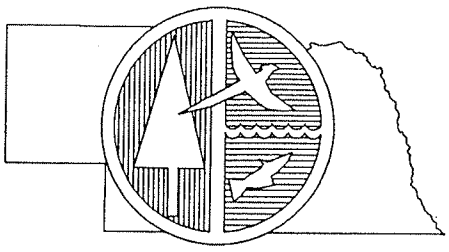
FISHERIES DIVISION



NEBRASKA GAME and PARKS COMMISSION

ANGLER USE AND FISH COMMUNITY DYNAMICS IN THE MIDDLE LOUP AND LOUP RIVER BASINS AND SHERMAN RESERVOIR.

Annual Progress Report
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Angler Use and Fish Community Dynamics in the Middle Loup and Loup River Basins and Sherman Reservoir.

INTRODUCTION

The Loup Basin located in central Nebraska encompasses 97,472 km^2 containing 2,602 km of streams (Bliss and Schainost 1973). The Loup Basin contains seven major rivers systems including the South Loup, Middle Loup, Dismal, North Loup, Calamus, Cedar and Loup rivers. In addition, there are three major reservoirs within the basin including Sherman (off-stream of Middle Loup River), Davis Creek (on Davis Creek) and Calamus (on Calamus River). Sherman and Calamus reservoirs are Bureau of Reclamation (BOR) projects built primarily to supply irrigation water to irrigation districts in the watershed, and provide a limited amount of flood control. Milburn Diversion Dam diverts water from the Middle Loup River into the Sargent Canal for use by irrigators served by the Sargent Irrigation District. The Arcadia Diversion Dam also diverts water from the Middle Loup River through the Sherman Feeder Canal which transfers water to Sherman Reservoir where it is stored prior to delivery via canals to irrigators served by the Farwell Irrigation District. The present water service contracts between the BOR and the Sargent and Farwell irrigation districts will expire starting in 1999. At the present time, the BOR has initiated a title transfer process that could possibly result in the transfer of the water projects up for water service contract renewal to the irrigation districts. As part of this new initiative the BOR will continue to develop a Resource Management Assessment (RMA) for the Middle Loup River and Loup River basins to identify management alternatives for these streams and Sherman Reservoir. The North Loup River and South Loup River basins were not to be evaluated as part of the present process.

Development of the RMA requires the collection and evaluation of a variety of resource data on the Middle Loup and Loup rivers and associated reservoir. The Nebraska Game and Parks Commission (NGPC) has management responsibility for these aquatic systems in terms of outdoor recreation use and fisheries resources. Fisheries managers from NGPC have performed a limited number of standard fish community surveys on Sherman Reservoir. However, information on fishing pressure, catch and harvest is totally lacking. An angler use survey has never been performed on this reservoir. Very little fish community data is available for the Middle Loup, Dismal, and Loup rivers beyond that provided by the statewide stream survey performed on this basin during 1972 (Bliss and Schainost 1973). The only angler use information available has been gathered by statewide telephone and mail surveys performed by the Nebraska Annual Social Indicators Survey (NASIS) as reported in Zuerlein (1984). Current information is required concerning the status of fishery resources and use by the public for completion of the BOR objectives and effective management of the watershed.

OBJECTIVES

This project assesses the present condition of the reservoir and riverine fisheries in the Middle Loup, Dismal and Loup river basins in Nebraska. During 1996, the study collected data on the following specific objectives:

1. Document on a seasonal basis the total fish community structure, distribution and age-growth dynamics in the Middle Loup, Dismal, and Loup rivers. In conjunction with these analyses, available fish habitat will be characterized.

2. Document the intensity and seasonality of sport fishing and harvest in the Middle Loup, Dismal, and Loup rivers.

3. Document the intensity and seasonality of sport fishing and harvest associated with Sherman Reservoir.

4. Document sport fish abundance, age distribution and growth dynamics associated with Sherman Reservoir.

Upon dicussion with the BOR and some preliminary sampling in two irrigation canals, the following fifth objective was eliminated from this project and attempts made to initiate a separate project specifically targeting this objective.

5. Evaluate the use of a diversion screen system on sport fish loss into irrigation diversion canals.

The lengthy river stretches examined in this project under Objectives 1 and 2 were chosen based on the opinion of Nebraska Game and Parks Commission fisheries managers that they may provide important angling opportunities for either channel catfish or trout. The presence of diversion structures on the Loup River at Genoa and on the Middle Loup River at Arcadia and Milburn may act as barriers for fish migrating upstream. Data resulting from angler use surveys on these stretches of river will be used to estimate angler use and harvest.

METHODS

Objective 1: Document fish community structure in the Middle Loup, Dismal, and Loup rivers.

We sampled the fish community and measured habitat parameters at 15 permanent sampling stations along the Dismal, Middle Loup and Loup rivers in Nebraska (Table 1). Three stations are located on the Dismal River between the Highway 97 bridge downstream to the Halsey National Forest. Seven stations are located on the Middle Loup River from Mullen downstream to Boelus. The remaining five stations are located on the Loup River from the Loup Junction Wildlife Management Area downstream to the Columbus City Park. Seasonal sampling goals consisted of collections at each station (as conditions permitted) during four periods:

Period 1 = spring (April-May)
Period 2 = early summer (June-July)
Period 3 = late summer (August-September)
Period 4 = autumn (October-November)

We collected fish using a combination of electroshocking, seining and hoop netting. A portable backpack electroshocking unit allowed fish collections from all major habitat types along the river. Typically, three 10-minute timed electroshocking runs were performed per station during each sampling period. We used an 8-m x 2-m bag seine (6.25-mm mesh) to collect fish from main channel areas. Four, approximately 100-m measured seine hauls were performed per station during each sampling period. We set four cheese-baited hoop nets overnight at each station per sampling period. We used 25.4-m mesh mini hoop nets (0.6-m tall hoops) to sample the shallow waters of the Loup Basin and to standardize our collections with studies in other river basins in Nebraska. The use of each of these techniques at each station depended upon the availability of sufficient discharge and appropriate habitat.

A delay in receiving final approval for the project resulted in an inability to sample during the spring of 1996. Therefore this report covers collections made from three sampling periods ranging from early summer through autumn of 1996.

All small cyprininds and juveniles <100 mm total length (TL) of larger species collected by electroshocking and seining were preserved in the field with 5% formalin. Larger species were identified, measured to the nearest 1 mm TL and weighed to the nearest 1 g wet weight and subsequently released at their collection site. Scales or spines were collected from a representative subsample of game species for age and growth determinations prior to the fish being released back into the river. We identified, measured and weighed the preserved fish collected by these two methods in the laboratory. We identified, measured and weighed fish collected by hoop nets in the field prior to being released. Fish greater than 250 mm TL that were caught at any station, by any collection method, were marked with numbered Floy tags prior to release to allow collection of movement data along the rivers.

We characterized the physical habitat present at each sampling stations following general methods described by Bovee (1982). Habitat parameters including depth, water velocity, substrate type, and cover type were assessed at 1.27 meter intervals along transect line spanning the width of the river channel. Three to five transects were run at each station dependent upon channel width. Mean channel width was calculated based on the bank to bank lengths of each transect line. Depth and mean column current velocity were recorded at each transect point using a graduated wading rod fitted with a pygmy current meter and headphone. We measured velocity at 0.6 x depth. Substrate present at each transect point was evaluated visually and the percent composition of each of four general particle size groups (i.e. silt, sand, gravel and rock) recorded. Discharge (cubic feet per second, cfs) was estimated for each sampling period at each site based on mean depth, mean width and mean current velocity measured across all transects at the station. In cases when these habitat parameters were not measured due to high water levels, visual estimates of discharge were recorded based on calculated discharges at adjoining sampling stations. Summary statistics by sampling period for each habitat parameters were calculated as the mean across all observations taken at each station. Period means for each station were averaged to obtain an overall habitat summary.

Length-weight relationships and relative weight indices (W_r) will be computed for all fish collected following Jerald (1983) and Anderson and Gutreuter (1983). Size structure of the fish populations will be evaluated using length frequency distribution indices such as Proportional Stock Density (PSD) and Relative Stock Density (RSD) following Anderson and

Gutreuter (1983) and Gabelhouse (1984). Scales removed for age determination will be impressed onto thin plastic slides. Pectoral spines collected from catfish will be processed as described by Sneed (1951). The resulting impressions and spine sections will be viewed using a microprojector, aged and measured. Data on fish age, length, distance to each annulus and distance to scale or spine edge will be entered into a Nebraska Game and Parks Commission computer program for backcalculations of fish growth. Standard intercept values (C) for use in backcalculations of lengths at age will follow Zuerlein and Taylor (1985).

Objective 2: Document sport fishing and harvest in the Middle Loup and Loup rivers

During 1996 a progressive-count access point angler use survey was employed within the Loup Basin to document fishing pressure, catch, harvest, and angler perceptions of the fishery. The survey followed a stratified multi-stage probability sampling regime (Malvestuto 1983; Newcomb 1992) using computer programs for creel design, sampling and analysis produced by the Nebraska Game and Parks Commission. The study area in the Loup Basin was divided into three survey sections due to logistical constraints (Table 2). The first section consists of nine access points along the Loup River stretching from the Columbus River Bridge (Hwy 81) upstream to the Loup Junction WMA. The second section consists of a series of six access points along the Loup River Power Canal from its confluence with the Platte River at Tailrace Park upstream to Headworks Park near Genoa. This section was surveyed in conjunction with the Middle Loup River. The third section consists of 13 access points in the Middle Loup River from the St. Paul River Bridge just upstream of the confluence with the North Loup River, upstream to the Milburn Diversion. Although initially we intended to establish survey points on the Dismal River, these were dropped from the present study for both logistic reasons and the extremely low number of anglers we percieved that could be contacted in this reach. In addition it was felt that the addition of the power canal survey would result in a greater representation of anglers using the sections of the basin we were surveying.

Each river section was treated separately during the analysis. Due to the late start of the project in 1996, the two river sections were sampled monthly between May and October. Since the Loup River Power Canal was added to the project after the Loup River survey had already begun, it only ran from July through October. This corresponds closely to the time period anglers use this canal associated with the irrigation season. We assigned each access point a sampling probability which determines the amount of time allocated to it during each creel count. Each river section was surveyed for 10 days per month. We stratified the number of survey days per month by day with six counts on weekdays and 4 counts on weekends. Each survey day is further stratified into two time periods: sunrise to zenith (morning), and zenith to sunset (afternoon). During each count the creel clerk records the number of bank anglers, boats and boat anglers present on the river at and around the access point. In addition, clerks will interview anglers to collect information on fishing effort, number, type and size of fish captured and harvested, and angler perceptions on the quality of their fishing experience.

Objective 3: Document sport fishing and harvest in Sherman Reservoir

During 1996 a roving creel survey was employed on Sherman Reservoir to document fishing pressure, harvest, and angler perceptions of the fishery. The angler use survey followed a stratified multi-stage probability sampling regime designed using computer programs produced by the Nebraska Game and Parks Commission. We surveyed each reservoir a total of 10 days per month between April and October with the number of survey days stratified with six counts on weekdays and 4 counts on weekends. Each creel day is further stratified into two time periods: sunrise to zenith (morning), and zenith to sunset (afternoon). During each count the creel clerk will record the number of bank anglers, boats and boat anglers present on the reservoir. In addition when time permits, clerks will interview anglers to collect information on fishing effort, number, type and size of fish captured and harvested, and angler perceptions on the quality of their fishing experience.

Objective 4: Document sport fish abundance, age distribution and growth dynamics in Sherman Reservoir

We performed a standard survey of the sport fish populations in Sherman Reservoir during 1996 to determine the species composition, size structure and growth dynamics of the fisheries. Survey sampling follows standard Nebraska Game and Parks Commission protocols (Zuerlein and Taylor 1985). Dependent upon the target species and the ability to effectively use each technique, either gill nets, frame nets, and/or seining will be used to sample fish. Fish abundance is reported in terms of catch per unit effort (CPUE) by gear type as follows: number of fish caught per net-night set for gill nets and frame nets; number of fish caught per seine haul. All fish collected are measured for total length. Sampling goals for Sherman Reservoir consist of the following:

a. Standard experimental gill nets
   - minimum of 4 net sets up to number of sets needed to achieve target goal
   - target goal is CPUE estimate with 80% confidence interval around mean (alpha-level = 0.2)

b. Frame nets
   - minimum of 4 net sets up to number of sets needed to achieve target goal
   - target goal is CPUE estimate with 80% confidence interval around mean (alpha-level = 0.2)

c. Seining with 33-m wide by 2-m tall, 6.25-mm mesh bag seine
   - 10-20, 90-degree arch seine hauls
   - performed during August for collection of gizzard shad data

We weighed a subsample of fish collected and removed hard structures (i.e. scales or spines) for age and growth analyses from five fish for each 10 mm size category. Analysis of fish population structure, age and growth data will follow the procedures outlined above under Objective 1.

Objective 5: Evaluate the use of a diversion screen system on sport fish loss into irrigation diversion canals.

In order to assess what fish were present in irrigation diversion canals, we sampled both the Sargent Canal and Sherman Feeder Canal using backpack electrofishing, hoop nets and bag seines as described in Objective 1 above.

RESULTS AND DISCUSSION

The following presentation and discussion includes data summarized and analyzed to date from the 1996 collections. Emphasis is placed on a description of the community composition and relative abundance of fish, habitat availability and angling effort, catch and harvest for each system sampled. As data analyses continue during the spring of 1997, additional information on fish size structure, age and growth dynamics and angler use will be available. This information will be included in the final project report.

Objective 1: Document fish community structure in the Middle Loup, Dismal, and Loup rivers.

Fish Community Structure

During 1996, we collected a total of 14,136 fish comprising 38 species from the main channel of the Republican River in Nebraska (Table 3). Backpack electroshocking was the most successful sampling technique collecting 63,950 fish from 38 species while seining yielded 2,527 fish from 18 different species, and hoop net sets captured 265 fish from 9 species. A complete breakdown of these fish collections for each sampling station by collection period, gear type and species is included in Appendix A. Seasonal trends in relative abundance will not be addressed at this time. Annual summaries by gear type for species collected by station are presented in Tables 4-6 and discussed below.

Eleven species represented at least 1% by numbers of the fish collected by electroshocking in the Loup Basin during 1996 with four species (red shiner-25.7%, sand shiner-20.8%, fathead minnow-15.2% and brassy minnow-13.6%) representing 75.3% of the total (Table 4). Other less common species occurring throughout the Loup Basin included western silvery minnow (6.3% of total), bigmouth shiner (3.9%), river carpsucker (3.2%), river shiner (1.6%), longnose dace (1.3%) and emerald shiner (1.1%). Most of these species exhibited a broad distribution and were found at most sampling stations. However, some species tended to be more abundant in the eastern, downstream portions of the Middle Loup River and Loup River (i.e. western silvery minnow, river shiner, river carpsucker and emerald shiner) than in the western, upstream portions of the basin such as the Dismal River and upper Middle Loup River (i.e. longnose dace). Ten species were represented by collections of 10 or less individuals (<0.1% of total fish collected by numbers) and generally showed limited distributions. These included goldeye, pearl dace, finescale dace, black bullhead, yellow bullhead, flathead catfish, sunfish hybrid, white crappie, Iowa darter and yellow perch.

