PUBLIC REVIEW DRAFT – FOR PUBLIC COMMENT

The Pecatonica River Targeted Water Quality Assessment of Non-wadable Waters

A Water Quality Monitoring Report by the Bureau of Water Quality to Restore and Protect Wisconsin's Waters.

Lafayette and Green Counties
WBICs = 889100 and 897800

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Southern District, Wisconsin DNR
February, 2016

Pecatonica River at HWY, 2015.
Photo by James Amrhein, Southern District Water Quality Biologist, DNR.

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Water Quality Monitoring and Planning

This Water Quality Monitoring Report was created under the state's Water Resources Monitoring and Planning Programs. The report reflects water quality program priorities and Water Resources Monitoring Strategy 2015-2020 and fulfills Wisconsin's Areawide Water Quality Management Plan requirements under Section 208 of the Clean Water Act. Condition information and resource management recommendations support and guide program priorities for the planning area.

This WQM Monitoring Report is approved by the Wisconsin DNR and is a formal update to the Sugar Pecatonica River Basin Plan and Wisconsin's statewide Areawide Water Quality Management Plan (AWQM Plan). This plan will be forwarded to USEPA for certification as a formal update to Wisconsin's AWQM Plan.

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Abbreviations

DNR: **Department of Natural Resources.** Wisconsin Department of Natural Resources is an agency of the State of Wisconsin created to preserve, protect, manage, and support natural resources.

FIBI: **Fish Index of biological integrity (Fish IBI).** An Index of Biological Integrity (IBI) is a scientific tool used to gauge water condition based on biological data. Results indicate condition and provide insight into potential degradation sources. In Wisconsin, specific fish IBI tools are developed for specific natural communities. Biologists review and confirm the natural community to use the correct fish IBI tool.

HUC: **Hydrologic Unit Code.** A HUC is a code that represents nested hydrologic watersheds delineated by a multiple agencies at the federal and state level including USGS, USFS, and Wisconsin DNR.

MIBI: **Macroinvertebrate Index of biological integrity.** In Wisconsin, the MIBI, or macroinvertebrate Index of biological integrity, was developed to assess macroinvertebrate community condition.

Monitoring Seq. No. Monitoring sequence number refers to a unique identification code generated by the Surface Water Integrated Monitoring System (SWIMS), which holds much of the state's water quality monitoring data except for fisheries taxonomy and habitat data.

NC: Natural Community. A system of categorizing water based on inherent physical, hydrologic, and biological components. Streams and Lakes have uniquely derived systems that result in specific natural community designations for each lake and river segment in the state. These designations dictate the appropriate assessment tools which improves the condition result, reflecting detailed nuances reflecting the modeling and analysis work foundational to the assessment systems.

MDM: Maximum Daily Averages – maximum daily average is a calculated metric that may be used for temperature, dissolved oxygen and related chemistry parameters to characterize water condition.

mg/L: milligrams per liter - a volumetric measure typically used in chemistry analysis characterizations.

Monitoring Seq. No. Monitoring Sequence Number refers to a unique identification code generated by the Surface Water Integrated Monitoring System (SWIMS), which holds much of the state's water quality monitoring data.

ND: No detection – a term used typically in analytical settings to identify when a parameter or chemical constituent was not present at levels higher than the limit of detection.

SWIMS ID. Surface Water Integrated Monitoring System (SWIMS) identification number is the unique monitoring station identification number for the location of monitoring data.

TP: Total Phosphorus - an analyzed chemical parameter collected in aquatic systems frequently positively correlated with excess productivity and eutrophication in many of Wisconsin's waters.

TSS: Total suspended solids – an analyzed physical parameter collected in aquatic systems that is frequently positively correlated with excess productivity, reduced water clarity, reduced dissolved oxygen and degraded biological communities.

WATERS ID. The Waterbody Assessment, Tracking, and Electronic Reporting System Identification Code. The WATERS ID is a unique numerical sequence number assigned by the WATERS system, also known as "Assessment Unit ID code." This code is used to identify unique stream segments or lakes assessed and stored in the WATERS system.

WBIC: Water Body Identification Code. WDNR's unique identification codes assigned to water features in the state. The lines and information allow the user to execute spatial and tabular queries about the data, make maps, and perform flow analysis and network traces.

WQC: Water quality criteria – a component of Wisconsin's water quality standards that provide numerical endpoints for specific chemical, physical, and biological constituents.

Introduction

The Pecatonica River and East Branch Pecatonica Rivers drain nearly 1000 square miles of Iowa, Lafayette, and Green counties in south central Wisconsin. The two branches flow south from the Military Ridge in central Iowa County. The Pecatonica River, sometimes referred to as "West Branch Pecatonica River" flows southeastward 63 miles where it is joined by the 41 mile long East Branch Pecatonica River 2 miles east of South Wayne at the Lafayette-Green county border. This mainstem then flows into Green County and another 12 miles to the Illinois border near Martintown. From there the Pecatonica flows south, then east another 92 miles until it joins the Rock River at Rockton, IL (WDNR, 2003).

For purposes of clarity in this report, the Pecatonica River upstream of the confluence with the East Branch will be referred to as the ***West Branch Pecatonica*** and ***the entirety of the Pecatonica River and East Branch Pecatonica will be referred to as the "Pecatonica River system."*** The West Branch Pecatonica River and mainstem flow unobstructed from the headwaters to the confluence with the Rock River – a total of nearly 170 miles. Dams in Argyle and Blanchardville are barriers on the East Branch.

About the Watershed

Overall, agriculture is the predominant land use in the Pecatonica River basin, making up 62 percent of the land use. Another 13 percent is in grassland or pasture and 22 percent in woodland. The land use of the West Branch Pecatonica River is more agricultural than the East Branch with agriculture making up 70% vs 53%, respectively. Wetlands, while lacking overall in the watershed, make up a greater percentage in the East Branch watershed than the West Branch watershed (1.6% vs 0.74%).

The department's current monitoring of lotic systems generally focuses on wadable resources within smaller management units (HUC 10 or 12). As such, larger systems with non-wadable sections tend to be overlooked, but can be a major indicator of ecosystem health on a much larger scale - HUC 8 or "basins". These larger systems also provide the habitat and forage for larger fish species, as well as serving as a source of species recruitment to tributaries, a conduit for fish movement, and a refuge for certain species during winter and/or low water years. Several rare species, such as the gravel chub, silver chub, black buffalo, and slender madtom have historically been reported in the Pecatonica system.

The upper 25 miles of the West Branch Pecatonica upstream of CTH G is considered wadable, as is the upper portion of the East Branch, two miles upstream of Blanchardville at Horseshoe Bend Road. As shown in Figure 1, the Wisconsin Streams Model (Lyons, 2008) shows the East Branch Pecatonica River to be a cold water system at its headwaters. It then transitions to cool-cold system down to Blanchardville. From Blanchardville to Argyle, the model predicts the river to be a cool-warm mainstem. Downstream of Argyle, the model portends the system to be a large river. Similarly, the West Branch Pecatonica begins as a cool transitional system from the headwaters downstream to Darlington. Downstream of Darlington to just west of South Wayne, the model shows the river to be a warm mainstem. Downstream from that point, and downstream of the confluence of the two branches, the model defines the system as a large river.

Monitoring Study

Purpose

The purpose of this study was to conduct a contemporary survey on the non-wadable portions of the Pecatonica River system which includes both water chemistry and biological indicators to determine the health of the system.

Methods

There are certain sections of the West Branch Pecatonica below Darlington and the East Branch downstream of Blanchardville that are wadable; however, these are truncated by long sections that are not wadable. Therefore, the most efficient and consistent way to sample the fishery assemblage of the system was to use the sampling protocol developed by Lyons, et. al. (2001) for sampling large, warmwater rivers.

To summarize, a pulsed-DC "miniboom" electrofishing unit was used to sample 1 mile (1600 meter) stations either upstream or downstream of 8 points of the Pecatonica system (Figure 2). Three sites were sampled on the West Branch and East Branch respectively, and 2 points were surveyed downstream of the confluence of the two branches on the mainstem. There was no scientific reason behind these points other than they provided an access large enough to launch the shocker boat and to obtain relatively uniform sampling

