



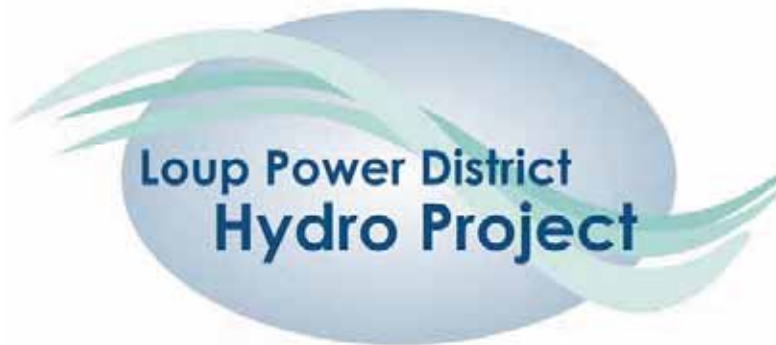
# LOUP RIVER HYDROELECTRIC PROJECT FERC PROJECT No. 1256

## CREEL SURVEY



FEBRUARY 11, 2011

STUDY 8.0 - RECREATION USE



**Loup River Hydroelectric Project  
FERC Project No. 1256**

# **Study 8.0 Recreation Use Creel Survey Report**

**February 11, 2011**

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**Prepared by:**

Loup Power District  
2404 15<sup>th</sup> Street  
Columbus, NE 68602

**With assistance by:**

HDR Engineering, Inc.  
8404 Indian Hills Drive  
Omaha, NE 68114

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## STUDY 8.0                    CREEL SURVEY REPORT

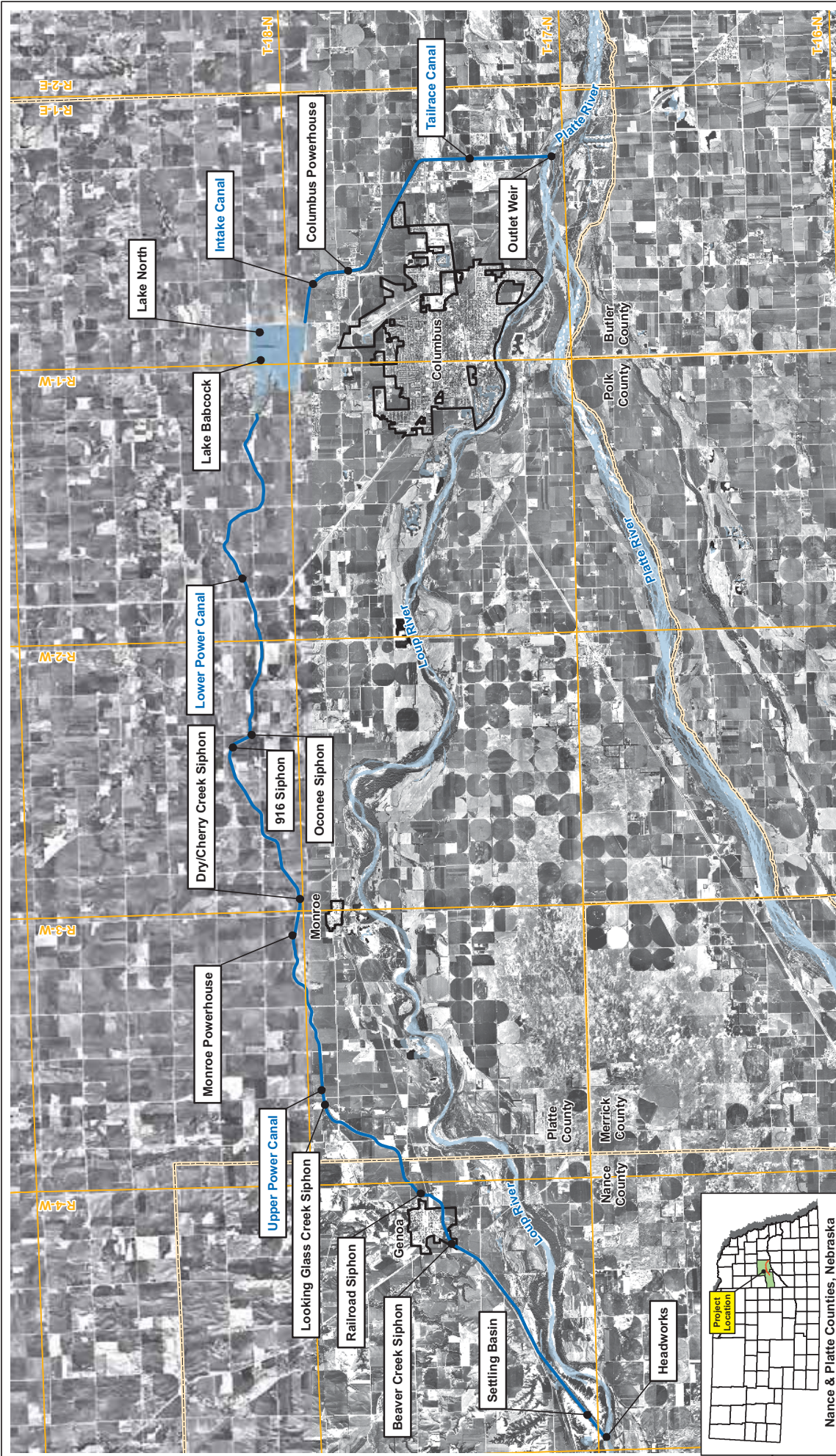
### 1.        INTRODUCTION

The Loup River Hydroelectric Project (Project) is located in Nance and Platte counties, Nebraska, where water is diverted from the Loup River and routed through the 35-mile-long Loup Power Canal, which empties into the Platte River near Columbus. The Project includes various hydraulic structures, two powerhouses, and two regulating reservoirs. The portion of the Loup River from the Diversion Weir to the confluence with the Platte River is referred to as the Loup River bypass reach.

Figure 1-1 shows the location of the Project and identifies the Project components. Specifically, the Project begins at the Headworks, where water is diverted from the Loup River into the Settling Basin and the Loup Power Canal. The Upper Power Canal carries the water to the Monroe Powerhouse, and then the Lower Power Canal carries the water from the Monroe Powerhouse into two regulating reservoirs, Lake Babcock and Lake North, which supply water to the Columbus Powerhouse via the Intake Canal. From the Columbus Powerhouse, water discharges to the Tailrace Canal, which in turn discharges to the Platte River, downstream of the confluence of the Loup and Platte rivers.

The Loup River Public Power District (Loup Power District or the District) has an established policy of providing public access and recreational opportunities, including fishing, at the Project. This includes the Loup Power Canal and the two regulating reservoirs (Lake Babcock and Lake North).

In 2010, the District conducted a comprehensive recreation use study, which included both a recreation use survey and an angler use and harvest (creel) survey, to gather data regarding existing recreation use of Project facilities, including use by anglers. The results of the recreation use survey are presented in this Second Initial Study Report, Appendix F1, General Recreation Use, while the results of the creel survey are presented in this report. The data collected from this recreation use study, including both the recreation use survey and the creel survey, and Study 10.0, Land Use Inventory, will be used by the District in the development of a Recreation Management Plan for District facilities. The Recreation Management Plan will outline District plans for enhancing existing recreation facilities and meeting future recreation demands. This creel survey report may also be used by the Nebraska Game and Parks Commission (NGPC) to evaluate fishery management strategies for the Loup Power Canal.