Three species represented 86.5% by numbers of the fish collected in bag seining in the Loup Basin during 1996 (Table 5). Red shiner and sand shiner were captured at most stations and accounted for 63.2 and 10.3 percent of total fish collected, respectively. In contrast, bigmouth shiner (13.0% of total) were mainly seined from two stations (Bowman Lake SRA

and Halsey National Forest) with only a few individuals appearing at each of the other seven stations it was collected from. Brassy minnow (4.35% of total) and fathead minnow (1.78%) were caught by seining at stations from each river section, however emerald shiner (2.97% of total) was captured primarily at Loup and Middle Loup stations while speckled chub (1.23%) and flathead chub (1.07%) were sampled only at the Loup River stations.

Cheese-baited hoop nets are typically set in rivers to selectively collect fish such as catfish, carp and suckers which depend on a highly developed sense of smell to locate prey. A total of 265 fish were collected in 180 net-nights of sampling (mean CPUE = 1.47 fish/net) comprising nine species. Channel catfish were the most abundant species captured in hoop nets set in the Loup Basin and represented 90.2% of the total catch by numbers during 1996 (Table 6). This species was captured at all Loup River stations and those Middle Loup River stations below the Milburn Diversion. No channel catfish was collected above the Milburn Diversion in 72 net-nights of effort in the upper Middle Loup or Dismal rivers. Only one channel catfish was caught at the station above the Arcadia Diversion and below the Milburn Diversion in 12 net-nights of effort. It is apparent that the two mainchannel diversion structures on the Middle Loup are acting as migration barriers to channel catfish. Of the remaining eight species, only white suckers (7 fish; 2.64% of total) were collected at more than three stations. Only 12 fish were collected in 84 net-nights of effort above the Arcadia Diversion station. The lowest CPUE of all stations which yielded fish was 0.08 fish/net at Mullen. No fish were captured in hoop nets near the Halsey National Forest station. The highest CPUE values were 7.75 fish/net just below the Arcadia Diversion.

Fish Tagging

We tagged a total of 145 channel catfish and 2 flathead catfish greater than 250 mm in the Loup Basin during 1996. A total of 4 tagged fish were either caught by anglers who returned the tags, or were fish we resampled for a total recapture rate of 2.7% for the year (Table 7). All of the recaptured fish were channel catfish ranging in size from 264 mm to 410 mm, two of which were tagged at the Arcadia Diversion and two tagged at Boelus. All four channel catfish were recaptured in the same areas they were released.

Habitat Availability

Habitat measurements made at regular intervals along multiple transects per sampling station were used to compute mean habitat values representative of each site in the river reaches of the Loup Basin. These mean habitat parameters are summarized by sampling period by station in Appendix B. An overall mean was then calculated for each station across sampling periods and presented in Table 8. Due to very high water levels in the Loup River during the third and fourth sampling periods, we were not able to obtain habitat measurements at three sites (i.e. Loup Junction WMA, Palmer, and Fullerton). Therefore, since only habitat data from sampling period two was collected (refer to Appendix B; Table B1) no annual means for these three sites were calculated These "annual" values are indicative of river conditions during the dates we sampled, and care must be taken when extrapolating them to represent the entire year. They do not necessarily reflect the entire range of habitat parameter variability that might be measured if sampling had been done on a more frequent basis. However, they do represent our best available estimates at this time.

Mean discharge estimates for 1996 generally increased along the Dismal River and upper Middle Loup River as you move downstream but the irrigation diversions at Milburn and Arcadia have an obvious negative impact (Table 8). Estimated mean discharge rates measured at these upstream sites ranged from 93.5 cfs at Hwy 97 Bridge on the Dismal, up to 1,065.6 cfs at the site below the Milburn Diversion. Discharge levels decline dramatically below the Arcadia Diversion but increase again in the Loup River sites following the confluence of the Middle Loup and the North Loup rivers near the city of Loup Junction. The relatively high discharge rates from Loup Junction down through Fullerton must be qualified in that discharge was not physically measured during periods three and four at these sites, but visually estimated (see Appendix B) due to high water levels limiting sampling. Discharge levels dropped significantly at the Genoa site in the Loup River due to the irrigation diversion in this reach which feeds water to the Loup River Power Canal through Lake North and Babcock.

Mean depth of the channel tended to be greater in the upstream sites with the shallowest mean depth just below the Arcadia Diversion (0.61 ft) and the deepest at Thedford on the Middle Loup (2.08 ft). Mean current velocity was also greater at the upstream sites and declined in the lower portions of the basin. Mean current velocities ranged from 2.44 ft/sec at Thedford down to 0.79 ft/sec just downstream of the diversion at Genoa. These trends in mean depth and current velocity appear to be related to mean stream width which tended to increase as you move downstream in each of the river reaches. The narrowest mean channel widths were measured at Hwy 97 Bridge on the Dismal (31.9 ft) and at Mullen on the Middle Loup (38.2 ft), while the widest channels measured were at the Milburn Diversion site in the Middle Loup (mean of 430.3 ft) and at Fullerton on the Loup (Period 2 mean 605 ft; Table B1). The predominant bottom substrate at all sampling stations was sand which comprised between 79 and 94 percent of the observations. Silt and gravel substrates were consistently present at all stations making up the remainder of the observations taken along the transects. These two substrate types represented over 20% of available habitat at only one station (i.e. Mullen) during 1996. Silt comprised between 3 and 13.0% of the available substrate along the river while gravel represented 0 to 11% of available substrate throughout the basin and occurred in the highest percentage of observations in the upper Middle Loup sites (at and above the Milburn diversion through Mullen). Although rock substrate (primarily man-made concrete) was present in the river its frequency of occurrence is quite low and generally associated with bank stabilization structures.

Characteristics of the fish population and associated habitat parameters indicate that the Loup Basin rivers are somewhat typical of rivers found in the agriculturally impacted areas of the central Great Plains grassland ecosystems. These reaches tend to be relatively shallow, exhibit low current velocities and are primarily sand-bottomed rivers. The discharge levels are tend to be consistent throughout the year and are impacted by strong rain events. They host a fish assemblage predominated by a number of widespread, generalist species (i.e. red shiner, sand shiner, fathead minnow, river carpsucker, channel catfish, etc.) with a few species that exhibit more limited distributions (i.e. brassy minnow, emerald shiner, bigmouth shiner, longnose dace, pearl dace and finescale dace).

Objective 2: Document sport fishing and harvest in the Middle Loup and Loup rivers

For logistical reasons, we divided the Loup Basin study area into three reaches for the purpose of conducting an angler use survey (Table 2). The Loup River reach stretches for 259.5 km from its mouth entering the Platte River near Columbus upstream to the confluence with the South Loup River near Boelus. The Loup River Power Canal runs for 55.2 km from the Genoa Diversion downstream to where it enters the Platte River below the confluence of the Loup and Platte rivers. The Middle Loup River extends for 326.7 km from its confluence with the South Loup River near Boelus upstream to its headwaters in Cherry County. Survey results from these reaches will be discussed separately below.

Loup River

We estimated a total of 1,401 anglers spent 1,751 hours fishing in the Loup River between May and October during 1996 (Table 9; Figure 1). This corresponds to approximately 1.15 anglers/ha and 1.44 hours/ha fishing in this reach (Figure 2). Angling effort declined from May to June before increasing to a maximum effort for the year of 0.49 hours/ha in August comprised of 0.39 anglers/ha. Approximately 70% of the anglers counted and their hours spent fishing occurred between June and August. Anglers caught an estimated total of 793 fish during the sampling period, of which 399 fish (50.3%) weighing 264.8 kg were harvested (Figure 3). Catch increased from zero in May to a maximum level during June followed by a quick decline over the next three months to zero again in September. Approximately 68.1% and 27.7% of the angler catch and 45.1 and 54.9% of the harvest occurred in June and July, respectively. Anglers harvested only 33.3% of the fish caught in June compared to 100% of those caught in July. Catch rates were highest in June at 0.25 fish/hour but declined over the next three months resulting in an average of 0.071 fish/hour for the entire period (Figure 4). Anglers harvested approximately 0.034 fish/hr which yielded 0.024 kg/hr for the survey period.

A total of four species of fish were caught by anglers in the Loup River reach during May through October 1996 but only two of these were harvested to some degree (Table 10). Creek chub and black bullhead were caught but not kept by anglers. Channel catfish dominated angler catch during 1996 comprising 71.0% of the total number of fish caught. Creek chub, black bullhead and green sunfish made up the remaining 15.1, 7.6 and 7.6% of the catch, respectively. Approximately 60.3% of the channel catfish were harvested representing 98.4% of the total weight anglers kept. In contrast, although 100% of the green sunfish that were caught were harvested, this made up only 1.6% of the total weight of fish harvested by anglers.

Loup River Power Canal

Early in the study period while performing the angler survey on the Loup River, we noticed that a large number of anglers were beginning to move over to fish in the Loup River Power Canal instead of the river. Therefore, in July we initiated an access point survey of the power canal to be run in conjunction with the Loup River survey. This resulted in an important modification in the project since the first years data suggests that the Loup River supported far less fishing pressure and catch than that seen along the Loup River Power

Canal. We estimated that approximately 6,172 anglers fished a total of 12,343.1 hours in this area between July and October during 1996 (Table 11; Figure 1). That represents an effort of only 67.82 hours/ha and 33.91 anglers/ha for this limited survey period (Figure 2). Angler effort decreased from a maximum during July throughout the remainder of the year. Effort ranged from 5,971.1 hours by 2,985.5 anglers in July down to 565.1 hours by 282.6 anglers in October. Anglers caught an estimated 10,179 fish during 1996 of which 4,999 fish (49.1% of total) weighing 1,895.7 kg were harvested (Figure 3). Catch decreased from a maximum in July of 4,777 fish, then declined quickly through the end of the survey period. No fish were caught in October. Number of fish harvested each month was similar throughout the summer with anglers harvesting 1,773.4 fish in July (35.5% of total), 1,485.6 in August (29.7%) and 1,739.8 fish in September (34.8%). The percentage of fish caught that were harvested each month was greatest in August (56.5%). The overall catch rate of 0.867 fish/hr seen in the Loup River Power Canal was an order of magnitude higher than the 0.0710 fish/hr seen in the Loup River (Figure 4). In addition, anglers harvested fish faster in the power canal (0.442 fish/hr) than in the river (0.037) and the weight of fish yielded was also more.

Eleven species of fish were caught by anglers in the Loup River Power Canal during July through October in 1996, however all but three of these fish, skipjack herring, white sucker and green sunfish, were harvested (Table 12). Four species dominated the catch by anglers in the Loup River Power Canal accounting for 92.2% of the catch by numbers, 90.6% of the harvest by numbers and 88.2% by weight. Freshwater drum was the most abundant species caught in the creel (3,299.1 fish; 32.4% of total), with 58.7% of the drum harvested. Crappie, channel catfish and white bass were next in abundance comprising 24%, 19% and 16.9% of the total catch, respectively, and yielding 12.1%, 13.7% and 26.0 % of the harvest, respectively. Although only a small number of goldeye, common carp and river carpsucker were caught all of them were harvested.

A distinct difference exists between these two reaches which are side by side in the Loup Basin. During the survey period (only four months in canal versus six in river) anglers expended more effort, catch more fish and harvest greater numbers and weight of fish in the smaller power canal than in the river. Fewer species are part of the creel in the Loup River than in the canal and CPUE estimates for both angler catch and harvest were lower. This may in part be explained by the inclusion of the Tailrace Park area as one of the canal's access points. This access point is right at the confluence of the power canal and the Platte River which represents a major fishing attraction for the area. In addition, the Columbus Power House access point is right below lakes North and Babcock which probably act as source pools for the canal below.

Middle Loup River

We estimated a total of 3,110 anglers spent 8,905 hours fishing in the Middle Loup River between May and October during 1996 (Table 13; Figure 1). This corresponds to approximately 1.54 anglers/ha and 4.40 hours/ha fishing in this reach (Figure 2). Angling effort increased from May to a maximum of 1.5 hours/ha (0.52 anglers/ha) in June before declining to a minimum effort for the year of 0.04 hours/ha in September comprised of 0.01 anglers/ha. Approximately 69.8% of the anglers counted and their hours spent fishing

occurred between June and August. Anglers caught an estimated total of 8,950 fish during the sampling period, of which only 1,433 fish (16.0%) weighing 602.3 kg were harvested (Figure 3). Angler catch was greatest during May, June and July period accounting for 40.5%, 22.2% and 26.7% of total, respectively, before a quick decline over the remainder of the survey period. Anglers harvest ranged from only 9.3% up to 24.6% of the fish caught in May through August with no fish kept in the last two months of the survey. Catch rates mirrored trends seen in number of fish caught with the highest rates in May at 1.724 fish/hour but declined over the next few months resulting in an average of 0.991 fish/hour for the entire period (Figure 4). Anglers harvested approximately 0.152 fish/hr which yielded 0.064 kg/hr for the survey period.

A total of ten species of fish were caught by anglers in the Middle Loup River reach during May through October 1996 but only four of these were harvested to some degree (Table 14). White sucker, black bullhead, white bass, bluegill, sunfish hybrid and largemouth bass were caught but not kept by anglers. Channel catfish and white bass dominated angler catch during 1996 comprising 72.4% and 15.7% of the total number of fish caught, respectively. Common carp, creek chub and crappie made up 4.1%, 1.2% and 7.6% of the catch, respectively. Approximately 18.4% of the channel catfish caught were harvested representing 74.2% of the total weight of fish anglers kept. Common carp made up 21.9% of the total weight of fish harvested by anglers.

Objective 3: Document sport fishing and harvest in Sherman Reservoir

We surveyed angler use and harvest from April through October 1996 on Sherman Reservoir as part of the present project. We estimated a total of 11,231 anglers spent 59,581.1 hours fishing Sherman Reservoir during April through October 1996 (Table 15; Fig. 1). This corresponds to approximately 9.75 anglers/ha and 51.72 hours/ha fishing pressure (Fig. 2). Angling effort increased rapidly from April through June then declined slowly through the summer to the lowest levels of the survey period in October. A maximum fishing effort of 13.32 hours/ha was seen in June comprised of 2.51 anglers/ha. Approximately 58.1% of the anglers counted and their hours spent fishing occurred between June and August. Anglers caught an estimated 35,934 fish during the survey period, of which 14,755 fish (41.1% of total) weighing 4,862.3 kg were harvested (Figure 3). Catch followed the same general trend as seen with effort with the peak in catch during June. Anglers harvested more fish (3,796) and a greater percentage of fish caught (54%) in May compared to any other month. Only 32.4% of the 10,111 fish caught in June were harvested (Table 15). Catch rates increased to a maximum in May (0.770 fish/hour) then declined throughout the summer until a second peak in September (0.677 fish/hour) and averaged 0.636 fish/hr for the entire survey period (Fig. 4). Anglers harvested 0.290 fish/hr which yielded 0.092 kg/hr for the entire period. As noted above harvest peaked during May at a rate of 0.478 fish/ha and 0.121 kg/ha.

