd
Ben.Dodd@dnr.iowa.gov

Membership
D. Allen Pattillo
pattillo@iastate.edu

Resolutions
vacant

Continuing Education
Clay Pierce
cpierce@iastate.edu

Student Affairs
Mike Weber
mjw@iastate.edu

Nominations
Gary Siegwarth
Gary.Siegwarth@dnr.iowa.gov

Best Paper
Chad Dolan
Chad.Dolan@dnr.iowa.gov

Newsletter Editor
Kim Hawkins
Kim.Hawkins@dnr.iowa.gov

President's Corner

Lewis Bruce

As I type this, Cold Springs Lake is freezing over and the area of open water occupied by geese is slowly shrinking. Soon we will be conversing with friends about our recent fall activities as we stare down at an icy hole waiting for the spring bobber to bounce. Does this sound familiar to some of you? Most every year I find myself going through the same familiar routines. I find it is easy to get caught up in these patterns and not step back to see if a new technique or method exists to improve success or just try something different. These "patterns" or "ruts", as they are often called can be found in our jobs as well. Often times someone new or just the right piece of news is required to raise an eyebrow and start asking questions.

During our last Iowa AFS chapter business meeting we voted to update our bylaws and clear up a grey area between the language in our grant application and the bylaws document. After reading the bylaws additional changes were suggested so the entire document was edited and is now awaiting NCD approval. These updates will improve operations within our chapter. For example, requiring committees to provide the membership with an annual update 30 days prior to the business meeting and placing a term limit on technical committee representatives. Providing the annual update prior to the meeting will shorten the business meeting or allow more discussion for new business. Term limits on technical committee representatives will provide chapter members with more leadership opportunities. Jeff Kopaska, Randy Schultz, and Ben Wallace stepped up to take lead roles with this effort and were instrumental in completing this task.

Something else I hear year after year is, "what are we going to do about the downward trend of AFS memberships?" I thought if I went back far enough in the archives I would find something in our newsletter about increasing memberships. The oldest newsletter I could find was published in July, 1987 with an article discussing a lack of growth in membership and providing fisheries professionals with a brochure to help stimulate membership recruitment. It seems membership numbers will always be an issue requiring attention and new ideas. The NCD is making changes to improve its website and other programs in an attempt to curtail the current trend in membership numbers. In addition to the NCD changes our chapter also has a new website, http://iowa.fisheries.org/, and I encourage you to check it out. Ryan Hupfeld graciously volunteered to take on the new duties of updating our webpages.

Lastly before I close I want to thank Ryan Hupfeld, Jeff Kopaska, and D. Allen Pattillo for all of the work they have put into planning the 2016 Iowa Chapter AFS meeting. Jeff has introduced some new ideas about presentation topics and I hope this generates more enthusiasm about being part of the Iowa Chapter of AFS. I am looking forward to seeing everyone in March at our chapter meeting.

Happy Holidays,

Lewis J Bruce

2016 Iowa Chapter AFS Annual Meeting

March 1-2, 2016
Honey Creek Lodge
Moravia, IA

Natural resource professionals and students in Iowa will meet to share new research, management experiences, and valuable insight on fisheries issues. Come connect with other experts, meet students, and expand your knowledge of fisheries management and research.

Tentative Schedule:

Tuesday, March 1

12-1 PM	**Registration**
1-4 PM	**Presentations**
4 PM	**Business Meeting**
5:30 PM	**Social**
6:30 PM	**Dinner**
7:30 PM	**Auction and Raffle**

Wednesday, March 2

8 AM-noon	**Presentations**

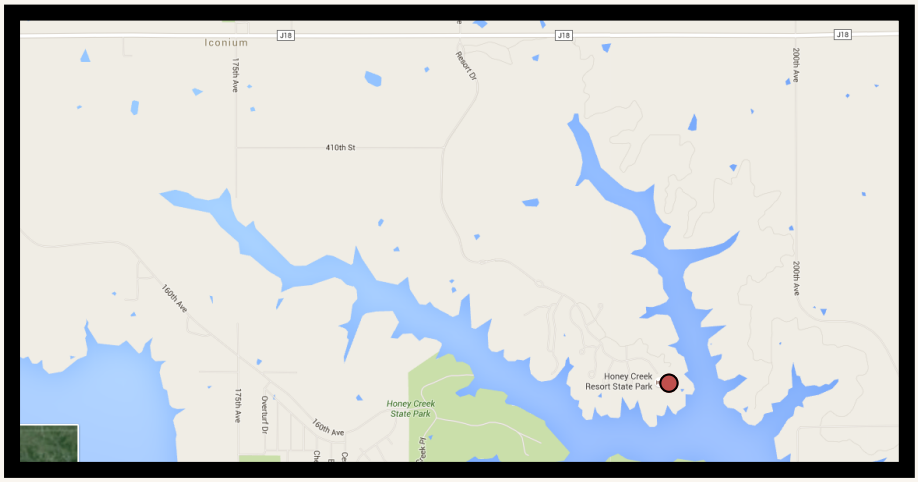
Lodging

Honey Creek Resort

12633 Resort Drive

Moravia, IA

641.724.9100



2016 Iowa Chapter AFS Annual Meeting

March 1-2, 2016

Moravia, Iowa

CALL FOR PAPERS

Please submit abstract along with following information:

- professional or student presentation
- oral or poster presentation

** abstract is limited to 350 words

Abstract Deadline: January 15, 2016 @ 5 PM.

Submit to: Jeff.Kopaska@dnr.iowa.gov

Let the Invasion Begin

Melvin C. Bowler, Long Term Resource Monitoring Program ~ Iowa DNR

Newsflash: A recent "rash" of Crystal Darter, *Crystallaria asprella* sightings has been observed in the upper portions of Pool 13 in the Upper Mississippi River near Bellevue, Iowa. I guarantee this is going to be better news than that ever evolving and seemingly endless list of invasive species that have crept into our everyday lives and routines - like how those pesky Snakeheads do, when you were washing your car or doing something else to that effect. O.K., maybe it's not so much a rash of sightings, but six separate collections by Iowa DNR fisheries personnel within a year's time is fairly significant – especially if you consider it over a twenty-five year chunk of time.

Prior to the fall of 2014, the last Crystal Darter collection in Pool 13 occurred in 2005. Before that, zippo. Nada. Nothing. No collections at all made of this elusive little *Percid* from a Mississippi River pool that has been sampled extensively with multiple gear types over the last twenty five years here. Now all of a sudden they're showing-up. What gives? There's only a handful of historic documentation of the fish in Iowa and these sparse records include a specimen taken near Motor Mill in the Turkey River (Clayton County) in 2002, two accounts in Pool 11 of the Mississippi River (Clayton County) in 1995 and 2001, plus one recent Pool 13 (Jackson County) record in 2014.

In the fall of 2014, a single specimen showed up in our annual night electrofishing surveys of sauger and walleye in the Bellevue tailwaters (U.S. Lock and Dam 12). I was pretty stoked when a co-worker popped his nose into the dip net, reached in, grabbed the fish, and unclenched his hand to me to reveal this little treasure. We got a couple quick pics and tossed it back along the sandy channel border. Very nice, but we saw no others the rest of the fall. This year around the last week of July our crew hit the river with the otter trawl to do our standard fixed site trawling in the main channel below Lock and Dam 12 at Bellevue. We typically wait until latter July to run this gear, as the trawl is good at picking-up early hatches of young of the year channel and flathead catfish and Shovelnose Sturgeon, *Scaphirhynchus platorynchus*. Over the years, we've occasionally collected other not so everyday species such as Stonecat, *Noturus flavus* and Shoal Chub, *Macrhybopsis hyostoma*, and the even the lesser common collections of Freckled Madtom, *Noturus nocturnus* or Lake Sturgeon, *Acipenser fulvescens* are possible gems in the tailwater trawls. It's not difficult to figure out where this is leading, and on our third trawl I got a smirky look from one of the fellas working-up the catch. I had an immediate feeling what was in his hand and sure enough - Crystal Darter (Figure 1).

Figure 1. *Crystal Darter , Mississippi*

That was the first one the Long Term Resource Monitoring Program (LTRMP) at Bellevue had collected in their standard fisheries monitoring since its inception in 1989, and after a couple of weeks passing and another round of tailwater trawling, we had our second specimen. The depths of which the trawl will cover over a 350m standardize run is anywhere from 4 to 8m (12 to 24 ft.) and it normally takes 7-9 minutes to make a com-

plete run barring we don't hit a major snag. The exact points and depths that we collected these two fish are unknown, but in general, the bottom substrate is very sandy and uneven (much like snow ski moguls) and surface water velocity is greater than 0.45m/sec.