Figure 1: Natural Communities of the Pecatonica River System

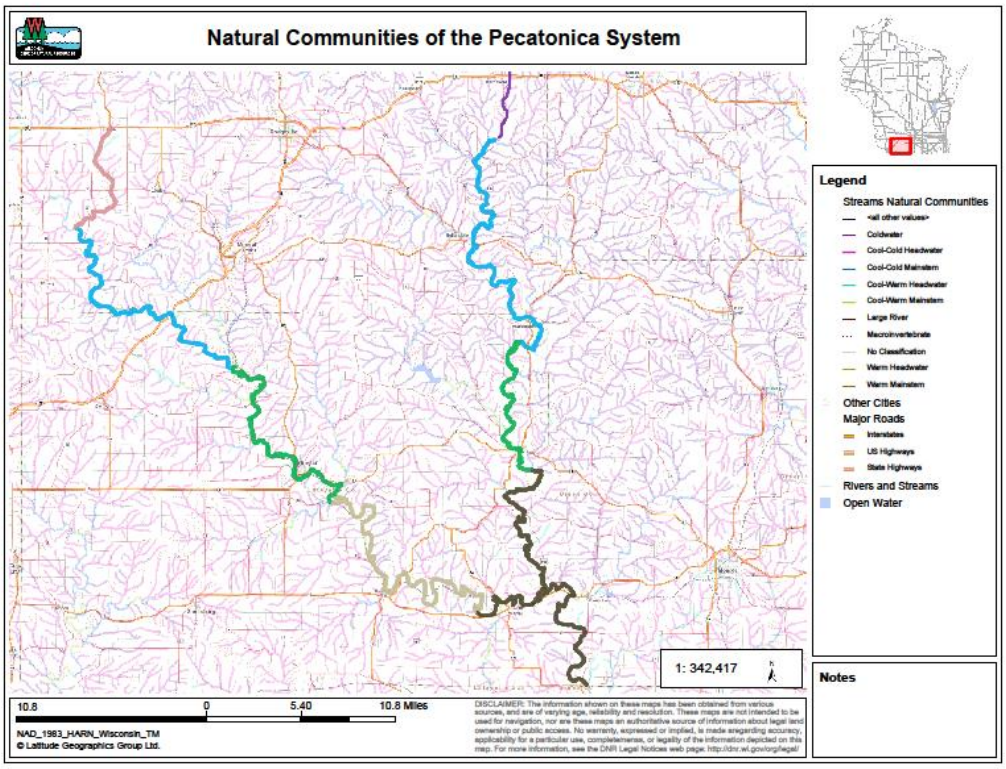
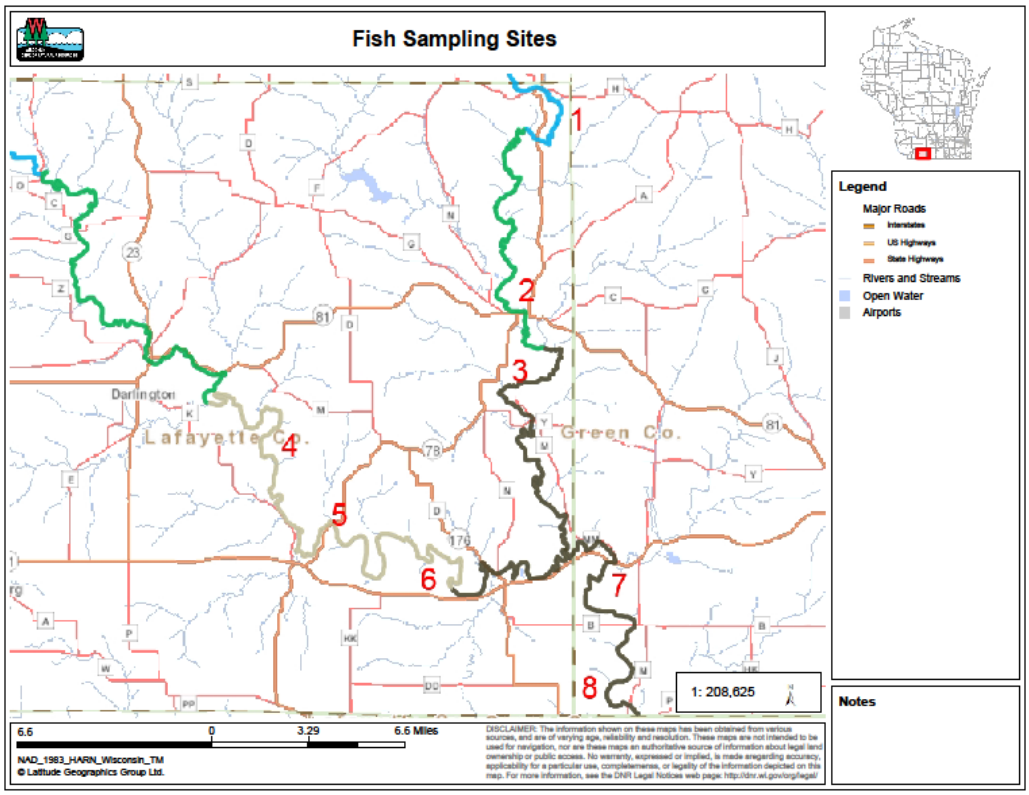


Figure 2: Pecatonica River System 2015 Fish Sampling Sites



Site Selection and Study Design

Monitoring study sites included: 1) East Branch at Blanchardville; 2) East Branch at Argyle; 3) East Branch at Blackhawk Park; 4) West Branch at Walnut Road; 5) West Branch at STH 78; 6) West Branch at Sargent Road; 7) Mainstem at STH 11; 8) Mainstem at CTH M (Martintown). Distances between sites over the length of the non-wadable sections of river. The only area not sampled was upstream of Darlington in an 8 mile stretch that is likely deemed non-wadable.

The individual surveys were always conducted in a downstream direction, with emphasis on sampling main channel border habitats in close proximity to the shoreline and generally consistent with the thalweg. The surveys were conducted between August 12th and August 17th, 2015. River flows for that sampling period (USGS, 2015) were below the 75 year median daily statistic when compared to USGS flow gauging stations located on the East Branch at Blanchardville, the West Branch at Darlington, and the mainstem at Martintown (See Appendix A).

Fish Collection

During sampling, 1 person stationed in the front of the boat used a 3/16-inch dip net in an attempt to capture all fish observed. All captured fish were identified. Game and panfish species were measured and weighed individually. Nongame fish were counted and weighed in aggregate by species.

Fish Habitat

At each site, qualitative notes on average stream width and depth, riparian buffers and land use, evidence of sedimentation, fish cover and potential management options were also recorded. A qualitative habitat survey (Simonson, et. al., 1994) for streams greater than 10 meters wide was also performed at each site. It should be noted this qualitative habitat assessment is more appropriate for wadable streams, but for the purposes of this study, was used for comparison of sites relative to one another.

Water Chemistry

In addition to the fisheries surveys, water chemistry samples were collected on a monthly basis during the growing season (May through October) by volunteers and analyzed for total phosphorus. Water samples were taken at the pour point of the HUC 10 watersheds in the system: at Walnut Road and at CTH D north of South Wayne on the West Branch, and at a footbridge in Blanchardville and at Cisserville Road on the East Branch. Additionally, the department conducts monthly monitoring of water chemistry on the mainstem at CTH M in Martintown.

Macroinvertebrate Sampling

To better understand the relationship between total phosphorus concentrations and its impacts on biota, macroinvertebrate samples were also collected at these sites. The macroinvertebrate samples were collected by hanging Hester Dendy type from cement blocks at 5 sites on the system according to Weigel and Dimick (2011). The samplers were collected after a minimum of 6 weeks of deployment.

Results

A total of 27 fish species were collected during the surveys (Table 1). Eleven of these species were collected in total numbers of a half dozen or less. Shorthead redhorse, silver redhorse, and bigmouth buffalo were the most commonly collected species and were the only species found at all 8 of the sampled sites. Smallmouth bass were the most commonly found game species, followed closely by walleye and then northern pike. Muskellunge, flathead, and channel catfish were the other sportfish species encountered. Common shiner, emerald shiner, and spotfin shiners were the most commonly found minnow species, although not consistently from site-to-site. Species diversity varied from 9 to 19 species. The lowest diversity and total number of fish were collected upstream of the Argyle dam on the East Branch and on the mainstem downstream of STH 11.

The large river index of biotic integrity (IBI) developed in Lyons, et. al. (2001) was calculated for all sites (Table 2). Total biomass ranged from approximately 71 kg on the mainstem at CTH M to 127 kg on the East Branch at Blackhawk Park (See Appendix B). The majority of the biomass was made up of the weight of the bigmouth buffalo, common carp, and silver redhorse or shorthead redhorse. Total IBI scores and rating ranged from 55 or “fair” to 85 or “excellent”.

Table 1. Summary of the Fisheries Data for the 2015 Pecatonica River System Non-wadable Survey
*Size range in inches

	(West Branch) <---Upstream Downstream-->			East Branch <---Upstream Downstream-->			Mainstem		Total per
Species	Walnut Rd	STH 78	Sargent Rd	Blanchardville	STH 81 - Argyle	Blackhawk Park	STH 11	Martintown	species
Bigmouth Buffalo	9	9	11	9	23	24	17	5	107
Bigmouth Shiner							1		1
Blackside Darter		1							1
Bluegill (Size range)						1 (3.7)		1 (4.3)	2
Bluntnose Minnow				4					4
Channel Catfish (Size range)	1 (18.9)	3 (12.4-16.3)				1 (11.9)		2 (12.0-17.9)	7
Common Carp	5	10	16		3	10	12	19	75
Common Shiner	10	22	6		3	8	11	8	68
Emerald Shiner	50	1						1	52
Flathead Catfish (Size range)		1 (7.9)				1 (10.6)		1 (7.0)	3
Freshwater Drum	6	1	1			2			10
Gizzard Shad						15			15
Golden Redhorse	17		1	12					30
Golden Shiner					4	1		1	6
Highfin Carpsucker						1			1
Hornyhead Chub				4				2	6
Muskellunge (Size range)		2 (38.8-42.0)							2
Northern Hog Sucker	1			1					2
Northern Pike (Size range)	2 (19.4-22.4)		2 (13.2-22.6)	3 (18.4-22.0)		3 (16.7-19.7)		2 (24.5-25.7)	12
Quillback	1	2			1	19	4	6	33
Shorthead Redhorse	54	11	11	19	1	22	7	16	141
Silver Redhorse	31	23	11	21	15	14	8	2	125
Slenderhead Darter								1	1
Smallmouth Bass (Size range)	3 (5.0-9.8)	2 (8.6-10.4)	1 (8.6)	7 (4.7-16.3)	2 (11.6-12.5)	1 (10.1)		1 (10.5)	17
Spotfin Shiner	3	18	11		4		7	6	49
Walleye (Size range)	1 (13.4)			5 (13.5-18.9)		4 (15.7-26.9)		6 (14.3-18.2)	16
White Sucker	3			9			1	2	15
Total # of Species	16	14	19	11	9	16	9	18	
Total # of Fish	197	106	71	94	56	127	68	82	