**Legend**

- Loup Power Canal
- Corporate Limits
- Township/Range
- County Line

**Project Location**

Loup River Hydroelectric Project  
 FERC Project No. 1256  
 Study 8.0 Recreation Use - Creel Survey

DATE February 2011  
 FIGURE 1-1

**Nance & Platte Counties, Nebraska**

Aerial Imagery: 2006 National Agricultural Inventory Project, Nance and Platte Counties Mosaic.  
 Streams/Lakes: 2000 Tiger Line Files, Platte and Nance Counties.

Prior the District's 2010 creel survey, a creel survey had not been conducted along the Loup Power Canal since NGPC conducted successive surveys in 1996 and 1997. During the NGPC surveys, a progressive-count access-point angler use survey was conducted within the Loup River Basin, including the Loup Power Canal, to document fishing pressure, catch, harvest, and angler perceptions of the fisheries (NGPC, June 1997 and April 1998).

## **2. GOALS AND OBJECTIVES OF STUDY**

The goal of the District's overall recreation use study is to determine the public awareness, usage, perception, and demand of both the Project's existing recreation facilities (including fisheries) and the Loup River bypass reach (including the Loup Lands Wildlife Management Area (WMA), to determine if potential improvements are needed, and to develop a Recreation Management Plan to address existing and future recreation needs.

The objectives of the recreation use study are as follows:

1. To measure recreation usage of Project recreation facilities (including fisheries) and the Loup River bypass reach (including the Loup Lands WMA).
2. To document the types of recreation use occurring at Project recreation facilities and along the Loup River bypass reach.
3. To determine whether Project recreation facilities meet current demand.
4. To determine the public's perception and awareness of Project recreation facilities, including fisheries, and to identify the impact of Project operations on recreation experiences.
5. To determine what species anglers are targeting and catching, including catch rates.
6. To collect data for use in the preparation of a Recreation Management Plan for the District's facilities.

As this report focuses on creel survey efforts, the results and discussion provided herein are intended to satisfy the above-listed objectives specific to angling.

## **3. STUDY AREA**

The study area encompassed by the District's creel survey includes the entire 35-mile length of the Loup Power Canal, beginning at the Project Headworks and ending at the Loup Power Canal's confluence with the Platte River. Included in the Study Area are the two regulating reservoirs: Lake Babcock and Lake North. For survey design purposes, the 35-mile canal was not divided into segments; the data presented in this report apply to the entire length of the Loup Power Canal. The principal features of the Project are described below, generally from upstream to downstream.



### 3.1 Settling Basin

Water diverted from the Loup River enters the Settling Basin. The Settling Basin is designed for very slow flow velocity to allow heavier sediment materials to settle out of the water before it enters the much narrower, faster flowing Upper Power Canal. Therefore, flow velocity through the Settling Basin is less than 1 foot per second. The Settling Basin is approximately 2 miles long and has a bottom width of 200 feet and a nominal depth of 16 feet. Hydraulic capacity of the basin is 3,500 cubic feet per second (cfs), and maximum basin water surface elevation is 1,572 feet.



Photo 1. View of the Settling Basin from the Project Headworks.

### 3.2 Upper Power Canal

The Upper Power Canal parallels the south side of the Nebraska Central Railroad (formerly Union Pacific Railroad) from the Settling Basin to Genoa, Nebraska, where it dips under Beaver Creek through an inverted siphon (Beaver Creek Siphon). The 10-mile canal segment then skirts along the south side of Genoa until it dips under the railroad in another siphon (Railroad Siphon). The Upper Power Canal continues along the north side of the Loup River Valley, crosses under Looking Glass Creek in a third siphon (Looking Glass Creek Siphon), and continues to the Monroe Powerhouse. All three siphons are three-barrel concrete structures designed as rigid boxes and are capable of passing the maximum canal flow of 3,500 cfs at a velocity of 5.22 feet per second.

From the Settling Basin to the Looking Glass Creek Siphon, the Upper Power Canal has a bottom width of 73 feet and a normal water depth of 14.3 feet. Freeboard is 5 feet, and the design velocity is 2.25 feet per second. Much of this upstream canal segment is constructed in sand. From the Looking Glass Creek Siphon to the Monroe Powerhouse, the Upper Power Canal has a bottom width of 39 feet and a normal water depth of 19.5 feet. The canal bottom profile slopes only 3 inches per mile.



Photo 2. Typical view of the Upper Power Canal.

### **3.3 Lower Power Canal**

The Lower Power Canal extends approximately 13 miles from the Monroe Power House to Lake Babcock, a regulating reservoir, and has a bottom width of 39 feet and a water depth of 19.5 feet. The Lower Power Canal dips under two siphons, the Dry/Cherry Creek Siphon and the Oconee Siphon (at the Union Pacific Railroad). These siphons, like those on the Upper Power Canal, are three-barrel concrete structures designed as rigid boxes. Additionally, the 916 Siphon carries Lost Creek under the Lower Power Canal.



Photo 3. Typical view of the Lower Power Canal.

### **3.4 Lake Babcock**

Lake Babcock, the Project's original regulating reservoir, is located 3 miles north of Columbus, Nebraska. Its purpose is to temporarily pond water for later release through the Columbus Powerhouse during peak load periods. Lake Babcock was created in a natural depression by building compacted earth embankments on the north, east, and south sides. The lake covers 760 acres at its full pool elevation of 1,531 feet. The original storage capacity of 11,000 acre-feet was drastically reduced by sediment deposition during the first 25 years of Project operation, prior to the construction of Lake North, discussed in Section 3.5. When Lake North was opened, it was estimated that Lake Babcock had a storage capacity of 2,400 acre-feet at an elevation of 1,531 feet and 1,050 acre-feet at an elevation of 1,529 feet. In 1995, when the lake was last surveyed, these values had dropped to approximately 2,270 acre-feet and 730 acre-feet, respectively. Daily fluctuation of the reservoir surface averages about 2 feet; however, in certain circumstances, it can be as much as 3 feet.

The open water portion of the lake experiences substantial wave buildup on windy days. Therefore, much of the shore is protected with riprap. In addition, a substantial reach of embankment near the outlet and bordering Lake North is protected with a concave seawall constructed of concrete.



Photo 4. View of Lake Babcock from the south dike at the outlet.

### **3.5 Lake North**

After 25 years of Project operation, sediment accumulation in Lake Babcock had substantially reduced its ponding capacity. The District determined that the best solution to the problem was to build a second regulating reservoir adjacent to and connected with Lake Babcock. This new regulating reservoir, named Lake North, was completed in 1962. It was constructed by adding new compacted earth embankments to the north and east and using existing Lake Babcock embankments to the south and west. Lake North covers 200 acres at an elevation of 1,531 feet, providing 2,080 acre-feet of storage.

A concrete control structure in the south dike links the two regulating reservoirs. The control structure is located such that Lake North does not experience the rapid sedimentation that occurred in Lake Babcock; therefore, Lake North is a major recreation feature of the Project. A set of steel stoplogs are stored at the control structure, and they can be installed to isolate the regulating reservoirs as necessary for maintenance or emergency purposes.

To control erosion, much of the Lake North shoreline has been lined with steel sheet pile protection and concrete riprap.



Photo 5. View of Lake North from the boat launch area in the northeast corner.

### **3.6 Intake Canal**

Water exiting Lake Babcock flows 1.5 miles through the Intake Canal to the Columbus Powerhouse. The Intake Canal was designed for a capacity of 4,800 cfs, which is the hydraulic capacity of the turbine generating units in the Columbus Powerhouse. The bottom width of the Intake Canal is 108 feet when it leaves Lake Babcock. This width reduces to 94 feet as the Intake Canal approaches the Powerhouse Inlet Structure. The embankments for the Intake Canal were constructed of compacted earth fill, similar to the reservoir dikes. Intake Canal water depth varies from 17.2 to 22.2 feet, depending on the reservoir stage and rate of flow. The slope of the canal profile is 3 inches per mile. Flow velocity in the canal varies from 1.4 to 2.0 feet per second.



