Minnesota DNR

F-29-R(P)

Area F312

January 23, 2009

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

DIVISION OF FISHERIES AND WILDLIFE

Progress Report

Fisheries and stream morphology assessment of the Mississippi River from the Crow Wing River Confluence to St. Cloud, Minnesota, 2007-2008.

River Miles 926 to 993.

By

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Little Falls Area Fisheries

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Summary

A fishery survey of the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota sampled 40 different species and one hybrid, and indicated a diverse fish community was present. Water levels were very low during the sampling period from July to September 2007. Habitat varied based on dam influences with upstream reaches usually higher in gradient and faster flowing with coarse substrates and reaches immediately upstream of dams typically slower with more sand type substrates. Water quality was good and did not indicate excessive nutrient loading.

Species richness was similar to prior surveys and assessments and the total number of fish species documented in this and previous surveys combined was 46. Index of Biotic Integrity (IBI) ratings at 17 sampling stations varied from fair to good, with the majority of stations rated as good. There were no clear patterns of IBI ratings in any dam-to-dam river section. There were a few differences in species composition between dam-to-dam sections, with the Sartell Dam to St. Cloud Dam section having significantly lower species richness.

Gamefish species including walleye, smallmouth bass, and muskellunge were difficult to sample and the results of this survey may not accurately represent their abundance or size structure. Adult gamefish were especially difficult to sample due to low water levels and extremely clear water.

Rosgen (1996) Type II stream morphology evaluations were completed at seven stations in the study area during 2008. The river was entrenched, had high width/depth ratios, moderate sinuosity and was dominated by cobble and gravel at all stations indicating F3 and F4 Rosgen (1996) classifications.

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INTRODUCTION

The Mississippi River from the Crow Wing River confluence to the dam at St. Cloud, Minnesota covers approximately 66.8 river miles. The river is an important natural resource to the central part of the state and is used for recreation, hydropower, cropland irrigation, and municipal water for the City of St. Cloud. This section of the river was unique, flowing through a transition zone from primarily forested lands to mainly agricultural lands. Lands west of the river were typically forested south to Little Falls where agricultural land uses began to dominate the landscape. On the east bank, forested lands transitioned to irrigated cropland near the Crow Wing County line.

The river was entrenched and flowed through a well-defined channel with fairly steep banks. Width to depth ratios were high throughout the study area and streambed substrates were dominated by sand, gravel and cobble. Sinuosity was low to moderate. Development along the river was typically intensive in urban areas and light to moderate in rural areas. Adjacent lands were a mix of private and public (state, county, and municipal) and land use was predominately recreational, agricultural, and municipal.

The river was divided into four sections by five dams from Brainerd to St. Cloud: Brainerd Dam to Little Falls Dam, Little Falls Dam to Blanchard Dam, Blanchard Dam to Sartell Dam, and Sartell Dam to St. Cloud Dam. A diverse fish community existed within these sections of the Mississippi River with a combined 42 species sampled in this survey. Common gamefish species included, northern pike, muskellunge, channel catfish, rock bass, bluegill, smallmouth bass, black and white crappie, and walleye. Abundant non-gamefish species included, common carp, hornyhead chub, common shiner, spotfin shiner, white sucker, shorthead redhorse, silver redhorse, Johnny darter, and logperch. Species richness was similar in all sections with the exception of somewhat lower diversity found in the Sartell to St. Cloud section.

This survey was part of a statewide, cooperative, comprehensive Mississippi River Survey being conducted from Lake Itasca, Minnesota to Coon Rapids, Minnesota.

Reach Descriptions

The Mississippi River, from Lake Itasca to Coon Rapids was divided into 49 Reaches. Little Falls Area Fisheries personnel surveyed the Mississippi River between the confluence of the Crow Wing River (CWRC) and St. Cloud Dam, or Reaches 35 through 41 (Figure 1).

Reach 35. Reach 35 began at the confluence of the Crow Wing River, which entered from the west, and ended at the Nokasippi River, and was characterized as having low sinuosity. The river was fairly narrow and deep, had lower gradient, and had few island and riffle areas. Substrates were mainly sand and gravel in runs and pools with rubble and boulder in riffle areas. The Crow Wing River is a large tributary flowing from the west that contributed significant flow to this reach. Camp Ripley Military Reservation exists on the west shoreline of Reach 35 and was mainly forested. The east bank was a mixture of forest and irrigated cropland.

Reach 36. Reach 36 started at the confluence of the Nokasippi River, which entered from the east, and ended at Belle Prairie Rapids. This reach had higher gradient, very wide and shallow riffles, and many areas with islands and braided channels. Substrates were dominated by sand, gravel and boulder. The Nokasippi River and Fletcher Creek are significant tributaries to this reach. Camp Ripley Military Reservation exists on the west shoreline of Reach 36 and was mainly forested. The east shoreline was a mixture of upland forest, bottomland forest, and irrigated cropland.

Reach 37. Reach 37 had lower gradient, was dominated by sand substrates, and included the reservoir above Little Falls Dam. Some island areas were also present in this stretch. This reach had moderate to heavy residential development on both banks and had a significant amount of recreational boating. The Little Elk River is a major tributary that entered this reach from the west.

Reach 38. Reach 38 comprised Zebulon Pike Reservoir and began at Little Falls Dam and ended at Blanchard Dam near Royalton. This reach had a short tailwater section with sand/gravel/rubble/boulder substrates and fairly high gradient, which then transitioned to a sandy, more reservoir-like section to Blanchard Dam. This reach also had fairly high residential development on the east and west banks with some agricultural lands present on the west bank. Recreational boating was popular on this reach. Major tributaries entering this reach from the west include Pike Creek and the Swan River.

Reach 39. Reach 39 began at Blanchard Dam and extended downstream to the confluence with the Platte River. This reach was dominated by sand/gravel/rubble/boulder substrates, had fairly high gradient, was fairly shallow, and had several island areas. Adjacent lands were mainly undeveloped on the east bank. The west bank included some agricultural lands. Residential development was light. Hay Creek, Little Two River and North Two River are tributaries that enter this reach from the west.

Reach 40. Reach 40 began at the confluence of the Platte River and ended at Sartell Dam. This reach had fairly low gradient and substrates dominated by sand. Few islands were present and residential development was fairly light upstream and became heavy downstream near Sartell. Cropland exists on adjacent lands in the upper half of the reach. Significant tributaries entering this reach include Spunk Creek and Stony Creek from the west, and the Platte River and Little Rock Creek from the east.

Reach 41. Reach 41 comprised the section of the river from Sartell Dam to St. Cloud Dam. Fairly high gradient exists within this reach down to Sauk Rapids where the river transitioned to more reservoir-like characteristics. Class 3 rapids existed at Sauk Rapids. Substrates ranged from sand/gravel, rubble/boulder in the upper half of the reach to mainly sand downstream. Adjacent lands were entirely residential and municipal development although a thin buffer of trees existed along most of the reach.

Sample Stations

Electrofishing stations consisted of 15 boat electrofishing stations and four stream shocker stations (Figure 2). Trapnet stations included 15 standard lake survey trap net sets and 15 one-quarter inch trapnet sets (Figure 3). Ten trotlines were used to sample channel catfish in Reach 38. One seine haul was conducted in Reach 36. Rosgen (1996) stream morphology stations were established at seven boat electrofishing stations (Figure 4).

Pertinent Issues within Reaches

Reach 35 and 36. An important issue relating to these two reaches pertained to adjacent lands. Camp Ripley Military Reservation has pursued an ACUB (Army Compatible Use Buffer) by purchasing lands and easements to prevent further significant development in the area that might conflict with current military training activities. DNR and other conservation agencies have supported and participated in this activity as it has led to protection of sensitive riparian lands and important natural resource corridors.

Irrigated cropland was significant along these reaches and could have future impacts on baseflow, especially during dry periods or droughts. Two irrigators pump surface water directly from the Mississippi River within these reaches and are subject to protected flow laws. A local gauging station was not used to determine if low flows are critical in this area. This may be a potential shortcoming of the protected flow regulation for this section of the Mississippi River. GPS locations of surface water irrigation sites will be obtained during future survey activities.

Several erosion sites existed within Reaches 35 and 36. Shoreline stabilization efforts such as installation of rip rap, tree plantings and alteration of tributary stream channels have been completed. An overflow channel was constructed at the mouth of Fletcher Creek to abate flooding. Several hundred feet of the Mississippi River were rip rapped at the Fletcher Creek confluence to prevent erosion. Ditching of tributaries, wetland drainage, and construction of roads and highways has decreased the ability of adjacent lands to hold water resulting in increased flashiness and higher erosion potential. The Mississippi Headwaters Board (MHB) is relegated authority to establish and enforce zoning laws for this section of the Mississippi River. GPS locations of erosion sites and shoreline alterations will be documented in future survey activities.

Reach 37. Pertinent issues within this reach are primarily associated with development. Residential development was moderate to heavy and likely increasing north of Little Falls. Sedimentation and build-up of decaying vegetation in the reservoir above Little Falls Dam and in the vicinity of the Highway 10 Bridge has been an issue with shoreline residents in the past. The City of Little Falls is currently considering a bridge construction project at the downstream end of this reach. Impervious surface is considerable in the City of Little Falls and likely results in degradation of water quality. Repairs to Little Falls Dam require significant reservoir drawdown that has resulted in dewatering of important fish habitats in the past. A proposal for a fish passage around Little Falls Dam would connect this section of the river with Zebulon Pike Reservoir downstream and could benefit fish species that require long unimpeded sections of river for their survival. The MHB has regulatory authority of shoreland zoning laws.

Reach 38. Important issues associated with this reach are similar to those in Reach 37. Impervious surface near the City of Little Falls is an issue and likely impacts water quality. Treated wastewater from the City of Little Falls enters the river just downstream of the dam and has water quality impacts. The Swan River and Pike Creek enter the river in this reach and drain primarily agricultural lands, which degrades water quality. Residential development is likely increasing in this stretch, especially on the west bank. A petroleum pipeline crossed the river in this reach. The MHB is responsible for regulating shoreland zoning. The proposed fish passage around Little Falls Dam will also have impacts to this reach. Little Falls Dam has been required to operate in run-of-the-river mode where the amount of water allowed through the dam must equal water received upstream. Minnesota Power and Light owns the dam and is interested in adding an additional turbine to the facility. Surface water irrigators exist within this stretch and are subject to protected flow regulations. Sloughing banks were present in this reach and GPS locations will be documented in future survey activities.

Reach 39. Pertinent issues within this reach included erosion and sloughing banks. Bank stabilization projects have used riprap to mitigate erosion. These erosion sites will be mapped with GPS in future survey efforts. Increased residential development may be an issue as the St. Cloud metropolitan area expands. DNR Fisheries will pursue conservation easements and aquatic management areas within this reach as lands become available. Tributaries drain primarily agricultural lands and impact water quality. Surface water irrigators exist within this reach and are subject to protected flow laws. Surface water irrigation sites will be mapped with GPS in upcoming survey efforts. Jet boat technology has increased accessibility within this reach and may increase angling pressure in the future. Public access to the river is limited in this section of the river. The MHB is responsible for regulating shoreland zoning only on lands in Morrison County. This regulatory authority ends just south of County Road 26 on the east bank and runs the entire length of this reach on the west bank.

Reach 40. Issues within this reach correspond to development pressures associated with the growth of the greater St. Cloud Area. Demand for shoreland will increase in the future as the population continues to rise. Residential development increased in a downstream direction from the Platte River to the City of Sartell. Conservation easements and AMA's will be pursued when lands become available. A parcel of land, including approximately 0.5 mile of shoreline owned by the Franciscan Sisters, may become available as either a conservation easement or an AMA. Tributaries drain primarily agricultural lands and likely results in degraded water quality. Irrigated cropland is common on adjacent lands and may impact groundwater flow, baseflow and water quality in the Mississippi River. Surface water irrigators were present within this reach and are subject to protected flow regulations. Surface water irrigation sites will be mapped using GPS in future survey efforts. Benton and Stearns Counties are responsible for regulating shoreland ordinances in this reach.

Reach 41. Reach 41 was entirely within the St. Cloud metropolitan area. Pertinent issues included water quality degradation due to urban runoff associated with extensive impervious surface. The City of St. Cloud's water supply is drawn from the river and therefore is subject to protected flow laws. Education of St. Cloud residents regarding water conservation is important, especially during drought conditions. Bridge construction projects require due diligence by DNR staff to avoid fish habitat destruction. Critical review of municipal development on riparian lands is also important. A man-made rock spine is currently being manipulated to optimize fishing opportunities at a shore fishing site.

Water Quality

Water quality samples were taken at nine locations within the study area. Sample locations were typically at the midpoint of a dam-to-dam section and immediately upstream of the dam. Water quality parameters measured included: total phosphorus, chlorophyll a, total alkalinity, pH, total dissolved solids, conductivity, and chloride. Results of water quality analysis are listed in Table 1. In general, total phosphorus and chlorophyll a measured lower at the midpoints of our dam-to-dam sections and higher immediately above the dams. Total alkalinity, pH, total dissolved solids conductivity and chloride measures were similar at all sampling sites. Total phosphorus, chlorophyll a, and conductivity increased in a downstream direction from Brainerd to St. Cloud. Chloride levels were similar from Brainerd to Sartell Dam but were elevated from Sartell Dam to St. Cloud Dam.

Hydrology

Discharge information was gathered from the United States Geological Survey website. USGS gage stations are located at Brainerd, near Royalton and at St. Cloud. Discharge is typically high in April and May, low during summer, increases somewhat in fall, and is low again during winter. In 2007, stream flows were typically normal to slightly below normal in spring, well below normal in summer, and somewhat above normal to normal in fall and winter (Figures 4-6).

Climate and human activity are variables that have significantly impacted the Mississippi River watershed from Brainerd to St. Cloud. Agricultural activities such as land clearing for cropland, ditching, stream channelization, wetland drainage and irrigation have had impacts on the natural hydrology of the watershed. Dam and road construction, impervious surface, logging and water appropriations have also had impacts on watershed hydrology in the area. Climate and human activity have caused tributaries to the Mississippi River to be “flashy” in nature and have lower baseflow during dry periods.

Mississippi River Gage Station at Brainerd (05242300). The Mississippi River at Brainerd has a mean annual discharge of 3,446.3 cubic feet per second (cfs) measured at gage station for the period of record from 1987 through 2007. The highest recorded flow was measured at 17,500 on April 30, 2001. The historical low flow of 348 cfs was measured on July 30, 1988. Discharge was extremely low during the 2007 survey, ranging from 429 to 769 cfs.

Mississippi River Gage Station near Royalton (05267000). Mean annual discharge for the Mississippi River at Royalton is 4,806.2 cfs. The highest flow recorded during the period of record from 1924 through 2007 was 38,200 cfs on April 8, 1997. The lowest recorded discharge was 254 cfs on November 25, 1936. Flows during 2007 survey efforts between Little Falls and Blanchard Dams and Blanchard and Sartell Dams were extremely low and measured from 1,140 to 1,570 cfs.

Mississippi River Gage Station at St. Cloud (05270700). The Mississippi River at St. Cloud has a mean annual discharge of 6,489.4 cfs measured at gage station for the period of record from 1988 through 2007. The highest measured discharge was 46,900 cfs recorded on April 8, 1997. The historical low of 909 cfs was recorded on August 17, 2006. Discharge levels during 2007 survey work in the Sartell to St. Cloud Dam section were extremely low, and ranged from 1,160 to 1,380 cfs.

The stretch of the Mississippi River from Brainerd to St. Cloud is under protected flow regulations. MN DNR Division of Waters is directed by statute, section 103G.285, to limit consumptive appropriations of surface water under extremely low flow conditions. The annual Q90 excedance value for discharge for the period of record analyzed is used as the specified low flow value for suspending certain surface water appropriations. The Mississippi River from Brainerd to St. Cloud has a protected stream flow of 2,240 cfs measured at the Coon Rapids USGS gage station.

Methods

Little Falls Area Fisheries staff conducted fish sampling and Rosgen (1996) Level II stream morphology classification evaluations on the section of the Mississippi River between the confluence of the Crow Wing River and St. Cloud Dam. This survey is part of a coordinated effort between DNR Area Fisheries Offices to sample the river from Bemidji to Coon Rapids Dam. These area offices included, Bemidji Area Fisheries, Grand Rapids Area Fisheries, Aitkin Area Fisheries, Brainerd Area Fisheries, Little Falls Area Fisheries, Montrose Area Fisheries, and West Metro Area Fisheries.