A total of 10 species of fish were present in the Sherman angler survey during 1996 and all of these were harvested to some degree (Table 16). Crappie and walleye dominated angler catch in Sherman representing 37.5% and 29.4% of total number of fish taken, respectively and comprising 53.9% and 4.7% of the harvest by numbers and 27.1% and

15.3% by weight, respectively. Channel catfish was the third most abundant species in the catch (15.1% of total) and represented 23.4% of the harvest by numbers and 35.2% by weight. White bass was the fourth most abundant species in the creel accounting for only 10.7% of the catch, but 14.3% of the harvest by numbers and 12.5% by weight. The majority of the remaining catch and harvest was spread among freshwater drum (4.7% of catch; 1.5% harvest by numbers), with bluegill, common carp, largemouth bass, northern pike and yellow perch comprising much small portions.

Objective 4: Document sport fish abundance, age distribution and growth dynamics in Sherman Reservoir

The 1996 evaluation of the status of the sport fisheries in Sherman Reservoir was composed of two main efforts: shoreline seining and standard survey sampling. In August, shoreline seining was performed primarily to document the abundance of young-of-the-year gizzard shad which represents the main prey species for many of the sport fish species in the reservoirs. A total of 20 seine hauls were conducted in the reservoir during 1996 resulting in the collection of 2,555 fish comprising 14 species (Table 17). Gizzard shad dominated the fish collected in the seines (2,103 total) making up 82.3% of the total. This represents a CPUE of 105.2 shad per seine haul indicating the presence of an abundance prey base in Sherman Reservoir. Emerald shiner, golden shiner and freshwater drum were next in abundance in the hauls representing 5.4%, 4.7% and 3.4% of total catch, respectively.

In September, gill nets and frame nets were used to collect relative abundance data on the main sport species present from Sherman Reservoir. Table 17 summarizes the total catch and CPUE for species captured in four gill nets and four frame nets set in the reservoir during 1996. Thirteen species were collected in the gill nets. Walleye (103 fish total) dominated the samples with a CPUE value of 25.8 fish/net. This high value for walleye reflects why this species was one of the top two species in the angler creel in the reservoir. Gizzard shad (60 fish), white bass (57 fish) and channel catfish (50 fish) were also abundant in the gill nets yielding CPUE values of 15, 14.2 and 12.5 fish/net, respectively. Although crappie were the most abundant species caught by anglers, white crappie (24 fish) and black crappie (3 fish) were not abundant in gill net catches. This is not unusual in that crappie tend to be more susceptible to frame netting than gill netting. White crappie (95 fish) and black crappie (52 fish) were the two most abundant species out of the nine species collected in frame nets with CPUE values of 23.8 fish/net and 13.0 fish/net, respectively. Bluegill (10 fish) were not very abundant in the frame net samples yielding a CPUE of 2.5 fish/net. This low population abundance of bluegill is consistent with the small numbers caught by anglers during the study period.

Objective 5: Evaluate the use of a diversion screen system on sport fish loss into irrigation diversion canals.

A site visit evaluating the possibility of installing nets to capture fish on the Arcadia

and Milburn diversion structures was performed and preliminary concepts developed by an USGS specialist. A report was submited to the BOR by USGS detailing potentials and needs for installing a net system. Consequently, activities associated with this objective were redirected by the BOR and further work was terminated at this time.

During June 1996, a series of fish collections were made in the Sherman Feeder Canal downstream of the Arcadia Diversion and in the Sargent Canal downstream of the Milburn Diversion. Backpack electrofishing, hoop netting and bag seining were used to characterize what fish were present in the two canals (Table 18) and to allow comparisons with the fish assemblage found in the Middle Loup River from which the water is diverted to feed into these canals.

Electrofishing samples taken from the Sherman Feeder Canal were dominated by red shiner (194 fish; 37.5% of total) followed by fathead minnow (81 fish; 15.6%), sand shiner (74 fish; 14.3%) and green sunfish (64 fish; 12.4%). Two major sport fish were collected in abundance by electrofishing; channel catfish and common carp. These two species were also the two most abundant species captured in hoop nets in the Sherman Feeder Canal representing 34.8% (8 fish) and 39.1% (9 fish) of the samples, respectively. Hoop nets also captured white sucker (5 fish) and a single shorthead redhorse. Red shiner made up approximately 98.4% of the bag seine hauls in the Sherman Feeder Canal with fathead minnow and sand shiner being the only other species collected. These sampling method have demonstrated that the assemblage of fish entering the Sherman Feeder Canal is very similar to that present in the Middle Loup River where the water originates. It also demonstrates that sport fish such as channel catfish, common carp, and green sunfish are entering the canal and may potentially be lost in significant numbers.

Collections from the Sargent Canal were similar in a number of ways to those seen in the Sherman Feeder Canal. Electrofishing samples yielded ten species dominated by common carp (207 fish; 32.5% of total), fathead minnow (150 fish; 23.5%) and green sunfish (141 fish; 22.1%) with smaller numbers of white sucker, bluegill and red shiner also present. The bag seine collections were almost identical in nature to those seen in the Sherman Feeder Canal with red shiner comprising 91.1% of the samples along with fathead minnow and brassy minnow. The major difference between collections from the two canals was the absence of channel catfish in both electrofishing and hoop net samples from the Sargent Canal. However, this is understandable when you compare the Middle Loup River collections from above the Milburn Diversion which feeds the Sargent Canal. No channel catfish were collected in hoop nets above the diversion and only a single channel catfish was collected between Arcadia and Milburn. This supports the theory that these two barriers are preventing or highly limiting upstream migration of channel catfish.

PROJECTED TIMETABLE FOR PROJECT COMPLETION

Data collection will continue during 1997 at all stations sampled during 1996. Final analyses of data collected during 1996 will be completed during summer 1997 in preparation for the final report. A progress report summarizing 1997 collections will be submitted during the winter of 1998 followed by a final report summarizing general trends between the two

years of the study and emphasizing information on fish community size structure, age and growth, seasonal analyses of fish abundance and community composition, and longitudinal analyses of river angler use. This final report will be prepared and delivered to the Bureau of Reclamation by summer 1998.

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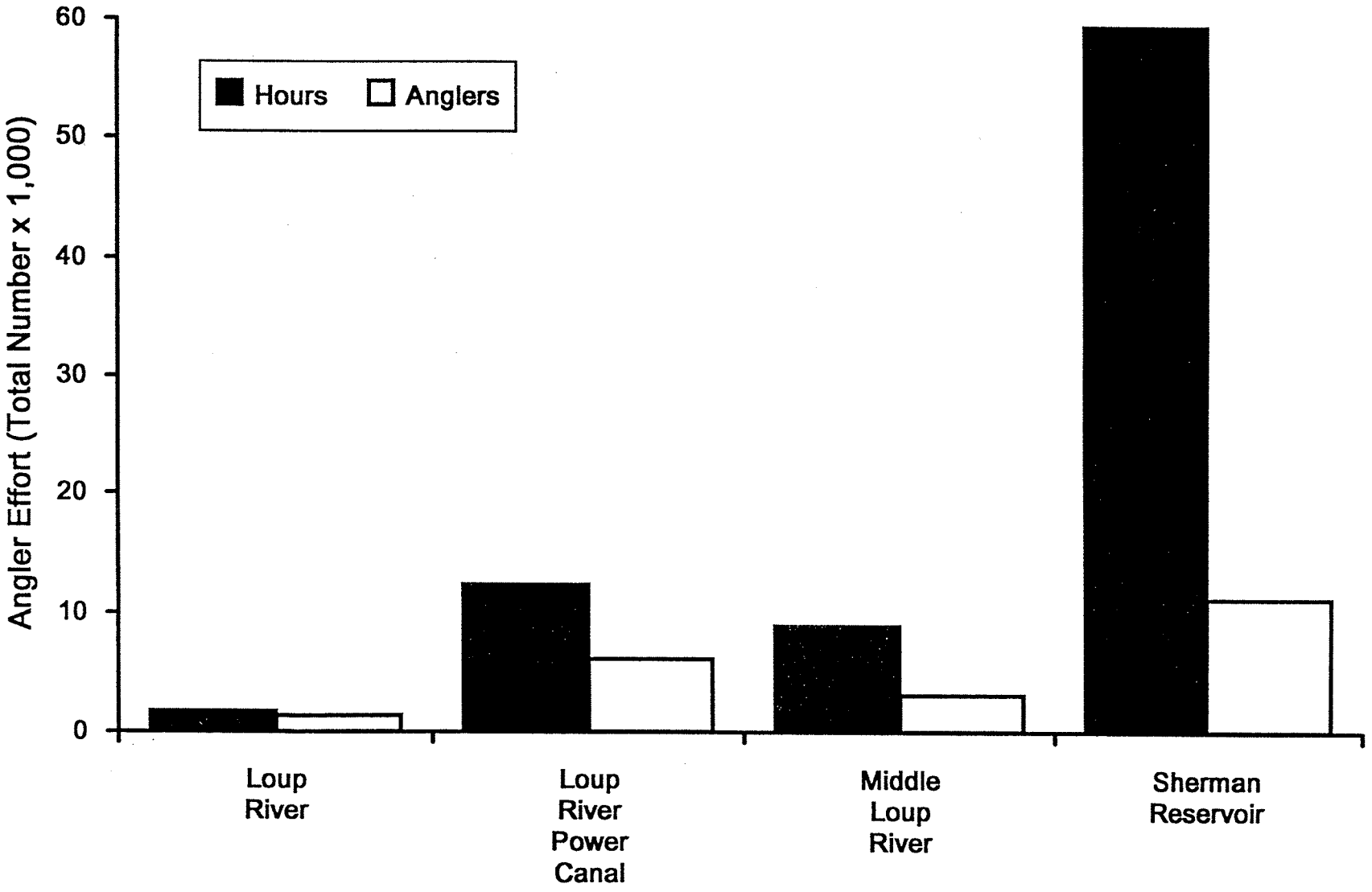

Figure 1. Total estimated angler effort in the Loup Basin during 1996.

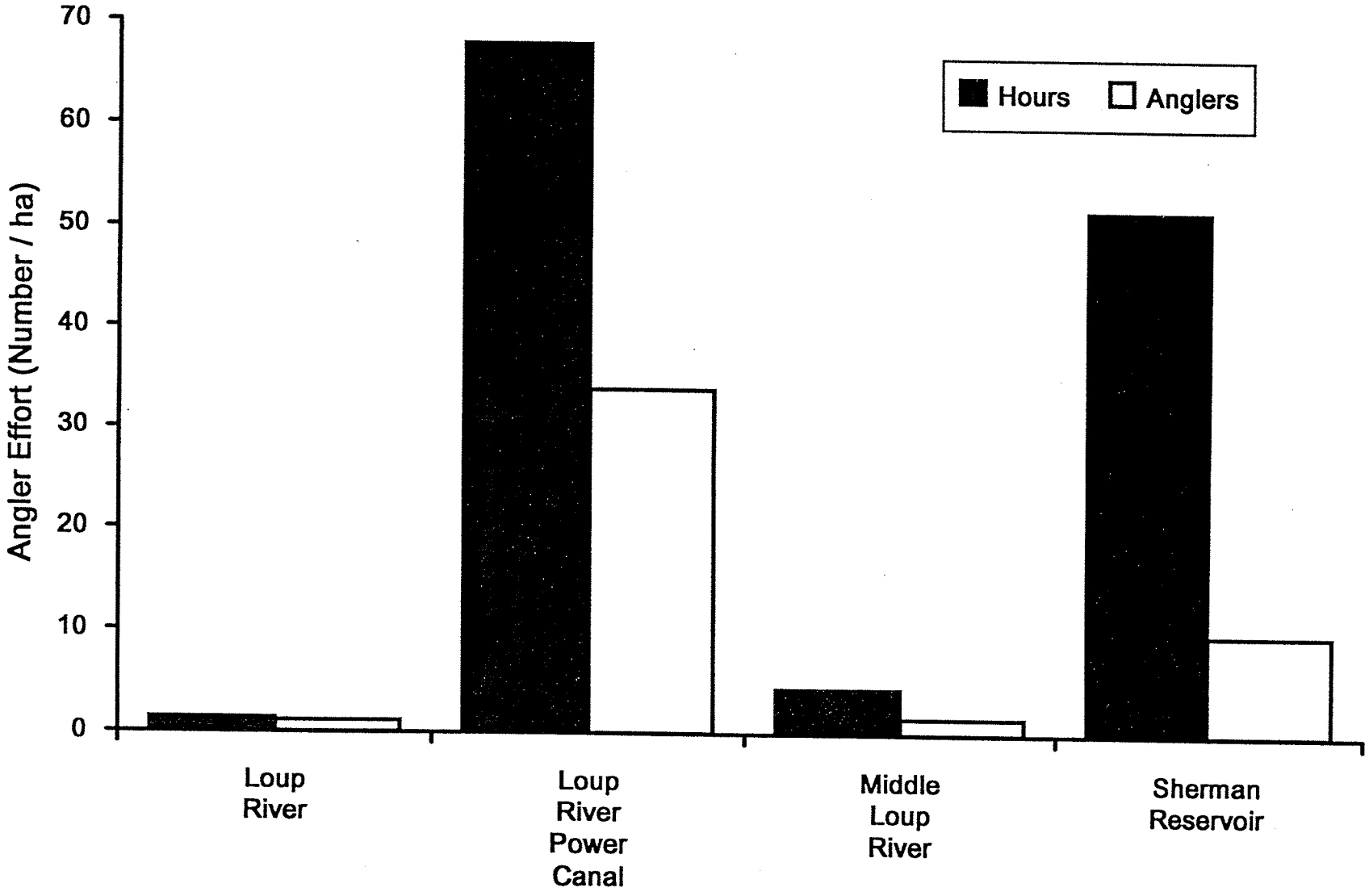

Figure 2. Total estimated angler effort based on surface area in the Loup Basin during 1996.

