Prairie River 2011-2012 Survey Report

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The Prairie River arises near Kinderhook and flows 54 miles northwesterly to its confluence with the St. Joseph River south of the city of Three Rivers. The Prairie River watershed encompasses 201 square miles and includes portions of Branch and St. Joseph counties in Michigan and Steuben County, Indiana. Agriculture is the predominant land use in the watershed. There are two registered dams (Centreville Dam and Lake Templene Dam) on the mainstem. An unknown number of small unregistered dams have been constructed on tributaries to the Prairie River. The portion of the Prairie River from Bowers Road to McKale Road currently is classified as a Type 4 trout stream.

The topography within the watershed is flat to gently rolling. Stream gradient averages 6 ft/mile in Branch County and 3 ft/mile from St. Joseph Road to McKale Road. The surficial geology of this area consists primarily of glacial outwash sand and gravel and postglacial alluvium with scattered end moraines of coarse-textured till. The river flows through a mosaic of soil types, but most of the watershed is covered by sandy loams and loamy sands. In Branch County, the Prairie River is a designated county drain. Many of the tributaries to the mainstem also are designated drains and large portions of the river system have been affected by dredging and channelization. During 1997-2003, temperature loggers were placed at various locations on the Prairie River (Table 1). Mean July water temperatures ranged from 65.7 ^{o}F at Orland Road in 1997 to 69.5 ^{o}F at Burr Oak Road in 2002.

The first fisheries survey on the Prairie River was completed in 1969. Electrofishing near the St. Joseph Road and McKale Road crossings yielded a total of 13 fish species. The only game fish collected during the survey were one adult largemouth bass and a few small yellow perch. In 1971, an annual brown trout stocking program was initiated. For the first decade of this stocking program, yearling brown trout generally were released at the Middle Colon Road and McKale Road crossings. Electrofishing surveys were completed at multiple locations from St. Joseph Road to McKale Road during 1972-1976. The cumulative brown trout catch for this period was 13 fish. Total lengths for captured brown trout varied from 6 inches to 9 inches.

The first electrofishing surveys on the Branch County portion of the Prairie River were conducted in 1977. Twenty-one fish species were collected during this effort, including the creek chubsucker which is listed as endangered in Michigan. Ten brown trout (total length = 7-14 inches) were captured. These fish had moved upstream from their stocking locations in St. Joseph County.

Beginning in spring 1983, yearling brown trout were stocked annually at several sites in Branch and St. Joseph counties (Table 2). During the summer of 1983, electrofishing surveys were conducted at 6 sites on the Prairie River from Bowers Road to US-12. The cumulative catch from Bowers Road to Bawden Road (4 sites) was 104 brown trout. Three brown trout were captured near the Prairie River Road crossing, and zero brown trout were collected near the US-12 crossing. Most of the brown trout were yearlings that presumably were stocked in 1983. Two young-of-year fish and five age 2 fish also were captured, indicating that some natural reproduction was occurring in this system.

Electrofishing was completed near the Cranson Road and Orland Road crossings in 1988. Two yearling brown trout were collected at Cranson Road and zero were captured at Orland Road. Water levels were low, and biologists speculated that trout had moved downstream to find deeper pools.

As part of county drain maintenance, the Prairie River was dredged and large woody structure was removed from Orland Road to approximately 0.5 miles downstream of St. Joseph Road during the early 1990s. These activities reduced the abundance of fish cover in the stream, altered flow regimes, and reduced shading resulting in increased summer water temperatures. In 1992, electrofishing was conducted at five sites from St. Joseph Road to McKale Road. Eight brown trout were collected, including four wild young-of-year fish. Due to the habitat alterations and poor trout catch during the survey, brown trout stocking was discontinued after 1992.

No brown trout were captured during electrofishing surveys conducted near the Block Road, Bowers Road, and St. Joseph Road crossings in 1993 (Kosek 1994). However, sampling completed in 2000 yielded very different results. Brown trout population estimates were obtained for a 725 ft station at Orland Road and an 800 ft station at Bowers Road using the two-pass depletion method. The brown trout population estimates were 175 fish (1,272 fish/mile) at the Orland Road station and 247 fish (1,633 fish/mile) at the Bowers Road station. Young-of-year fish composed 72% of the catch at Orland Road and 92% of the catch at Bowers Road. Only one fish larger than 10 inches was captured at Bowers Road, whereas 11 fish $\geq$ 10 inches were collected at Orland Road. No fish older than age 2 were captured, indicating poor survival or emigration of larger fish. The Michigan Department of Environmental Quality (MDEQ) conducted additional sampling at two sites on the Prairie River in 2005. Seven brown trout were captured at the Bowers Road station and zero trout were collected at the McKale Road station (Walterhouse 2007).

