Bio-blitz inventory of fishes in streams of the Whiterock Conservancy, Guthrie County, Iowa

John Olson

Iowa Department of Natural Resources

Des Moines, IA

July 2012

Summary:

Fishes in the streams of the Whiterock Conservancy in Guthrie County, Iowa, were inventoried as part of a biodiversity blitz, or "bio-blitz", sponsored by the Conservancy on June 8 and 9, 2012. Seventeen fish species from five families were collected from the six sites sampled during the bio-blitz (from noon on June 8th to noon on June 9th); all collections were made in the Middle Raccoon River as it flows through the Whiterock Conservancy. The fish species and families found during the bio-blitz are similar to those sampled as part of the previous (2008) bio-blitz and to species collected as part of Iowa Department of Natural Resources biological monitoring from 2001 to 2011. Compared to the results of historical surveys conducted in the upper portion of the Middle Raccoon River basin, however, results of recent surveys show potential losses of several fish species from the upper basin including common shiner, golden shiner, suckermouth minnow, and orangespotted sunfish. All these species occur in basins in adjacent river basins in the Mississippi River drainage (e.g., North Raccoon River and North and Middle river basins). If all historical surveys are considered, the Middle Raccoon basin tends to lack several species that commonly occur in other subbasins of the Raccoon and upper Des Moines river basins (e.g., redhorses (*Moxostoma* spp.).)

Introduction:

The Whiterock Conservancy (WRC) is an Iowa nonprofit land trust that seeks to protect Iowa's natural resources and to provide environmental education and outdoor recreational opportunities to the public. The Whiterock Conservancy encompasses 4,300 acres and is located immediately south of Coon Rapids, IA, along the Middle Raccoon River in northern Guthrie County and lies in the upper portion of the Middle Raccoon River basin (HUC-10: 0710000701) (Figure 1). I was invited by Whiterock Conservancy land manager, Chris Troendle, to conduct fish surveys for Whiterock Conservancy's 2012 "bio-blitz" conducted on June 8 and 9, 2012.

Although Iowa's earliest fish surveys were conducted in the late 19th Century (e.g., Meek 1892; Call 1892), the first known fish surveys in the Middle Raccoon river were not conducted until the mid-20th Century. These surveys were conducted by state fisheries biologists and are summarized as distribution maps in Harlan and Speaker (1956). Historical fish surveys in the upper portion of the Middle Raccoon

River basin have been conducted by Iowa fisheries biologists (Harrison and Stufflebeam (1962), Paragamian 1990, Iowa Department of Natural Resources (IDNR)-Boone Fish Management (2002), and IDNR Manchester Fish Management (2002)). Streams in this subbasin were also sampled in 1984 as part of a statewide survey of fishes conducted by Bruce Menzel (1984) and students from Iowa State University. Other surveys were conducted as part of special projects; e.g., the 1998 Natural History Foray in Guthrie and Adair counties (Olson and Howell 1988) and IDNR-Environmental Protection Division stream use assessments (Olson 1998). This information is summarized and available in the Iowa Rivers Information System (http://maps.gis.iastate.edu/iris/). More recent (2001-2011) monitoring has been conducted on the Middle Raccoon River and at Long and Springbrook creeks as part of biological monitoring programs of the Iowa Department of Natural Resources and as special project (Morarend 2011).

Methods:

Sampling was conducted on June 8 and 9, 2012, at six locations all on the Whiterock Conservancy and all within the Middle Raccoon River-Willow Creek HUC-12 basin (071000070106) (Figures 2 through 5). Sampling at most sites was conducted with a single backpack electro-fisher. A 5x20-foot (1/4-inch mesh) seine was used at Site 3 and was used as a supplemental gear at Site 5. Electrofishing was conducted in an upstream direction; seining was conducted in a downstream direction. Travis Morarend (State Hygienic Laboratory, Ankeny office) and Matt Reiling (Whiterock Conservancy staff) assisted with fish collections. According to Whiterock Conservancy staff, flow in the Middle Raccoon River during the bio-blitz was well below normal for early June; one staff remarked that the river had not been this low in June since the drought year of 1988. Regardless of low water conditions, the pool/riffle system in the Middle Raccoon River as it flows through the Whiterock Conservancy resulted in relatively deep pools, with some pools exceeding four-feet in water depth (e.g., at sites 1, 5 and 6). Stream flow in tributaries of the Middle Raccoon River (e.g., Long Creek near Site 2), however, was very low such that fish habitat was limited due to very shallow water. Despite the occasional pools in the Middle Raccoon River that were too deep to sample, sample effectiveness with both the electro-fisher and seine was good to excellent. Fish were identified to species in the field; no fish were preserved. Field notes were prepared for all collections.

Results:

A total of 17 fish species was collected at the six sample sites during the 2012 bio-blitz (Table 1). Collections at all sites were primarily made on the Middle Raccoon River with only limited sampling of tributaries near their confluences with the Middle Raccoon River. Species richness per site varied from a low of six species at Site 1 at the WRC campground to a maximum of 13 species at Site 3 approximately 0.8 miles downstream from the campground (Figures 2 through 5). As is typical for Iowa streams, the fish community was dominated numerically by minnows (family Cyprinidae) with the spotfin shiner and sand shiner the most common minnow species. Sucker species (family Catostomidae) were relatively rare with only small numbers of white suckers and river carpsuckers collected. Regarding catfishes (family Icataluridae), both channel catfish and stonecat were locally common with good numbers of

larger adult channel catfish present. Sunfishes (family Centrarchidae) were relatively rare with the green sunfish being the most common sunfish collected. The only member of the perch family (Percidae) sampled was the johnny darter with only a few individuals being found at four of the six sample sites (see Figure 6).

