Iowa Chapter Report

March 27, 2018

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Links: http://www.iowadnr.gov/Things-to-Do/Canoeing-Kayaking/Dam-Mitigation-Projects

Willow Creek

The third of three dams on Willow at East Park in Mason City was improved for fish passage in January 2018. The third dam was a removal. Two other dams near where this tributary's mouth at the Winnebago River were modified in January of 2017. One was removed and replaced with a low-cross vane structure. The other was converted to a rock arch rapids.

Quaker Mill Dam, Maquoketa River

The Quaker Mill Dam north of Manchester on the Maquoketa River was removed in the fall of 2017 as a phase 1 project. A starter channel was meandered through the former lakebed and seeded down for one year of growth prior to reconnecting it to flowing water.

Quaker Mill Dam
Phase 1

James T. Dietrich, Ph.D.
Assistant Professor
Director, Iowa Low-Altitude Remote Sensing Lab

2018 Dam Mitigation Projects

* Phase 2 of the Quaker Mill Dam project
* Ames River Valley Park Dam conversion to whitewater facility/fish passage channel
* A mitigation bank is being reviewed for USACE approval based on the removal of two dams in Fort Dodge on the Des Moines River, which may be either the first stream mitigation bank in Iowa. Setting up mitigation banks in Iowa is now possible due to work Iowa DNR led to develop a method of evaluating credits to measure adverse and beneficial effects of different project type to allow credit trading. This would open fish passage to the entire East Fork Des Moines River, and the West Fork Des Moines River upstream to the Reasoner Dam in Humboldt. The project comes on the heels of the Cornbelt Dam removal in early 2016, which was just below the confluence of the two main forks of the Des Moines River. The removal of the lower of the two Fort Dodge dams also brings reliable fish passage to Lizard Creek, another major tributary that enters the Des Moines in town.

Three dams in downtown Des Moines are under study for conceptual development on the Des Moines and Racccoon Rivers. While the project is in large part a downtown development project centering around whitewater recreation, incorporation of fish passage and habitat into each project site is a key component. Iowa DNR fisheries and river programs staff have been involved in advising on potential locations and approaches for fish-passable areas within the overall plans.

River Restoration

The Iowa River Restoration Best Management Toolbox is nearing completion, and is due on April 30, 2018. Iowa DNR hired Stantec in December 2016 to complete the project under review of an inter-agency committee. It will contain an assessment tool to identify key instability drives, geomorphic design practice guideliness, and guidelines for successfully designing and executing commonly used structures and techniques used in restoration/stabilization projects. A main goal is to improve understandings and foster communication among biologists, project managers, landowners, and engineers to arrive at stable, successful, budget friendly projects.

Missouri River Monitoring Team

Contact: Ryan Hupfeld, 712-249-1997, Ryan.Hupfeld@dnr.iowa.gov

Biological Monitoring of the Deer Island Shallow Water Habitat Project

A major channel top widening project was constructed on the Missouri River by the U.S. Army Corps of Engineers at the Deer Island State Wildlife Management Area to create habitat for early life stages of federally endangered Pallid Sturgeon and other native fishes. Construction of this site was completed in 2014. Deer Island and a nearby control site were sampled with a sixteen foot small mesh otter trawl and push trawl to evaluate fish community response to the constructed habitat. The objective was to compare diversity and catch rates of the fish community as an indicator of site performance. Overall, 1,938 fish were collected representing 30 species. Based on these catches, diversity indices appeared similar between sites, however catch rates at the control site were greater than at Deer Island for the majority of species and length categories. One young of year and likely age-1 Shovelnose Sturgeon were collected at Deer Island in 2017. Additionally, $\geq$ age-1 Shovelnose Sturgeon catch rates were greater at Deer Island than at the control site. Collections of young of year and $\geq$ age-1 Shovelnose Sturgeon suggest Deer Island may provide suitable habitat for young of year Sturgeon spp. Additional information on habitat usage data for all species may help to guide efforts towards more successful habitat rehabilitation projects in the future for the entire fish community. Future research and monitoring at Deer Island is suggested to provide a long term data set of fish usage and to determine if this channel widening project has reached the intended objectives.

Fish Population Assessment

Flathead Catfish Biennial Sampling:
The Iowa Department of Natural Resources has continued its biennial monitoring of Flathead Catfish. Flathead Catfish sampling was conducted using low frequency electrofishing from June to October 2017. A total of 39 sampling events were conducted from Sioux City, IA to Hamburg, IA. Lengths ranged from 80-1170 mm with a mean length of ~266 mm (Figure 13 and 14). Catch per unit effort were as follows by habitat: Overall (1.52), Modified Rock Structures (1.55), Revetment (1.59), and Wing Dykes (1.43). Channel Catfish monitoring is planned to continue during the summer 2018.

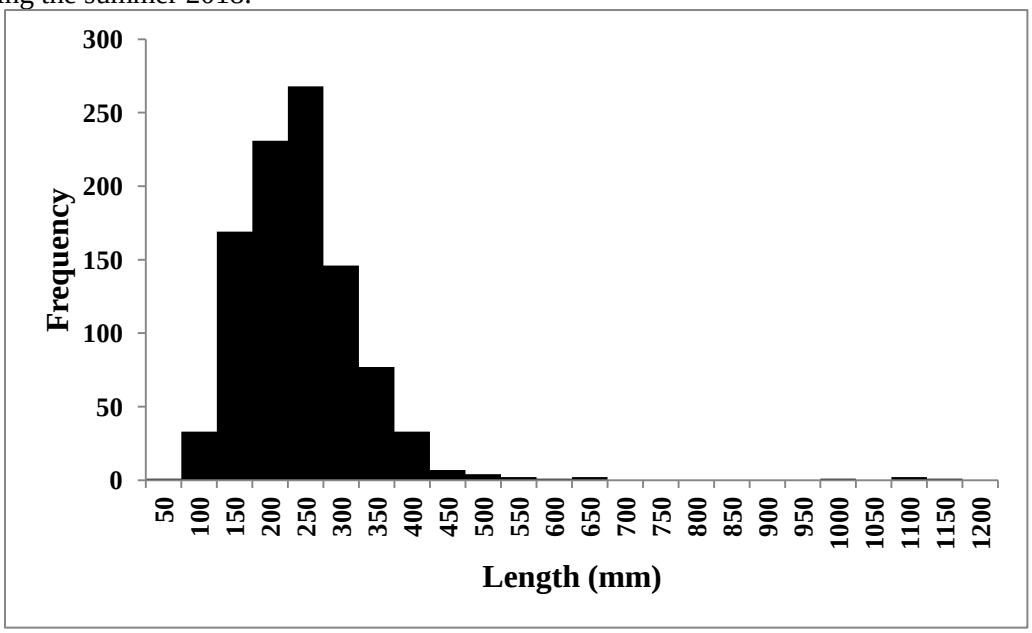

Figure 1. Length frequency for Flathead Catfish collected from the Missouri River from June-October 2017.