The number of intolerant species varied from 0 to 2, with smallmouth bass being the most commonly encountered intolerant species found at most sites. The number of sucker species ranged from 3 (fair) to 7 (good) and were represented most often by bigmouth buffalo, shorthead redhorse and silver redhorse with quillback, golden redhorse, white sucker, and highfin carpsucker also being reported. Numbers of riverine species varied from 2 (poor) to 5 (fair) with most sites in the "poor" range. The individual metrics of WPUE (weight per unit effort), percent riverine species, and percent DELT (disease, erosions, lesions, and tumors) were "good" for all sites.

Table 2. Large River Index of Biotic Integrity for the 2015 Pecatonica River Sites

	(West Branch)			East Branch			Mainstem	
	<---Upstream		Downstream-->	<---Upstream		Downstream-->		
Metric	**Walnut Rd**	**STH 78**	**Sargent Rd**	**Blanchardville**	**STH 81 - Argyle**	**Blackhawk Park**	**STH 11**	**Martintown**
WPUE	95,500 (10)	59,177 (10)	38,827 (10)	76,864 (10)	86,432 (10)	105,914 (10)	56,458 (10)	39,370 (10)
Native spp	15 (5)	13 (5)	9 (0)	11 (0)	8 (0)	15 (5)	8 (0)	17 (10)
Sucker spp	7 (10)	3 (5)	3 (5)	6 (10)	4 (5)	5 (10)	4 (5)	5 (10)
Intolerant spp	2 (5)	2 (5)	1 (0)	2 (5)	1 (0)	2 (5)	0 (0)	2 (5)
Riverine spp	5 (5)	4 (0)	3 (0)	2 (0)	3 (0)	2 (0)	4 (0)	5 (5)
% Riverine (n)	27 (10)	42 (10)	32 (10)	40 (10)	36 (10)	27 (10)	29 (10)	21 (10)
% Lithophils (n)	85 (10)	55 (10)	41 (10)	71 (10)	34 (5)	38 (5)	40 (5)	44 (10)
% Insectivores (wt)	85 (10)	21 (5)	48 (10)	77 (10)	85 (10)	54 (10)	68 (10)	21 (5)
% Round suckers (wt)	60 (10)	29 (10)	18 (5)	48 (10)	23 (5)	12 (5)	21 (5)	21 (5)
% DELT	0 (10)	0 (10)	0 (10)	0 (10)	0 (10)	0 (10)	0 (10)	0 (10)
Total	85	70	60	75	55	70	55	80
	Metric scores: 0 = Poor; 5 = Fair; 10 = Good							
	Total score: 0-20 = Very Poor; 21-39 = Poor; 40-59 = Fair; 60-79 = Good; ≥ 80 = Excellent							

Qualitative habitat analysis (Table 3) showed the overall scores were similar and ranged from 36 to 54, all of which were in the "fair" rating. The mean stream width with was approximately 10 meters on the East Branch at Blanchardville, but generally 20 to 30 meters at the other sites. The habitat rating was buoyed by the maximum thalweg depth and fish cover scores. Overall, the system lacked rocky substrate (percent of substrate that is particle size of gravel or larger) and riffles or bends. Streambank erosion varied from fair to good.

Table 3. Qualitative Habitat Assessment of the Pecatonica River Sites

Pecatonica River Station Name	Stream Width (m)	Bank Stability Score	Maximum Thalweg Depth Score	Bend to Bend Riffle to Riffle Score	Rocky Substrate Score	Fish Cover Score	Qualitative Habitat Score	Qualitative Habitat Rating
(West Branch) Walnut Road	20	4 (Fair)	16 (Good)	0 (Poor)	0 (Poor)	16 (Good)	36	Fair
(West Branch) STH 78	21	4 (Fair)	16 (Good)	4 (Fair)	8 (Fair)	16 (Good)	48	Fair
(West Branch) Sargent Road	25	4 (Fair)	25 (Excellent)	0 (Poor)	0 (Poor)	25 (Excellent)	54	Fair
East Branch - Blanchardville	10	4 (Fair)	16 (Good)	8 (Good)	8 (Fair)	16 (Good)	52	Fair
East Branch - Upstream Argyle	25	8 (Good)	25 (Excellent)	4 (Fair)	0 (Poor)	8 (Fair)	45	Fair
East Branch - Blackhawk Park	20	8 (Good)	16 (Good)	4 (Fair)	0 (Poor)	16 (Good)	44	Fair
Mainstem - STH 11	25	8 (Good)	25 (Excellent)	0 (Poor)	0 (Poor)	8 (Fair)	41	Fair
Mainstem - Martintown	30	4 (Fair)	16 (Good)	0 (Poor)	8 (Fair)	16 (Good)	44	Fair

Total phosphorus samples showed all samples to be above the 0.1 mg/l criteria for phosphorus (WDNR, 2014) except for the October samples where 2 of the 5 sites were less than 0.1 mg/l (Table 4). Concentrations generally varied between 0.15 and 0.25 mg/l at all sites throughout the season and the median was similar amongst the sites. There were several exceptionally high individual samples in May, June, and September, but it was not immediately clear as to the cause.

Table 4: Phosphorus Results (mg/l) from the Pecatonica Watersheds

	East Branch		West Branch		Mainstem
Date	Blanchardville	Cisserville Rd	Walnut Rd	CTH D	CTH M
May-2015	0.14	0.16	0.18	0.42	0.15
Jun-2015	0.23	0.18	0.26	0.25	0.44
Jul-2015	0.15	0.15	0.15	0.19	0.18
Aug-2015	0.19	0.16	0.17	0.16	0.17
Sep-2015	0.38	0.18	0.25	0.20	0.22
Oct-2015	0.09	0.10	0.11	0.09	0.10
Median	0.17	0.16	0.18	0.19	0.17

Macroinvertebrate samples were collected at 2 sites on each branch of the river (Table 5). The Hester-Dendy device deployed on the mainstem at CTH M was lost due to vandalism. The data showed the communities to be either good or excellent based on the IBI (Weigel and Dimick, 2011). The higher scores were at the upstream locations on each branch.

Table 5: Non-wadable Macroinvertebrate IBIs

	Site			
	Pecatonica River		E. Br. Pecatonica	
Metric	Walnut Road	Sargent Road	Blanchardville	Cisserville Rd
Insect - T	39 (10)	29 (5)	40 (10)	26 (5)
Insect - %I	99.5 (10)	95.1 (10)	98.1 (10)	100 (10)
EPT - T	13 (5)	9 (5)	17 (10)	10 (5)
Dom3 - %I	40.4 (10)	58.1 (5)	53.0 (5)	52.0 (5)
MPTV	5.4 (10)	5.5 (10)	4.9 (10)	5.1 (10)
IntolEPT2 - %I	3.9 (10)	0.5 (5)	3.6 (10)	24.9 (10)
TolChir8 - %I	4.2 (5)	0.5 (10)	0 (10)	0.6 (10)
EcoFTN	12 (5)	9 (5)	10 (5)	8 (0)
Gath - %I	43.5 (5)	54.4 (0)	23.1 (5)	28.8 (5)
Scr - %I	19.4 (10)	30.3 (10)	37.1 (10)	22.0 (10)
Total	80	65	85	70
Metric Scores: 0 = Poor; 5 = Fair; 10 = Good				
Total Score: ≤19 = V. Poor; 20-39 = Poor; 40-59 = Fair; 60-79 = Good; ≥80 = Excellent				

Discussion

The fisheries data indicate moderate variation between sites. Overall IBI scores ranged from 55 (Fair) to 85 (Excellent). The species assemblage correspondingly varied between 9 and 19 species and was generally dominated by shorthead and silver redhorse and bigmouth buffalo. Mass of fish collected varied markedly by site as represented by WPUE and was not correlated to position in the watershed (i.e. upstream vs downstream). The IBI score was enhanced by the metrics of WPUE, % riverine, % insectivores, and % DELT found. The score was depressed by the lack of number of native, intolerant, and riverine species. While the number of riverine species was low, they made up a good percentage of the fish captured. The DELT metric has been shown to be particularly sensitive to industrial and other sewerage discharges and/or the presence of persistent toxins (Lyons, et. al. 2001). In the absence of this type of pollution in the Pecatonica system, it is not surprising the impact of this metric was negligible and "good" scores were reflected across all sites.