Photo 6. View of the Intake Canal as it exits Lake Babcock.

### **3.7 Tailrace Canal**

After passing through the Columbus Powerhouse, water is discharged to the Tailrace Canal for its return to the river basin. The Tailrace Canal is approximately 5.5 miles long and has a bottom width of 42 feet and a normal water depth of about 19 feet. This canal was designed to carry a nominal 4,800 cfs at a velocity of 3 feet per second. The Tailrace Canal was excavated along its entire length, and the slope of the hydraulic gradient is 0.0007 foot/foot.



Photo 7. View of the Tailrace Canal from the Columbus Powerhouse.

### **3.8 Outlet Weir**

The Outlet Weir, also called the Tailrace Weir, is located at the confluence of the Tailrace Canal and the Platte River. It is east of Columbus and approximately 2 miles downstream of the confluence of the Loup River with the Platte River. This concrete overflow weir has a straight 700-foot-long crest. The transition from canal section to this width is 550 feet long. The flow characteristics and accessibility of the Outlet Weir make this a popular fishing, viewing, and recreation area.



Photo 8. View of the Outlet Weir from the west bank.

#### **4. METHODOLOGY**

The methodology used to complete the District’s creel survey included three tasks, described below.

##### ***Task 1 Pre-Survey Activities***

Pre-survey activities were completed as follows:

- Survey Proctor Training – District staff and District representatives attended NGPC survey proctor training on February 11, 2010. During this training, final survey schedules were established in accordance with NGPC protocols for randomizing survey efforts.
- Outreach – To encourage public participation in the creel survey, the District prepared press releases, paid newspaper advertisements, and website updates to announce the survey. In addition, signs notifying anglers of the survey were posted at multiple entry points to the District’s recreation facilities.

##### ***Task 2 Data Collection***

The creel survey was conducted along the entire length of the Loup Power Canal, from the Diversion Weir on the Loup River to the canal’s confluence with the Platte River. The survey was conducted by District representatives, in collaboration with



NGPC’s Northeast District Office, and spanned the 2010 open water fishing season (May 1 through October 31).

A progressive count bus-route creel survey design was used to gather data from anglers. Data collection was conducted on 10 randomly selected days per month (6 weekdays and 4 weekend days) throughout the daylight hours.

Surveys were conducted by one team of two proctors on weekdays and two teams of two proctors on weekend days and holidays. Proctors used only access locations reachable by vehicle and rotated survey start locations and start times between the Project Headworks and Tailrace Canal in accordance with the randomly generated survey schedule. Interviews and pressure counts were conducted concurrently.

### **Task 3 Data Analysis**

Data collected from angler interviews and pressure counts were entered and analyzed using NGPC’s Creel Survey Computer System. Estimates of fishing pressure per angler hours; mean party size; mean trip length; catch, release, and harvest by species; and catch, release, and harvest rates (fish per angler hour) by species were computed.

Questions relative to the following were not specifically asked in conjunction with the creel survey:

- The number of miles traveled to reach the Loup Power Canal
- The angler’s race
- The angler’s annual household income
- The angler’s level of satisfaction with the fishery

However, all respondents to the District’s general recreation use survey (which included persons taking part in various forms of recreation, including anglers) were asked these questions. The results included herein relative to these questions from the general recreation use survey are specific to those respondents who indicated that they had fished or planned to fish, either from shore or boat, during their visit to the Loup Power Canal.

## **5. RESULTS AND DISCUSSION**

The results of the District’s 2010 creel survey are summarized in Section 5.1, and a full discussion of the analyses follows in Sections 5.2 through 5.6. The discussion provides tabular and graphical data that support this study’s conclusions.

Table 5-1 indicates the total number of surveys conducted and the average number of creel surveys conducted per survey day in 2010.

**Table 5-1. Number of Surveys Conducted**

	May	June	July	August	September	October	Total
Survey Days	10	10	10	10	10	10	60
Creel Surveys Conducted	90	67	85	71	86	40	439
Average Surveys per Survey Day	9.00	6.70	8.50	7.10	8.60	4.00	7.32

Table 5-2 provides the common and scientific names of fish species referenced in this creel survey report.

**Table 5-2. Common and Scientific Names of Applicable Fish Species**

Common Name	Scientific Name
bluegill	<i>Lepomis macrochirus</i>
bighead carp	<i>Hypophthalmichthys nobilis</i>
buffalo spp.	<i>Ictiobus spp.</i>
channel catfish	<i>Ictalurus punctatus</i>
common carp	<i>Cyprinus carpio</i>
crappie spp.	<i>Pomoxis spp.</i>
flathead catfish	<i>Pylodictis olivaris</i>
freshwater drum	<i>Aplodinotus grunniens</i>
gizzard shad	<i>Dorosoma cepedianum</i>
goldeye	<i>Hiodon alosoides</i>
hybrid striped bass	<i>Morone saxatilis x Morone chrysops</i>
largemouth bass	<i>Micropterus salmoides</i>
northern pike	<i>Esox lucius</i>
sauger	<i>Sander canadensis</i>
walleye	<i>Sander vitreus</i>
white bass	<i>Morone chrysops</i>
yellow bullhead	<i>Ameiurus natalis</i>

## 5.1 Summary of Results

### 5.1.1 Fishing Pressure per Angler Hours

Total fishing pressure along the Loup Power Canal during the 2010 open water fishing season is estimated to be 32,766 angler hours, or 119 angler hours per hectare (ha). Angler effort estimates are highest for the months of September (7,739 hours) and May (6,531 hours), and shore fishing is estimated to account for over 94 percent of the angler hours expended (as opposed to fishing from a boat). The 2010 creel survey estimates that angler effort in 2010 was 265 percent and 118 percent of the estimated angler hours associated with the 1996 and 1997 NGPC surveys, respectively.

### 5.1.2 Catch, Release, and Harvest Estimates

Anglers fishing the Loup Power Canal between May 1 and October 31, 2010, harvested an estimated 8,973 fish (all species and fishing methods combined), including an estimated channel catfish harvest of 4,185, which was nearly 47 percent of the overall harvest. The overall and channel-catfish-specific harvests were most abundant in October despite estimated catch values peaking in May. Other species commonly harvested in 2010 included freshwater drum (22.2 percent), crappie species (12.4 percent), and white bass (9.1 percent).

The estimated number of fish caught and released on the Loup Power Canal from May 1 to October 31, 2010, is 11,843. Release estimates exceeded the number of fish harvested for every species except white bass, bluegill, and sauger.

### 5.1.3 Catch, Release, and Harvest Rates

The average harvest rate for all anglers fishing the Loup Power Canal from May 1 to October 31, 2010, was 0.30 fish per angler hour. The highest estimated catch rates occurred in May (1.31 fish per angler hour) and October (0.86 fish per angler hour), respectively. The highest estimated harvest rate occurred in October (0.57 fish per angler hour).

The average channel catfish harvest rate (for anglers targeting channel catfish) was 0.22 fish per angler hour. The highest associated catch rates occurred in July (0.65 fish per angler hour) and October (0.52 fish per angler hour), while the highest estimated harvest rate occurred in May and October (0.35 fish per angler hour).

### 5.1.4 Angler Demographics and Satisfaction

More than 99 percent of the anglers surveyed along the Loup Power Canal between May 1 and October 31, 2010, were Nebraska residents. More specifically, over 58 percent of surveyed anglers reside in Platte County, Nebraska (which includes the City of Columbus).

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Angling parties averaged 1.75 members in size, indicated a mean completed trip length of 2.90 hours, and **made** an estimated **11,299** angler **trips**.