Paddlefish:
The Missouri River Paddlefish season in Iowa has declined in popularity and success rate since its reopening in 2015 (Table 1). Survey cards sent out to anglers suggest some of the primary reasons for decline could be: 1) the state regulations/border between Nebraska and Iowa is very confusing and should be more consistent between states (no harvest is currently allowed in the Nebraska waters south of Sioux City), 2) no harvest of Asian Carp was allowed, and 3) season start dates are too late.

New to the 2018 season rules to help increase popularity and success include:

- Anglers can buy up to two tags – one from Dec. 15 to Dec. 31 and an additional tag from Jan. 1 to Jan. 7, or two tags if you didn't buy one in December.
- The season has been extended, opening Feb. 4 and running through April 30.
- Rough fish, including Asian Carp, can be harvested during the paddlefish snagging season.

Paddlefish Survey Card Results			
Year	**2015**	**2016**	**2017**
# Tags Sold	740	407	336
# Survey Cards Returned	107	51	61
Survey Card Return Rate	0.14	0.13	0.18
# who snagged for pdfh	95	33	44
% who snagged for pdfh	88.79%	64.71%	72.13%
# of fish Harvested	53	10	7
Success Rate	55.79%	30.30%	15.91%
Avg. Length Harvested (inches)	32	33.25	33
Max size harvested (inches)	34.75	34.5	34
# of paddlefish released less than 35"		36	15
# of paddlefish released 35-45"		24	8
# of paddlefish released larger than 45"		0	3
Avg. # of trips	3.8	3.75	3.7
Total Estimated # of tag buyers who snagged	657	263	242
Total Estimated # of fish harvested	**367**	**80**	**39**

Table 1. Missouri River Paddlefish Season returned angler survey card results from 2015-2017.

Missouri River Fisheries Management Staff are participating in the Mississippi Interstate Cooperative Resource Association (MICRA) national Paddlefish stock assessment. The objective is to assess abundance, habitat use, movement, and exploitation. Fifty seven Paddlefish were jaw tagged in 2017. Three jaw tags were recovered in gillnets (2 Iowa tags and 1 Nebraska tag). South Dakota Game Fish and Parks reported 3 Iowa jaw tags below Gavin's Point Dam during their Paddlefish sampling.

Iowa State University Research

Habitat Improvement Projects for Stream and Oxbow Fish of Greatest Conservation Need: Database and Landscape Analyses

Courtney L. Zambory, Clay L. Pierce, Kevin J. Roe, Michael J. Weber

This project will focus on habitat restorations and responses of stream fish of greatest conservation need (SGCN), specifically Topeka shiners (*Notropis topeka*) and plains topminnows (*Fundulus sciadicus*). Extensive GIS analysis using a new, state-of-the-art framework will be undertaken to assist in guiding current and future restoration efforts. Monitoring of the fish populations in an adaptive management approach will be necessary to ensure fish are responding as expected to efforts to increase and improve their habitat. Additional SGCN potentially benefitting from the work include banded darters (*Etheostoma zonale),* blacknose shiners (*Notropis heterolepsis*), Iowa darters (*Etheostoma exile*), blackside darters (*Percina maculate*), longnose dace (*Rhinichthys cataractae*), slenderhead darters (*Percina phoxocephala*), slender madtoms (*Noturus exilis*), southern redbelly dace (*Phoxinus erythrogaster*), tadpole madtoms (*Noturus gyrinus*), and trout perch (*Percopsis omiscomaycus*). Species occurrence databases from both states will be compiled and combined to reveal locations where the two species have

been documented as occurring. Minnesota's Watershed Health Assessment Framework (WHAF) will be used in MN portions of the project area, and WHAF will be implemented in Iowa portions utilizing existing geospatial resources.

The graduate student, Courtney Zambory, has completed entry of all Topeka Shiner presence records (historical and present) in a master database and developed a database for comprehensive entry of this project's data. She has completed her statistical analysis of landscape variable data that influences Topeka Shiner distribution in both oxbow and stream habitats and generated a species distribution model to map current distribution of Topeka Shiners. In addition, she has completed analysis of the process created to identify historical stream meanders and current oxbow lakes as potential restoration sites in the Boone, North Raccoon, and Rock River watersheds. The methodology used to create the WHAF has been applied to Iowa using comparable methods when data availability allowed. Health Index scores have been completed. Courtney plans on defending her thesis work and working on papers for submission to peer-reviewed journals.

Habitat Improvement Projects for Stream and Oxbow Fish of Greatest Conservation Need: Field Monitoring and Assessment
Alexander P. Bybel, Clay L. Pierce, Kevin J. Roe, Michael J. Weber

This project will focus on habitat restorations and responses of stream fish of greatest conservation need (SGCN), specifically Topeka shiners (*Notropis topeka*) and plains topminnows (*Fundulus sciadicus*). Extensive GIS analysis using a new, state-of-the-art framework will be undertaken to assist in guiding current and future restoration efforts. Monitoring of the fish populations in an adaptive management approach will be necessary to ensure fish are responding as expected to efforts to increase and improve their habitat. Additional SGCN potentially benefitting from the work include banded darters (*Etheostoma zonale)*, blacknose shiners (*Notropis heterolepsis*), Iowa darters (*Etheostoma exile*), blackside darters (*Percina maculate*), longnose dace (*Rhinichthys cataractae*), slenderhead darters (*Percina phoxocephala*), slender madtoms (*Noturus exilis*), southern redbelly dace (*Phoxinus erythrogaster*), tadpole madtoms (*Noturus gyrinus*), and trout perch (*Percopsis omiscomaycus*). We will survey at least 20 sites in Iowa and Minnesota for Topeka shiners, plains topminnows, and habitat. Data will be collected on all fish species encountered. Genetic analysis of Topeka shiners and plains topminnows will be conducted through the use of microsatellite markers.

DNA of 798 Topeka shiners from 43 sites have been extracted and genotyped. Only 9 loci of the original 13 showed polymorphism. Analysis of the genetic data is ongoing. Genetic analysis of microsatellite data will continue in the summer for both Topeka Shiner and Plains topminnows.

