Red River of the North
Fisheries Management Plan

Minnesota Department of Natural Resources
North Dakota Game and Fish Department
Manitoba Water Stewardship
South Dakota Department of Game, Fish and Parks

2017 - 2027

Red River of the North Description

Red River of the North, hereafter Red River, begins at the confluence of the Bois de Sioux and Otter Tail rivers and flows northward approximately 545 miles through the relic bed of glacial Lake Agassiz where it empties into Lake Winnipeg (Figure 1). The upstream 400 miles of Red River forms the Minnesota-North Dakota border and the downstream 145 miles flow through southern Manitoba, Canada.

Red River has a watershed area of approximately 45,000 square miles excluding the Assiniboine River basin, which joins Red River at Winnipeg. Twenty-one primary sub watersheds located in North Dakota, Minnesota, and Manitoba empty into Red River (Figure 1). Approximately 46.6% of the Red River watershed (21,000 mi^2) lies in North Dakota, 38.9% (17,500 mi^2) in Minnesota, 12.7% (5,700 mi^2) in Manitoba and 1.8% (810 mi^2) in South Dakota (Eddy et al. 1972). Agriculture dominates land use throughout the basin.

For management purposes, the US portion of Red River is divided into four reaches (Figure 3) with management shared by MN DNR and NDGFD. For this report, reaches are numbered sequentially from 1 to 4 with the upstream boundary of Reach 1 located at the beginning of the named Red River of the North (Figure 2) and the downstream boundary of Reach 4 located at the Canada border. River mile (RM) numbering, however, begins with RM 0.0 at the Canada border and ends at the upstream boundary of Reach 1 (RM 400.4). Reach 1 extends from the confluence of the Bois de Sioux and Ottertail rivers (RM 400.4) in Wahpeton-Breckenridge north to the Fargo North dam (RM 307.5). Reach 2 extends from the Fargo North dam (RM 307.5) to the Riverside dam in Grand Forks (RM 144.6). Reach 3 extends from Riverside dam (RM 144.6) north to the Drayton dam (RM 49.5) in Drayton, ND. Reach 4 extends from the Drayton dam (RM 49.5) to the international border with the province of Manitoba (RM 0.0).

Red River is very low gradient, ranging from 0.2 to 1.3 ft/mile (Renard et al. 1986). The highest gradient segment (1.3 ft/mi) is found between river mile (RM) 398 and RM380, just downstream from the former dam site at Wahpeton, ND/Breckenridge, MN (Figure 3). The next highest gradient segment (gradient = 0.9 ft/mi) is located from RM226 to RM181, between the confluences with Wild Rice River, MN, and Sand Hill River, MN. These higher gradient segments contain the most riffles throughout any stretch surveyed on Red River. Renard et al. (1986) reported the segment from RM226 to RM181 contained 15 individual riffles, and the segment from RM398 to RM380 contained 4 riffles. Eight dams that were built on the main stem of Red River in the U.S. have reduced the gradient through many segments compared to the natural channel profile. For instance, the construction of the Midtown and North dams in Fargo, ND, reduced the stream gradient through that stretch of river from its original 1.8 ft/mile to the present 0.2 ft/mile.

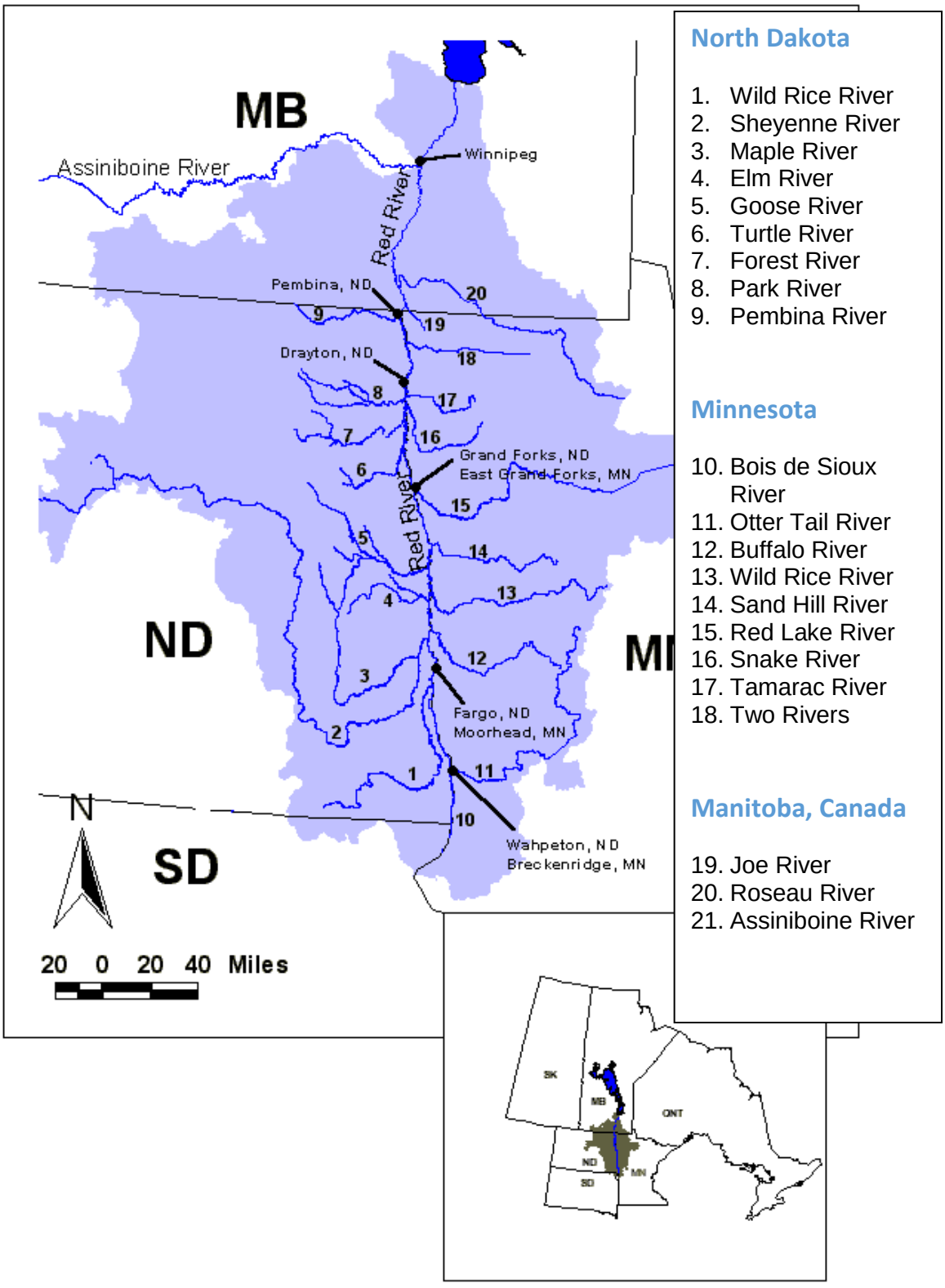
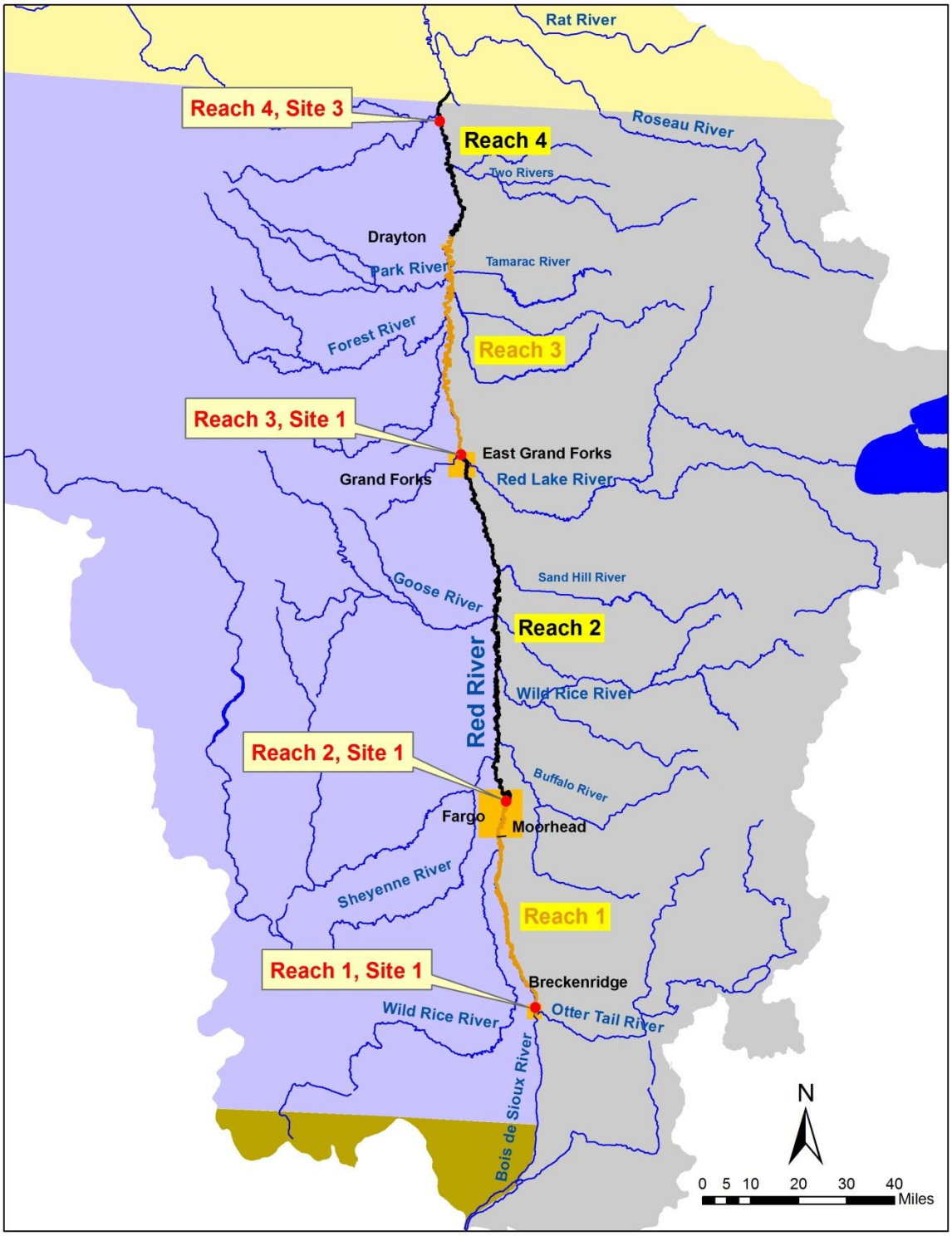