Irrigation commonly is used to enhance agricultural production within the Prairie River watershed. In analyses of past surveys, fisheries managers expressed concerns about the effects of surface water withdrawals on discharge patterns and brown trout production in the river. Since July 9, 2009, Part 327 of Public Act 451 requires all large-quantity withdrawals (defined as 70 gallons per minute [100,000 gallons per day] or greater) to be registered with MDEQ. A water withdrawal assessment tool (WWAT) was created to facilitate estimation of the ecological effects of proposed withdrawals (Hamilton and Seelbach 2011). If a proposed withdrawal is predicted to have adverse effects on the fish community, the applicant is directed to pursue alternative options (e.g., digging a deeper well, finding a different location for a well, or acquiring water from other farmers within the sub-watershed that are not using all of their permitted withdrawal capacity). The Prairie River watershed provides an excellent location to test the logistics of implementing the registration process and assess performance of the WWAT in protecting fish communities under a variety of environmental conditions.

Materials and Methods

A stream shocker (250 V DC, 6A, two probes) was used to capture fish in the Prairie River on July 20, 2011 as part of MDNR's Status and Trends Program. This program involves standardized sampling on randomly selected stream segments to provide information on spatial and temporal trends in Michigan fish communities. The sampling station began 300 ft downstream of the Orland Road crossing and extended upstream for a distance of 800 ft (Figure 1). A single electrofishing run was completed while moving in an upstream direction. Total length was recorded for all brown trout captured. Scale samples were collected from 10 brown trout per inch group for age determination. For non-game fish species, all fish were counted and total lengths were recorded for the first 30 individuals. Weights for all fish species were calculated using the length-weight regression coefficients compiled by Schneider et al. (2000b). Fish habitat and riparian bank conditions within the sampling station were assessed using the methods outlined by Wills et al. (2005). An Onset® Hobo® Temp Pro v2 temperature logger was deployed 30 ft downstream

of the Orland Road crossing on January 12, 2011. The logger was programmed to record water temperatures every hour and was retrieved on December 7, 2011.

A severe drought occurred in 2012 and Fisheries Division received reports of extremely low water levels in the Prairie River. To evaluate the effects of the drought on the brown trout population, electrofishing was conducted at the same 800 ft sampling station on July 30, 2012. Brown trout were captured during a single electrofishing run with a stream shocker (250 V DC, 6A, two probes) while moving in an upstream direction. Total length was recorded for all brown trout captured. No data were collected for non-game fish species.

Additional sampling was completed near the Bowers Road crossing on September 12, 2012. The station began 900 ft downstream of the Bowers Road culvert and extended upstream to the culvert. Brown trout were collected during a single electrofishing run with a stream shocker (250 V DC, 5A, two probes) while moving in an upstream direction. Total length was recorded for all brown trout captured. All non-game fish were counted, but total lengths were not recorded for these species.

Onset® Hobo® Temp Pro v2 temperature loggers were deployed at 19 locations within the Prairie River watershed on March 14, 2012 (Table 3; Figure 1). The loggers were programmed to record water temperatures every hour. The loggers were retrieved during December 18-19, 2012.

Results

In 2011, 228 brown trout were captured at the Orland Road sampling station. The total length range for these fish was 2-22 inches. Seven percent of the brown trout collected were of legal size ($\geq$ 10 inches; Figure 2). Analyses of scale samples revealed the presence of four year classes (ages 0-3). No scales suitable for age determination were obtained from the 22 inch brown trout, but this fish clearly was older than age 3. Young-of-year (YOY) fish composed 60% of the brown trout catch (Figure 3). Mean lengths-at-age were above statewide averages (Figure 4).

Eleven additional fish species were captured during the 2011 fish community survey at Orland Road (Table 4). Hornyhead chubs, blacknose dace, and rainbow darters were the most abundant non-game species in the catch. Coldwater and transitional fish species made up 66% of the catch by number and 91% of the catch by weight.

Gravel and small cobble covered 65% of the Orland Road sampling station in 2011. Deep pools and large woody structure were scarce. Large cobble (11%) and boulders (2%) were present and provided cover for small brown trout. The channel was incised due to past dredging activity, and bank stability was rated as "poor" (50-75% of streambank = bare soil) at 54% of the measurement locations. The estimated discharge at the time of the 2011 survey was 10.4 cfs. During July 2011, the mean water temperature was 67.9 ^{o}F and the mean daily maximum temperature was 70.8 ^{o}F. The mean temperature during the hottest week (July 18-24) was 71.4 ^{o}F.

