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

April 2008 - 2012

I. Red River of the North Description

The hydrologic headwaters of Red River of the North (Red River) originate in the upper portions of the Otter Tail River watershed. Red River of the North, by name, begins at the confluence of the Bois de Sioux and Otter Tail rivers and flows northward approximately 545 miles through the 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 subwatersheds 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). Land use throughout the basin is dominated by agricultural practices.

Red River is a highly sinuous, low gradient warmwater river with an extensive floodplain. Stream sinuosity through the U.S. portion of Red River averages 2.0, ranging from 1.6 to 2.6 through the different segments. Stream gradient varies 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 2). The next highest gradient segment (gradient = 0.9 ft/mi) is located from RM226 to RM181 between the confluences with Wild Rice River, Minnesota, and Sand Hill River, MN. Eight dams have been built on the mainstem of Red River in the U.S. and these reduce the gradient through many segments. 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. As would be expected, the higher gradient segments contain the most riffles. 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. Red River averages approximately 150 feet wide in the upstream segments and approximately 250 feet wide in the lower segments. Water depths reach a maximum of approximately 30 feet.

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 (USGS), 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 tributaries as a result of regional patterns of precipitation, evapotranspiration, soils, 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.

Five of the eight dams on the U.S. segment of mainstem Red River have been converted into rock-arch rapids in order to allow for fish passage, remove erosive hydraulic currents and reduce public safety hazards (Figure 2). The three remaining, unmodified dams are located near the towns of Christine, Hickson and Drayton, ND. One additional dam lies on the Canadian segment of mainstem Red River at Lockport, Manitoba.