Figure 1. Primary rivers and streams in the Red River basin.



Reach 1. Wahpeton/Breckenridge to Fargo/Moorhead, U.S. River Mile 400 to 300.
Reach 2. Fargo/Moorhead to Grand Forks/East Grand Forks, U.S. River Mile 300-145.
Reach 3. Grand Forks/East Grand Forks to Drayton, U.S. River Mile 145-50.
Reach 4. Drayton to Minnestoa/Manitoba border, U.S. River Mile 50-0.

Figure 2. Management reaches and sample sites on Red River.

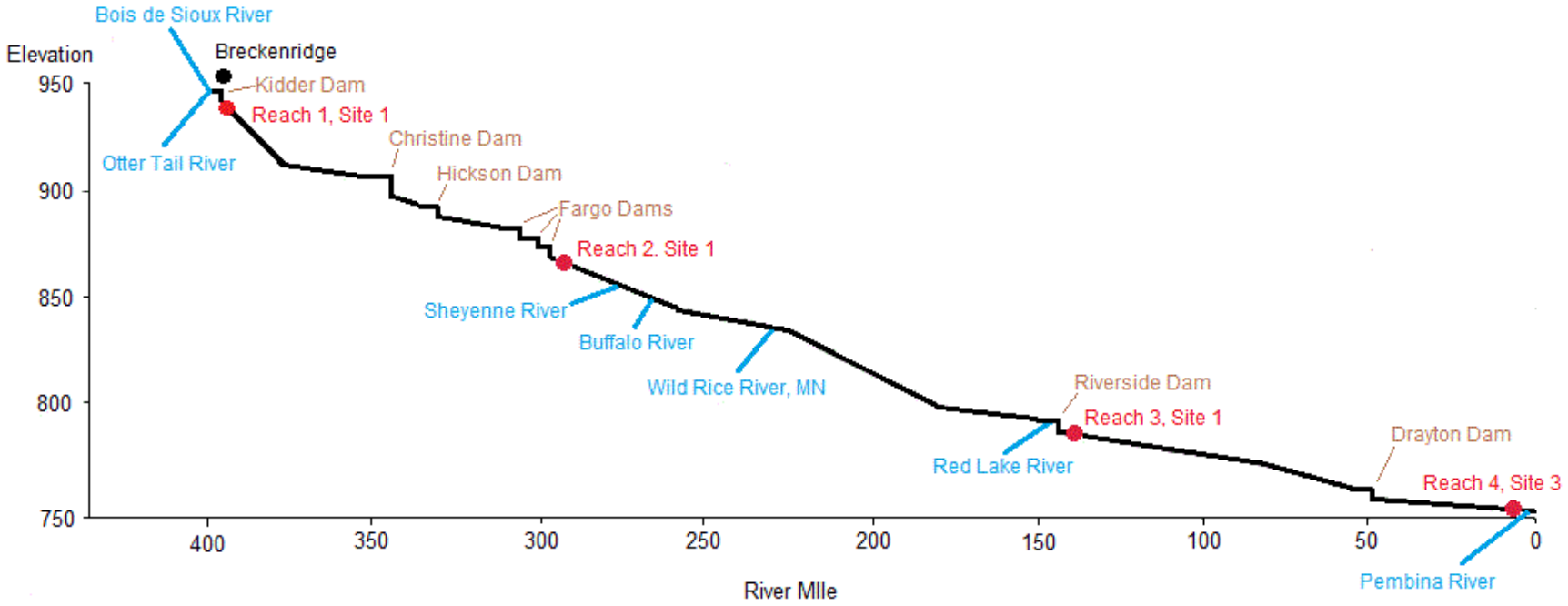


Figure 3. Red River longitudinal profile with selected reference points (modified from Renard 1986).

Red River is a highly sinuous river with an extensive floodplain. Stream sinuosity through the U.S. portion of Red River averages 2.0, ranging from 1.7 to 2.3 through the different segments (Table 1). Red River averages approximately 150 feet wide in the upstream reaches and approximately 250 feet wide in the lower reaches, ranging from 100 to 500 feet wide. The average thalweg depth ranges from 2.5 – 9.0 feet and a maximum of approximately 30 feet (Renard et al. 1986). A more complete description of the Red River watershed is available in Topp et al (1994).

Table 1. General information for Red River management Reaches 1 to 4.

Variable	Reach 1	Reach 2	Reach 3	Reach 4	Entire Length
Gradient (feet/mile)	0.7	0.2	0.6	0.2	0.5
Sinuosity	2.3	2.1	2.0	1.7	2.0

Mean annual flow for Red River at Wahpeton, ND is 657 cubic feet per second (cfs) and increases to 4,514 cfs at Drayton, ND, and to approximately 8,400 cfs at Lake Winnipeg (Aadland et al. 2005). The majority of Red River's annual flow comes from the eastern (Minnesota) tributaries as a result of regional precipitation patterns, evapotranspiration, soil types, and topography (Stoner et al. 1993). Most runoff occurs in spring and early summer as a result of rains falling on melting snow or heavy rains falling on saturated soils.

Seven of the eight dams constructed on the U.S. segment of main stem Red River have been converted into rock-arch rapids to allow for fish passage, remove erosive hydraulic currents and reduce public safety hazards (Table 2). The one remaining, unmodified dam is located near the town of Drayton, ND. One additional dam lies on the Canadian segment of main stem Red River at Lockport, Manitoba that is only passable during high flows.

Table 2. Low head dams in the U.S. portion of Red River.

Dam	Location	Location (T.R.S.)
Drayton	Drayton, ND RM 49.5	T159N, R50W, sec. 18
Riverside*	East Grand Forks, MN: RM 144.6	T152N, R50W, sec. 34
Fargo North*	Fargo, ND RM 298.3	T140N, R48W, sec. 32
Fargo Midtown*	Fargo, ND RM 301.6	T139N, R48W, sec. 07
Fargo South*	Fargo, ND RM 307.5	T139N, R48W, sec. 30
Hickson*	Hickson, ND RM 332.6	T137N, R48W, sec. 19
Christine*	Christine, ND RM 346.4	T136N, R48W, sec. 18
Kidder*	Breckenridge, MN RM 398.0	T133N, R47W, sec. 33

* Since 1999, all dams on the Red River in the United States, except Drayton, have been modified into rock-arch-rapids.