The overall species assemblage is likely underrepresented for Cyprinids (minnows) and Percids (darters) because these species generally inhabit areas not effectively sampled by boom shocking and/or because the net mesh size is too large to retain these specimens. Common shiner and spotfin shiner were the most common minnow species encountered.

Game species were present, although in small numbers of a few individuals per site. Smallmouth bass and walleye were the most common species, followed by northern pike and then channel catfish. There is likely a larger representation of Ictalurid species – both channel and flathead catfish – but boom shocking is not the most effective way to sample these species. Hoop net surveys were conducted on the system in 2002 and 2004 and were better able to characterize the catfish population (Table 5). As shown in Appendix C, overall, populations of channel catfish in the Pecatonica system as compared to other rivers in Wisconsin sampled from 1997 through 2012 showed the Pecatonica River to be near the statewide average for catch per unit effort (CPUE) and proportional stock density (PSD_{16}). It was well below the statewide average for relative stock density (RSD_{24}). Data also showed these populations of channel catfish to be very similar to the Sugar River. This information would be better served if the data could be broken down by average annual flow.

Table 6. Summary of Baited Hoop Net Surveys – Pecatonica River 2002-2004

		Channel Catfish			Flathead Catfish		
Site	Dates	Total Number Captured	Size Range (inches)	Mean Length (inches)	Total Number Captured	Size Range (inches)	Mean Length (inches)
East Branch Pecatonica downstream of Arygle Dam	July 23 - 25, 2002	125	8.5-29.0	16.1	6	15.8 - 31.0	23.05
East Branch Pecatonica downstream of Arygle Dam	March 30 - April 1, 2004*	4	9.0 - 22.0	16.9			
Pecatonica River upstream of STH 11	August 17 - 19, 2004	62	9.-29.5	20.6	3	15.0 - 17.0	16.2
Pecatonica River upstream of Riverside Rd	August 4 - 6, 2004	97	10.8-27.5	19.9	2	21.0 - 31.0	26
(West Branch) Pecatonica River upstream of Larse Rd	August 10 - 11, 2004	78	11.5-27.1	18.7	1	31.5	n/a
	* Non-baited hoop net						

As was noted in the introduction, there are no dams on the west or main branch of the Pecatonica. There are 2 dams on the East Branch Pecatonica. Since a survey was not conducted upstream of Blanchardville, one cannot compare upstream/downstream effects. However, the East Branch was sampled upstream and downstream of the dam at Argyle. Upstream from the dam, the river was wide (mean stream width of 25 meters), fairly deep (maximum thalweg depths greater than 4 meters), and more closely resembled a lentic environment due to the dam backing up water in a wetland landscape for the first 2 miles immediately upstream of the dam. Upstream of the dam, only 9 species were collected vs. 16 downstream at Blackhawk Park; however, there is not much crossover between the species found exclusively upstream vs. downstream of the dam or vice versa. In other words, there are species found upstream of the dam that are not found downstream as well as the opposite scenario. Smallmouth bass were the only game species found just above the dam, but further upstream at Blanchardville, both walleye and northern pike were captured, representing a much more similar game assemblage in comparison to the Blackhawk site. Large river species such as flathead catfish, freshwater drum, and gizzard shad were only found below the dam. No catfish were found upstream of the Argyle dam. Quillback were quite common downstream of the dam, but virtually absent upstream from it. Aside from the obvious morphological differences between the Argyle site, which was more lentic and the Blanchardville and Blackhawk sites, which were lotic, there is not a clear indication if the difference in species assemblage is because of the dam, the size and/or morphology of the sites, or a combination of factors. This is unlike the Sugar River system where species diversity and increases substantially downstream of the lowest dam at Brodhead (WDNR, 2015).

The qualitative habitat assessment, while not necessarily appropriate for overall determination of habitat, can be used to compare metrics between sites. Because of past and current land management practices in the watershed, and due to its geography and geology, the Pecatonica River system has been seriously impacted by nonpoint sources of pollution (WDNR, 2003). This land use and associated pollution has affected in-stream habitat, increased streambank erosion, and has limited the river's recreational uses. The river has become entrenched in this agricultural landscape, leading to many areas of steeply eroding banks. Bank stability scores were fair to good with the East Branch Pecatonica in better shape than the west or main branch. This is likely due to the East Branch flowing through a much larger complex of wetlands which allow greater connectivity with its floodplain, thereby reducing water velocity and bank erosion. Bank erosion was also correlated with riparian land cover – meadow vs. woodland. The wooded corridor, while providing cover for fish in the way of fallen trees, also shades the banks and allows for very little vegetative cover for bank stabilization. As shown in the picture at the right, bank erosion is exacerbated when the trees fall in the water, making fresh soil susceptible to shear forces. While there is an abundance of wood in the river to provide cover for fish, it is generally the only habitat available aside from overall depth. Rocky substrate is virtually absent as sand and silt dominate the bottom composition. The river's low gradient attributes to the settling of sediment and also influences the variety in the habitat – or lack thereof - which is dominated by runs with very few riffles save for the one site on the East Branch Pecatonica downstream of Blanchardville. Overall habitat scores were very similar, ranging from 36 to 54 – all in the "fair" range.

Because the habitat scores are so similar, it is difficult to draw distinctions between the fishery and the qualitative habitat in this system. It can be noted that the lowest IBI scores were correlated with the lowest fish cover. However, the highest IBI scores were not correlated with the highest overall habitat scores. There was also no correlation of the individual fishery metrics or IBI with position of the site in the watershed.

The water quality of the Pecatonica system has been monitored for decades. A long-term trend monitoring station exists at CTH M in Martintown near the Illinois border. Water samples are taken monthly and analyzed for nutrients, total suspended solids, chlorophyll-a, alkalinity and bacteria. Trend analysis has shown the flow-weighted annual geometric mean total phosphorus concentration has decreased from 0.294 mg/l in 1961 to 0.106 mg/l in 2010 (Matt Diebel, WDNR, pers. comm.). In addition to monitoring at this site, the department also sampled total phosphorus at the various pour points of the HUC 10 watersheds in 2005 through 2010. In 2012, the Pecatonica system was added to the state's 303(d) list of impaired waters due to phosphorus in exceedance of the criteria. With the help of volunteers, the Pecatonica system was sampled for total phosphorus again in 2015. The median total phosphorus concentration exceeded the 0.1 mg/l criteria (WDNR, 2014) at all sites, did not vary significantly between years and sites, and was not reflective of watershed extent (Figure 3). The 2015 data was consistent with previous data which has been collected for the pour points of the watersheds over the past 10 years and confirmed the impaired waters listing. It should be noted that while total phosphorus has decreased over the past 50 years, mean nitrate concentration has increased from 1.42 mg/l to 6.16 mg/l over the same period Matt Diebel, WDNR, pers. comm.).

The overall median growing season phosphorus concentration for data collected at the long-term trend site at Martintown since 2005 was 0.19 mg/l. This concentration is similar in nature to the Sugar River at Brodhead, which also had a median growing season phosphorus concentration of 0.19 mg/l over the past 11 growing seasons.

However, the total suspended solids (TSS) concentration as measured at Martintown is about double the TSS concentration on the Sugar River. The mean and median TSS concentration for the Pecatonica River at Martintown was 52.3 and 38 mg/l respectively compared to 21.9 and 17 mg/l respectively measured on the Sugar River at Brodhead.

Generally, research on lentic and lotic systems puts the breakpoint for quality fisheries somewhere between 15-30 mg/l (Giblin, 2017, Jackson, et. al., 2010, MPCA, 2011). It is reasonable that the watershed and riparian land use, stream entrenchment, bank erosion, and bedload sediment all contribute to the higher TSS concentration in the Pecatonica system. These factors also contribute to depressed habitat metrics (i.e. rocky substrate and fish cover) which in-turn leads to a lower quality fish community.

Figure 3. Median Total Phosphorus Concentration - Historic vs. Current by Pour Point and Watershed Area

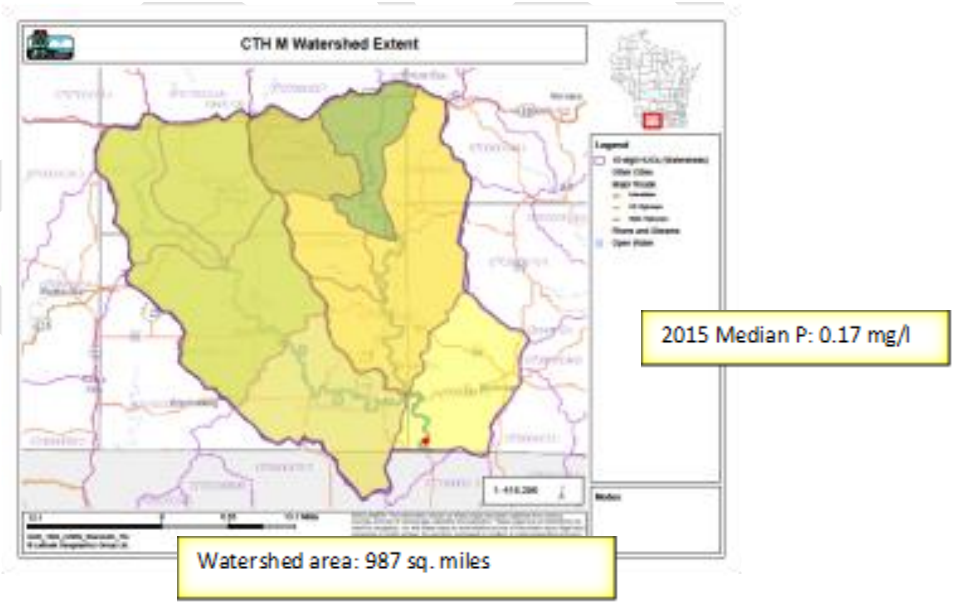
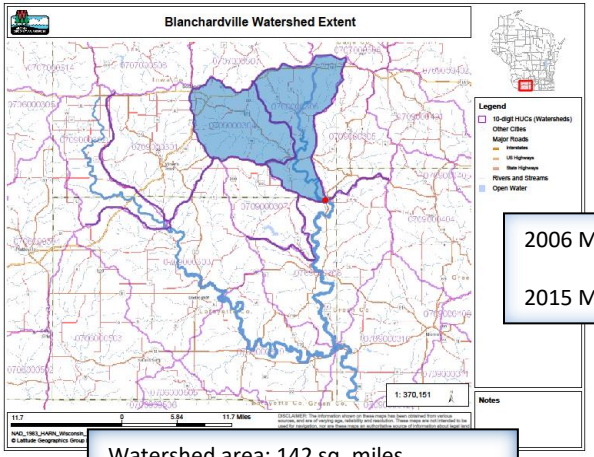