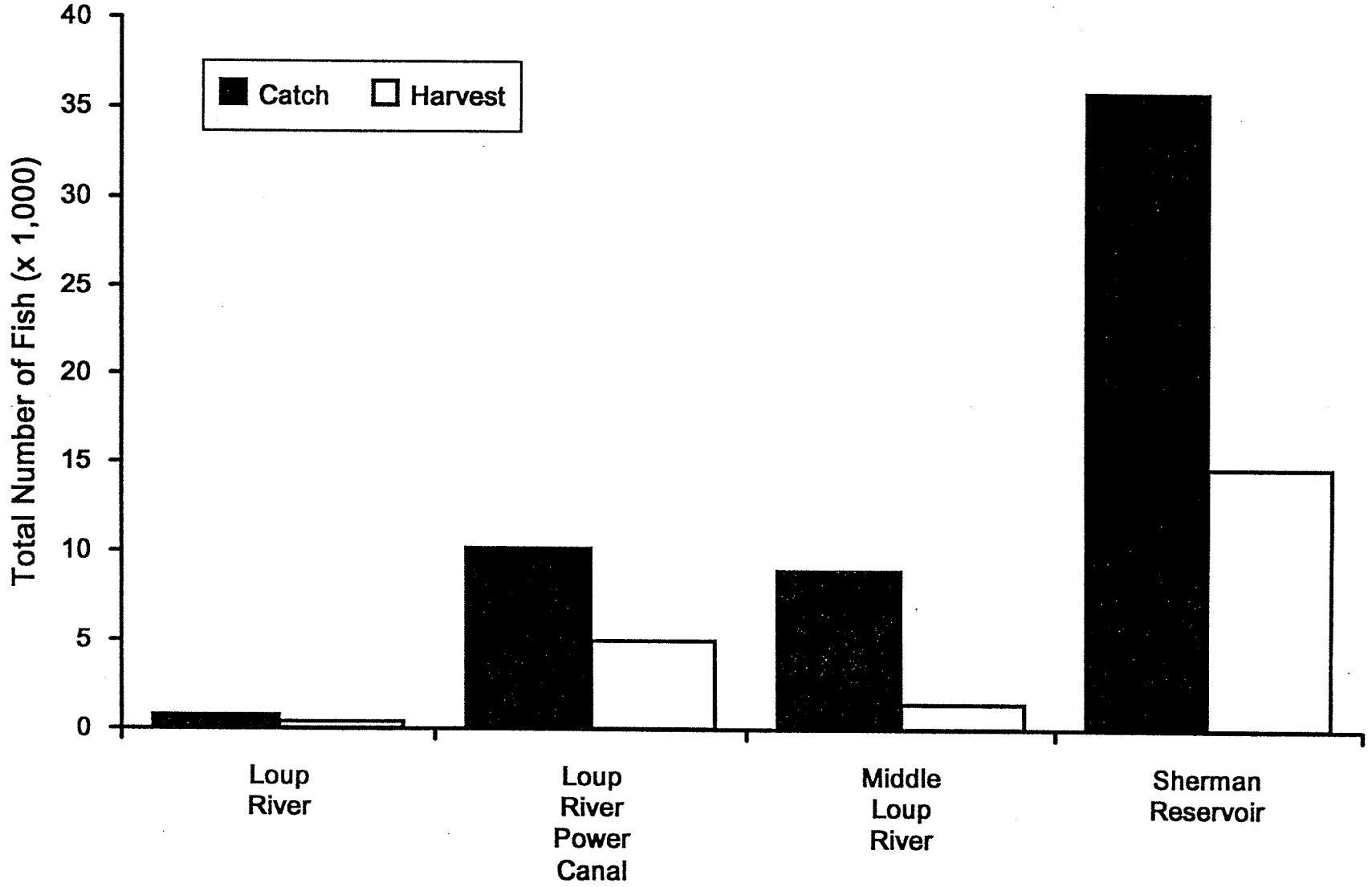

Figure 3. Total estimated angler catch and harvest in the Loup Basin during 1996.

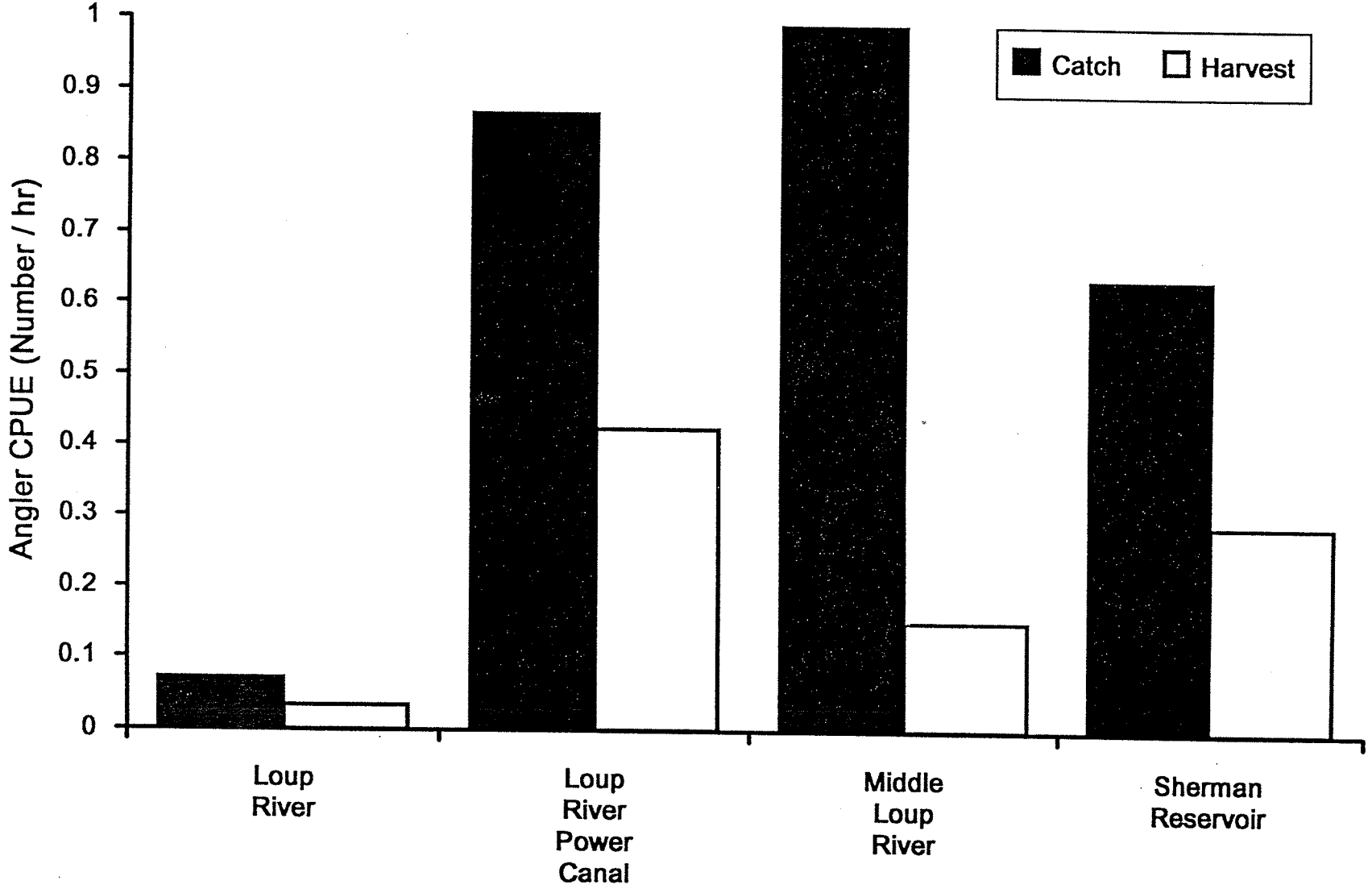

Figure 4. Total estimated angler catch and harvest rates in the Loup Basin during 1996.

Table 1. Location and legal description of Dismal, Middle Loup and Loup River fish community sampling stations.

LOUP RIVER		
Station Number	Location	Legal Description
1	Columbus City Park	S30,T17N,R1E
2	Genoa	S25,T17N,R4W
3	Fullerton	S23,T16N,R6W
4	Palmer	S16,T15N,R10W
5	Loup Junction WMA	S13,T15N,R10W
MIDDLE LOUP RIVER		
Station Number	Location	Legal Description
6	Boelus	S29,T13N,R12W
7	Bowman Lake SRA	S13,T15N,R15W
8	Arcadia Diversion WMA	S36,T18N,R17W
9	Milburn Diversion WMA	S32,T21N,R21W
10	Halsey National Forest	S3,T22N,R26W
11	Thedford	S11-12,T23N,R32W
12	Mullen	S8,T24,R32W
DISMAL RIVER		
Station Number	Location	Legal Description
13	Halsey National Forest	S7-8,T21N,R25W
14	Highway 83 Bridge	S23,T21N,R28W
15	Highway 97 Bridge	S29,T22N,R32W

Table 2. Location, legal description, and sampling probability of Loup River Power Canal, Loup River and Middle Loup River creel sites.

LOUP RIVER POWER CANAL			
Access Point	Location	Legal Description	Sampling Probability
31	Tailrace Park	S1,T16N,R1E	.166
32	Columbus Power House	S9,T17N,R1E	.166
33	Okeny Syphon	S26,T18N,R2W	.166
34	Monroe Power House	S36,T18N,R3W	.166
35	Looking Glass Creek Syphon	S5,T17N,R3W	.166
36	Headworks Park	S32,T17N,R4W	.166

LOUP RIVER			
Access Point	Location	Legal Description	Sampling Probability
1	Columbus River Bridge	S30,T17N,R1E	.083
2	Looking Glass Creek WMA	S12,T17N,R3W	.083
3	George Syas WMA	S20,T17N,R3W	.083
4	Prairie Wolf WMA	S25,T17N,R4W	.083
5	Loup Lands WMA	S28,33,T17N,R4W	.083
6	Headworks Park	S33,T17N,R4W	.083
7	Fullerton River Bridge	S23,T16N,R6W	.083
8	Palmer River Bridge	S16-17,T15N,R8W	.083
9	Loup Junction WMA	S13,T15N,R10W	.083

MIDDLE LOUP RIVER			
Access Point	Location	Legal Description	Sampling Probability
20	St. Paul River Bridge	S10,T14N,R10W	.083

21	Harold Andersen WMA	S31,T14N,R10W	.083
22	Highway 11 River Bridge	S29,30,T13N,R11W	.083
1	Boelus River Bridge	S29,T13N,R12W	.058
2	Rockville River Bridge	S8,T13N,R13W	.058
3	Bowman Lake SRA	S13,T15N,R15W	.118
4	Arcadia River Bridge	S26,T17N,R16W	.058
5	Arcadia Diversion WMA	S35,T18N,R17W	.235
6	Comstock River Bridge	S2,T18N,R17W	.058
7	Sargent River Bridge	S10,T19N,R18W	.058
8	Gates River Bridge	S33,T20N,R20W	.058
9	Milburn River Bridge	S9,10,T20N,R21W	.085
10	Milburn Diversion WMA	S32,T21N,R21W	.235

Table 3. Sampling effort used, number of fish and number of fish species collected from the Loup Basin, Nebraska during 1996.

	Electroshocking	Seining	Hoop Nets	Total
Sampling Effort	1,358.7 minutes	180	180	
Number of Fish	63,950	2,527	265	66,742
Number of Species	38	18	9	38

Table 4. Total number of fish and percent of total collected backpack electrofishing by species and sampling station from the Loup River Basin in 1996.

Table 4	Station															
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Total Effort (minutes)	90.9	90.3	90.5	90.7	90.9	90.7	90.5	90.8	90.1	90.3	90.6	89.3	90.7	92.0	90.4	1358.7
Goldeye	1 <0.01	1 0.02														2 <0.01
Gizzard Shad	2 0.02	57 1.30	8 0.49	2 0.06	3 0.18											72 0.11
Speckled Chub	11 0.10	1 0.02														12 0.02
Silver Chub	7 0.06	14 0.32														21 0.03
Flathead Chub	105 0.92	26 0.59	80 4.88	47 1.37	37 2.20	11 0.72	1 0.02	1 <0.01	2 0.03			4 0.47	3 0.05			317 0.50
Creek Chub				3 0.09		1 0.06			5 0.07	157 5.71	85 14.38	33 3.89	120 1.86	7 0.67		427 0.67
Red Shiner	2588 22.81	2754 62.86	1242 75.73	1720 50.12	1138 67.74	1080 70.40	2481 36.47	1640 12.00	1497 21.09	21 0.76	2 0.34	4 0.47	240 3.71	10 0.96		16,417 25.67
Emerald Shiner	396 3.49	265 6.05		3 0.09	7 0.42	1 0.06	1 0.02									673 1.08
River Shiner	835 7.36	95 2.17	8 0.49	46 1.34	17 1.01											1,001 1.56
Bigmouth Shiner	42 0.37	3 0.07		22 0.64	3 0.18		96 1.41	205 1.50	50 0.70	522 18.99	26 4.40	24 2.83	1416 21.91	69 6.64		2,478 3.87
Sand Shiner	1941 17.11	619 14.13	43 2.62	562 16.38	49 2.92	216 14.08	2579 37.91	2358 17.25	1744 24.57	879 31.98	83 14.04	162 19.08	1462 22.69	619 59.52		13,316 20.82
Western Silvery Minnow	3734 32.91	270 6.16			2 0.12	1 0.06				43 1.56						4,050 6.33
Brassy Minnow	466 4.11	58 1.32	120 7.32	599 17.45	60 3.57	35 2.28	303 4.45	2821 20.63	2199 30.98	75 2.73	29 4.91	282 33.22	1601 24.77	17 1.64		8,666 13.55
Fathead Minnow	95 0.84	15 0.34	3 0.18	59 1.72	4 0.24	10 0.65	1040 15.29	5834 42.67	1252 17.64	47 1.71	22 3.72	13 1.53	976 15.10	33 3.17		9,700 15.17
Pearl Dace				1 0.03								1 0.12				2 <0.01

Table 4

Species	Station															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Finescale Dace				9 0.26												9 0.01
Longnose Dace		1 0.02						3 0.02	15 0.21	118 4.29	89 15.06	206 24.26	43 0.66	133 12.79		837 1.31
Common Carp	33 0.29	14 0.32	14 0.85	33 0.96	99 5.89	12 0.78	6 0.09	23 0.17	7 0.10	16 0.58		2 0.24	1 0.02	1 0.10		261 0.41
River Carpsucker	802 7.07	96 2.19	52 3.17	211 6.15	167 9.94	62 4.04	215 3.16	464 3.39	2 0.03	1 0.04						2,072 3.24
White Sucker							6 0.09	32 0.23	83 1.17	791 28.77	226 38.24	98 11.54	535 8.28	144 13.85		2,040 3.19
Shorthead Redhorse			2 0.12	3 0.09	2 0.12	6 0.39	1 0.02	3 0.02	125 1.76	32 1.16	13 2.20		4 0.06			191 0.30
Black Bullhead	1 <0.01															1 <0.01
Yellow Bullhead	1 <0.01															2 <0.01
Channel Catfish	123 1.08	42 0.96	5 0.30	28 0.82	11 0.66	3 0.20	2 0.03	11 0.08								225 0.35
Flathead Catfish	1 <0.01	1 0.02														2 <0.01
Stonecat			1 0.06	3 0.03			1 0.02		1 0.01	2 0.07	2 0.34	1 0.12		4 0.38		13 0.02
Plains Topminnow							4 0.06	20 0.15	4 0.06	11 0.40	1 0.17	2 0.24	24 0.37		2 0.30	69 0.11
Plains Killifish							18 0.26	202 1.48								220 0.34
Green Sunfish	145 1.28	20 0.46	41 2.50	55 1.60	48 2.86	36 2.35	24 0.35	47 0.34	49 0.69	3 0.11		17 2.00	27 0.42	1 0.10		513 0.80
Orangespotted Sunfish	1 <0.01	8 0.18	2 0.12	2 0.06		1 0.06										14 0.02
Bluegill	12 0.11	4 0.09			13 0.77		4 0.06	1 <0.01	11 0.16	1 0.04			1 0.02			47 0.07
Sunfish Hybrid						1 0.06										1 <0.01
Largemouth Bass	4 0.04	8 0.18	18 1.10	14 0.41	10 0.60	57 3.72	20 0.29	5 0.04	53 0.75	30 1.09	13 2.20		10 0.16	2 0.19		244 0.38

Table 4 Species	Station															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
White Crappie		2 0.05						2 0.02								4 <0.01
Iowa Darter							1 0.02						1 0.02			2 <0.01
Yellow Perch				1 0.03												1 <0.01
Walleye		3 0.07	1 0.06	6 0.18	3 0.18											13 0.02
Freshwater Drum		4 0.09		4 0.12	7 0.42	1 0.06										16 0.03
TOTAL	11,346	4,381	1,640	3,432	1,680	1,534	6,803	13,672	7,099	2,749	591	849	6,464	1,040	670	63,950

Table 5. Total number of fish and percent of total collected seining by species and sampling station from the Loup River Basin in 1996.