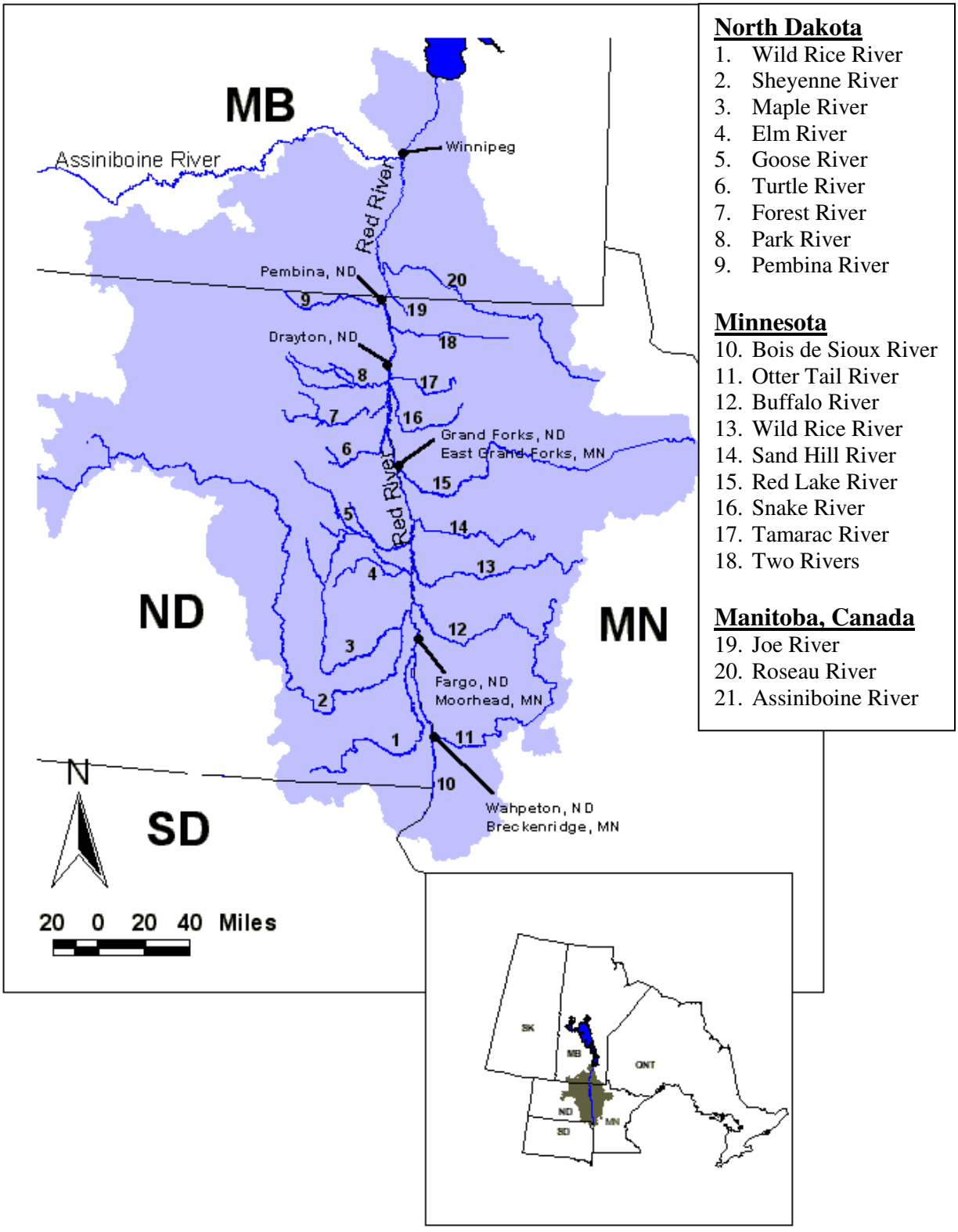


Figure 1. Primary rivers and streams of the Red River basin.

Red River is a warm water stream with temperatures that regularly reach into the low 80s°F in July and August, and ices over in the winter (USGS real-time gage station data). Red River is known for its high concentration of suspended solids, which results primarily from fine clay and silt sediments from the glacial lake plain. 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 that any of the other Minnesota tributary streams (Paakh et al. 2006). The states of North Dakota and Minnesota list Red River, along with many of the tributary streams, as impaired waters due to sediment; i.e., water quality is not sufficient to meet State designated uses (http://www.pca.state.mn.us/water/tmdl/tmdl-303dlist.html http://www.health.state.nd.us/WQ/SW/Z2_TMDL/TMDL_Lists/B_TMDL_List.htm). Primary sediment sources include stream channel erosion and agricultural runoff resulting from changes in vegetative land cover types and alterations to the hydrology of the watershed.

Dissolved oxygen (DO) levels in Red River mainstem generally stay above 5 mg/l. However, periodic 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 *draft*). 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 2008).

II. 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 more popular walleye or northern pike. 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 the early 1980's, biological surveys were conducted to document the river's fish populations and aquatic fauna. 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. 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.

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 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 that end, 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.

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 both established a conservation season (CS) for walleye, sauger, and northern pike from March 1 to the first Friday in May. During the CS, more restrictive regulations were in place to protect these species during a time of high vulnerability and potentially high fishing pressure. During most of the year the walleye and sauger limit was 5 (combined), but during the CS the limit was 3 including only 2 walleye less than 18”; all walleye or sauger from 18-28” were to be immediately released; and only 1 walleye could be over 28”. The year round northern pike limit was 3 (no size restriction) except during the CS when no pike over 27” were allowed to be harvested. The channel catfish limit was 5 (only 1 over 24”); largemouth/smallmouth bass limit was 3, yellow perch limit was 50, the muskellunge limit was 1 with a minimum length limit of 40”, and there was no open season for lake sturgeon.

The conservation season was eliminated in 2004. Currently, there is a continuous fishing season on the Minnesota/ North Dakota segment of Red River. South Dakota has seasonal closures for walleye, sauger, northern pike, smallmouth bass and largemouth bass and Manitoba has a general spring season closure. Angling for lake sturgeon is continuously closed on all segments of Red River in both the U.S. and Canada. Daily bag and possession limits for fish species other than lake sturgeon vary between Minnesota, North Dakota, South Dakota and Manitoba depending on which waters are being fished.

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 and this program continues (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 over the next 20 to 30 years.

Various investigators have studied various aspects of Red River fisheries since 1895 (Eddy et al. 1972) including the MN DNR, ND G&F, Manitoba Fisheries and different Universities. These studies have included channel catfish habitat use and availability, spawning patterns of several

fish species, angler use surveys, fish population assessments, channel catfish population estimates, water chemistry monitoring, disease and parasite monitoring, and fish flesh contaminant analyses.