Discussion:

The fish results of the 2012 bio-blitz compare well with recent fish surveys at WRC (Table 2). The list of 17 fish species from five families collected for the 2012 bio-blitz is very similar to that from the previous (2008) bio-blitz conducted at WRC: 15 species from the same five families (Table 2). The only species collected for the 2008 bio-blitz not collected in the 2012 bio-blitz was black bullhead; other differences are minor and involve sunfish species that inhabit stream/river habitats primarily as escapees from farm ponds and lakes (e.g., largemouth bass and black crappie). Results of IDNR biological monitoring at WRC in 2011 (one site) are also similar to the 2008 and 2012 bio-blitz results.

While the fish community of the WRC potion of the upper Middle Raccoon subbasin is moderately diverse and appears stable, the fish community is considerably less diverse than that of the lower Middle Raccoon River subbasin (10 digit HUC 0710000707) (the boundary between the upper and lower Middle Raccoon River subbasins is the confluence of Willow Creek with the Middle Raccoon River approximately three miles south of Bayard (Figure 1)). Species reported from the lower Middle Raccoon subbasin that are absent from the upper basin are summarized in Table 3. Species such as the shoal chub, bullhead minnow, slenderhead darter, and freshwater drum that are absent from the upper Middle Raccoon subbasin tend to prefer habitats of larger rivers and would not be expected in medium-sized rivers such as the WRC portion of the Middle Raccoon River. Other species, including suckermouth minnow, northern hog sucker, Iowa darter and even yellow bullhead would be expected to be distributed throughout the Middle Raccoon basin but are absent from the basin upriver from the confluence with Willow Creek.

Even more unusual is the avoidance of the entire Middle Raccoon basin by redhorse species (*Moxostoma* spp.). Based on distribution maps for Iowa fishes in Harlan and Speaker (1956) and Harlan et al. (1987), and based on collection records in the fish database of the Iowa Rivers Information System and Iowa DNR's biological monitoring database, there are no historical or current records for any of Iowa's five redhorse species in the entire Middle Raccoon River basin. While the Middle Raccoon River basin is at the western distributional limit of several of Iowa's redhorse species, the shorthead redhorse (*M. macrolepidotum*) is distributed statewide, including in the chronically turbid rivers of southern and western Iowa.

Possible explanations for the lower fish diversity in the upper Middle Raccoon River compared to the lower Middle Raccoon River basin (in which the Whiterock Conservancy lies) include (1) potentially higher turbidities in stream systems of the upper basin due to its partial drainage of the more erosive Loess Hills and Rolling Prairies ecoregion compared to the Des Moines Lobe egoregion (Figure 7) and (2) the barrier to upstream movement of fishes presented by the dam of Lake Panorama, a 1,400-acre

privately-owned recreational impoundment constructed in the late 1960s on the Middle Raccoon River approximately 25 river miles downstream from the Whiterock Conservancy.

References:

Boone Fish Management. 2003. Field notes and unpublished reports. Southwest Management District, Fisheries Bureau, Iowa Department of Natural Resources, Boone, Iowa.

Call, R. Elsworth. 1892. The fishes of the Des Moines basin. Proc. Iowa Acad. Sci., 1, pt. 2 (1890, 1891): 43-56.

Harlan, J.R. and E.B. Speaker. 1956. Iowa Fish and Fishing. State Conservation Commission. 377 p.

Harlan, J.R., E.B. Speaker, and J. Mayhew. 1987. Iowa Fish and Fishing. Iowa Department of Natural Resources. 323 p.

Harrison, H. and D. Stufflebean. 1962. Progress report: Middle Raccoon River renovation project. Quarterly Biology Reports 14(3):52-55.

Iowa DNR. Iowa's ecological regions. Watershed Monitoring and Assessment Section, Iowa Department of Natural Resources. Accessed in July 2012: http://www.igsb.uiowa.edu/wqm/biological/EcoRegions.html

Manchester Fish Management. 2002. Field notes and unpublished reports. Northeast Management District, Fisheries Bureau, Iowa Department of Natural Resources, Manchester, Iowa.

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

Menzel, B.W. 1984. Field notes: Des Moines-Skunk. Iowa State University, Ames, Iowa

Morarend, T. 2011. Pre-trail conditions of Whiterock Conservancy's aquatic resources. State Hygienic Laboratory at the University of Iowa, Ankeny Office. 31 p.

Museum of Zoology. 2002. Division of Fishes collection database. University of Michigan, Ann Arbor, Michigan. http://www.ummz.lsa.umich.edu/. (May, 2002).

Olson, J.R. 1998. Historic fish survey database. Water Quality Bureau, Iowa Department of Natural Resources, Des Moines, Iowa.

Olson, J.R. and D. Howell. 1988. Iowa Natural History Foray: Guthrie and Adair counties. Unpublished report, Iowa Department of Natural Resources. 5p.

Paragamian, V.L. 1990. Fish populations of Iowa rivers and streams. Technical Bulletin No. 3, Iowa Department of Natural Resources, Des Moines, Iowa.

Pflieger, W.L. 1997. The fishes of Missouri. Missouri Department of Conservation. 372 p.