Red River is a warmwater stream with temperatures that regularly reach into the low 80's^{o} F in July and August, and ices over in the winter. Red River typically has a high concentration of suspended solids during open water periods. Fine clay and silt from the glacial lake plain contribute to the high turbidity levels. Median concentrations of total suspended solids during open water periods are noticeably higher downstream from the tributary confluences of Sheyenne River (ND), Buffalo River (MN) and Wild Rice River (MN) compared to upstream (Paakh et al. 2006). Suspended sediment contributions from tributary streams are likely a factor. The two Minnesota tributary streams that drain into Red River upstream from these confluences, Bois de Sioux River and Otter Tail River, have lower median suspended sediment concentrations than any of the other Minnesota tributary streams in the Red River Valley (Paakh et al. 2006). North Dakota and Minnesota list Red River, along with many of the tributary streams, as impaired waters due to turbidity (MPCA 2012). Primary sources include stream channel erosion, agricultural runoff resulting from changes in vegetative land cover types, and hydrologic alterations to the watershed.

Dissolved oxygen (DO) levels in Red River main stem generally stay above 5 mg/l. However, occasional dips in DO are known to have occurred. The Minnesota Pollution Control Agency (MPCA) reported DO levels on Red River in Fargo reached a low of 0.40 mg/l in August 2003 and the USGS gage station in Fargo documented DO levels below 4.0 mg/l on July 25 and 26, 2006 (MPCA 2007, unpublished). Each of these events coincided with a documented fish kill in the area. Many tributary stream segments are listed as impaired due to low dissolved oxygen levels (MPCA 2012).

There are 87 fish species representing 20 families known to inhabit rivers and streams in the Red basin (Aadland et al. 2005). Thirty seven (37) species have so far been sampled during coordinated sampling efforts since 1995.

Fisheries Management

Early state and provincial fishery management activities on Red River were given little emphasis because the dominant fishery was for Channel Catfish, rather than the regionally more popular Walleye or Northern Pike. In the early 1980's, biological surveys were conducted to document the river's fish populations, aquatic fauna, and habitat. Some of this work was done in response to the proposed Garrison Diversion project, which would have delivered Missouri River water from Lake Sakakawea to Red River watershed. Biological surveys were conducted by Manitoba, the Minnesota Department of Natural Resources, the University of North Dakota at Grand Forks, the North Dakota Game and Fish Department, and other governmental entities.

Prior to 1954, both Minnesota's and North Dakota's inland fishing regulations also applied to Red River at their common boundary. In 1954, both North Dakota and Minnesota had regulations that closed Red River to spring angling for game fish, but other fishing regulations differed between the two states. In 1988, Minnesota, North Dakota, South Dakota and the Province of Manitoba convened a catfish coordination meeting. The resulting working group named itself the International Red River Fisheries Management Steering Committee in 1990. The group's primary focus was to provide protection for Red River's Channel Catfish population

from over harvest and to coordinate assessment work in the basin. To address concerns of overharvest, North Dakota and Minnesota enacted regulations in 1990 that restricted angler harvest of Channel Catfish to five fish in possession, only one of which could be over 24 inches. In 1992, Manitoba adopted a no harvest regulation for Channel Catfish 24 inches or larger for Red River.

Lysack (1986) conducted a recreational user survey on a ten-mile segment of Red River above Lake Winnipeg and found that an estimated 7,920 lbs. of Channel Catfish were harvested from the study area with 90% of the harvested Channel Catfish being larger than 30 inches. It was felt that there was the possibility for over harvest of large Channel Catfish from that region.

In 1998-2000, North Dakota regulations included a continuously open game fish season on Red River, while Minnesota retained its closure to the taking of game fish from March 1 through the first Friday in May. The North Dakota daily limits were: three Northern Pike; a combined total of five Walleye, Sauger or Saugeye; a combined total of three bass, no limit on yellow perch, one muskellunge, and no protection for Lake Sturgeon. The Minnesota daily and possession limits were: three Northern Pike, a combined total of six Walleye or Sauger, six bass, 100 yellow perch, one muskellunge and no open season for Lake Sturgeon.

In 2000, Minnesota and North Dakota standardized fishing regulations on the Red River for all species. The fishing season was opened year round, with the exception of a conservation season that extended from March 1 through the first weekend of May. During the spring conservation season, bag limits for Walleye, Sauger and Northern Pike were reduced and size restrictions imposed. In 2004, the conservation season was eliminated, as well as the size restrictions on Walleye and Northern Pike. Currently, the fishing season is continuous on the Minnesota/North Dakota border waters of the Red River. Regulations for the most sought-after sport fish species are as follows: Channel Catfish, a possession limit of five with only one fish over 24 inches; Walleye/Sauger (either or combined), a possession limit of three; Northern Pike, a possession limit of three; and Largemouth/Smallmouth Bass (aggregate), a possession limit of three. In 2015, Minnesota initiated a catch and release season for Lake Sturgeon with a spawning season closure in effect for Lake Sturgeon from April 15 through June 15.

In 2002, the MN DNR began implementing a 20-year plan to restore the once abundant Lake Sturgeon population(s) in the Red River basin (MN DNR 2002). Lake Sturgeon fry and fingerlings are stocked into rivers and lakes as part of a comprehensive program to re-establish Lake Sturgeon populations in their native ranges. The goal of the program is to re-establish a sexually mature, naturally reproducing population within 20 to 30 years. The White Earth Nation and Red Lake Nation also stock fingerlings in lakes and rivers within tribal boundaries to re-establish Lake Sturgeon populations.

Researchers have studied various aspects of Red River fisheries since 1895 (Eddy et al. 1972; Clarke et al. 1980) including the MN DNR, ND G&F, Manitoba Fisheries and different Universities. These studies have included Channel Catfish habitat use and availability (Wendel 1999), larval fish assessments (Menaks 2000; Resseguie 2002), angler use surveys (MacDonald 1990), fish population assessments (Koel 1997; Koel and Peterka 1998), Channel

Catfish population estimates (Hegrenes 1992; Siddons 2015), water chemistry monitoring, disease and parasite monitoring, and fish flesh contaminant analyses. Currently, hydroacoustic research is being conducted throughout the Red River to assess the broad scale movement patterns of large river fish species.

Several angler use surveys have been conducted on Red River (Lysack 1986; Topp 1996a; Schlueter 1998; Brooks and Schlueter 1999; Brooks and Schlueter 2002; Topp 2003, Brooks and Schlueter 2005; Brooks and Gangl 2012; Wendel 2016a). The four most recent surveys used similar methods and covered the same time period, May 1 through September 30. Total angler effort has consistently declined in every survey since 1995. The majority of the decline in angler effort can be attributed to reduced shore angler effort (Wendel 2016a). The estimated angler harvest of Channel Catfish has also declined, from 15,787 fish in 1994 to 6,868 fish in 2015.

Channel Catfish population assessments have been conducted on the U.S. portion of Red River at five year intervals beginning in 1995 (Henry 1996; Huberty 1996; Topp 1996b; Martini and Stewig 2002; Henry 2007; Groshens 2011; Wendel 2016b). Surveys in 1995, 2000, and 2005 utilized trap nets and trot lines set in locations likely to capture high numbers of Channel Catfish. Survey techniques were standardized prior to the 2010 survey to improve catch rate comparisons between surveys (Attachment 1). Current protocol specifies trap net (30 per reach) and trotline sets (18 each in Reaches 3 and 4) systematically distributed lengthwise through each site and fished for one night. Supplemental nets may be used to increase the sample of large Channel Catfish but should not be included in CPUE calculations.

The MN DNR and ND G&F intend to continue to coordinate and conduct fish population assessments once every five years. Manitoba Water Stewardship also intends to explore options to coordinate fish population surveys beginning in 2020. Angler use surveys will also be conducted once every five years in conjunction with the fish population assessment. Information from all past and future studies will be used to best manage Red River's recreational fishery.

Goals and Objectives

Goals

- Provide a high quality, self-sustaining Channel Catfish fishery and secondary angling opportunities for Walleye, Sauger, and Northern Pike.
- Re-establish a self-sustaining population of Lake Sturgeon in the Red River basin.
- Reconnect Red River and its tributaries by removing or modifying dams in order to restore uninterrupted fish migration pathways.
- Protect and/or rehabilitate within-channel, riparian, and upland habitat on Red River and in its watershed in order to sustain or enhance components necessary for a healthy and stable riverine ecosystem.
- Provide viable, native fish populations through habitat protection and enhancement, fisheries management, and resource monitoring.