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). Two of these surveys (Topp 1996a and 2003) used identical methods covering the same time period, May 1 through September 30 and found that total estimated angler effort (hours) dropped 32% between 1994 (159,723 hrs) and 2001 (108,182 hours). Similarly, the estimated number of catfish harvested dropped 26% from 15,787 fish in 1994 to 11,747 fish in 2001. Alternately, the weight of channel catfish harvested increased 51% from 28,384 lbs in 1994 to 42,981 lbs in 2001.

The Red River Steering Committee intends to continue conducting fish population assessments once every five years. 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 the Red River of the North's recreational fishery.

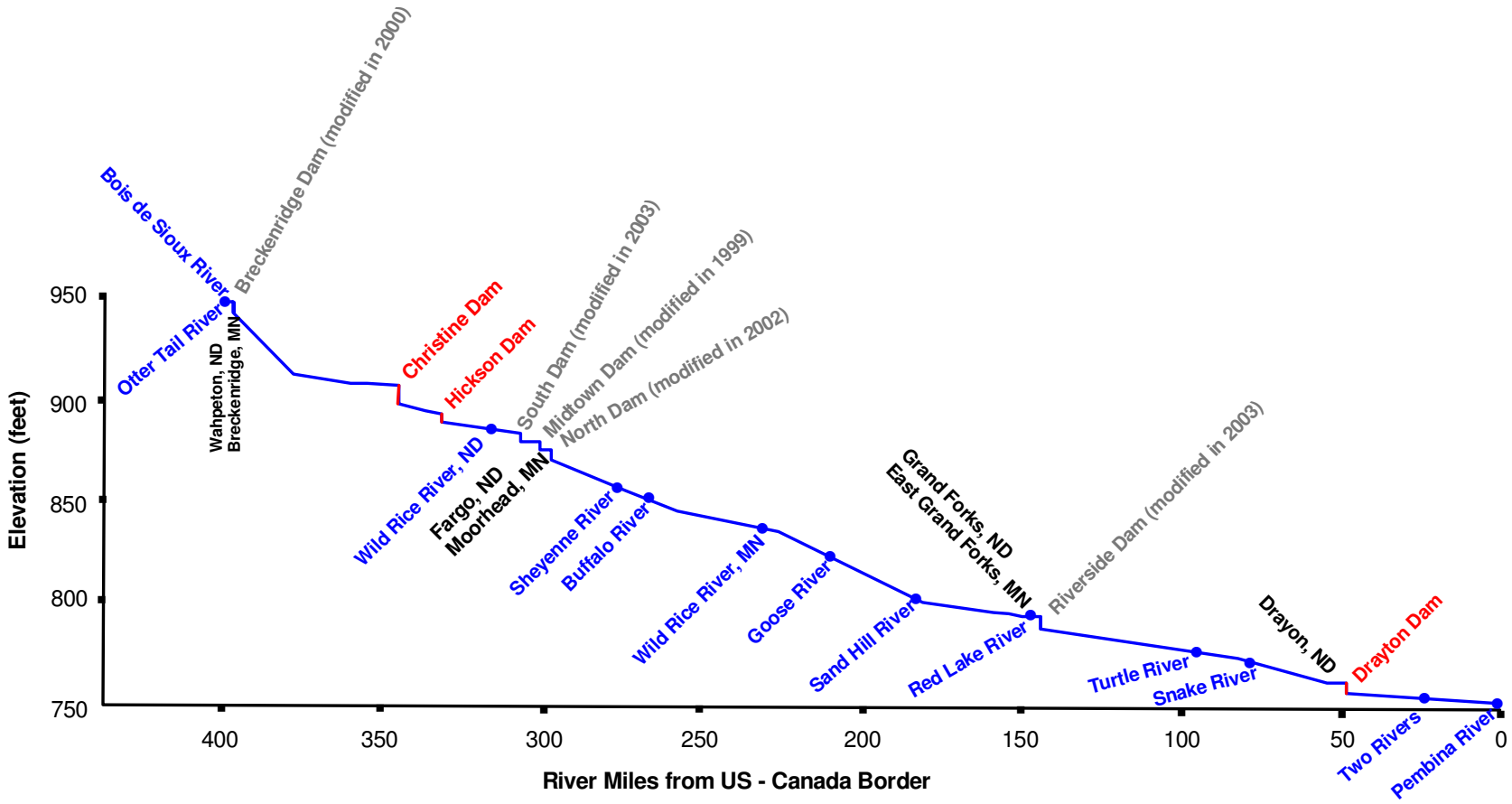


Figure 2. Longitudinal profile of the U.S. portion of Red River of the North with major cities, tributary confluences and dam locations.