Table 1. Results of fish June 8 and 9, 2012, fish surveys at Whiterock Conservancy, Guthrie County, Iowa, conducted as part of the Whiterock Conservancy's 2012 "bio-blitz". Relative abundances: R=rare, from 1 to 5 individuals; U=uncommon, from 5 to 20 individuals; C=common, from 20 to 100 individuals; A=abundant, greater than 100 individuals.

Family	**Scientific Name**	**Common Name**	**Site 1: M. Raccoon R.: Riffles at main campground**	**Site 2: M. Raccoon R.: Dobby's Riffle**	**Site 3: M. Raccoon R.: ~0.8 mi. dstr main campground**	**Site 4: M. Raccoon R.: at Fig Ave. bridge**	**Site 5: M. Raccoon R.: 0.25 SSE WRC main office**	**Site 6: M. Raccoon R.: 0.75 mi. SSE WRC main office**	**Number of sites where collected:**
Cyprinidae	*Cyprinella spiloptera*	spotfin shiner	C	C	A	A	A	A	6
Cyprinidae	*Cyprinus carpio*	common carp		U	R	U			3
Cyprinidae	*Notropis dorsalis*	bigmouth shiner		R	C				2
Cyprinidae	*Notropis stramineus*	sand shiner	C	U	A	C	C	C	6
Cyprinidae	*Pimephales notatus*	bluntnose minnow	C	U	C	U	C	C	6
Cyprinidae	*Pimephales promelas*	fathead minnow			R				1
Cyprinidae	*Rhinichthys atratulus*	blacknose dace			R				1
Cyprinidae	*Semotilus atromaculatus*	creek chub		R	U	R		R	4
Catostomidae	*Carpiodes carpio*	river carpsucker			U			R	2
Catostomidae	*Catostomus commersonii*	white sucker	R	R	R				3
Ictaluridae	*Ictalurus punctatus*	channel catfish	U	C	U	R		R	5
Ictaluridae	*Noturus flavus*	stonecat	C	C		U	U	R	5
Centrarchidae	*Lepomis cyanellus*	green sunfish		R		U	U	R	4
Centrarchidae	*Lepomis macrochirus*	bluegill				R	U	R	3
Centrarchidae	*Micropterus salmoides*	largemouth bass			U				1
Centrarchidae	*Pomoxis annularis*	white crappie				R		R	2
Percidae	*Etheostoma nigrum*	johnny darter		R	R	R	R		4
		Total Number of Species:	***6***	***11***	***13***	***11***	***7***	***10***	***17***

Whiterock Conservancy Bio-Blitz, 2012

Fishes

Table 2. Summary of fish surveys in the Middle Raccoon River basin in Iowa (HUC: 07100007). Records from Harlan and Speaker (1956) and Harlan et al. (1987) are taken from distribution maps; records from IRIS (Iowa Rivers Information System) are available at http://maps.gis.iastate.edu/iris/, IDNR bio-monitoring data are available in the IDNR BioNet database. The boundary between the upper Middle Raccoon basin (HUC-10: 0710000701) and the lower Middle Raccoon basin (HUC-10: 0710000707) is the confluence with Willow Creek (HUC-10: 0710000702) approximately 3 miles south of Bayard, IA (see Figure 1).

Family	Scientific Name	Common Name	Harlan and Speaker (1956)	Harlan et al. (1987)	In IRIS (up though 2002)	2008 WRC Bio-Blitz	IDNR Bio-monitoring (2001-2011):	2012 WRC Bio-Blitz	Number of surveys found:	Distribution in Middle Raccoon basin
Clupeidae	*Dorosoma cepedianum*	gizzard shad	N	N	Y	N	N	N	1	Lower only
Cyprinidae	*Campostoma anomalum*	central stoneroller	Y	N	Y	N	Y	N	3	Basin wide
Cyprinidae	*Cyprinella lutrensis*	red shiner	Y	N	Y	N	Y	N	3	Lower only
Cyprinidae	*Cyprinella spiloptera*	spotfin shiner	Y	Y	Y	Y	Y	Y	6	Basin wide
Cyprinidae	*Cyprinus carpio*	common carp	Y	Y	Y	Y	Y	Y	6	Basin wide
Cyprinidae	*Hybognathus hankinsoni*	brassy minnow	Y	Y	Y	N	N	N	3	Lower & Willow
Cyprinidae	*Luxilus cornutus*	common shiner	Y	N	Y	N	N	N	1	Lower only
Cyprinidae	*Macrhybopsis hyostoma*	shoal chub	N	N	Y	N	N	N	1	Lower only
Cyprinidae	*Notemigonus crysoleucas*	golden shiner	Y	Y	Y	N	N	N	3	Lower only
Cyprinidae	*Notropis atherinoides*	emerald shiner	N	Y	Y	N	N	N	2	Lower only
Cyprinidae	*Notropis dorsalis*	bigmouth shiner	y	Y	Y	Y	Y	Y	5	Basin wide
Cyprinidae	*Notropis stramineus*	sand shiner	Y	Y	Y	Y	Y	Y	6	Basin wide
Cyprinidae	*Phenacobius mirabilis*	suckermouth minnow	Y	Y	Y	N	N	N	3	Lower only
Cyprinidae	*Pimephales notatus*	bluntnose minnow	Y	Y	Y	Y	Y	Y	6	Basin wide
Cyprinidae	*Pimephales promelas*	fathead minnow	Y	Y	Y	N	Y	Y	5	Basin wide
Cyprinidae	*Pimephales vigilax*	bullhead minnow	N	N	Y	N	N	N	1	Lower only
Cyprinidae	*Rhinichthys atratulus*	blacknose dace	N	Y	Y	Y	Y	Y	5	Basin wide
Cyprinidae	*Semotilus atromaculatus*	creek chub	Y	Y	Y	Y	Y	Y	6	Basin wide
Catostomidae	*Carpiodes carpio*	river carpsucker	Y	Y	Y	N	N	Y	4	Basin wide
Catostomidae	*Carpiodes cyprinus*	quillback	N	Y	Y	Y	N	N	3	Basin wide
Catostomidae	*Carpiodes velifer*	highfin carpsucker	N	N	Y	N	N	N	1	Lower only
Catostomidae	*Catostomus commersonii*	white sucker	Y	N	Y	N	Y	Y	4	Basin wide