The majority of the surveyed anglers (64.5 percent) were targeting channel catfish, while 9.7 and 9.3 percent were targeting “anything” and walleye/sauger, respectively.

According to collected data, the vast majority (over 87 percent) of anglers described themselves as white (non-Hispanic, Latino, or Spanish). Additionally, more than 11 percent of anglers described themselves as white (Hispanic, Latino, or Spanish). The most common annual household income range reported by anglers was \$26,000 to \$50,000 (over 42 percent). Respondent frequency generally decreased as income increased.

Fifty-seven percent of respondents rated shore fishing opportunities along the Loup Power Canal as “Excellent” or “Above Average.” An additional 35 percent of respondents rated shore fishing opportunities as “Average.”

## 5.2 Fishing Pressure per Angler Hours

Multiple analyses related to estimates of fishing pressure per angler hour derived from survey data collected between May 1 and October 31, 2010, along the Loup Power Canal are detailed below.

### 5.2.1 Angler Hours by Month

As indicated in Table 5-3, total fishing pressure along the Loup Power Canal during the 2010 open water fishing season is estimated to be 32,766 angler hours. Table 5-3 also suggests that angler effort was highest during the months of September and May, respectively.

**Table 5-3. Estimated Angler Hours by Month**

	May	June	July	August	September	October	Total
Hour Estimate	6,531	5,075	5,575	4,574	7,739	3,272	32,766
(Standard Error)	(1,271.90)	(975.75)	(381.00)	(253.92)	(1,069.33)	(520.47)	(NA)

Note:

NA = Not applicable.

### 5.2.2 Angler Hours by Type

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When the **estimated area of fishable water within** the Loup Power Canal (**275** hectares) is considered in relation to the estimate of total angler hours, a value of approximately **119** angler hours per hectare is derived, as shown in Table 5-4.

With regard to the type of fishing that occurs along the Loup Power Canal (boat vs. shore fishing), Table 5-4 shows that shore fishing accounts for more than 94 percent of the angler hours expended.

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**Table 5-4. Estimated Angler Hours by Type**

Area (ha)	Boat			Shore			Combined	
	Angler Hours	Percent of Total	Hours/ha	Angler Hours	Percent of Total	Hours/ha	Angler Hours	Hours/ha
275	1,740	5.3	6.3	31,026	94.7	112.8	32,766	119.1

5.2.3 Angler Hours by Year

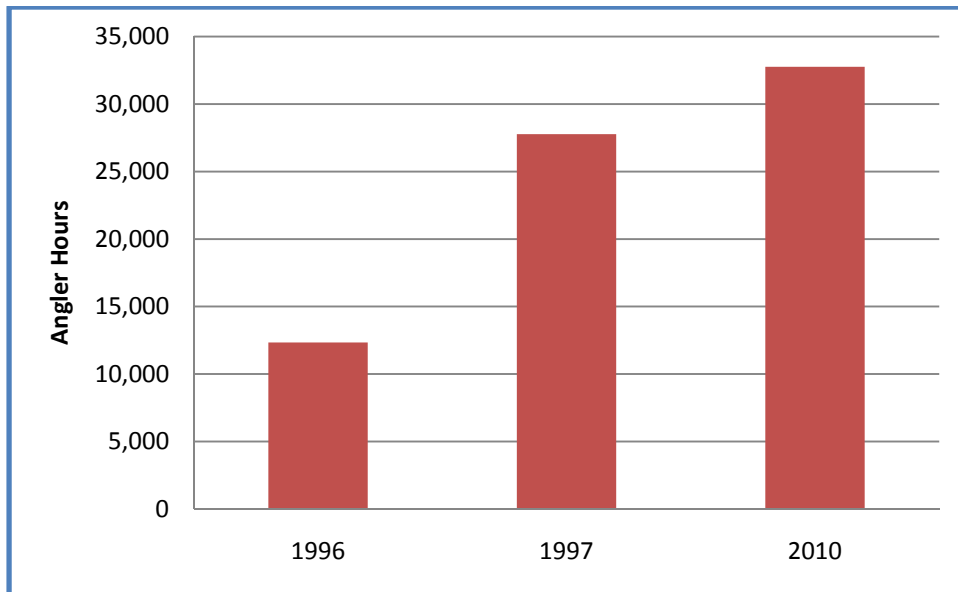
The 2010 creel survey estimates that angler effort in 2010 was 265 and 118 percent of the estimated angler hours associated with the 1996 and 1997 NGPC surveys, respectively, as shown in Table 5-5 and Figure 5-1.

**Table 5-5. Estimated Angler Hours by Survey Year**

Year	Estimated Hours	Reference
1996 <sup>1</sup>	12,343	NGPC, June 1997
1997 <sup>2</sup>	27,767	NGPC, April 1998
2010 <sup>3</sup>	32,766	District’s creel survey, 2010

Notes:

- <sup>1</sup> Survey period spanned July through October (4 months).
- <sup>2</sup> Survey period spanned April through October (7 months).
- <sup>3</sup> Survey period spanned May through October (6 months).



**Figure 5-1. Estimated Angler Hours by Survey Year**

### 5.3 Catch, Release, and Harvest Estimates

Multiple analyses related to catch, release, and harvest estimates derived from survey data collected between May 1 and October 31, 2010, along the Loup Power Canal are detailed below.

#### 5.3.1 Total Fish Harvest

Anglers fishing the Loup Power Canal between May 1 and October 31, 2010, harvested an estimated 8,973 fish (all species and fishing methods combined), including an estimated channel catfish harvest of 4,185, which is nearly 47 percent of the overall harvest, as shown in Table 5-6. Other species commonly harvested in 2010, and quantified in Table 5-6, included freshwater drum (22.2 percent), crappie species (12.4 percent), and white bass (9.2 percent). Additional species harvested included bluegill, flathead catfish, walleye, sauger, striped bass hybrid, northern pike, goldeye, gizzard shad, buffalo, bullhead species, common carp, and bighead carp. Collectively, these species made up 9.5 percent of the estimated total fish harvest.

**Table 5-6. Estimated Fish Harvest**

	Channel Catfish	Freshwater Drum	Crappie	White Bass	Other <sup>1</sup>	Bluegill	Flathead Catfish	Walleye	Sauger	Total
Harvest Estimate (Standard Error)	4,185 (387.7)	1,991 (255.4)	1,113 (580.6)	820 (193.5)	388 (NA)	219 (139.6)	155 (50.1)	64 (31.2)	38 (32.5)	8,973
Percent of Total	46.7	22.2	12.4	9.2	4.3	2.4	1.7	0.7	0.4	100.0

Notes:

NA = Not applicable

<sup>1</sup> “Other” includes goldeye, gizzard shad, common and bighead carp, buffalo, yellow bullhead, northern pike, and hybrid striped bass.

### 5.3.2 Fish Caught and Released

Catch and release, either mandated by length-limit regulations or voluntary, is an important part of the Loup Power Canal sport fishery. As indicated in Table 5-7, the estimated number of fish caught and released on the Loup Power Canal from May 1 to October 31, 2010, is 11,843.<sup>1</sup> Release estimates exceeded the number of fish harvested for every species except white bass, bluegill, and sauger.<sup>2</sup>

**Table 5-7. Estimated Count of Fish Caught and Released**

	Channel Catfish	Crappie	Freshwater Drum	Other <sup>1</sup>	White Bass	Flathead Catfish	Bluegill	Walleye	Sauger	Total
Catch and Release Estimate (Standard Error)	5,503 (1,143.8)	3,037 (1,668.0)	2,145 (368.0)	448 (NA)	211 (96.5)	186 (57.6)	147 (64.6)	128 (36.8)	38 (26.6)	11,843
Percent of Total	46.5	25.6	18.1	3.8	1.8	1.6	1.2	1.1	0.3	100.0

Notes:

NA = Not applicable.