Table 5	Station															
Species	1	.. 2	3	4	5	6	7	8	.. 9	10	11	12	13	14	15	Total
Total Effort (hauls)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	180
Goldeye																
Gizzard Shad		2 1.35														2 0.08
Speckled Chub	14 18.42	7 4.73	6 21.43	1 0.17	3 1.76											31 1.23
Silver Chub	3 3.95															3 0.12
Flathead Chub	11 14.47	2 1.35	6 21.43	6 1.00	2 1.18											27 1.07
Creek Chub																
Red Shiner	22 28.95	86 58.11	9 32.14	509 84.41	145 85.29	157 92.90	635 61.65	22 70.97		1 16.67		1 16.67	8 6.20	1 3.03		1,596 63.16
Emerald Shiner	17 22.37	13 8.78			1 0.59		2 0.19		42 48.84							75 2.97
River Shiner																
Bigmouth Shiner				9 1.49	4 2.35	1 0.59	204 19.81	1 3.23		2 33.33		1 16.67	104 80.62	2 6.06		328 12.98
Sand Shiner	3 3.95	17 11.49	3 10.71	20 3.32	6 3.53	4 2.37	132 12.82	5 16.13	35 40.70	2 33.33		1 16.67	5 3.88	28 84.85		261 10.33
Western Silvery Minnow	6 7.90	13 8.78														19 0.75
Brassy Minnow		6 4.05		52 8.62	2 1.18	5 2.96	25 2.43		6 6.98			3 50.00	11 8.53			110 4.35
Fathead Minnow			1 3.57	2 0.33		1 0.59	27 2.62	3 9.68	2 2.33				1 0.78		8 80.00	45 1.78
Pearl Dace																

Table 5 Species	Station															
	1	. . 2	3	4	5	6	7	8	. . 9	10	11	12	13	14	15	Total
Finescale Dace																
Longnose Dace										1 16.67				2 6.06	1 10.00	4 0.16
Common Carp				2 0.33												2 0.08
River Carpsucker		2 1.35	3 10.71	3 0.50	7 4.12	1 0.59	3 0.29		1 1.16							20 0.79
White Sucker															1 10.00	1 0.04
Shorthead Redhorse																
Black Bullhead																
Yellow Bullhead																
Channel Catfish																
Flathead Catfish																
Stonecat							1 0.10									1 0.04
Plains Topminnow																
Plains Killifish							1 0.10									1 0.04
Green Sunfish																
Orangespotted Sunfish																
Bluegill																
Sunfish Hybrid																
Largemouth Bass				1 0.17												1 0.04

Table 5 Species	Station															
	1	. . 2	3	4	5	6	7	8	. . 9	10	11	12	13	14	15	Total
White Crappie																
Iowa Darter																
Yellow Perch																
Walleye																
Freshwater Drum																
TOTAL	76	148	28	603	170	169	1,030	31	86	6	0	6	129	33	10	2,527

Table 6. Total number of fish and percent of total collected hoop netting by species and sampling station from the Loup River Basin in 1996.

Table 6 Species	Station															
	1	.. 2	3	4	5	6	7	8	.. 9	10	11	12	13	14	15	Total
Total Effort (net nights)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	180
Goldeye																
Gizzard Shad																
Speckled Chub																
Silver Chub																
Flathead Chub																
Creek Chub																
Red Shiner																
Emerald Shiner																
River Shiner																
Bigmouth Shiner																
Sand Shiner																
Western Silvery Minnow																
Brassy Minnow																
Fathead Minnow																
Pearl Dace																

Table 6

Species	Station															
	1	. . 2	3	4	5	6	7	8	. . 9	10	11	12	13	14	15	Total
Finescale Dace																
Longnose Dace																
Common Carp								2 2.15								2 0.75
River Carpsucker				1 4.17												1 0.38
White Sucker								1 1.08			1 100.0	2 100.0		1 33.33	2 100.0	7 2.64
Shorthead Redhorse							1 8.33	2 2.15	1 50.00							4 1.51
Black Bullhead				1 4.17										2 66.67		3 1.13
Yellow Bullhead			1 20.00													1 0.38
Channel Catfish	11 100.0	35 100.0	3 60.00	21 87.50	15 100.0	56 98.25	11 91.67	86 94.47	1 50.00							239 90.19
Flathead Catfish																
Stonecat																
Plains Topminnow																
Plains Killifish																
Green Sunfish						1 1.75		1 1.08								2 0.75
Orangespotted Sunfish																
Bluegill			1 20.00					2 2.15					2 100.0			5 1.89
Sunfish Hybrid																
Largemouth Bass				1 4.17												1 0.38

Table 6 Species	Station															
	1	.. 2	3	4	5	6	7	8	.. 9	10	11	12	13	14	15	Total
White Crappie																
Iowa Darter																
Yellow Perch																
Walleye																
Freshwater Drum																
TOTAL	11	35	5	24	15	58	12	93	2	0	1	2	2	3	2	265

Table 7. Summary of the tag returns from the Loup River Basin in 1996.

Species	Tagging Location	Tag Date	Tag Length	Tag Weight	Return Location	Return Date	Return Length	Return Weight
Channel Catfish	Arcadia Div.	7/31/96	264	134	Arcadia Div.	8/05/96	-	-
Channel Catfish	Arcadia Div.	7/31/96	264	119	Arcadia Div.	9/03/96	264	108
Channel Catfish	Boelus	7/25/96	410	430	Boelus	7/25/96	-	-
Channel Catfish	Boelus	9/09/96	352	335	Boelus	9/30/96	-	-

Table 8. Mean habitat parameters for all sampling periods on the Loup River in 1996.

Table 8 Site	Discharge (cfs)	Mean Depth (ft)	Mean Velocity (ft/sec)	Mean Width (ft)	Mean Substrate Composition		
					Silt	Sand	Gravel
LOUP RIVER							
Columbus	416.0	0.64	1.33	354.2	9	87	5
Genoa	81.6	0.76	0.79	144.1	5	94	0
Fullerton*	(2818.0)						
Palmer*	(3020.9)						
Loup Junction WMA*	(1166.7)						
MIDDLE LOUP RIVER							
Boelus	620.3	0.79	1.51	379.8	5	94	0
Bowman Lake SRA	705.3	0.80	1.49	346.8	7	92	1
Arcadia Diversion	660.4	0.61	1.59	417.9	4	94	1
Milburn Diversion	1065.6	1.10	1.88	430.3	3	87	11
Halsey Nat'l Forest	464.2	1.27	2.18	163.5	4	89	7
Thedford	335.4	2.08	2.44	67.2	9	85	6
Mullen	144.7	1.65	2.30	38.2	13	79	8
DISMAL RIVER							
Halsey Nat'l Forest	398.3	0.78	1.62	261.3	12	85	3
Hwy 83 Bridge	224.3	1.53	2.04	79.7	7	93	0
Hwy 97 Bridge	93.5	1.48	2.05	31.9	9	91	1

* Full habitat data sets were not collected due to high water; discharge estimates are given in parenthesis

Table 9. Summary of total effort, catch, and CPUE by month and seasonal total from Loup River angler creel survey in 1996.

	April	May	June	July	August	September	October	Total
Angler Effort (Total)								
Hours	-	355.0	255.0	376.9	596.1	168.0	0.0	1,751.0
Hours / Hectare	-	0.29	0.21	0.31	0.49	0.14	0.00	1.44
Anglers	-	284.0	204.0	301.9	476.9	134.4	0.0	1,400.8
Anglers / Hectare	-	0.23	0.17	0.25	0.39	0.11	0.00	1.15
Angler Catch (Total)								
Catch (No.)	-	0.0	540.0	219.4	33.8	0.0	0.0	793.2
Release (No.)	-	0.0	360.0	0.0	33.8	0.0	0.0	393.7
Harvest (No.)	-	0.0	180.0	219.4	0.0	0.0	0.0	399.4
Harvest (Kg)	-	0.0	88.2	176.6	0.0	0.0	0.0	264.8
Angler CPUE (Total)								
Catch (No.) / Hour	-	0.000	0.250	0.103	0.036	0.000	0.000	0.071
Release (No.) / Hour	-	0.000	0.167	0.000	0.036	0.000	0.000	0.037
Harvest (No.) / Hour	-	0.000	0.083	0.103	0.000	0.000	0.000	0.034
Harvest (Kg) / Hour	-	0.000	0.041	0.083	0.000	0.000	0.000	0.024

Table 10. Summary of estimated catch, release, and harvest by species from Loup River angler creel survey in 1996.

Species	Catch (No.)	Release (No.)	Harvest (No.)	Harvest (Kg)
Creek Chub	120.0	120.0	0.0	0.0
Black Bullhead	60.0	60.0	0.0	0.0
Channel Catfish	553.2	213.8	339.4	260.6
Green Sunfish	60.0	0.0	60.0	4.2

Table 11. Summary of total effort, catch, and CPUE by month and seasonal total from Loup Power Canal angler creel survey in 1996.

	April	May	June	July	August	September	October	Total
Angler Effort (Total)								
Hours	-	-	-	5,971.1	3,483.0	2,323.9	565.1	12,343.1
Hours / Hectare	-	-	-	32.81	19.14	12.77	3.11	67.82
Anglers	-	-	-	2,985.5	1,741.5	1,162.0	282.6	6,171.6
Anglers / Hectare	-	-	-	16.40	9.57	6.38	1.55	33.91
Angler Catch (Total)								
Catch (No.)	-	-	-	4,776.5	2,629.1	2,773.3	0.0	10,178.9
Release (No.)	-	-	-	3,003.0	1,143.5	1,033.5	0.0	5,180.0
Harvest (No.)	-	-	-	1,773.4	1,485.6	1,739.8	0.0	4,998.9
Harvest (Kg)	-	-	-	634.8	718.3	542.6	0.0	1,895.7
Angler CPUE (Total)								
Catch (No.) / Hour	-	-	-	0.656	1.150	1.194	0.000	0.867
Release (No.) / Hour	-	-	-	0.407	0.598	0.405	0.000	0.442
Harvest (No.) / Hour	-	-	-	0.249	0.552	0.789	0.000	0.425
Harvest (Kg) / Hour	-	-	-	0.096	0.197	0.234	0.000	0.146

Table 12. Summary of estimated catch, release, and harvest by species from Loup Power Canal angler creel survey in 1996.

Species	Catch (No.)	Release (No.)	Harvest (No.)	Harvest (Kg)
Goldeye	278.2	0.0	278.2	84.1
Skipjack Herring	87.2	87.2	0.0	0.0
Common Carp	44.5	0.0	44.5	56.8
River Carpsucker	67.3	0.0	67.3	28.6
White Sucker	29.1	29.1	0.0	0.0
Channel Catfish	1,929.7	1,247.0	682.7	415.7
Flathead Catfish	234.4	153.0	81.4	54.5
White Bass	1,718.0	416.4	1,301.6	260.3
Green Sunfish	48.7	48.7	0.0	0.0
Crappie	2,442.9	1,837.5	605.4	67.6
Freshwater Drum	3,299.1	1,361.2	1,937.9	928.1

Table 13. Summary of total effort, catch, and CPUE by month and seasonal total from Middle Loup River angler creel survey in 1996.

	April	May	June	July	August	September	October	Total
Angler Effort (Total)								
Hours	-	2,296.1	3,033.6	2,016.5	1,168.8	84.0	306.0	8,905.0
Hours / Hectare	-	1.13	1.50	1.00	0.58	0.04	0.15	4.40
Anglers	-	801.8	1,059.3	704.2	408.2	29.3	106.9	3,109.7
Anglers / Hectare	-	0.40	0.52	0.35	0.20	0.01	0.05	1.54
Angler Catch (Total)								
Catch (No.)	-	3,621.1	1,986.4	2,393.0	799.3	0.0	150.0	8,949.8
Release (No.)	-	3,281.5	1,594.8	1,805.2	685.1	0.0	150.0	7,516.5
Harvest (No.)	-	339.6	391.6	587.8	114.3	0.0	0.0	1,433.3
Harvest (Kg)	-	245.9	149.3	178.5	28.5	0.0	0.0	602.3
Angler CPUE (Total)								
Catch (No.) / Hour	-	1.724	0.636	1.248	0.346	0.000	0.064	0.991
Release (No.) / Hour	-	1.538	0.561	0.919	0.313	0.000	0.064	0.839
Harvest (No.) / Hour	-	0.185	0.075	0.328	0.033	0.000	0.000	0.152
Harvest (Kg) / Hour	-	0.119	0.024	0.108	0.008	0.000	0.000	0.064

Table 14. Summary of estimated catch, release, and harvest by species from Middle Loup River angler creel survey in 1996.

Species	Catch (No.)	Release (No.)	Harvest (No.)	Harvest (Kg)
Creek Chub	108.2	16.2	92.0	17.5
Common Carp	365.5	231.2	134.3	132.2
White Sucker	30.0	30.0	0.0	0.0
Black Bullhead	390.9	390.9	0.0	0.0
Channel Catfish	6,482.0	5,291.0	1,191.0	446.8
White Bass	1,401.9	1,401.9	0.0	0.0
Bluegill	84.5	84.5	0.0	0.0
Sunfish Hybrid	35.4	35.4	0.0	0.0
Largemouth Bass	35.4	35.4	0.0	0.0
Crappie	16.0	0.0	16.0	5.8

Table 15. Summary of total effort, catch, and CPUE by month and seasonal total from Sherman Reservoir angler creel survey in 1996.