Boone River Watershed (BRW) Stream Fish and Habitat Monitoring, IA
Nicholas Simpson, Clay L. Pierce, Michael J. Weber, Kevin J. Roe

Fish assemblages and habitat conditions in two streams in the Boone River Watershed (BRW), White Fox Creek and Eagle Creek, will be monitored to evaluate their potential as Topeka shiner population sources and conduits for associated oxbow habitats. Eagle Creek and associated natural oxbows support the only known remnants of the Topeka shiner distribution in the BRW. Topeka shiners are presumed extirpated from the White Fox Creek sub-watershed, but five oxbows have been restored there for Topeka shiners and three of them have subsurface tile inflow for maintenance of water supply and nitrate sequestration. The success of restored oxbows for Topeka shiners is dependent on existence of populations in associated streams with suitable

habitat. Our monitoring and assessment results will help guide present and future oxbow restorations and inform potential future Topeka shiner reintroduction to the BRW.

During the 2016 and 2017 field seasons, 101 fish and habitat surveys were conducted at 95 sites throughout the BRW. This includes 66 in-stream sites and 29 oxbows. In addition to 23 sites in the White Fox Creek HUC10 and 20 sites in the Eagle Creek HUC10, 52 sites were sampled throughout other sub-basins of the watershed. A total of 145,887 fish including 55 species were sampled. The five most abundant species were Common Shiner, Fathead Minnow, Black Bullhead, Orangespotted Sunfish, and Green Sunfish. The five most commonly occurring (# sites present/total # sites) species were Common Shiner, Creek Chub, Green Sunfish, White Sucker, and Bluntnose Minnow. Habitat assessments were also performed at each of these sites. Many habitat variables were measured or visually estimated in each habitat assessment. Each habitat variable along with several variables describing the fish assemblage are considered when evaluating which characteristics are associated with the presence of Topeka Shiners to be included in thesis analysis.

Of the 95 total sites sampled in the BRW, Topeka Shiners were sampled at 32 (34%). This includes 19 in-stream reaches and 13 oxbows. Topeka Shiners were not sampled at any White Fox Creek sites but were present at 6 Eagle Creek sites. In addition to Eagle Creek, Topeka Shiners were sampled in the Boone River, Middle Branch Boone River, East Branch Boone River, Prairie Creek, Otter Creek, Drainage Ditch 4, and Drainage Ditch 94. Topeka shiner abundance at sites where they were sampled ranged from 1-453 individuals with a mean of 57 and median of 16 individuals per site. Overall, 2010 Topeka Shiners were sampled in the BRW in 2016-2017 making them the 16th most abundant and 19th most commonly occurring species in our sampling.

Topeka Shiner presence and abundance was most consistent in Prairie Creek and its associated oxbows. Fourteen of 32 (43.7%) positive Topeka Shiner sites and 1633 of 2010 total Topeka Shiners sampled were in Prairie Creek or one of its oxbows. Topeka Shiners were sampled at 14 of 17 (82.4%) sites in the Prairie Creek HUC10 compared to 18 of 78 (23.1%) sites throughout all other HUC10s of the BRW. This was surprising because there were only two detections of Topeka Shiners in this HUC10 in two previous Iowa State University stream fish studies since 1997.

This work was presented at the Midwest Fish and Wildlife Conference as well as the Iowa Chapter of the American Fisheries Society annual meeting in both 2017 and 2018. In addition a presentation was given at the 2018 Iowa Water Conference.

Fish and habitat sampling has been completed for this project in the BRW. We are currently working through analyzing data and selecting models to accurately describe habitat and fish community associations of Topeka Shiners. Variable selection for any multivariate analysis is an important step when there are dozens of variables that could potentially describe variation between sites. Building random forests is a method that can be used to aid in variable selection. We have been working with random forests to aid in selecting which variables should be included in a multivariate logistic regression. The goal of logistic regression is to determine which variables are significantly different between sites with Topeka Shiners and sites without Topeka Shiners and to what extent.

Asian Carp population evaluation along the invasion edge in the Upper Mississippi River
Aaron J. Matthews

Silver Carp (*Hypophthalmichthys molotrix*) and Bighead Carp (*H. nobilis*), collectively Asian carp, are invasive species spreading throughout the Upper Mississippi River Basin (UMRB). Like many invasive species, Asian carp have negative economic and ecological impacts. The Upper Mississippi River (UMR) is divided by a series of lock and dams, creating lotic habitat below dams followed by pooled, lentic habitat before the next dam. Pooled sections of the UMR limit reproductive success and inhibit expansion. Despite the lack of optimal reproductive habitat within the UMR, tributaries of the UMRB contain stretches of free-flowing, unimpounded sections where reproduction has been documented in the Des Moines, Iowa and Skunk rivers. Adult densities within the UMR bordering Iowa are highest below Lock and Dam 19 (LD 19) near Keokuk. Although presence above LD 19 is not uncommon, abundance decreases progressively upstream. The objectives of this project are to (1) evaluate stock-recruitment trends present within the UMR where both adult stock and recruits have been sampled (Des Moines, Skunk, and Iowa Rivers) and (2) to assess accuracy of random forest models previously constructed to identify fish species based on egg morphometrics within the UMRB. Sampling was conducted from April to September in 2016 and 2017 every ten days. Larvae and eggs were collected with icthyoplankton nets in backwater, channel border and thalweg habitats. Biotic and abiotic samples taken include chlorophyll *a*, zooplankton, and discharge from United States Geological Survey and Army Corps of Engineers river gauges. Results from this project will help provide a better understanding of where Asian carp are reproducing along the invasion front, in addition to egg and larval abundance in order to better inform management practices.

Prey selection and dynamics of native larval fish in the Upper Mississippi River across a gradient of Bigheaded carp density
Nathan A. Tillotson

Aquatic systems are particularly susceptible to biological invasions due to their high level of connectivity and use by humans for recreational and commercial activities. In recent years, Silver Carp (*Hypophthalmichthys* molitrix) and Bighead Carp (*H. nobilis*) have established themselves throughout the Mississippi River basin, and become one of the most recognizable invasive species in North America. Collectively referred to as Bigheaded carps, these invasive fish are planktivorous and have strong potential to compete with native adult planktivores and all larval stages of fish within the Mississippi River. Bigheaded carp have reduced/altered plankton communities in some systems, and even caused reduced condition in adult Bigmouth Buffalo and Gizzard Shad. However, there is no evidence so far linking Bigheaded carp feeding strategies to competitive relationships with larval fish. In larval fish, growth rates and prey selection are two important factors affecting mortality and year-class strength. Within the Upper Mississippi River, the invasion front of Bigheaded carp falls along the southeast border of Iowa, USA. The goals of this study are to investigate the dynamics of larval growth rates, prey selection, gut fullness, and timing of exogenous feeding of two important forage fish taxa (*Dorosoma cepedianum* and *Lepomis macrochirus*) in relation to the gradient of Bigheaded carp population density along the invasion front. Adult Bigheaded carp, native larval fish, and plankton community data were collected from various sites along the invasion front in the UMR from 2014 – 2018. These data will be used to identify site-specific density gradients of adult Bigheaded carp, construct size-specific prey selection electivity indices given available food data, and compare larval characteristics of exogenous feeding *D. cepedianum* and *L. macrochirus* across the Bigheaded carp density gradient. Further understanding of potential alterations in larval fish prey selection and resulting effects on growth and survival in southeast Iowa is needed to provide evidence of a

suspected competitive relationship, and eventually result in the improvement of fish management strategies in the UMR.