Between those weeks of trawl efforts, our fisheries research crew in Bellevue was conducting their annual electrofishing surveys for walleye in Pool 13. Not too far down river of the tailwaters, maybe a mile at most, the crew was shocking one of a series of closing dams (rock structures designed to deflect water back into the main channel) in a moderate sized side channel near the Duck Creek tributary. Whalah - Crystal Darter! When they returned to the same closing dam to shock a few days later, they netted yet another (Figure 2). We coincidently had an electrofishing run later this fall along the same side channel and closing dam that yielded another Crystal Darter specimen, with a couple of other scoundrels that avoided our dip netters in that run. That made five Pool 13 Crystal Darter collections in a relatively brief period, and that'd be six if you count the specimen from the previous fall.

Figure 2. Crystal Darter , Mississippi River

So what's going on here? We were recently asked to whether the recent and seemingly abundant catches of Crystal Darters here were a sign of improving river health or were these merely lucky catches. That was an excellent question, and after some thought here's my take: Comparatively, the presence of Crystal Darters where they are fairly abundant will be indicative of superior water quality and most likely a healthy aquatic system. However these fish are not abundant in the Mississippi River and these catches appear to be particularly localized. There are microhabitats that exist within the Mississippi River that may be conducive for this fish to survive and perhaps good enough for some limited reproduction. However, a general and blanket statement equating the catches of a few of these fish should be taken as a sign of good river health, probably isn't the correct thing to say. Crystal Darters inhabit moderately fast moving water like we find along the main channel of the Mississippi River. However life history studies indicate that these fish are extremely intolerant of silty substrates. It is generally agreed upon by river biologists and ecologist that the biggest detriment to the Mississippi River is siltation and sedimentation from our tributary rivers and streams. Aquatic habitat degradation due to this sedimentation is very evident, as the vast majority of the main channel border habitats have large expanses of silty substrates. This would explain in part why they aren't very abundant in the Mississippi River and that's why we really shouldn't directly equate these recent catches to improving river health.

Now I must admit, just because we haven't seen Crystal Darters much in a couple of decades in our sampling, that doesn't mean that these fish haven't been here in the river. It is well known that Crystal Darters have affinities for moderate to high water velocities and they often bury themselves in deeper sugary, sandy bottoms. Their cryptic coloration also allows them

to nearly render themselves invisible from above in gravelly or pebbly substrates. Given all the piscivory going on in-and-along the main channel of the Mississippi River, laying low and occupying river niches that are a little less prevalent with predators is a survival necessity when you're potentially lunch. However those deep, swift water niches of the Crystal Darter are not ideal for much of the sampling gear that we utilize in the LTRMP sampling regimes. An example of this is the absence of Paddlefish, *Polyodon spathula* from our LTRMP collections in Pool 13. Now if we drifted trammel nets in the main channel or used snagging as a sampling method in our fisheries program, we'd collect Paddlefish. That's as simple as that. So perhaps until we'd incorporate some other bottom sampling gear or deplore our trawl out of the main channel, we may not have a good handle on the abundances of Crystal Darters in this neck of the river.

So, lucky catch? Maybe. Well then, if Crystal Darters haven't been well established in this river pool historically, then why the sudden uptick in occurrence? Perhaps better asked, where have they come from? Let's see. Louis Pasteur dispelled the doctrine of spontaneous generation long ago, so that's not it. How about this: Let me start by citing another example of a fish species we collected last year in Pool 13 that hasn't been documented in the Iowa portion of the Mississippi River (let alone anywhere in the state) for 50-plus years.

Well into our five month sampling season in early August of 2014 in the lower half of Pool 13 below the confluence of the Elk River (Clinton County, Iowa), we came across a small *Cyprinid* that looked a little different. We collected three specimens of Weed Shiner, *Notropis texanus* (endangered status in Iowa) in that electrofishing run, but this other fish was unfamiliar to me.

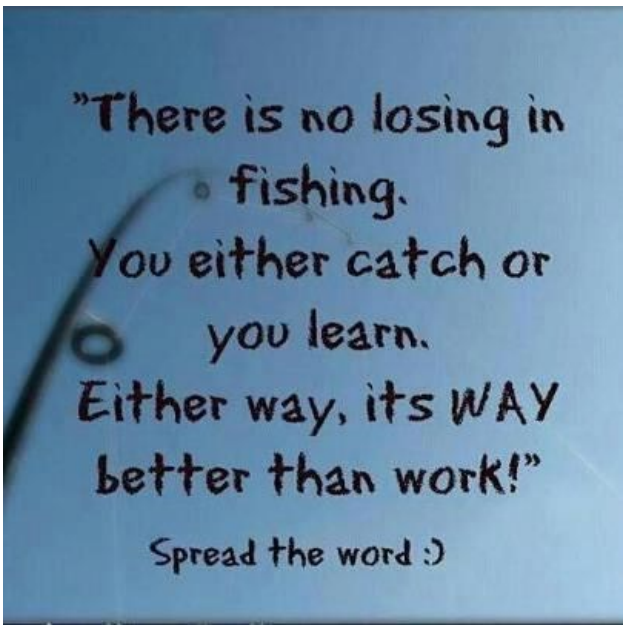
Upon returning to the office that afternoon with the specimen, I pulled out William Pflieger's *Fishes of Missouri* and began to key-out the mystery fish. The fish keys to Pallid Shiner, *Hybopsis amnis* (Figure 3). Hmmm. Very odd. I've gone wrong somewhere. I started over, but the more of the same at the end – Pallid Shiner. What the…! This species is generally thought to be extirpated here in Iowa. So as I usually do when unsure, I elicit the help of old friend Bob Hrabik (Missouri Department of Conservation). I snapped a few pics under the digital scope and sent them off to Bob and John Lyons (Wisconsin Department of Natural Resources). John's the first to reply and shortly after, Bob. Two thumbs up from Bob and John, but they want additional pictures and Bob has tagged-in Konrad Schmidt from Minnesota and John Olson from our Des Moines office. Not too much hubbub ensues, and the consensus is Pallid Shiner.

Figure 3. *Pallid Shiner , Mississippi*

Cool beans! A week or so goes by and we stumble into another single collection. A few more days pass and now we are catching multiples in the tailwaters of Pool 13. What the? John Lyons conveys back in an e-mail stating he's collected 29 specimens up to the north in Pool 11 of the river. By seasons end, we had collected 119 Pallid Shiners at 25 different sites in Pool 13. Konrad later sends me an e-mail saying in mid-October, four confirmed Pallid Shiners were seined from upper Pool 9 of the river in Minnesota and that those collections are the first in Pool 9 since 1969. If the recent Crystal Darter occurrences in the Mississippi River can be characterized as a rash, then precipitous appearance of Pallid Shiners last year should be similarly regarded as an epidemic - and at last count we've logged twenty-five individuals from our annual routine monitoring for the 2015 season.

But again, here's the question – why are we abruptly seeing a very uncommon species show-up in the river and where did they come from? The strongest historic Upper Midwest distributions of these two species in the Upper Mississippi River (UMR) watershed appear to have occurred mainly in Minnesota and Wisconsin. *Iowa Fish and Fishing* and *Fishes of Wisconsin* suggest the furthest southern ranges of the two species in the UMR watershed would be very close Pool 13. Generally, smaller statured fish species inherently lack the capacity to make longer migrations in high order, lentic environments due to energy constraints. I mean we're not talking Blue Catfish, *Ictalurus furcatus* or Chinook Salmon, *Oncorhynchus tshawytscha* here. These are diminutive, little fish. Not to mention it certainly is a predator heavy, fish eat fish world in the Mississippi River. So it surely doesn't seem that probable that these two fish species immigrated upstream from some secret tributary or that they are expanding their ranges in response to climate change. So what then? Here's my take: The appearances of the Crystal Darter and Pallid Shiner in moderate numbers here in Pool 13 of the UMR may be explained by downstream dispersions due to extreme and prolonged high water levels in the 2014 spring and summer of the northern UMR watersheds – possibly from the lower St. Croix, Root, and Zumbro Rivers of Minnesota; and possibly from the lower Black, Chippewa, Red Cedar, Trempealeau, and Wisconsin Rivers of Wisconsin. Quite simply, these two species may have just been flushed out of those aforementioned tributaries from Minnesota and Wisconsin and then went with the flow (so to speak) downstream. As many of us here in the Upper Midwest and UMR basin can attest to, we've had some extraordinary rainfall events in June and July of 2014.

Yes it's difficult to predict how the fish biota responds to Mother Nature's rather unexpected weather tantrums and uproars. I think that sometimes fish genuinely just get displaced by such environmental anomalies, and in response, they may literally ride the waves to St. Elsewhere. After all, this logic reasonably explains the presence and spread of several Asian Carp species into the UMR watershed. What should be more telling with the recent Crystal Darter and Pallid Shiner occurrences is to see if we continue to document them in the years to come, now that they seem to be here. Both Crystal Darter and Pallid Shiner are certainly welcome members to the existing diverse mix of our finned friends that we presently have here in Pool 13, and I undoubtedly look forward to encountering a few more of them the rest of the fall sampling season and in the years to come..