Table 2. Continued.

Family	Scientific Name	Common Name	Harlan and Speaker (1956)	Harlan et al. (1987)	In IRIS (up though 2002)	2008 WRC Bio-Blitz	IDNR Bio-monitoring (2001-2011):	2012 WRC Bio-Blitz	Number of surveys found:	Distribution in Middle Raccoon basin
Catostomidae	*Hypentelium nigricans*	northern hog sucker	N	N	Y	N	N	N	1	Lower only
Ictaluridae	*Ameiurus melas*	black bullhead	Y	Y	Y	Y	Y	N	5	Basin wide
Ictaluridae	*Ameiurus natalis*	yellow bullhead	N	N	Y	N	N	N	1	Lower & Willow
Ictaluridae	*Ictalurus punctatus*	channel catfish	Y	Y	Y	Y	Y	Y	6	Basin wide
Ictaluridae	*Noturus flavus*	stonecat	Y	N	Y	Y	Y	Y	4	Basin wide
Ictaluridae	*Pylodictis olivaris*	flathead catfish	N	N	N	N	Y	N	1	Lower only
Esocidae	*Esox lucius*	northern pike	N	N	Y	N	N	N	1	Lower only
Moronidae	*Morone mississippiensis*	yellow bass	N	N	Y	N	N	N	1	Lower only
Centrarchidae	*Lepomis cyanellus*	green sunfish	Y	Y	Y	Y	Y	Y	6	Basin wide
Centrarchidae	*Lepomis humilis*	orangespotted sunfish	Y	Y	N	N	N	N	2	Basin-wide?
Centrarchidae	*Lepomis macrochirus*	bluegill	N	Y	Y	Y	N	Y	4	Basin wide
Centrarchidae	*Lepomis microlophus*	redear	N	Y	N	N	N	N	1	
Centrarchidae	*Micropterus dolomieu*	smallmouth bass	N	Y	Y	N	N	N	1	Lower & Willow
Centrarchidae	*Micropterus salmoides*	largemouth bass	Y	Y	Y	Y	Y	Y	6	Basin wide
Centrarchidae	*Pomoxis annularis*	white crappie	N	Y	Y	N	N	Y	3	Basin-wide
Centrarchidae	*Pomoxis nigromaculatus*	black crappie	N	Y	Y	N	N	N	1	Lower & Willow
Percidae	*Etheostoma exile*	Iowa darter	N	N	Y	N	N	N	1	Lower only
Percidae	*Etheostoma nigrum*	johnny darter	Y	Y	Y	Y	Y	Y	6	Basin wide
Percidae	*Percina phoxocephala*	slenderhead darter	N	N	Y	N	N	N	1	Lower only
Percidae	*Sander vitreus*	walleye	N	Y	Y	N	N	N	2	Lower only
Sciaenidae	*Aplodinotus grunniens*	freshwater drum	N	N	Y	N	N	N	1	Lower only
		Total number of species:	***22***	***26***	***40***	***15***	***18***	***17***	***43***	

Table 3. Fish species with collection records for Iowa's lower Middle Raccoon River subbasin (HUC-10: 0710000707) and/or Willow Creek subbasin (HUC-10: 0710000702) but not for the upper Middle Raccoon subbasin (HUC-10: 0710000701). Bolded rows are for species that might be expected to occur in the upper Middle Raccoon subbasin. The boundary between the upper Middle Raccoon basin and the lower Middle Raccoon basin is the confluence with Willow Creek 3 miles south of Bayard, IA (see Figure 1). Fish habitat preferences are taken from Pflieger (1997) and Harlan et al. (1987).