<sup>1</sup> “Other” includes goldeye, gizzard shad, common and bighead carp, buffalo, yellow bullhead, northern pike, and hybrid striped bass.

### 5.3.3 Catch, Release, and Harvest by Month

Table 5-8 provides catch (including separate release and harvest) values for notable species by month. As shown, catch values were highest in May; more than 29 percent of the total estimated catch occurred during this month alone. Monthly harvest was most abundant in October, despite the estimated catch for October being roughly half that of May.

<sup>1</sup> The estimate of released fish is based on anglers’ ability to recall what they released and therefore may be biased up or down.

<sup>2</sup> The number of sauger harvested versus released was equal (38 fish were harvested and 38 fish were released). Additionally, estimates of the number of released sauger may be biased by an angler’s ability to correctly distinguish the species from walleye, a species of similar appearance.

**Table 5-8. Estimated Catch (Release and Harvest) by Month**

Fish Species		Value <sup>1,2</sup>						
		May	June	July	August	September	October	Total
Channel Catfish	Catch	766 (161.2)	1,205 (228.0)	2,778 (1,003.1)	1,468 (175.5)	1,484 (281.3)	1,987 (500.3)	9,688 (1,201.9)
	Release	385 (135.6)	781 (206.7)	2,089 (1,032.6)	749 (180.7)	753 (218.7)	746 (316.9)	5,503 (1,143.8)
	Harvest	381 (70.8)	424 (108.5)	689 (143.8)	719 (156.2)	731 (162.7)	1,241 (249.3)	4,185 (387.7)
Freshwater Drum	Catch	1,102 (289.7)	1,003 (209.9)	497 (107.7)	604 (122.7)	479 (195.6)	450 (256.3)	4,135 (508.5)
	Release	720 (224.4)	513 (152.7)	225 (70.1)	194 (62.1)	237 (117.3)	256 (198.1)	2,145 (368.0)
	Harvest	382 (91.3)	490 (124.3)	273 (115.3)	410 (114.1)	242 (102.7)	194 (67.6)	1,991 (255.4)
Crappie	Catch	3,902 (2,220.4)	39 (27.4)	0	59 (34.6)	28 (23.8)	123 (70.4)	4,151 (2,222.1)
	Release	2,926 (1,666.9)	0	0	41 (23.1)	0	70 (54.0)	3,037 (1,668.0)
	Harvest	976 (577.5)	39 (27.4)	0	17 (14.9)	28 (23.8)	53 (45.1)	1,113 (580.6)
White Bass	Catch	81 (36.9)	43 (25.5)	0	45 (23.7)	525 (169.4)	335 (151.2)	1,029 (232.6)
	Release	34 (26.3)	28 (15.1)	0	8 (5.9)	37 (25.8)	104 (87.7)	211 (96.5)
	Harvest	47 (25.9)	15 (12.6)	0	37 (23.6)	489 (166.0)	232 (92.3)	820 (193.5)
Other <sup>3</sup>	Catch	109	155	254	61	145	112	836
	Release	50	84	139	30	145	0	448
	Harvest	59	71	115	31	0	112	388
Bluegill	Catch	0	0	81 (45.7)	0	85 (47.0)	200 (168.8)	366 (181.1)
	Release	0	0	50 (37.4)	0	57 (40.5)	40 (33.8)	147 (64.6)
	Harvest	0	0	31 (26.4)	0	28 (23.8)	160 (135.0)	219 (139.6)
Flathead Catfish	Catch	61 (27.7)	122 (62.9)	73 (32.6)	9 (7.4)	73 (41.3)	0	338 (86.9)
	Release	61 (27.7)	95 (48.8)	30 (13.1)	0	0	0	186 (57.6)
	Harvest	0.0	27 (14.2)	46 (23.5)	9 (7.4)	73 (41.3)	0	155 (50.1)



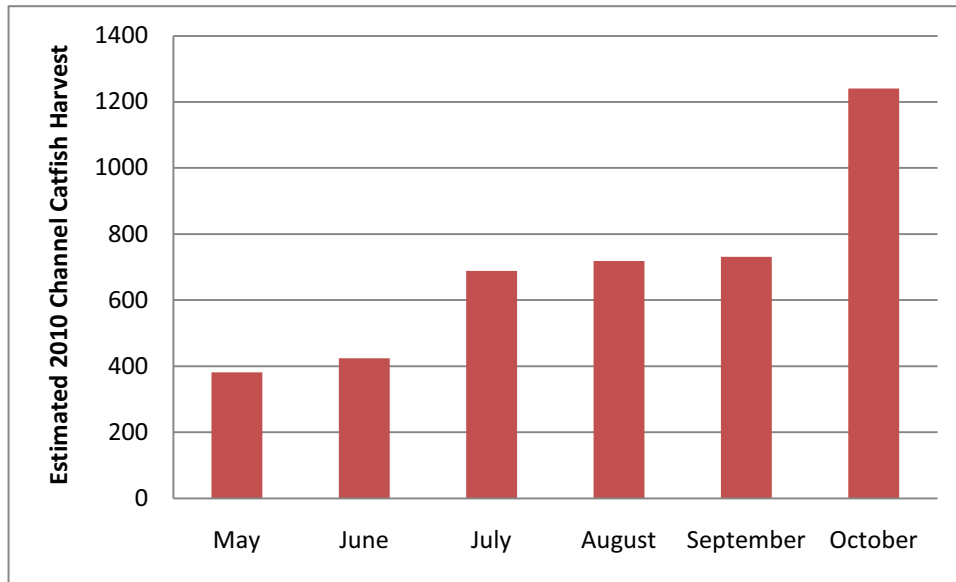
Fish Species		Value <sup>1,2</sup>						
		May	June	July	August	September	October	Total
Walleye	Catch	156 (24.6)	27 (23.2)	0	9 (7.4)	0	0	192 (34.6)
	Release	92 (27.6)	27 (23.2)	0	9 (7.4)	0	0	128 (36.8)
	Harvest	64 (31.2)	0	0	0	0	0	64 (31.2)
Sauger	Catch	0	0	0	0	76 (42.0)	0	76 (42.0)
	Release	0	0	0	0	38 (26.6)	0	38 (26.6)
	Harvest	0	0	0	0	38 (32.5)	0	38 (32.5)
Totals	Catch	6,177	2,594	3,683	2,255	2,895	3,207	20,811
	Release	4,268	1,528	2,533	1,031	1,267	1,216	11,843
	Harvest	1,909	1,066	1,154	1,223	1,629	1,992	8,973

Notes:

- <sup>1</sup> Standard error provided in parentheses for those values to which it applies.
- <sup>2</sup> In some instances, the sum of the release and harvest values does not equal the associated catch value due to significant figure rounding discrepancies.
- <sup>3</sup> “Other” includes goldeye, gizzard shad, common and bighead carp, buffalo, yellow bullhead, northern pike, and striped bass hybrid.