BIG SPRING APPRECIATION DAY CONNECTS FARMERS TO THE PATH OF WATER THAT DRAINS FROM THEIR LAND

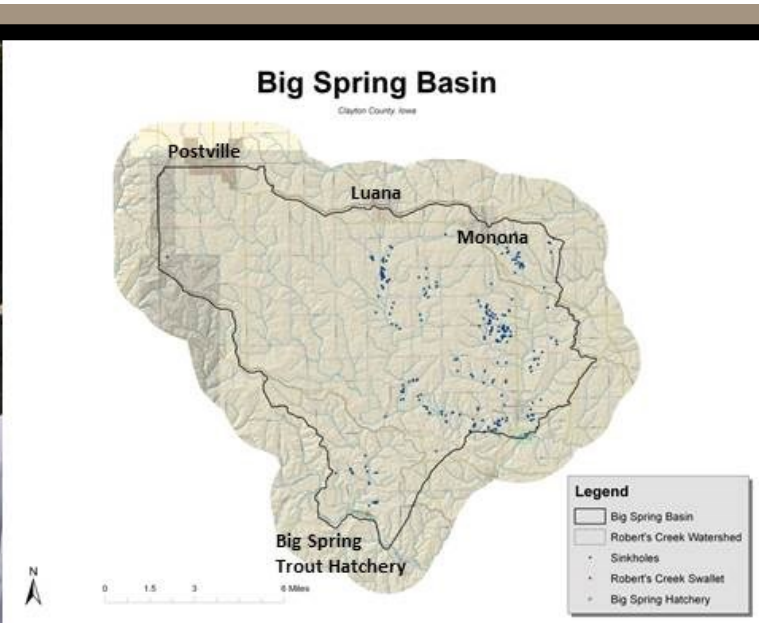
Gary Siegwarth, Hatchery Biologist ~ Iowa DNR

Area farmers in the Big Spring Watershed were recently invited to follow the path of the water that drains from land they farm to where it comes out at Big Spring Trout Hatchery. The first time event was a way of acknowledging producers for conservation practices added to land they farm within the Big Spring Watershed, which has a direct benefit to the water quality of the spring. The evening included a geological history of the spring, a tour of the trout hatchery, demonstration of a rainfall simulator, fishing with their kids and grandchildren at the kids trout pond, horse pulled wagon rides, and an evening meal. The appreciation day was sponsored by Clayton County Pheasants Forever, the Clayton County Conservation Awareness Network, the Clayton County Soil & Water Conservation District, and the Iowa DNR.

As part of the Big Spring appreciation day, local farmers were treated to a variety of activities at Big Spring Trout Hatchery. The event was a chance for producers to follow the path of water that drains from their farms to where it comes out at Iowa's largest coldwater spring.

Sinkhole on Roberts Creek. *This sinkhole on Roberts Creek shows the direct surface water connections that influence water quality at Big Spring.*

A number of farmers in attendance had never been to Big Spring even though they've farmed in the watershed their entire life. The Big Spring Basin drains more than 66,000 acres, which was mapped out in the late 1970's and 80's as part of a comprehensive project using dye tracing of sinkholes and losing streams to determine where the water came from. During that time, a lot of effort went into working with producers in the watershed to reduce the silt load and excess nutrients of the spring. Since that time, however, many of those farms have changed hands and a significant amount of land has been converted from woodlands and pasture to row crops. This has created a renewed need to promote additional conservation practices such as no-till, cover crops, stream buffer strips, field prairie strips, terraces, and contour strip cropping to offset the more intense row crop production within the watershed.

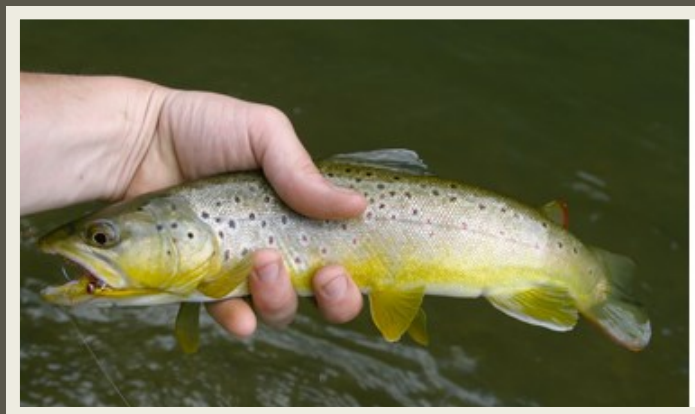


A tree branch was used as an analogy showing the direct connection between all land in a watershed and the stream or river where the water and nutrients eventually drains to. This was used to illustrate how farming practices within the Big Spring Basin directly affect water quality of the spring. Big Spring is the largest spring in Iowa, draining more than 66,000 acres. The water makes its way underground through numerous sinkholes and losing streams. Conservation practices implemented by farmers and landowners improves water quality and soil health, reduces flooding, and provides vital habitat for numerous wildlife species.

In 2013, the Clayton Soil & Water Conservation District secured an Iowa Water Quality Initiative Demonstration Project grant. The grant provides additional incentives to further promote cover crops, no-till and other sustainable conservation systems within the watershed. These practices keep soil and nutrients in place on farm fields, helping prevent them from becoming a source of pollution to water resources like Big Spring, Roberts Creek, and the Turkey River. Over 1,700 acres of cover crops were used in 2014. The appreciation day was an opportunity for many producers to see the direct connection their conservation efforts have on improving water quality and outdoor recreational opportunities at Big Spring.

As part of the rainfall simulator demonstration at the Big Spring Watershed landowner appreciation day, Jered Finley of the Natural Resource Conservation Service shows the difference in the amount of water that soaks into the ground on no-till vs. conventional tilled corn fields following a 2-inch rain. On the left photo, nearly all the simulated rain soaked into the soil plug taken from a field that had been no-tilled for three years (corn on corn) with cover crops planted for two years. On the tilled soil (right photo), nearly all the rain flowed off as runoff, carrying with it valuable topsoil and nutrients that makes its way to the nearest stream or river.

Big Spring Hatchery is one of three Department of Natural Resources operated trout hatcheries in Iowa. The unique topography, coldwater springs, and trout streams found only in the northeast corner of Iowa were formed by a combination of glaciers missing this part of the state and nearly 500,000 years of stream/river down cutting. Over that amount of time, the forces of erosion and stream down cutting have removed overlying glacial deposits and carved deep valleys below the limestone bedrock, which allows groundwater to flow out as springs. Big Spring was first developed as a private fishing club/hatchery in the late 1930's by Otto and Mary Bankes before they sold it to the state in 1961. Mary recently celebrated her 100th birthday and still resides in Elkader. In the early days, their attempt to reduce the heavy silt loads that plagued the spring was to locate and plug sinkholes they suspected drained to the spring. Today, more than 250,000 rainbow and brook trout are reared to catchable size at Big Spring and stocked in streams throughout Northeast Iowa.



GETTING DATA FROM THE FIELD TO YOUR DESKTOP FASTER

Andy Fowler, Management Biologist ~ Iowa DNR

In today's world, we have the ability to collect an astounding amount of data to answer some really important questions. However, manually entering that data from field sheets and generating barebones descriptive statistics, as well as inferential statistics, requires a substantial amount of valuable time. Fortunately, in the fisheries profession we routinely capture the same predetermined data points repeatedly, but at varied spatial or temporal scales. This is why electronic data collection and automated data analysis can make such a vast difference in the time allocated for our various projects. In this article, I will describe the Fisheries Bureau's latest investment into android tablet field data collection for creel surveys and wifi remote server data syncing using Amazon Web Services. While this article will not discuss the server setup for this software, we would highly recommend the excellent customer service, low fees, and ease of use that Amazon Web Services provided for this project.

Comparison of three software application products

The first response to a technological advancement such as this usually starts off something like, "Well, that sounds great, but we can't afford it." It is true that this project will require an investment. However, the initial cost for each Google Nexus 7 android tablet used was only $159. Other android tablets do exist, but we chose the Google Nexus 7 because of the very positive internal bureau reviews we received from another project involving these tablets. There are many varied software packages which collect data on android tablets and we compare three in this article: Pendragon Forms Universal, Fulcrum, and Droid DB). They all have varying prices from monthly subscriptions to one time fees (Table 1).

Table 1. Cost comparison of three chosen software packages for field data collection by android tablets.

