Iowa Chapter Report

March 29, 2016
Greg Gelwicks
Iowa DNR Fisheries Research

<u>Manchester Fisheries Management Station</u>

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<u>Hewett Creek (Clayton County)</u>

A herd of goats were experimentally used for the second consecutive year (2015) to manage riparian corridor vegetation along Hewett Creek in Ensign Hollow Wildlife Management Area. The goal of this project was to control problematic vegetation including willows, poison ivy, and wild parsnip that limit public use during summer months and provide attractive habitat for beaver. Goats provided by a contractor grazed vegetation on about 7 acres of the corridor during an 8-week period in late summer. No grazing is planned for 2016 as we evaluate long-term vegetation control and cost effectiveness of goat grazing as a riparian corridor management strategy.

<u>Maquoketa River (Delaware County)</u>

A whitewater project was completed at the Manchester Dam site on the Maquoketa River during spring 2015. This project was initiated by the City of Manchester through advocacy by a grass-roots organization of citizens interested in improving the aesthetics of the waterfront and stimulating business in downtown Manchester while providing additional recreational opportunities. A secondary benefit of this project was improved fishing access in-and-around the old dam site as well as fish passage improvement for native fish. Manchester Fish Management consulted with project coordinators and engineers regarding fishery benefits and fish passage design, as well as provided environmental review and on-site fish passage inspection during the construction phase. Evaluation of fishery aspects of this project are ongoing as part of a long-tern study being conducted by the DNR Rivers and Streams Research team. This project was completed at a cost of $1.8M funded through local contributions and multiple grants. Fish and Wildlife funds were not part of the funding mechanism.

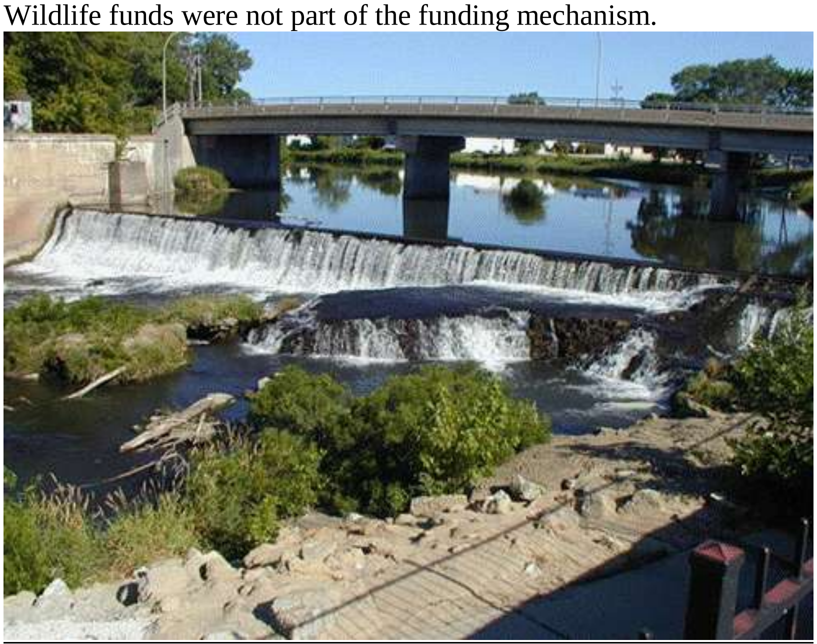

Figure 1. Manchester Dam prior to Whitewater Park construction

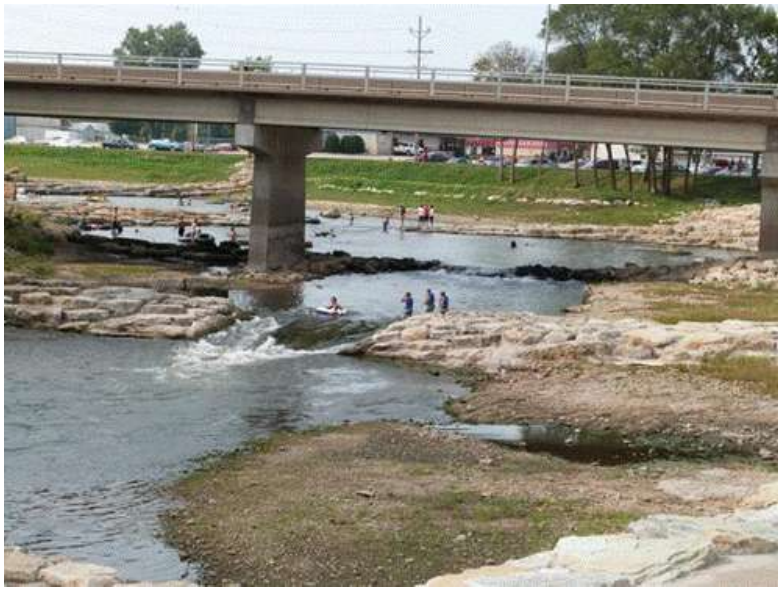

Figure 2. Manchester Dam following Whitewater Park construction

Buffalo Creek (Linn and Buchanan County)
Iowa DNR has partnered with Linn County CCB, US FWS, and a private consultant to address fish passage and safety issues at Coggon Dam on Buffalo Creek. A staged removal project commenced on Buffalo Creek at Coggon Iowa during early March 2016 with the removal of 3’ of dam. Plans for this staged removal are to allow for a flood event and to follow it with additional dam removal (twice). The dam structure was originally about 10’ high and will eventually be reduced to approximately 3’ high. After removal of the top 6-7’ feet of dam, a rock arch structure will be placed for grade control and fish passage.