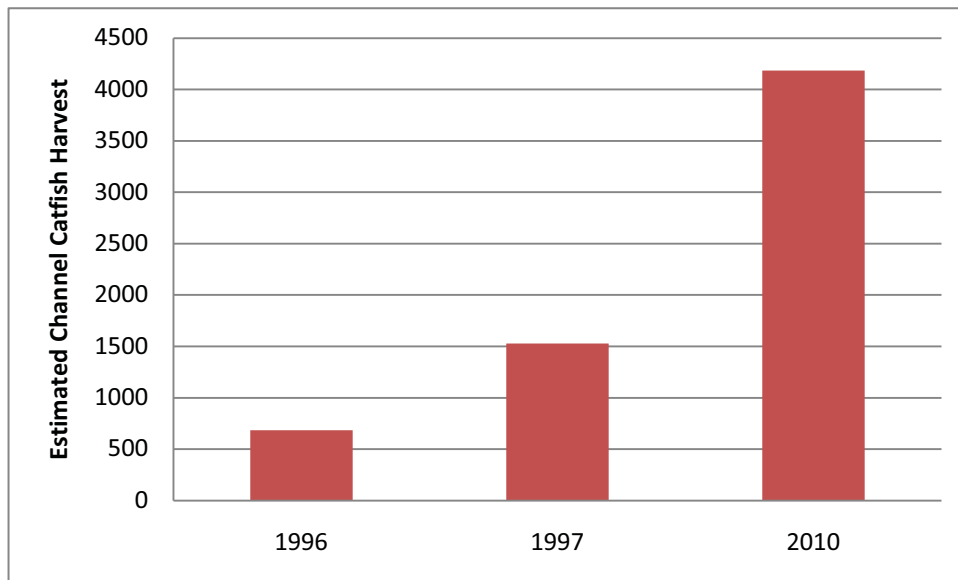
### 5.3.4 Channel Catfish Harvest Estimates

As depicted in Figure 5-2, the channel catfish harvest was approximately 400 fish per month in May and June, increased to approximately 700 fish per month from July through September, and peaked at over 1,200 harvested fish in October.



**Figure 5-2. Estimated Channel Catfish Harvest**

In comparison to Loup Power Canal channel catfish harvest estimates derived from 1996 and 1997 NGPC angler use and harvest surveys, a considerable increase in channel catfish harvest was estimated for 2010. Figure 5-3 graphically depicts the increased harvest.



**Figure 5-3. Estimated Channel Catfish Harvest by Survey Year**

Table 5-9 quantifies the percentage of completed fishing trips in which a certain number of channel catfish were harvested. Over 41 percent of fishing trips completed between May 1 and October 31, 2010, resulted in no channel catfish harvest. A notable percentage of anglers harvested one (24.5 percent) or two (20.8 percent) channel catfish per completed trip. No surveys indicated channel catfish harvest exceeding six fish.

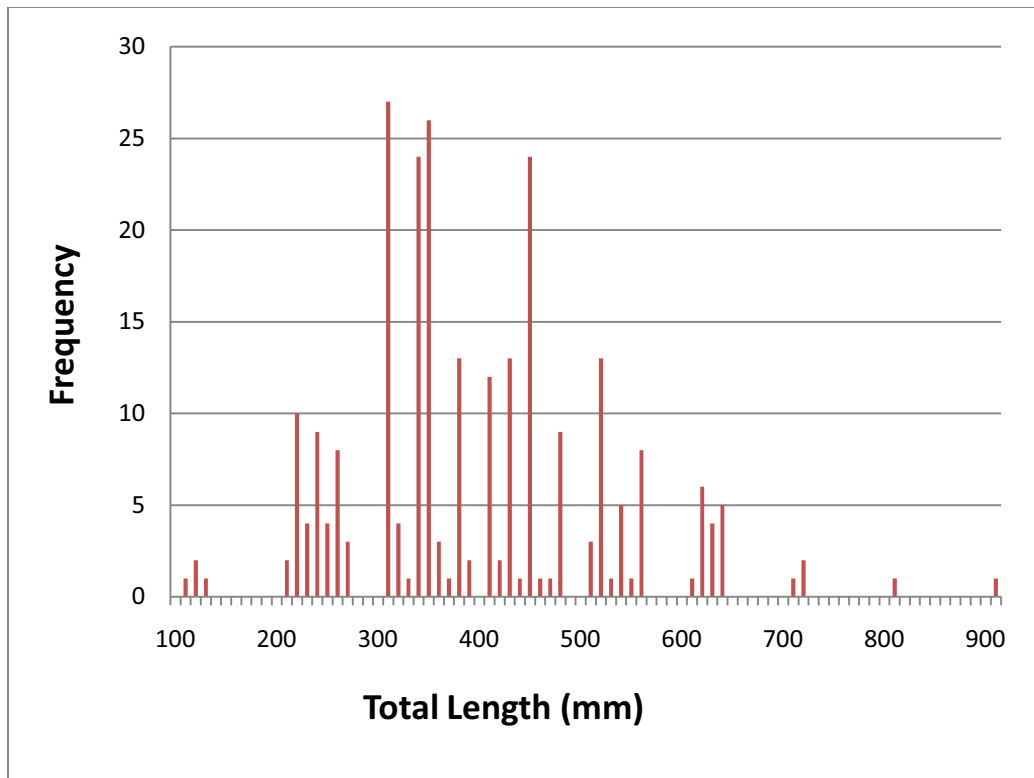
**Table 5-9. Number of Channel Catfish Harvested per Completed Trip**

Channel Catfish Harvested per Angler <sup>1</sup>	Percent
0	41.5
1	24.5
2	20.8
3	7.5
4	0.0
5	1.9
6	3.8
> 6	0.0

Note:

- <sup>1</sup> The 2010 Nebraska inland waters bag and possession limits for channel catfish are 10 and 20, respectively. These limits apply to the Loup Power Canal as no special bag or possession limits were applied to the Canal in 2010.

The length frequencies of angler-harvested channel catfish were developed and are presented in Figure 5-4. Channel catfish of a preferred length (greater than 610 millimeters [mm]), including large channel catfish over 700 millimeters, were harvested.



**Figure 5-4. Length Frequencies of Harvested Channel Catfish**

#### **5.4 Catch, Release, and Harvest Rates**

The catch per unit effort (CPUE) estimates derived from survey data collected between May 1 and October 31, 2010, along the Loup Power Canal are detailed below.

##### **5.4.1 Combined Species Catch per Unit Effort**

The average harvest rate for all anglers fishing along the Loup Power Canal from May 1 to October 31, 2010, was 0.30 fish per angler hour, as shown in Table 5-10. The highest estimated catch rates occurred in May (1.31 fish per angler hour) and October (0.86 fish per angler hour), respectively. The highest estimated harvest rate occurred in October (0.57 fish per angler hour).

**Table 5-10. All Species Catch, Release, and Harvest Rate Estimates**

	Value <sup>1,2</sup>						
	May	June	July	August	September	October	Average
Catch Rate (Fish/Hour)	1.31	0.58	0.71	0.41	0.40	0.86	0.71
Release Rate (Fish/Hour)	0.96	0.41	0.48	0.15	0.17	0.28	0.41
Harvest Rate (Fish/Hour)	0.36	0.17	0.23	0.25	0.23	0.57	0.30

Notes:

- <sup>1</sup> In some instances, the sum of the release rate and harvest rate values does not equal the associated catch rate value due to significant figure rounding discrepancies.
- <sup>2</sup> Provided values result from the effort expended by all anglers.

#### 5.4.2 Channel Catfish Catch per Unit Effort

The average channel catfish harvest rate for anglers targeting channel catfish along the Loup Power Canal from May 1 to October 31, 2010, was 0.22 fish per angler hour, as shown in Table 5-11. The highest estimated catch rates occurred in July (0.65 fish per angler hour) and October (0.52 fish per angler hour), respectively. The highest estimated harvest rate occurred in May and October, during which anglers harvested 0.35 fish per angler hour.