Only three brown trout were captured at the Orland Road sampling station in 2012. The total length range for these fish was 3-10 inches. Scale samples were not collected for age determination. Based on the total lengths of the fish and the length-at-age data from 2011, the 2012 catch consisted of one YOY fish, one yearling, and one age 2 fish. Data were not collected for non-game species, but abundance of these fish appeared to be substantially lower than in 2011. The estimated discharge at the time of the 2012 survey was 4.3 cfs.

Thirty-seven brown trout were captured at the Bowers Road sampling station in 2012. The total length range for captured brown trout was 3-15 inches (Figure 5). Only three YOY fish were collected. Twelve other fish species were observed during the survey (Table 5). Creek chubs and rainbow darters were the most abundant species in the sampling station. Coldwater and transitional fish species made up 68% of the catch by number.

In 2012, mean July water temperatures in the Prairie River varied from 66.8 ^{o}F at Bowers Road to 74.4 ^{o}F at McKale Road (Tables 6-7). Mean daily maximum water temperatures during July 2012 were lowest at Walker Road (72.6 ^{o}F) and highest at Prairie River Road (84.2 ^{o}F). During the hottest week (July 1-7), mean water temperatures varied from 68.3 ^{o}F at Bowers Road to 77.6 ^{o}F at McKale Road. In general, water temperatures were substantially cooler at the headwaters (Walker Road to Parham Road) than in the downstream reaches (Prairie River Road to McKale Road).

Mean July water temperatures in tributaries to the Prairie River ranged from 57.9 ^{o}F in the Sutter & Pinney Drain to 75.5 ^{o}F in the Blosser Drain. Mean daily maximum water temperatures and mean water temperatures during the hottest week followed a similar trend, being lowest in the Sutter & Pinney Drain and highest in the Blosser Drain. Four tributaries had mean July water temperatures < 68 ^{o}F.

Analysis and Discussion

A variety of factors influence brown trout population dynamics in the Prairie River. Some of these factors involve physical modifications that have long-term effects on the aquatic ecosystem, whereas other factors are continually changing (e.g., discharge and water temperature). Dredging, channelization, and large woody structure removal create physical changes that affect fish habitat in the Prairie River watershed for years or even decades after the projects are completed. On most stream reaches, fish cover (e.g., logjams or undercut banks) is scarce. Stream banks in the dredged channels are steep and often are poorly vegetated. The sediment that erodes from the raw stream banks covers spawning gravel and reduces habitat heterogeneity in the stream bottom and thus production of macroinvertebrates. Sedimentation also increases turbidity, which can reduce brown trout foraging efficiency (Stuart-Smith et al. 2004). The physical changes caused by drain construction and maintenance activities affect fish indirectly by influencing water temperatures and discharge patterns within the river. The removal of trees along the stream bank reduces shading which, in turn, increases summer water temperatures. Dredging, channelization, and draining of wetlands alter the hydrology of the system, resulting in a flow regime characterized by rapid increases in discharge followed by equally rapid decreases in flow.

Discharge patterns strongly influence brown trout abundance in this system. Discharge has been measured at the United States Geological Survey gauge site on the Prairie River near M-66 since October 1962. Brown trout catch rates in the Prairie River were high in 2000 and 2011. Mean monthly flows for June and July were average (within 25% of mean monthly flows for the period of record) in 2000 and above average in 2011. On the other hand, brown trout catch rates were low in 2012 when monthly mean flows for June and July were substantially below the long-term averages. During June 2012, the monthly mean flow was only 13.5 cfs, whereas the long-term average for June was 65 cfs. Daily mean discharge dropped below 5 cfs during July 11-18, 2012 before rain events caused flows to rebound somewhat in late July.

Droughts, such as the one experienced in 2012, affect fish populations in multiple ways. As water levels decline, the quantity of available habitat decreases. Lobón-Cerviá (2007) found that mean stream depth

was an important determinant of the carrying capacity for riverine fish populations, and Stoneman and Jones (2000) demonstrated that the quantity of pool habitat influences trout biomass in southern Ontario streams.

Summer water temperatures also tend to be higher under drought conditions (Elliott 2000), which has important consequences for the brown trout fishery in the Prairie River. Brown trout growth occurs when water temperatures are between 39 ^{o}F and 67 ^{o}F (Elliott 1993), and McMichael and Kaya (1991) observed that brown trout catch per angler hour decreased when water temperatures exceeded 66 ^{o}F. Similarly, brown trout in Jocassee Reservoir exhibited a preference for water $\leq$ 68 ^{o}F (Barwick et al. 2004) and data collected during the Michigan Rivers Inventory indicated that streams with mean July temperatures (MJTs) > 68 ^{o}F rarely supported sizeable trout populations (Andy Nuhfer, MDNR – Fisheries Division, personal communication). Unusually hot weather, coupled with the drought conditions, resulted in abnormally high water temperatures in the Prairie River in 2012. Every site on the mainstem except the Bowers Road site had MJTs > 68 ^{o}F. The MJT at the Prairie River Road crossing was 8 ^{o}F higher in 2012 than in 1997 (when the mean monthly flow for July was close to the long-term average).