III. Goals and Objectives For Red River of the North

Goals

- Provide a high quality, sustainable 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.
- Prevent invasive species from being introduced, established or spread within waters of the Red River basin.

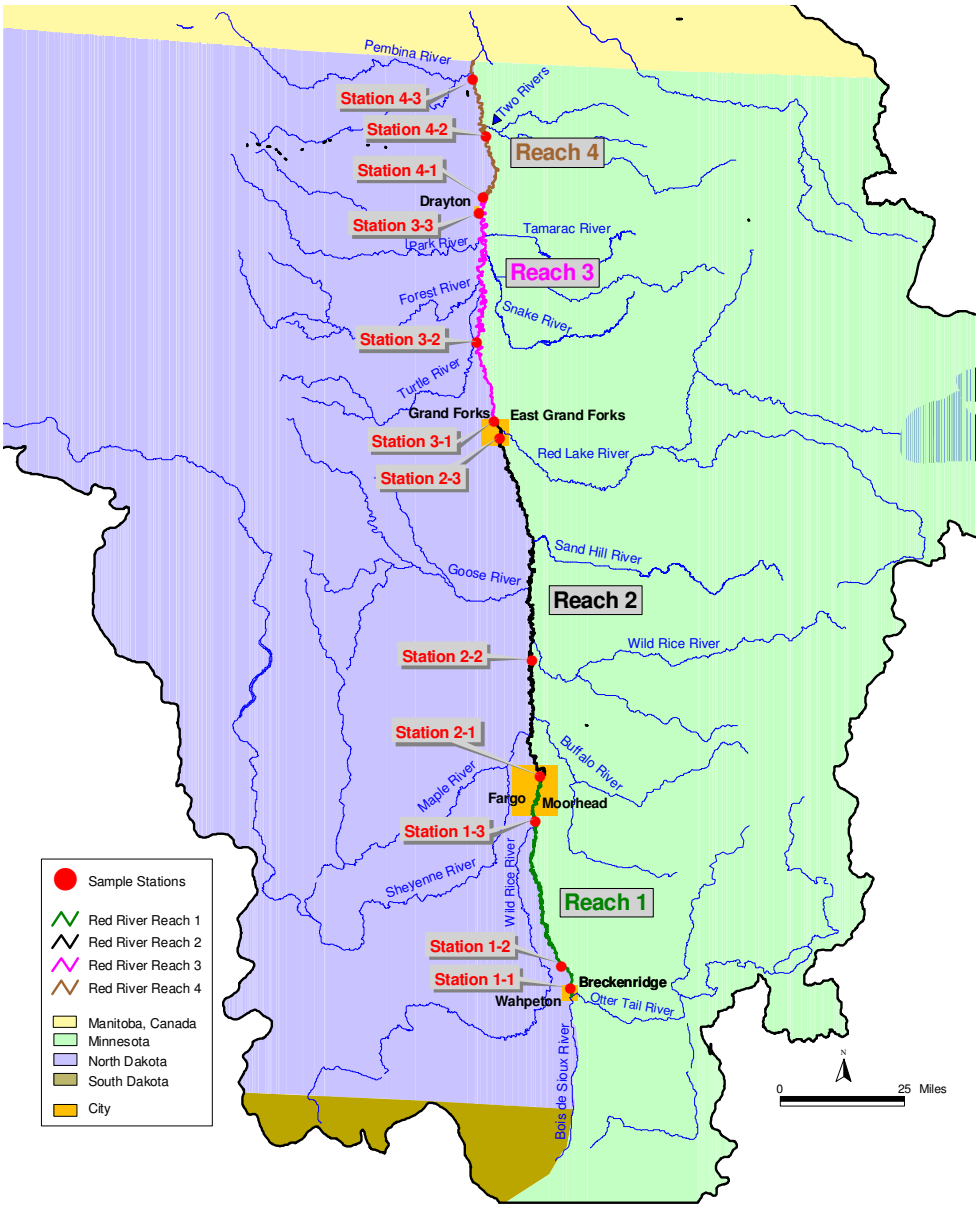
Fish Population Objectives

Only, three coordinated fish population surveys have been conducted on Red River (Henry 1996, Huberty 1996, Topp 1996b, Martini and Stewig 2002, Henry 2007). There is limited fish population data 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 on information obtained through the three aforementioned fish surveys. These objectives will be refined in the future as knowledge of fish populations in Red River of the North increases.