Family	Scientific Name	Common Name	Distribution in Middle Raccoon basin	Habitat Preference:	Would be expected in upper Middle Raccoon Basin?
Clupeidae	*Dorosoma cepedianum*	gizzard shad	Lower only	larger rivers; lakes; reservoirs	N
Cyprinidae	***Hybognathus hankinsoni***	**brassy minnow**	**Lower & Willow**	**small streams**	**Y**
Cyprinidae	***Luxilus cornutus***	**common shiner**	**Lower only**	**small streams**	**Y**
Cyprinidae	*Macrhybopsis hyostoma*	shoal chub	Lower only	larger rivers	N
Cyprinidae	**Notemigonus crysoleucas**	**golden shiner**	**Lower only**	**variety of stream sizes; prefers quiet water/backwater habitats**	**Y**
Cyprinidae	*Notropis atherinoides*	emerald shiner	Lower only	larger rivers	N
Cyprinidae	*Pimephales vigilax*	bullhead minnow	Lower only	larger rivers	N
Catostomidae	*Carpiodes velifer*	highfin carpsucker	Lower only	medium-sized and larger rivers	N
Catostomidae	**Hypentelium nigricans**	**northern hog sucker**	**Lower only**	**small and medium-sized streams**	**Y**
Ictaluridae	*Ameiurus natalis*	yellow bullhead	Lower & Willow	streams	Y
Ictaluridae	*Pylodictis olivaris*	flathead catfish	Lower only	larger rivers	N
Esocidae	*Esox lucius*	northern pike	Lower only	larger rivers; lakes	N
Moronidae	*Morone mississippiensis*	yellow bass	Lower only	larger rivers; lakes	N
Centrarchidae	**Micropterus dolomieu**	**smallmouth bass**	**Lower & Willow**	**medium-sized and larger rivers**	**Y**
Centrarchidae	*Pomoxis nigromaculatus*	black crappie	Lower & Willow	larger rivers; lakes; reservoirs	N
Percidae	**Etheostoma exile**	**Iowa darter**	**Lower only**	**small to mid-sized streams; backwaters**	**Y**
Percidae	*Percina phoxocephala*	slenderhead darter	Lower only	medium-sized and larger rivers	N
Percidae	*Sander vitreus*	walleye	Lower only	larger rivers; lakes; reservoirs	N
Sciaenidae	*Aplodinotus grunniens*	freshwater drum	Lower only	larger rivers; lakes; reservoirs	N

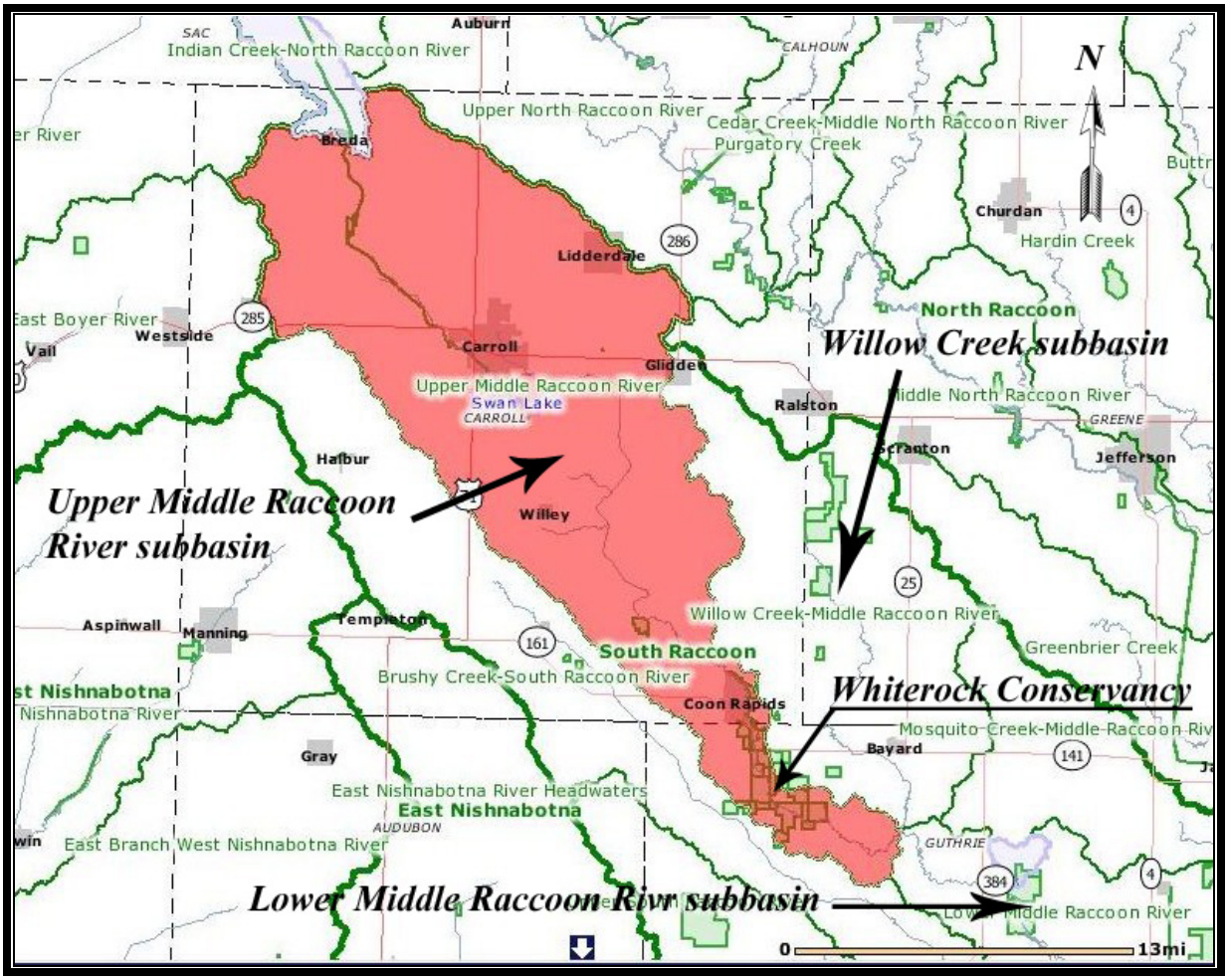


Figure 1. Subbsins of the Middle Raccoon River basin in Carroll and Guthrie counties in Iowa. Ten-digit hydrologic unit codes (HUCs) for these basins are as follow: upper Middle Raccoon subbasin (0710000701); lower Middle Raccoon River subbasin (0710000707), Willow Creek subbasin (0710000702). The boundary between the upper Middle Raccoon basin and the lower Middle Raccoon basin is the confluence with Willow Creek 3 miles south of Bayard, IA (just downriver from the Whiterock Conservancy).