- Provide public access to Red River and its tributaries for fishing, boating, canoeing, kayaking, and other river related activities.
- Expand educational opportunities and promote appreciation for the Red River basin ecosystem.
- Seek opportunities to standardize fishing regulations.
- Promote the prevention and spread of aquatic invasive species within waters of the Red River Basin.

Fish Population Objectives

The primary fishery management species on Red River are Channel Catfish and Lake Sturgeon. Secondary management species include: Walleye, Northern Pike, and Sauger.

Five coordinated Channel Catfish population surveys have been conducted on Red River (Henry 1996; Huberty 1996; Topp 1996b; Martini and Stewig 2002; Henry 2007; Groshens 2011; Wendel 2016). Limited fish population data exists to identify trends in stock size, which makes it difficult to set specific fish population objectives. Dam modifications intended to benefit fish populations, highly variable net and line catch rates, highly variable stream flows between sample years, and variations in sample periods (months) complicates data analyses and interpretation used to establish objectives based on population trend data. Regardless, it is important to establish population and habitat objectives to guide management efforts and set a benchmark by which management success can be evaluated. The following objectives were based primarily on information obtained through the 2010 and 2015 Channel Catfish surveys which encompass the new sampling methodology established in 2010. These objectives will be refined in the future as knowledge of fish populations in Red River increases and more surveys are conducted.

Trap net and trotline catch rate objectives values were determined by simple averaging of the CPUE for the two years of standardized surveys (2010 and 2015; Table 3). Proportional stock density (PSD) values were calculated from trap net catch data using a stock size of 11 inches and a quality size of 16 inches, and objective values were determined by simple averaging across sample years (Tables 4 and 5). PSD objectives were not established for reaches 3 and 4 due to typically low sample sizes and high variability in calculations. Trotline catch rates of Channel Catfish >24 inches (Table 6) were used to establish size structure objectives for reaches 3 and 4.

Survey design and data collection methods were developed to target Channel Catfish. Efforts are currently underway to incorporate strategies to effectively evaluate Walleye, Sauger, Northern Pike and Lake Sturgeon populations. Numerical objectives will be developed for those species in the future.

Reach 1 Objectives

- Channel Catfish
  - Trap net catch rate (CPUE) of 57 fish/lift
  - PSD24 of 2
- Lake Sturgeon
  - Establish a self-sustaining population
- Walleye
  - Maintain a self-sustaining population
- Sauger
  - Maintain a self-sustaining population
- Northern Pike
  - Maintain a self-sustaining population.

Reach 2 Objectives

- Channel Catfish
  - Trap net catch rate (CPUE) of 18 fish/lift
  - PSD24 of 9
- Lake Sturgeon
  - Establish a self-sustaining population
- Walleye
  - Maintain a self-sustaining population
- Sauger
  - Maintain a self-sustaining population
- Northern Pike
  - Maintain a self-sustaining population

Reach 3 Objectives

- Channel Catfish
  - Trap net catch rate of 1.5 fish/lift
  - Trotline catch rate of 4.5 fish/line set
  - Trotline catch rate of 1.6 fish>24 inches/line set
- Lake Sturgeon
  - Establish a self-sustaining population
- Walleye
  - Maintain a self-sustaining population
- Sauger
  - Maintain a self-sustaining population
- Northern Pike
  - Maintain a self-sustaining population

Reach 4 Objectives

- Channel Catfish
  - Trap net catch rate of 4 fish/lift

    - Trotline catch rate of 4.0 fish/line set
    - Trotline catch rate of 3.1 fish>24 inches/line set
- Lake Sturgeon
    - Establish a self-sustaining population
- Walleye
    - Maintain a self-sustaining population
- Sauger
    - Maintain a self-sustaining population
- Northern Pike
    - Maintain a self-sustaining population

Manitoba segment(s): U.S./Manitoba border to Lake Winnipeg. Manitoba will submit management objectives at a future date.

Table 3. Channel Catfish catch rates from trap nets fished at specific sample sites during the Red River surveys conducted in 1995, 2000, 2005, 2010, and 2015. Catch rates for 2015 and 2010 surveys only include data collected from the core 30 nets, not supplemental nets set to increase sample size for length frequencies.

	2015	2010	2005	2000	1995
Reach 1	40.3	74.6	82.2	13.4	38.6
Reach 2	12.9	22.9	40.6	10.4	64.5
Reach 3	2.0	0.9	8.0	2.6	0.0
Reach 4	2.2	5.5	1.4	3.0	0.4

Table 4. Channel Catfish stock density indices calculated from Red River surveys conducted in 1995, 2000, 2005, 2010, and 2015 at Reach 1, Site 1.

	N	PSD	PSD_{20}	PSD_{24}	PSD_{30}
2015	1160	26	10	3	<1
2010	1410	37	9	2	<1
2005	49	31	6	2	0
2000	163	61	25	4	0
1995	243	47	15	2	0

Table 5. Channel Catfish stock density indices calculated from Red River surveys conducted in 1995, 2000, 2005, 2010, and 2015 at Reach 2, Site 1.

	N	PSD	PSD_{20}	PSD_{24}	PSD_{30}
2015	447	42	23	9	4
2010	505	67	26	9	1
2005	507	50	26	18	8
2000	89	60	35	16	2
1995	720	42	21	7	1

Table 6. Channel Catfish catch rates from trot lines fished at specific sample sites during the Red River surveys conducted in 1995, 2000, 2005, 2010, and 2015.

	2015		2010		2005		2000		1995	
Reach	Total	≥24 inch	Total	≥24 inch	Total	≥24 inch	Total	≥24 inch	Total	≥24 inch
Reach 3	3.1	1.4	3.2	1.9	4.4	1.3	8.5	2.2	2.3	0.8
Reach 4	5.5	2.6	5.1	3.6	3.4	1.6	4.5	1.8	3.1	2.0

Current Channel Catfish Population Status

Red River supports a high quality Channel Catfish fishery known for numbers of large fish. The population in the upper reaches of Red River are high density with relatively smaller fish. As the river flows north, the population changes to lower density but with much larger fish. The areas near Grand Forks and Drayton are well known by anglers for the opportunity to catch very large size Channel Catfish.

The Channel Catfish population in Red River is at the northern portion of its range and has slower growth rates than more southern populations. However, the population is still able to produce very large fish due to the longevity of the population. Fish are regularly estimated at over 20 years of age during targeted Channel Catfish surveys.

Overall, the Channel Catfish population in Red River appears healthy and should continue to support a high quality fishery. Mortality rates continue to be relatively low compared to other populations. Large fish (>30 inches) are captured throughout Red River and found in higher numbers in the lower reaches. Also, natural reproduction appears to be consistent as nearly all year classes are represented in age distributions. Continued efforts to restore connectivity and

improve habitat in the Red River basin should also benefit Channel Catfish and improve the population's resiliency to changing conditions such as climate, land use, hydrology, and invasive species introductions.

Angler harvest of large (> 24 inches) Channel Catfish should continue to be monitored closely. The mean length of Channel Catfish harvested in the lower sampling clusters was over 24 inches. Also, Channel Catfish > 24 inches were harvested in much greater proportion than found in a targeted netting survey in 2015. More restrictive regulations may be considered if harvest of large fish was a concern.

Angling effort on the Red River has consistently declined in each creel survey. Much of this decline can be attributed to reduced shore fishing effort. Promoting angling opportunities on the Red River, particularly in urban areas such as Fargo-Moorhead, should be considered.

Habitat Objectives

Information on Red River instream habitat is generally sparse. However, information regarding macrohabitat in Red River (e.g., gradient, channel sinuosity, hydrologic regime, and water quality) is available. Tributary streams have a major impact on fish populations and habitat conditions within Red River, so activities designed to help achieve Red River objectives must include tributary streams. The following habitat objectives apply to all Reaches and segments of Red River and its tributaries.

Objective 1: Establish and maintain stable stream channels.

A stable stream channel is one that has the ability to transport the sediment and flows produced by its watershed in such a manner that the stream maintains a consistent dimension, pattern and profile over time without either aggrading or degrading (Rosgen 1996). Stable stream channels provide the best potential for providing high quality instream habitat conditions and, because they are in balance with their sediment supply, minimize the potential for problems associated with excessive sediment loading.

In the past 100 years, many rivers and streams in the Red River basin were straightened, ditched, and cleared of snags with a goal of improving drainage. These activities have caused much instability in stream channels and destroyed hundreds of miles of aquatic habitat. These habitat losses continue today and have directly resulted in reduced fish and wildlife populations within channelized reaches of river corridors. Restoration and enhancement of channelized river segments is a top priority in the Red River basin.