Maquoketa River (Jones County)
Manchester Fisheries Management worked with Jones County CCB on planning and development of dam mitigation and fish passage at Mon-Maq Dam near Monticello. Preliminary design work and survey is currently underway with additional public engagement, design, and permitting work planned for 2016.

Boone Fisheries Management Station
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Boone Fisheries Management has been involved with a plan to delineate multi-use recreational water trails in central Iowa. Information on the effort can be found at: http://dmampo.org/water-trails/

River Restoration and Stream Mitigation

DNR is currently working with its partners to coordinate and improve river restoration efforts. To date, the DNR has developed a strategy, proposed a draft method for evaluating stream mitigation plans, and begun to assemble tools and techniques supporting river restoration. In addition, to make joint federal and state approval of stream mitigation projects more predictable and efficient, and to achieve long-lasting effective mitigations, the DNR has proposed modifications to Missouri's Stream Mitigation Method for use in Iowa. More information on these efforts can be found at: River Restoration

Iowa State University Research

Distribution and Population Dynamics of Asian Carp in Iowa Rivers
Carlos A. Camacho, Christopher J. Sullivan, Michael J. Weber, Clay L. Pierce

Invasive Silver Carp (*Hypophthalmichthys molotrix*) and Bighead Carp (*H. nobilis*; collectively called Asian Carp) are expanding throughout the Upper Mississippi River Basin (UMRB) and are of great concern due to their potential economic and ecological impacts. Pooled sections on the Upper Mississippi River associated with lock and dams may be poor habitats for reproduction and recruitment due to their lentic flow characteristics and perceived lack of adequate spawning habitat compared to more free-flowing unimpounded sections in the lower Mississippi River where evidence of reproduction has been documented. However, Iowa interior rivers connected to pooled sections of the Upper Mississippi River possess several requirements needed for successful spawning and observations of adults are becoming more prevalent. Unfortunately, little is known regarding the basic ecology and reproductive status of Asian Carp populations in these tributary systems. In order to properly make management decisions, information on reproductive success and factors that regulate populations must be understood. In this study, we evaluate 1) reproduction and recruitment patterns and 2) adult population characteristics and dynamics of Asian Carp in the Mississippi, Des Moines, Skunk, Iowa, and Cedar rivers in southeastern Iowa. Ichthyoplankton nets were used to capture 10,190 eggs and 38,868 age-0 fishes in 2014 and 5,929 eggs and 33,513 age-0 fishes in 2015 of unknown species from the Cedar, Iowa, Skunk, Des Moines and Mississippi rivers. In addition, 2,964 adult Asian Carp were collected from the Mississippi, Des Moines, Skunk, and Iowa rivers. Gonadosomatic index of female Silver Carp peaked in May 2014 and 2015 and were lowest in July during 2014 and August during 2015. Spawning females were not captured in 2014 but were captured from April to June in 2015. Post-spawn females were observed starting in June with 93% of females exhibiting spent gonads in July 2014 and were present in all months sampled in 2015. Egg densities peaked in late May and mid-June while age-0 fish densities were greatest during August in both years. Asian Carp eggs and age-0 fish were captured in the Skunk, Iowa, and Mississippi rivers in 2014. The highest densities of age-0 Asian Carp occurred within the tributaries and immediately downstream of each confluence with the Mississippi River. Adult Silver Carp were more numerous than Bighead Carp in all locations sampled. Catch rates of Silver Carp increased monthly during spring through fall, with low catch rates associated with high river flow in 2014 and 2015 as well as with low river flow in 2015. Asian Carp size and age structure varied among sites, with downstream sites having larger size and older age structures for Silver Carp and an opposing pattern for Bighead Carp. Additionally, Asian Carp growth rates varied among sites. Egg, larval, and adult samples will continue to be processed and additional data analysis will be conducted in 2016 to evaluate spatiotemporal patterns of reproduction and adult population characteristics.

Factors affecting mercury concentrations in Iowa fishes
Nathan T. Mills, Michael J. Weber, Clay L. Pierce, and Darcy Cashatt