Using Fish Habitat Assessments to Inform Conservation Goals for Prairie Streams
Contact: Jeff Kopaska, 515-432-2823 X109, Jeff.Kopaska@dnr.iowa.gov

Iowa's current conditions in regard to water quality are influenced by Iowa's production landscape. Iowa has one of the most altered landscapes in the world, transitioning from less than 40% of its land in row crop agriculture prior to 1940, to ~75% of acres in row crop production consistently since the 1980s. Historical records of water quality, water quantity and stream conditions exist back to the 1800s in some cases. These historical conditions provide a frame of reference regarding what was, and the National Fish Habitat Plan provides a currents assessment of the condition of Iowa's rivers and streams. Utilizing this information is necessary to appropriately frame current perspectives and discussions of what future conditions could become. Prairie restoration efforts in Iowa indicate that historic water quality conditions can be achieved today, thus the past is very insightful in this regard. Future conditions should not be solely determined by what is viewed as technologically achievable, but also what is ecologically appropriate.
More information can be found in the following publication: Kopaska, J. 2018. Fish Habitat in Iowa's Streams. PP 28-30. In Corey, H., Brown, L., and Wright, J. (eds.) Getting Into Soil and Water 2018. Iowa Water Center. Ames, IA.

Aquatic Invasive Species (AIS) in Iowa Rivers and Streams
Contact: Kim Bogenschutz, 515-432-2823 ext. 103, kim.bogenshutz@dnr.iowa.gov

Zebra mussel abundance and distribution expanded greatly in the Missouri River bordering Iowa in 2017. The rivers and streams in Iowa where zebra mussels have been documented include the following: Mississippi River, Winnebago River, Shell Rock River, Cedar River, Iowa River, Missouri River, Little Sioux River.

Bighead Carp and Silver Carp have been reported in increasing numbers throughout the Mississippi and Missouri Rivers and their tributaries in Iowa since the mid-2000s. DNR-AIS staff surveyed Bighead Carp, Silver Carp, and Grass Carp in the Des Moines, Skunk, Cedar, Iowa, and Maquoketa Rivers in 2017 to monitor the upstream advance of their populations and to monitor for evidence of reproduction. DNR-AIS staff also continued to monitor the condition of Bigmouth Buffalo in areas of the Des Moines River with and without Bighead and Silver Carp to determine the impacts of Asian carp on this native planktivore. An Asian carp research project at Iowa State University (ISU) funded by DNR-AIS and the U.S. Fish and Wildlife Service began in 2013 and will continue through 2018. The project is evaluating Asian carp population characteristics, dynamics, and reproduction in the Mississippi, Des Moines, Skunk, Iowa, Cedar, Rock, and Maquoketa Rivers. Egg, larval, and adult Asian carp were captured each year from 2014 through 2016 in the Cedar, Iowa, Skunk, Des Moines and Mississippi rivers. Data from 2017 has not been analyzed to date. Bighead, Silver, and Grass Carp reproduction had not been documented in Iowa prior to the study.

Due to the identification of New Zealand mudsnails in Black Earth Creek in Wisconsin in 2013, seasonal employees began interviewing Iowa trout stream anglers in 2014. Natural Resources Aides for the Decorah and Manchester areas conducted 380 interviews on 30 trout streams in 2017. Only 50% of those anglers were familiar with AIS or knew about the AIS Law, and only 23% were familiar with New Zealand mudsnails, which are a prohibited AIS in Iowa.

Iowa Stream Biological Assessment – 2017/2018

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https://programs.iowadnr.gov/bionet/Docs/About

The Iowa Department of Natural Resources Water Quality Monitoring and Assessment Section (DNR-WQMA) and the State Hygienic Laboratory (SHL) Limnology Section continue gathering benthic macroinvertebrate, fish assemblage and stream habitat data throughout the State to assess the biological condition of Iowa's rivers and streams in accordance with Federal Clean Water Act monitoring and reporting requirements. The bioassessment program currently has five primary focus areas: 1) status and trend monitoring; 2) reference (benchmark) biological criteria development; 3) random site survey sampling; 4) impaired stream assessment; and 5) nutrient criteria development.

Status and Trend Monitoring

Status and trend monitoring continues according to a four-year rotational schedule established for approximately 100 warm water ***wadeable stream reference sites***. In 2017, 35 sites from the FY17 and FY18 contracts were sampled due to poor sampling conditions in 2016. In 2018, 24 wadeable stream reference sites are scheduled to be sampled. In the next few years, the current population of wadeable reference sites, along with other sites that have been sampled historically, will be reviewed to see if changes (additions and/or subtractions) need to be made to the wadeable reference site population.

Status and trend monitoring continues according to a four-year rotational schedule established for 16 ***coldwater stream reference and candidate reference sites.*** The Iowa coldwater reference site network is sampled on a four year rotation with three or four sites sampled annually. In 2017, three CW reference sites were sampled and four sites are planned for 2018. A report on the ***coldwater stream benthic macroinvertebrate IBI (CBI)*** is available on the web at http://publications.iowa.gov/21843/.

Biological Trend Sampling

In 2016, the Iowa DNR chose nine reference sites (seven WW and two CW) to be sampled annually for fish, benthic macroinvertebrates and physical habitat. Also in 2016, equipment was installed at the nine biological trend sites to record continuous water and air temperature and stream stage. These sites will be part of EPA Region VII's Regional Monitoring Network (RMN). The biological trend sampling will continue at the same nine sites for the foreseeable future.

Reference condition development

The focus of ***reference condition development*** work continued/continues on candidate reference sites representing ***small (headwater) warm water perennial streams***. More intensive sampling was conducted from 2013-2017 on headwater streams than occurred

in the past. The DNR WQMA has begun the process of analyzing all the HW data and developing fish and macroinvertebrate IBIs for HW streams.