Objective 2: Define, identify, improve and protect high quality Channel Catfish, Lake Sturgeon, Walleye, and Northern Pike spawning and rearing habitats within appropriate Red River stream segments and tributary streams.

Objective 3: Restore fish passage/river connectivity throughout Red River and wherever appropriate in tributary streams.

Objective 4: Provide heterogeneous and complex physical habitat components consistent with the physiographic setting and important to aquatic species in the Red River basin.

Habitat components include: suitable spawning and rearing substrates, cover structure such as boulders or large woody materials, a mixture of mesohabitats (riffle, pools and runs), and riparian vegetation. Habitat components for each species of interest should be guided by habitat suitability criteria developed by Aadland and Kuitunen (2006).

Objective 5: Provide water of sufficient quality to sustain healthy aquatic communities.

Although it is important that all constituents meet water quality standards as defined by the individual State or Province, this objective focuses on the two that most commonly exceed water quality standards in the Red River basin.

- Dissolved oxygen levels should be maintained at or above 5 mg/l
- Turbidity levels should be maintained below 25 NTU (nephelometric turbidity units, a measure of suspended particles in water)

Objective 6: Define and re-establish a more natural flow regime.

Five characteristics of flow regime influence river ecosystems: magnitude, frequency, duration, timing, and rate of change. Alterations in any one of these characteristics can directly impact habitat and aquatic biota. River discharge varies on time scales ranging from hours to years to even longer and it is this variability, absent human disturbance, that defines a streams natural flow regime. The naturally variable flow regime creates and maintains instream physical habitat. Aquatic species within a river or stream have evolved with the natural flow regime and depend on the predictable seasonal variation in discharge (Bunn and Arthington 2002). The natural flow regime is a major determinant of instream physical habitat, which, in turn, is a determinant of the biotic composition within a stream.

It is widely known that natural flow regimes of Red River and its tributaries have been substantially altered by a number of factors including, but not limited to: ditching, channelization, land use cover changes, and vegetative cover changes. Alterations to the flow regimes have destabilized stream channels and negatively impacted fish populations and aquatic communities. Working to re-establish more natural flow regimes will help to stabilize stream channels, increase the quality of instream habitat, and improve water quality leading to healthier aquatic communities and individual fish stocks.

Objective 7: Establish biologically based protected minimum flows that support a healthy, functioning biological community.

Operational Plan

Fish Population and Angler Surveys and Assessments

- Fish population assessments

  Sample fish populations every 5 years using standardized gear and sampling period(s). The next assessments are planned to occur in 2020 and 2025. Sampling gear and timing for assessments will include trap nets (3 ft by 6 ft, 0.75 in. mesh) and trotlines (45 m long with 25 drop lines using #4 hooks) set at specified locations in June. Additionally, effort should be made to evaluate techniques to supplement the number of small Channel Catfish in Reaches 3 and 4. Mid-channel hoop nets in these reaches should be considered.
- Recreational use surveys

  North Dakota and Minnesota will conduct angler use surveys once every five years, in conjunction with the fish population assessment, to estimate angler pressure and harvest by species for the main stem Red River. The next angler use surveys are scheduled for 2020; led by ND G&F, and 2025; led by MN DNR. The design of future creel surveys should be evaluated to address changes in angler effort on the Red River and funding reductions that have reduced the number of creel clerks used in the survey. Strategies to collect more interviews of boat anglers should be evaluated. Possible options include scheduling more time for creel clerks to spend at sites with boat access or providing creel clerks boats to collect interviews of boat anglers during their trip.
- Fishery assessments, angler use surveys, and other relevant information will be evaluated so that necessary management adjustments can be made to ensure the sustainability of the fisheries resources.
- Methods to adequately sample and evaluate Walleye, Sauger, Northern Pike and Lake Sturgeon populations will be developed and implemented.
- Current survey design and analysis techniques used to evaluate the status of fish populations in Red River will be reviewed and updated based on the latest and best available fisheries knowledge and techniques.

Habitat

The overall approach to habitat management in Red River is to maintain, restore, enhance and protect riverine and upland habitats and their functions. The majority of factors affecting the aquatic resources in the main stem of Red River operate at the watershed scale and managing the river must include a watershed scale approach. The two most significant and widespread causes of habitat degradation within the Red River basin are alterations to the hydrologic regime and increased sediment loading. Primary factors responsible for these include ditching, channelization, agricultural and urban land use practices, and changes in vegetative land cover types. Further, several fish populations, including important species such as Channel Catfish, Lake Sturgeon, Walleye and Northern Pike, depend on tributary streams to provide habitat that is not available in the main stem Red River during critical life history stages. Much of the highest quality spawning habitat available for species that require swifter currents and larger substrate particles is found primarily in the beach ridge areas. Many different fish species make large

migrations up tributary streams from main stem Red River to use these high quality habitat areas. Therefore, strategies to protect and improve fish habitat must include tributary streams.

Along with watershed management, activities intended to benefit fish populations in Red River should include instream habitat management. Rabeni (1993) suggests that the most efficient approach to improving habitat conditions for warmwater fish communities is to increase instream habitat diversity. Fish species diversity is often correlated with habitat diversity (Orth and White 1993). Rabeni (1993) also suggests that, given the limited time and money often available to fisheries managers, most instream habitat diversity objectives within warmwater streams can be adequately met by increasing the amount and variety of available depths and physical structure types. Activities to improve Red River instream habitat conditions include:

- Promote watershed and floodplain uses that are compatible with healthy river systems.
- Restore, enhance or protect wetlands along Red River and its tributaries
- Restore, enhance or protect functional riparian habitat and streamside buffers along Red River and its tributaries
- Establish, restore and maintain critical flow regimes
- Restore the natural functions of altered stream channels
- Work with entities involved with flood damage reduction strategies and Watershed Restoration and Protection Strategies (WRAPS) to incorporate stream protection and enhancement measures in project design and operation
- Provide sufficient quantities of instream structure
    - Protect and/or enhance instream structure, such as complex woody material (e.g., snags, fallen trees, root systems) and boulders
    - Maintain, restore, enhance and protect functional riparian areas
    - Instream snag removal and floodplain tree removal projects should be scrutinized and discouraged when proposed solely for aesthetics. Snagging projects shall be required to follow the stream obstruction removal guidelines set forth by the American Fisheries Society (AFS 1983)
- Reconnect river habitats and energy pathways by removing or modifying all dams on the main stem and high priority dams on tributary streams to address public safety concerns, erosion and to promote fish passage. Continue to develop partnerships with private, local, state, and federal entities to promote the removal or modification of dams
- Identify, protect and enhance critical fish habitat or areas of concern by acquiring land as Aquatic Management Areas, and by funding and supporting fish habitat improvement projects
- Participate on the International Red River Fisheries Steering Committee, other interstate, and interagency groups or committees focused on natural resource conservation, with the intent of coordinating management strategies
- Foster relationships with local watershed districts, communities, interest groups, landowners, and concerned citizens to discuss natural resource issues, promote sound land management practices, and implement projects that meet mutual goals

- Support and participate in educational programs to promote a better understanding of natural stream functions and processes, habitat conservation, and resource management

Stocking

- Stock Lake Sturgeon fry and fingerlings in the Red River basin to re-establish the population as per the Lake Sturgeon restoration plan (MN DNR 2002). Lake Sturgeon will be stocked through the year 2022 as outlined in the following table (MN DNR 2016):

Stocking location	Life State	Number	Frequency	Jurisdiction
Otter Tail Lake	Fingerling	4,000	Annual	MN DNR
White Earth Lake	Fingerling	8,000	Annual	White Earth Band
Round Lake	Fingerling	5,000	Annual	White Earth Band
Big Detroit Lake	Fingerling	2,000	Annual	MN DNR
Otter Tail River	Fingerling	1,000	Annual	MN DNR
Buffalo River	Fingerling	1,000	Annual	MN DNR
Red Lake River	Fry	100,000	Annual	MN DNR
Red Lake	Fingerling	10,000	Annual	Red Lake Band
Roseau River	Fry	100,000	Annual	MN DNR
Big Pine Lake	Fingerling	4,730	Surplus	MN DNR
Little Pine Lake	Fingerling	1,969	Surplus	MN DNR
Wild Rice River	Fingerling	1,000	Surplus	White Earth Band

- With the exception of Lake Sturgeon, no stocking of additional fish species is recommended. Future stocking considerations will be carried out only after a review has been conducted by the state proposing the introduction. The review would include the proposing state's protocol for species introductions, use of the American Fisheries Society's policy #15 for species introductions, and consultation with other state and provincial agencies.