Type of Cost	Pendragon Forms Universal	Fulcrum	Droid DB
Google Nexus 7 Tablet	$129	$129	$129
Additional car and wall charger	$5	$5	$5
Case for tablet	$25	$25	$25
Total for android tablet	**$159**	**$159**	**$159**
One time purchase of form building software	$299	Included	$125
One time purchase of 3 licenses	$207	Included	$20
One time purchase of server software	Included	Included	$400
Monthly fee	$0	$88	$0
Amazon Web Services Server Rental Monthly Fee	$7.72	Included	$7.72
Projected 3 year total cost Software and Server	**$783.92**	**$3,168.00**	**$822.92**

We completed a trial period for each software type. The software of all three companies has many limitations in customizing the forms exactly to our specifications. As this type of software develops in the following years, this customizing ability should most likely improve considerably. Currently, it is adequate to meet our needs. The customer service via phone was excellent for all three prior to purchasing the application. They answered questions quickly and efficiently. The trial period was brief, but Fulcrum tended to have a simpler user interface that was entirely internet based. Also, its online help center forum with a searchable archived history of past questions and answers was extremely helpful. Consequently, Fulcrum ranked highest on usability and customer service, however, their high cost (monthly payments ranged from 4 users @ $88, 20 users @ $440, and 50 users @ $1100) was the main deciding factor against using their application. It also appeared more difficult to get relational tables exported out of Fulcrum, however, that option wasn't explored in depth. Droid DB had similar customer service strengths prior to purchase, however, relational tables and the data itself seemed slightly more difficult to manage.

We decided to purchase Pendragon Forms due to its one-time fee structure which resulted in significant long term savings and a framework built on the Microsoft Access relational database platform. Pendragon's customer service was adequate up until the point of purchase, but then decreased after the purchase was made. Phone calls were answered roughly 95% of the time, but answers were delayed until the 2nd or 3rd phone call attempts. Answers to emails were also sporadic and delayed. They do have a forum of questions available to users, but it does not appear to be used very often. We felt that the many questions that were answered over email would help so many others if they were automatically added to the forum.

Using Pendragon Forms Universal

Regardless of their customer service, their product is well made and fairly easy to use. Pendragon Forms does have a slight learning curve with a proprietary programming code that can be used to make forms more user friendly. However, the Pendragon user manual does a good job of explaining most of this code. Relational table structure (i.e. one creel day with multiple interviewed anglers) is adequate to meet our needs and very similar to the other software available, however this feature is the major limitation of all the software explored. The main form building page is fairly self-intuitive with a little help from the manual (Figure 1) and the main form editing page follows along with the same level of intuition (Figure 2).

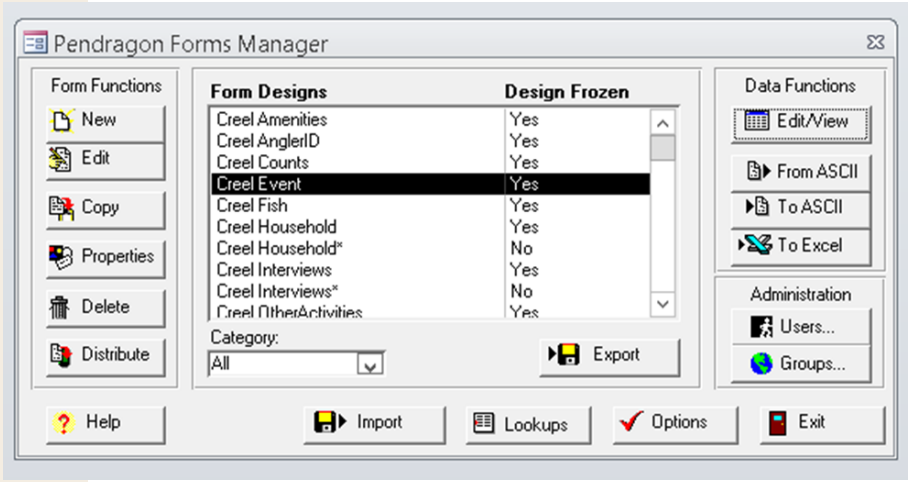


Figure 1. Pendragon Forms main form builder front page

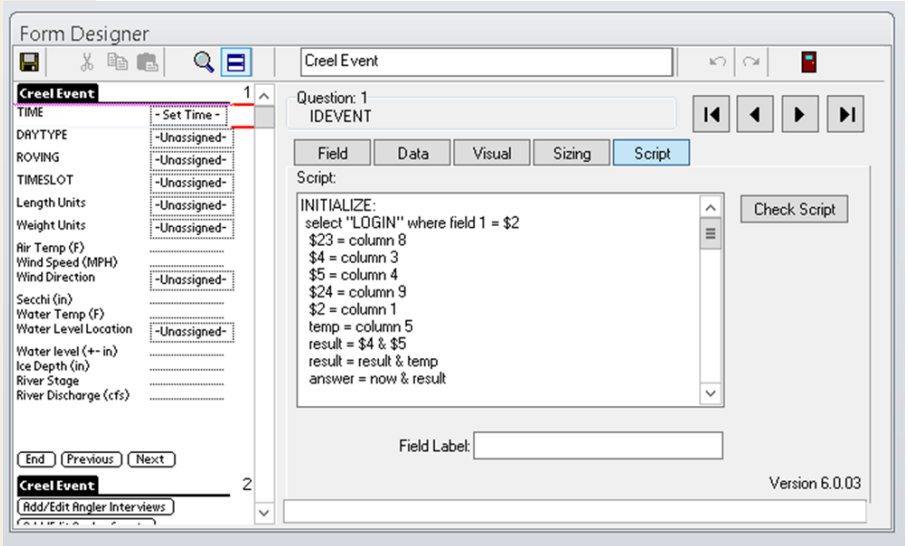


Figure 2. Pendragon Forms main form editor page.

The android tablet interface for our creel survey is also fairly intuitive. It consists of a login screen where users can select from drop down boxes to select their region, name, waterbody, etc., as well as choosing which module to run (Figure 3). Various modules are under construction, however the creel survey application is the only one that is completed. Types of data that can be incorporated in the interface include: text, integers, drop down boxes, date, time, gps coordinates taken with the onboard gps, images taken with the onboard camera, and barcodes read by the onboard camera. The current structure of the creel survey module allows pre-defined

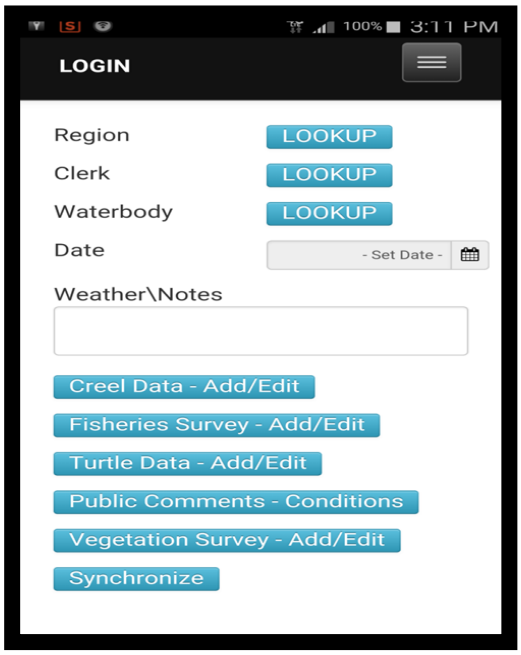
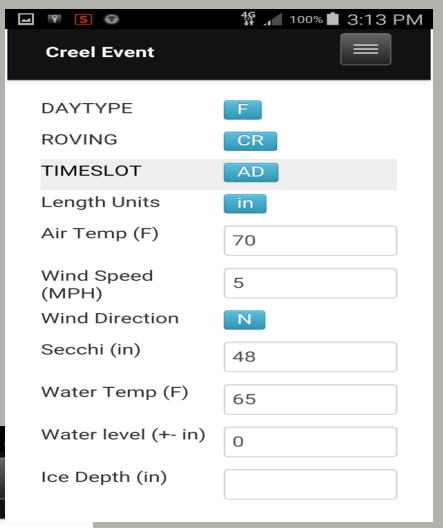


Figure 3. Login screen on the android tablet for the creel survey

users to log in with their region (fisheries station name) before they enter the event page (Figure 4) (this page defines the information about the day, i.e. weekend or weekday, continuous roving or scheduled roving, AM or PM, etc). The region filters what fields are visible and required for the user all of the varied forms of the module. Many fields are specific to a certain region, thereby customizing the form to the specific creel. Currently, this creel module is built to accommodate 5 different region's creel surveys within our bureau: Chariton, Cold Springs, Manchester, Clear Lake, and Spirit Lake. If other regions would want to be included, a simple selection of desired fields is all that is needed to implement a minor change in the programming code to customize the new region's creel survey form. From the event page, a user can then select two forms: 1) angler counts where the user can enter counts of angler types and boats (Figure 5) or 2) creel interviews where the user can answer specific fields from the personal interview with an angler such as number and type of fish caught, zipcode, etc (Figure 6).