The DNR Bioassessment program is also continuing to work on the development of a **non-wadeable river benthic macroinvertebrate IBI**. Benthic macroinvertebrate samples were collected in non-wadeable rivers across the state at both existing and new sites in 2012-2016. In 2017, a four-year rotational schedule of sampling 15 ambient monthly WQ sites annually (60 total sites) began. In 2017, 14 ambient WQ sites were sampled (one site was cancelled due to flooding) and sampling at 16 sites is planned for 2018.

Random survey sampling
Beginning in 2017, DNR-WQMA began a new random survey. The survey involves sampling 150 total sites in a five year period. The breakdown of sites includes sampling 15 repeat REMAP (2002-2006) sites/year for 5 years (75 total sites) and also sampling 15 new random sites (REMAP2) sites/year for 5 years (75 total sites). In 2017, 14 repeat REMAP sites and 12 REMAP2 sites were sampled. In 2018, the goal is to sample 16 repeat REMAP sites and 18 REMAP2 sites to get back on schedule.

Impaired stream assessment
Historically intensive water quality monitoring and bioassessments were completed as part of the ***Stressor Identification (SI)*** process. Due to budgetary constraints, future SI monitoring and development is on hold.

In 2017, no fish assemblage sampling was conducted in stream segments needing ***status updates*** following ***fishkill events*** that occurred several years ago resulting in Section 303(d) impairment listings for aquatic life uses.

Nutrient criteria development
Sampling and analysis of benthic macroinvertebrate, fish and water quality data continues to be done to support the development and evaluation of ***nutrient criteria*** for the protection of ***stream aquatic communities***. The current work is focusing on collecting and analyzing data for nutrient stressor and response parameters including nitrogen, phosphorus, benthic and sestonic algal chlorophyll A, and diel dissolved oxygen flux. Biological, nutrient and other WQ data were collected at three sites in 2017 and the nutrient sampling is planned at three sites in 2018.

Stream habitat indicators
Physical habitat characteristics such as stream width, depth, instream cover, and substrate composition are important environmental factors that shape Iowa's stream fish species assemblages. The DNR's stream biological assessment program collects physical habitat data to help interpret fish assemblage sampling results in order to assess stream health condition and the attainment status of designated aquatic life uses. In 2015, a study was completed from which quantitative habitat indicators and interpretative guidelines were developed for specific applications within the stream bioassessment program. These tools might also be useful to natural resource managers for purposes such as stream habitat

improvement prioritization, goal-setting, and performance assessment. The final report is available at http://publications.iowa.gov/id/eprint/21408.

Online Fish, Benthic Macroinvertebrate, Habitat and Water Quality Data

BioNet, the Iowa bioassessment ***internet database*** **(**https://programs.iowadnr.gov/bionet/**)**, is online and it stores and provides public access to data from the Iowa DNR's stream bioassessment program. BioNet summarizes sampling data for benthic macroinvertebrates, fish, and stream habitat from 1994 to the present and also links to both water quality data collected at the sites and the assessments developed for the sites. BioNet is also the new repository for stream fish sampling data collected by the Fisheries Bureau of the Iowa DNR. BioNet is continually updated and improved.

Interior Rivers Research

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Response of Fish and Habitat to Stream Rehabilitation Practices in Iowa

Stream habitat is a key factor influencing the health of stream fish populations. Iowa's river and stream fish resources have been greatly impacted by habitat degradation. Concerned with the continued degradation of river and stream habitats and fisheries, Iowa resource managers are interested in using stream rehabilitation practices to effectively improve these resources. This study began in 2010 to evaluate Iowa river and stream rehabilitation practices and develop management guidelines to improve river and stream habitat as well as fishing opportunities for Iowa anglers.

The first project being evaluated is the modification of the Vernon Springs Dam on the Turkey River at Cresco. The dam was converted into a series of rock arch rapids in late July 2010 to address safety and fish passage concerns. Pre-construction fish community and habitat sampling was done at three sites above the dam and two sites below. Over 3,900 game and non-game fish were marked below the dam to monitor fish movement over the new structure. Fish community and habitat sampling was also done at three sites on the Volga River to serve as control sites for the three upstream sites on the Turkey River. Post-construction sampling upstream of the project found 16 Black Redhorse, 11 Golden Redhorse, 3 Walleye, and 1 Northern Hog Sucker that moved upstream over the structure. Smallmouth Bass and Black Redhorse were sampled post-construction above the dam at sites on the Turkey River and N. Branch Turkey River where they were not found pre-construction.

Pre-project fish and habitat data were collected in 2012 and 2013 for a dam removal on the Shell Rock River in Rockford. The dam was removed in the winter of 2014 and three years of post-project sampling have been completed. Golden Redhorse and Northern Hog Sucker were collected for the first time at sites above the dam in 2014, and increasing numbers of these species were found upstream in 2015 and 2017. Channel Catfish numbers also increased at sites above the former dam.

A whitewater park and habitat improvement project was completed in spring 2015 at the site of the Marion Street Dam on the Maquoketa River in Manchester. Pre-project fish and habitat sampling was done at sites upstream and downstream of the dam in 2012-2014. Over 8,700 fish of 19 species were marked downstream of the dam to monitor fish movement over the new structures. Sampling in 2015-2017 found 348 marked fish representing 9 species that had moved upstream over the structures. Continued monitoring of these projects and investigations of

additional stream rehabilitation projects will help guide future decisions and lead to improved methods, designs, and sharing of resources to improve Iowa's river and stream fisheries.

Angler Response to Stream Rehabilitation Practices in Iowa

Interest in modifying and removing aging, low head dams on Iowa's interior rivers has increased over the past several years. This interest is driven by safety/liability concerns, deterioration of existing dams, and a desire to increase river recreation opportunities. Areas below dams are often popular fishing locations. A common concern is that dam removal or modification projects will negatively impact angling, particularly below the dam. The impact of dam removal or modification on angling has not been studied in Iowa and minimal information is available from other states. A recent whitewater park and habitat improvement project on the Maquoketa River in Manchester provided an opportunity to quantify the impacts of a dam removal project on angler use, catch, and harvest. The project, completed in spring 2015, involved removing the dam and building six structures to create whitewater features while also allowing fish to pass upstream. A roving angler survey was conducted from April-October for three years before and three years after project construction. Total fishing effort (angler hours) was variable ranging from 4,232-6,797 pre-project and 3,770-7,597 post-project, and mean total fishing effort was similar before (5,267) and after (5,180) project construction. Mean overall angler catch rates (number/hour) were also similar before (1.47) and after (1.64) project construction, and varied annually from 1.14-1.95 pre-project and 0.92-2.56 post-project. By quantifying the impacts of this project on anglers, this study provides information that will help managers address angler concerns and increase fisheries benefits of future projects.