Regulations

- Angling regulations will be standardized where possible to protect the fisheries resources, make regulations easier for anglers to understand, and help enforcement efforts. Angler compliance with regulations will be fostered through a pro-active information campaign (e.g., news releases, pamphlets, signs) and effective enforcement.

Angler Access

- Adopt and implement the Red River of the North canoe and boating route master plan (River Keepers 2002).
- Update and reprint the "Fishing on the Red River of the North" brochure as needed.

Lake Sturgeon

- Update and implement the Lake Sturgeon restoration plan (MN DNR 2002).

Invasive Species

- Implement a pro-active prevention program to build awareness of invasive species and the pathways they use for introduction and spread.
- Implement agency plans to address invasive species introductions and spread, and control environmental impacts.

Supplemental Information

Lake Sturgeon Restoration

Historical accounts suggest that Lake Sturgeon were abundant in the Red River basin until the late 1800's (Gough 1988-1992). Lake Sturgeon populations in the Red River basin were decimated by over exploitation, construction of dams, and declines in water quality. By the mid-1900's Lake Sturgeon had effectively been extirpated from the Red River basin. Although there are occasional, unconfirmed reports of Lake Sturgeon being caught in Red River, there is little chance that this population can recover on its own.

The long-range goal for Lake Sturgeon restoration in the Red River basin is to establish a self-sustaining population within 20 to 30 years of reintroduction (MN DNR 2002). Restoration activities will include removal or modification of dams so that the maturing Lake Sturgeon population will be able to access historic spawning areas and reproduce naturally, sturgeon stocking, protective regulations and water quality improvement.

A major component of the Lake Sturgeon restoration plan is the reintroduction of Lake Sturgeon at selected sites in the Red River basin using fry and fingerling stocking. Successful reintroduction efforts may hinge upon stocking a young enough life stage so that imprinting to the receiving water is maximized. Lake Sturgeon grow slowly and mature at a late age, so stocking a minimum of 20 Lake Sturgeon year classes is recommended.

Other sturgeon restoration activities include a public information/outreach program to inform the public of our restoration plan, a no harvest regulation to remain in effect indefinitely on Red River and its tributaries, and general water quality improvement and/or protection throughout the Red River basin.

A complete description of Minnesota's plan for Lake Sturgeon restoration in the Red River basin can be found in MN DNR (2002) and the current stocking regime can be found in MN DNR (2016). An update to the Lake Sturgeon Plan has been initiated but was not completed prior to finalization of this plan.

Dam Removal and Stream Restoration

The flow in Red River is directly affected by the presence of eight low head dams in the U.S. The purpose of these dams is to store municipal water supplies, control river levels, or both.

Approximately l60 dams on tributary waters in Minnesota alone indirectly affect flow, with numerous flood control projects presently proposed. Primary purposes of tributary dams include floodwater retention, lake level maintenance, water supply, waterfowl production, or hydropower.

Dams are often in disrepair and serve no existing discernable function. Many of the dams in the Red River basin are barriers to fish migration and pose a drowning threat to the public. The MN DNR, ND G&F and other project partners have worked to remove or modify dams to allow for fish migration and address public safety concerns. Currently, seven of the eight main stem dams on U.S. segment of Red River have been modified. Plans to modify the last remaining dam on the U.S. portion of main stem Red River (Drayton Dam near Drayton, ND) are progressing.

Numerous dam removal/modification projects have also been completed on Red River tributary streams. These projects have resulted in the reconnection of hundreds of miles of stream habitat across the Red River basin and the potential exists to reconnect hundreds more through continued efforts.

Water Quality

Major issues concerning Red River include flood control, drought, irrigation, sedimentation, pollution (industrial, agricultural and municipal), recreation enhancement, municipal and private water appropriations, and inter-basin water transfer. Several communities are established on the banks of Red River; the three largest include the metropolitan areas of Fargo-Moorhead and Grand Forks-East Grand Forks in the U.S. and Winnipeg in Manitoba.

The Red River watershed lies in an area of intense agricultural land use with extensive ditch and transportation systems. Ditches are steeply sloped and many have unstable banks and lack adequate, effective vegetative streamside buffers. The majority of the wetlands in the Red River basin have been drained and stream channelization is common. Native vegetation has been replaced with intensive row crop agriculture. This situation results in increased water temperatures, decreased dissolved oxygen concentrations, and heavy sediment loads being carried to Red River causing increased sedimentation and turbidity. Increased sedimentation increases stress and mortality to aquatic organisms and directly effects spawning, nursery and other important fish habitat by covering substrates, filling interstitial spaces, and reducing pool depths.

Extreme river turbidity levels resulting from elevated sediment inputs indicates the need for increased erosion control on all lands within the Red River watershed, especially those under frequent tillage. Methods to improve water quality (e.g., reduce turbidity, PCBs and fecal coliform levels) in Red River are: (l) restore functional, vegetative streamside buffers, (2) improve soil conservation practices on watershed lands, (3) protect and restore wetlands throughout the watershed, (4) stabilize stream banks and restore the natural functions of altered stream channels, and (5) improve municipal and industrial point source discharges.

Fish Stocking

Fish stocking can be done for a variety of reasons including: to increase population size, to maintain a population at the current level, to introduce a new species, to re-establish a species that has been lost from an area, or as a reaction to social concerns.

There should be a clearly defined biological need for any stocking effort occurring in the Red River basin and this should be described in a management plan for the particular species. In all cases, fish stocking should not compromise existing fish populations or create problems for the ecosystem. To minimize risk, stocking efforts should follow protocols established by the state or province conducting the stocking. Any fish stocking into Red River should be done in consultation with the other potentially affected states and province.

Invasive Species

Species that have been introduced, or moved, by humans into an area where they do not naturally occur are called “exotic” or “non-native” species. Non-native species that cause ecological or economic problems are termed “invasive species”. Invasive species can be introduced into waters within the Red River basin through a variety of sources and pose a threat to the Red River ecosystem and its recreational fisheries.

Zebra mussels were first discovered in the Red River basin in 2009 in Pelican Lake. Since then, the species has spread to numerous other waterbodies in the basin. Adult zebra mussels were first documented in the Red River in 2015.

Preventing invasive species from being introduced and established in a system is the most effective strategy against infestation. A pro-active prevention program should be implemented across the Red River watershed to build awareness of invasive species and the pathways they use for introduction and spread. State agencies have plans to address invasive species introductions and spread and general information and guidelines for preventing invasive species can be found online at: http://www.dnr.state.mn.us/invasives/index.html and at https://gf.nd.gov/ans.

The next step beyond prevention is early detection and rapid response. Early detection of an invasive species and a quick, coordinated response offers the best chance to control the spread of the invasive species and offers the best chance to minimize ecological and economic impacts. For many aquatic species there is no known selective control, so the problems they cause continue indefinitely. Management directed toward established invasive species focuses primarily on controlling spread and negative impacts.

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Red River of the North Channel Catfish Survey Methodology

Tom Groshens
Red River Fisheries Specialist
Minnesota Dept. Natural Resources

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Red River of the North
Channel Catfish Survey Methodolgy

Background

The coordinated Red River of the North (Red River) fish survey has been conducted three times (1995, 2000, and 2005) over the past 15 years (Henry 1996, Huberty 1996, Topp 1996, Martini and Stewig 2002, Henry 2007). These, along with the assessments done by Topp et al. (1994), Hegrenes (1992), McDonald (1990) and Wendel (1999) have provided valuable baseline information on the channel catfish population and, to a lesser extent, other fishes found in the mainstem of Red River. The surveys also provided insight into how to effectively and efficiently sample channel catfish along the 400 miles of large river habitat in a manner that will provide useful information to those responsible for managing the Red River fishery.

Fisheries professionals reviewed the information obtained from the above mentioned surveys and, through several meetings and discussions held in 2009 and 2010, implemented a number of modifications to the initial survey design that are intended to improve the quality and usefulness of the data. It was anticipated that the modifications will provide better monitoring information on the Red River catfish population and help ensure that resources expended are used in a cost effective and efficient manner given the amount of resources available.

The purpose of this survey is to provide accurate information on the Red River channel catfish population(s) sufficient to guide management decisions in order to achieve the population goals and objectives as outlined in the Red River of the North Fisheries Management Plan (MN DNR et al. 2008). The survey's primary focus is on channel catfish population size (length and weight) structure, with special emphasis on larger ($\geq$ 20 inches TL) fish.