The primary fishery management species on Red River are channel catfish (*Ictalurus punctatus*) and lake sturgeon (*Acipenser fulvescens*). Secondary management species include: walleye (*Sander vitreum*), northern pike (*Esox lucius*), and sauger (*Sander canadensis*). For fishery management purposes the U.S. portion of Red River was divided into four segments, referred to as Reaches (Figure 3).

Major assumptions when setting the following fish population objectives were that fish abundance and size structure within each individual fish population for which objectives are listed had characteristics reflective of a healthy, reproducing population during the times of sampling. Trap net and trotline catch rate objectives values were determined by simple averaging of the CPUE across the three existing sample years (1995, 2000, and 2005; Table 1). Proportional stock density (PSD) and relative stock density of fishes $\geq$ 24 inches (RSD_{24}) 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 (Table 2). Percentage of fish ≥24 inches and ≥30 inches was calculated from trotline data and objective values were determined by simple averaging across sample years (Tables 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. 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/Manitboa border, U.S. River Mile 50-0.

Figure 3. Reach delineations for Red River of the North including 2005 sample site locations.

Reach 1 Objectives

- Channel catfish
  - Trap net catch rate (CPUE) of 63.0 fish/lift
  - Trap net PSD of 50% and an RSD_{24} of 5%
  - Trotline catch rate of 4.5 fish/line set
  - 15% of catfish caught on trotlines are $\geq$ 24 inches and 10% are $\geq$ 30 inches.
- Lake sturgeon
  - Establish a self-sustaining, reproducing population
- Walleye
  - Maintain a self-sustaining, reproducing population
- Sauger
  - Maintain a self-sustaining, reproducing population
- Northern Pike
  - Maintain a self-sustaining, reproducing population.

Reach 2 Objectives

- Channel catfish
  - Trap net catch rate (CPUE) of 35 fish/lift
  - Trap net PSD of 55% and an RSD_{24} of 15%
  - Trotline catch rate of 3.0 fish/line set
  - 20% of catfish caught on trotlines are $\geq$ 24 inches and 15% are $\geq$ 30 inches.
- Lake sturgeon
  - Establish a self-sustaining, reproducing population
- Walleye
  - Maintain a self-sustaining, reproducing population
- Sauger
  - Maintain a self-sustaining, reproducing population
- Northern Pike
  - Maintain a self-sustaining, reproducing population

Reach 3 Objectives

- Channel catfish
  - Trap net catch rate of 3.0 fish/lift
  - Trap net PSD of 40% and an RSD_{24} of 25%
  - Trotline catch rate of 4.5 fish/line set
  - 40% of catfish caught on trotlines are $\geq$ 24 inches and 4% are $\geq$ 30 inches.
- Lake sturgeon
  - Establish a self-sustaining, reproducing population
- Walleye
  - Maintain a self-sustaining, reproducing population
- Sauger
  - Maintain a self-sustaining, reproducing population
- Northern Pike
  - Maintain a self-sustaining, reproducing population

Reach 4 Objectives

- Channel catfish
  - Trap net catch rate of 2.0 fish/lift
  - Trap net PSD of 30% and an RSD_{24} of 10%
  - Trotline catch rate of 4.0 fish/line set
  - 45% of catfish caught on trotlines are $\geq$ 24 inches and 1% $\geq$ 30 inches
- Lake sturgeon
  - Establish a self-sustaining reproducing population
- Walleye
  - Maintain a self-sustaining, reproducing population
- Sauger
  - Maintain a self-sustaining, reproducing population
- Northern Pike
  - Maintain a self-sustaining, reproducing population

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

Table 1. Trap net catch rates (CPUE; fish/net set) for channel catfish during coordinated sampling events on Red River of the North.

Reach		1995	2000	2005	Average
1	CPUE	80.2	22.8	86.9	63.3
	(No. of net sets)	(31)	(29)	(30)	
2	CPUE	52.2	7.5	50.2	36.6
	(No. of net sets)	(56)	(30)	(30)	
3	CPUE	0.3	2.8	5.7	2.9
	(No. of net sets)	(27)	(27)	(29)	
4	CPUE	0.2	3.0	2.6	1.9
	(No. of net sets)	(30)	(38)	(30)	

Table 2. PSD and RSD24 values for channel catfish sampled using trap nets during coordinated sampling events on Red River of the North. Values were rounded to the nearest percentage.