Figure 4. Event form screen on the android tablet for the creel survey



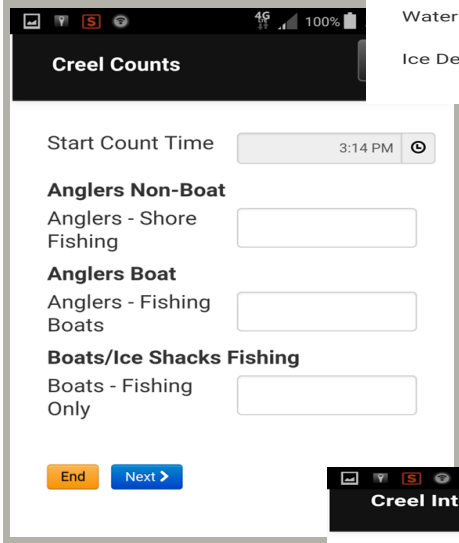
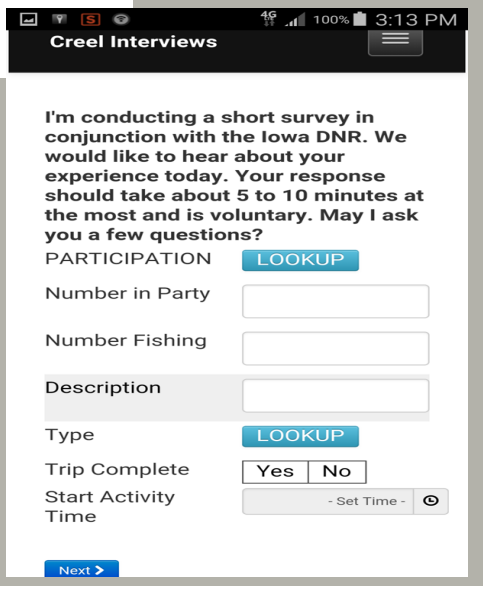


Figure 5. Angler count form screen on the android tablet for the creel survey

Figure 6. Angler interview form screen on the android tablet for the creel survey



At the end of the creel survey day, any local wifi connection can be used to sync the data to the server. The entire synced database is then automatically replicated once per day to another copy that is available for download via a simple url link at any time. All of the calculations, creel data expansions, and descriptive statistics of the data can then be completed using predefined queries that are also contained in the available database. Not only does this increase the efficiency of data management and the querying of data, but it also standardizes creel questions across the state into one database. This makes it possible to more effectively address the many tough issues we face as an agency in keeping and attracting anglers to, and within, the state. An investment of time and money into this project will reap substantial dividends by simplifying the process of managing, standardizing, and analyzing the creel data. We would strongly urge others outside of this bureau to attempt a similar project.

AFS END-OF-YEAR BOOK SALE

I AFS is offering over 100 publications at reduced prices. From now until January 11, 2016, take advantage of our End-of-Year Book Sale and save on selected titles. Complete your science library at dramatically reduced prices - all sale publications are priced from $5.00 to $20.00. See http://fisheries.org/shop for a list of titles.

Fisheries Abstracts

Effectiveness of pulsed direct current at reducing walleye escapement from a simulated reservoir

Michael J. Weber[a], Megan D. Thul[b], Mark Flammang[c]

- [a] Department of Natural Resource Ecology and Management, Iowa State University, 339 Science Hall II, Ames, IA
- owa Department of Natural Resources, 22693 205th Ave., Manchester, IA 52057, USA
- [c] Iowa Department of Natural Resources, 15053 Hatchery Place, Moravia, IA 52571, USA
- Iowa Department of Natural Resources, 22693 205th Ave., Manchester, IA 52057, USA
- [c] Iowa Department of Natural Resources, 15053 Hatchery Place, Moravia, IA 52571, USA

Received 1 July 2015, Revised 21 August 2015, Accepted 26 November 2015, Available online 14 December 2015

Fish escapement from reservoirs is problematic and makes management of these fisheries challenging. Historically, physical barriers have been used to limit fish movement but are prone to clogging and require constant maintenance. Thus, evaluations of alternative technologies are needed to limit reservoir fish escapement. Electrical barriers may offer an effective option for reducing fish escapement, but their effectiveness may be species-specific. Here, we predicted pulsed direct current with a graduated field would (1) alter walleye *Sander vitreus* behavior, (2) reduce escapement and (3) not induce mortality. Laboratory experiments compared walleye behavior, escapement, and mortality at four pulse (0, 0.3, 0.5, and 0.8 ms) and three voltage (0, 60, and 80 V) settings. The average voltage gradient 80 cm in front of the outlet was 0.09 V/cm (power density = 1.36 μW/cm^3) at 60 V and 0.14 V/cm (power density = 3.36 μW/cm^3) at 80 V. Our results demonstrate that pulsed direct current was successful at reducing approaches and increasing deflections of walleyes, suggesting fish avoided the barrier. Altered behavior resulted in nearly an 80% reduction in escapement with smaller fish more likely to escape compared to larger individuals. However, pulse width and voltage did not influence escapement rates. Walleye mortality was 0% for control trials, ranged from 0.5–5.7% with the current activated, and was greatest at the highest barrier setting (0.8 ms, 80 V). Our laboratory results indicate pulsed direct current may be effective at reducing fish escapement from reservoirs. Lower pulse and voltage settings should be used due to their ability to reduce escapement while inflicting minimal mortality compared to higher settings. Additional work should evaluate the success of electric barriers in reservoir field settings under a wider range of conditions and on additional species.

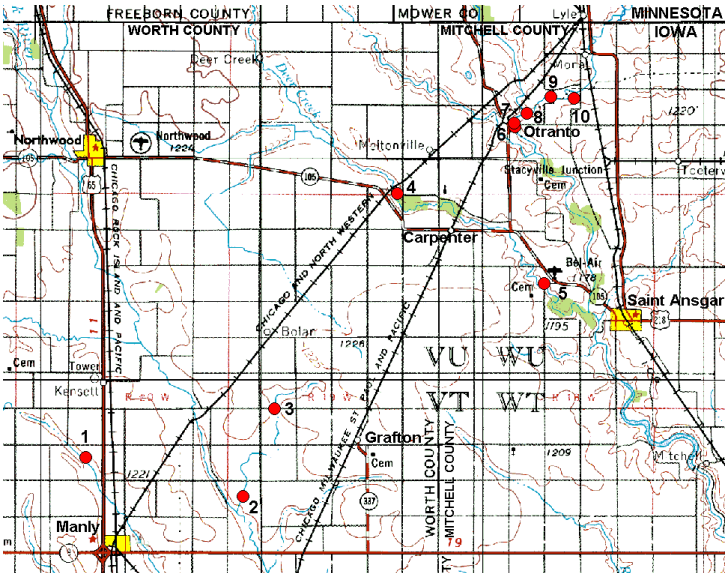
FORAY INTO THE WILDS OF IOWA FINDS NORTHERN PEARL DACE AND LEAST DARTER BUT NOT NORTHERN SUNFISH

John Olson ~ Iowa DNR

Lacking any formal state agency-level mechanism for tracking the status of rare fishes in Iowa, this responsibility sometimes falls to others with the requisite motivation and expertise. In the past, I have relied on this informal mechanism— in the form of assistance from NANFA stalwarts Konrad Schmidt and Bob Hrabik—to attempt to update the status of rare and "presumed extirpated" fishes in Iowa. For example, in late June 2011, we three met in northwest Iowa to conduct surveys for a species believed to be extirpated from the state since the early 1940s: the Plains Topminnow (Fundulus sciadicus) (Hrabik and Schmidt, 2012). It took Konrad and Bob about five minutes at our first site to collect this species which hadn't been reported in the state for 70 years.

The impetus for the current survey was the discovery in July and August 2014 of four Lepomis specimens tentatively identified as Longear Sunfish (L. megalotis) in flooded hatchery ponds at Iowa DNR's Fairport Fish Hatchery located along the shore of Pool 16 of the upper Mississippi River (UMR) near Muscatine. This was the first Iowa record for a fish in the Longear Sunfish complex in 50 years and only the third record in the last 100 years. If genetic analysis confirms that these four specimens are L. megalotis (Longear Sunfish), this would be a new species for Iowa as the form that has been historically documented in Iowa is L. peltastes, Northern Sunfish (Figure 1).