The ultimate lethal temperature for brown trout is 85.8 ^{o}F (Elliott 1981). At this temperature, brown trout will perish in approximately 10 minutes. In 2012, this threshold was exceeded on multiple occasions in the Prairie River at Prairie River Road and in four tributary streams (sites 3, 10, 13, and 18; Table 6). The incipient lethal temperature for brown trout is 76.5 ^{o}F (Elliott 1981; Elliott 2000). This is the maximum temperature brown trout can tolerate for a 7 day period. During July 1-7, 2012, mean water temperatures exceeded this threshold in the Blosser and County No. 59 drains and in the Prairie River at the Prairie River Road and McKale Road crossings (Table 6). Mean water temperatures for this period were slightly below the incipient lethal temperature in the Prairie River at St. Joseph Road and in the Stewart Lake Drain.

Some of the tributaries to the Prairie River receive substantial groundwater inputs. These tributaries reduce water temperatures in the mainstem and provide coldwater refugia for brown trout. The Sutter & Pinney, Lanes, County No. 25, and Weaver drains had mean July temperatures < 68 ^{o}F and maintained suitable temperatures for trout through the hottest week of the summer.

In summary, 2012 was a difficult year for brown trout in the Prairie River as evidenced by the drastic decline in brown trout abundance at Orland Road from 2011 to 2012. The low water levels and elevated water temperatures in 2012 were the result of scant precipitation, above average air temperatures, and surface water withdrawals for irrigation. Low water levels in 2012 also exacerbated conflicts between irrigators, anglers, and riparian landowners.

Some of the thermal classifications in the WWAT appear to be incorrect. Mean July water temperature and the species composition of the fish community are used to assign stream segments to a particular thermal class. Because 2012 was an abnormally hot, dry year the MJTs measured in 2012 were higher than would be expected in a “normal” year. Thus, it would not be appropriate to move a stream segment from its current thermal class to a warmer thermal class based on the 2012 data. Conversely, it would be appropriate to move a stream from its current thermal class to a colder thermal class based on the 2012 data. For example, the Sutter & Pinney Drain currently is classified as a warm stream, but its MJT in 2012 indicates that it should be classified as a cold stream. Fish community data are lacking for the Sutter & Pinney Drain and most tributaries to the Prairie River. Due to their small size and lack of public access, fishing pressure on these streams is minimal. From a fisheries standpoint, the primary functions of these streams are to provide cold water for the mainstem and to serve as short-term coldwater refuges for trout

and other fish that spend most of their lives in the Prairie River. Thus, thermal classifications for these streams should be based primarily on MJTs.

The Branch County portion of the Prairie River currently is classified as a warm stream. The 2012 temperature logger data for sites from Parham Road to St. Joseph Road supports this classification. However, warm streams do not support naturally reproducing brown trout populations. The 2011 electrofishing survey at Orland Road and the 2012 electrofishing survey at Bowers Road revealed fish communities dominated by coldwater and transitional fish species (Tables 4-5), which is indicative of a cold-transitional stream (Lyons et al. 2009). Furthermore, the MJT recorded at Bowers Road in 2012 and the MJT recorded at Orland Road in 1997 were within the expected range for a cold transitional stream (Table 1). In 2011, the MJT at Orland Road (67.9 ^{o} F) was slightly above the range for cold transitional streams; however, the mean air temperature for July also was above average (Jeruzal 2011). Based on all of the available evidence, the portion of the Prairie River upstream of the Bronson No. 12 Drain confluence should be classified as a cold transitional stream and the stream segment between the Bronson No. 12 Drain confluence and St. Joseph Road should be reclassified as a warm transitional stream.

This study has focused on the brown trout because it is the species that is most sensitive to elevated water temperatures in the Prairie River. However, all fish species are negatively affected by reductions in pool habitat and removal of large woody structure. Another group of organisms that could be particularly affected by low flow conditions is freshwater mussels. Recent data on mussel abundance and distribution in the Prairie River are not available. According to the Michigan Natural Features Inventory Database (http://mnfi.anr.msu.edu/), three special concern species (elktoe, ellipse, and rainbow) were found in the lower reaches of the river in 1930. As mussels have limited mobility, they are subject to desiccation when water levels drop rapidly. Golladay et al. (2002) documented an 80% decline in mussel abundance in several Georgia rivers under drought conditions. Like the Prairie River, these streams were connected to aquifers that were heavily utilized for irrigation.