Primary Sampling - Fish Community IBI

A total of 15 boat electrofishing stations and one stream shocker station were established on the Mississippi River between the confluence of the Crow Wing River and St. Cloud Dam (Table 2). Two boat electrofishing stations in Reach 35 were sampled in 2008. Three additional stream shocker stations were used only for supplemental sampling.

Boat stations were approximately 500 meters long. Three electrofishing runs conducted in a downstream direction were completed at each station, one along each bank, and one down the middle of the river. Boat electrofishing stations were sampled with a 16-foot Coffelt VVP-2E boom shocker with a sphere and dropper type anode powered by a 5000 watt Honda generator. The boat hull acted as the cathode. Output varied from 3 to 5 amps. Due to low water levels, one boat electrofishing station was changed to a stream shocker station in Reach 41. The stream shocker station consisted of one upstream run approximately 460 m long utilizing a Smith Root 5.0 GPP electrofishing unit. Two handheld anodes were used, and the cathode was a metal plate on the bottom of the shocker barge.

Fish captured were identified, measured for length (or a length range recorded for non-gamefish species), weighed, examined for DELT (diseases, lesions and tumors), and released. Prior to release, bony structures were taken on gamefish species to determine length at age. A small subsample of common carp, white sucker, shorthead redhorse, silver redhorse, channel catfish, northern pike, rock bass, bluegill, black crappie, smallmouth bass, yellow perch, and walleye were kept for contaminant monitoring.

Primary sampling was based on Niemela and Feist’s (2002) IBI methodology for coolwater streams in the upper Mississippi River Basin. Fish community index of biotic integrity (IBI) scores were calculated for each station. A set of ten metrics, established based on rivers with watersheds greater than 200 square miles, were used to calculate IBI scores. Metrics were based on species richness and composition, trophic composition, reproductive guild, functional guild, and fish abundance and condition. Each metric received a score of 0, 2, 5, 7, or 10 based on the quality of the electrofished sample. The sum of the metrics at each station produced the IBI score for each station. Sampling stations with scores from 0-19 were labeled as having “very poor” biological integrity, scores from 20-39 were considered to have “poor” integrity, scores from 40-59 were considered to have “fair” integrity, scores from 60-79 were considered to have “good” integrity and scores from 80 to 100 were considered to have “excellent” biotic integrity (Niemela and Feist, 2002).

Secondary Sampling – Fish Species Richness

Stream-Shocker Stations. Stream-shocker stations were established at three sites to supplement assessment of species richness (Table 2). Station lengths were approximately 200 meters in length and were comprised of one run in an upstream direction. Gamefish captured were identified, measured for length, weighed, examined for DELT (deformities, lesions and tumors), a bony structure taken, and released. Non-gamefish were identified, a length range obtained for each species, bulk weighed by species, examined for DELT (deformities, lesions and tumors), and released. IBI scores were obtained based on methodology developed by Niemela and Feist (2002).

Trapnet Stations. A total of 30 trapnet stations (Table 3) were established within four reaches that had reservoir characteristics to supplement analysis of species richness. Eight trapnet sets, including four ¾ inch standard lake survey trapnets and four ¼ inch trapnets, were set in Reaches 37, 38, and 40. Three ¾ inch and three ¼ inch trapnets were set in Reach 41. Nets were set in areas with little or no current with lead staked to shore and trap end stretched into the river. Gamefish captured were identified, measured, weighed, and released. A scale sample or other bony structure was taken for age determination. Non-gamefish species were identified and were either measured for length or a length range was obtained. Individual or bulk weights were obtained depending on species prior to release. A small subsample of common carp, white sucker, shorthead redhorse, silver redhorse, channel catfish, northern pike, rock bass, bluegill, black crappie, smallmouth bass, and walleye were kept for contaminant monitoring.

Trotline Stations. Ten trotline stations were established in Reach 38 to obtain a quantitative estimate of channel catfish abundance (Table 4). Trotlines were 150 feet in length and had 25 droppers with 4/0 Mustad O'Shaughnessy hooks. Trotlines were baited with a cut bait of sucker or redhorse, staked to shore, and angled in a downstream direction into suspected catfish habitat. Catfish captured were measured, weighed and a pectoral spine removed prior to release. A subsample of channel catfish was kept for contaminant monitoring.

Seine Station. One 50-foot shoreline seine haul was conducted within Reach 36. The seine used was 50 feet in length and had ¼ inch mesh size. The seine was dragged along shore with one person walking near shore, and one person dragging approximately 20 feet from shore. Fish captured were identified, enumerated, and a length range obtained for each species prior to release. Gamefish captured were measured for total length then released.

Contaminant Monitoring. An effort was made to collect a subsample of fish within our study reaches for contaminant monitoring. Species sampled were typically those that are commonly consumed by anglers and included, common carp, white sucker, shorthead redhorse, silver redhorse, channel catfish, northern pike, rock bass, bluegill, black crappie, smallmouth bass, yellow perch and walleye. For smaller species a total of ten individuals, when available, were obtained for each dam-to-dam section. For larger species, five individuals were kept per dam-to-dam section when available. Samples were individually wrapped in tin foil, labeled, frozen, and transferred in coolers to the DNR Toxicology Lab in St. Paul.

Water Sampling. Water grab samples were taken during the summer in 2007 and 2008 at nine stations from the confluence of the Crow Wing River to St. Cloud Dam. Samples were sent to the water quality lab in St. Paul. Parameters measured included, total phosphorus (ppm), chlorophyll a (ppb), total alkalinity (ppm), pH, total dissolved solids (ppm), conductivity (umhos) and chloride ion (ppm).

Stream Morphology and Classification

Rosgen (1996) Level II stream morphology classification evaluations were conducted at seven stations, one within each reach, during summer 2008. Channel cross-section, longitudinal profile, and substrate particle composition were surveyed at each sample station. Due to the large size of the Mississippi River, cross-section surveying was supplemented with a Garmin 420s chart-plotter where depths were too extreme to wade. The chart-plotter transducer was attached to the transom of a boat and calibrated for depth with a surveying rod. The boat was then driven from the last manually surveyed cross-section point on the left side of the river to a point where manual surveying could continue near the right bank. The chart-plotter recorded depth readings at one-second intervals and tracked distance in feet between depth readings. Wetted surface elevations were then added to depth measurements recorded by the chart-plotter to complete the cross section.

Due to extreme depths, longitudinal profiles were also obtained using the Garmin 420s chart-plotter. The chart-plotter transducer was attached to the transom of the boat and calibrated with a surveying rod. The thalweg was then followed with the boat while the chart-plotter recorded depth and distance measurements at one-second intervals. Wetted surface elevations were surveyed using a laser level and surveying rod at upstream and downstream ends of the longitudinal profile. Additional wetted surface measurements were made along the longitudinal profile if significant elevation changes were perceived to occur. Longitudinal profiles were approximately 500 meters in length.

Survey data were used to estimate bankfull cross-sectional areas and dimensionless ratios (i.e., width to depth ratio, slope, sinuosity, etc.) needed to describe stream morphology and classify the stream segments according to Rosgen (1996). All data were loaded into RiverMorph v.4.1.1 software for analysis. Watershed maps (Figures 8 through 15) were constructed using ArcGIS 9 software.

Results

<u>Fish Community</u>

Dam-to-Dam Comparison. Combining all fish sampling methods from 2007 and 2008, 42 species of fish were captured in the Mississippi River from the confluence of the Crow Wing River to St. Cloud Dam (Table 5). Species richness was highest (35 species) from Blanchard Dam to Sartell Dam followed by the sections from the Crow Wing River confluence (CWRC) to Little Falls Dam (32 species) and Little Falls Dam to Blanchard Dam (27 species). The section of the river from Sartell Dam to St. Cloud Dam (20 species) had the lowest species richness.

Gamefish species common in all four sections of the Mississippi River from the CWRC to St. Cloud Dam included, rock bass, bluegill, smallmouth bass, black crappie, yellow perch and walleye. Channel catfish were sampled in all sections but were most common in the Blanchard Dam to Sartell Dam and Sartell Dam to St. Cloud Dam sections. Largemouth bass are uncommon in this stretch of the river and were captured in low numbers in the upstream three sections of the study area. Muskellunge are known to exist in all sections of the river from Brainerd Dam to St. Cloud Dam, but were only sampled in the CWRC to Little Falls Dam section.

Non-gamefish species common in all four sections of the Mississippi River in the Little Falls study area included, common carp, hornyhead chub, bluntnose minnow, white sucker, shorthead redhorse, silver redhorse and burbot. Species that were sampled only in the CWRC to Little Falls Dam section included central mudminnow, blackchin shiner and greater redhorse. Brassy minnow, emerald shiner, creek chub and bigmouth buffalo were sampled exclusively in the Blanchard Dam to Sartell Dam section and blackside darter were unique to the Sartell Dam to St. Cloud Dam section.

Nine species considered sensitive to or intolerant of water quality and habitat degradation (Niemela and Feist, 2002) were sampled in the study area. Sensitive species captured in the CWRC to Little Falls Dam section included, hornyhead chub, blacknose shiner, longnose dace, greater redhorse, muskellunge, mottled sculpin, rock bass and smallmouth bass. From Little Falls Dam to Blanchard Dam, sensitive species included hornyhead chub, mottled sculpin, rock bass and smallmouth bass. Sensitive species observed in the Blanchard Dam to Sartell Dam stretch included hornyhead chub, spottail shiner, longnose dace, rock bass, and smallmouth bass. Intolerant species sampled in the Sartell Dam to St. Cloud Dam section included hornyhead chub, spottail shiner, rock bass and smallmouth bass.

A total of seven tolerant species that are known to persist in poor quality streams (Niemela and Feist, 2002) were present throughout the study area. Common carp and white sucker were sampled in all dam-to-dam sections and were the most common tolerant species. Green sunfish and bluntnose minnow were captured in all sections except Sartell Dam to St. Cloud Dam. Black bullheads were observed in all sections except the Little Falls Dam to Blanchard Dam section. Bigmouth buffalo and creek chub were sampled only in the Blanchard Dam to Sartell Dam section while central mudminnow was unique to the CWRC to Little Falls Dam stretch.

Fish Abundance. A total of 4,032 (minus hybrids) fish were sampled in all gear types in 2007 and 2008 fish surveys. Total catch by species is reported in Table 6. Hornyhead chub (N=811) was the most numerically abundant species comprising 20.1% of the catch followed by bluegill (N=526, 13.0%), rock bass (N=356, 8.8%), smallmouth bass (N=276, 6.8%) and logperch (N=266, 6.6%). Other species common in the catch included spotfin shiner (N=254, 6.3% of the catch), shorthead redhorse (N=250, 6.2%), common shiner (N=248, 6.2%) and white sucker (N=132, 3.3%).

Fish Biomass. Catch biomass was dominated by Catostomids and common carp (Table 6). The catch biomass of shorthead redhorse was highest at 149,594 grams. Common carp (121,493 g), channel catfish (104,108 g), white sucker (83,883 g), and silver redhorse (55,708 g) were other species dominating biomass of the catch.

Catch Per Effort. Total boat electrofishing effort for the survey was 6.96 hours and ranged from 0.38 hour in Station 36-3, to 0.54 hour in Station 40-2 (Table 7). Boat and stream shocker electrofishing catch rates for all species by reach are reported in Table 8 and Table 9 respectively. In general, catch rates for non-gamefish species were dominated by common shiner, hornyhead chub, logperch, shorthead redhorse, and white sucker. CPUE for hornyhead chub and tadpole madtom were higher in Reaches 35 through 38 than in downstream reaches. Catch rates for gamefish were typically high for rock bass, smallmouth bass, and walleye. Catch rates of rock bass were higher in upstream reaches while smallmouth catch rates were highest in downstream reaches. CPUE for bluegill was high in Reaches 38 and 40, both of which contained stations in more reservoir type habitats.

Fish Species Index of Biotic Integrity (IBI)

IBI scores were calculated at 15 boat electrofishing and four stream shocker stations using criteria established by Niemela and Feist (2002) for large rivers (Table 10). IBI scores for boat electrofishing stations ranged from 79 at 36-1 to 53 at 37-2 and 39-1. Biotic integrity was rated as “good” at ten stations and “fair” at five stations. Scores calculated at stream shocker stations ranged from 75 at station 39-2 to 51 at station 41-1. Three stream shocker stations were rated “good” and one station was rated “fair”. Metric scores for all electrofishing stations are recorded in Table 11.

Reach 35. Two IBI boat electrofishing stations were sampled in Reach 35 in 2008 (35-1, 35-2). Station 35-1 had an IBI score of 56 that indicated “fair” biotic integrity. High scores were obtained for a high number of intolerant species, low percent tolerant species, and low percent omnivore individuals and fish abundance. Moderate scores were obtained for number of piscivore species, percent lithophilic spawners and percent of individuals with deformities, lesions and tumors. Low scores were obtained for total species richness; number of darter, sculpin and madtom species; and number of invertivore species.

Reach 36. IBI scores were calculated at three boat electrofishing stations (36-1, 36-3, 36-5) in Reach 36. In general, high scores were obtained for species composition metrics and fish abundance and condition metrics. High scores were also received for low numbers of omnivore species sampled. Moderate scores were calculated for number of invertivore and piscivore species. Low scores were obtained for total number of species and percent simple lithophils. Total number of species and number of invertivore species tended to decrease in a downstream direction, while percent simple lithophils increased in a downstream direction. All boat electrofishing stations in Reach 36 were rated as having good biotic integrity.

Two supplemental stream shocker stations (36-2 and 36-4) were sampled and received biotic integrity ratings of good. IBI scores for Stations 36-2 and 36-4 were 67 and 74 respectively. Metric scores were moderately high, to high, for all metrics in Station 36-2 with the exception of total number of species and percent simple lithophils, which had low scores. Station 36-4 had high scores for most species composition metrics, all fish abundance and condition metrics, and for low percent of omnivore species. Moderate metric scores were received for number of invertivore species and number of piscivore species. Low scores were calculated for total number of species, and percent simple lithophils.

Reach 37. Electrofishing Station 37-1 received a good rating receiving high scores for species composition metrics, low percent omnivore species, high number of piscivore species, and fish abundance and condition metrics. Moderate scores were received for number of darter, sculpin, and madtom (DSM) species and percent simple lithophils. Low scores were calculated for total number of species and a low number of invertivore species. Station 37-2 received a fair score with low metric scores for number of species, number of DSM species, and number of invertivore species. Most other metrics had moderate scores. High scores were obtained for metrics of fish abundance and condition.

Reach 38. IBI scores were obtained at two boat electrofishing stations (38-1 and 38-2) in Reach 38. Station 38-1 had an IBI score of 71 and was rated good. Metrics with high scores were number of intolerant species, percent tolerant species, percent omnivore species, and fish abundance and condition metrics. Low scores were received for total number of species and number of invertivore species. Station 38-2 rated fair with an IBI rating of 57. High scores were obtained for fish abundance and condition metrics. Metrics receiving low scores at this station included total number of species, number of DSM species, and number of invertivore species. The remaining metrics had moderate scores.

Reach 39. IBI scores were calculated at three boat electrofishing stations (39-1, 39-3, 39-4) in Reach 39. In general, high scores were obtained for fish abundance and condition metrics while low scores were calculated for a low total number of species; a low number of darter, sculpin and madtom species; and a low number of invertivore species. Moderate scores were received for having good numbers of intolerant species, low numbers of tolerant species, low percent of omnivore species, moderate numbers of piscivore species, and moderate percentage of simple lithophils. One station had good biotic integrity and two stations had fair biotic integrity in Reach 39.

One stream shocker station (39-2) was sampled and received an IBI score of 75 indicating good biotic integrity. High metric scores were obtained for number of intolerant species, percent of tolerant species, percent omnivore species, number of fish per 100 meters, and percent DELT anomalies. Moderate scores were obtained for all other metrics.

Reach 40. Two boat electrofishing stations (40-1 and 40-2) had good biotic integrity ratings within Reach 40. Both stations received moderate to high scores for most metrics. Both stations had high scores for fish abundance and condition metrics and for having a high number of intolerant species. A low score was calculated at Station 40-1 for having a low number of piscivore species. A low score was calculated at Station 40-2 for having a low percent of simple lithophilic spawners in the sample.