Mercury contamination in aquatic ecosystems is a global concern due to the health risks of consuming contaminated aquatic organisms, particularly fishes. Mercury concentrations in fishes are highly variable and influenced by a range of biotic and abiotic variables. Currently, factors influencing mercury accumulation in Iowa fishes are not well understood. The Iowa Department of Natural Resources (IDNR) has issued fish consumption advisories for various lakes and river reaches throughout the state. However, relatively few systems, species, and individuals are sampled each year and little is known regarding factors affecting mercury concentrations in Iowa fishes. An understanding of factors regulating mercury concentrations in Iowa fishes would improve mercury monitoring programs and consumption guidelines. The objectives of this study are to (I) evaluate seasonal variation in mercury concentrations in largemouth bass (*Micropterus salmoides*) from two reservoirs to assess the need for temporally standardized mercury sampling and (II) evaluate the influence of a suite of biotic and abiotic factors on fish mercury concentrations in both river and lake systems. In collaboration with the IDNR, largemouth bass have been intensively sampled from Red Haw and Twelve Mile lakes to evaluate temporal variation in largemouth bass mercury concentrations. Additionally, bluegill (*Lepomis macrochirus*), white and black crappie (*Pomoxis annularis, P. nigromaculatus*), yellow perch (*Perca flavescens*), largemouth and smallmouth (*M. dolomieu*) bass, walleye (*Sander vitreus*), northern pike (*Esox lucius*), channel catfish (*Ictalurus punctatus*), and flathead catfish (*Pylodictis olivaris*) have been collected from 32 lakes and reservoirs and 12 rivers across Iowa and analyzed for mercury concentrations. Largemouth bass mercury concentrations varied across months in Red Haw Lake, with the highest concentrations observed during July, and the lowest concentrations observed during October. In contrast, largemouth bass mercury concentrations were similar across months in Twelve Mile Lake. Mercury concentrations of fishes in Iowa are generally low, with mercury concentrations <0.30 mg/kg for ~90% of fishes collected and mercury concentrations below detectable levels (<0.05 mg/kg) for ~40% of fishes. However, there were fishes collected that contained high mercury concentrations. The highest concentration detected in interior rivers was 0.86 mg/kg in a 17.6” smallmouth bass from the Upper Iowa River, nearly three-times the one-meal per week advisory limit. Exploratory analyses suggest mercury concentrations increase with fish length and indicate differences in mercury accumulation among interior river systems and reaches and fish species. For interior rivers, the highest mercury concentrations were generally found in large flathead catfish, smallmouth bass, and walleye. Multivariate models are being developed to evaluate the influence of regional (e.g., watershed area, land use), local (e.g., lake area, depth, water chemistry), and individual fish characteristics (e.g., length, age, sex) on mercury concentrations. Additional results from this study will provide a comprehensive understanding of the influence of various biotic and abiotic factors on mercury accumulation in fish from a broad range of aquatic systems. These results could then be used in the development of fish consumption advisories, standardized fish sampling protocols for long-term monitoring, and harvest regulations.

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. The graduate student, Nick Simpson, has been selected and plans are being made for the 2016 field season. Field work will commence in April 2016.

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 been selected and she has begun compiling species occurrence databases and GIS resources to guide planning for the 2016 field season. Database construction and analysis and landscape analysis will proceed in 2016.

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. The graduate student, Alex Bybel, has been selected and plans are being made for the 2016 field season. Field work will commence in April 2016.

Aquatic Invasive Species (AIS) in Iowa Rivers and Streams

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The Cedar and Iowa Rivers are influenced by the zebra mussel population in Clear Lake because the outlet of Clear Lake flows into Willow Creek and then to the Winnebago, Shell Rock, Cedar, and Iowa Rivers. Low densities of veligers and individual adults have been collected from each of those rivers during past sampling. The expanding population of zebra mussels in the Spirit/Okoboji chain of lakes has the potential to impact the Little Sioux River if veligers move downstream from Lower Gar Lake through Mill Creek during high water. A new zebra mussel infestation was discovered in Lake Cornelia in 2014 when DNR-AIS staff found veligers in water samples and individual adult zebra mussels in two locations around the lake. In 2015, a single veliger was found in a water sample, and no adults were found in the lake. The outlet of Lake Cornelia flows into White Fox Creek, which is a tributary to the Boone River. Monitoring will continue in 2016 in Lake Cornelia, White Fox Creek, and the Boone River to determine if zebra mussels are present in those systems.

Bighead Carp and Silver Carp have been reported in increasing numbers throughout the Mississippi and Missouri Rivers and tributaries in Iowa for over 10 years. A new location reported for Silver Carp in 2015 was in the Skunk River at Cedar Creek, above the Oakland Mills Dam. DNR-AIS staff assisted with Asian carp collection for an Iowa State University (ISU) research project funded by DNR-AIS that began in 2013. The project is evaluating Asian carp population characteristics, dynamics, and reproduction in the Mississippi, Des Moines, Skunk, Iowa, and Cedar Rivers. A summary of that study is provided under the Iowa State University Research section of this report. DNR-AIS staff also sampled for Bighead, Silver, and Grass Carp in the Des Moines, Iowa, Cedar, Maquoketa, Chariton, and Little Sioux Rivers in 2015. The highest densities continue to be observed below the Red Rock Dam on the Des Moines River and below the Rathbun Dam on the Chariton River. Larval and juvenile grass carp were collected in 2015 by DNR Fisheries staff and ISU researchers in the Iowa, Cedar, Skunk, and Mississippi Rivers.

Due to the identification of New Zealand mudsnails in Black Earth Creek in Wisconsin in 2013, an interview survey was developed for Iowa trout stream anglers in 2014. Natural Resources Aides for the Decorah and Manchester areas conducted 260 interviews on 30 trout streams during the summer of 2015. Only 16% of those anglers were familiar with New Zealand mudsnails, which are a prohibited AIS in Iowa.

Iowa Stream Biological Assessment – 2015/2016

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Iowa Department of Natural Resources, Water Quality Monitoring and Assessment Section, Stream Bioassessment Program. https://programs.iowadnr.gov/bionet/Docs/About

The Iowa Department of Natural Resources Water Quality Monitoring and Assessment Section (IDNR-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 four primary focus areas: 1) status and trend monitoring; 2) reference (benchmark) biological criteria development; 3) impaired stream assessment; and 4) nutrient criteria development.