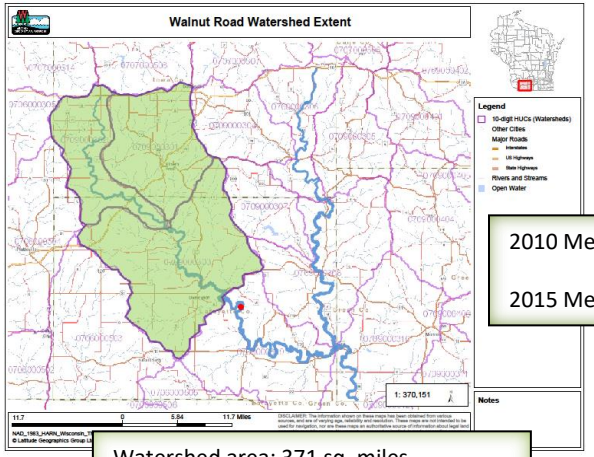
Figure 3. Median Total Phosphorus Concentration - Historic vs. Current by Pour Point and Watershed Area



2006 Median P: 0.16 mg/l

2015 Median P: 0.17 mg/l

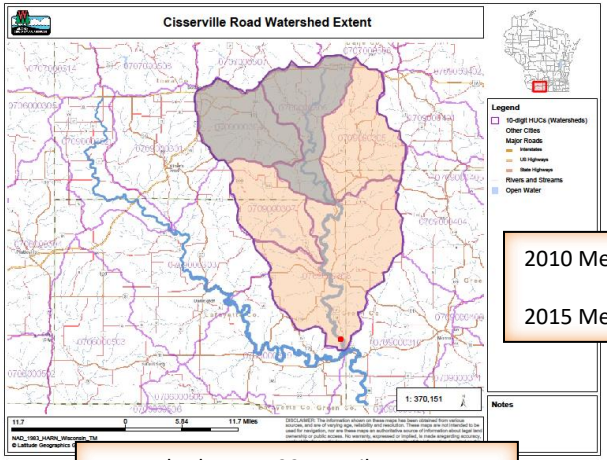
Watershed area: 142 sq. miles



2010 Median P: 0.20 mg/l

2015 Median P: 0.18 mg/l

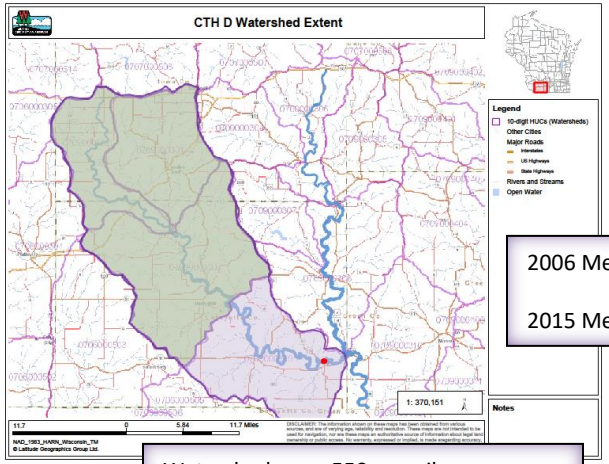
Watershed area: 371 sq. miles



2010 Median P: 0.18 mg/l

2015 Median P: 0.16 mg/l

Watershed area: 422 sq. miles



2006 Median P: 0.20 mg/l

2015 Median P: 0.19 mg/l

Watershed area: 550 sq. miles

One would assume that the macroinvertebrate community would also be impacted given the total phosphorus concentrations in excess of the breakpoints (Weigel and Robertson, 2007) and the criteria. However, the non-wadable macroinvertebrate IBIs for both branches of the river were good to excellent. This is consistent with the findings of Weigel and Dimick (2011) who showed, "the relatively small rivers limited to the Driftless Area ecoregion were evaluated as moderately to severely disturbed because of their highly agricultural watershed and excessive nutrient concentrations, yet the macroinvertebrate assemblages at these sites were comparable to those at relatively least-disturbed sites around the state." They went on to say that "it's possible the (non-wadable) IBI is not particularly sensitive to moderate levels of nonpoint source pollution in this area" and suggested that wadable stream assessment methods may be more appropriate for Driftless Area rivers.

Overall, the combination of fish, macroinvertebrate, habitat and water chemistry data seem to suggest that habitat, particularly the presence/absence of hard substrate and fish cover play a larger role in determining the fishery assemblage than total phosphorus and potentially other water quality indicators. The species assemblage and resulting fishery IBI for the Pecatonica system likely resemble the state of the resource, in that it is impacted by more than a century of environmental perturbations brought about by intense agricultural land use.

Summary

The assemblage of biological, chemical and physical measures indicates that the non-wadable portions of the Pecatonica River system are impacted most certainly by habitat quality issues and possibly water quality (particularly TSS) issues as well. The fishery assemblage and associated IBI show a variation in quality ranging from "fair" to "excellent", with most sites with an index in the "good" range. This is in comparison to the Sugar River system (WDNR, 2015), in which all the sites had an IBIs from 80 -100 or "excellent". Overall qualitative habitat scores were consistent and in the "fair' range for all sites. A lack of diversity of habitat as well as an absence of rocky substrate was a common issue at all sites. Streambank erosion was noted as an issue at most sites, owing to the river's incised nature in a heavily agrarian basin.

Recommendations

Because the Pecatonica system encompasses such a large area, improvements to the river system will come slowly. Working in smaller, HUC 12 watersheds provides a practical size area to implement best management practices on the landscape such as soil health, barnyard and pasture management, and streambank stabilization to reduce runoff of sediment and nutrients from fields and reduce streambank erosion. Work in these smaller, individual watersheds will not be reflected in the Pecatonica system immediately. The idea is to continue to work progressively on these smaller watersheds, and then presumably this will someday improve the river as a whole.