Reach 41. IBI scores were calculated at one stream-shocker station (41-1) and one boat electrofishing station (41-2) in Reach 41. High metric scores in Station 41-1 were obtained for low percent of tolerant species, low number of invertivore species, and fish abundance and condition metrics. All other metric scores were low with the exception of a moderate score for number of piscivore species. High metric scores in Station 41-2 were for high number of intolerant species, low number of tolerant species, fish abundance, and condition metrics. Low metric scores were received for a low total number of species sampled; low number of darter, sculpin and madtom species; low number of invertivore species; and a low percentage of simple lithophilic spawners. Stream shocker Station 41-1 had a biotic integrity rating of fair and boat electrofishing Station 41-2 had a biotic integrity rating of good.

<u>Gamefish</u>

Game fish species commonly sampled in the survey included northern pike, channel catfish, rock bass, bluegill, smallmouth bass, black crappie, yellow perch and walleye. Length and weight statistics for selected gamefish species captured in electrofishing and trapnet stations are reported in Tables 12 and 13. Largemouth bass were uncommon and were sampled in low numbers. Muskellunge are known to inhabit all sections of the Mississippi River in the study area but were sampled only in Reach 35. Previous surveys also sampled white crappie in the Blanchard Dam to Sartell Dam and Sartell Dam to St. Cloud Dam sections, but were not captured during this survey.

Northern pike. Northern pike are common in the Mississippi River and were sampled at 12 of 19 electrofishing stations and in all reaches except Reach 41 (Table 14). CPUE ranged from 0.0/hour in Reach 41 to 6.32/hour in Reach 37. The majority of fish sampled were small ranging from 177 mm to 577 mm in length. Northern pike captured ranged from age 0 to age 5 and grew at an average rate when compared to lakes in central Minnesota. Young-of-the-year (YOY) northern pike captured in the survey averaged 192.6 mm in length.

Channel catfish. Channel catfish abundance in the study area increased in a downstream direction. Catfish were captured in eight electrofishing stations and all reaches except Reach 40 (Table 14). Catch rates ranged from 0.0/hour in Reach 40 to 29.4/hour in Reach 41. Catfish sampled ranged from 59 mm to 713 mm in length, although all but two fish sampled were adult fish. The majority of the fish sampled were age 5 to age 8. Growth was fairly slow with individuals exceeding 508 mm in six years.

Rock bass. Rock bass were common in all reaches and were captured in 16 of 17 electrofishing stations. CPUE ranged from 7.8/hour in Reach 41 to 55.8/hour in Reach 37. In general, rock bass catch declined in a downstream direction in the study area. Rock bass sampled ranged from 22 mm to 280 mm in length.

Bluegill. Bluegill were sampled in low numbers in stations or reaches in higher gradient areas, but were common in low gradient, reservoir type habitats (Table 14). Catch rates were highest in Reaches 38 (CPUE=39.6/hour) and 40 (CPUE=78.9/hour) which contained reservoir habitat. Bluegill CPUE was lowest in Reach 36 (0.75/hour), which is characterized by more riffle type habitat. Bluegill sampled in the assessment ranged from 26 mm to 196 mm in length. Bluegill captured ranged from YOY to age 8. Growth was exceptionally fast with individuals exceeding 180 mm at age 3.

Smallmouth bass. A total of 265 smallmouth bass were sampled in the survey and moderate to high numbers were captured in all reaches (Table 14). YOY and yearling bass were especially abundant. Catch rates of smallmouth bass were lowest in Reach 35 (CPUE=4.21). CPUE of smallmouth bass in Reaches 36 through 38 were similar ranging from 14.7/hour to 17.7/hour. Highest catch rates were observed in the downstream three reaches (CPUE range=30.8/hour to 74.5/hour). Smallmouth bass captured during the study ranged from 50 mm to 486 mm in length. Age of smallmouth bass captured ranged from YOY to age 10. Smallmouth bass exhibited good growth with age 5 fish averaging 392 mm. YOY smallmouth captured in the survey averaged 85.9 mm.

Black crappie. Black crappies were electrofished in low numbers at nine of 19 stations and in all similar reaches except Reach 37 (Table 14). CPUE ranged from 0.0/hour in Reach 37 to 5.8/hour in Reach 40. Black crappie captured in the assessment ranged from 133mm to 312 mm in length. Ages 1 through 5 were present with age 2 comprising 81.4% of the aged subsample. Growth was similar to that seen in fast growth populations in central Minnesota lakes.

Yellow perch. Yellow perch were not well represented in the electrofishing catch and were captured in only three stations and only in Reaches 36, 37 and 40. Only one yellow perch was sampled in both Reach 36 and Reach 37 measuring 70 mm and 55 mm respectively. Sixteen yellow perch were captured in Reach 40 ranging from 130 mm to 259 mm (mean=84.6 mm) in length.

Walleye. Walleye are common in this section of the Mississippi River and were captured in all reaches and all but three electrofishing stations (Table 14). CPUE for walleye ranged from 1.0/hour in Reach 40 to 12.8/hour in Reach 36. Walleye captured ranged from 85 mm to 455 mm in length. Ages of sampled walleye ranged from age 0 to 5 with the majority of the sample (62.5%) comprised of age 1 individuals. Growth was average to slightly below average through the second year, and slow for ages 3 and older, when compared to means for central Minnesota lakes. YOY walleye averaged 109.9 mm in length.

Trapnetting

Small mesh trapnets (1/4” mesh) and standard lake survey trapnets (3/4”) were set to sample fish species in reservoir habitats in Reaches 37, 38, 40 and 41. Catches for ¼” and ¾” trapnets are reported in Tables 15 and 16. Trapnets set in Reach 37 sampled eight species that weren’t captured in electrofishing gear. Species captured in trapnets not seen in the electrofished sample included: bluntnose minnow, silver redhorse, black bullhead, yellow bullhead, brown bullhead, brook silverside, and largemouth bass. Species exclusive to trapnets in Reach 38 included bowfin, yellow bullhead, brown bullhead, brook silverside and yellow perch. Six species not seen in electrofishing samples were captured in trapnets in Reach 40 including bowfin, bigmouth buffalo, black and yellow bullhead, brook silverside, and green sunfish. Species added in Reach 41 included silver redhorse, black bullhead, Johnny darter and yellow perch. Small mesh trapnets were effective sampling Cyprinids and YOY gamefish, but were also effective in sampling larger species. Large mesh trapnets appeared to be somewhat more effective in sampling Catostomids and Esocids.

Trotlines

Trotlines were set in Reach 38 to quantify channel catfish abundance. Five catfish averaging 623.4 mm in length and 2,318 grams in weight were captured on ten trotline sets. Low catch rates may be due to baits being eaten by turtles or crayfish. Trotlines were not used in other reaches due to high mortality of softshell turtles in Reach 38.

Shoreline Seine

One shoreline seine was conducted in Reach 36. A total of 11 species were sampled with the majority being YOY Cyprinids (Table 17). Hornyhead chubs (estimated thousands) and common shiners (hundreds) were especially abundant in the catch. Gamefish sampled included two YOY rock bass and two YOY smallmouth bass. One intolerant species, blacknose shiner, was added to the species sampled list.

Stream Morphology

Stream morphology data was collected near seven of the established electrofishing stations, one per similar reach, in 2008. A summary of stream morphology statistics is reported in Table 18. Bankfull widths ranged from 418.50 feet at station 35-1 to 592.02 feet at station 37-1 (Table 18). Calculated bankfull cross-sectional areas ranged from 1,306.90 sq. ft. at station 38-1, which was in a shallow riffle below Little Falls Dam, to 3,907.33 sq. ft. at station 37-1, which was probably impacted by the reservoir above Little Falls Dam. These two stations also had the shallowest (2.5 feet) and deepest (6.6 feet) mean bankfull depths, respectively, and the highest (209.10) and lowest (89.70) width to depth ratios, respectively. Width to depth ratios were high for all stations (Table 18). Flood prone widths were not expansive and were typically not much wider than bankfull width. Flood prone widths varied from 440 feet at 35-1 to 709 feet at 40-1. The river was entrenched at all stations with entrenchment ratios between 1.05 and 1.33. Pebble count data indicated D50 substrate types of gravel at four stations (35-1, 37-1, 39-1, and 40-1) and cobble at three stations (36-1, 38-1, and 41-1). RiverMorph 4.1.1 software was used to calculate stream classifications of F3 (36-1, 38-1 and 41-1) and F4 (35-1, 37-1, 39-1, and 40-1) for the study area (Table 18).

Discussion

The fish community in the Mississippi River from the CWRC to St. Cloud Dam appeared to be healthy with 42 species and one hybrid collected using a variety of sampling methods in the survey. Three species sampled in 2007 were not documented in previous assessments on this stretch of the river and included central stoneroller, brassy minnow, and green sunfish. A combined 46 species have been documented in this and previous assessments. Sampling efforts identified nine species considered sensitive to pollution or degraded habitats (Niemela and Feist, 2002). Brainerd Fisheries Personnel sampled one other intolerant species, spottail shiner, between Brainerd Dam and the CWRC. With the exception of muskellunge and greater redhorse, the majority of intolerant species observed were common or abundant in fish samples collected, which is a further indicator of good habitat and water quality. Hornyhead chub was the most abundant fish sampled during the survey and rock bass and smallmouth bass were abundant gamefish sampled. Additional shoreline seining or stream shocker sampling may have increased the diversity of the Cyprinid catch.

Four previous assessments completed in 1987, 1992, 1993 and 1995 by DNR Fisheries catalogued 35 different species on the Mississippi River from the CWRC to Little Falls Dam compared to 34 species observed in 2007 and 2008 sampling. Species collected in previous surveys that were not seen during sampling in 2007 and 2008 included bowfin, golden shiner, emerald shiner, spottail shiner, blacknose dace, creek chub and bigmouth buffalo. The 2007/2008 survey sampled central stoneroller, spotfin shiner, brown bullhead, channel catfish, brook silverside, and green sunfish that were not sampled in previous assessments. Combining the 2007/2008 survey with prior assessments, 41 species have been sampled in this stretch of the river.

Prior assessments completed in 1982, 1987, 1992 and 1995 on the stretch of the river from Little Falls Dam to Blanchard Dam documented 32 different species. Survey efforts in 2007 sampled 25 species. Species captured in previous assessments that were not observed in 2007 included central mudminnow, muskellunge, golden shiner, emerald shiner, blacknose shiner, spottail shiner, bigmouth buffalo, greater redhorse, black bullhead, yellow bullhead, trout-perch, and Johnny darter. Five species were captured in 2007 that were not seen in previous surveys including bluntnose minnow, channel catfish, brook silverside, green sunfish, and mottled sculpin. With 2007 data included, 37 species have been documented on this stretch of the river.

A total of 35 species were documented in four previous assessments (1986, 1987, 1992 and 1995) on the Mississippi River from Blanchard Dam to Sartell Dam. A total of 35 species were documented during the

2007 survey. Species unique to previous surveys included muskellunge, blacknose shiner, fathead minnow, greater redhorse, white crappie, and mottled sculpin. Species sampled in 2007 that were not documented in the past included central stoneroller, brassy minnow, creek chub, tadpole madtom, green sunfish and pumpkinseed. With 2007 data included, 41 species have been identified on this section of the river.

Assessments completed in 1986, 1987, 1992 and 1995 were also conducted on the stretch of the river from Sartell Dam to St. Cloud Dam. A total of 18 different species were sampled during previous assessments while seventeen species were captured during the 2007 survey. Species catalogued from prior assessments that were not seen in 2007 included northern pike, muskellunge, yellow bullhead, largemouth bass, yellow perch and logperch. Species captured in 2007 that were not observed in the past included bowfin, hornyhead chub, spottail shiner, tadpole madtom, and bluegill. A total of 23 species were documented on this stretch of the river when all surveys and assessments were considered.

Differences in species composition between dam-to-dam sections are likely due to habitat differences within the river, development pressures within the riparian corridor, and dams acting as barriers to movement. Species richness was highest in this survey, and historically, in the three upstream sections. The stretch from Sartell Dam to St. Cloud Dam is within the St. Cloud metropolitan area and has intense development pressure that may have impacts on species richness. It is also much shorter than upstream sections, which may select against species that require long, unimpeded sections of river for their life history. Blackside darter has not been sampled above Sartell Dam suggesting the dam acts as a barrier to this species. Also, white crappies are known to exist up to Blanchard Dam, which acts as the upstream barrier for this species.

Fish species IBI ratings ranged from fair to good at all stations within reaches and IBI scores ranged from 51 to 79. Selection of stations was highly constrained by low water and accessibility issues. In general, stations that received IBI scores garnering a good biotic integrity rating were located in stretches of river that had more diverse habitats. These stations typically had a higher percentage of coarse substrates, vegetation or woody cover. Most stations that received low scores and fair ratings were located at sites with fairly low habitat diversity. Habitats at these stations typically had sand substrates and little or no vegetation or coarse substrate. Station 39-1 had low habitat diversity and had an IBI score of 53, however, a stream shocker station immediately downstream had an IBI score of 75 and a good biotic integrity rating. Station 38-2 had a fair rating primarily due to very heavy vegetation at the site that made netting fish difficult. A station (38-1) upstream approximately 0.75 mile upstream had a good biotic integrity rating and IBI score. Station 41-1 was a stream shocker station established due to an inability to use a boat electrofishing unit at the site. Wading made it difficult to electrofish deeper habitats within the sampling run. Most of the station consisted of shallow sand habitat with few boulders that resulted in low species richness.

Walleye and smallmouth bass are likely much more abundant than this survey indicated. River levels were at historic low levels during sampling in 2007 and water clarity was at levels rarely seen on the Mississippi River in the study area. Many walleye and smallmouth bass, especially adults, were observed avoiding or skirting the electric field during electrofishing runs. This electrofishing survey was most useful at determining species richness and distribution, rather than documenting abundance or size structure.

Evaluation of species richness was enhanced in all dam-to-dam sections by supplemental stream shocker stations, trapnetting and shoreline seining. Silver redhorse, a species typically vulnerable to boat electrofishing, was not sampled effectively during the 2007 survey, likely due to low, clear water conditions. Trapnetting was especially effective for sampling this species and documented their presence in three dam-to-dam sections. Trapnetting also documented bullhead species in all sections in habitats too deep for effective electrofishing. Other species more typical of lacustrine habitats such as bowfin and a variety of Centrarchid species were sampled in trapnets.

Analysis of Rosgen (1996) Type II stream morphology data collected near electrofishing stations 35-1, 36-1, 37-2, 38-1, 39-1, 40-1 and 41-1, suggested "F" type channels exist in this section of the Mississippi River. Streams with high entrenchment, moderate to high width/depth ratios and moderate sinuosity, typify F type channels. The existence of large lakes and reservoirs at the headwaters of the Mississippi River and the presence of several dams in the headwaters and in the study area create a very stable river channel that rarely, if ever, leaves its banks. Historically, the river in this area was also used for transporting logs, which may have impacted the stream channel and streambed.

Pebble counts at all stream morphology stations were either gravel or cobble dominated leading to F4 (gravel) or F3 (cobble) stream type classifications. Stream classification stations at 35-1, 37-2, 39-1, and 40-1 were classified as F4 channels dominated by gravel. D50 particle sizes ranged from 3.62mm at station 35-1 to 26.71mm at station 39-1. Station 35-1 had more very fine gravel probably due to the presence of depositional areas within the study area. Station 37-2 was dominated by fine gravel and sand as most of the section was in the reservoir above Little Falls Dam. Station 39-1 was in a long riffle area dominated by larger gravel with few depositional areas included in the pebble count. Medium gravel was the D50 particle size at station 40-1, which was in a longer run.

Stream classification stations at 36-1, 38-1 and 41-1 were calculated as F3 channels dominated by cobble. D50 particles sizes ranged from 87.11mm at station 41-1 to 117.83 at station 36-1. While cobble dominated streams are rare in central Minnesota, stations 36-1 and 41-1 were located in long riffle sections with significant gradient while station 38-1 was influenced by the Little Falls Dam tailwater. Another possible confounding factor was the stations were only 500 meters in length, and not a full two meanders in length. Longer longitudinal profiles may have included more sand and gravel pebble counts at these stations.

Recommendations

Boat electrofishing efficacy appeared to be lower than previous assessments done on the Mississippi River due mainly to extreme low water levels and very clear water. Larger gamefish and non-gamefish species were observed avoiding the electric field, or were spooked by the approaching boat. One anode consisting of a sphere and single dropper was used in sampling and may have been a poor choice for conditions. Two anodes with an array of several droppers may have been more effective in low water, clear conditions.

Due to low water levels, small gamefish and minnow species were attracted to wild celery and river pondweed patches in the upstream three dam-to-dam sections of the river. The smaller pull behind stream shocker was very effective in sampling these habitats and IBI scores for these stations were typically high. Adding more of these stations may have given a more accurate picture of the fish community present in different reaches.