Status and Trend Monitoring

Status and trend monitoring continues according to a five-year rotational schedule established for approximately 100 warm water ***wadeable stream reference sites***. In 2012-2014, the number of wadeable reference sites sampled was increased to approximately 30/year to try to catch up and get back on a five-year sampling rotation. In 2015, 21 warm water wadeable stream reference sites were sampled and in 2016 26 sites will 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 five-year rotational schedule established for 16 ***coldwater stream reference sites*** The Iowa coldwater reference site network is sampled on a five year rotation with four sites sampled annually. A report on the ***coldwater stream benthic macroinvertebrate IBI (CBI)*** has been finalized and is available on the web at http://publications.iowa.gov/21843/.

Reference condition development

The focus of ***reference condition development*** work continued/continues to be sampling candidate reference sites representing ***small (headwater) warm water perennial streams***. More intensive sampling was conducted in 2013-2015 on headwater streams than has occurred in the past and this sampling increase will occur again in 2016.

The IDNR 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 2012-2015. The non-wadeable BMIBI development will continue in 2016.

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 2015, fish assemblage sampling was conducted in five stream segments needing ***status updates*** following ***fishkill events*** that occurred several years ago resulting in Section 303(d) impairment listings for aquatic life uses. In 2016, IDNR WIS and WQMA sections plan on sampling 6-10 streams needing status updates due to fish kills.

In 2015, five potentially biologically impaired streams had verification sampling conducted to determine their status. In 2016, three potentially biologically impaired streams will have verification sampling conducted to determine their status.

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.

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

Interior Rivers Research

Contact: Greg Gelwicks, (563) 927-3276, gregory.gelwicks@dnr.iowa.gov

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 that effectively improve these resources. A new study began in 2010 to evaluate Iowa river and stream rehabilitation practices. This study will help develop management guidelines for use of stream rehabilitation practices 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 conducted at three sites above the dam and two sites below. Over 4,400 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 completed 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 detected 16 Black Redhorse, 11 Golden Redhorse, 3 Walleye, and 1 Northern Hog Sucker 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 was 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 two 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. . 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 conducted at sites upstream and downstream of the dam in 2012-2014. Over 4,200 fish of 18 species were marked downstream of the dam to monitor fish movement over the new structures. Sampling in 2015 found 98 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 allocation of resources for improving 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 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. The dam was removed and six structures were built to create whitewater features while also allowing fish to pass upstream. The project is expected to improve angler access and fish habitat at the site. A roving angler survey was initiated in April 2012 to collect pre-project data on angler use, catch, and harvest on the Maquoketa River upstream and downstream of the dam. Anglers were surveyed in April-October for three years before, and will be surveyed for three years after construction. During 2012-2014, total angler participation ranged from 4,232 to 6,797 angler hours/year. Smallmouth Bass, Common Carp, Walleye, Bluegill, Crappie, Suckers, and Channel Catfish were caught most frequently during this period. Post-project monitoring began in April 2015. During 2015, total angler participation was 4,181 angler hours/year, and Walleye, Smallmouth Bass, Rock Bass, and Suckers were caught most frequently.

Measuring the impacts of a dam modification or removal project in Iowa will provide information to help managers address angler concerns with future projects. This information may also help identify project features which benefit anglers that can be incorporated into 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 size and genetic strain requested for 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 a new 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 Mississippi River strain Walleye fingerlings using an alternative method, intensive fry 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 populations.

Study sites were selected on three 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. Nearly 44,000 marked intensively and extensively cultured walleye fingerlings were stocked in the Wapsipinicon, Maquoketa, and Cedar rivers during June 2015. Study sites were sampled during late-September to determine survival and growth of walleye fingerlings. This process will be repeated for several years. The resulting information will inform decision making for the production and stocking of Walleye fingerlings that will provide the greatest benefits for sustaining and improving Walleye fisheries in Iowa rivers.

Iowa DNR, Mississippi River Fish Research
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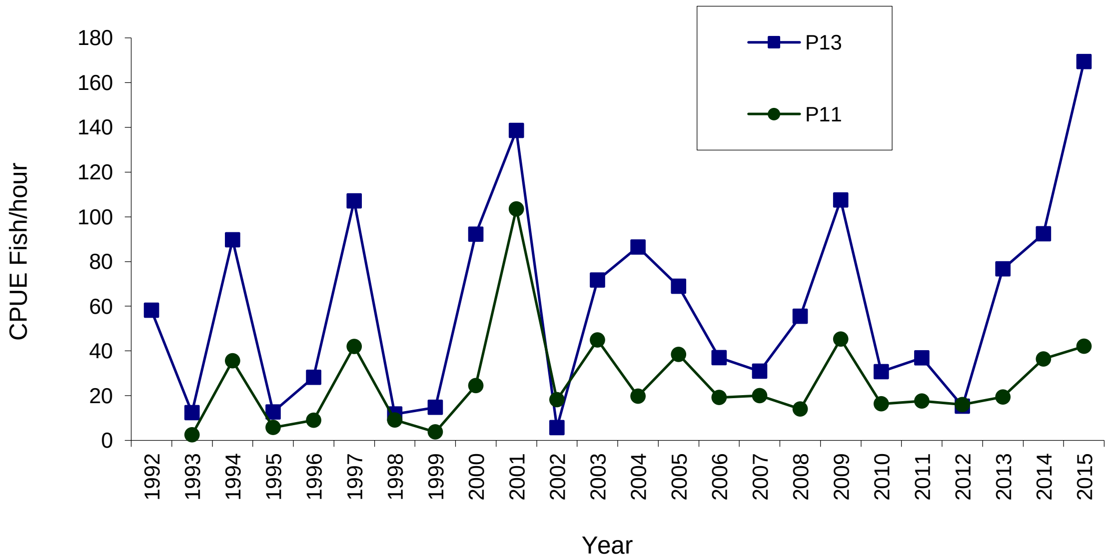
An evaluation of Walleye and Sauger populations and associated fisheries in Pools 11 and 13 of the Upper Mississippi River