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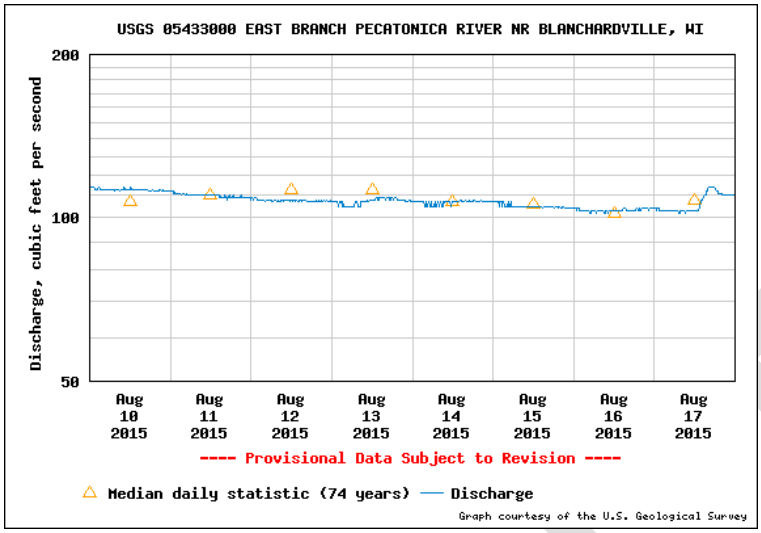
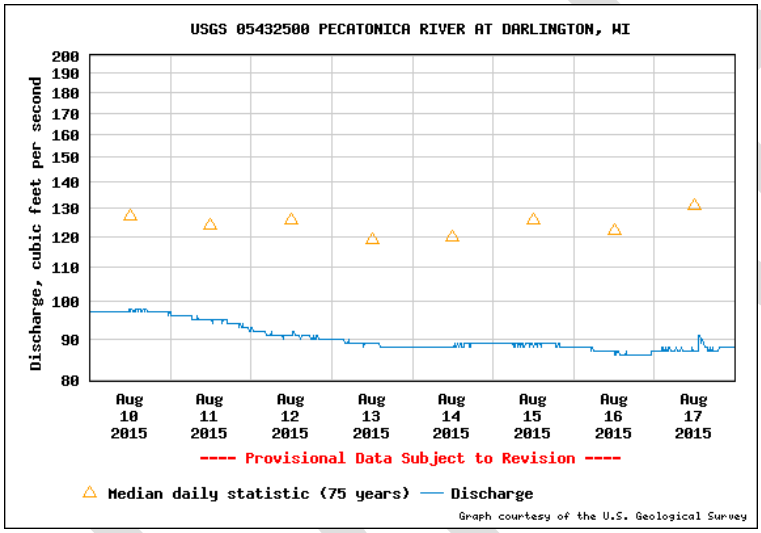
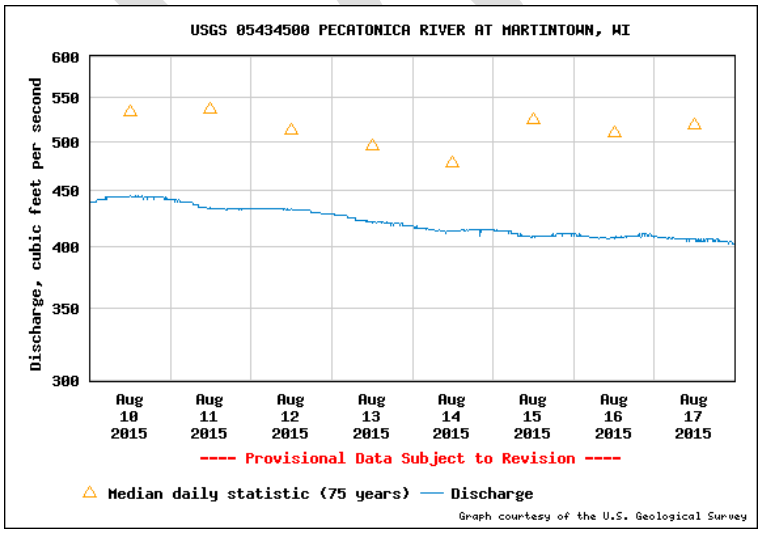
Appendix A: USGS Discharge Information for the Pecatonica System, August 10-17, 2015







Appendix B: Species Assemblage and Large River IBI – Pecatonica River System 2015

(West Branch) Pecatonica River at Walnut Road

Species	Number of Fish	Length (in)	Weight (grams)		Origin	Tolerance	Feeding	Habitat	Spawning		**Metric**	Value	Points	Rating
SHORTHEAD REDHORSE	54	-	18550		Native	Other	Insectivore	Other	Lithophil		WPUE	95500	10	Good
BIGMOUTH BUFFALO	9	-	18600		Native	Other	Insectivore	Other	Other		Native spp	15	5	Fair
SILVER REDHORSE	31	-	33450		Native	Other	Insectivore	River	Lithophil		Sucker spp	7	10	Good
GOLDEN REDHORSE	17	-	12360		Native	Other	Insectivore	River	Lithophil		Intolerant spp	2	5	Fair
COMMON CARP	5	-	10700		Exotic	Tolerant	Omnivore	Other	Other		Riverine spp	5	5	Fair
FRESHWATER DRUM	6	-	7700		Native	Other	Insectivore	Large	Other		% Riverine (n)	0.27	10	Good
NORTHERN HOG SUCKER	1	-	250		Native	Intolerant	Insectivore	River	Lithophil		% Lithophils (n)	0.85	10	Good
QUILLBACK	1	-	800		Native	Other	Omnivore	River	Other		% Insectivore (wt)	0.85	10	Good
EMERALD SHINER	50	-	100		Native	Other	Insectivore	Large	Lithophil		*% Round Suckers (wt)*	0.60	10	Good
WHITE SUCKER	3	-	1550		Native	Tolerant	Omnivore	Other	Lithophil		% DELT (n)	0	10	Good
SPOTFIN SHINER	3	-	15		Native	Other	Insectivore	River	Other				85	Excellent
COMMON SHINER	10	-	60		Native	Other	Insectivore	Other	Lithophil					
CHANNEL CATFISH	1	18.9	950		Native	Other	Carnivore	Other	Other					
WALLEYE	1	13.4	350		Native	Other	Carnivore	Other	Lithophil					
SMALLMOUTH BASS	1	9.8	230		Native	Intolerant	Carnivore	Other	Other					
SMALLMOUTH BASS	1	6.6	60		Native	Intolerant	Carnivore	Other	Other					
SMALLMOUTH BASS	1	5	25		Native	Intolerant	Carnivore	Other	Other					
NORTHERN PIKE	1	22.4	1200		Native	Other	Carnivore	Other	Other					
NORTHERN PIKE	1	19.4	800		Native	Other	Carnivore	Other	Other					
Total Fish =	197		107750	= Total Wt										
			95500	= Total wt minus tolerants										

Appendix B: continued

(West Branch) Pecatonica River at STH 78

Species	Number of Fish	Length (in)	Weight (grams)		Origin	Tolerance	Feeding	Habitat	Spawning		**Metric**	Value	Points	Rating
COMMON CARP	10	-	23400		Exotic	Tolerant	Omnivore	Other	Other		WPUE	59177	10	Good
BIGMOUTH BUFFALO	9	-	17200		Native	Other	Insectivore	Other	Other		Native spp	13	5	Fair
QUILLBACK	2	-	2700		Native	Other	Omnivore	River	Other		Sucker spp	3	5	Fair
FRESHWATER DRUM	1	-	700		Native	Other	Insectivore	Large	Other		Intolerant spp	2	5	Fair
SHORTHEAD REDHORSE	11	-	4480		Native	Other	Insectivore	Other	Lithophil		Riverine spp	4	0	Poor
SILVER REDHORSE	23	-	19221		Native	Other	Insectivore	River	Lithophil		% Riverine (n)	0.42	10	Good
COMMON SHINER	22	-	165		Native	Other	Insectivore	Other	Lithophil		% Lithophils (n)	0.55	10	Good
EMERALD SHINER	1	-	5		Native	Other	Insectivore	Large	Lithophil		% Insectivore (wt)	0.21	5	Fair
SPOTFIN SHINER	18	-	87		Native	Other	Insectivore	River	Other		*% Round Suckers (wt)*	0.29	10	Good
BLACKSIDE DARTER	1	-	9		Native	Other	Insectivore	River	Lithophil		% DELT (n)	0	10	Good
FLATHEAD CATFISH	1	7.9	100		Native	Other	Carnivore	Large	Other				70	Good
MUSKELLUNGE	1	38.8	6000		Native	Intolerant	Carnivore	Other	Other					
MUSKELLUNGE	1	42	6800		Native	Intolerant	Carnivore	Other	Other					
SMALLMOUTH BASS	1	10.4	250		Native	Intolerant	Carnivore	Other	Other					
SMALLMOUTH BASS	1	8.6	140		Native	Intolerant	Carnivore	Other	Other					
CHANNEL CATFISH	1	16.3	600		Native	Other	Carnivore	Other	Other					
CHANNEL CATFISH	1	15.4	480		Native	Other	Carnivore	Other	Other					
CHANNEL CATFISH	1	12.4	240		Native	Other	Carnivore	Other	Other					
Total Fish =	106		82577	= Total Wt										
			59177	=Total wt minus tolerants										

Appendix B: continued

(West Branch) Pecatonica River at Sargent Road

Species	Number of Fish	Length (in)	Weight (grams)		Origin	Tolerance	Feeding	Habitat	Spawning		Metric	Value	Points	Rating
SILVER REDHORSE	11	-	8720		Native	Other	Insectivore	River	Lithophil		WPUE	38827	10	Good
SHORTHEAD REDHORSE	11	-	4500		Native	Other	Insectivore	Other	Lithophil		Native spp	9	0	Fair
BIGMOUTH BUFFALO	11	-	22050		Native	Other	Insectivore	Other	Other		Sucker spp	3	5	Fair
COMMON CARP	16	-	34850		Exotic	Tolerant	Omnivore	Other	Other		Intolerant spp	1	0	Poor
FRESHWATER DRUM	1	-	1750		Native	Other	Insectivore	Large	Other		Riverine spp	3	0	Poor
GOLDEN REDHORSE	1	-	19		Native	Other	Insectivore	River	Lithophil		% Riverine (n)	0.32	10	Good
COMMON SHINER	6	-	37		Native	Other	Insectivore	Other	Lithophil		% Lithophils (n)	0.41	10	Good
SPOTFIN SHINER	11	-	61		Native	Other	Insectivore	River	Other		% Insectivore (wt)	0.48	10	Good
NORTHERN PIKE	1	22.6	1325		Native	Other	Carnivore	Other	Other		*% Round Suckers (wt)*	0.18	5	Fair
NORTHERN PIKE	1	13.2	200		Native	Other	Carnivore	Other	Other		% DELT (n)	0	10	Good
SMALLMOUTH BASS	1	8.6	165		Native	Intolerant	Carnivore	Other	Other				60	Good
Total Fish =	71		73677	= Total Wt										
			38827	=Total wt minus tolerants										