Seining was completed at only one station and added a species to the species richness table. Additional seining would have been a valuable addition to sampling effort during the survey and may have added more rare minnow species that utilize backwater areas.

Angling was an effective method of sampling all gamefish species. Catch per effort information was not collected as efforts were directed at collecting fish for contaminant monitoring when other gears failed to obtain a large enough sample for testing. Trotlines were effective in sampling channel catfish in Reach 38 but were not used in other reaches due to a high by-catch of softshell turtles. An ethical decision was made to stop using this gear type when catfish were effectively sampled with electrofishing and angling. Overall, the variety of sampling gears used was effective in assessing the fish community in this section of the Mississippi River. Several species never observed on these sections of the Mississippi River, were captured during this survey and added to the historical list of species sampled.

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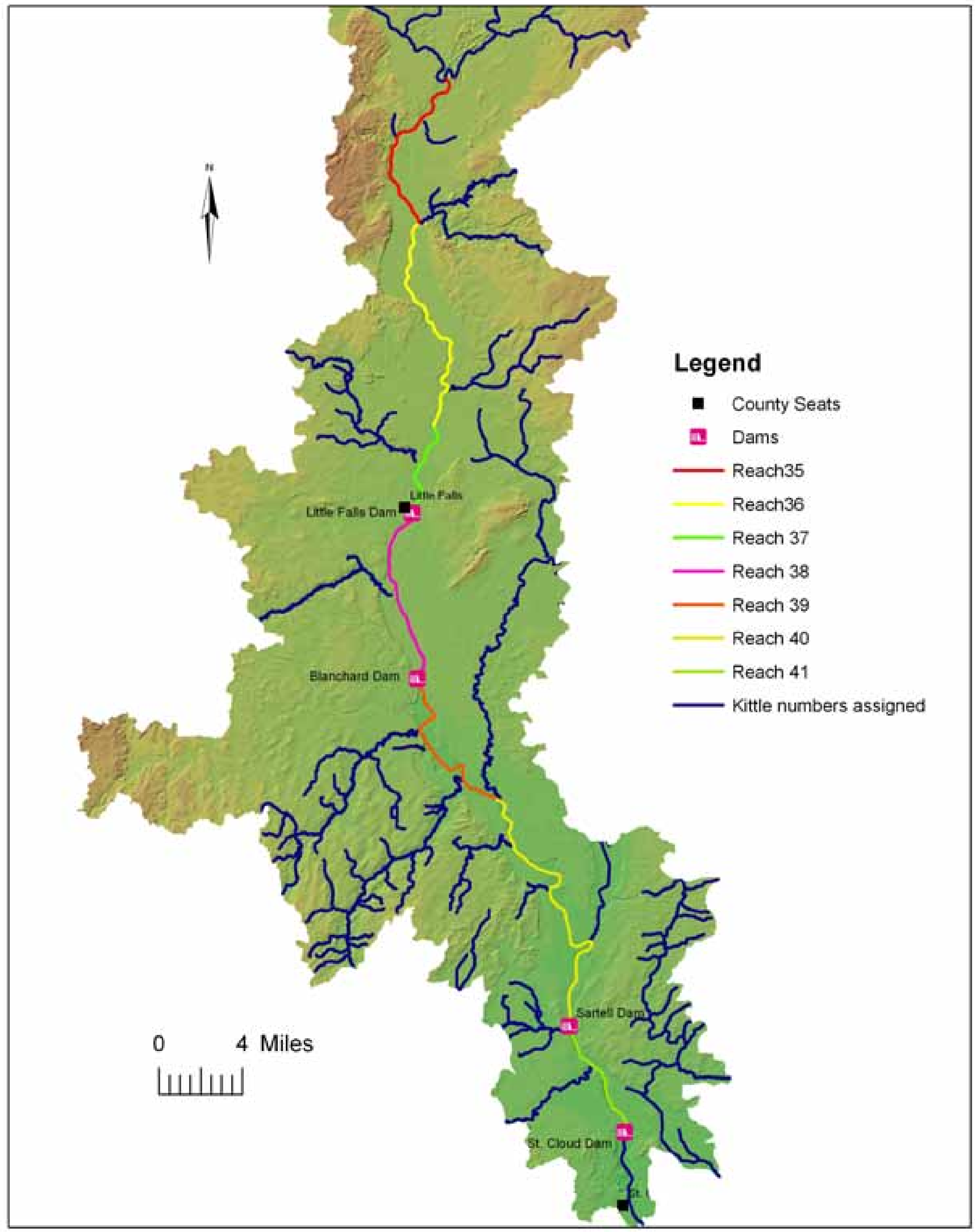

Figure 1. Location of similar reaches on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota, 2007-2008.

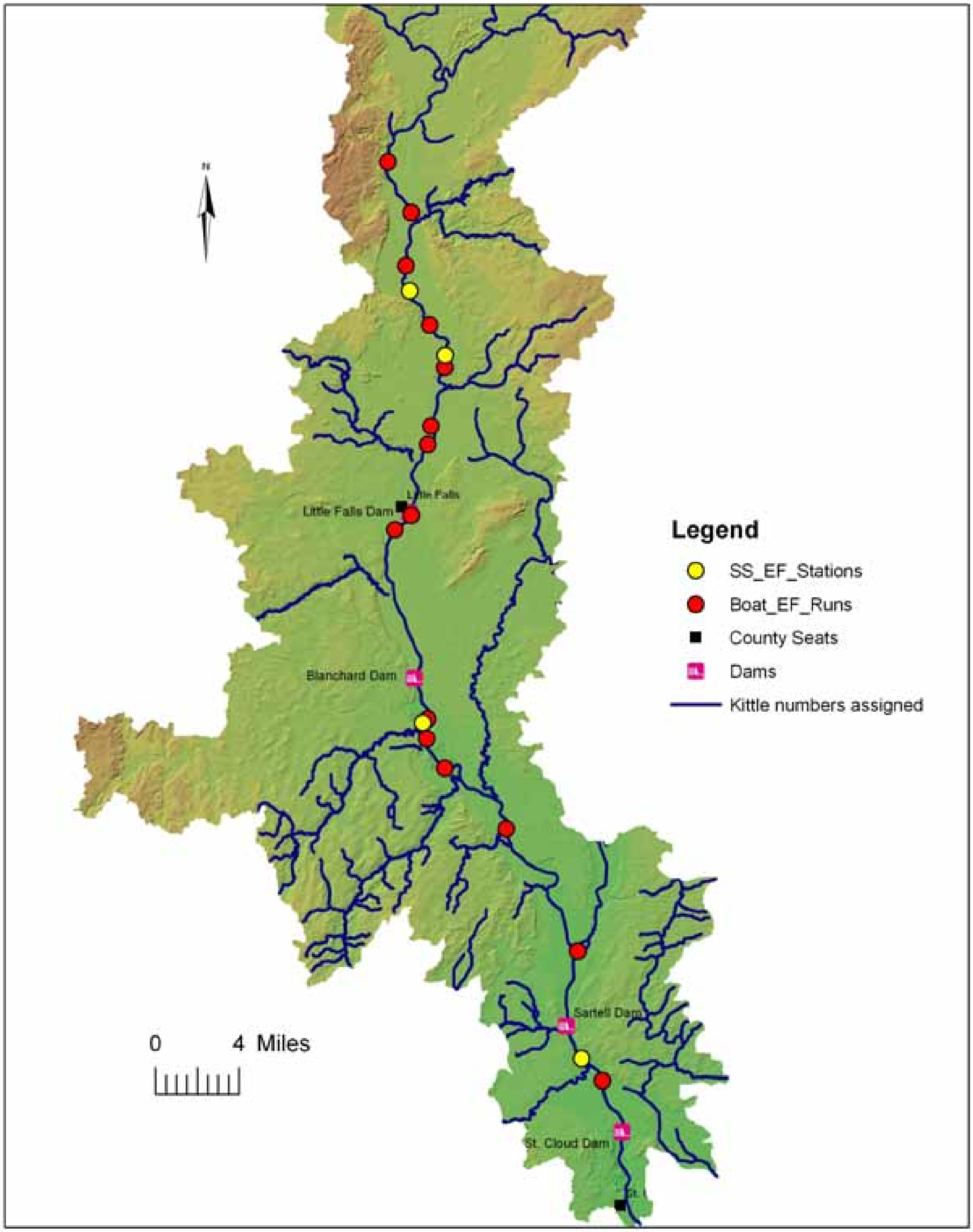

Figure 2. Location of stream shocker and boat electrofishing stations on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota, 2007-2008.

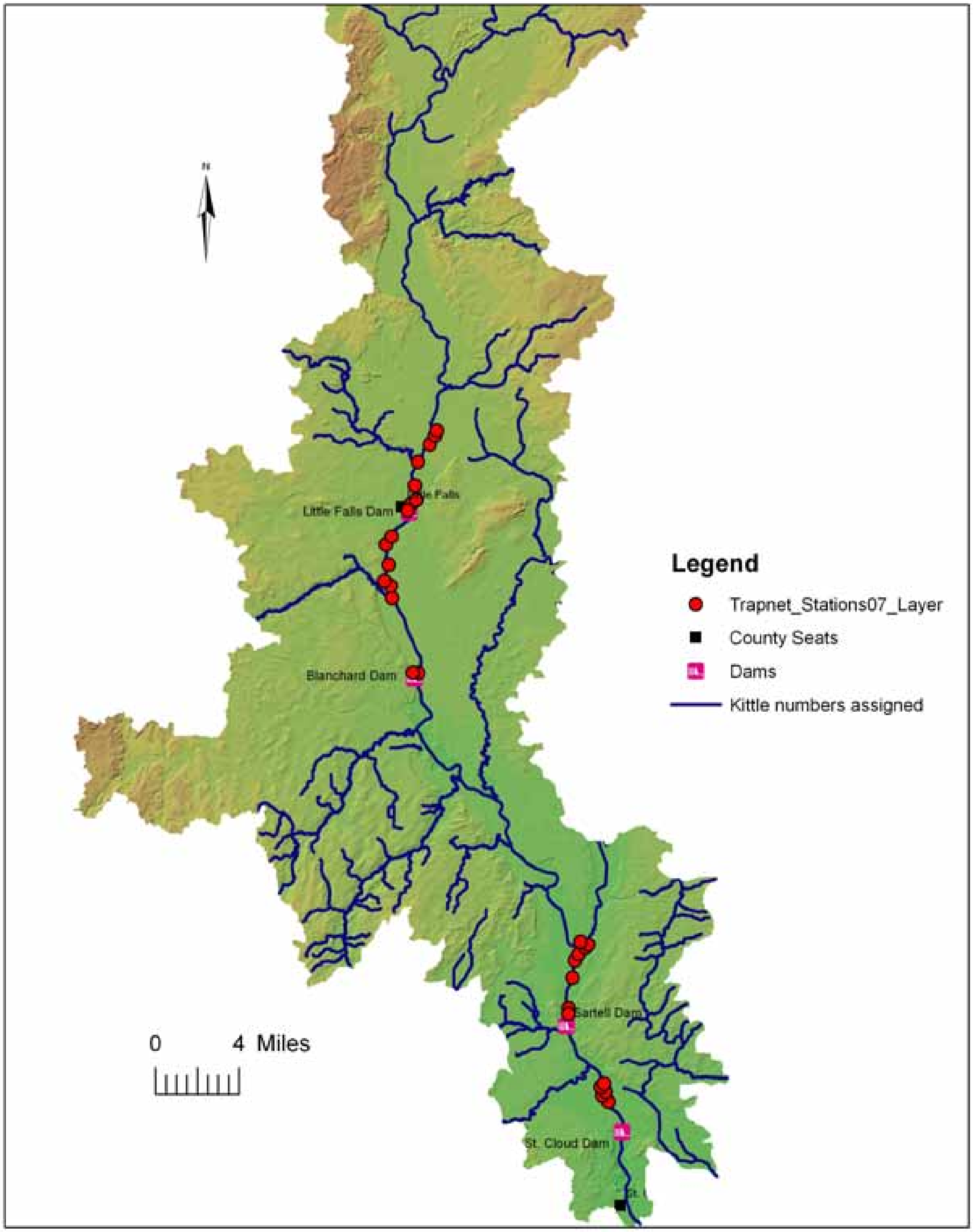

Figure 3. Location of trapnet stations on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota, 2007.

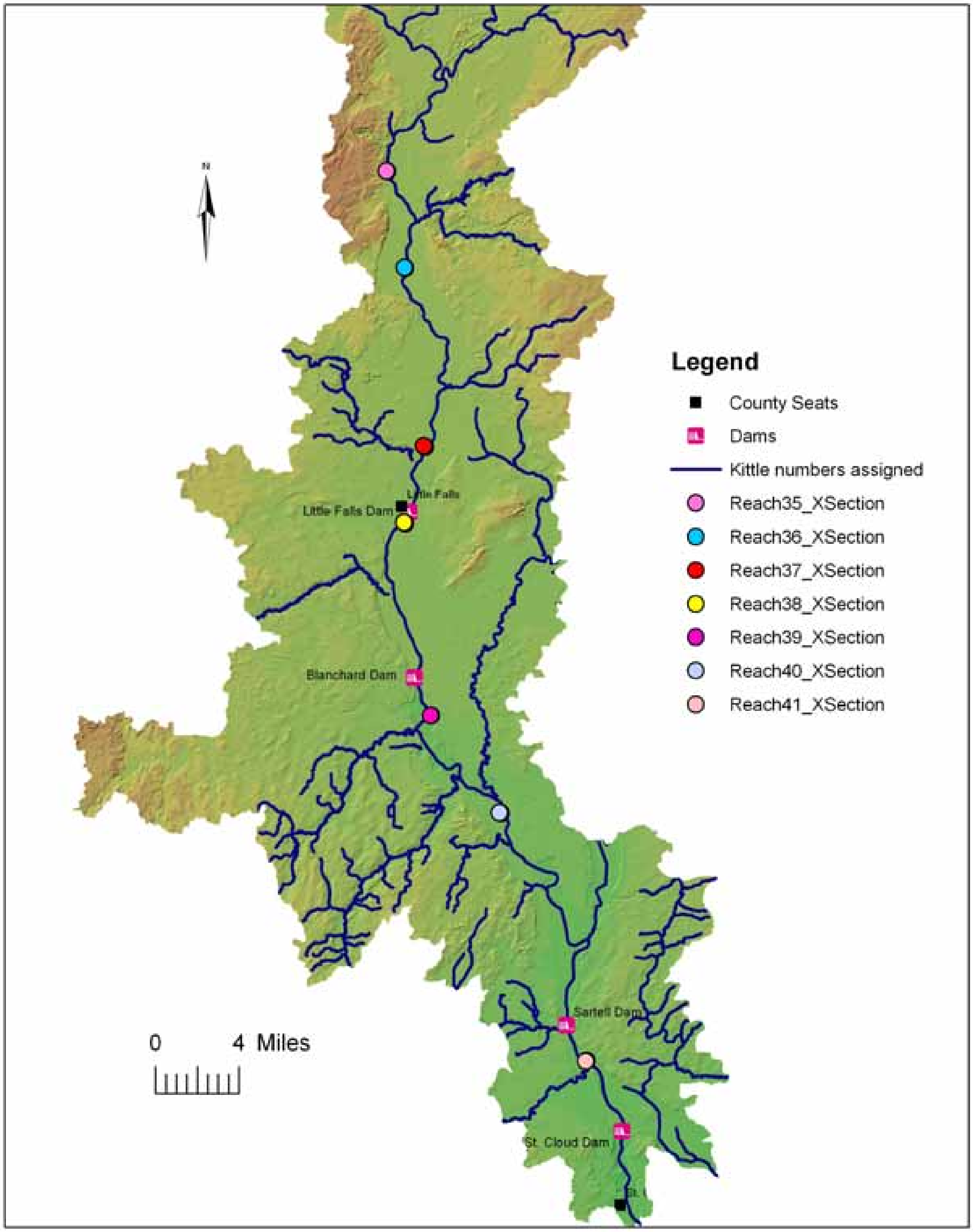

Figure 4. Location of Rosgen (1996) stream morphology stations on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota, 2008.