Table 2. Continued.

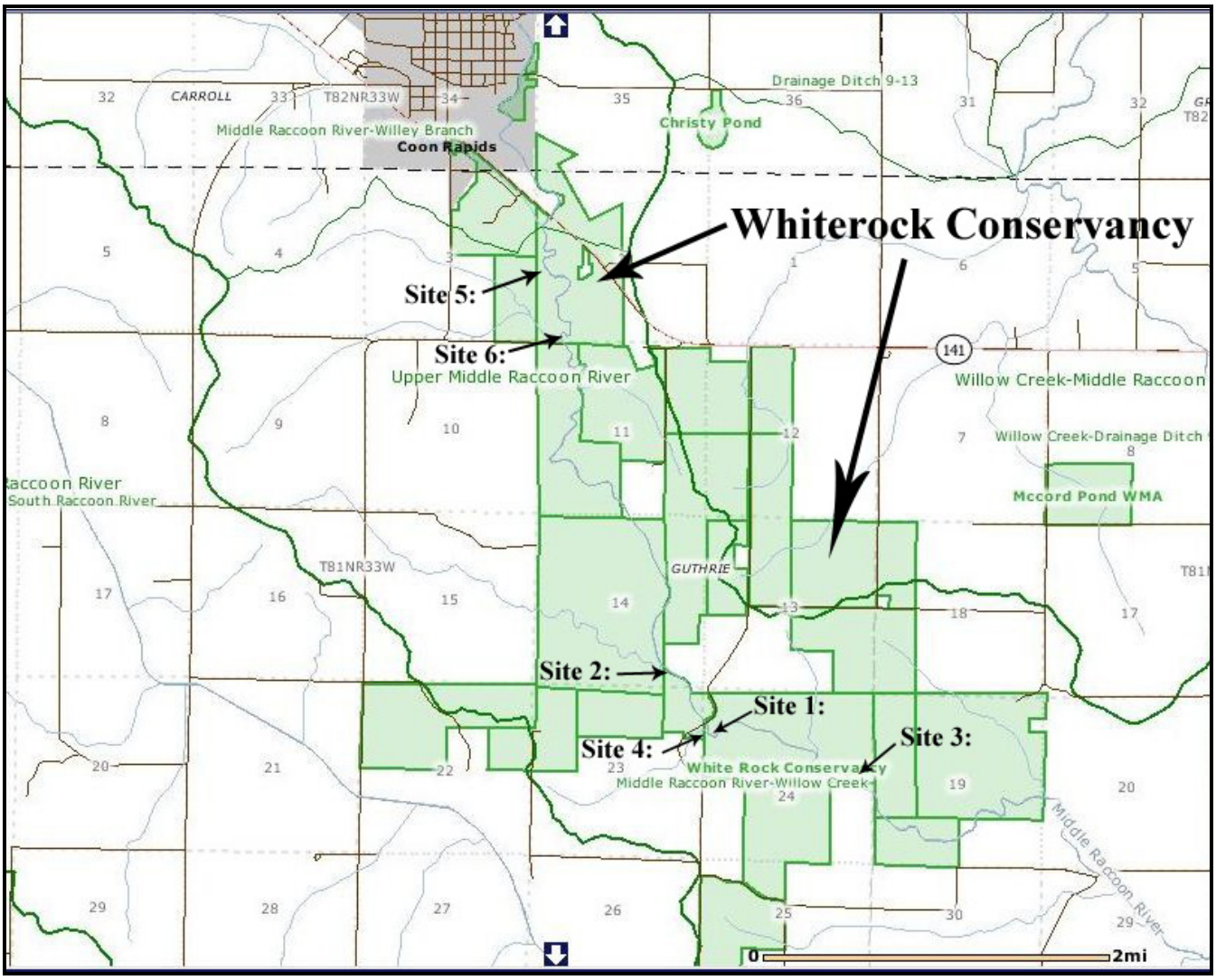


Figure 2. Sites on the Middle Raccoon River sampled for fishes during the June 8-9, 2012, bio-blitz at the Whiterock Conservancy in Guthrie County, Iowa. See Figures 4 and 5 for detailed locations of sample sites.

Site 1: at WRC campground.

Site 2: upstream Fig Ave; Dobby's riffle.

Site 3: 0.8 mi. dstr. WRC campground.

Site 4: dstr Fig Ave; at WRC campground.

Site 5: 0.25 mi SSE of WRC main office.

Site 6: 0.75 mile SSE of WRC main office.

Figure 3. Sites on the Middle Raccoon River in Guthrie County, Iowa, sampled on June 8 and 9, 2012, as part of the Whiterock Conservancy's "bio-blitz".