This study was initiated to estimate abundance, length frequency, age structure, total mortality, and growth of Walleye and Sauger in Pools 11 and 13 of the Upper Mississippi River (UMR). Since 2004, this study has also included an evaluation of the 20–27 inch release slot harvest regulation for Walleye in Pools 12-20. This regulation was implemented in April 2004 to increase spawning stock and ultimately stabilize and increase recruitment.

Sampling for Walleye and Sauger in Pools 11 and 13 was conducted using pulsed DC electrofishing. Tailwater sampling was conducted at night in October 2015. A total of 8092 Walleye and Sauger were collected from Pools 11 and 13. Fall electrofishing catch rates during 2015 for Walleye and Sauger were 185.1 and 177.3 fish/hr in the Pool 13 tailwater and 52.5 and 61.5 fish/hr in Pool 11. CPUE for age 0 walleye (<10 inches) was 169.4 fish/hr. the highest observed in 24 years of sampling (Figure 1).

Figure 1. Fall tailwater electrofishing CPUE of age 0 Walleye (<10 inches) collected in Pools 11 and 13 in the UMR from 1992 to 2015**.**



2015 river levels were favorable in June through September for electrofishing walleyes on wing dams in each of the two pools. Length frequency histograms, indices of proportional size distribution (PSD) and satisfied walleye anglers indicate the 20-27 inch release slot regulation for Walleye has been successful in increasing the abundance and size structure of walleye in Pool 13. In upcoming years, this evaluation will focus on determining if these changes will translate into improved Walleye recruitment in the UMR.

An evaluation of the status, distribution, and habitats of Northern Pike in the Upper Mississippi River

Northern Pike *Esox luscious* provide a relatively important recreational fishery for Upper Mississippi River (UMR) anglers. Habitat use by Northern Pike in lakes has been well documented although little or no information exists on movement and seasonal habitat selection of Northern Pike in the UMR. In October of 2011 and 2012, 60 northern pike were collected using a combination of standard fyke nets and electrofishing from backwater complexes in Pool 10 and Pool 13 in the UMR. Northern pike were surgically implanted with radio transmitters. Northern Pike occupied 3 habitat strata, backwater lakes, side channels and the main channel border of the UMR. All Northern Pike in Pool 10 overwintered in habitat consistent with that observed for Centrarchid species. In Pool 13, many backwater lakes are too shallow and degraded by sedimentation for overwintering fish. In Pool 13, some radio tagged Northern Pike overwintered in side channel habitats and sought out areas of much lower flow than was utilized during open water portions of the year. This research will help guide future backwater habitat restoration projects on the UMR. Field work and data collection is complete for the Northern Pike project and we are in the analysis and completion report phase.

Assessment of Iowa's Shovelnose Sturgeon sport fisheries

Job 1. Standard sampling protocols for Shovelnose Sturgeon.
Efficiency and size selectivity of boat electrofishing, drifted trammel netting, and trawling were assessed on the Cedar River during annual Shovelnose Sturgeon (*Scaphirhynchus platorynchus*) sampling 4-5 May 2015. Boat electrofishing units traveled downstream occasionally varying their speed in relation to current. Pedal time was recorded for each electrofishing run. Trammel nets were 100-ft in length by 6-ft deep with ½-inch Foamcore float lines and 30-lb. Leadcore lead lines. Outer wallings were constructed of number 9 multifilament nylon and were 6-ft deep with 12-in bar mesh. Inner wallings were constructed of number 139 multifilament nylon and were 8-ft deep (hobbled to 6-ft) with 2-in bar mesh. Wooden mules were attached to the ends of nets while drifting to pull them downstream and help prevent them from closing. Trammel nets were set perpendicular to flow and allowed to drift downstream. Time and distance of each drift was recorded with a watch and GPS unit. Trawling was conducted with a modified (Missouri) trawl (Herzog et al. 2005) by personnel from the Missouri Department of Conservation and Southeast Missouri State University who were experts with the gear. Trawls were deployed and pulled in a downstream direction, typically for three minutes, but time was recorded for each trawl. All captured fish were enumerated and measured to the nearest 0.1-inch fork length (FL), weighed to the nearest gram, and tagged on a pectoral fin with an individually numbered Monel bird wing tag (Model 1000-3). Sex of each fish was recorded as female (flowing eggs or obvious distended abdomen with large black stripe), male (flowing milt), or unknown.