Red River Channel Catfish Survey Methods

A. Timing

The survey is focused on channel catfish and previous efforts have shown early June to be an effective time period for sampling Red River catfish, likely because this time coincides with spawning behavior and/or seasonal high flows. Therefore, sampling will continue to be targeted for a two week period in early June. Exact sample dates may vary depending on river conditions. Sampling frequency will be maintained on a 5 year schedule; sampling is planned for 2010, 2015, etc.

B. Reaches

Red River was divided into four fisheries management reaches for channel catfish surveying and reporting (Figure 1, Table 1; Topp et al. 1994). The length of each river reach is based primarily on administrative considerations with specific reach boundaries strategically placed to coincide with major river hydrologic and biological features (dams) near the administrative boundaries. Since the

time the Reach boundaries were first established, the dams at Wahpeton/Breckenridge, Fargo/Moorhead, and Grand Forks/East Grand Forks have all been modified into rock-arch-rapids and now allow for fish passage at all flows. Regardless, it was determined that the Reach boundaries would remain the same for consistency and the initial Reaches will be used ad reference for all sampling associated with this survey.

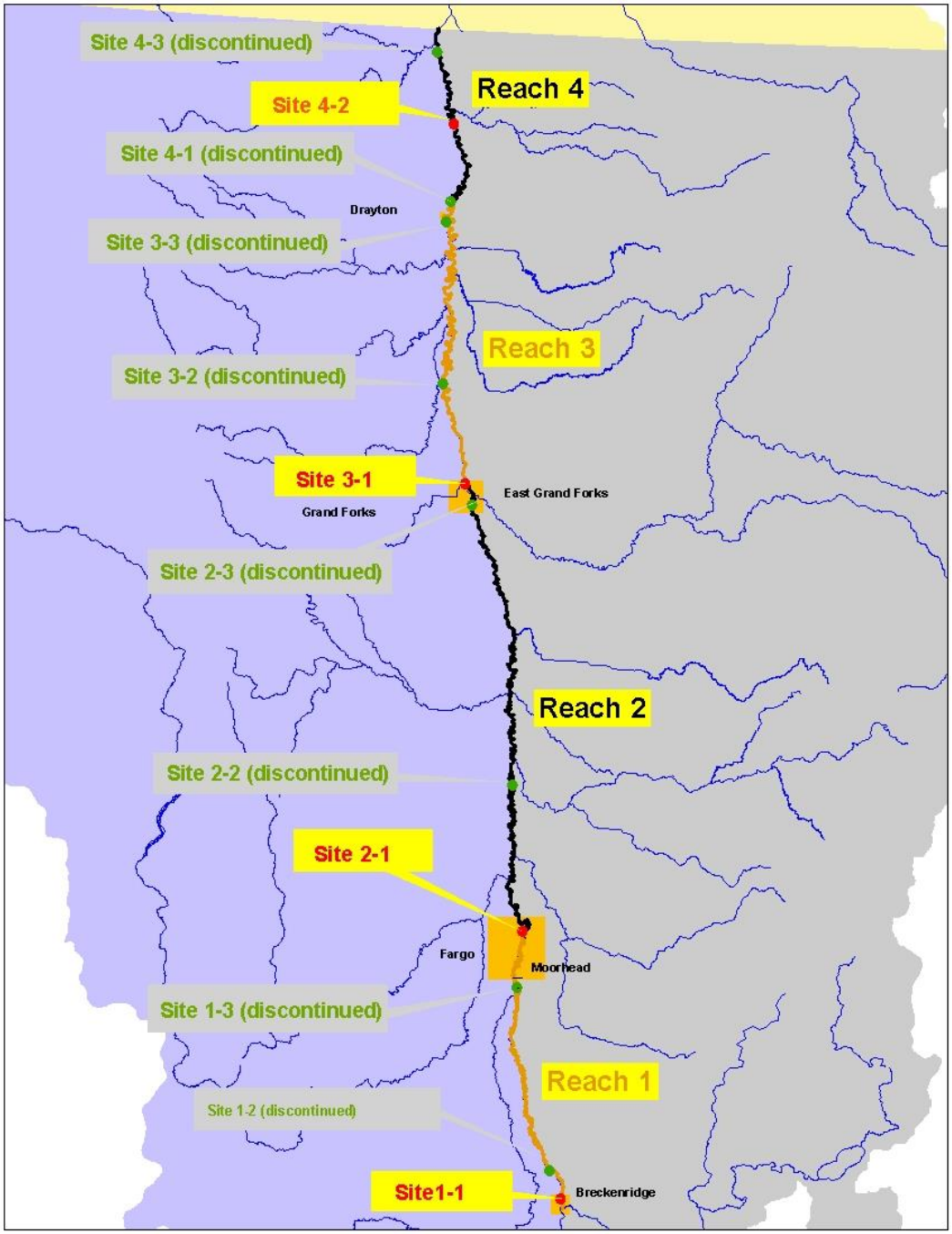

Figure 1. Red River reaches and sample site locations.

Table 1. Description of Red River management Reaches.

Reach Number	Upstream Boundary	Downstream Boundary	Length (river miles)
1	RM 400.4 Confluence of Otter Tail and Bois de Sioux rivers	RM 307.5 Fargo North Dam (modified)	92.9
2	RM 307.5 Fargo North Dam (modified)	RM 144.6 Riverside Dam (modified), Grand Forks	162.6
3	RM 144.6 Riverside Dam (modified), Grand Forks	RM 49.5 Drayton Dam	95.1
4	RM 49.5 Drayton Dam	RM 0.0 U.S. / Canada border	49.5

C. Sample Sites

A sample "site" refers to a segment of river wherein a number of trap nets and trotlines, or other gear as determined appropriate, are deployed for sampling channel catfish during this survey. Sites to be sampled for long-term channel catfish population monitoring will be:

Reach 1, Site 1

Reach 1, Site 1 is a 2.4 mile long site with its upstream boundary at the Kidder Dam rapids (Figure 1 and Appendix I, Figure A1).

Reach 2, Site 1

Reach 2, Site 1 is a 5.5 mile site with its upstream boundary located 1.5 miles upstream from the access located at M.B. Johnson Park in Moorhead (Figure 1 and Appendix I, Figure A2).

Reach 3, Site 1

Reach 3, Site 1 is a 4.0 mile site with its upstream boundary located 1.1 miles downstream from Riverside Dam rapids in Grand Forks (Figure 1 and Appendix I, Figure A3).

Reach 4, Site 2

Reach 4, Site 2 is a 3.0 mile site with its upstream boundary located 1.5 miles upstream from the access at Highway 175 west of Hallock (Figure 1 and Appendix I, Figure A4)

D. Stations, Gear and Effort

An individual trap net or trotline set location within a site is referred to as a sample "station". It has been assumed that the Red River survey coincides with the major channel catfish spawning migration for the year. Therefore, it is recommended that stations within a site be sampled in an upstream to downstream progression in an attempt to reduce the possibility of recapturing catfish.

1. Trap Nets

Minnesota DNR standard, non-baited trap nets (91 x 183 cm frame, 1.9 cm bar-mesh, 12.2 m x 0.75 m lead) will be used to sample channel catfish. There will be 30 trap net sample station locations distributed as evenly as possible throughout a sample site with the intent of collecting a representative sample of channel catfish. To facilitate net setting, each site will be divided

into 30 equal-length segments and reference points for trap net set locations were plotted in the center of each segment (Appendix I, Figures A1 through A4). Field crews should use a GPS unit to navigate to each reference point and set a trap net at a suitable location as close as possible to the given point. Nets should be set no farther than one-half the distance (either upstream or downstream) to adjacent reference points. Exact net locations should be chosen to maximize the number of channel catfish caught in each trap net set. It is recognized that some nets will be set in what may be considered lower quality channel catfish habitat at the time (e.g., runs, glides) and channel catfish catches in these nets may be lower than nets set in what is considered higher quality habitats (e.g., log jam in a pool on the outside of a meander bend).

Trap nets are set by anchoring the pot end on the shoreline using the best manner possible (e.g., attaching to woody debris or staking), attaching a fluke anchor to the lead (10 lbs. recommended) and stretching the lead downstream at an approximately 45-degree angle relative to shore; the angle may be less where necessary based on water velocity. Complete the trap net and trotline set/lift data form for each sample station (Appendix II). GPS coordinates for each individual trap net station will be recorded both on the set/lift data and in the GPS unit as a waypoint.