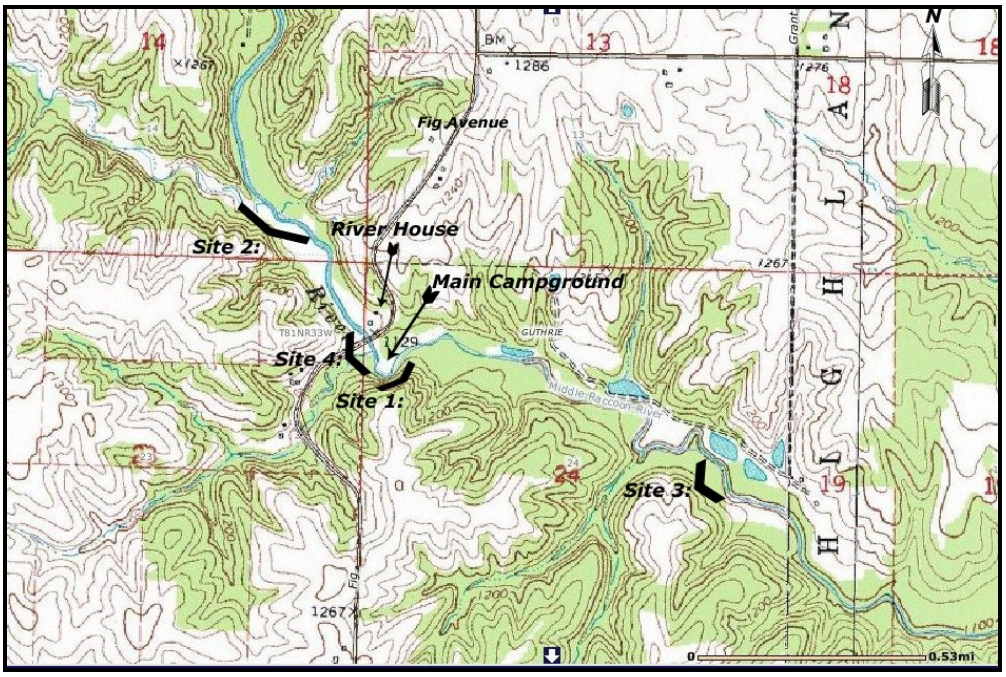


Figure 4. Locations of fish sample sites 1 through 4 of the Whiterock Conservancy bio-blitz on June 8-9, 2012, Guthrie County, Iowa.

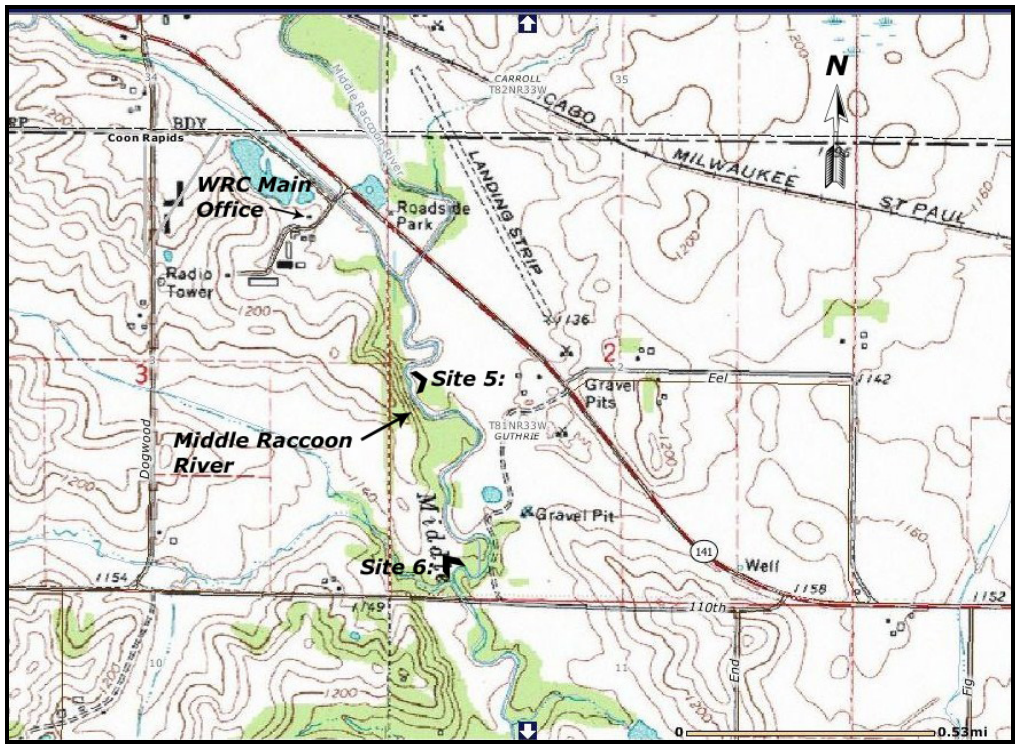


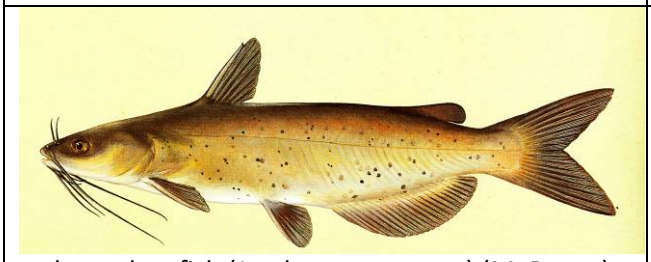
Figure 5. Locations of fish sample sites 5 and 6 of the Whiterock Conservancy bio-blitz on June 8-9, 2012, Guthrie County, Iowa.