	April	May	June	July	August	September	October	Total
Angler Effort (Total)								
Hours	6,209.7	11,732.0	15,340.0	10,040.0	9,224.8	5,547.8	1,486.8	59,581.1
Hours / Hectare	5.39	10.18	13.32	8.72	8.01	4.82	1.29	51.72
Anglers	1,170.5	2,211.5	2,891.6	1,892.5	1,738.9	1,045.8	280.3	11,231.0
Anglers / Hectare	1.02	1.92	2.51	1.64	1.51	0.91	0.24	9.75
Angler Catch (Total)								
Catch (No.)	5,102.6	7,030.3	10,110.8	5,166.3	4,906.3	3,392.1	225.8	35,934.2
Release (No.)	4,066.1	3,234.8	6,837.8	2,731.5	2,318.6	1,822.4	168.0	21,179.2
Harvest (No.)	1,036.5	3,795.6	3,273.0	2,434.7	2,587.7	1,569.7	57.8	14,755.0
Harvest (Kg)	435.0	1,085.7	894.8	994.5	869.4	563.3	19.6	4,862.3
Angler CPUE (Total)								
Catch (No.) / Hour	0.635	0.779	0.682	0.545	0.535	0.677	0.128	0.636
Release (No.) / Hour	0.528	0.301	0.440	0.255	0.239	0.393	0.088	0.346
Harvest (No.) / Hour	0.107	0.478	0.242	0.290	0.296	0.284	0.039	0.290
Harvest (Kg) / Hour	0.055	0.121	0.061	0.118	0.102	0.115	0.009	0.092

Table 16. Summary of estimated catch, release, and harvest by species from Sherman Reservoir angler creel survey in 1996.

Species	Catch (No.)	Release (No.)	Harvest (No.)	Harvest (Kg)
Common Carp	270.7	188.9	81.7	99.0
Channel Catfish	5,428.7	1,971.0	3,457.7	1,711.3
Northern Pike	124.4	47.3	77.1	245.7
White Bass	3,859.8	1,748.1	2,111.8	605.7
Bluegill	276.7	183.7	93.0	11.0
Largemouth Bass	254.3	203.5	50.7	50.4
Crappie	13,462.6	5,504.0	7,958.7	1,317.4
Yellow Perch	5.0	0.0	5.0	0.5
Walleye	10,569.3	9,874.4	695.0	746.1
Freshwater Drum	1,682.7	1,458.3	224.3	75.3

Table 17. Summary of total catch and catch per unit effort from the standard fall survey and summer seining in Sherman Reservoir in 1996.

Species	Sherman Reservoir		
	Gillnet 4 nets	Framenet 4 nets	Seine 20 hauls
	Total (CPUE)	Total (CPUE)	Total (CPUE)
Gizzard Shad	60 (15.0)	8 (2.0)	2,103 (105.2)
Red Shiner			9 (0.5)
Golden Shiner			121 (6.0)
Emerald Shiner			139 (7.0)
Bigmouth Shiner			2 (0.1)
Common Carp	8 (2.0)	1 (0.2)	11 (0.6)
River Carpsucker	19 (4.8)	2 (0.5)	1 (<0.1)
Shorthead Redhorse	1 (0.2)		
Channel Catfish	50 (12.5)		7 (0.4)
Northern Pike	4 (1.0)	1 (0.2)	
White Bass	57 (14.2)	1 (0.2)	10 (0.5)
Bluegill		10 (2.5)	32 (1.6)
Largemouth Bass	1 (0.2)	3 (0.8)	27 (1.4)
White Crappie	24 (6.0)	95 (23.8)	6 (0.3)
Black Crappie	3 (0.8)	52 (13.0)	1 (<0.1)
Yellow Perch	3 (0.8)		
Walleye	103 (25.8)		
Freshwater Drum	26 (6.5)		86 (4.3)

Table 18. Total number of fish collected by species and collection method from the Middle Loup River irrigation canals in 1996.

Species	Sherman Feeder Canal			Sargent Canal		
	ES (38)	HN (8)	BS (8)	ES (15)	HN (4)	BS (4)
Red Shiner	194 (37.5)		477 (98.4)	20 (3.1)		92 (91.1)
Sand Shiner	74 (14.3)		1 (0.2)	5 (0.8)		
Brassy Minnow				2 (0.8)		1 (1.0)
Fathead Minnow	81 (15.6)		7 (1.4)	150 (23.5)		8 (7.9)
Longnose Dace	2 (0.4)					
Common Carp	37 (7.1)	9 (39.1)		207 (32.5)		
River Carpsucker	1 (0.4)					
White Sucker	3 (0.6)	5 (21.7)		47 (7.4)		
Shorthead Redhorse	15 (2.9)	1 (4.3)		7 (1.1)		
Channel Catfish	44 (8.5)	8 (34.8)				
Green Sunfish	64 (12.4)			141 (22.1)	9 (100.0)	
Bluegill	2 (0.4)			54 (8.5)		
Largemouth Bass				4 (0.6)		
TOTAL	518	23	485	637	9	101

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

APPENDIX A

SAMPLING EFFORT KEY

ES = Backpack Electroshocking (minutes)

HN = Hoop Net (net nights)

BS = Bag Seine (hauls)

Table A1. Total number of fish collected and percent of total by species, collection method, and sampling period at Columbus on the Loup River in 1996.

Table A1	Period 1			Period 2			Period 3			Period 4			Total	
Species	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.8)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	Number	Percent
Goldeye							1 (<0.1)						1	<0.01
Gizzard Shad							2 (0.1)						2	0.02
Speckled Chub									1 (4.4)	11 (0.1)		13 (40.6)	25	0.22
Silver Chub							6 (0.4)			1 (<0.1)		3 (9.4)	10	0.09
Flathead Chub				3 (0.2)			5 (0.3)		1 (4.4)	97 (1.2)		10 (31.2)	116	1.01
Creek Chub														
Red Shiner				466 (37.1)		19 (90.5)	569 (35.1)		3 (13.0)	1553 (18.3)			2,610	22.83
Emerald Shiner							8 (0.5)		17 (73.9)	388 (4.6)			413	3.61
River Shiner				1 (<0.1)			40 (2.5)			794 (9.4)			835	7.30
Bigmouth Shiner				5 (0.4)			12 (0.7)			25 (0.3)			42	0.37
Sand Shiner				52 (4.1)			120 (7.4)			1769 (20.9)		3 (9.4)	1,944	17.00
Western Silvery Minnow				565 (45.0)		2 (9.5)	4 (0.2)		1 (4.4)	3165 (37.4)		3 (9.4)	3,740	32.71
Brassy Minnow				89 (7.1)			115 (7.1)			262 (3.1)			466	4.08
Fathead Minnow				4 (0.4)			14 (0.9)			77 (0.9)			95	0.83
Pearl Dace														
Finescale Dace														

Table A1 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.8)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	Number	Percent
Longnose Dace														
Common Carp				26 (2.1)			5 (0.3)			2 (<0.1)			33	0.29
River Carpsucker				25 (2.0)			501 (30.9)			276 (3.3)			802	7.01
White Sucker														
Shorthead Redhorse														
Black Bullhead				1 (<0.1)									1	<0.01
Yellow Bullhead							1 (<0.1)						1	<0.01
Channel Catfish				17 (1.4)	8 (100)		90 (5.6)	3 (100)		16 (0.2)			134	1.17
Flathead Catfish							1 (<0.1)						1	<0.01
Stonecat														
Plains Topminnow														
Plains Killifish														
Green Sunfish							114 (7.0)			31 (0.4)			145	1.27
Orangespotted Sunfish				1 (<0.1)									1	<0.01
Bluegill							12 (0.7)						12	0.10
Sunfish Hybrid														
Largemouth Bass				1 (<0.1)			3 (0.2)						4	0.03
White Crappie														

Table A1 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.8)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	1,256	8	21	1,623	3	23	8,467	0	32	11,433	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A2. Total number of fish collected and percent of total by species, collection method, and sampling period at Genoa on the Loup River in 1996.

Table A2 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	Number	Percent
Goldeye				1 (<0.1)									1	0.02
Gizzard Shad							57 (5.2)		2 (2.9)				59	1.29
Speckled Chub				1 (<0.1)					5 (7.1)			2 (66.7)	8	0.18
Silver Chub				14 (1.1)									14	0.31
Flathead Chub				9 (0.7)		1 (1.3)	3 (0.3)		1 (1.4)	14 (0.7)			28	0.61
Creek Chub														
Red Shiner				958 (72.5)		47 (62.7)	801 (73.5)		39 (55.7)	995 (50.5)			2,840	62.23
Emerald Shiner				18 (1.4)		9 (12.0)	3 (0.3)		3 (4.3)	244 (12.4)		1 (33.3)	278	6.09
River Shiner				2 (0.2)						93 (4.7)			95	2.08
Bigmouth Shiner										3 (0.2)			3	0.07
Sand Shiner				179 (13.6)		2 (2.7)	115 (10.6)		15 (21.4)	325 (16.5)			636	13.94
Western Silvery Minnow				51 (3.9)		8 (10.7)	4 (0.4)		5 (7.1)	215 (10.9)			283	6.20
Brassy Minnow				17 (1.3)		6 (8.0)	3 (0.3)			38 (1.9)			64	1.40
Fathead Minnow							3 (0.3)			12 (0.6)			15	0.33
Pearl Dace														
Finescale Dace														

Table A2 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	Number	Percent
Longnose Dace				1 (<0.1)									1	0.02
Common Carp				4 (0.3)			7 (0.6)			3 (0.2)			14	0.31
River Carpsucker				40 (3.0)		2 (2.7)	46 (4.2)			10 (0.5)			98	2.15
White Sucker														
Shorthead Redhorse														
Black Bullhead														
Yellow Bullhead														
Channel Catfish				20 (1.5)	19 (100)		21 (1.9)	16 (100)		1 (<0.1)			77	1.69
Flathead Catfish				1 (<0.1)									1	0.02
Stonecat														
Plains Topminnow														
Plains Killifish														
Green Sunfish				2 (0.2)			9 (0.8)			9 (0.5)			20	0.44
Orangespotted Sunfish							4 (0.4)			4 (0.2)			8	0.18
Bluegill				1 (<0.1)			1 (<0.1)			2 (0.1)			4	0.09
Sunfish Hybrid														
Largemouth Bass							8 (0.7)						8	0.18
White Crappie							1 (<0.1)			1 (<0.1)			2	0.04

Table A2 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye				2 (0.2)						1 (<0.1)			3	0.07
Freshwater Drum							4 (0.4)						4	0.09
TOTAL	0	0	0	1,321	19	75	1,090	16	70	1,970	0	3	4,564	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A3. Total number of fish collected and percent of total by species, collection method, and sampling period at Fullerton on the Loup River in 1996.

Table A3	Period 1			Period 2			Period 3			Period 4			Total	
Species	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	ES (30.3)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad							8 (2.6)						8	0.48
Speckled Chub												6 (46.2)	6	0.36
Silver Chub														
Flathead Chub				15 (1.7)		1 (8.3)	25 (8.2)			40 (8.6)		5 (38.5)	86	5.14
Creek Chub														
Red Shiner				782 (89.8)		7 (58.3)	169 (55.8)		2 (66.7)	291 (62.4)			1,251	74.78
Emerald Shiner														
River Shiner							3 (1.0)			5 (1.1)			8	0.48
Bigmouth Shiner														
Sand Shiner				19 (2.2)		1 (8.3)	2 (0.7)			22 (4.7)		2 (15.4)	46	2.75
Western Silvery Minnow														
Brassy Minnow							25 (8.2)			95 (20.4)			120	7.17
Fathead Minnow				2 (0.2)					1 (33.3)	1 (0.2)			4	0.24
Pearl Dace														
Finescale Dace														

Table A3 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	ES (30.3)	HN (4)	BS (4)	Number	Percent
Longnose Dace														
Common Carp				7 (0.8)			5 (1.6)			2 (0.4)			14	0.84
River Carpsucker				12 (1.4)		3 (25.0)	35 (11.5)			5 (1.1)			55	3.29
White Sucker														
Shorthead Redhorse							2 (0.7)						2	0.12
Black Bullhead														
Yellow Bullhead								1 (100)					1	0.06
Channel Catfish				4 (0.5)	3 (75.0)		1 (0.3)						8	0.48
Flathead Catfish														
Stonecat				1 (0.1)									1	0.06
Plains Topminnow														
Plains Killifish														
Green Sunfish				21 (2.4)			15 (5.0)			5 (1.1)			41	2.45
Orangespotted Sunfish							2 (0.7)						2	0.12
Bluegill					1 (25.0)								1	0.06
Sunfish Hybrid														
Largemouth Bass				8 (0.9)			10 (3.3)						18	1.08
White Crappie														

Table A3 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	ES (30.3)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye							1 (0.3)						1	0.06
Freshwater Drum														
TOTAL	0	0	0	871	4	12	303	1	3	466	0	13	1,673	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A4. Total number of fish collected and percent of total by species, collection method, and sampling period at Palmer on the Loup River in 1996.

Table A4 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.3)	HN (4)	BS (4)	ES (30.4)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad							2 (0.2)						2	0.05
Speckled Chub												1 (1.4)	1	0.02
Silver Chub														
Flathead Chub				27 (4.7)		4 (6.2)	9 (0.8)			11 (0.6)		2 (2.9)	53	1.31
Creek Chub				3 (0.5)									3	0.07
Red Shiner				375 (65.0)		33 (50.8)	452 (41.8)		453 (96.8)	893 (50.4)		23 (32.9)	2,229	54.92
Emerald Shiner				1 (0.2)						2 (0.1)			3	0.07
River Shiner				2 (0.3)						44 (2.5)			46	1.14
Bigmouth Shiner				7 (1.2)		9 (13.8)				15 (0.8)			31	0.76
Sand Shiner				33 (5.7)		1 (1.5)	24 (2.2)		3 (0.6)	505 (28.5)		16 (22.9)	582	14.34
Western Silvery Minnow														
Brassy Minnow				82 (14.2)		14 (21.5)	346 (32.0)		12 (2.6)	171 (9.6)		24 (34.3)	649	15.99
Fathead Minnow						1 (1.5)	23 (2.1)			36 (2.0)		1 (1.4)	61	1.50
Pearl Dace				1 (0.2)									1	0.02
Finescale Dace				9 (1.6)									9	0.22

Table A4 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.3)	HN (4)	BS (4)	ES (30.4)	HN (4)	BS (4)	Number	Percent
Longnose Dace														
Common Carp				1 (0.2)			21 (1.9)			11 (0.6)		2 (2.9)	35	0.86
River Carpsucker				16 (2.8)		2 (3.1)	139 (12.8)			56 (3.2)	1 (100)	1 (1.4)	215	5.30
White Sucker														
Shorthead Redhorse							3 (0.3)						3	0.07
Black Bullhead								1 (6.2)					1	0.02
Yellow Bullhead							1 (<0.1)						1	0.02
Channel Catfish				5 (0.9)	7 (100)		7 (0.6)	14 (87.5)		16 (0.9)			49	1.21
Flathead Catfish														
Stonecat				1 (0.2)									1	0.02
Plains Topminnow														
Plains Killifish														
Green Sunfish				8 (1.4)			37 (3.4)			10 (0.6)			56	1.38
Orangespotted Sunfish				1 (0.2)						1 (<0.1)			2	0.05
Bluegill														
Sunfish Hybrid														
Largemouth Bass						1 (1.5)	12 (1.1)	1 (6.2)		2 (0.1)			16	0.40
White Crappie														

Table A4 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.3)	HN (4)	BS (4)	ES (30.4)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch							1 (<0.1)						1	0.02
Walleye				5 (0.9)			1 (<0.1)						6	0.15
Freshwater Drum							4 (0.4)						4	0.10
TOTAL	0	0	0	577	7	65	1,082	16	468	1,773	1	70	4,059	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A5. Total number of fish collected and percent of total by species, collection method, and sampling period at Loup Junction WMA on the Loup River in 1996.