Reach		1995	2000	2005	Average
1	PSD	51	65	39	52
	RSD_{24}	2	5	10	6
2	PSD	51	62	56	56
	RSD_{24}	6	15	30	17
3	PSD	*	71	55	42
	RSD_{24}	*	20	28	24
4	PSD	*	23	37	30
	RSD_{24}	*	9	17	13

* Sample size was insufficient for calculating PSDs or RSDs.

Table 3. Trotline catch rates (CPUE; fish/line set) for channel catfish during coordinated sampling events on Red River of the North.

Reach		1995	2000	2005	Average
1	CPUE	4.0	6.0	3.4	4.5
	(No. of line sets)	(24)	(18)	(18)	
2	CPUE	5.1	2.6	1.5	3.1
	(No. of line sets)	(9)	(18)	(17)	
3	CPUE	3.8	7.5	2.9	4.7
	(No. of line sets)	(44)	(35)	(27)	
4	CPUE	2.8	4.3	4.1	3.7
	(No. of line sets)	(48)	(33)	(26)	

Table 4. Percentage of all channel catfish greater or equal to 24 and 30 inches that were captured using trotlines during coordinated sampling events on Red River of the North.

Reach		1995	2000	2005	Average
1	≥24 in	2.1	16.5	27.9	15.5
	≥30 in	3.7	6.3	20.8	10.3
2	≥24 in	8.7	10.6	48.0	22.4
	≥30 in	5.2	2.3	41.0	16.2
3	≥24 in	16.1	28.8	78.2	41.0
	≥30 in	2.2	0.0	8.0	3.4
4	≥24 in	16.3	42.3	77.2	45.3
	≥30 in	0	0	3.3	1.1

Habitat Objectives

Information on Red River instream habitat is generally sparse. Selected information regarding macrohabitat in Red River (e.g., gradient, channel sinuosity, hydrologic regime, 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 nor 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.

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: Provide uninterrupted fish passage/river connectivity throughout Red River and its 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 of the North 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.

IV. 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 assessment is planned to occur in 2010. 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) in June, and boat electrofishing in the spring and/or fall.
- 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 mainstem Red River. The next angler use survey is scheduled for 2010 using the standard survey design as outline by Topp (2001).
- 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 mainstem 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, 000channelization, 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 mainstem Red River during critical life history stages. It is generally know that the highest quality spawning habitat available for species that require swifter currents and larger substrate particles, such as walleye and lake sturgeon, is found primarily in the beach ridge areas and fish migrate up tributary streams from mainstem Red River to use them. 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 a 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 using natural channel design principles
- Work with entities involved with flood damage reduction strategies 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).
    - Add cover materials to pool and backwater areas
- 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 2005):

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
Roseau River	Fry	100,000	Annual	MN DNR

- 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

- 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.

V. 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 over the next 20 to 30 years (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 (2005).

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, five of the eight main stem dams on U.S. segment of Red River have been modified: Fargo Midtown Dam (Fargo, ND) was modified in 1999; Kidder Dam (Wahpeton, ND) was modified in 2000; Riverside Dam (Grand Forks, ND) was modified in 2002; Fargo North Dam (Fargo, ND) was modified in 2002, and

Fargo South Dam (Fargo, ND) was modified in 2003. Plans to modify the three remaining dams on the U.S. portion of mainstem Red River (Christine Dam near Christine, ND, Hickson Dam near Hickson, ND, and Drayton Dam near Drayton, ND) are progressing.

Numerous dam removal/modification projects have been completed on Red River tributary streams including, but not limited to: the Roseau City dam modification (Roseau River) and Old Mill State Park dam removal (Middle River in 2001, the Buffalo River State Park dam (Buffalo River) removal in 2002, the diversion dam fish by-pass project (Fergus Falls, MN Otter Tail River) in 2002, the Lions Park Club Dam modification (Frazee MN; Otter Tail River) in 2003, the East Grand Forks dam modification (Red Lake River) in 2003, the Crookston Dam modification (Red Lake River, Crookston, MN) in 2005, the Heiberg dam modification (Wild Rice River, Twin Valley, MN) in 2006, and the Argyle Dam removal (Middle River, Argyle, MN) in 2007, and the Lake Breckenridge dam (Otter Tail River, Breckenridge, MN) in 2007. 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.