Most of the historical records for Longear Sunfish (as L. peltastes) in Iowa are from the work of Seth Meek in the late 19th century (Meek, 1892). The only two verified records from the 20th century are from the same location: the Cedar River at the unincorporated village of Otranto in Mitchell County in extreme northern Iowa about three miles from the Iowa/Minnesota state line. One of these records is from a July 1932 survey conducted by J. Clark Salyer, then of the University of Michigan, who along with Carl Hubbs, was contracted by the state of Iowa to conduct a survey of Iowa fishes as part of natural resource management planning activities (Crane and Olcott, 1933). In his 1932 field notes, Salyer reported



2014 Survey Stations: (1) Beaver Creek. (2 and 3) Shell Rock River tributary. (4 and 5) Deer Creek. (6) Cedar River (above and below dam at Otranto. (8 and 9) Otter Creek. (10) Poor Creek. (Map by Konrad Schmidt)

Photos by the author unless otherwise indicated.

John Olson has worked in the Iowa DNR Water Quality Section since 1985, where his primary responsibility has been complying with reporting requirements of the federal Clean Water Act. He has been involved with stream fish survey work in Iowa since participating in a statewide survey of Iowa fishes from 1981–1984, and has continued to participate in fish surveys in Iowa streams as part of various Iowa DNR water quality projects and as part of special surveys targeted toward state threatened and endangered fish species. John has co-authored papers on invasive fishes in Iowa and on the occurrence of Chestnut Lamprey (Ichthyomyzon castaneus) in a southern Iowa river. He has a Bachelor of Science degree in Animal Ecology from Iowa State University, with an emphasis in fisheries biology.

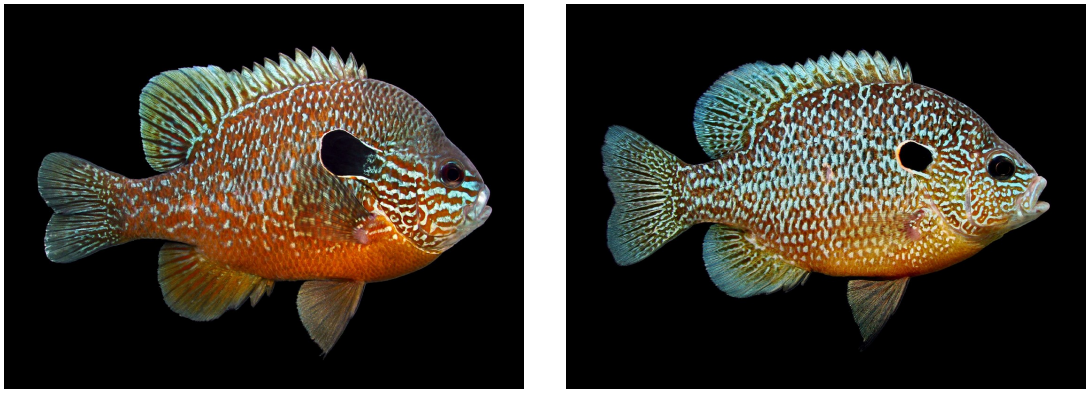


Figure 1. Left: Longear Sunfish (Lepomis megalotis) from Salt Fork Vermilion River, Vermilion County, IL. Right: Northern Sunfish (Lepomis peltastes), Hillsdale County, MI. (Photos by Lance Merry)

"longeared sunfish" (identified at UMMZ as *L. m. peltastes*). A second collection was made in July 1963 by Dr. Karl Eugene Goellner, a biology professor at Coe College in Cedar Rapids from 1949 to 1974 (Meek was also a professor at Coe College from 1887 to 1892). In their respective field notes, both Salyer and Goellner refer to occurrence of springs in the river bed at this location and growths of aquatic vegetation (macrophytes) near the springs. As part of a 1981–84 statewide survey of Iowa fishes conducted by Bruce Menzel at Iowa State University, I had visited and collected fishes at this site on two occasions (1981 and 1982), and made an additional collection in 1986. None of these collections produced Longear (now Northern) Sunfish. In the most recent summary of Iowa fishes (Harlan et al., 1987), this species is considered extirpated from the state.

With the unexpected occurrence of a form of Longear Sunfish in Pool 16 of the UMR near Muscatine, IA, in July 2014, the time seemed right to make yet another attempt to collect the Northern Sunfish from the upper Cedar River. In a late July e-mail, I mentioned to Konrad and Bob that Northern Sunfish had been collected from the upper Cedar River in Iowa in 1932 and 1963, and that this segment of river had at one time been identified in as "the only major vegetated stream relict left in Iowa" (Harlan and Speaker, 1956:136). That was all the push needed to begin the planning for our survey which we set for late August. We met in northern Iowa on Friday, August 22nd for our three-day collecting trip. We also enlisted the services of regional fish experts George Cunningham from Nebraska and Lance Merry from Illinois. Our survey headquarters was a motel in the town of Northwood in Worth County, IA. This portion of Iowa—the upper portions of the Cedar River basin, including the Shell Rock River subbasin— supports a relatively high diversity of fishes including the Northern Pearl Dace (*Margariscus nachtriebi*) and Least Darter (*Etheostoma microperca*), both of which are listed as state-endangered species (Figure 2). The upper Shell Rock basin occupies the eastern border of Iowa's portion of the Des Moines Lobe ecoregion (the topographically youngest and most poorly drained land surface in Iowa), and the upper Cedar Riverbasin occupies

Figure 2. Top: Northern Pearl Dace from Rose Creek, Mower County, MN. Bottom: Least Darter from Long Lake, Itasca County, MN. (Photos by Konrad Schmidt)

Iowan Erosion Surface ecoregion, a gently rolling landscape with shallow soils over limestone bedrock and generally coarse substrates in stream channels (Prior, 1991; Griffith et al., 1994).

The Northern Pearl Dace was first documented in Iowa in 1972 by Menzel and Boyce (1973) from Beaver Creek (aka, Rose Creek), a small tributary of the Shell Rock River near the town of Manly in Worth County (Figure 3). These authors concluded that this population likely represented a glacial relict at the southern extent of its current distribution in North America. This stream has remained Iowa's only known location for Northern Pearl Dace. Although samplings in this stream in 1981 and 1986 had been unsuccessful, this species was again collected from the Beaver Creek system in 1992 by Cunningham. According to the database for the Iowa Natural Areas Inventory (http://www.iowadnr.gov/Environment/ThreatenedEndangeredNaturalAreas-Inventory.aspx), there had been no subsequent collections of Northern Pearl Dace from this stream since 1992.

About 12 miles east of Northwood is another "only known location" for an Iowa fish species. A small tributary of Otter Creek (locally known as Poor Creek) in the upper Cedar River basin, is the only known Iowa location where the Least Darter still occurs. This species once had a wider distribution in Iowa with verified (museum) records from the late 19th century from the lower Cedar Riverbasin (Cedar County) and from the Maquoketa River basin (Delaware County) in eastern Iowa (Meek, 1892; Burr, 1978). The Least Darter was documented in the Minnesota portion of the Otter Creek drainage in 1962 (Phillips and Underhill, 1967 and by Konrad Schmidt in 1998, 1999, and 2008 personal communication) and in the Iowa portion ofthe Otter Creek drainage (Poor Creek) by Tom Coon in 1980 (personal communication). An additional collection was made by James Russell in the mid-1970s from the upper portion of the Maquoketa River at Joy Springs County Park in southwestern Clayton County (Roosa, 1977; Menzel, 1981). The last known collection of Least Darter from Poor Creek had been in 1986 by Iowa DNR personnel including the author. Thus, while we were in the area attempting to document the continued occurrence of the Northern Sunfish in Iowa (a long-shot, to be sure), it seemed like a good idea to check on the status of the Northern Pearl Dace and Least Darter and their very restricted respective distributions in the state.

NORTHERN PEARL DACE

With Konrad and George manning the seine, we were able to collect a number of individuals of Northern Pearl Dace from Beaver Creek, where they had been previously, and exclusively, found (Figure 3). In the hopes of finding other Shell Rock tributaries that held Northern Pearl Dace, we later sampled two locations on an additional tributary, but no Northern Pearl Dace were captured. A thunderstorm on the morning of August 23rd caused the already elevated flows in this tributary to rise further thus potentially reducing our collection efficiency. Regardless, our failure to find Northern Pearl Dace in other nearby tributaries of the Shell Rock River was consistent with findings of Menzel and Boyce (1973).

Figure 3. Top: Seining Beaver Creek. Bottom: Northern Pearl Dace collected at site.

LEAST DARTER

We also had good success on the tributary (aka, Poor Creek) to Otter Creek where the Least Darter was last

Figure 4. (From top) Rustad plaque. Least Darter from Poor Creek. George showing another Rustad generation these tiny fish. (Bottom photo by Lance Merry).

collected in 1986. With our chest waders on, the five of us arrived in two vehicles at the farm through which this tributary flows. The family was the same one that had lived there in 1986 when I last visited this site. Further, this family proudly showed us a plaque they had received in 1988 from The Nature Conservancy for their dedication to conservation and preservation of the small stream on their property inhabited by this smallest of darters. In the many years and many hundreds of fish collections made between us in the agricultural Midwest, none of us had encountered a farm family that proudly displayed a plaque for their dedication to protecting habitat for a fish (Figure 4). We seined a number of specimens of Least Darter from the tributary along with a number of other fish species including the Ozark Minnow (Notropis nubilus), Rainbow Darter (E. caeruleum) and Banded Darter (E. zonale) (these additional fish species are quite commonly distributed in the upper Cedar River basin).