A creek chubsucker was captured in the Prairie River in 1977, but no creek chubsuckers were observed during the 2011 and 2012 electrofishing surveys. This species typically is found in clear headwater streams and is highly sensitive to siltation and pollution (Carman 2001). Additional work is needed to determine the status of this state-endangered species in the Prairie River watershed.

Management Recommendations

The Prairie River has supported a self-sustaining brown trout fishery since 1992. As the only trout stream in Branch County, it is a unique resource that should be protected. Habitat degradation is the main factor limiting trout production in this system. Eight management goals have been developed for the Prairie River. Goal 1: Support MDEQ's and Michigan Department of Agriculture and Rural Development's (MDARD) efforts to identify unregistered water withdrawals. Goal 2: Change the thermal classifications for some stream segments within the Prairie River watershed based on mean July water temperatures and fish community data. Goal 3: Reduce rapid fluctuations in stream discharge. Goal 4: Reduce erosion and sedimentation. Goal 5: Increase fish cover within the Prairie River and tributary streams. Goal 6: Monitor the brown trout population to ascertain if it can recover from the drought of 2012. Goal 7: Collect additional information on the status and distribution of creek chubsuckers in the Prairie River watershed. Goal 8: Collect additional information on the abundance and distribution of mussels in the Prairie River.

To accomplish Goal 1, Fisheries Division will work with MDEQ, MDARD, and other partners to identify unregistered water withdrawals within the watershed. MDEQ has scheduled an "on-the-ground"

assessment of water withdrawals in 2013. Fisheries Division will continue to work with various partners to inform irrigators and other interested stakeholders of the ecological consequences of excessive water withdrawals.

The 2012 temperature logger and 2011-2012 fish community data revealed major discrepancies between the existing thermal classifications in the WWAT and the actual conditions in several stream segments within the Prairie River watershed. Reclassifications are recommended for the following stream segments (proposed thermal classifications listed): Prairie River upstream of the Bronson No. 12 Drain confluence = cold transitional, Prairie River between the Bronson No. 12 Drain confluence and St. Joseph Road = warm transitional, Lanes Drain = cold, Weaver Drain = cold transitional, County No. 25 Drain = cold transitional, and Sutter & Pinney Drain = cold. In 2013, temperature loggers will be deployed in roughly the same locations as in 2012. This data will be used to further evaluate and refine the thermal classifications for stream segments within the watershed.

A variety of methods will be used to accomplish Goal 3. One approach for reducing stream flashiness is to slow the movement of runoff into the river through restoration of wetlands. The Friends of the St. Joe River (Friends) received funding from the United States Environmental Protection Agency to conduct a functional assessment of all historic and existing wetlands within the St. Joseph River watershed. That assessment is nearly completed. The Friends and partner organizations have used this tool to identify high quality wetlands for protection (e.g., conservation easements) and potential sites for wetland restoration. This information will be relayed to local units of government so that they can incorporate wetland conservation and restoration planning into their zoning and ordinances. The wetlands tool also has been used to identify and invite landowners to wetland protection and restoration workshops, and some wetland restoration projects already are underway as a result of these efforts. Another method to reduce stream flashiness is to restore connectivity between the river and its floodplain. This could be accomplished by cutting berms or creating a floodplain within the banks (i.e., a two-stage ditch). As much of the Prairie River system consists of designated drains, such projects would require extensive collaboration with the Branch County and St. Joseph County drain commissioners. The measures outlined for Goals 1 and 2 also will facilitate attainment of Goal 3.

Throughout much of the watershed, stream banks are steep and sparsely vegetated. Thus, sediment is a major pollutant in this system. The Branch County Conservation District (BCCD) has received a Section 319 (Nonpoint Source Management Program) grant to write a watershed management plan for the Prairie River. One component of the planning process is to identify sources of sedimentation and develop strategies to reduce sediment inputs to the river. Fisheries Division will work with BCCD, MDEQ, riparian landowners, and the drain commissioners to implement soil erosion and sediment control practices throughout the watershed. Goals 3-4 are inter-related, and the measures discussed for Goal 3 also will facilitate progress toward accomplishing Goal 4.

Large woody structure has been cleared from many stream reaches to facilitate rapid downstream movement of water. The removal of large woody structure directly affects trout by reducing habitat complexity and abundance of holding cover and affects trout indirectly by reducing abundance of macroinvertebrates. Fisheries Division will work with the county drain commissioners to develop options for retaining fish cover (i.e., Goal 5) while meeting the needs of the adjacent landowners.