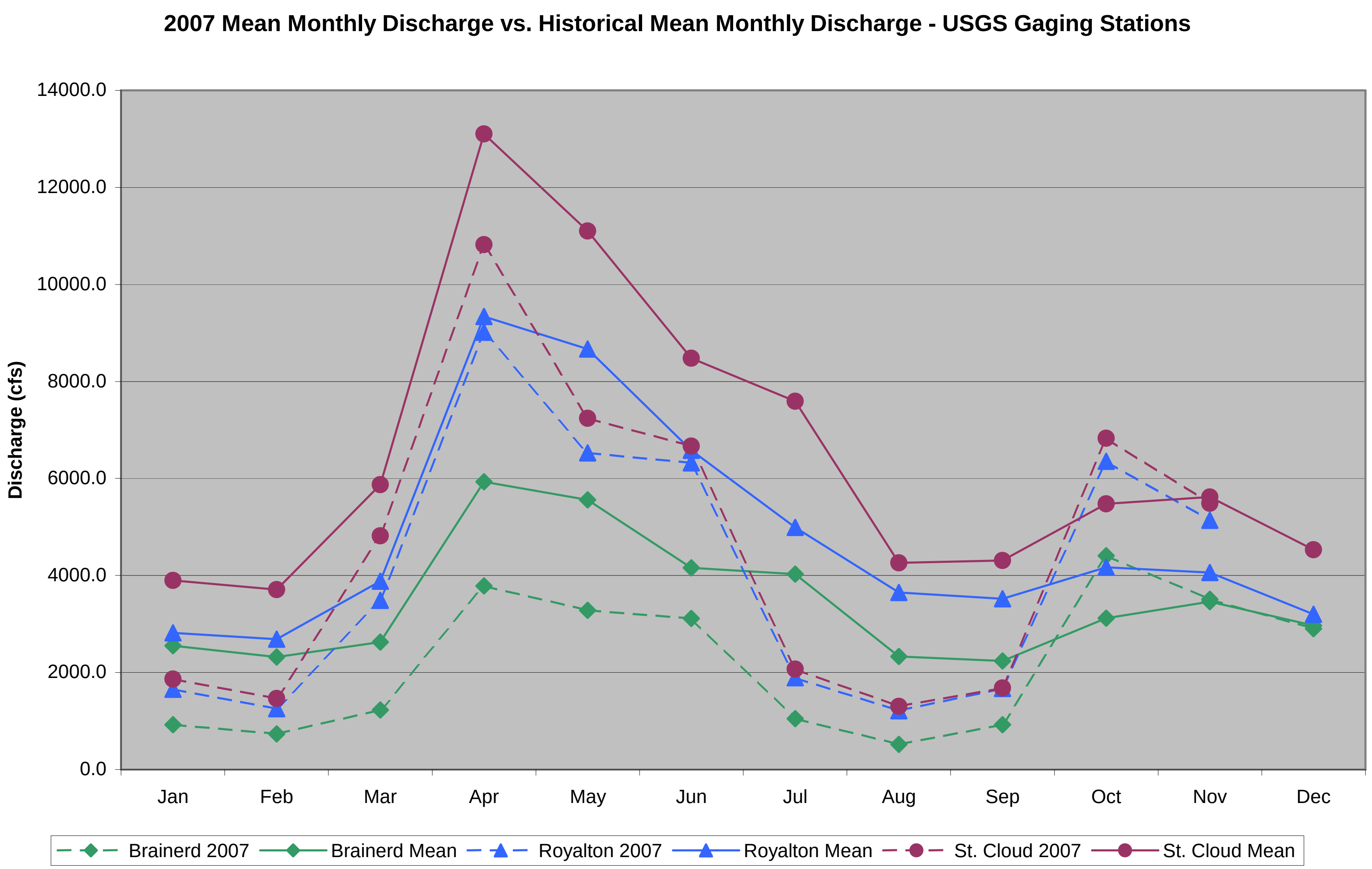

Figure 5. 2007 Mean monthly discharge vs. historical mean monthly discharge for the Mississippi River from USGS Gaging Stations at Brainerd, Royalton, and St. Cloud, Minnesota.

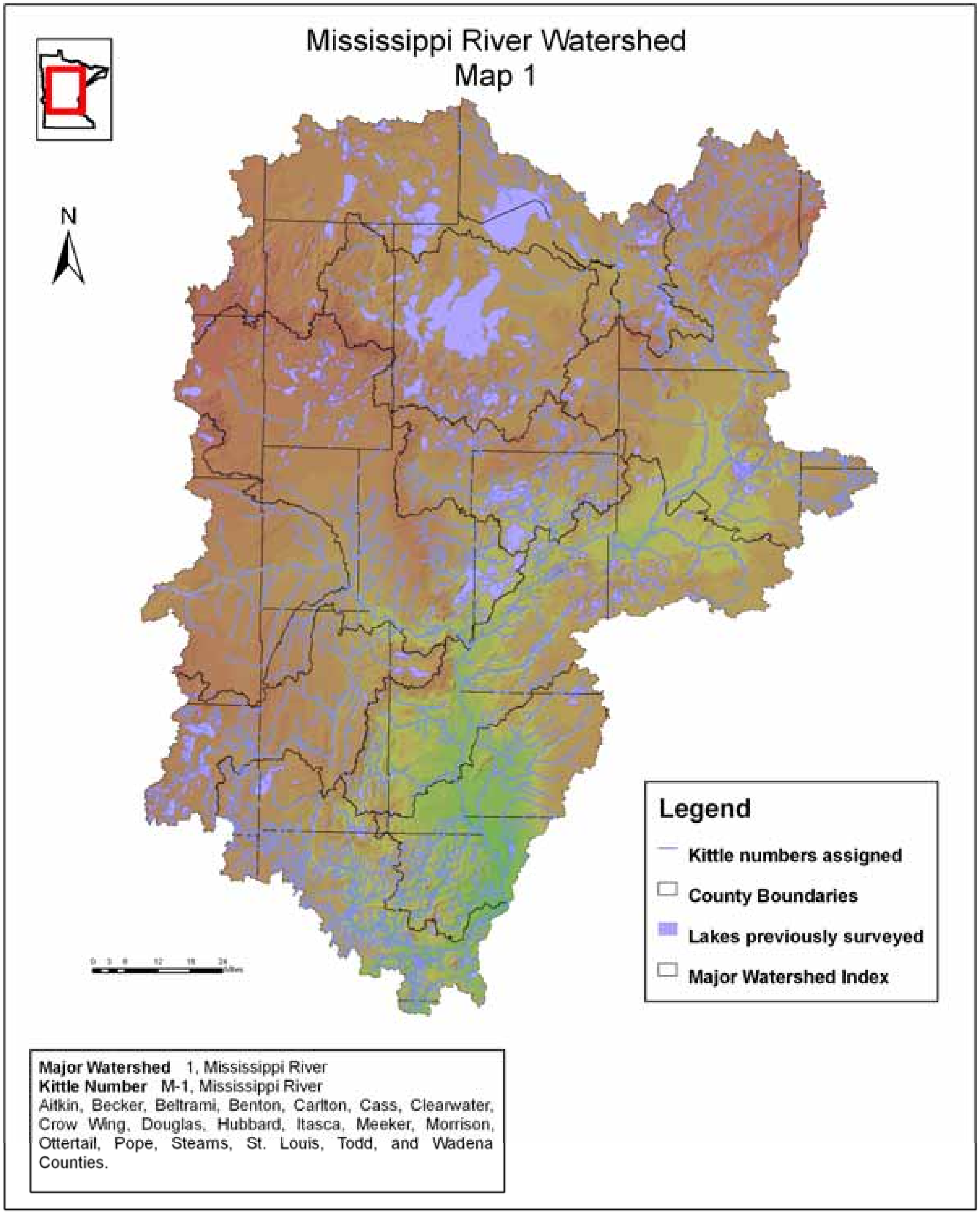

Figure 6. Mississippi River watershed map (Map 1) showing shaded relief, streams with assigned Kittle number, and DNR major watersheds, Mississippi River (M-1, various counties).

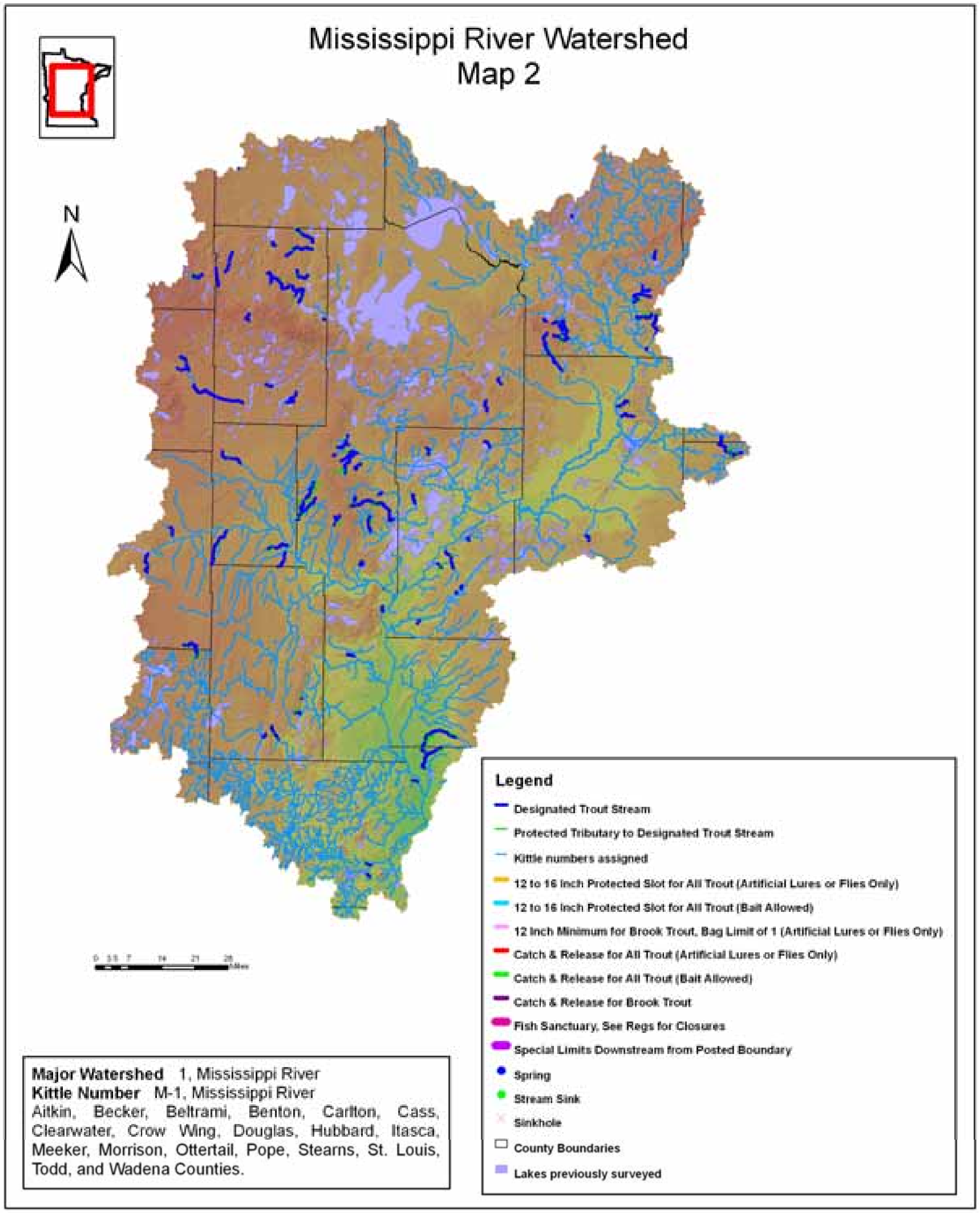

Figure 7. Mississippi River watershed map (Map 2) showing assigned Kittle number and trout streams, Mississippi River (M-1, various counties)

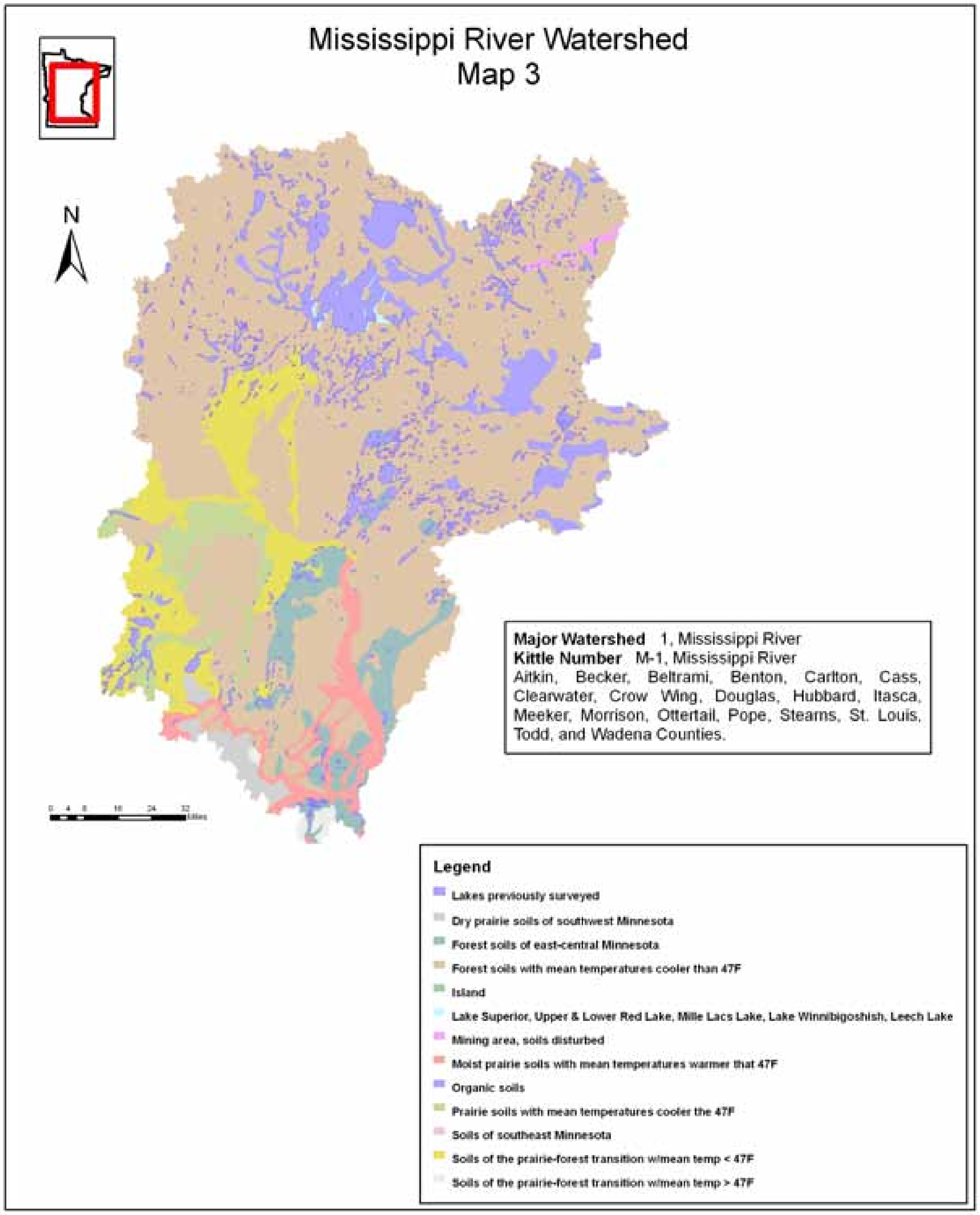

Figure 8. Mississippi River watershed map (Map 3) showing general soil characteristics, Mississippi River (M-1, various counties).