Mean fork length (FL) of Shovelnose Sturgeon captured with trammel nets was significantly larger than those captured with electrofishing or trawling, which did not differ (ANOVA; $F = 16.09$; $df = 2, 1,936$; $p <0.0001$; Tukey). Efficiency of each gear was compared by dividing the number of Shovelnose Sturgeon captured by each gear type by the number of boat days the gear was utilized (i.e. three electrofishing boats sampling for two days = 6 boat days). Electrofishing crews captured on average 38 and 39 more Shovelnose Sturgeon per sampling day than crews trawling or drifting trammel nets, respectively (Table 1). The percentage of female, male, and unknown sex Shovelnose Sturgeon captured in each gear was significantly different ($\chi^2 = 100.5$; d.f. = 4; $p <0.0001$). Trammel netting captured a higher percentage of female and a lower percentage of unknown sex Shovelnose Sturgeon than electrofishing. Percent of catch identified as male was identical for both gears. Trawling captured the lowest percentage of female and male sturgeon and the highest percentage of unknown sex fish. We will continue to evaluate gears in future segments and this information will be used to develop standard sampling protocols for Shovelnose Sturgeon.

Table 1. Sample size, mean length (in), standard error, size range, effort, and catch per boat per day of Shovelnose Sturgeon captured via electrofishing, drifted trammel net, and modified (Missouri) trawl on the Cedar River, May 4-5, 2015.

Gear	EF	Trawl	TN
N	1,316	270	353
Mean (in)	23.3	23.5	24.1
SE	0.062	0.146	0.126
Min (in)	9.3	13.2	13.9
Max (in)	32.7	30.2	31.7
Boat Days	6.0	1.5	2.0
Catch/day	226	188	187

Evaluation of Mississippi River habitat restoration projects

It is widely accepted among fisheries managers that availability of suitable overwintering habitat is a limiting factor for centrarchids in the Upper Mississippi River (UMR). Lock and dam construction in the 1930's greatly increased total aquatic area of the UMR and provided deep backwater areas favorable to centrarchid populations; however, sediment deposition in backwaters has reduced the quantity of deepwater lentic habitats. Recent fish telemetry studies found that centrarchids travel short distances (< 3 miles) to reach suitable overwintering backwater areas with low current velocities, water depth > 1 m, water temperatures 1-3° C warmer than the main channel, and adequate dissolved oxygen levels (Pitlo 1992; Gent et al. 1995; Knights et al. 1995; Steuck 2010). As the post-impoundment UMR ages and backwater sedimentation continues, these areas will be less common and centrarchid abundance will likely decline.

The Water Resources Development Act of 1986 created the U.S. Army Corps of Engineers' Upper Mississippi River Restoration – Environmental Management Program (UMRR-EMP) Program and its two components, the Long Term Resource Monitoring Program (LTRMP) and Habitat Rehabilitation and Enhancement Projects (HREP). The Iowa Department of Natural Resources works collaboratively as part of the partnership of state and federal agencies that make up the UMRR-EMP. Creation of the HREP component provided river managers with a means for restoring river habitat and multiple HREPs have specifically focused on mitigating effects of backwater sedimentation through sediment dredging, restoration of aquatic connections between backwater and channel areas, and installing control structures that allow introduction of oxygen-rich channel water into backwaters areas during periods of hypoxia.

The Pool 12 Overwintering HREP will involve rehabilitation and enhancement of four overwintering areas in Pool 12, UMR: Kehough Slough, and Stone, Sunfish, and Tippy lakes. Construction of Phase I, Sunfish Lake is nearing completion and construction on Phase II, Stone and Tippy lakes, is scheduled to begin in 2016. Pre-construction monitoring was initiated in 2006 to assess temporal changes in fish abundance, physical condition, and biomass at three spatial scales: 1) the individual contiguous backwater scale, 2) contiguous backwater aquatic areas scale (all backwaters within a pool), and 3) navigation pool scale (all aquatic area within a pool).

In order to study centrarchid winter habitat use and spring dispersal patterns from overwintering lakes, 150 crappie *spp.* were radio transmittered in three backwater lakes in Pool 12, Upper Mississippi River: Greens, Stone, and Tippy lakes (Figure 1). Two of these lakes, Stone and Tippy, are scheduled to be rehabilitated as part of the Pool 12 Overwintering Stage II Habitat Rehabilitation and Enhancement Project (HREP) with construction scheduled to begin in 2016.

Fifty crappie *spp.* were transmittered in each backwater starting in mid-November 2014 after water temperatures had fallen below 10° C following methods of Steuck (2010). Centrarchids generally begin moving into overwintering areas when water temperatures drop below 10° C (Steuck 2010), so fish captured within a known overwintering backwater at this time will presumably remain there through winter. Advance Telemetry Systems (ATS) Model F2210 radio transmitters were attached to dorsal spines using stainless steel suture following methods described by Steuck (2010). Transmitters had separate radio and battery components that were connected by flexible wire so that each component could be placed on either side of the dorsal spines to evenly distribute transmitter weight. During 10-14 November 2014, 77 crappie *spp.* were captured with a combination of electrofishing and fyke netting before ice formed on backwaters. The remaining 73 tags were placed on fish captured by angling and under ice gill netting or electrofishing in March at ice out before fish began migrating out of backwater lakes.