East Branch Pecatonica River downstream of Blanchardville

Species	Number of Fish	Length (in)	Weight (grams)		Origin	Tolerance	Feeding	Habitat	Spawning		Metric	Value	Points	Rating
BIGMOUTH BUFFALO	9	-	24500		Native	Other	Insectivore	Other	Other		WPUE	76864	10	Good
WHITE SUCKER	9	-	8200		Native	Tolerant	Omnivore	Other	Lithophil		Native spp	11	0	Poor
SILVER REDHORSE	21	-	27600		Native	Other	Insectivore	River	Lithophil		Sucker spp	6	10	Good
SHORTHEAD REDHORSE	19	-	6223		Native	Other	Insectivore	Other	Lithophil		Intolerant spp	2	5	Fair
GOLDEN REDHORSE	12	-	7161		Native	Other	Insectivore	River	Lithophil		Riverine spp	2	0	Poor
NORTHERN HOG SUCKER	1	-	130		Native	Intolerant	Insectivore	River	Lithophil		% Riverine (n)	0.40	10	Good
BLUNTNOSE MINNOW	4	-	12		Native	Tolerant	Omnivore	Other	Other		% Lithophils (n)	0.71	10	Good
HORNYHEAD CHUB	4	-	35		Native	Other	Insectivore	River	Other		% Insectivore (wt)	0.77	10	Good
SMALLMOUTH BASS	1	10.9	340		Native	Intolerant	Carnivore	Other	Other		*% Round Suckers (wt)*	0.48	10	Good
SMALLMOUTH BASS	1	9.3	190		Native	Intolerant	Carnivore	Other	Other		% DELT (n)	0	10	Good
SMALLMOUTH BASS	1	10.9	340		Native	Intolerant	Carnivore	Other	Other				75	Good
SMALLMOUTH BASS	1	10.5	320		Native	Intolerant	Carnivore	Other	Other					
SMALLMOUTH BASS	1	4.7	25		Native	Intolerant	Carnivore	Other	Other					
SMALLMOUTH BASS	1	15.9	1000		Native	Intolerant	Carnivore	Other	Other					
SMALLMOUTH BASS	1	16.3	1200		Native	Intolerant	Carnivore	Other	Other					
WALLEYE	1	21.7	2200		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	18.9	1100		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	13.5	400		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	18.5	1400		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	15	600		Native	Other	Carnivore	Other	Lithophil					
NORTHERN PIKE	1	18.7	600		Native	Other	Carnivore	Other	Other					
NORTHERN PIKE	1	22	1000		Native	Other	Carnivore	Other	Other					
NORTHERN PIKE	1	18.4	500		Native	Other	Carnivore	Other	Other					
Total Fish =	94		85076	= Total Wt										
			76864	=Total wt minus tolerants										

Appendix B: continued

East Branch Pecatonica River upstream of Argyle dam

Species	Number of Fish	Length (in)	Weight (grams)		Origin	Tolerance	Feeding	Habitat	Spawning		Metric	Value	Points	Rating
SILVER REDHORSE	15	-	21450		Native	Other	Insectivore	River	Lithophil		WPUE	86432	10	Good
SHORTHEAD REDHORSE	1	-	750		Native	Other	Insectivore	Other	Lithophil		Native spp	8	0	Poor
COMMON CARP	3	-	10900		Exotic	Tolerant	Omnivore	Other	Other		Sucker spp	4	5	Fair
BIGMOUTH BUFFALO	23	-	61400		Native	Other	Insectivore	Other	Other		Intolerant spp	1	0	Poor
QUILLBACK	1	-	1900		Native	Other	Omnivore	River	Other		Riverine spp	3	0	Poor
SPOTFIN SHINER	4	-	23		Native	Other	Insectivore	River	Other		% Riverine (n)	0.36	10	Good
GOLDEN SHINER	4	-	30		Native	Tolerant	Omnivore	Other	Other		% Lithophils (n)	0.34	5	Fair
COMMON SHINER	3	-	9		Native	Other	Insectivore	Other	Lithophil		% Insectivore (wt)	0.85	10	Good
SMALLMOUTH BASS	1	11.6	410		Native	Intolerant	Carnivore	Other	Other		*% Round Suckers (wt)*	0.23	5	Fair
SMALLMOUTH BASS	1	12.5	490		Native	Intolerant	Carnivore	Other	Other		% DELT (n)	0	10	Good
Total Fish =	56		97362	= Total Wt									55	Fair
			86432	=Total wt minus tolerants										

East Branch Pecatonica River at Blackhawk Park

Appendix B: continued

Species	Number of Fish	Length (in)	Weight (grams)		Origin	Tolerance	Feeding	Habitat	Spawning		Metric	Value	Points	Rating
HIGHFIN CARPSUCKER	1	-	700		Native	Intolerant	Omnivore	River-Large	Other		WPUE	105914	10	Good
QUILLBACK	19	-	20600		Native	Other	Omnivore	River	Other		Native spp	15	5	Fair
GIZZARD SHAD	15	-	4170		Native	Other	Other	Large	Other		Sucker spp	5	10	Good
SILVER REDHORSE	14	-	6800		Native	Other	Insectivore	River	Lithophil		Intolerant spp	2	5	Fair
BIGMOUTH BUFFALO	24	-	51450		Native	Other	Insectivore	Other	Other		Riverine spp	2	0	Poor
SHORTHEAD REDHORSE	22	-	8140		Native	Other	Insectivore	Other	Lithophil		% Riverine (n)	0.27	10	Good
COMMON CARP	10	-	20600		Exotic	Tolerant	Omnivore	Other	Other		% Lithophils (n)	0.38	5	Fair
FRESHWATER DRUM	2	-	2000		Native	Other	Insectivore	Large	Other		% Insectivore (wt)	0.54	10	Good
COMMON SHINER	8	-	24		Native	Other	Insectivore	Other	Lithophil		*% Round Suckers (wt)*	0.12	5	Fair
GOLDEN SHINER	1	-	25		Native	Tolerant	Omnivore	Other	Other		% DELT (n)	0	10	Good
CHANNEL CATFISH	1	11.9	200		Native	Other	Carnivore	Other	Other				70	Good
NORTHERN PIKE	1	19.7	800		Native	Other	Carnivore	Other	Other					
NORTHERN PIKE	1	16.7	410		Native	Other	Carnivore	Other	Other					
NORTHERN PIKE	1	16.8	430		Native	Other	Carnivore	Other	Other					
WALLEYE	1	26.9	3200		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	26.3	2900		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	15.7	570		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	26.1	3050		Native	Other	Carnivore	Other	Lithophil					
FLATHEAD CATFISH	1	10.6	220		Native	Other	Carnivore	Large	Other					
SMALLMOUTH BASS	1	10.1	240		Native	Intolerant	Carnivore	Other	Other					
BLUEGILL	1	3.7	10		Native	Other	Insectivore	Other	Other					
Total Fish =	127		126539	= Total Wt										
			105914	=Total wt minus tolerants										