NORTHERN SUNFISH

Our primary target for this trip, however, was the sunfish-formerly known as the Longear Sunfish but now called the Northern Sunfish. Both the 1932 and 1963 collections of this Lepomis species from the Cedar River near the village of Otranto mentioned a lowhead dam at this location, and both mentioned springs in the river bed downriver from the dam. Thus, one area of focus was the series of springs in the river about 700 feet downriver from the dam. In his field notes from a warm summer evening in July of 1932, J. Clark Salyer described the Cedar River at Otranto and its springs as follows:

6:00 PM. Ia-74; jar. July 14. Air: 95; water: 85.5. Cedar River at Otranto, Mitchell Co., close to Minn. Line here (3 miles to it). River is 125' wide & runs from 1 ft up to ho1e waist deep. . . has nice sand & gravel bottom. Large boulders strewn all over bottom. An abundance of Potamogeton in stream here—P. richardsoni, P. interior & pectinatus. Some elodea & coontail. A dam here of concrete & poles—110 ft. long & 6' high. 1/8 mile below dam, 3 large springs in river bed. One forced water up in air above river some 6" or 7". This springs temp at 47 degrees F. This was coldest water or spring we encountered in Iowa. River water in vicinity of spring lowered to 69 degrees F.

Salyer goes on to mention the fishes collected at this loca-

tion:

Seined below dam: S. [Noturus] gyrinus, [Lepomis cyanellus, rock bass, [Notropis stramineus] deliciosus, [Luxilus] cornutus-many, [Nocomis] biguttatus, B. [E.] nigrum, N. [Lythurus] umbratilis, [Campostoma anomalum] pullum, H. [Pimephales] notatus, smallmouth, bluegills, long-eared

sunfish, fat-head minnows.

Salyer's specimen of "long-eared sunfish" was placed in the collection of the University of Michigan's Museum of Zoology (UMMZ 101383), was 65 mm TL, and was identified as Lepomis megalotis peltastes.

To begin our search, we sampled the lower portion of Otter Creek (of Least Darter fame) which enters the Cedar River approximately one-half mile upriver from the lowhead dam at Otranto. Aerial photos showed some promising off

The survey soldiers of Northern Iowa. Left to Right: John Olson, George Cunningham, Bob Hrabik, Konrad Schmidt, and Lance Merry.

channel habitats along the lower segment of Otter Creek. Prior to the arrival of Bob and Lance, we (Konrad, George, and I) canoed up the Cedar River from the boat access at Otranto Park to the mouth of Otter Creek and seined several of these off-channel areas in our attempt to locate L. peltastes. Unfortunately, the reality of the poor quality of these off channel habitats during late summer of 2014 did not meet the somewhat higher expectations based on the aerial photos: these off-channel areas were typically isolated from the main stream and were generally dominated by filamentous algae. The only Lepomis found was, not surprisingly, Green Sunfish (L. cyanellus).

On the following day, the full team also sampled the Cedar River both upriver and downriver from the lowhead dam at Otranto. While our efforts with dip nets, seines, and a backpack electrofisher produced a number of species, we did not encounter L. peltastes. All agreed that the habitats-present did not appear suitable for supporting this species. The area of springs at this location appears to have declined immensely in quality since Salyer's visit in 1932. A very small patch of springs continue to enter the river at this location, but the flows appear greatly reduced, and their impacts on the river's water quality and growth of in-stream aquatic vegetation appear minimal. Similarly, the diversity of aquatic macrophytes described by Salyer appears to have declined significantly with only a few patches of Potamogeton natans

present upriver from the dam; no aquatic macrophytes were observed downriver. Thus, the statement that the Cedar River at Otranto is "the only major vegetated stream relict left in Iowa" (Harlan and Speaker, 1956)

References:

Burr, B. M. 1978. Systematics of the percid fishes of the subgenus microperca, genus Etheostoma. Bulletin of the Alabama Museum of Natural History, 4:1–53.

Crane, J. L. and G. W. Olcott. 1933. Report on the Iowa twenty-five year conservation plan. Des Moines, Iowa.

Griffith, G. E., J. M. Omernik, T. F. Wilton, and S. M. Pierson. 1994. Ecoregions and subecoregions of Iowa: a framework for water quality assessment and management. Journal of the Iowa Academy of Science. 10(1):5–13.

Harlan, J. R. and E. B. Speaker. 1956. Iowa Fish and Fishing. Iowa Conservation Commission, Des Moines, Iowa. 365 p.

Harlan, J. R., E. B. Speaker, and J. Mayhew. 1987. Iowa fish and fishing. Iowa Conservation Commission, Des Moines, Iowa. 323p.

Hrabik, R. A. and K. P. Schmidt. 2012. Forays into Iowa yield new records of Plains Topminnow (Fundulus sciadicus) and more data on Pugnose Shiner (Notropis anogenus). American Currents 37(3): 11–13. North American Native Fishes Association.

Meek, S. E. 1892. Report upon the fishes of Iowa, based upon observations and collections made during 1889, 1890, and 1891. Bull. U.S. Fish Comm. 10(1890):217–248.

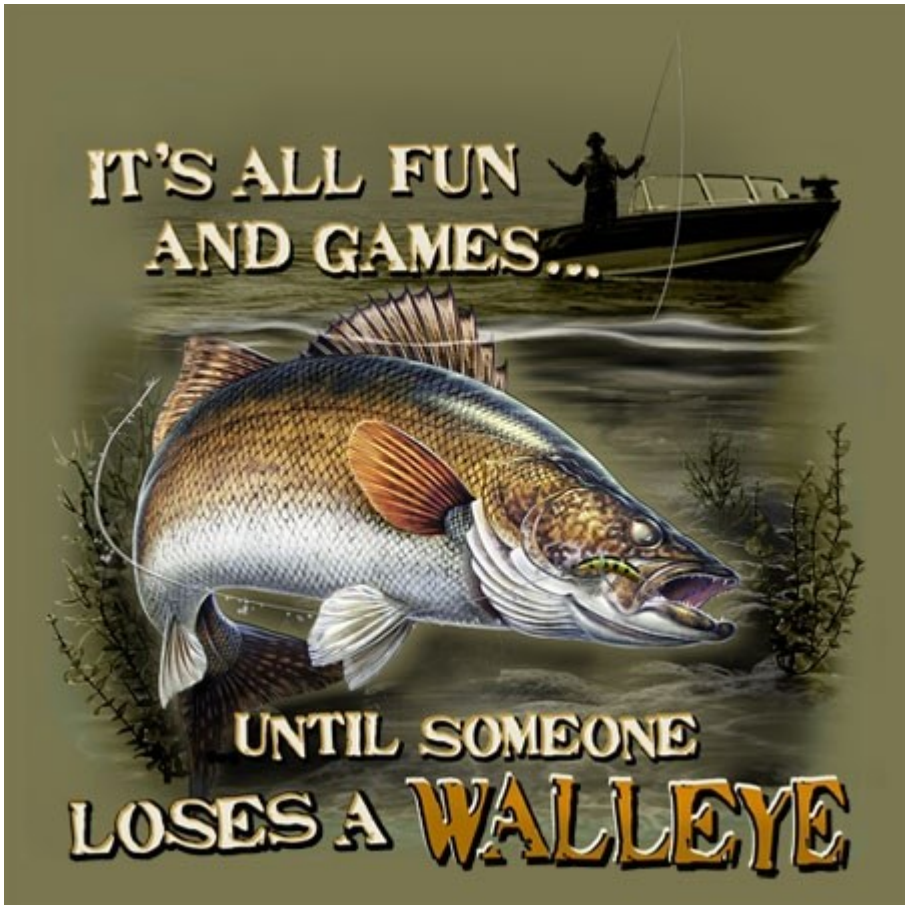
Menzel, B. W. 1981. Unpublished interview with James Russell, August 20, 1981, in Auburn, Ia., on fishes of eastern Iowa. 14 pages; handwritten.

Menzel, B. W. and M. S. Boyce. 1973. First record of the pearl dace, Semotilus margarita (Cope), from Iowa. Iowa State Journal of Research. 47(4):245–248.

Phillips, G. L. and J. C. Underhill. 1967. Revised distribution records for some Minnesota fishes, with addition of two species to the faunal list. J. Minn. Acad. Sci. 34:177–80.

Prior, J. S. 1991. Landforms of Iowa. University of Iowa Press. 153 p.