**Table 5-11. Channel Catfish Catch, Release, and Harvest Rate Estimates**

	Value <sup>1,2</sup>						
	May	June	July	August	September	October	Average
Catch Rate (Fish/Hour)	0.42	0.35	0.65	0.37	0.23	0.52	0.42
Release Rate (Fish/Hour)	0.07	0.23	0.47	0.18	0.10	0.17	0.20
Harvest Rate (Fish/Hour)	0.35	0.12	0.18	0.19	0.13	0.35	0.22

Notes:

- <sup>1</sup> In some instances, the sum of the release rate and harvest rate values does not equal the associated catch rate value due to significant figure rounding discrepancies.
- <sup>2</sup> Provided values result only from the effort expended by anglers specifically targeting channel catfish.

## **5.5 Angler Demographics**

Multiple characteristics of the anglers surveyed along the Loup Power Canal between May 1 and October 31, 2010, are detailed below.

Although questions relative to the number of miles traveled to reach Loup Power Canal, the angler's race, and the angler's annual household income were not specifically asked in conjunction with the creel survey, these questions were asked of all respondents to the District's general recreation use survey (which included persons taking part in various forms of recreation, including anglers). The results included herein relative to these questions from the general recreation use survey are specific to those respondents who indicated that they had fished or planned to fish, either from shore or boat, during their visit to the Loup Power Canal.

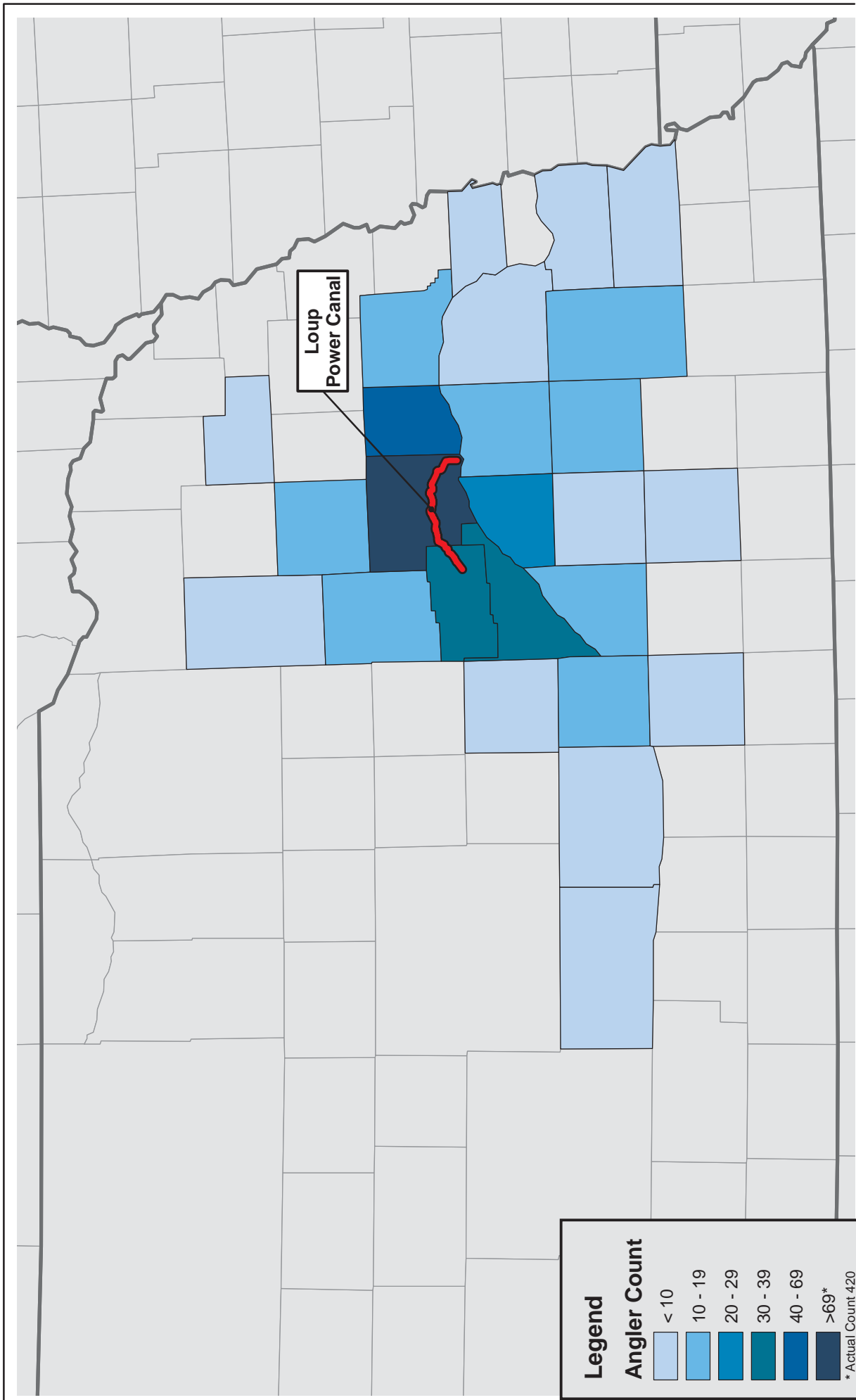
### **5.5.1 Origin of Anglers**

As depicted in Table 5-12 and Figure 5-5, more than 99 percent of anglers surveyed along the Loup Power Canal between May 1 and October 31, 2010, were Nebraska residents. More than 58 percent of the surveyed anglers were from Platte County, Nebraska (which includes the City of Columbus and the majority of the Project Boundary). Other represented Nebraska counties and states are listed in Table 5-12.

Similarly, as depicted in Table 5-12, more than 67 percent of surveyed anglers traveled 25 miles or less to access the Loup Power Canal, while more than 96 percent traveled 100 miles or less. The 96 percent of anglers who traveled 100 miles or less very nearly correlates with the 99 percent of anglers who indicated a Nebraska residency; this is consistent with the approximate 100-mile distance to the nearest north, south, and east border state.

**Table 5-12. Residence of Surveyed Anglers**

State	County	Count	Percent
Georgia	Unknown	1	0.1
Oklahoma	Unknown	2	0.3
Nebraska  Total Count = 710 Total Percent = 99.6	Platte	420	58.9
	Colfax	65	9.1
	Nance	37	5.2
	Merrick	31	4.3
	Polk	24	3.4
	Dodge	17	2.4
	Madison	16	2.2
	Hall	15	2.1
	Hamilton	15	2.1
	Butler	12	1.7
	Lancaster	11	1.5
	Boone	10	1.4
	Seward	10	1.4
	Douglas	8	1.1
	Howard	4	0.6
	Antelope	2	0.3
	Buffalo	2	0.3
	Cass	2	0.3
	Saunders	2	0.3
	Wayne	2	0.3
Adams	1	0.1	
Dawson	1	0.1	
Fillmore	1	0.1	
Otoe	1	0.1	
York	1	0.1	
Total		713	100.0



DATE February 2011  
FIGURE 5 - 5

**Residence of Surveyed Anglers by County**  
Loup River Hydroelectric Project  
FERC Project No. 1256  
Study 8.0 Recreation Use - Creel Survey © 2011 Loup River Public Power District





**Table 5-13. Miles Traveled to the Loup Power Canal**

Miles Traveled	Shore Anglers		Boat Anglers		Total	
	Count <sup>1</sup>	Percent <sup>1</sup>	Count <sup>1</sup>	Percent <sup>1</sup>	Count <sup>1</sup>	Percent <sup>1</sup>
0-25	421	67.3	20	76.9	441	67.7
26-50	112	17.9	1	3.9	113	17.4
51-100	70	11.2	4	15.4	74	11.4
101-200	13	2.1	1	3.8	14	2.2
201-300	1	0.2	0	0.0	1	0.1
300-400	1	0.2	0	0.0	1	0.1
400+	7	1.1	0	0.0	7	1.1
Total	625	100.0	26	100.0	651	100.0

Note:

<sup>1</sup> Count and percent are derived from anglers surveyed during the District’s general recreation use survey (as discussed in Section 5.5).