Spotfin shiner (*Cyprinella spiloptera*) (K. Schmidt)

Sand shiner (*Notropis stramineus*) (K. Schmidt)

bluntnose minnow (*Pimephales notatus*) (K. Schmidt)

White sucker (*Catostomus commersonii*) (W. Schmid)



channel catfish (*Ictalurus punctatus*) (M. Reece)

Stonecat (*Noturus flavus*) (K. Schmidt)

johnny darter (*Etheostoma nigrum*) (K. Schmidt)

Figure 6. Common fish species collected from the Middle Raccoon River at the Whiterock Conservancy during the June 8-9, 2012, biodiversity blitz. All photos from *Natural History of Minnesota Fishes* web site (http://hatch.cehd.umn.edu/research/fish/fishes/natural_history.html) except channel catfish (from Harlan et al. (1987).

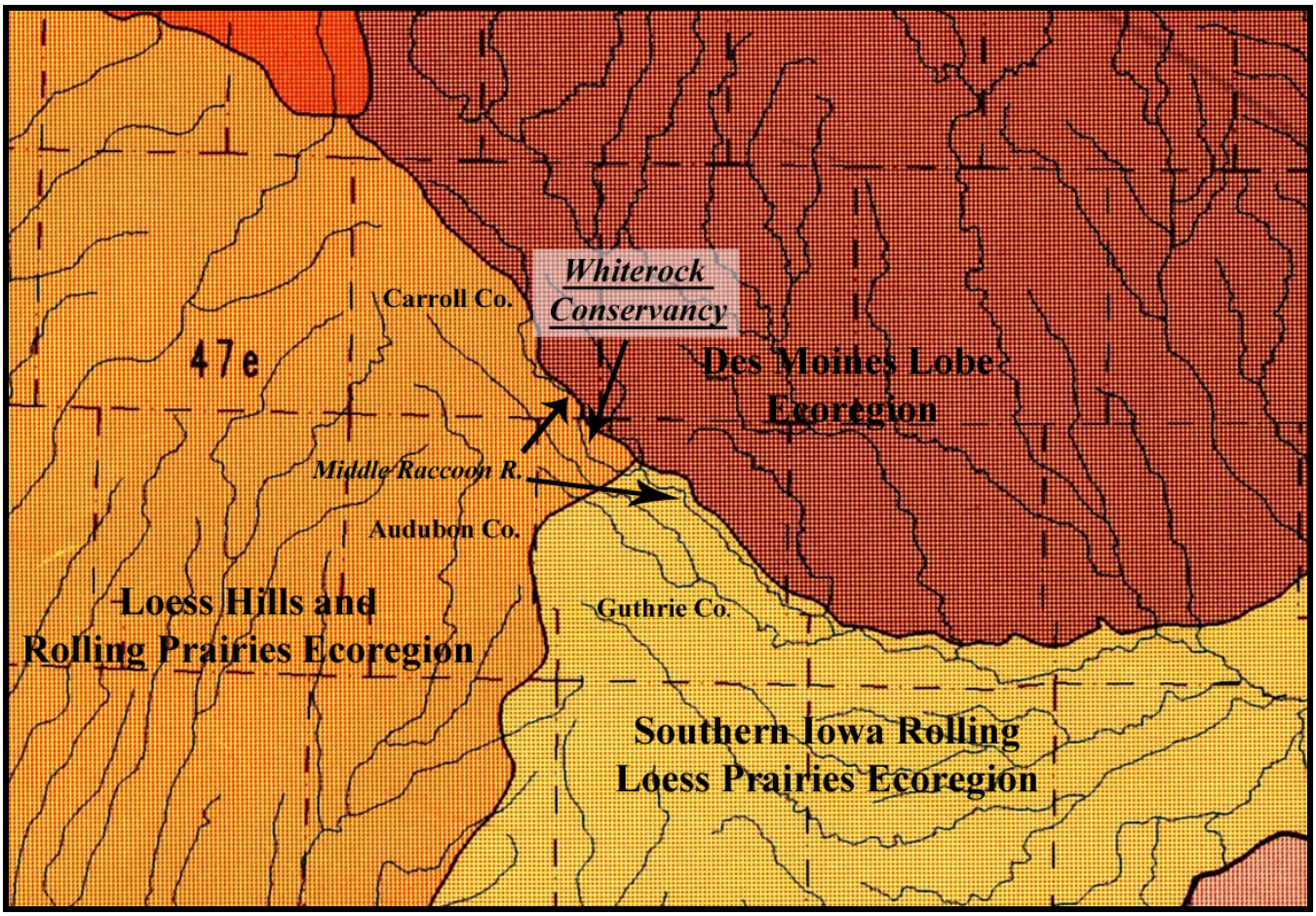


Figure 7. Location of the Whiterock Conservancy relative to Iowa ecoregions of west-central Iowa. The Des Moines Lobe is a geologically young land surface that has low topographic relief, is poorly drained, and has generally low rates of soil erosion. The Loess Hills and Rolling Prairies and Southern Iowa Rolling Loess Prairie ecoregions are geologically much older land surfaces with well-developed drainage patterns and relatively high rates of soil erosion (modified from Iowa DNR (http://www.igsb.uiowa.edu/wqm/biological/EcoRegions.html)).