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 (Schlueter 2007; MN DNR 2007) 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 http://gf.nd.gov/fishing/ans.html. Fisheries operations in the Red River basin should follow the guidelines outlined in MN DNR (2007 *draft*).

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.

Recreational Access

Public access to Red River has been identified as an area in need of improvement to facilitate outdoor recreational activities including, but not limited to: angling, canoeing, and boating. In 2001 and 2002, River Keepers, a Fargo-Moorhead based non-profit organization, inventoried recreational use infrastructure (e.g., access sites, dams, road crossings) and developed a detailed master plan (River Keepers 2002) to "…guide [infrastructure] development to maximize sustainable use, encourage safety, and contribute to economic development." Included in the plan are detailed descriptions of existing and potential boat and canoe access sites, and a strategy for implementing the overall plan. This plan should be used as the primary guide for access development on Red River.

Literature Cited and Reference Documents

Aadland, L. P., T. M. Koel, W. G. Franzin, K.W. Stewart and P. Nelson. 2005. Changes in fish assemblage structure of the Red River of the North. American Fisheries Society Symposium 15:293-371, Annapolis, MD.

Aadland, L.P. and A. Kuitunen. 2006. Habitat suitability criteria for stream fishes and mussels of Minnesota. Division of Ecological Services, Special Publication No. 162. Minnesota Department of Natural Resources, St. Paul, MN

AFS. 1983. Stream obstruction removal guidelines. American Fisheries Society, Bethesda, MD.

Brooks, L. and L.R. Schlueter. 1999. Angler use and sport fishing catch survey on the Red River of the North, North Dakota: April 01 through May 05, 1999. North Dakota Game and Fish Department, Fisheries Division.

Brooks, L. and L.R. Schlueter. 2002. Angler use and sport fishing catch survey on the Red River of the North, North Dakota: March 15 through October 31, 2000. North Dakota Game and Fish Department, Fisheries Division.

Brooks, L. and L.R. Schlueter. 2005. Angler use and sport fishing catch survey on the Red River, North Dakota: April 1 through May 31, 2003. North Dakota Game and Fish Department, Fisheries Division.

Bunn, S.E. and A.H. Arthington. 2002. Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity. Environmental Management 30: 492-507.

Clarke, R. McV., R.W. Boychuck, and D.A. Hodgins. 1980. Fishes of the Red River at Winnipeg, Manitoba. Department of Fisheries and Oceans, Winnipeg, Manitoba.

Gough, B.M., editor. 1988-1992. The journal of Alexander Henry the Younger, 1799-1814, Volume I. The Champlain Society, Toronto, Canada.

Eddy, S., R.C. Tasker and J.C. Underhill. 1972. Fishes of the Red River, Rainy River and Lake of the Woods, Minnesota, with comments on the distribution of species in the Nelson River Drainage. Bell Museum of Natural History, University of Minnesota. Occasional Paper No. II.

Hegrenes, Scott. 1992. Age, growth and reproduction of channel catfish in the Red River of the North. Master's thesis, University of North Dakota, Grand Forks, ND.

Henry, M. 1996. Red River of the North population assessment, river miles 309-397.8. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Fergus Falls, MN.

Henry, M. 2007. Red River of the North fisheries population assessment, summer 2005 combined reach report, reaches 1-4, river mile 0.0 to 400.4. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Bemidji, MN.

Huberty, G. 1996. Stream fish population assessment of the Red River, Reach two, from East Grand Forks upstream to Moorhead; Polk, Norman and Clay counties, May 30-June 9, 1995. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Detroit Lakes, MN.

International Joint Commission. 2000. Living with the Red. November 2000.

Koel, M.T. 1997. Distribution of fishes in the Red River of the North basin on Environmental gradients. PhD dissertation, North Dakota State University, Fargo, ND.

Koel, T.M. and J.J. Peterka. 1998. Stream fishes of the Red River of the North basin, United States: a comprehensive review. Canadian Field-Naturalist 11:631-646.

Lysack, W. 1986. The angling fishery of the lower Red River. Manitoba Natural Resources, Fisheries, Manuscript report No. 86-16.