Revised 03/08/11

**5.5.2 Party Size, Trip Length, Pressure, and Angler Trips**

As indicated in Table 5-14, the mean completed trip length (boat and shore anglers combined) for the Loup Power Canal from May 1 through October 31, 2010, during the daylight period was 2.90 hours. Table 5-14 also specifies that angling parties averaged 1.75 members in size. The total number of angler trips (11,299) was estimated by dividing the estimated pressure (angler hours) by the mean completed trip length.

Revised 03/08/11

Revised 03/08/11

**Table 5-14. Party Size, Trip Length, Pressure, and Angler Trips (2010)**

Mean Party Size	Mean Completed Trip Length (hours)	Total Angler Hours	Total Angler Trips
1.75	2.90	32,766	11,299

**5.5.3 Fish Species Sought by Anglers**

Table 5-15 illustrates that anglers surveyed along the Loup Power Canal between May 1 and October 31, 2010, targeted a diverse array of fish species and that the majority of these anglers (64.5 percent) were specifically targeting channel catfish. Anglers not targeting a specific fish species (those fishing for “anything”) were the second most prevalent (9.7 percent), while those targeting walleye or sauger accounted for 9.3 percent of the surveyed anglers. Beyond the three most common

targets of angling parties, other targeted fish species were freshwater drum, flathead catfish, crappie, carp, striped hybrid bass, largemouth bass, white bass, and bluegill, as shown in Table 5-15.

**Table 5-15. Fish Species Sought**

	Channel Catfish	Anything	Walleye/Sauger	Freshwater Drum	Flathead Catfish	Crappie	Other <sup>1</sup>	White Bass	Bluegill	Total
Anglers Targeting Species	460 <sup>2</sup>	69	66	39	28	23	15	11	2	713
Percent of Total	64.5	9.7	9.3	5.5	3.9	3.2	2.1	1.5	0.3	100.0

Notes:

- <sup>1</sup> “Other” includes carp and minnow family, hybrid striped bass, and largemouth bass.
- <sup>2</sup> Includes 20 anglers who were seeking catfish but did not specify channel catfish or flathead catfish.

#### 5.5.4 Racial Composition of Survey Respondents

Table 5-16 depicts angler responses to the question “How would you describe your race?” Collected data suggest that the vast majority (over 87 percent) of anglers describe themselves as white (non-Hispanic, Latino, or Spanish). Additionally, more than 11 percent of anglers describe themselves as white (Hispanic, Latino, or Spanish). No other racial groups were heavily represented among surveyed anglers.

**Table 5-16. Racial Composition of Surveyed Anglers**

Race	Count <sup>1</sup>	Percent <sup>1</sup>
White (non-Hispanic, Latino, or Spanish)	556	87.7
White (Hispanic, Latino, or Spanish)	74	11.6
American Indian or Alaska Native	2	0.3
Black, African American, or Negro	1	0.2
Other	1	0.2
Asian or Pacific Islander	0	0.0
Total	634	100.0

Note:

- <sup>1</sup> Count and percent are derived from anglers surveyed during the District’s general recreation use survey (as discussed in Section 5.5).

### 5.5.5 Annual Household Income of Survey Respondents

Table 5-17 depicts angler responses to the question “Which of the following ranges includes your yearly household income (the income ranges listed in Table 5-17 were provided to respondents as options)?” The most common annual household income range reported by anglers was \$26,000 to \$50,000 (over 42 percent). Respondent frequency generally decreased as income increased.

**Table 5-17. Annual Household Income of Anglers**

Income	Shore Anglers		Boat Anglers		Total	
	Count <sup>1</sup>	Percent <sup>1</sup>	Count <sup>1</sup>	Percent <sup>1</sup>	Count <sup>1</sup>	Percent <sup>1</sup>
\$0 - \$25,000	135	27.7	4	20.0	139	27.4
\$26,000 - \$50,000	211	43.3	6	30.0	217	42.8
\$51,000 - \$75,000	91	18.7	5	25.0	96	18.9
\$76,000 - \$100,000	37	7.6	3	15.0	40	7.9
\$100,000+	13	2.7	2	10.0	15	3.0
Total	487	100.0	20	100.0	507	100.0

Note:

<sup>1</sup> Count and percent are derived from anglers surveyed during the District’s general recreation use survey (as discussed in Section 5.5).

## 5.6 Angler Satisfaction

Anglers’ attitudes about fishing and their preferences concerning management options are important considerations for a fishery. Historically, fishery biologists have primarily focused their efforts on understanding biological aspects of fish populations and monitoring sport fish harvest and use. Recently, biologists have realized the necessity and value of understanding angler attitudes, level of satisfaction, and preferences. Consequently, more attitude, preference, and satisfaction data have been collected in recent years. Angler responses are helpful in evaluating whether current management practices and regulations are providing a fishery that meets angler needs and expectations (South Dakota Department of Game, Fish and Parks, 2009).

Although a question relative to angler satisfaction was not specifically asked in coordination with the creel survey, this type of question was asked of all respondents to the District’s general recreation use survey (which included persons taking part in various forms of recreation, including anglers). The results included herein relative to this question from the general recreation use survey are specific to those respondents who indicated that they had, or planned to, fish (either from shore or boat) during

their visit to the Loup Power Canal. Because over 94 percent of angler effort occurs from shore, as shown in Table 5-4, satisfaction results are limited to shore fishing.

Table 5-18 provides ratings specific to shore fishing opportunities along the Loup Power Canal (including Lake Babcock and Lake North). Collected data suggest that the majority of respondents are satisfied with the shore fishing opportunities along the Loup Power Canal; 57 percent of these respondents rated shore fishing opportunities as “Excellent” or “Above Average.” An additional 35 percent of respondents rated shore fishing opportunities as “Average.” The respondents who rated shore fishing opportunities as “Below Average” or “Poor” cited the following reasons:

- Abundance of snags due to the rocky shoreline and trees in the canal
- Steep banks along the canal
- Overgrown vegetation along the shoreline
- Trash at shoreline fishing access locations
- Lack of submerged structure in Lake North

**Table 5-18. Shore Fishing Ratings**

Rating	Count <sup>1</sup>	Percent <sup>1</sup>
(No Answer)	2	0.3
Excellent	91	14.5
Above Average	267	42.5
Average	218	34.7
Below Average	16	2.6
Poor	8	1.3
NA	26	4.1
Total	628	100.0

Note:

NA = Not applicable

<sup>1</sup> Count and percent are derived from anglers surveyed during the District’s general recreation use survey (as discussed in Section 5.6).

## 6. STUDY VARIANCE

This study has been conducted consistent with the Recreation Use study plan, which was approved with modifications by the Federal Energy Regulatory Commission (FERC) in its Study Plan Determination on August 26, 2009. No discernable study variance has occurred. Coordination with NGPC throughout the creel survey,

including NGPC's error check of final data inputs, ensured that applied methods were consistent with applicable study methods.

## **7. REFERENCES**

- FERC. August 26, 2009. Letter from Jeff C. Wright, Director, Office of Energy Projects, FERC, to Neal D. Suess, President/CEO, Loup Power District, regarding Study Plan Determination for the Loup River Hydroelectric Project.
- NGPC. June 1997. Angler Use and Fish Community Dynamics in the Middle Loup and Loup River Basins and Sherman Reservoir. Annual Progress Report (March - November 1996). Fisheries Division.
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- South Dakota Department of Game, Fish and Parks. 2009. Annual Fish Population and Angler Use and Sportfish Harvest Surveys on Lewis and Clark Lake and the Lower Missouri River, South Dakota, 2009. Annual Report No. 10-07.