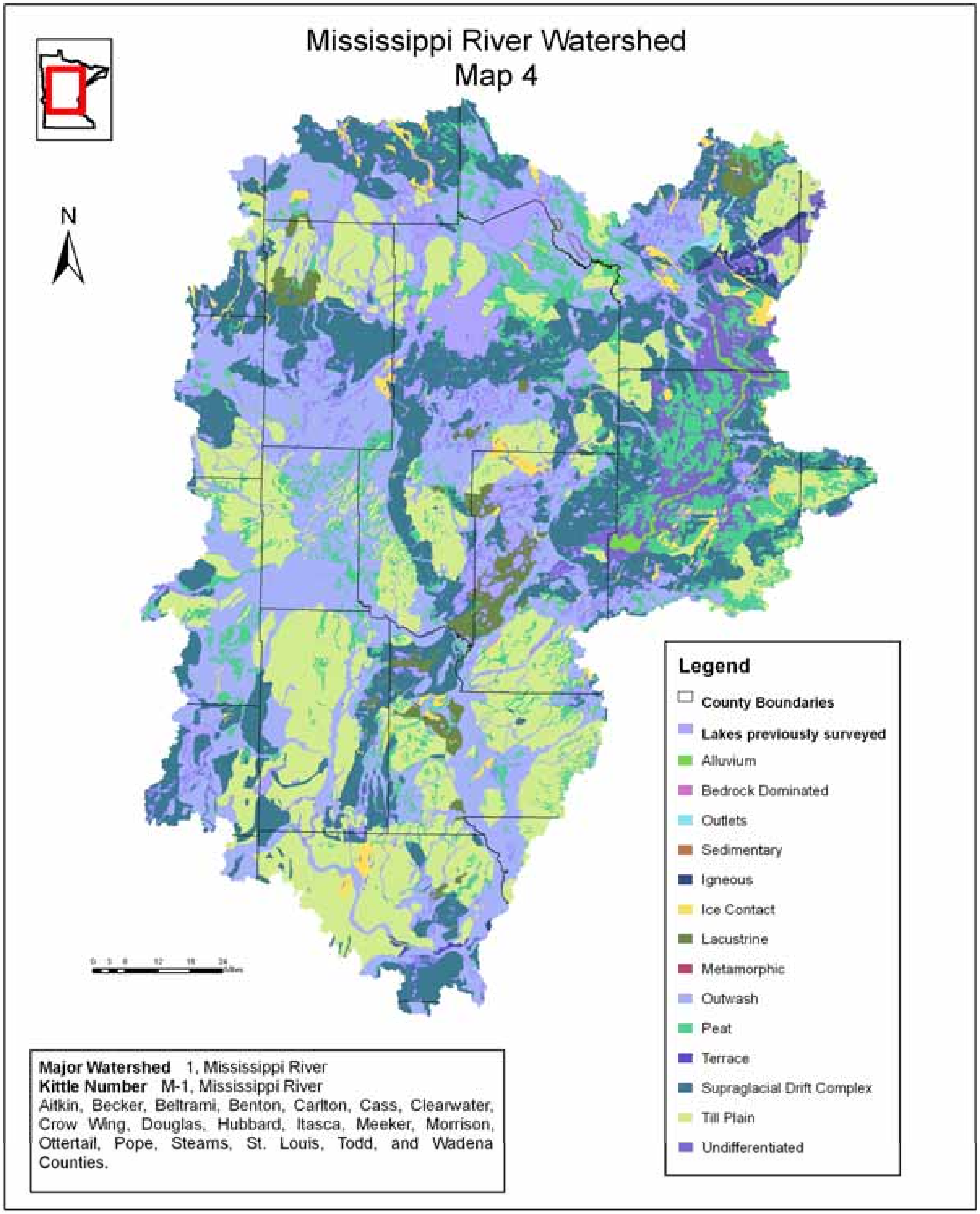

Figure 9. Mississippi River watershed map (Map 4) showing geomorphic sedimentary associations, Mississippi River (M-1, various counties).

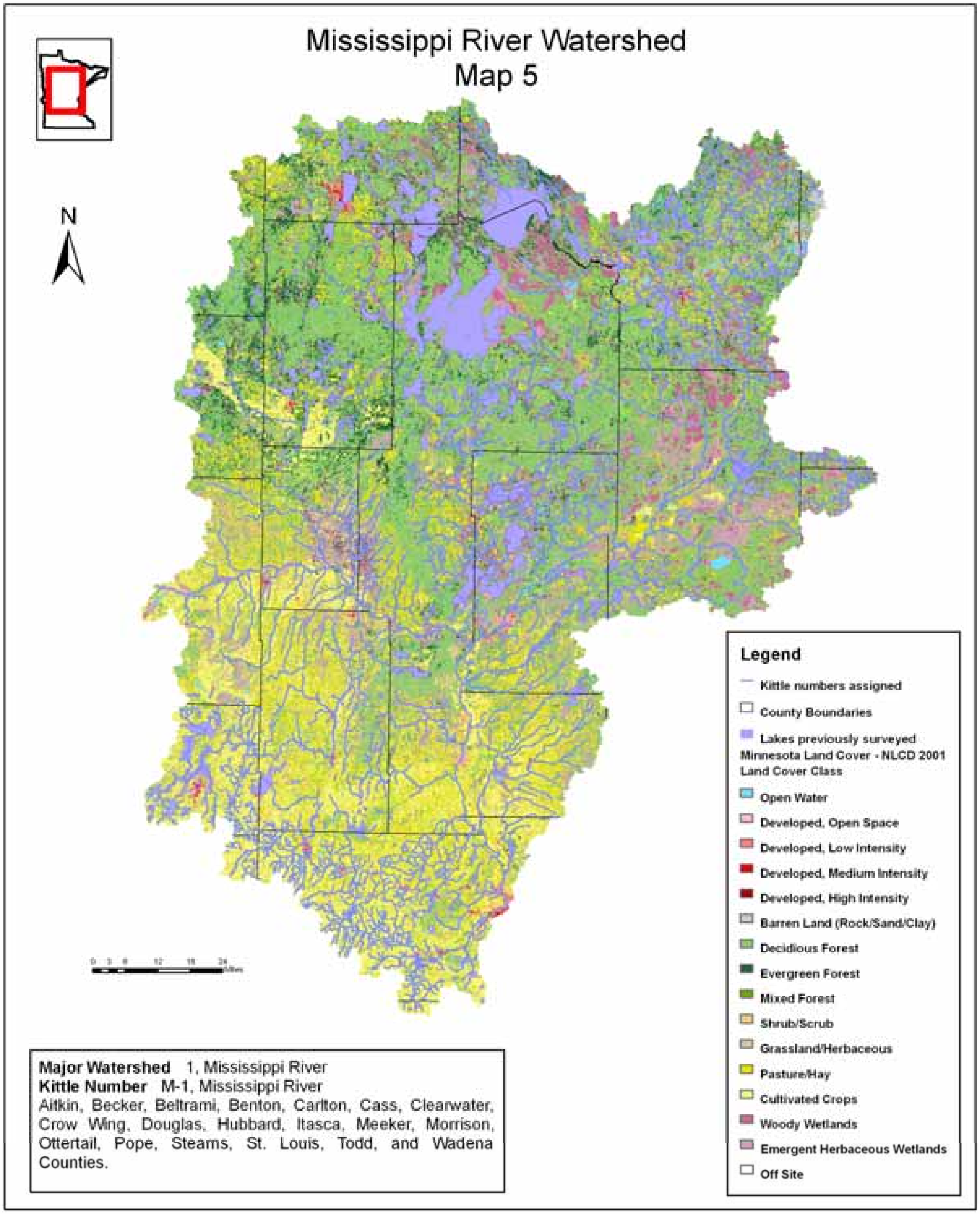

Figure 10. Mississippi River watershed map (Map 5) showing land cover information from 1992 satellite imagery and streams with assigned Kittle number, Mississippi River (M-1, various counties).

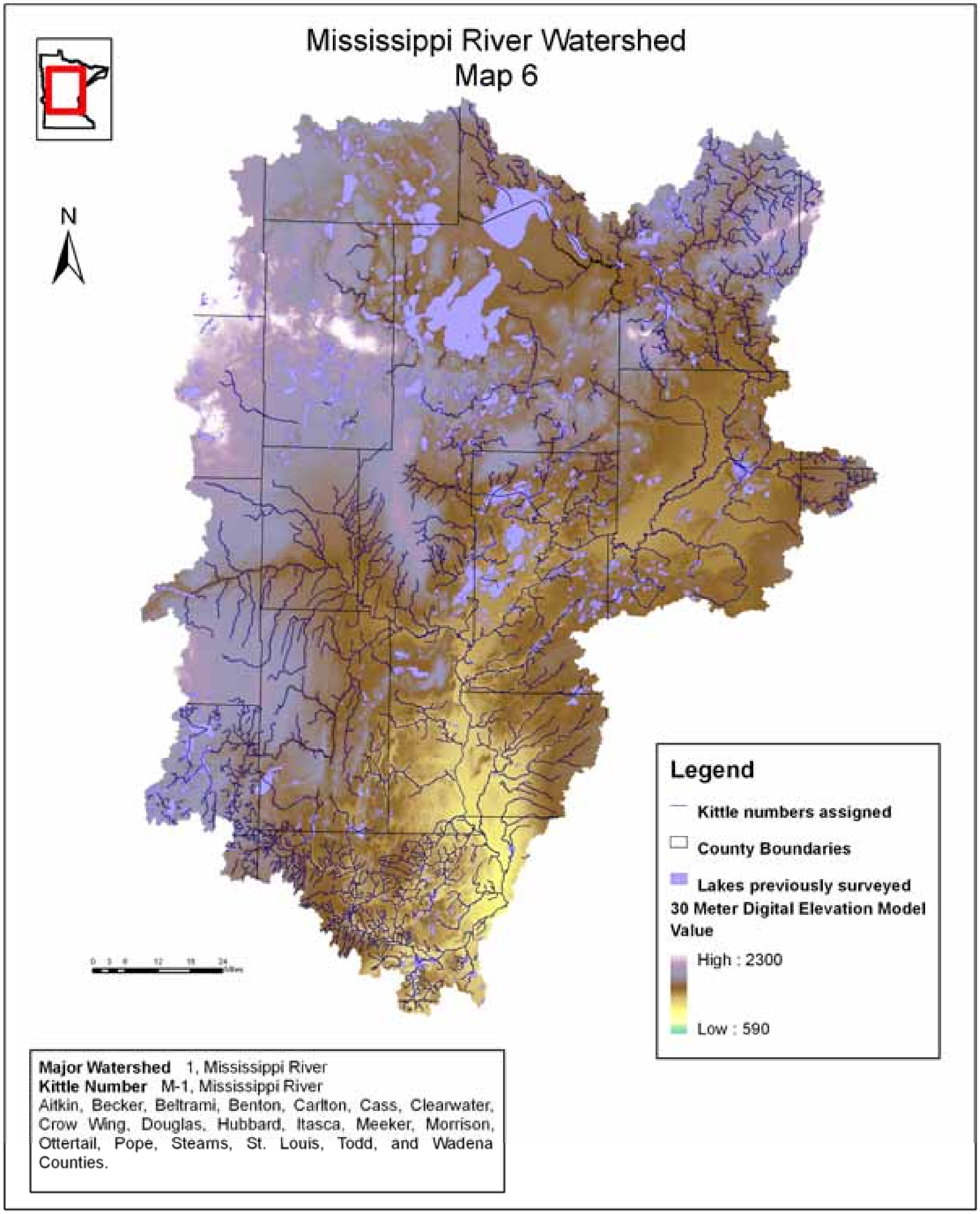

Figure 11. Mississippi River watershed map (Map 6) showing 30 meter digital elevation model and streams with assigned Kittle number, Mississippi River (M-1, various counties).

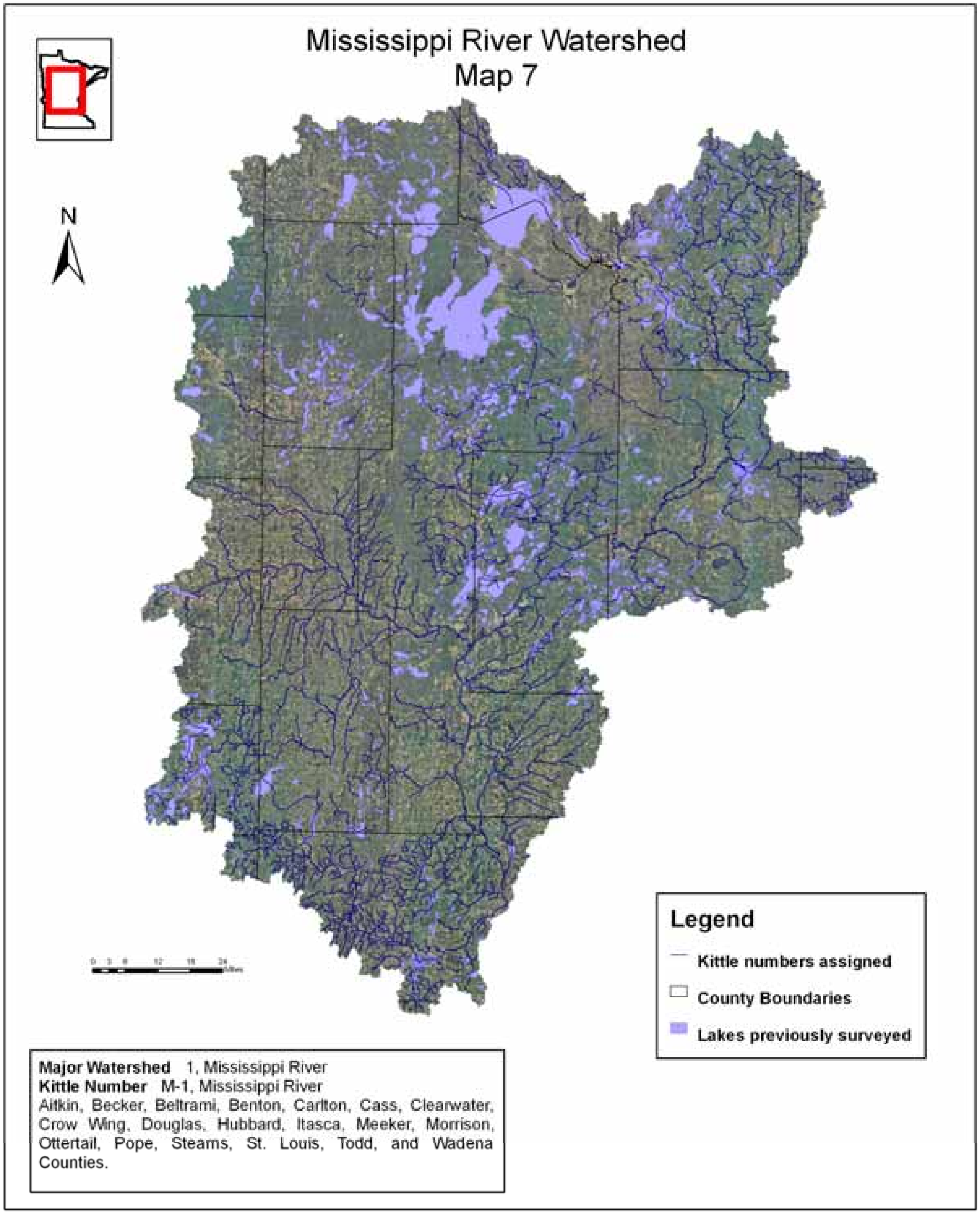

Figure 12. Mississippi River watershed map (Map 7) showing 2008 FSA aerial photography and streams with assigned Kittle number, Mississippi River (M-1, various counties).