To accomplish Goals 6 and 7, electrofishing surveys will be conducted at the Orland Road and Bowers Road sampling stations during the summer of 2013. These surveys will follow the same sampling

protocols as the 2011 Status and Trends survey at Orland Road. Brown trout stocking is not recommended at this time, but may be prescribed if catch rates do not improve in 2013.

Nineteen mussel species are listed as threatened or endangered in Michigan, and several of these species have been found in Branch and St. Joseph counties. To accomplish Goal 8, Fisheries Division will request assistance from mussel experts from universities, private consulting firms, or other organizations. Mussel surveys will be conducted at various locations along the mainstem Prairie River, and Fisheries Division personnel will assist with these surveys as necessary.

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Table 1.–Mean July water temperatures and mean daily maximum water temperatures in July at various locations on the Prairie River, 1997-2003. Water temperatures were recorded with Onset StowAway® loggers. Water temperatures were recorded every hour in 2003 and once every 2 hours during 1997-2002.

Site	Year	Mean July temperature (°F)	Mean daily maximum temperature (°F)
Orland Road	1997	65.7	69.2
Prairie River Road	1997	66.4	71.0
Burr Oak Road	1998	68.9	71.7
Burr Oak Road	2002	69.5	72.4
St. Joseph Road	2003	69.3	72.6

Table 2.–Brown trout stocking in the Prairie River, 1979-1992. Unless otherwise indicated, all fish were stocked as yearlings.

Year	County	Site	Number	Average length (inches)
1979	St. Joseph	Middle Colon Road	2,100	6.24
1980	St. Joseph	McKale Road*	12,000	2.84
1982	St. Joseph	Middle Colon Road	1,800	4.68
		Needham Road	1,300	4.68
		McKale Road	2,200	4.68
1983	Branch	Bowers Road	800	6.36
		Snow Prairie Road	1,000	6.36
		Cranson Road	1,200	6.36
		Rierson Road	1,200	6.36
		Orland Road	1,000	6.40
		Bawden Road	1,200	6.40
	St. Joseph	Middle Colon Road	1,350	6.40
		Needham Road	1,000	6.40
		McKale Road	2,910	6.40
1984	Branch	Bowers Road	800	5.92
		Snow Prairie Road	1,000	5.84
		Cranson Road	1,200	5.84
		Rierson Road	1,200	5.92
		Orland Road	1,000	5.84
		Prairie River Road	1,000	5.84
	St. Joseph	Middle Colon Road	2,000	5.84
		Needham Road	1,500	5.84
		McKale Road	2,500	6.84
1985	Branch	Bowers Road	520	6.40
		Snow Prairie Road	680	6.28
		Cranson Road	1,010	7.44
		Rierson Road	1,010	6.40
		Orland Road	680	6.28
		Bawden Road	1,010	6.36
		Prairie River Road	810	6.36
	St. Joseph	Middle Colon Road	1,530	6.36
		Needham Road	1,030	6.36
		McKale Road	1,530	6.36
1986	Branch	Bowers Road	580	6.48
		Snow Prairie Road	850	6.96
		Cranson Road	1,050	6.96
		Rierson Road	1,050	6.48
		Orland Road	850	6.96

Table 2.–Continued.

Year	County	Site	Number	Average length (inches)
1986	Branch	Bawden Road	1,050	6.96
		Prairie River Road	850	6.96
	St. Joseph	Middle Colon Road	1,500	5.68
		Needham Road	1,000	5.68
		McKale Road	1,500	5.68
1987	Branch	Bowers Road	620	5.92
		Snow Prairie Road	880	5.72
		Cranson Road	1,080	5.72
		Rierson Road	1,080	5.92
		Orland Road	880	5.72
		Bawden Road	1,080	5.72
		Prairie River Road	880	5.72
	St. Joseph	Middle Colon Road	1,700	6.44
		Needham Road	1,200	6.44
		McKale Road	1,700	6.44
1988	Branch	Bowers Road	800	5.56
		Snow Prairie Road	1,000	5.56
		Cranson Road	1,200	5.56
		Rierson Road	1,200	5.56
		Orland Road	1,000	5.56
		Bawden Road	1,200	5.56
		Prairie River Road	1,000	5.56
	St. Joseph	Middle Colon Road	2,030	5.36
		Needham Road	1,530	5.36
		McKale Road	2,030	5.36
1989	Branch	Bowers Road	800	5.92
		Snow Prairie Road	1,000	5.92
		Cranson Road	1,200	5.92
		Rierson Road	1,200	5.92
		Orland Road	1,000	5.92
		Bawden Road	1,200	5.92
		Prairie River Road	1,000	5.92
	St. Joseph	Middle Colon Road	2,000	6.36
		Needham Road	1,500	6.36
		McKale Road	2,000	6.36
1990	Branch	Bowers Road	800	5.08
		Snow Prairie Road	1,000	5.32
		Cranson Road	1,200	5.32
		Rierson Road	1,200	5.08

Table 2.–Continued.