Evaluating Interior River Fingerling Walleye Stocking Strategies

Walleye fingerling stocking has greatly increased Iowa's interior river walleye populations over the last 20 years. This has resulted in an increasingly popular fishery that has brought walleye fishing opportunities close to home for many Iowa anglers. The success of this program has also increased demand for two inch long, Mississippi River strain walleye fingerlings. Limited hatchery capacity has made it difficult to consistently produce enough fingerlings of the size and genetic strain requested for the program. Providing information needed to more efficiently utilize our limited hatchery production capacity and exploring the potential of alternative fish culture systems in meeting the demands of the river walleye program is the focus of this study.

Available pond culture space has been a limiting factor for producing Mississippi River strain fingerling walleye to stock in interior rivers. Recent research at the Rathbun Fish Culture Research Facility has shown promising results raising walleye fingerlings using an alternative

method, intensive fry culture. Intensively reared walleye fry are stocked into recirculating tanks and trained on formulated feed from day 1 post-hatch, instead of stocking them into ponds where they feed on zooplankton (extensive culture). Evaluating the relative contribution of intensively reared fingerlings to interior river walleye fisheries will determine whether this production method could help further improve river walleye fisheries.

Study sites were selected on four Iowa rivers to evaluate the relative contribution of intensively reared walleye fingerlings to interior river Walleye populations. Extensively reared fingerlings were marked, hauled, and stocked alongside intensively reared fingerlings to serve as a control. Walleye fingerlings produced by this culture method are known to survive and contribute to river walleye fisheries if river conditions are favorable. Intensively cultured walleye fingerlings were marked with a circle freeze brand and extensively cultured fish were marked with a bar brand. Between 44,000 and 57,500 marked intensively and extensively cultured walleye fingerlings were stocked annually in the Wapsipinicon, Maquoketa, and Cedar rivers during June 2015-2017, and in the Shell Rock River in June 2016. Study sites were sampled in late-September and October each year to determine survival and growth of walleye fingerlings. Preliminary results indicate that intensively reared fingerlings contribute to interior river walleye populations at a lower rate than extensively reared fingerlings. Intensively reared fingerlings have accounted for 20% or less of branded young-of-year fish sampled during fall at most sites during most years. River conditions were not conducive to survival of walleye fingerlings raised by either culture method in some rivers each year. We will continue to mark and stock walleye fingerlings raised by each culture method and monitor their survival and growth. The resulting information will guide production and stocking decisions for walleye fingerlings that will provide the greatest benefits for sustaining and improving walleye fisheries in Iowa rivers.

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Habitat Improvement
Several meetings, conference calls, and data collection trips occurred during 2017 for the Huron Island HREP as work continued with the Project Delivery Team (PDT) from the Rock Island District of the USACE. Huron Island is a backwater complex in Pool 18 of the Mississippi River. The project is designed to raise the topographic diversity on a portion of Huron Island to provide improved habitat for mast producing trees. Dredging has been completed in some of the backwater habitat to provide enhanced overwintering opportunity for lentic fish species. Dredge spoil was used to create a berm around the project area to reduce the amount of flow coming into the dredge areas during high-water events (Figure 1). The berm will also create topographic diversity for planting of mast producing trees like oaks. Part of the project is also designed to provide shoreline protection to some of the small islands within Huron Chute. Future project components include planting trees and submersed aquatic vegetation. With the creation of the berm, woody structure was removed from the shoreline during construction. Fairport staff worked with USACE staff and Andy Robbins (IA DNR Wildlife Biologist) to mitigate this removal by adding woody structure as fish habitat. This habitat feature will place seven clusters of 3 trees anchored perpendicular to the shore. The tree top/branches will extend out into the deeper dredge cuts for fish habitat. The trees will also provide loafing areas to wood ducks and basking habitat for snakes and turtles. Trees for the project will come from tree removal on the island to facilitate planting mast producing trees. The project is currently in phase two: clearing and grubbing of trees, reshaping the berm, placing trees for fish habitat, and rock placement.

Figure 1. Photo of the tree clearing and berm in the Huron Island project area

Walleye and Sauger Surveys

Night electrofishing for walleye and sauger was completed October 9-12th and 23-26th. Due to poor weather, we were only able to sample 4 nights during that 2 week period. Electrofishing was completed in Pool 16 (October 9th, 12th, and 25th) and in Pool 18 (October 11th). Pool 18 electrofishing was halted for this year after only one day due to high water levels and the resulting low catch rates. We hope to try again next year to expand this valuable assessment to additional areas of our management district. We collected 140 walleyes and 220 saugers in Pool 16, equivalent to an overall CPUE of 29.5 and 46.3 fish/hr, respectively. The average electrofishing CPUE per hr since 2002 was 14.7 young-of-the-year (YOY) walleyes and 15.6 walleyes ≥ 10 in. In 2017, overall CPUE was lower than average for YOY walleyes (11.0 fish/hr) and higher than average for walleyes ≥ 10 in (18.5 fish/hr) (Table 1). CPUE for YOY walleye and walleyes ≥ 10 in are maintaining if not slightly increasing over time (Fig. 2). In 2017, YOY walleyes had an average length of 8.7 in and all walleyes caught ranged in length from 7.5-24.8 in.

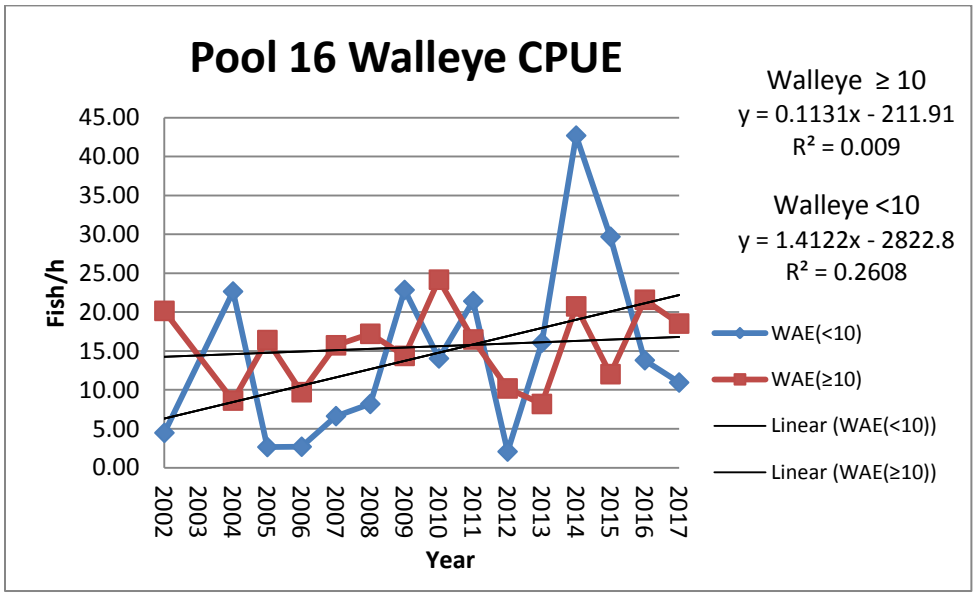

Figure 2. Pool 16 walleye catch per unit effort night electrofishing October 2002-2017