Table A5	Period 1			Period 2			Period 3			Period 4			Total	
Species	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.8)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad							3 (0.8)						3	0.16
Speckled Chub									1 (1.0)			2 (3.4)	3	0.16
Silver Chub														
Flathead Chub				21 (4.5)			6 (1.5)		2 (1.9)	10 (1.2)			39	2.09
Creek Chub														
Red Shiner				306 (66.0)		9 (100)	210 (53.0)		88 (85.4)	622 (75.8)		48 (82.8)	1,283	68.76
Emerald Shiner							1 (0.2)			6 (0.7)		1 (1.7)	8	0.43
River Shiner							6 (1.5)			11 (1.3)			17	0.91
Bigmouth Shiner									4 (3.9)	3 (0.4)			7	0.38
Sand Shiner				12 (2.6)			9 (2.3)		2 (1.9)	28 (3.4)		4 (6.9)	55	2.95
Western Silvery Minnow										2 (0.2)			2	0.11
Brassy Minnow				30 (6.5)			2 (0.5)		1 (1.0)	28 (3.4)		1 (1.7)	62	3.32
Fathead Minnow				1 (0.2)			1 (0.2)			2 (0.2)			4	0.21
Pearl Dace														
Finescale Dace														

Table A5 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.8)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	Number	Percent
Longnose Dace														
Common Carp				55 (11.8)			23 (5.8)			21 (2.6)			99	5.31
River Carpsucker				23 (5.0)			70 (17.7)		5 (4.8)	74 (9.0)		2 (3.4)	174	9.32
White Sucker														
Shorthead Redhorse							1 (0.2)	1 (7.7)		1 (0.1)			3	0.16
Black Bullhead														
Yellow Bullhead														
Channel Catfish				5 (1.1)	3 (100)		4 (1.0)	12 (92.3)		2 (0.2)			26	1.39
Flathead Catfish														
Stonecat														
Plains Topminnow														
Plains Killifish														
Green Sunfish				4 (0.9)			35 (8.8)			9 (1.1)			48	2.57
Orangespotted Sunfish														
Bluegill							13 (3.3)						13	0.70
Sunfish Hybrid														
Largemouth Bass				4 (0.9)			6 (1.5)						10	0.54
White Crappie														

Table A5 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.8)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye				3 (0.6)									3	0.16
Freshwater Drum							6 (1.5)			1 (0.1)			7	0.38
TOTAL	0	0	0	464	3	9	396	13	103	820	0	58	1,866	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A6. Total number of fish collected and percent of total by species, collection method, and sampling period at Boelus on the Middle Loup River in 1996.

Table A6	Period 1			Period 2			Period 3			Period 4			Total	
Species	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.5)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad							8 (1.5)						8	0.45
Speckled Chub														
Silver Chub														
Flathead Chub				3 (0.4)						8 (2.4)			11	0.62
Creek Chub				1 (0.1)									1	0.06
Red Shiner				522 (75.6)		6 (85.7)	393 (74.9)		55 (96.5)	165 (50.5)		96 (91.4)	1,237	69.97
Emerald Shiner				1 (0.1)									1	0.06
River Shiner														
Bigmouth Shiner												1 (1.0)	1	0.06
Sand Shiner				124 (18.0)		1 (14.3)	64 (12.2)		1 (1.8)	28 (8.6)		2 (1.9)	220	12.44
Western Silvery Minnow										1 (0.3)			1	0.06
Brassy Minnow				2 (0.3)			4 (0.8)			29 (8.9)		5 (4.8)	40	2.26
Fathead Minnow				3 (0.4)			4 (0.8)		1 (0.8)	3 (0.9)			11	0.62
Pearl Dace														
Finescale Dace														

Table A6 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.5)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	Number	Percent
Longnose Dace														
Common Carp				1 (0.1)						11 (3.4)			12	0.68
River Carpsucker				7 (1.0)			7 (1.3)			48 (14.7)		1 (1.0)	63	3.56
White Sucker														
Shorthead Redhorse							4 (0.8)			2 (0.6)			6	0.34
Black Bullhead														
Yellow Bullhead														
Channel Catfish				1 (0.1)	36 (97.3)		2 (0.4)	10 (100)			10 (100)		59	3.34
Flathead Catfish														
Stonecat														
Plains Topminnow														
Plains Killifish														
Green Sunfish				24 (3.5)	1 (2.7)		8 (1.5)			4 (1.2)			37	2.09
Orangespotted Sunfish							1 (0.2)						1	0.06
Bluegill														
Sunfish Hybrid							1 (0.2)						1	0.06
Largemouth Bass				1 (0.1)			28 (5.3)			28 (8.6)			57	3.22
White Crappie														

Table A6 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.5)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye														
Freshwater Drum							1 (0.2)						1	0.06
TOTAL	0	0	0	690	37	7	525	10	57	327	10	105	1,768	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A7. Total number of fish collected and percent of total by species, collection method, and sampling period at Bowman Lake SRA on the Middle Loup River in 1996.

Table A7	Period 1			Period 2			Period 3			Period 4			Total	
Species	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	ES (30.3)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad														
Speckled Chub														
Silver Chub														
Flathead Chub				1 (<0.1)									1	0.01
Creek Chub														
Red Shiner				611 (53.7)		10 (41.7)	553 (42.0)		5 (62.5)	1317 (30.3)		620 (62.1)	3,116	39.72
Emerald Shiner				1 (<0.1)		1 (4.2)			1 (12.5)				3	0.04
River Shiner														
Bigmouth Shiner				2 (0.2)		3 (12.5)	6 (0.5)			88 (2.0)		201 (20.1)	300	3.82
Sand Shiner				507 (44.6)		8 (33.3)	474 (36.0)			1598 (36.7)		124 (12.4)	2,711	34.56
Western Silvery Minnow														
Brassy Minnow				1 (<0.1)			43 (3.3)			259 (6.0)		25 (2.5)	328	4.18
Fathead Minnow				2 (0.2)		2 (8.3)	133 (10.1)		2 (25.0)	905 (20.8)		23 (2.3)	1,067	13.60
Pearl Dace														
Finescale Dace														

Table A7 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	ES (30.3)	HN (4)	BS (4)	Number	Percent
Longnose Dace														
Common Carp				1 (<0.1)			5 (0.4)						6	0.08
River Carpsucker				2 (0.2)			62 (4.7)			151 (3.5)		3 (0.3)	218	2.78
White Sucker							1 (<0.1)			5 (0.1)			6	0.08
Shorthead Redhorse				1 (<0.1)	1 (9.1)								2	0.03
Black Bullhead														
Yellow Bullhead														
Channel Catfish				1 (<0.1)	10 (90.9)		1 (<0.1)				1 (100)		13	0.17
Flathead Catfish														
Stonecat							1 (<0.1)					1 (0.1)	2	0.03
Plains Topminnow										4 (<0.1)			4	0.05
Plains Killifish										18 (0.4)		1 (0.1)	19	0.24
Green Sunfish				5 (0.4)			16 (1.2)			3 (<0.1)			24	0.31
Orangespotted Sunfish														
Bluegill							2 (0.2)			2 (<0.1)			4	0.05
Sunfish Hybrid														
Largemouth Bass				2 (0.2)			18 (1.4)						20	0.25
White Crappie														

Table A7 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	ES (30.3)	HN (4)	BS (4)	Number	Percent
Iowa Darter										1 (<0.1)			1	0.01
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	1,137	11	24	1,315	0	8	4,351	1	998	7,845	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A8. Total number of fish collected and percent of total by species, collection method, and sampling period at Arcadia Diversion on the Middle Loup River in 1996.

Table A8 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.8)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad														
Speckled Chub														
Silver Chub														
Flathead Chub				1 (<0.1)									1	<0.01
Creek Chub														
Red Shiner				386 (17.8)			380 (41.9)		22 (70.1)	874 (10.6)			1,662	14.53
Emerald Shiner														
River Shiner														
Bigmouth Shiner				22 (1.0)			12 (1.3)		1 (3.2)	171 (2.1)			206	1.80
Sand Shiner				1212 (55.9)			208 (22.9)		5 (16.1)	938 (11.4)			2,363	20.66
Western Silvery Minnow														
Brassy Minnow				37 (1.7)			35 (3.9)			391 (4.8)			463	4.05
Fathead Minnow				384 (17.7)			133 (14.7)		3 (9.7)	5317 (64.5)			5,837	51.03
Pearl Dace														
Finescale Dace														

Table A8 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.8)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Longnose Dace				2 (<0.1)						1 (<0.1)			3	0.03
Common Carp				4 (0.2)	1 (2.4)		5 (0.5)	1 (2.0)		14 (0.2)			25	0.22
River Carpsucker				48 (2.2)			94 (10.4)			322 (3.9)			464	4.06
White Sucker				14 (0.6)			1 (0.1)			17 (0.2)	1 (25.0)		33	0.29
Shorthead Redhorse							1 (0.1)			2 (<0.1)	2 (50.0)		5	0.04
Black Bullhead														
Yellow Bullhead														
Channel Catfish				1 (<0.1)	39 (95.1)		6 (0.7)	46 (93.9)		4 (<0.1)	1 (25.0)		97	0.85
Flathead Catfish														
Stonecat														
Plains Topminnow				19 (0.9)						1 (<0.1)			20	0.17
Plains Killifish				21 (1.0)			5 (0.6)			176 (2.1)			202	1.77
Green Sunfish				17 (0.8)			21 (2.3)	1 (2.0)		9 (0.1)			48	0.42
Orangespotted Sunfish														
Bluegill					1 (2.4)		1 (0.1)	1 (2.0)					3	0.03
Sunfish Hybrid														
Largemouth Bass							5 (0.6)						5	0.04
White Crappie				1 (<0.1)						1 (<0.1)			2	0.02

Table A8 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.8)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	2,169	41	0	907	49	31	8,238	4	0	11,439	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A9. Total number of fish collected and percent of total by species, collection method, and sampling period at Milburn Diversion on the Middle Loup River in 1996.

Table A9	Period 1			Period 2			Period 3			Period 4			Total	
Species	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad														
Speckled Chub														
Silver Chub														
Flathead Chub				1 (<0.1)						1 (<0.1)			2	0.03
Creek Chub				1 (<0.1)			1 (0.2)			3 (<0.1)			5	0.07
Red Shiner				167 (10.6)			224 (32.8)			1106 (22.8)			1,497	20.83
Emerald Shiner														
River Shiner														
Bigmouth Shiner				11 (0.7)		1 (11.1)	14 (2.0)			25 (0.5)		41 (53.2)	92	1.28
Sand Shiner				685 (43.6)			111 (16.2)			948 (19.6)		35 (45.4)	1,779	24.75
Western Silvery Minnow														
Brassy Minnow				235 (14.9)		6 (66.7)	56 (8.2)			1908 (39.4)			2,205	30.68
Fathead Minnow				409 (26.0)		2 (22.2)	136 (19.9)			707 (14.6)			1,254	17.45
Pearl Dace														
Finescale Dace														

Table A9 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Longnose Dace				5 (0.3)			9 (1.3)			1 (<0.1)			15	0.21
Common Carp							4 (0.6)			3 (<0.1)			7	0.10
River Carpsucker				1 (<0.1)			1 (0.2)					1 (1.3)	3	0.04
White Sucker				17 (1.1)			29 (4.2)			37 (0.8)			83	1.15
Shorthead Redhorse				10 (0.6)	1 (50.0)		20 (2.9)			95 (2.0)			126	1.75
Black Bullhead														
Yellow Bullhead														
Channel Catfish					1 (50.0)								1	0.01
Flathead Catfish														
Stonecat										1 (<0.1)			1	0.01
Plains Topminnow				3 (0.2)			1 (0.2)						4	0.06
Plains Killifish														
Green Sunfish				25 (1.6)			18 (2.6)			6 (0.1)			49	0.68
Orangespotted Sunfish														
Bluegill				2 (0.1)			9 (1.3)						11	0.15
Sunfish Hybrid														
Largemouth Bass				1 (<0.1)			50 (7.3)			2 (<0.1)			53	0.74
White Crappie														

Table A9 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	1,573	2	9	683	0	0	4,843	0	77	7,187	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A10. Total number of fish collected and percent of total by species, collection method, and sampling period at Halsey National Forest on the Middle Loup River in 1996.

Table A10 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad														
Speckled Chub														
Silver Chub														
Flathead Chub														
Creek Chub				26 (2.8)			78 (7.0)			53 (7.5)			157	5.69
Red Shiner				8 (0.9)		1 (50.0)	5 (0.4)			8 (1.1)			22	0.80
Emerald Shiner														
River Shiner														
Bigmouth Shiner				270 (29.1)			58 (5.2)			194 (27.5)		2 (50.0)	524	18.98
Sand Shiner				438 (47.2)			191 (17.0)			250 (35.4)		2 (50.0)	881	31.91
Western Silvery Minnow				43 (4.6)									43	1.56
Brassy Minnow							70 (6.2)			5 (0.7)			75	2.72
Fathead Minnow				4 (0.4)			33 (2.9)			10 (1.4)			47	1.70
Pearl Dace														
Finescale Dace														

Table A10 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	Number	Percent
Longnose Dace				71 (7.6)		1 (50.0)	25 (2.2)			22 (3.1)			125	4.53
Common Carp							15 (1.3)			1 (0.1)			16	0.58
River Carpsucker				1 (0.1)									1	0.04
White Sucker				41 (4.4)			606 (54.1)			144 (20.4)			791	28.65
Shorthead Redhorse				14 (1.5)			11 (1.0)			7 (1.0)			32	1.16
Black Bullhead														
Yellow Bullhead														
Channel Catfish														
Flathead Catfish														
Stonecat				1 (0.1)						1 (0.1)			2	0.07
Plains Topminnow				11 (1.2)									11	0.40
Plains Killifish														
Green Sunfish							2 (0.2)			1 (0.1)			3	0.11
Orangespotted Sunfish														
Bluegill										1 (0.1)			1	0.04
Sunfish Hybrid														
Largemouth Bass							21 (1.9)			9 (1.3)			30	1.09
White Crappie														

Table A10 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	ES (30.2)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	928	0	2	1,121	0	0	706	0	4	2,761	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A11. Total number of fish collected and percent of total by species, collection method, and sampling period at Thedford on the Middle Loup River in 1996.