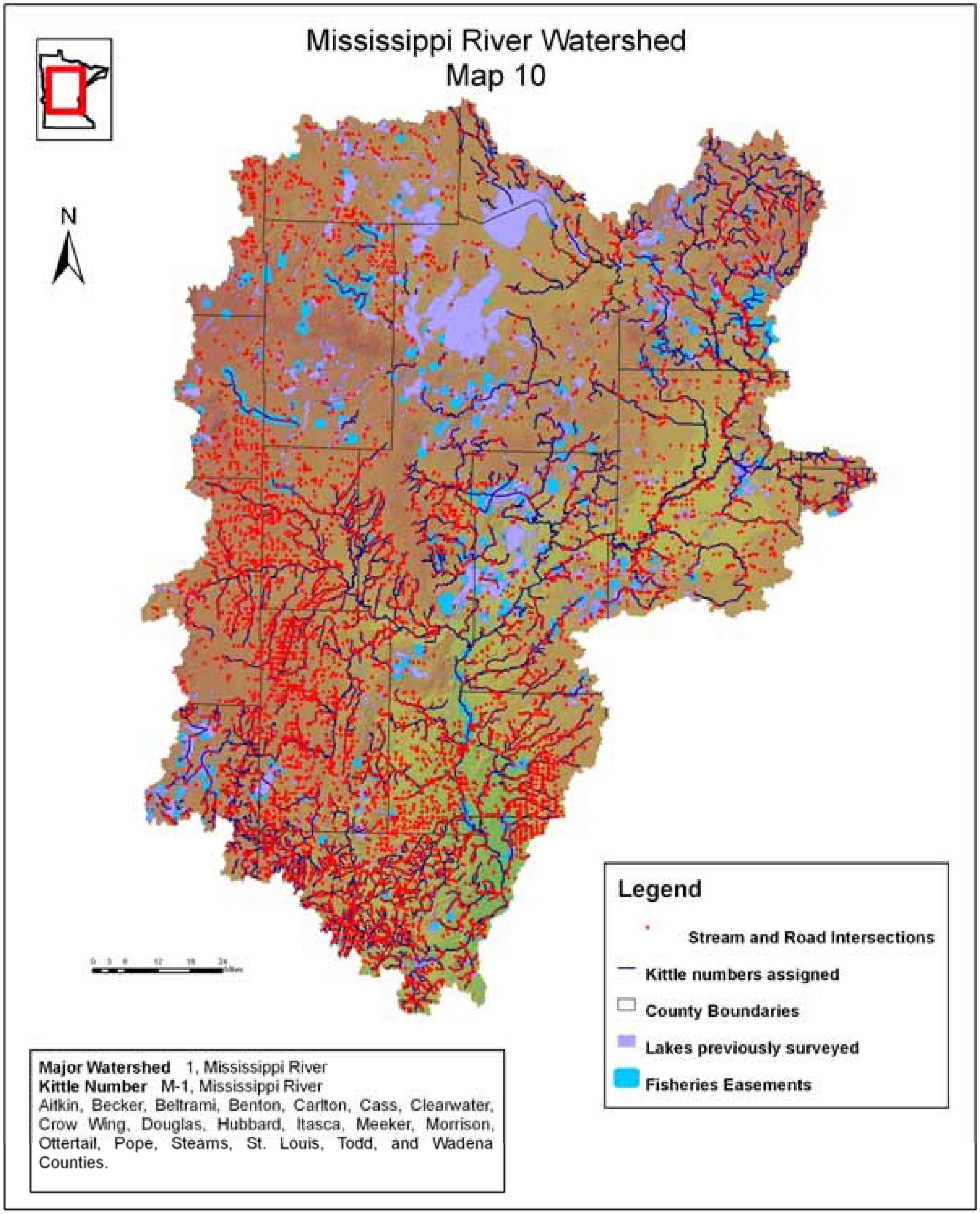

Figure 13. Mississippi River watershed map (Map 10) showing map of dams, channelized reaches, road crossings and culverts, and other barriers to fish movement and streams with assigned Kittle number, Mississippi River (M-1, various counties).

Table 1. Water chemistry analysis from 2007 and 2008 at nine locations on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

Station	Location	Total Phosphorous (ppm)		Chlorophyll a (ppb)		Total Alkalinity (ppm)		pH		Total dissolved solids (ppm)		Conductivity (umho)		Chloride Ion (ppm)	
		2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
WQ1	Fletcher Cr. Access	0.032	0.034	2.7	3.7	157	161	8.58	8.55	208	204	297	337	9.3	8.3
WQ2	Le Bourget Park	0.032	0.044	2.6	2.1	156	160	8.61	8.57	196	224	297	337	9.7	8.6
WQ3	Pike Cr. Access	0.042	0.036	5.0	2.6	156	161	8.53	8.52	192	220	299	342	9.8	9.0
WQ4	Above Blanchard Dam	0.048	0.042	26.0	8.3	153	162	8.44	8.49	180	208	292	342	9.2	8.6
WQ5	Royalton Access	0.034	0.040	7.0	9.6	155	162	8.23	8.34	200	204	300	346	9.5	8.8
WQ6	Stearns Co. Park	0.040	0.041	13.8	11.2	154	162	8.42	8.58	192	216	296	343	9.6	8.9
WQ7	Above Sartell Dam	0.059	0.049	42.5	22.9	154	163	8.62	8.68	184	224	293	337	9.6	9.2
WQ8	Municipal Park	0.033	0.054	4.6	11.6	158	160	8.18	8.26	200	232	367	368	11.6	12.1
WQ9	Above St. Cloud Dam	0.063	0.071	37.3	23.9	159	165	8.66	8.61	200	196	361	366	12.9	12.1

Table 2. Location and description of electrofishing sampling stations on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

Station						**Upstream GPS**		**Downstream GPS**		
Number	Length (ft.)	Width (ft.)	Date	Gear	River Mile	Easting	Northing	Easting	Northing	On-Time (sec.)
35-1	1640	592	7/21/08	Boat	986	392410	5119357	392322	5118764	1666
35-2	1640	763	7/21/08	Boat	984	394199	5115446	394496	5115001	1766
36-1	1640	413	7/20/2007	Boat	981	393730	5111620	393732	5111203	1700
36-2	600	1150	8/1/2007	Stream Shocker	979	393863	5109371	393978	5109181	1701
36-3	1640	377	7/19/2007	Boat	977	395646	5106686	395837	5106286	1374
36-4	600	1160	8/20/2007	Stream Shocker	975	396780	5104466	396732	5104269	1830
36-5	1640	380	7/30/2007	Boat	974	396741	5103482	396708	5103025	1705
37-1	1640	1000	7/31/2007	Boat	971	395767	5098885	395930	5098513	1800
37-2	1640	577	7/31/2007	Boat	970	395424	5097583	395258	5097533	1620
38-1	1640	475	7/20/2007	Boat	966	394155	5092074	393894	5091722	1650
38-2	1640	770	7/19/2007	Boat	965	393004	5090899	392668	5090505	1800
39-1	1640	490	8/2/2007	Boat	954	395508	5076351	395061	5076164	1600
39-2	650	653	8/2/2007	Stream Shocker	954	395102	5076038	394930	5075936	1800
39-3	1640	460	8/13/2007	Boat	953	395318	5074775	395371	5074304	1550
39-4	1640	783	8/13/2007	Boat	951	396792	5072507	397209	5072392	1390
40-1	1640	470	8/3/2007	Boat	946	401112	5069125	401373	5068750	1800
40-2	1640	1465	8/14/2007	Boat	934	407134	5058290	406799	5058021	1950
41-1	1505	838	8/17/2007	Stream Shocker	930	407336	5050134	407743	5049940	2332
41-2	1640	825	8/17/2007	Boat	928	408897	5048589	408985	5048137	1850

Table 3. Location and description of trapnet sampling stations on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

Station					GPS Coordinates	
Number	Set Date	Lift Date	Gear	River Mile	Easting	Northing
TN1	8/23/2007	8/24/2007	3/4" Mesh	970	396151	5098613
TN2	8/23/2007	8/24/2007	1/4" Mesh	970	396032	5098205
TN3	8/23/2007	8/24/2007	3/4" Mesh	970	395640	5097527
TN4	8/23/2007	8/24/2007	1/4" Mesh	969	394733	5096197
TN5	8/23/2007	8/24/2007	3/4" Mesh	968	394488	5094368
TN6	8/23/2007	8/24/2007	1/4" Mesh	967	394565	5093258
TN7	8/23/2007	8/24/2007	3/4" Mesh	966	394245	5092972
TN8	8/23/2007	8/24/2007	1/4" Mesh	966	393938	5092448
TN9	8/15/2007	8/16/2007	1/4" Mesh	964	392719	5090415
TN10	8/15/2007	8/16/2007	3/4" Mesh	964	392257	5089818
TN11	8/15/2007	8/16/2007	1/4" Mesh	963	392460	5088262
TN12	8/15/2007	8/16/2007	3/4" Mesh	962	392137	5087002
TN13	8/15/2007	8/16/2007	1/4" Mesh	961	392651	5086593
TN14	8/15/2007	8/16/2007	3/4" Mesh	961	392724	5085679
TN15	8/15/2007	8/16/2007	1/4" Mesh	957	394326	5079902
TN16	8/15/2007	8/16/2007	3/4" Mesh	957	394747	5079877
TN17	8/14/2007	8/15/2007	3/4" Mesh	937	407255	5059128
TN18	8/14/2007	8/15/2007	1/4" Mesh	937	407822	5058921
TN19	8/14/2007	8/15/2007	3/4" Mesh	936	407629	5058727
TN20	8/14/2007	8/15/2007	1/4" Mesh	936	407097	5058187
TN21	8/14/2007	8/15/2007	3/4" Mesh	935	406807	5057705
TN22	8/14/2007	8/15/2007	1/4" Mesh	934	406641	5056371
TN23	8/14/2007	8/15/2007	1/4" Mesh	932	406317	5054016
TN24	8/14/2007	8/15/2007	3/4" Mesh	932	406339	5053587
TN25	8/27/2007	8/28/2007	1/4" Mesh	929	409041	5048205
TN26	8/27/2007	8/28/2007	3/4" Mesh	929	408805	5047930
TN27	8/27/2007	8/28/2007	1/4" Mesh	928	409185	5047530
TN28	8/27/2007	8/28/2007	3/4" Mesh	929	408919	5047253
TN29	8/27/2007	8/28/2007	1/4" Mesh	927	409384	5046843
TN30	8/27/2007	8/28/2007	3/4" Mesh	927	409428	5046765

Table 4. Location and description of trotline sampling stations in Reach 38 on the Mississippi River from the Little Falls, Minnesota to Blanchard Dam.

Station				GPS Coordinates		
Number	Set Date	Lift Date	Gear	River Mile	Easting	Northing
LFTL1M	7/24/2007	7/25/2007	Trotline	966	394135	5092062
LFTL2M	7/24/2007	7/25/2007	Trotline	966	394126	5091903
LFTL3L	7/24/2007	7/25/2007	Trotline	965	393726	5091377
LFTL4M	7/24/2007	7/25/2007	Trotline	965	392984	5090912
LFTL5R	7/24/2007	7/25/2007	Trotline	965	392520	5090296
LFTL6R	7/25/2007	7/26/2007	Trotline	962	392371	5086968
LFTL7L	7/25/2007	7/26/2007	Trotline	961	392982	5085999
LFTL8R	7/25/2007	7/26/2007	Trotline	960	393051	5084753
LFTL9R	7/25/2007	7/26/2007	Trotline	958	394618	5111603
LFTL10R	7/25/2007	7/26/2007	Trotline	957	394199	5079647

Table 5. Fish species sampled by reach using all gear types in the Mississippi River, Crow Wing River confluence to St. Cloud, Minnesota.

	Reach						
Species	35	36	37	38	39	40	41
Amiidae							
Bowfin				X		X	X
Cyprinidae							
Central stoneroller		X			X	X	
Spotfin shiner		X	X	X	X	X	
Common carp			X	X	X	X	X
Brassy minnow					X	X	
Common shiner	X	X	X	X	X	X	
Hornyhead chub	X	X	X	X	X	X	X
Emerald shiner					X	X	
Blacknose shiner		X					
Spottail shiner						X	X
Bluntnose minnow		X	X	X	X	X	
Longnose dace		X			X		
Creek chub						X	
Catostomidae							
White sucker	X	X	X	X	X	X	X
Bigmouth buffalo						X	
Shorthead redhorse	X	X	X	X	X	X	X
Silver redhorse	X	X	X	X	X	X	X
Greater redhorse	X						
Ictaluridae							
Channel catfish		X	X	X	X		X
Tadpole madtom		X	X		X		X
Black bullhead			X			X	X
Yellow bullhead			X			X	
Brown bullhead			X	X			
Esocidae							
Northern pike	X	X	X	X	X	X	
Muskellunge	X						
Umbridae							
Central mudminnow		X					
Percopsidae							
Trout-perch		X				X	
Gadidae							
Burbot		X	X	X	X		X
Atherinidae							
Brook silverside		X	X	X	X	X	
Cottidae							
Mottled sculpin	X	X		X			
Centrarchidae							
Rock bass	X	X	X	X	X	X	X
Green sunfish		X		X		X	
Bluegill	X	X	X	X	X	X	X
Pumpkinseed				X		X	
Smallmouth bass	X	X	X	X	X	X	X
Largemouth bass			X	X		X	
Black crappie	X	X	X	X	X	X	X
Percidae							
Johnny darter	X	X	X		X	X	
Yellow perch		X	X	X		X	
Logperch	X	X	X	X	X	X	
Blackside darter							X
Walleye	X	X	X	X	X	X	X

Table 6. Total number of fish sampled of all species, and biomass of selected species from all gear types combined, on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

Species	Number	Biomass (grams)
Bowfin	7	16,530
Central stoneroller	3	23
Spotfin shiner	254	287
Common carp	45	121,493
Brassy minnow	18	22
Common shiner	248	NA
Hornyhead chub	811	NA
Emerald shiner	5	7
Blacknose shiner	3	1
Spottail shiner	53	63
Bluntnose minnow	64	119
Longnose dace	89	NA
Creek chub	2	3
White sucker	132	83,883
Bigmouth buffalo	4	5,440
Shorthead redhorse	250	149,594
Silver redhorse	30	55,708
Greater redhorse	3	4,484
Channel catfish	64	104,108
Tadpole madtom	58	NA
Black bullhead	11	1,533
Yellow bullhead	5	2,295
Brown bullhead	6	2,490
Northern pike	36	11,886
Muskellunge	1	NA
Central mudminnow	3	8
Trout-perch	2	13
Burbot	30	2,273
Brook silverside	11	5
Mottled sculpin	21	NA
Rock bass	356	NA
Green sunfish	9	45
Bluegill	526	NA
Pumpkinseed	22	1,317
Hybrid sunfish	2	102
Smallmouth bass	276	31,267
Largemouth bass	8	1,510
Black crappie	85	12,070
Johnny darter	93	85
Yellow perch	44	4,073
Logperch	266	1,209
Blackside darter	13	30
Walleye	65	9,511
Total	4,034	NA

Table 7. Sampling effort for all gear types for sampling stations on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

Reach	Station	SSEF (hours)	BOEF (hours)	Trap net (nights)	Trot line (# of hooks)	Seine (hauls)
35	1		0.46			
35	2		0.49			
36	1		0.46			
36	2	0.47				
36	3		0.38			
36	4	0.51				
36	5		0.47			
36	SE01					1
37	1		0.50			
37	2		0.45			
37	TN01			1		
37	TN02			1		
37	TN03			1		
37	TN04			1		
37	TN05			1		
37	TN06			1		
37	TN07			1		
37	TN08			1		
38	1		0.46			
38	2		0.50			
38	TN01			1		
38	TN02			1		
38	TN03			1		
38	TN04			1		
38	TN05			1		
38	TN06			1		
38	TN07			1		
38	TN08			1		
38	TL01				25	
38	TL02				25	
38	TL03				25	
38	TL04				25	
38	TL05				25	
38	TL06				25	
38	TL07				25	
38	TL08				25	
38	TL09				25	
38	TL10				25	
39	1		0.42			
39	2	0.50				
39	3		0.43			
39	4		0.39			

Table 7. Continued.