Year	County	Site	Number	Average length (inches)
1990	Branch	Orland Road	1,000	5.32
		Bawden Road	1,200	5.32
		Prairie River Road	1,000	5.32
	St. Joseph	Middle Colon Road	2,000	5.32
		Needham Road	1,500	5.32
		McKale Road	2,000	5.32
1991	Branch	Bowers Road	783	5.92
		Snow Prairie Road	981	5.92
		Cranson Road	1,179	5.92
		Rierson Road	1,179	5.92
		Orland Road	990	5.92
		Bawden Road	1,190	5.92
		Prairie River Road	990	5.92
	St. Joseph	Middle Colon Road	2,075	5.84
		Needham Road	1,554	5.84
		McKale Road	2,076	5.84
1992	Branch	Cranson Road	1,189	6.08
		Rierson Road	1,190	6.08
		Orland Road	989	6.08
		Prairie River Road	989	6.08
	St. Joseph	Middle Colon Road	1,960	6.08
		Needham Road	1,460	6.08
		McKale Road	1,960	6.08

* Fish stocked as spring fingerlings

Table 3.–Temperature logger deployment sites in the Prairie River watershed, March-December 2012.

Site #	Stream	Nearest road crossing	Latitude	Longitude
1	Kinderhook No. 2 Drain	Southern Road	41.78185	-85.04713
2	Prairie River	Walker Road	41.78982	-85.05432
3	County No. 59 Drain	Block Road	41.79531	-85.08363
4	Lanes Drain	Booth Road	41.78934	-85.10760
5	Weaver Drain	Rubley Road	41.80086	-85.11448
6	Prairie River	Bowers Road	41.80065	-85.11459
7	Prairie River	Parham Road	41.83259	-85.16540
8	County No. 25 Drain	Cemetery Road (adjacent)	41.83767	-85.18483
9	Bethel & Bronson No. 4 & 1 Drain	Kosmerick Road	41.84014	-85.19125
10	Bronson No. 12 Drain	Bawden Road	41.84206	-85.21640
11	Prairie River	Prairie River Road	41.82777	-85.23374
12	Sutter & Pinney Drain	Prairie River Road	41.82412	-85.23357
13	Blosser Drain	Douglas Road	41.82559	-85.24585
14	County No. 10 Drain	Carpenter Road	41.83995	-85.25733
15	Prairie River	St. Joseph Road	41.84124	-85.29345
16	Burr Oak County Line Drain	Burr Oak Road	41.84111	-85.31136
17	Prairie River	Middle Colon Road	41.85466	-85.33116
18	Stewart Lake Drain	Cowles Road	41.86555	-85.35725
19	Prairie River	McKale Road	41.87097	-85.36916

Table 4.–Numbers, calculated weights, total lengths, and thermal classifications for fish species collected at the Orland Road electrofishing station on the Prairie River on July 20, 2011. Thermal classifications from Lyons et al. (2009).

Species	Number	Percent by number	Weight (lb)	Percent by weight	Total length range (inches)	Thermal classification
Brown trout	228	46.2	23.5	74.2	2-22	Coldwater
Hornyhead chub	108	21.9	2.2	7.0	1-7	Warmwater
Blacknose dace	58	11.8	0.3	0.9	1-2	Transitional
Rainbow darter	49	9.9	0.2	0.5	1-2	Warmwater
Johnny darter	12	2.4	0.1	0.2	2-3	Transitional
Northern hog sucker	10	2.0	4.2	13.1	7-12	Transitional
Grass pickerel	9	1.8	0.3	0.9	2-9	Warmwater
White sucker	7	1.4	0.7	2.1	1-11	Transitional
Creek chub	4	0.8	0.2	0.6	2-7	Transitional
Central mudminnow	4	0.8	0.0	0.1	2-3	Transitional
American brook lamprey	3	0.6	0.0	0.1	5-5	Transitional
Green sunfish	1	0.2	0.0	0.1	3	Warmwater
Total	493		31.7			

Table 5.–Numbers and thermal classifications for fish species collected at the Bowers Road electrofishing station on the Prairie River on September 12, 2012. Thermal classifications from Lyons et al. (2009).