YOY saugers (<9 inches) and saugers ≥9 in had an overall CPUE of 35.0 and 11.4 fish/hr, respectively (Table 2). CPUE of YOY saugers has been increasing while CPUE of sauger ≥ 9 inches has been steady to slightly increasing (Fig.3). Since 2002, we have seen an average of 40.2 YOY saugers and 21.0 saugers ≥ 9 inches per hour of electrofishing. CPUE in 2017 was a lower than the long term average for both YOY saugers and saugers ≥9 in. YOY saugers had an average length of 7.7 inches and ranged in length from 5.9-18.5 inches.

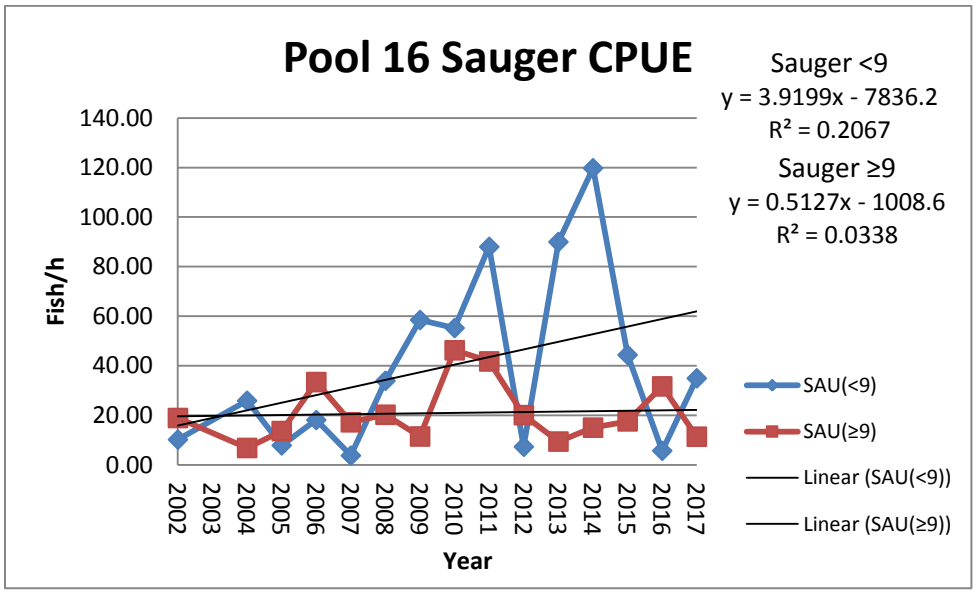

Figure 3. Pool 16 sauger catch per unit effort night electrofishing October 2002-2017.

Table 2. Pool 16 Walleye and Sauger Catch Per Unit Effort(fish/h) Night Electrofishing October 2002-2017

Year	WAE(<10)	WAE(≥10)	SAU(<9)	SAU(≥9)
2002	4.48	20.16	10.20	18.91
2004	22.65	8.63	25.88	6.83
2005	2.65	16.40	7.86	13.65
2006	2.69	9.70	18.10	33.43
2007	6.62	15.73	3.75	17.19
2008	8.19	17.21	33.93	20.24
2009	22.85	14.37	58.48	11.46
2010	14.04	24.17	55.24	46.27
2011	21.41	16.48	88.02	41.76
2012	2.07	10.18	7.31	20.07
2013	16.07	8.19	90.00	9.41
2014	42.69	20.73	119.76	15.02
2015	29.69	12.02	44.38	17.57
2016	13.81	21.59	5.69	31.68
2017	10.95	18.53	34.95	11.37
Average	14.72	15.61	40.24	20.99

Two out of 140 walleyes that were sampled had freeze brand marks on them originating from the Pool 14 Cordova Nuclear Plant stockings (Table 3). The two freeze branded fish had the "X" brand that originates from the 2014 Pool 14 stockings. Those fish were kept to remove otoliths and spines for Bellevue Fisheries Research Station's known age structure reference collection.

Table 3. Pool 16 Night Electrofishing Walleye Brands October 2002-2017

Year	Total Walleye	Walleye (<10 in.)	Walleye (≥10 in.)	Total Wae Branded	% Wae Branded	Total Age 0 Wae Branded	% Age 0 Wae Branded
2002	99	18	81	0	0.0	0	0.0
2004	87	63	24	4	4.6	1	1.6
2005	194	27	167	0	0.0	0	0.0
2006	152	33	119	0	0.0	0	0.0
2007	459	136	323	0	0.0	0	0.0
2008	369	119	250	0	0.0	0	0.0
2009	562	345	217	1	0.2	0	0.0
2010	526	191	335	9	1.7	2	1.1
2011	430	243	187	7	1.6	5	2.1
2012	166	28	138	2	1.2	0	0.0
2013	397	263	134	4	1.0	4	1.5
2014	777	523	254	9	1.2	6	1.2
2015	406	289	117	11	2.7	5	1.7
2016	305	119	186	6	2.0	2	1.7
2017	140	52	88	2	1.4	0	0.0

Bellevue LTRMP station

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Pool 13 - Fish Stuff:

Despite the weekly yo-yo's in water levels throughout the sampling periods, all 300 samples were completed on time. We collected a total of 21,134 fish of 67 species in 2017. We collected one new species of record for the year – pirate perch.

We also collected specimens of black buffalo, brown bullhead, northern hogsucker, pallid shiner, silver redhorse, silver lamprey, weed shiner, and western sand darter. The five most numerically abundant species collected in 2017 were bluegill, emerald shiner, mimic shiner, weed shiner, and spottail shiner. Species collected that have endangered or threatened status in Iowa included one redfin pickerel, three western sand darters and 1,854 weed shiners. No bighead, grass, or silver carp were collected within the pool in 2017, although silver carp were confirmed from commercial harvest.