Table A11 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	ES (30.6)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad														
Speckled Chub														
Silver Chub														
Flathead Chub														
Creek Chub				31 (17.6)			35 (12.8)			19 (13.5)			85	14.36
Red Shiner				2 (1.1)									2	0.34
Emerald Shiner														
River Shiner														
Bigmouth Shiner				11 (6.2)			11 (4.0)			4 (2.8)			26	4.39
Sand Shiner				11 (6.2)			29 (10.6)			43 (30.5)			83	14.02
Western Silvery Minnow														
Brassy Minnow				4 (2.3)			23 (8.4)			2 (1.4)			29	4.09
Fathead Minnow				19 (10.8)			1 (0.4)			2 (1.4)			22	3.72
Pearl Dace														
Finescale Dace														

Table A11 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	ES (30.6)	HN (4)	BS (4)	Number	Percent
Longnose Dace				35 (19.9)			44 (16.1)			10 (7.1)			89	15.03
Common Carp														
River Carpsucker														
White Sucker				57 (32.4)			114 (41.6)	1 (100)		55 (39.0)			227	38.34
Shorthead Redhorse							8 (2.9)			5 (3.6)			13	2.20
Black Bullhead														
Yellow Bullhead														
Channel Catfish														
Flathead Catfish														
Stonecat							2 (0.7)						2	0.34
Plains Topminnow										1 (0.7)			1	0.17
Plains Killifish														
Green Sunfish														
Orangespotted Sunfish														
Bluegill														
Sunfish Hybrid														
Largemouth Bass				6 (3.4)			7 (2.6)						13	2.20
White Crappie														

Table A11 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	ES (30.6)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	176	0	0	274	1	0	141	0	0	592	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A12. Total number of fish collected and percent of total by species, collection method, and sampling period at Mullen on the Middle Loup River in 1996.

Table A12	Period 1			Period 2			Period 3			Period 4			Total	
Species	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (29.3)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad														
Speckled Chub														
Silver Chub														
Flathead Chub				1 (0.4)			2 (1.0)			1 (0.2)			4	0.47
Creek Chub				16 (7.1)			8 (1.9)			8 (1.9)			33	3.85
Red Shiner							4 (1.9)		1 (20.0)				5	0.58
Emerald Shiner														
River Shiner														
Bigmouth Shiner				6 (2.6)			9 (4.5)		1 (20.0)	9 (2.1)			25	2.92
Sand Shiner				9 (4.0)			40 (19.9)			113 (26.8)		1 (100)	163	19.02
Western Silvery Minnow														
Brassy Minnow				94 (41.6)			37 (18.4)		3 (60.0)	151 (35.8)			285	33.26
Fathead Minnow				5 (2.2)			2 (1.0)			6 (1.4)			13	1.52
Pearl Dace							1 (0.5)						1	0.12
Finescale Dace														

Table A12 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (29.3)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Longnose Dace				75 (33.2)			75 (37.3)			56 (13.3)			206	24.04
Common Carp				2 (0.9)									2	0.23
River Carpsucker														
White Sucker				5 (2.2)	2 (100)		18 (9.0)			75 (17.8)			100	11.67
Shorthead Redhorse														
Black Bullhead														
Yellow Bullhead														
Channel Catfish														
Flathead Catfish														
Stonecat										1 (0.2)			1	0.12
Plains Topminnow				2 (0.9)									2	0.23
Plains Killifish														
Green Sunfish				11 (4.9)			4 (2.0)			2 (0.5)			17	1.98
Orangespotted Sunfish														
Bluegill														
Sunfish Hybrid														
Largemouth Bass														
White Crappie														

Table A12 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (29.3)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	226	2	0	201	0	5	422	0	1	857	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A13. Total number of fish collected and percent of total by species, collection method, and sampling period at Halsey Nat'l Forest on the Dismal River in 1996.

Table A13 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.6)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad														
Speckled Chub														
Silver Chub														
Flathead Chub				1 (0.1)			2 (<0.1)						3	0.05
Creek Chub				22 (2.9)			46 (2.1)			52 (1.5)			120	1.82
Red Shiner				54 (7.0)			76 (3.4)		5 (23.8)	110 (3.2)		3 (3.1)	248	3.76
Emerald Shiner														
River Shiner														
Bigmouth Shiner				68 (8.9)		4 (36.4)	335 (15.2)		7 (33.3)	1013 (29.0)		93 (95.9)	1,520	23.05
Sand Shiner				78 (10.2)		1 (9.1)	342 (15.5)		3 (14.3)	1042 (29.9)		1 (1.0)	1,467	22.24
Western Silvery Minnow														
Brassy Minnow				433 (56.5)		6 (54.6)	689 (31.2)		5 (23.8)	479 (13.7)			1,612	24.44
Fathead Minnow				30 (3.9)			343 (15.5)		1 (4.8)	603 (17.3)			977	14.81
Pearl Dace														
Finescale Dace														

Table A13 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.6)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	Number	Percent
Longnose Dace				18 (2.4)			23 (1.0)			2 (<0.1)			43	0.65
Common Carp										1 (<0.1)			1	0.02
River Carpsucker														
White Sucker				45 (5.9)			321 (14.5)			169 (4.8)			535	8.11
Shorthead Redhorse							1 (<0.1)			3 (<0.1)			4	0.06
Black Bullhead														
Yellow Bullhead														
Channel Catfish														
Flathead Catfish														
Stonecat														
Plains Topminnow				1 (0.1)			8 (0.4)			15 (0.4)			24	0.36
Plains Killifish														
Green Sunfish				16 (2.1)			10 (0.5)			1 (<0.1)			27	0.41
Orangespotted Sunfish														
Bluegill							1 (<0.1)	2 (100)					3	0.05
Sunfish Hybrid														
Largemouth Bass							10 (0.4)						10	0.15
White Crappie														

Table A13 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.6)	HN (4)	BS (4)	ES (30.1)	HN (4)	BS (4)	Number	Percent
Iowa Darter							1 (<0.1)						1	0.02
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	766	0	11	2,208	2	21	3,490	0	97	6,595	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A14. Total number of fish collected and percent of total by species, collection method, and sampling period at Hwy 83 Bridge on the Dismal River in 1996.

Table A14 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.5)	HN (4)	BS (4)	ES (31.5)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad														
Speckled Chub														
Silver Chub														
Flathead Chub														
Creek Chub				2 (0.7)			3 (1.1)			2 (0.4)			7	0.65
Red Shiner				4 (1.5)		1 (100)	4 (1.4)			2 (0.4)			11	1.02
Emerald Shiner														
River Shiner														
Bigmouth Shiner				9 (3.3)			15 (5.3)			45 (9.3)		2 (6.2)	71	6.60
Sand Shiner				162 (59.8)			129 (45.4)			328 (67.6)		28 (87.5)	647	60.13
Western Silvery Minnow														
Brassy Minnow				6 (2.2)			1 (0.4)			10 (2.1)			17	1.58
Fathead Minnow				5 (1.8)			11 (3.9)			17 (3.5)			33	3.07
Pearl Dace														
Finescale Dace														

Table A14 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.5)	HN (4)	BS (4)	ES (31.5)	HN (4)	BS (4)	Number	Percent
Longnose Dace				55 (20.3)			47 (16.6)			31 (6.4)		2 (6.2)	135	12.55
Common Carp							1 (0.4)						1	0.09
River Carpsucker														
White Sucker				26 (9.6)	1 (33.3)		70 (24.6)			48 (9.9)			145	13.48
Shorthead Redhorse														
Black Bullhead					2 (66.7)								2	0.19
Yellow Bullhead														
Channel Catfish														
Flathead Catfish														
Stonecat				1 (0.4)			1 (0.4)			2 (0.4)			4	0.37
Plains Topminnow														
Plains Killifish														
Green Sunfish				1 (0.4)									1	0.09
Orangespotted Sunfish														
Bluegill														
Sunfish Hybrid														
Largemouth Bass							2 (0.7)						2	0.19
White Crappie														

Table A14 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.5)	HN (4)	BS (4)	ES (31.5)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	271	3	1	284	0	0	485	0	32	1,076	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

Table A15. Total number of fish collected and percent of total by species, collection method, and sampling period at Hwy 97 Bridge on the Dismal River in 1996.

Table A15 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.4)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Goldeye														
Gizzard Shad														
Speckled Chub														
Silver Chub														
Flathead Chub														
Creek Chub				2 (1.0)			4 (1.8)			8 (3.2)			14	20.6
Red Shiner														
Emerald Shiner														
River Shiner														
Bigmouth Shiner														
Sand Shiner														
Western Silvery Minnow														
Brassy Minnow							1 (0.5)						1	0.15
Fathead Minnow				108 (53.5)		8 (88.9)	83 (38.1)			106 (42.7)			305	44.85
Pearl Dace														
Finescale Dace														

Table A15 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.4)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Longnose Dace				79 (39.1)		1 (11.1)	97 (44.5)			53 (21.4)			230	33.82
Common Carp														
River Carpsucker														
White Sucker				13 (6.4)			33 (15.1)	2 (100)	1 (100)	79 (31.8)			128	18.82
Shorthead Redhorse														
Black Bullhead														
Yellow Bullhead														
Channel Catfish														
Flathead Catfish														
Stonecat														
Plains Topminnow										2 (0.8)			2	0.29
Plains Killifish														
Green Sunfish														
Orangespotted Sunfish														
Bluegill														
Sunfish Hybrid														
Largemouth Bass														
White Crappie														

Table A15 Species	Period 1			Period 2			Period 3			Period 4			Total	
	ES (0)	HN (0)	BS (0)	ES (30.0)	HN (4)	BS (4)	ES (30.4)	HN (4)	BS (4)	ES (30.0)	HN (4)	BS (4)	Number	Percent
Iowa Darter														
Yellow Perch														
Walleye														
Freshwater Drum														
TOTAL	0	0	0	202	0	9	218	2	1	248	0	0	680	100.00

Key: ES = Backpack Electrofishing (Effort = minutes)
HN = Hoop Nets (Effort = net nights)
BS = Bag Seine (Effort = hauls)

APPENDIX B

Table B1. Habitat parameters for sampling period 2 on the Loup River in 1996.

Table B1 Site	Discharge (cfs)	Mean Depth (ft)	Mean Velocity (ft/sec)	Mean Width (ft)	Mean Substrate Composition		
					Silt	Sand	Gravel
LOUP RIVER							
Columbus	225.5	0.51	1.31	277.0	10	84	7
Genoa	52.6	0.42	0.95	129.3	6	94	0
Fullerton	1453.9	1.18	1.57	605.0	16	82	2
Palmer	1562.8	1.81	2.11	390.0	4	95	1
Loup Junction WMA	600.2	1.06	1.61	292.7	12	86	2
MIDDLE LOUP RIVER							
Boelus	336.6	0.48	1.19	462.0	4	95	1
Bowman Lake SRA	385.6	0.84	1.28	226.0	6	92	2
Arcadia Diversion	199.4	0.49	1.17	305.6	5	92	3
Milburn Diversion	1055.2	1.34	1.92	365.0	1	83	16
Halsey Nat'l Forest	420.5	1.35	1.97	154.0	7	85	8
Thedford	339.4	1.85	2.53	73.0	15	77	8
Mullen	138.7	1.58	2.08	41.3	16	76	8
DISMAL RIVER							
Halsey Nat'l Forest	404.4	0.78	1.68	248.3	18	77	5
Hwy 83 Bridge	225.1	1.33	2.01	86.3	7	93	0
Hwy 97 Bridge	90.0	1.31	2.04	34.0	13	86	1

Table B2. Habitat parameters for sampling period 3 on the Loup River in 1996.

Table B2 Site	Discharge (cfs)	Mean Depth (ft)	Mean Velocity (ft/sec)	Mean Width (ft)	Mean Substrate Composition		
					Silt	Sand	Gravel
LOUP RIVER							
Columbus	207.5	0.45	0.96	340.0	14	81	5
Genoa	39.6	0.54	0.76	95.5	6	93	1
Fullerton*	(1900)						
Palmer*	(2000)						
Loup Junction WMA*	(800)						
MIDDLE LOUP RIVER							
Boelus	342.0	0.69	1.13	286.5	6	94	0
Bowman Lake SRA	326.2	0.84	1.17	230.0	11	88	1
Arcadia Diversion	275.0	0.62	1.18	269.0	1	97	2
Milburn Diversion	932.4	1.22	1.68	366.0	5	81	14
Halsey Nat'l Forest	475.9	1.30	2.03	165.6	4	85	11
Thedford	326.6	2.17	2.33	65.7	8	85	7
Mullen	144.3	1.67	2.36	37.0	12	83	5
DISMAL RIVER							
Halsey Nat'l Forest	386.6	0.69	1.58	284.3	13	84	3
Hwy 83 Bridge	219.0	1.81	1.99	74.0	7	92	1
Hwy 97 Bridge	96.1	1.48	2.25	30.1	8	92	0

* no habitat data collected due to high water, and discharge estimates are given in parenthesis

Table B3. Habitat parameters for sampling period 4 on the Loup River in 1996.

Table B3 Site	Discharge (cfs)	Mean Depth (ft)	Mean Velocity (ft/sec)	Mean Width (ft)	Mean Substrate Composition		
					Silt	Sand	Gravel
LOUP RIVER							
Columbus	815.1	0.96	1.72	445.6	3	95	2
Genoa	152.5	1.32	0.66	207.5	4	96	0
Fullerton*	(5100)						
Palmer*	(5500)						
Loup Junction WMA*	(2100)						
MIDDLE LOUP RIVER							
Boelus	1182.3	1.19	2.21	391.0	6	94	0
Bowman Lake SRA	1404.0	0.71	2.01	584.5	3	97	0
Arcadia Diversion	1506.9	0.71	2.42	679.0	6	94	0
Milburn Diversion	1209.3	0.74	2.03	560.0	2	96	2
Halsey Nat'l Forest	496.3	1.15	2.55	171.0	2	96	2
Thedford	340.1	2.21	2.45	63.0	5	93	2
Mullen	151.1	1.69	2.45	36.3	11	77	12
DISMAL RIVER							
Halsey Nat'l Forest	404.0	0.86	1.59	251.3	6	93	2
Hwy 83 Bridge	228.7	1.45	2.13	78.7	7	93	0
Hwy 97 Bridge	94.3	1.66	1.86	31.5	5	94	1

* no habitat data collected due to high water, and discharge estimates are given in parenthesis