Reach	Station	SSEF (hours)	BOEF (hours)	Trap net (nights)	Trot line (# of hooks)	Seine (hauls)
40	1		0.50			
40	2		0.54			
40	TN01			1		
40	TN02			1		
40	TN03			1		
40	TN04			1		
40	TN05			1		
40	TN06			1		
40	TN07			1		
40	TN08			1		
41	1	0.65				
41	2		0.51			
41	TN01			1		
41	TN02			1		
41	TN03			1		
41	TN04			1		
41	TN05			1		
41	TN06			1		
Totals		2.13	6.01	30	250	1

Table 8. Catch Per Unit Effort of fish sampled by reach by boat electrofishing in the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

	Reach						
Secies	35	36	37	38	39	40	41
Central stoneroller					0.79	0.96	
Spotfin shiner		6.77	2.11	1.04	3.17	7.69	
Common carp			7.37	4.17	6.35	15.38	3.92
Brassy minnow						9.62	
Common shiner	17.89	28.57	22.11	16.67	3.97	11.54	
Hornyhead chub	31.58	79.70	40.00	8.33	2.38	5.77	1.96
Emerald shiner						0.96	
Spottail shiner						10.58	5.88
Bluntnose minnow				5.21	1.59	8.65	
Longnose dace		4.51			1.59		
Creek chub						1.92	
White sucker	20.00	2.26	28.42	7.29	5.56	30.77	7.84
Shorthead redhorse	7.37	16.54	8.42	51.04	82.54	15.38	21.57
Silver redhorse	2.11	0.75		1.04	3.97	5.77	
Greater redhorse	3.16						
Channel catfish		0.75	1.05	3.13	28.57		29.41
Tadpole madtom		9.02	9.47		0.79		
Northern pike	4.21	3.76	6.32	1.04	3.17	5.77	
Muskellunge	1.05						
Trout-perch						0.96	
Burbot		6.02	3.16	1.04			1.96
Mottled sculpin	2.11	3.01		1.04			
Rock bass	12.63	36.84	55.79	20.83	12.70	9.62	7.84
Green sunfish				1.04			
Bluegill	3.16	0.75	2.11	39.58	2.38	78.85	3.92
Pumpkinseed				1.04		0.96	
Smallmouth bass	4.21	15.04	14.74	17.71	34.13	30.77	74.51
Largemouth bass				1.04		2.88	
Black crappie	2.11	2.26		1.04	1.59	5.77	3.92
Johnny darter	10.53	18.80	1.05		0.79	10.58	
Yellow perch		0.75	1.05			15.38	
Logperch	1.05	15.04	4.21	27.08	21.43	18.27	
Blackside darter							25.49
Walleye	1.05	12.78	7.37	10.42	5.56	0.96	7.84

Table 9. Catch Per Unit Effort of fish sampled by reach by stream shocker electrofishing in the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

	Reach		
Species	36	39	41
Bowfin			1.54
Central stoneroller	1.02		
Spotfin shiner	63.27	168.00	
Brassy minnow		6.00	
Common shiner	75.51	30.00	
Hornyhead chub	447.96	38.00	
Emerald shiner		4.00	
Bluntnose minnow		38.00	
Longnose dace	82.65	2.00	
White sucker	11.22	8.00	
Shorthead redhorse		2.00	38.46
Channel catfish			3.08
Northern pike	1.02		
Central mudminnow	3.06		
Tadpole madtom	31.63		1.54
Burbot	4.08	2.00	7.69
Brook silverside		4.00	
Mottled sculpin	14.29		
Rock bass	63.27	8.00	
Green sunfish	2.04		
Bluegill		8.00	
Smallmouth bass	18.37	38.00	98.46
Black crappie	1.02	4.00	
Johnny darter	13.27	52.00	
Logperch	8.16	316.00	
Walleye	3.06	6.00	

Table 10. Index of Biotic Integrity score by electrofishing station for the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

Reach	Station	RM	IBI Score	Miles from Itasca
35	1	986.6	56	359.9
35	2	984.5	60	362.0
36	1	981.5	79	365.0
36	2*	979.7	67	366.8
36	3	977.6	71	368.9
36	4*	975.5	74	371.0
36	5	975.0	69	371.5
37	1	971.5	64	375.0
37	2	970.7	53	375.8
38	1	966.3	71	380.2
38	2	965.4	57	381.1
39	1	954.7	53	391.8
39	2*	954.2	75	392.3
39	3	953.1	63	393.4
39	4	951.2	57	395.3
40	1	946.8	66	399.7
40	2	936.2	72	410.3
41	1*	930.2	51	416.3
41	2	929.4	62	417.1

*Indicates stream shocker station.

Table 11. Index of Biotic Integrity metric data and scores for stations sampled on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

Reach	35				36									
Station	01		02		01		02*		03		04*		05	
Metric[1]	Data	Score	Data	Score	Data	Score	Data	Score	Data	Score	Data	Score	Data	Score
Species richness and composition														
Total number of species	12	0	13	2	18	5	16	2	15	2	14	2	12	0
Number of darter, sculpin, and madtom species	1	2	3	7	4	10	3	7	3	7	4	10	3	7
Number of intolerant species	5	10	4	10	5	10	5	10	4	10	5	10	5	10
Percent tolerant species	8	10	8	10	6	10	19	7	7	10	7	10	8	10
Trophic and reproductive function														
Number of invertivore species	6	2	6	2	10	5	7	2	8	5	8	5	6	2
Percent omnivore species	11	7	20	7	6	10	6	10	7	10	0	10	8	10
Number of piscivore species	4	5	5	5	6	7	6	7	5	5	4	5	4	5
Percent simple lithophils	53	5	36	2	29	2	24	2	27	2	21	2	55	5
Fish abundance and condition														
Number of fish per 100 meters	10.6	10	12	10	31.2	10	69.2	10	29.8	10	93.2	10	10.4	10
Percent DELT anomalies	2	5	2	5	1	10	1	10	0	10	0	10	0	10
Overall Score		56		60		79		67		71		74		69
Rating		Fair		Good		Good		Good		Good		Good		Good

[1]Criteria for each metric score are available in Niemela and Feist (2002)

*Stream Shocker used for sampling

Table 11. Continued.

Reach	37				38				39							
Station	01		02		01		02		01		02*		03		04	
Metric[1]	Data	Score	Data	Score	Data	Score	Data	Score	Data	Score	Data	Score	Data	Score	Data	Score
Species richness and composition																
Total number of species	16	2	11	0	15	2	14	2	10	0	18	5	18	5	11	0
Number of darter, sculpin, and madtom species	3	7	1	2	2	5	1	2	1	2	2	5	2	5	1	2
Number of intolerant species	3	7	3	7	4	10	3	7	2	5	4	10	3	7	3	7
Percent tolerant species	13	10	18	7	13	10	21	7	20	7	11	10	17	7	18	7
Trophic and reproductive function																
Number of invertivore species	7	2	3	0	7	2	5	2	3	0	9	5	7	2	3	0
Percent omnivore species	13	7	18	7	7	10	14	7	20	7	6	10	11	7	18	7
Number of piscivore species	6	7	5	5	6	7	5	5	5	5	5	5	5	5	6	7
Percent simple lithophils	29	2	47	5	56	5	51	5	64	7	51	5	44	5	61	7
Fish abundance and condition																
Number of fish per 100 meters	24	10	9	10	22.8	10	17.8	10	10.4	10	68.8	10	21.2	10	22.2	10
Percent DELT anomalies	1	10	0	10	1	10	1	10	0	10	0	10	0	10	0	10
Overall Score		64		53		71		57		53		75		63		57
Rating		Good		Fair		Good		Fair		Fair		Good		Good		Fair

[1]Criteria for each metric score are available in Niemela and Feist (2002)
*Stream shocker used for sampling

Table 11. Continued.

Reach	40				41			
Station	01		02		01*		02	
Metric[1]	Data	Score	Data	Score	Data	Score	Data	Score
Species richness and composition								
Total number of species	19	5	21	5	6	0	13	2
Number of darter, sculpin, and madtom species	2	5	2	5	1	2	1	2
Number of intolerant species	4	10	4	10	1	2	4	10
Percent tolerant species	21	7	14	10	0	10	15	10
Trophic and reproductive function								
Number of invertivore species	10	5	10	5	2	0	5	2
Percent omnivore species	11	7	10	10	0	10	15	7
Number of piscivore species	3	2	6	7	4	5	6	7
Percent simple lithophils	53	5	20	0	31	2	31	2
Fish abundance and condition								
Number of fish per 100 meters	17.8	10	34	10	19.6	10	20.2	10
Percent DELT anomalies	0	10	0	10	0	10	0	10
Overall Score		66		72		51		62
Rating		Good		Good		Fair		Good

[1]Criteria for each metric score are available in Niemela and Feist (2002)
+*Stream shocker used for sampling

Table 12. Length and weight statistics for selected gamefish species from all electrofishing stations combined on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

Species	Number	Minimum Length (mm)	Maximum Length (mm)	Mean Length (mm)	Mean Weight (g)
Channel catfish	58	59	713	538.1	1574.4
Northern pike	27	177	577	352.0	338.9
Rock bass	239	22	280	NA	47.4
Bluegill	142	26	196	NA	15.5
Smallmouth bass	268	50	486	138.7	110.1
Largemouth bass	4	81	354	158	191.5
Black crappie	18	133	312	183.2	114.5
Yellow perch	18	55	259	176.2	88.0
Walleye	53	85	455	201.0	154.9

Table 13. Length and weight statistics for selected gamefish species from all trapnet stations combined on the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

Species	Number	Minimum Length (mm)	Maximum Length (mm)	Mean Length (mm)	Mean Weight (g)
Northern pike	9	255	498	375.0	273.0
Rock bass	115	42	278	167.3	165.3
Bluegill	384	26	231	NA	14.9
Smallmouth bass	6	54	370	215.0	288.2
Largemouth bass	4	109	334	191.5	186.0
Black crappie	67	63	319	197.0	149.4
Yellow perch	26	64	251	186.7	95.7
Walleye	12	105	469	177.9	111.2

Table 14. Number of fish sampled by electrofishing sampling station in the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

	Reach-Electrofishing Station - * indicates stream shocker station										
Species	35-01	35-02	36-01	36-02*	36-03	36-04*	36-05	37-01	37-02	38-01	38-02
Amiidae											
Bowfin											
Cyprinidae											
Central stoneroller						1					
Spotfin shiner				25	9	37		2		1	
Common carp								4	3		4
Brassy minnow											
Common shiner	14	3	10	40	23	34	5	10	11		16
Hornyhead chub	6	24	46	197	54	242	6	37	1	2	6
Emerald shiner											
Spottail shiner											
Bluntnose minnow											5
Longnose dace			1	30	4	51	1				
Creek chub											
Catostomidae											
White sucker	6	13	2	11	1		1	16	11	3	4
Shorthead redhorse	3	4	8		4		10	8		36	13
Silver redhorse	2		1								1
Greater redhorse	3										
Ictaluridae											
Channel catfish			1					1		3	
Tadpole madtom			7	18	5	13		9			
Esocidae											
Northern pike	1	3	3	1	2			2	4		1
Muskellunge	1										
Umbridae											
Central mudminnow				1		2					
Percopsidae											
Trout-perch			1								
Gadidae											
Burbot			4	3		1	4	2	1	1	
Atherinidae											
Brook silverside											
Cottidae											
Mottled sculpin		2	3	2		12	1			1	
Centrarchidae											
Rock bass	5	7	20	15	22	47	7	34	19	8	12
Green sunfish				2						1	
Bluegill	2	1			1				2	23	15
Pumpkinseed										1	
Smallmouth bass	3	1	2	7	11	11	7	12	2	11	6
Largemouth bass											1
Black crappie		2		1	2					1	
Percidae											
Johnny darter	7	3	19	6	3	7	3	1			
Yellow perch			1					1			
Logperch		1	6		7	8	7	3	1	17	9
Blackside darter											
Walleye		1	14	1	2	2	1	4	3	1	9

Table 14. Continued.

	Reach-Electrofishing Station - * indicates stream shocker station								
Species	39-01	39-02*	39-03	39-04	40-01	40-02	41-01*	41-02	Total
Amiidae									
Bowfin							1		1
Cyprinidae									
Central stoneroller			1			1			3
Spotfin shiner		84	4		5	3			170
Common carp	1		6	1	4	12		2	37
Brassy minnow		3	5		10				18
Common shiner		15	5		11	1			198
Hornyhead chub		19	3		1	5		1	650
Emerald shiner		2			1				3
Spottail shiner					2	9		3	14
Bluntnose minnow		19	2		4	5			35
Longnose dace		1		1					89
Creek chub					2				2
Catostomidae									
White sucker	3	4	1	3	7	25		4	115
Shorthead redhorse	24	1	16	64	13	3	25	11	243
Silver redhorse	4		1		3	3			15
Greater redhorse									3
Ictaluridae									
Channel catfish	1		5	30			2	15	58
Tadpole madtom				1			1		54
Esocidae									
Northern pike	2		1	1		6			27
Muskellunge									1
Umbridae									
Central mudminnow									3
Percopsidae									
Trout-perch					1				2
Gadidae									
Burbot		1					5	1	23
Atherinidae									
Brook silverside		2							2
Cottidae									
Mottled sculpin									19
Centrarchidae									
Rock bass	2	4	12	2	2	8		4	230
Green sunfish									3
Bluegill		4	3		2	80		2	135
Pumpkinseed						1			2
Smallmouth bass	14	19	21	8	14	18	64	38	269
Largemouth bass						3			4
Black crappie		2		2	4	2		2	18
Percidae									
Johnny darter		26	1		9	2			87
Yellow perch						16			18
Logperch	2	158	25		11	8			263
Blackside darter								13	13
Walleye	2	3	3	2		1		4	53

Table 15. Number of fish sampled in small mesh trapnets (1/4”) at sampling stations in the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

	Reach-Small (1/4") Trapnet Station															
Species	37-2	37-4	37-6	37-7	38-1	38-3	38-5	38-7	40-2	40-4	40-6	40-7	41-1	41-3	41-5	Total
Amiidae																
Bowfin						1	1					1				3
Cyprinidae																
Central stoneroller																
Spotfin shiner	29					26	1		19			3				78
Common carp									1		1					2
Common shiner	6					3			1			5				15
Hornyhead chub	10								1							11
Emerald shiner									1			1				2
Spottail shiner									4	4		31				39
Bluntnose minnow	6					2	4		12			1				25
Catostomidae																
White sucker					1	2		2		1	2					8
Bigmouth buffalo									1			1				2
Shorthead redhorse					1						1					2
Silver redhorse					2	1	1	2								6
Ictaluridae																
Black bullhead		2		2								1		3		8
Yellow bullhead				1						1						2
Brown bullhead				2			1									3
Atherinidae																
Brook silverside	4					2						2				8
Centrarchidae																
Rock bass	17	1	20	6	3	6	5		2	5	2	1	2	1		71
Green sunfish									6							6
Bluegill	1		4			24	117	1	28	41	1	68	2	22	13	322
Pumpkinseed							2									2
Smallmouth bass	1				1								1			3
Largemouth bass									1							1
Black crappie	1		9			1	2		4					1		18
Percidae																
Johnny darter												1		1		2
Yellow perch	1						2	1	2	3		1			1	10
Logperch					1											1
Walleye						2			7							9

Table 16. Number of fish sampled in large mesh trapnets (3/4”) at sampling stations in the Mississippi River from the Crow Wing River confluence to St. Cloud, Minnesota.

	Reach-Large (3/4") Trapnet Station															
Species	37-1	37-3	37-5	37-8	38-2	38-4	38-6	38-6	40-1	40-3	40-5	40-8	41-2	41-4	41-6	Total
Amiidae																
Bowfin					1				1		1					3
Cyprinidae																
Common carp				1			1					2	2			6
Catostomidae																
White sucker	1	1	1			2	1		2	1						9
Bigmouth buffalo										2						2
Shorthead redhorse										2		1	1			4
Silver redhorse		1					5						2	1		9
Ictaluridae																
Channel catfish															1	1
Black bullhead			2									1				3
Yellow bullhead						1	1				1					3
Brown bullhead			2					1								3
Esocidae																
Northern pike	1				1	1	1	1			1	1		1	1	9
Centrarchidae																
Rock bass	7	6	7		2		3	4	1	1	2	1	6	4		44
Bluegill					13	1	20	10	10	1	5	2				62
Pumpkinseed					5	3	5	3	2							18
Smallmouth bass	1				1								1			3
Largemouth bass	1				1		1									3
Black crappie	2	2	1				3		4	11	3	3	16		3	48
Percidae																
Yellow perch						2	2		2	1	6	2				15
Walleye														3		3

Table 17. Number, minimum, and maximum length of fish species sampled by shoreline seine in Reach 36 on the Mississippi River from the Crow Wing River confluence to Little Falls, Minnesota.

Species	Number	Min Len	Max Len
Spotfin shiner	4	44	50
Common shiner	35	26	97
Hornyhead chub	150	26	86
Blacknose shiner	3	46	47
Bluntnose minnow	4	34	57
Tadpole madtom	4	26	88
Brook silverside	1	42	0
Rock bass	2	30	34
Smallmouth bass	2	98	108
Johnny darter	4	35	49
Logperch	1	65	0

Table 18. Stream morphology (Rosgen 1996) summary statistics for different reaches on the Mississippi River.

Reach-Station	Location River Mile	Drainage Area (sq. mi.)*	Bankfull Width (ft.)	Mean Depth (ft.)	Bankfull XS Area (ft^2)	Width/Depth Ratio	Flood Prone Width (ft.)	Entrenchment Ratio	D50 Substrate Type	Water Surface Slope	Sinuosity	Rosgen Stream Type
35-1	986.6	11,578	418.50	4.1	1,715.85	102.07	440	1.05	Gravel	0.00027	1.08	F4
36-1	981.5	11,578	570.15	3.3	1,881.50	172.77	607	1.06	Cobble	0.00092	1.14	F3
37-2	970.7	11,578	592.02	6.6	3,907.33	89.70	656	1.11	Gravel	0.00001	1.19	F4
38-1	965.6	11,578	522.76	2.5	1,306.90	209.10	554	1.06	Cobble	0.00006	1.12	F3
39-1	954.5	12,598	516.79	2.9	1,498.69	178.20	591	1.14	Gravel	0.00022	1.20	F4
40-1	946.0	12,598	534.98	4.8	2,567.90	111.45	709	1.33	Gravel	0.00019	1.30	F4
41-1	930.2	13,640	586.24	3.25	1,905.28	180.38	650	1.11	Cobble	0.00035	1.08	F3