Channel Catfish

Catch rates of channel catfish in our small hoop nets were poor this year – well below the twenty-four year median. Unusually high water levels throughout the sampling year may have been a contributing factor to the low catches of channel catfish in hoop nets this year. Channel catfish catches in 2009-2012 were also below average following excellent collections from 2006-2008.

Like last year, channel catfish had an another average spawning season in 2017 relative to the larger year classes of 2005, 2006, and 2010-2012. Tailwater trawling in Pool 13 for age-0 channel catfish (<4 inches) yielded 2.5 fish/haul which was equal to the twenty-five year median. The proportion of healthy, catchable-sized catfish (PSD and *Wr*) has remained fairly good over the last two-plus decades. Although size structure of fishes over 16" has been highly variable over time, the trend appears to be independent of body condition. That said, anglers and commercial harvesters should have another decent year of catfishing in 2017 in Pool 13.

Largemouth bass

The abundance and condition of largemouth bass populations in Pool 13 were once again very solid in 2017. The backwater day electrofishing catch rate of largemouth in 2017 (9.3 fish/15 min.) was slightly below the 24-year median catch, with peak catch rates occurring in 2011 and 2012. Abundance for the species has been somewhat variable over time, but has shown a steady increase over the last 24 years in Pool 13.

Trends in mean relative weight (*Wr*; fall 2000-2017) for largemouth bass in Pool 13 are graphed below. Mean *Wr* are calculated by Gabelhouse size categories of stock to quality, quality to preferred, and preferred to memorable lengths. There was decrease in mean *Wr* for all three size categories of largemouth bass compared to last year. Relative weight values continue to be well within accepted ranges for healthy bass populations and there appears to be no apparent detrimental effects of largemouth bass virus for this neck of the river. Recreational and tournament bass anglers here have been very pleased with the numbers of 2-3 pound fish for many years now.

Shovelnose sturgeon

Tailwater trawling catch rates were the second highest on record for shovelnose in 2017. Trawl yields for shovelnose sturgeon averaged 10.9 fish/haul, compared to the twenty-five year median of 2.7 fish/haul.

Collections of age-0 fish ($\leq$ 9 inches) attributed to 8% of the total sturgeon catch in our trawls in 2017. We have continued to see excellent recruitment of the strong 2011 year class over the last five to six years, although the spawns were on the lighter side from 2012-2014. Naturally, the annual recruitment of the 2011 year-class has been driving the increase of fish $\geq$ 15 over the last five years. Fish $\geq$ 25 inches contributed to 6% of the total catch in 2017.

Size structure trends (RSD 15, 20, and 25) in shovelnose sturgeon for the years 1993-2017 are as follows: (Note – Size structure for 1993 and 2006-2008 should be viewed with caution, because of small sample size: n < 30).

Pool 13 – Water Quality Stuff:
Standardized water quality monitoring was conducted at randomly selected sampling sites in Pool 13 and at fixed-site sampling in the mainstem and tributaries of Pools 12, 13, and 14 in 2017. Over 12,300 water quality observations were recorded using 20 parameters during this span. Annual long-term trend data from stratified random sampling collections in backwaters, impoundment, main channel, and side channels on Pool 13 from 1994-2016 (all periods; i.e., spring, summer, fall, and winter) indicates variable but flat trends of suspended solids, total nitrogen (one exception - winter), total phosphorus, and turbidity. The long-term trend of mean total nitrogen in all strata, (and especially the backwater stratum in winter) had been increasing over time from 2008-2011. Backwater mean total nitrogen peaked in 2011 and then in 2012 dramatically dropped to an all-time low. In 2016, total nitrogen in winter backwater samples spiked to a twenty-two year high. This large jump in total nitrogen may be partially attributed to a relatively mild winter. Area precipitation that is normally bound as snow in the winter months fell as rain. In turn, watershed run-off to Upper Mississippi River tributaries was unusually high, and Pool 13 river levels were atypically three to four feet higher than normal during these winter months.

Pool 13 - Vegetation Stuff:
Standardized aquatic vegetation monitoring was conducted at 450 sites randomly distributed within Pool 13 during 2017. Fourteen species of submersed vegetation and two species of rooted floating vegetation were sampled in 2017. No new species of aquatic vegetation were observed in 2017. Of the submersed plant species observed in Pool 13, six of the more prevalent species (coontail, curly-leaf pondweed, elodea, myriophyllum, sago pondweed, and vallsineria) were chosen to examine long-term abundance trends (abundance index) by stratum from 1998-2017. Abundance indices essentially measure the quantity of submersed species using presence or absence and the plant density rating in a given year. Coontail exhibited a long-term increase over time in all strata, but has been decreasing since 2011. Curly-leaf pondweed, Elodea and Myriophyllum abundance has been highly variable in backwaters and in the impounded portion of Pool 13. Trends for sago pondweed showed low variability in abundance from 1998-2006 in all strata, but has been somewhat variable since. Vallisneria has steadily increased abundance in the impounded portion of Pool 13 since 2002, but has been decreasing in abundance since 2013.

Also a summation of all submerged aquatic vegetation (SAV; pooled by year; abundance index) was examined, to get a general sense for broader vegetation trends in Pool 13 over the last twenty years. The overall trend in SAV has shown an increase in abundance from 2000-2012, with the main increase in SAV occurring from 2004-2012 and recent SAV abundance has curtailed since peaking in 2012.

Pool 12 HREP Stuff:
In late October and early November 2017, the Bellevue LTRM and Fisheries Research stations completed a twelfth year of electrofishing and fyke netting for the Pool 12 HREP fisheries evaluation. All data from 2017 has been entered and verified. We collected 3,723 fish of 28 species from the fyke netting segment of the study and 2,438 fish of 50 species from the electrofishing segment. One pallid shiner was documented from the pool-wide electrofishing segment, and one redfin (grass) pickerel was documented from the fyke netting segment. Six hundred-two bluegill were retained from the eight backwater fyke netting locations for aging and sexing in 2017, and we completed otolith extraction and sexing of bluegills in mid-November.

Data from aged bluegill were processed through a SAS script that randomly assigns ages to the unaged bluegill, so that we can obtain accurate age frequencies and mortality estimates for eight backwater lakes in 2017. We will be focusing on changes in the abundance, size structure, and condition in centrarchids among HREP backwaters in Pool 12 versus non-HREP Pool 12 backwaters (pre- versus post-HREP) with Pool 13 data serving as an overall point of control (a control for natural variation).