Each trap net will be fished for only one night; trap nets will not be reset at the same location. If a net set is determined to be invalid (biased) for any reason, such as a hole in net or the frame had collapsed, data will not be taken on fish from that net. The net will be emptied, repaired or replaced, and reset at that sample location until a valid net set has been sampled. If the required number of trap net sets (30) has been completed and less than 100 channel catfish greater than or equal to 20 inches TL were captured and recorded, then supplemental nets can be set and fished at any location within the site until the minimum sample size of fish is achieved. Data will still be collected on all fish in supplemental trap nets, however, only information from the original 30 sets will be used to construct and analyze channel catfish abundance indices (e.g., CPUE).

2. Trotlines

Trotlines to be used for sampling catfish will be 45 m long with 25 size 4/0 hooks on 0.3 m dropper lines. There will be 18 trotline sample stations distributed as evenly as possible throughout a sample site where trotlines are used. To facilitate trotline setting, each site was divided into 18 equal-length segments and reference points for line set locations were plotted in the center of each segment (Appendix I, Figures A5 and A6). Field crews should use a GPS unit to navigate to each reference point and set a trotline at a suitable location as close as possible to the given point. Trotlines should be set no farther than one-half the distance (either upstream or downstream) to adjacent reference points. Exact trotline locations should be chosen to maximize the number of channel catfish caught on each line set. It is recognized that some trotlines will be set in what may be considered lower quality channel catfish habitat at the time (e.g., runs, glides) and channel catfish catches on these lines may be lower than lines set in

what is considered higher quality habitats (e.g., log jam in a pool on the outside of a meander bend).

Trotlines are set by anchoring one end near shore using the best manner possible (e.g., staked using a fence post or tied off on woody debris), stretching the line downstream at an approximate 45-degree angle to shore and anchoring the end using a suitable anchor (e.g., 10 lb. fluke or block anchor). Hooks will be baited with a piece of goldeye (*Hiodon alosoides*), cisco (*Coregonus artedi*), white sucker (*Catostomus commersoni*) or redhorse (*Moxostoma* spp.). Both fresh and frozen baits are acceptable. Complete the trap net and trotline set/lift form for each sample station (Appendix II). GPS coordinates for each individual trotline station will be recorded both on the set/lift data and in the GPS unit as a waypoint.

Each trotline will be fished for only one night; trotlines will not be reset in the same location. If a trotline is determined to be invalid for any reason, such as a tangled or broken line, data will not be taken from fish on that trotline. Fish will be released, the trotline repaired or replaced, and the trotline will be reset at that station location until a valid trotline set has been sampled. If the required number of trotline sets (18) within a site has been completed and less than 100 channel catfish greater than or equal to 20 inches TL (trotline and trap net combined) were not captured, supplemental trotlines can be set and fished at any location within the site until the minimum sample size is achieved. Data will be collected on all fish on the supplemental trotlines, however, only information from the original 18 sets will be used to construct and analyze channel catfish abundance indices (e.g., CPUE).

3. Minimum sampling requirements for each site:

a. Reach 1, Site 1
   i. Minimum of 30 trap net sets **and** a minimum of 100 channel catfish greater than or equal to 20 inches total length
b. Reach 2, Site 1
   i. Minimum of 30 trap net sets **and** a minimum of 100 channel catfish greater than or equal to 20 inches total length
c. Reach 3, Site 1
   i. Minimum of 30 trap net sets
   ii. Minimum of 18 trotline sets
   iii. Minimum of 100 channel catfish greater than or equal to 20 inches total length (trap net and trotline combined)
d. Reach 4, Site 2
   i. Minimum of 30 trap net sets
   ii. Minimum of 18 trotline sets
   iii. Minimum of 100 channel catfish greater than or equal to 20 inches total length (trap net and trotline combined)

4. Sample Station ID Coding

Sample station identification will be coded using an alpha-numeric system that accounts for gear type, stream reach, site location and individual station identification. Gear types are trap net (TN) and trotline (ATL). Reaches are the four predefined Reaches from Breckenridge to the Canada border (first digit). Site locations are the overall stream segment wherein the individual stations are located (second digit). Station identification is the number assigned to an individual trap net or trotline set within a sample site (last two digits). For example:

Station ID: TN1103 represents trap net station #3 within site 1 in Reach 1.
Station ID: ATL4217 represents trotline station #17 within site 2 in Reach 4.

This coding system will be used for existing and future sample locations associated with the Red River survey. Any new sample sites will receive a new, unique identification number. Existing site numbers, including those used in previous surveys will remain with the location on Red River. In other words, sample site numbers represent a distinct segment of Red River used for sampling, so if a new location on Red River is sampled that has NOT been included in a previously identified sample site, that location will receive a new sample site number.

E. Catch Data

Catch data will be recorded according to the most recent standard procedures outlined in the MN DNR Fisheries Stream Survey Manual using the fish sampling catch form (Appendix II). Identify and enumerate all fish captured during the survey. All individual game fish, including channel catfish, lake sturgeon, walleye, sauger and northern pike, will be measured (total length). Measuring all individuals from other species is encouraged; however, a subsample of 25-50 individuals from each panfish and non-game fish species per trap net can be measured if desired.

Individual weights of all game fishes are required for five measured fish from each 10 mm length group up to 300mm, and 10 fish from each 25 mm length group for fish over 300mm. Individual weights of additional game or non-game fishes are optional. Enumerate and batch weigh game and non-game fish by species that have not been individually measured and weighed.

In situations when the sample set has been determined to be invalid for any reason (e.g., a large hole in a trap net, the frame was collapsed, trotline was broken) the gear will be emptied and catch data will not be recorded. Notable information associated with invalid sample sets, such the presence of a rare, unusual or exotic species, should be documented.

F. Fish Aging

Aging will be done on all game fish species sampled. Channel catfish less than or equal to 449 mm (17.7 inches) TL will be aged during every survey. Channel catfish of all lengths will be aged every other survey beginning in 2015 (i.e., 2015, 2025, 2030, etc.).

Channel catfish will be aged using disarticulated pectoral spines, unless or until an alternative technique becomes available that results in more accurate information and/or is less invasive while maintaining adequate accuracy. Aging structure collection will follow methods outlined in the DNR stream survey manual (MN DNR special publication 165), which states, "Collect appropriate aging structures from at least five (preferably ten) fish from each 10 mm length group for fish <300mm. For fish >300 mm, collect structures from 10 or more fish from each 25 mm group." The Bony Part (Fraser-Lee) form can be used to track the collection of aging structures during a survey (Appendix II).

G. Species Other Than Channel Catfish

Timing of survey is probably not good for documenting the status of species other than catfish. However, it is important to document information on other species as well. Data pertaining to these species will continue to be collected according to standard stream survey procedures.

To date, electrofishing efforts have not proven effective in capturing either walleye or sauger. Therefore, summer electrofishing efforts will not be required as part of this survey. Efforts to identify an efficient and effective strategy for sampling walleye and sauger populations will continue. Fish community and biotic integrity information will be obtained through MPCA's large river sampling, which will be coordinated with this survey.

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Red River of the North Fisheries Management Contacts

Henry Drewes
NW Region Fisheries Manager
Minnesota DNR
2115 Birchmont Beach Road
Bemidji, MN 56601
218-308-2633

Phil Talmage
Baudette Area Fisheries Manager
Minnesota DNR
204 Main Street East
Baudette, MN 56623
218-634-2522

Ted Sledge
NW Region Assistant Fisheries Manager
Minnesota DNR
2115 Birchmont Beach Road
Bemidji, MN 56601
218-308-2671

Kevin Casper
Regional Fisheries Manager
Manitoba Water Stewardship

204-642-2240

Jamison Wendel
Red River Fisheries Specialist
Minnesota DNR
14583 County Hwy 19
Detroit Lakes, MN 56501
218-846-8298

Jim Wolters
Fergus Falls Area Fisheries Manager
Minnesota DNR
1509 1st Avenue North
Fergus Falls, MN 56537
218-739-7576

Scott Gangl
Fisheries Management Section Leader
North Dakota Game and Fish Dept.
100 N. Bismarck Expressway
Bismarck, ND 58501-5095
701-328-6662

Nathan Olson
Detroit Lakes Area Fisheries Manager
Minnesota DNR
14583 County Highway 19
Detroit Lakes, MN 56501
218-846-8280

Mark Ermer
Regional Fisheries Manager
South Dakota Dept. of Game Fish & Parks
603 E. 8th Ave.
Webster, SD 57274
605-345-3381

Red River of the North Management Plan
Signature Page

_____ _____

Henry Drewes — Date
Minnesota Department of Natural Resources

_____ _____

Scott Gangl — Date
North Dakota Game and Fish Department

_____ _____

Kevin Casper — Date
Manitoba Water Stewardship

_____ _____

Mark Ermer — Date
South Dakota Department of Game, Fish, and Parks