Fish were tracked intensively starting on 16 December 2014 and will be tracked through Fall 2015. Each backwater lake and surrounding areas were searched every two weeks. By stratifying the year into two-week segments and attempting to locate every fish within each two-week period. During open water periods, GPS coordinates, dissolved oxygen, temperature, depth, secchi, and flow were measured at each fish location. During winter, GPS coordinates were recorded at each fish location and four fixed water quality sites were monitored for surface and bottom temperature and dissolved oxygen, secchi, flow, and ice and snow depths. Twelve tracking periods occurred during Segment 19 with 1,289 individual fish locations. Fish were located an average of 8.6 periods (range 0-12).

This research will yield a greater understanding of how many, and at what interval, overwintering areas are required in a pool to maintain healthy centrarchid populations, and this information will aid river managers in setting quantitative objectives for overwintering habitat restoration needs at the pool and ultimately reach scale. We will also address landscape pattern themes by looking at how landscape features around overwintering backwaters affect the utilization distribution of centrarchids, which will also aid in future project designs and site selections. We hope to broaden our understanding of the habitat requirements and preferences of centrarchids not only during critical winter months, but year-round. Data obtained during this study will also be used for future post-construction assessments of habitat use changes at Stone and Tippy lakes.

Bellevue LTRMP station

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Pool 13 - Fish Stuff:

Aside from working in high water levels in June and July, all 300 samples were completed on time. We collected a total of 44,298 fish in 2015, and the number of species observed this year was 69.

One new species of record to report for the year was crystal darter. Three crystal darters were collected at two sites in Pool 13 in 2015. Much like the pallid shiners of last year, the sudden appearance of this species may be partially explained by downstream dispersions due to extreme and prolonged high water levels in the spring and summer of 2014 in the northern Upper Mississippi River (UMR) watersheds. With the addition of the crystal darter, the number of species we've collected in Pool 13 is 90 since 1989.

We also collected specimens of black buffalo, blue sucker, brown bullhead, chestnut lamprey, golden and silver redhorse, Mississippi silvery minnow, pallid shiner, silver lamprey, weed shiner, and western sand darter in 2015. The five most numerically abundant species collected in 2015 were common carp (we hit a mother-load of them in a mini-fyke – over 20,000), mimic shiner, emerald shiner, bluegill, and river shiner. Species collected that have endangered or threatened status in Iowa included one chestnut lamprey, two western sand darters, and 234 weed shiners. No bighead, grass, or silver carp were observed or collected within the pool in 2015.

The following are a few examples of long-term abundance trends of selected Pool 13 fishes from 1993-2015.

Channel catfish

Catch rates of channel catfish in our small hoop nets were poor to fair this year, right about at the twenty-two year median. Channel catfish catches in 2009-2012 were also below average following excellent collections from 2006-2008.

The proportion of healthy, catchable-sized catfish (PSD and *Wr*) has remained fairly good over the last few years however. 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 2016 in Pool 13. Channel catfish had an average spawning season in 2015 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 4.0 fish/haul compared to the twenty-three year median of 3.0 fish/haul.

Crappie *spp.*

Catches of black and white crappie in Pool 13 backwater fyke nets had been sub-par from 2007-2011. Both black and white crappie abundances in 2015 were lower than in 2014, and both species were also well below the long-term median in 2015.

Largemouth bass

The abundance and condition of largemouth bass populations in Pool 13 were once again very solid in 2015. The backwater day electrofishing catch rate of largemouth in 2015 (16.6 fish/15 min.) was well above the 22-year median catch, with peak catch rates occurring in 2011 and 2012. There was a nominal decrease in mean *Wr* for all three size categories of largemouth bass compared to last year. However, *Wr* 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 very good for shovelnose in 2015. Trawl yields for shovelnose sturgeon averaged 6.0 fish/haul, and this was well above the twenty-three year median of 2.3 fish/haul.

Collections of age-0 fish ($\leq$ 9 inches) attributed to 11% of the total sturgeon catch in our trawls in 2015. We've seen excellent recruitment of the strong 2011 year class for the last four; however the spawn was toward 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 three years, and fish $\geq$ 25 inches contributed to 2% of the total catch in 2015.

Yellow perch

Last year, we thought it would be of interest to examine the age, growth, and mortality of yellow perch in Pools 12 and 13. Subsequently, we set additional fyke nets and ran extra electrofishing runs in selected backwaters in October to supplement base LTRMP collections of yellow perch in the fall of 2015. Fisheries staff kept 159 yellow perch for aging (otoliths) and sexing (gonads), and we collected an additional 427 fish that were randomly assigned ages from our aged fish. The vast majority of these unaged fish were assigned as age-0 fish. Age-0 yellow perch were fully recruited to electrofishing in the fall, but they were not fully recruited to our fyke nets. Unsurprisingly, once our river perch hit ten inches or so, they start turning into little footballs (that's a Pitlo saying that has stuck with me through the years) like many yellow perch populations in the Upper Midwest.

The un-weighted catch-curve regression analysis of age's 1-5 fish resulted in an estimate of 65% total annual mortality. Though female yellow perch were consistently longer than males of the same ages, we found no significant differences among length at age between the sexes based on the empirical data of 159 fish (paired *t*-tests; $\alpha = 0.05$). We did find some size specific differences in mean *Wr* between sexes, (Gabelhouse categorical, paired *t*-tests; $\alpha = 0.05$). Stock-quality sized males were a bit more fit than their counterpart females, and the opposite was true in quality-preferred length fish. It also appears that *Wr* increases in females as they grow longer, but not so much so for male yellow perch.