Appendix : continued

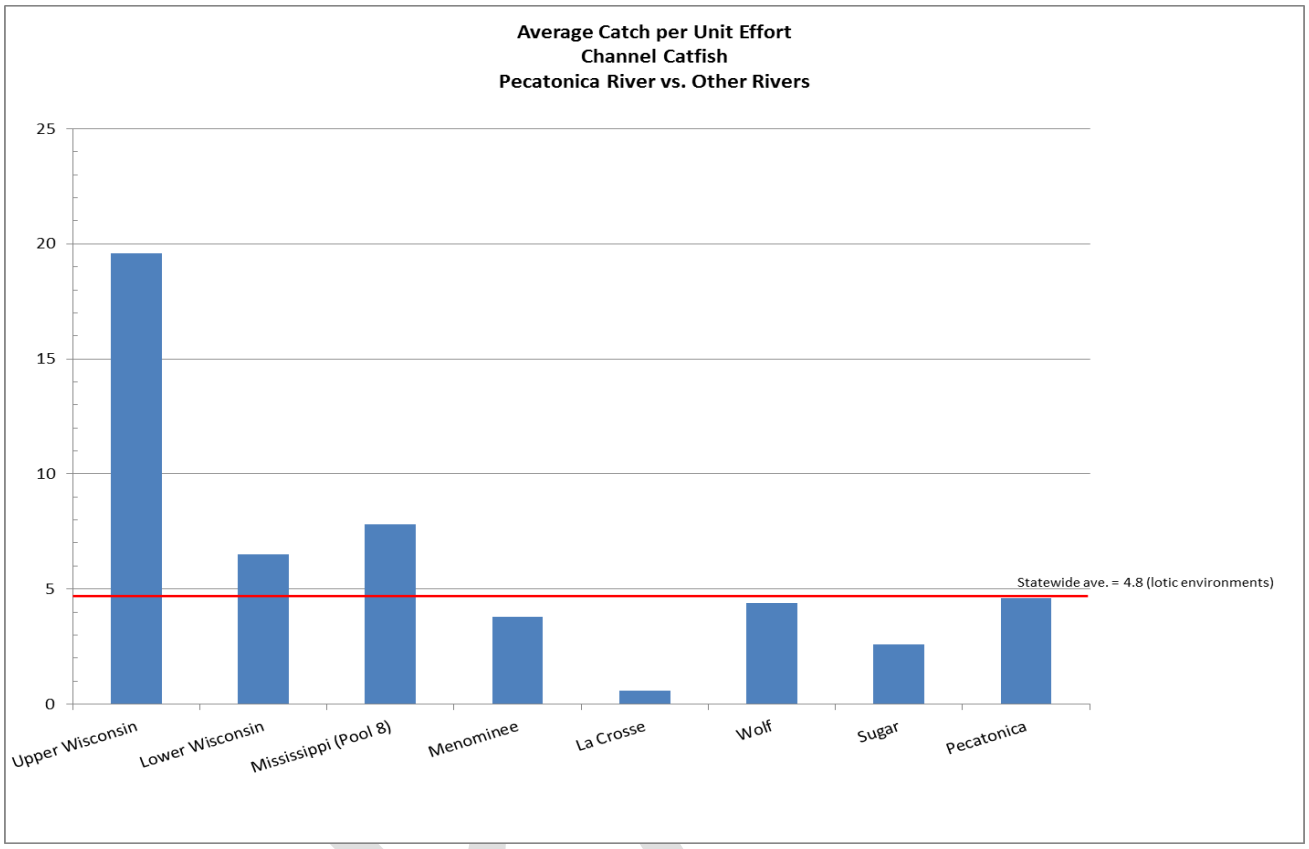
Pecatonica River downstream of STH 11

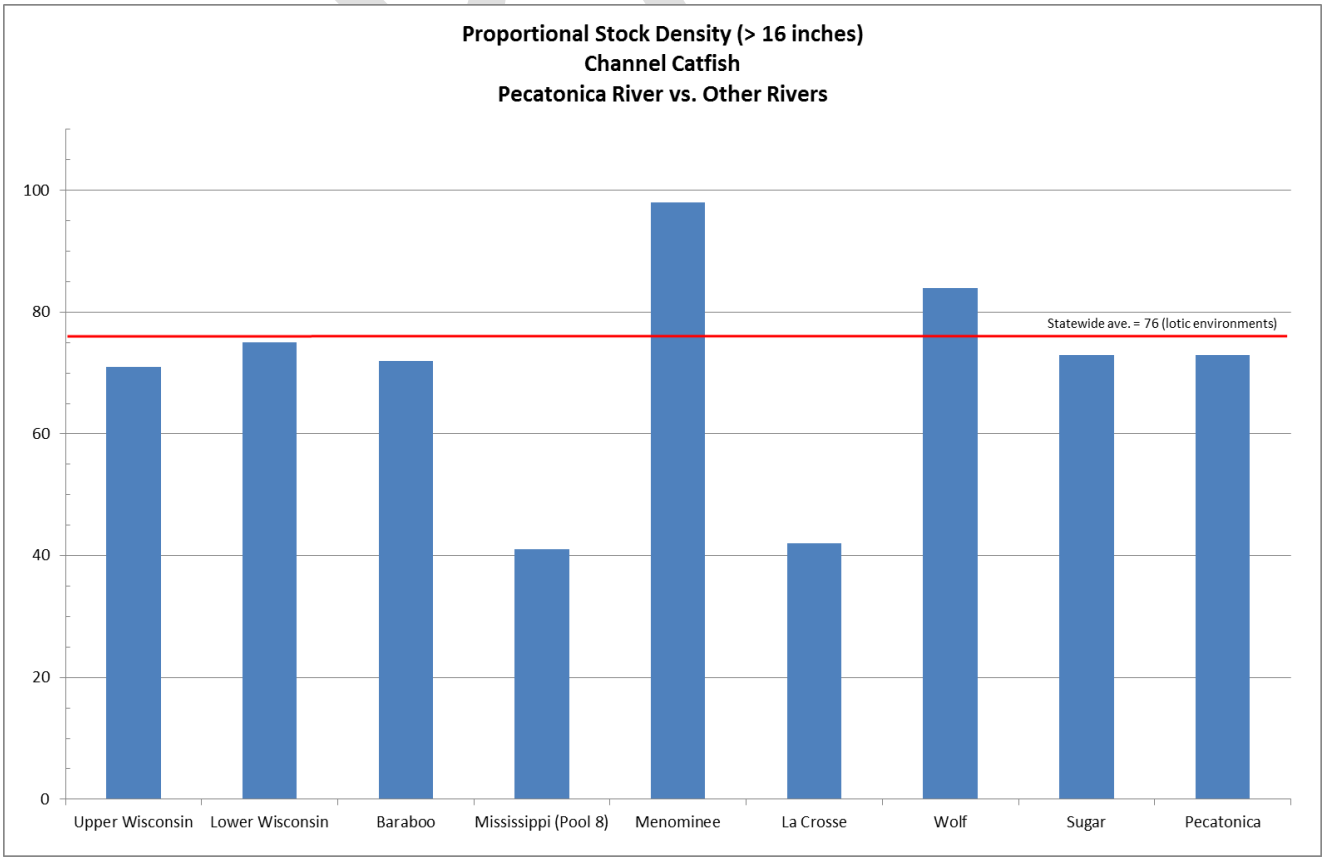
Species	Number of Fish	Length (in)	Weight (grams)		Origin	Tolerance	Feeding	Habitat	Spawning		Metric	Value	Points	Rating
COMMON CARP	12	-	19200		Exotic	Tolerant	Omnivore	Other	Other		WPUE	56458	10	Good
BIGMOUTH BUFFALO	17	-	36400		Native	Other	Insectivore	Other	Other		Native spp	8	0	Poor
SILVER REDHORSE	8	-	12600		Native	Other	Insectivore	River	Lithophil		Sucker spp	4	5	Fair
QUILLBACK	4	-	3900		Native	Other	Omnivore	River	Other		Intolerant spp	0	0	Poor
SHORTHEAD REDHORSE	7	-	3500		Native	Other	Insectivore	Other	Lithophil		Riverine spp	4	0	Poor
WHITE SUCKER	1	-	700		Native	Tolerant	Omnivore	Other	Lithophil		% Riverine (n)	0.29	10	Good
SPOTFIN SHINER	7	-	23		Native	Other	Insectivore	River	Other		% Lithophils (n)	0.40	5	Fair
COMMON SHINER	11	-	33		Native	Other	Insectivore	Other	Lithophil		% Insectivore (wt)	0.69	10	Good
BIGMOUTH SHINER	1	-	2		Native	Other	Insectivore	River	Other		*% Round Suckers (wt)*	0.21	5	Fair
Total Fish =	68		76358	= Total Wt							% DELT (n)	0	10	Good
			56458	=Total wt minus tolerants									55	Fair

Pecatonica River at CTH M (Martintown)

Species	Number of Fish	Length (in)	Weight (grams)		Origin	Tolerance	Feeding	Habitat	Spawning		Metric	Value	Points	Rating
COMMON CARP	19	-	30200		Exotic	Tolerant	Omnivore	Other	Other		WPUE	39370	10	Good
SHORTHEAD REDHORSE	16	-	12300		Native	Other	Insectivore	Other	Lithophil		Native spp	17	10	Good
QUILLBACK	6	-	7950		Native	Other	Omnivore	River	Other		Sucker spp	5	10	Good
BIGMOUTH BUFFALO	5	-	9800		Native	Other	Insectivore	Other	Other		Intolerant spp	2	5	Fair
WHITE SUCKER	2	-	1100		Native	Tolerant	Omnivore	Other	Lithophil		Riverine spp	5	5	Fair
SILVER REDHORSE	2	-	2200		Native	Other	Insectivore	River	Lithophil		% Riverine (n)	0.21	10	Good
SLENDERHEAD DARTER	1	-	3		Native	Intolerant	Insectivore	River	Lithophil		% Lithophils (n)	0.44	10	Good
HORNYHEAD CHUB	2	-	6		Native	Other	Insectivore	River	Other		% Insectivore (wt)	0.21	5	Fair
SPOTFIN SHINER	6	-	18		Native	Other	Insectivore	River	Other		*% Round Suckers (wt)*	0.21	5	Fair
COMMON SHINER	8	-	40		Native	Other	Insectivore	Other	Lithophil		% DELT (n)	0	10	Good
EMERALD SHINER	1	-	8		Native	Other	Insectivore	Large	Lithophil				80	Excellent
GOLDEN SHINER	1	-	3		Native	Tolerant	Omnivore	Other	Other					
WALLEYE	1	14.3	400		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	14.5	415		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	15.7	500		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	15.1	450		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	15.9	475		Native	Other	Carnivore	Other	Lithophil					
WALLEYE	1	18.2	800		Native	Other	Carnivore	Other	Lithophil					
FLATHEAD CATFISH	1	7	130		Native	Other	Carnivore	Large	Other					
NORTHERN PIKE	1	25.7	1300		Native	Other	Carnivore	Other	Other					
NORTHERN PIKE	1	24.5	1300		Native	Other	Carnivore	Other	Other					
SMALLMOUTH BASS	1	10.5	230		Native	Intolerant	Carnivore	Other	Other					
BLUEGILL	1	4.3	25		Native	Other	Insectivore	Other	Other					
CHANNEL CATFISH	1	12	220		Native	Other	Carnivore	Other	Other					
CHANNEL CATFISH	1	17.9	800		Native	Other	Carnivore	Other	Other					
Total Fish =	82		70673	= Total Wt										
			39370	=Total wt minus tolerants										

Appendix C: Summary of Channel Catfish Surveys: Pecatonica River vs. Other Rivers





Appendix C: continued