Roosa, D. M. 1977. Endangered and threatened fish of Iowa. State Preserves Advisory Board in cooperation with the Fisheries Section, Iowa Conservation Commission. Special Report of the Preserves Board, No. 1. Des Moines, IA. 25 p. + appendix.

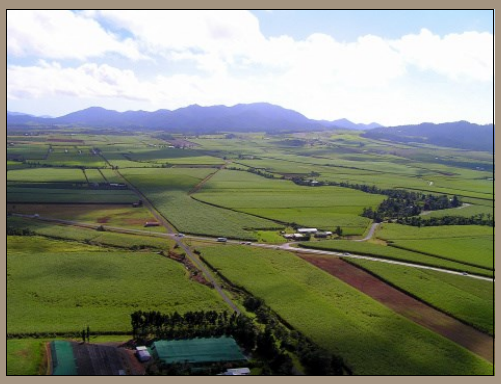


WHY DIDN'T THE FISH CROSS UNDER THE ROAD?

November 30,2015 by The Fisheries Blog by Stephanie Januchowski-Hartley

Think about how you arrived to work or school today, yesterday, or last week.

Did you go by car, bike, or train? Did your journey include traveling over a river, wetland, stream, or estuary? If you answered yes to either of these questions, it is very likely that you crossed over a possible barrier to fish and other aquatic organisms.



Roads criss-crossing a tropical Australian landscape. Photo credit: Stephanie Januchowski-Hartley

What could this barrier be, you ask? Well, it's none other than a road culvert. You know what I am talking about, right? Those metal pipes under roads, sometimes they extend out from underneath the road, and they can even be a little bit creepy (who knows what could be hiding in there!!). Yeah those, those are culverts.

Road culvert on a small stream in rural Wisconsin, USA. Photo credit: Carmen Hardin, Wisconsin Department of Natural Resources

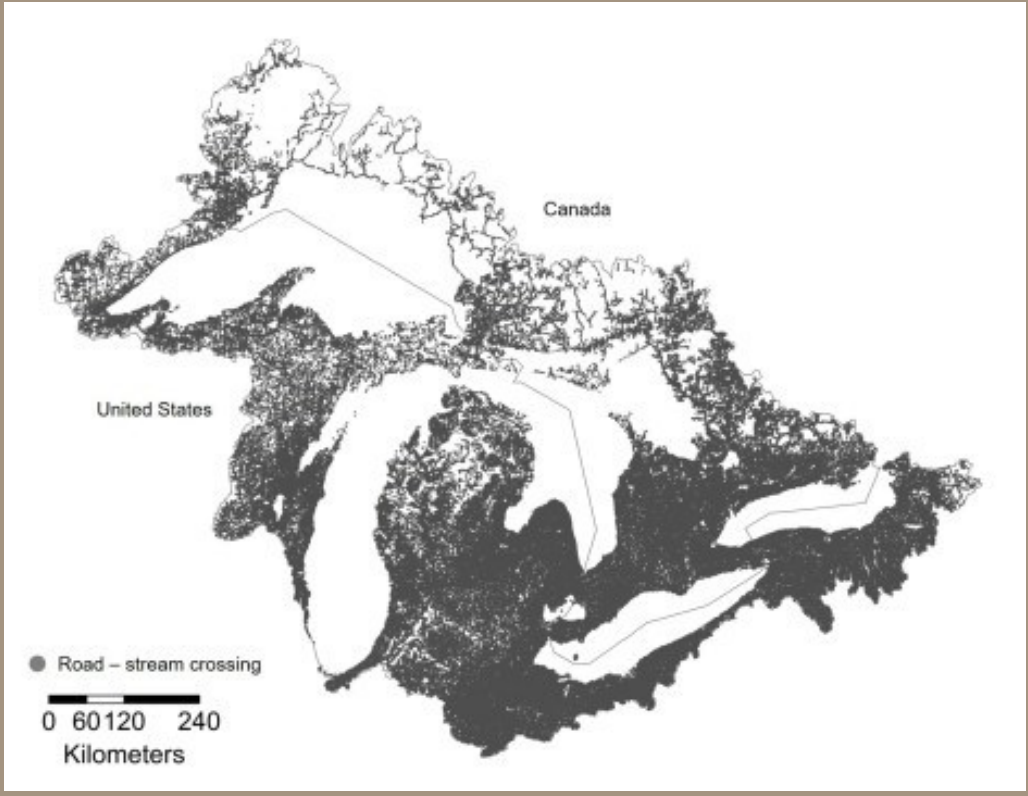
Around the world culverts have been installed where roads cross over streams. Most of the culverts that can cause problems for aquatic species like fish occur on streams or river reaches relatively small in size (think of streams less than 10 feet or a few meters in width). On bigger stream and river reaches, bridges, or box culverts (often made of cement or wood) are used to allow water to flow through freely and don't cause as many problems for fishes.

So what's all the fuss about culverts anyway? Well, culverts can have several major impacts on fishes and their movements. First, culverts that are smaller than the width of the stream where they sit can actually act like giant fire hoses during times of high water flow, projecting high flowing water and making it very difficult for species to move upstream. Second, culverts in hilly or mountainous areas can form mini-waterfalls that also limit movement of fishes and other aquatic organisms. These mini waterfalls result from culverts that are not placed in alignment with the river bottom and are therefore 'perched' above the water. Not only do these perched culverts create mini waterfalls, they can often be elevated so far from the water's surface that fish would need extreme leaping abilities (think salmon) to enter in the culvert. The firehose and waterfall effects are particularly bad because often high flows coincide with when fishes (and other aquatic species) need to move upstream for their breeding. Limiting species movement upstream for breeding can result in reduced numbers of individuals and in some extreme cases the loss of entire species.

There are likely to be hundreds of thousands to even millions of road culverts that occur on small streams and rivers across the globe. In the Laurentian Great Lakes, we documented some 250,000 road – stream crossings that could support a culvert that acts as potential barriers to migratory fishes (read more about it, here). The accumulation of small, but abundant barriers, like culverts, is contributing to the decline of fish numbers and impacting fish communities across the globe (imagine towns disconnected by walls that don't allow people to move in and out).

So, what can we do about this? Well government agencies, citizen and community groups, even academic researchers across many different parts of the globe are working to identify solutions through coordinated efforts. There is even a World Fish Migration Day, devoted to raising awareness about the importance of open rivers! There are diverse and creative solutions underway! In New Zealand, groups are using ropes secured between perched culverts and streambeds, and in North America, troublesome culverts are increasingly being replaced with eco-culverts that allow organisms to move freely through culverts. It is a great time to be thinking about fish passage; there are a growing number of success stories, with fish passage being improved along entire river networks!

With all of this talk about culverts, don't be surprised if you start identifying road-stream crossings on your next drive into work or school! You never know, you might just pass over a remediated culvert with fishes swimming through merrily!



More than 260,000 road-stream crossings (the point at which a road crossings over a stream) occurring across the Laurentian Great Lakes Basin. Read more about the project to map these barriers, here.

MOUNTAIN GROWTH HELPED SPAWN FISH DIVERSITY IN NEW ZEALAND

ScienceDaily®
Your source for the latest research news

The growth of mountain ranges on New Zealand's South Island directly influenced the evolution of different freshwater fish species in the region, according to new University of Otago-led research.

The findings are published online this week in *Nature Geoscience*.

The study provides an example of how natural changes in the Earth's landscape and topography can help shape and increase local biodiversity.

Mountain ranges form when tectonic plates collide, and the uplift of a new range can separate biological populations and eventually lead to the creation of new species. However, clear examples of the links between the changing topographic landscape and biodiversity are rare.

Department of Geology Professor Dave Craw and colleagues at Otago, GNS Science and the University of Tasmania used a numerical model to reconstruct the topographic evolution of the South Island over the past 25 million years.

The researchers show that the island's landscape developed in six main tectonic zones, each with distinct river drainage catchments.

The team then used new and existing analyses of the evolutionary tree of freshwater fish populations from these drainage catchments, based on over 1,000 specimens from more than 400 localities, to show that the fish DNA sequences diverge over time, in tandem with the growth of the mountains.

Professor Craw says the South Island is a great place to study how geology can shape biology—as both the landscape and its native species show such rapid rates of change.

"By modelling the mountain-building processes, we can really start to understand how the changing landscape has shaped biological processes. New Zealand's geographic isolation and dynamic geology make it the perfect place for understanding evolution," he says.

Co-author Professor Jon Waters of the Department of Zoology says he and Professor Craw have been working together on geology and genetics for about 15 years. "We come from different perspectives, but are finding a lot of common ground," he says.

"This study takes a pretty broad view, looking at the evolution of several different groups of freshwater fish across South Island. One particularly interesting thing about the study, from a biological point of view, is that we find such similar evolutionary patterns in unrelated groups of fish species, which really highlights the important role of geology," Professor Waters says.

The research was supported by the Marsden Fund of New Zealand