The growth curve estimate of theoretical maximum length of yellow perch (von Bertalanffy - sexes combined) is roughly 387 mm or about 15.2 inches. Although the upper and lower 95% confidence limits at age are a little wide (the product of the variation in length at age between the sexes), I feel pretty good about that estimate considering we collected very few preferred-length (and greater) fish. Plus, the fairly recent Iowa state record for yellow perch (a 16 inch teeter-pig) came from Pool 12 in 2012.

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 2015. 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 1994-2014 (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; Figure 1.1) 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. A possible explanation for lower nitrogen levels in the winter may be related to reduced ice depths and shorter duration of ice cover. In 2013, mean total nitrogen sharply rose and it was equivalent to the median of 2.4 mg/L. In 2014 total nitrogen rose again and it was near the 90^{th} percentile for the 20-year period.

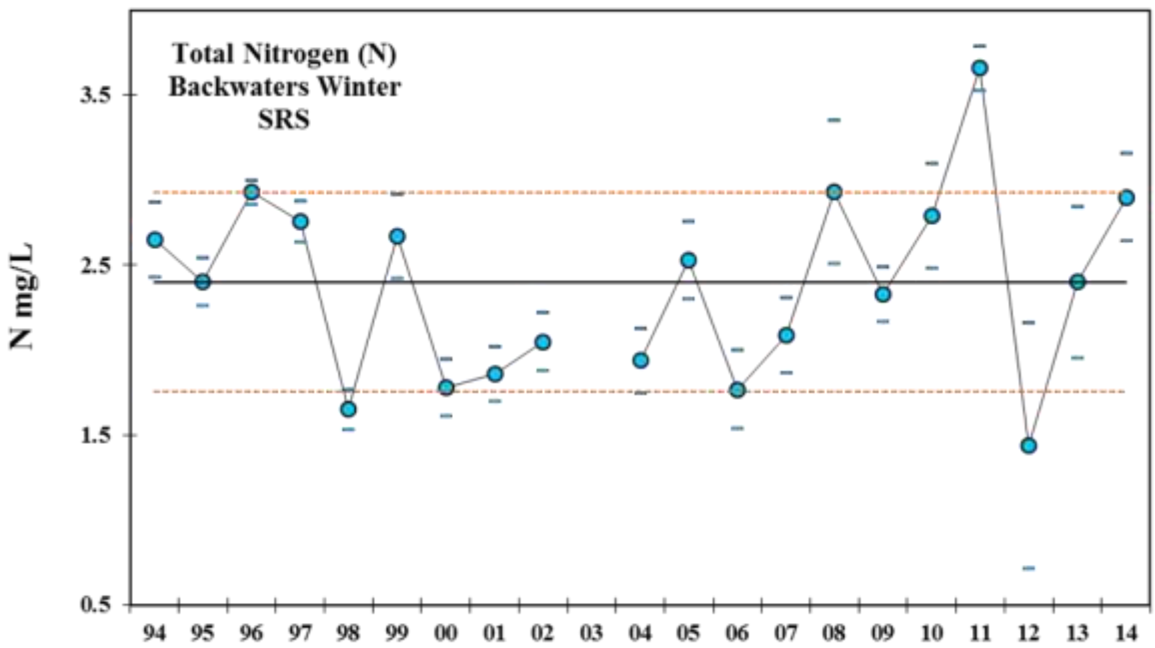

Figure 1.1. Twenty-year trends in mean total nitrogen (mg/L; circles, ± 1 standard error) in winter stratified random sampling of backwaters in Pool 13 from 1994-2014. A twenty year median is expressed as a solid line with 10% and 90% percentiles (dashed lines) around median.

Pool 13 - Vegetation Stuff:
Standardized aquatic vegetation monitoring was conducted at 450 sites randomly distributed within Pool 13 during 2015. Fifteen species of submersed vegetation and two species of rooted floating vegetation were sampled in 2015. No new species of aquatic vegetation were observed in 2015. Of the submersed plant species observed in Pool 13, six 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 1998-2014*.

Coontail exhibited a long-term increase in abundance over time in all strata, but has been decreasing since 2011. Curly-leaf pondweed has been highly variable from year to year in backwaters, but has shown an increase in abundance since 2004. Elodea and myriophyllum abundances have 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 have been somewhat more variable since. Vallisneria has increased steadily in abundance since 1998 in all strata, and has especially increased in the impounded portion of Pool 13.

Pool 12 HREP Stuff:
In late October and early November 2015, the Bellevue LTRMP and Fisheries Research stations completed a tenth year of electrofishing and fyke netting for the Pool 12 HREP fisheries evaluation. All data from 2015 has been entered and verified. We collected 3,453 fish of 22 species from the fyke netting segment of the study and 3,133 fish of 45 species from the electrofishing segment. Forty-three pallid shiners were documented from the pool-wide electrofishing segment in backwater, impounded, and side channel strata. Nine hundred twenty-five bluegills were retained from the eight backwater fyke netting locations for aging and sexing in 2015, 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 2015. 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).