MacDonald, D. 1990. The channel catfish sport fishery of the lower Red River. Masters Practicum. University of Manitoba, Winnipeg, Canada.

Martini, K.J. and J.D. Stewig. 2002. Red River of the North: fisheries population assessment summer 2000 including the 1990-2000 assessment summaries. Minnesota Department of Natural Resources. Study IV, Job 551, Completion Report. St. Paul, MN.

Menaks, M. 2000. Juvenile and larval fishes of the Red River of the North. M.S. thesis, University of Minnesota, St. Paul, MN

MN DNR. 2007. Operation order #113; invasive species. Division of Ecological Services, Minnesota Department of Natural Resources, St. Paul, MN.

MN DNR. 2007 (*draft*). Fisheries discipline guidelines for reducing the spread of non-target or invasive species and pathogens. Division of Fish and Wildlife, Fisheries Management Section and Division of Ecological Services, Minnesota Department of Natural Resources, St. Paul, MN.

MN DNR. 2005. Revised MN DNR Red River basin sturgeon stocking regime. Minnesota Department of Natural Resources, Bemidji, MN.

MN DNR. 2002. Restoration of extirpated lake sturgeon, *Acipenser fulvescens*, in the Red River of the North Watershed. Minnesota Department of Natural Resources, Section of Fisheries, Bemidji, MN.

MPCA. 2007 (*draft*). Fish kills on the Red River of the North; a report on the August 2003 and July 2006 fish kills in the Fargo Moorhead area. Minnesota Pollution Control Agency, Detroit Lakes, MN.

MPCA. 2008. Minnesota's impaired waters list. Minnesota Pollution Control Agency, www.pca.state.mn.us/water/tmdl/tmdl-303dlist.html.

Paakh,B., W. Goeken and D. Halvorson. State of the Red River of the North; assessment of the 2003/2004 water quality data for the Red River and its major Minnesota tributaries. Minnesota Pollution Control Agency, Detroit Lakes Regional Office, Detroit Lakes, MN.

Rabeni, C.F. 1993. Warmwater Streams. pages 427-443 *in* C.C. Kohler and W.A. Hubert, editors. Inland fisheries management in North America. American Fisheries Society, Bethesda, MD.

Renard, P.A., S.R. Hanson and J.W. Enblom. 1986. Biological survey of the Red River of the North, Special Publication No. 142. Division of Fish and Wildlife, Minnesota Department of Natural Resouces, St. Paul, MN.

Resseguie, T. J. 2002. Distribution, relative abundance, and reproductive seasonality of larval fish in the Red River. M.S. thesis, University of North Dakota, Grand Forks, ND.

River Keepers. 2002. Red River of the North canoe and boating route master plan.

Schlueter, L.R. 1998. Red River of the North: results of the April 1998 angler survey. North Dakota Game and Fish Department, Fisheries Division report.

Stoner, J.D., Lorenz, D.L., Wiche, G.J., and Goldstein, R.M. 1993. Red River of the North Basin, Minnesota, North Dakota, and South Dakota. American Water Resources Association Monograph, Series No. 19 and Water Resources Bulletin, v.29, no.4, pp. 575-615.

Schlueter, L.R. 2002 (*draft*). Investigations of the channel catfish population and their macro habitats in the Red River of the North. North Dakota Fish and Game Department.

Schlueter, L. 2007. North Dakota aquatic nuisance species (ANS) management plan. North Dakota Game and Fish Department, Devils Lake, ND.

Topp, D. 1996a. Red River of the North angler survey, 1994. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Baudette, MN

Topp, D. 1996b. Red River of the North population assessment, Reaches 3 and 4. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Baudette, MN.

Topp, D. 2001. Red River of the North creel survey: May 1-September 30, 2001. Minnesota Department of Natural Resources, Baudette, MN.

Topp, D. 2003. Red River of the North creel survey: May 1 – September 30, 2001. Minnesota Department of Natural Resources, Baudette, MN.

Topp, D., H. Drewes, M. Henry, G. Huberty and P. Jacobson. 1994. Assessment of the Red River fishery, with special emphasis on channel catfish. Minnesota Department of Natural Resources, Division of Fisheries and Wildlife, St. Paul, MN.

Wendel, J.L. 1999. Habitat use and movements of channel catfish in the Red River of the North. Master's thesis, University of North Dakota, Grand Forks, ND.

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