Species	Number	Percent by number	Thermal classification
Creek chub	496	43.3	Transitional
Rainbow darter	346	30.2	Warmwater
Johnny darter	123	10.7	Transitional
White sucker	90	7.9	Transitional
Brown trout	37	3.2	Coldwater
Blacknose dace	28	2.4	Transitional
Grass pickerel	10	0.9	Warmwater
Bluegill	5	0.4	Warmwater
Green sunfish	5	0.4	Warmwater
Yellow bullhead	2	0.2	Warmwater
Northern hog sucker	1	0.1	Transitional
Pirate perch	1	0.1	Warmwater
Central mudminnow	1	0.1	Transitional
Total	1,145		

Table 6.–Mean July water temperatures, mean daily maximum water temperatures in July, and mean water temperatures during the hottest week (July 1-7) at various sites within the Prairie River watershed in 2012. All temperatures are in degrees Fahrenheit.

Site #	Stream	Nearest road crossing	Mean July water temperature	Mean daily maximum water temperature in July	Mean water temperature during hottest week
1	Kinderhook No. 2 Drain	Southern Road	69.8	71.4	70.8
2	Prairie River	Walker Road	68.8	72.6	70.1
3	County No. 59 Drain	Block Road	73.9	81.7	76.9
4	Lanes Drain	Booth Road	63.3	70.1	64.3
5	Weaver Drain	Rubley Road	66.2	72.7	67.7
6	Prairie River	Bowers Road	66.8	73.7	68.3
7	Prairie River	Parham Road	70.2	73.0	71.9
8	County No. 25 Drain	Cemetery Road (adjacent)	64.3	68.3	66.8
9	Bethel & Bronson No. 4 & 1 Drain	Kosmerick Road	68.5	71.6	71.2
10	Bronson No. 12 Drain	Bawden Road	72.2	82.6	75.1
11	Prairie River	Prairie River Road	74.3	84.2	76.6
12	Sutter & Pinney Drain	Prairie River Road	57.9	61.6	56.0
13	Blosser Drain	Douglas Road	75.5	83.6	78.0
14	County No. 10 Drain	Carpenter Road	72.3	75.9	67.7
15	Prairie River	St. Joseph Road	74.1	77.4	76.3
16	Burr Oak County Line Drain*	Burr Oak Road	---	---	---
17	Prairie River*	Middle Colon Road	---	---	---
18	Stewart Lake Drain	Cowles Road	72.6	80.9	76.4
19	Prairie River	McKale Road	74.4	77.9	77.6

* Temperature loggers were stolen or washed downstream

Table 7.–Mean July water temperatures (MJTs), current thermal classifications in Michigan's Water Withdrawal Assessment Tool, and thermal classifications based on water temperature data collected within the Prairie River watershed in 2012. All temperatures are in degrees Fahrenheit. For 2012, streams were classified as cold if MJT was < 63.5 ^{o}F, cold transitional if MJT was between 63.5 ^{o}F and 67.1 ^{o}F, cool if MJT was between 67.1 ^{o}F and 69.8 ^{o}F, and warm if MJT was > 69.8 ^{o}F.

Site #	Stream	Nearest road crossing	Mean July water temperature	Current thermal classification	Thermal classification based on 2012 data
1	Kinderhook No. 2 Drain	Southern Road	69.8	Warm	Cool
2	Prairie River	Walker Road	68.8	Warm	Cool
3	County No. 59 Drain	Block Road	73.9	Warm	Warm
4	Lanes Drain	Booth Road	63.3	Warm	Cold
5	Weaver Drain	Rubley Road	66.2	Warm	Cold transitional
6	Prairie River	Bowers Road	66.8	Warm	Cold transitional
7	Prairie River	Parham Road	70.2	Warm	Warm
8	County No. 25 Drain	Cemetery Road (adjacent)	64.3	Warm	Cold transitional
9	Bethel & Bronson No. 4 & 1 Drain	Kosmerick Road	68.5	Warm	Cool
10	Bronson No. 12 Drain	Bawden Road	72.2	Warm	Warm
11	Prairie River	Prairie River Road	74.3	Warm	Warm
12	Sutter & Pinney Drain	Prairie River Road	57.9	Warm	Cold
13	Blosser Drain	Douglas Road	75.5	Warm	Warm
14	County No. 10 Drain	Carpenter Road	72.3	Warm	Warm
15	Prairie River	St. Joseph Road	74.1	Cool	Warm
16	Burr Oak County Line Drain*	Burr Oak Road	---	Cool	---
17	Prairie River*	Middle Colon Road	---	Cool	---
18	Stewart Lake Drain	Cowles Road	72.6	Cool	Warm
19	Prairie River	McKale Road	74.4	Cool	Warm

* Temperature loggers were stolen or washed downstream

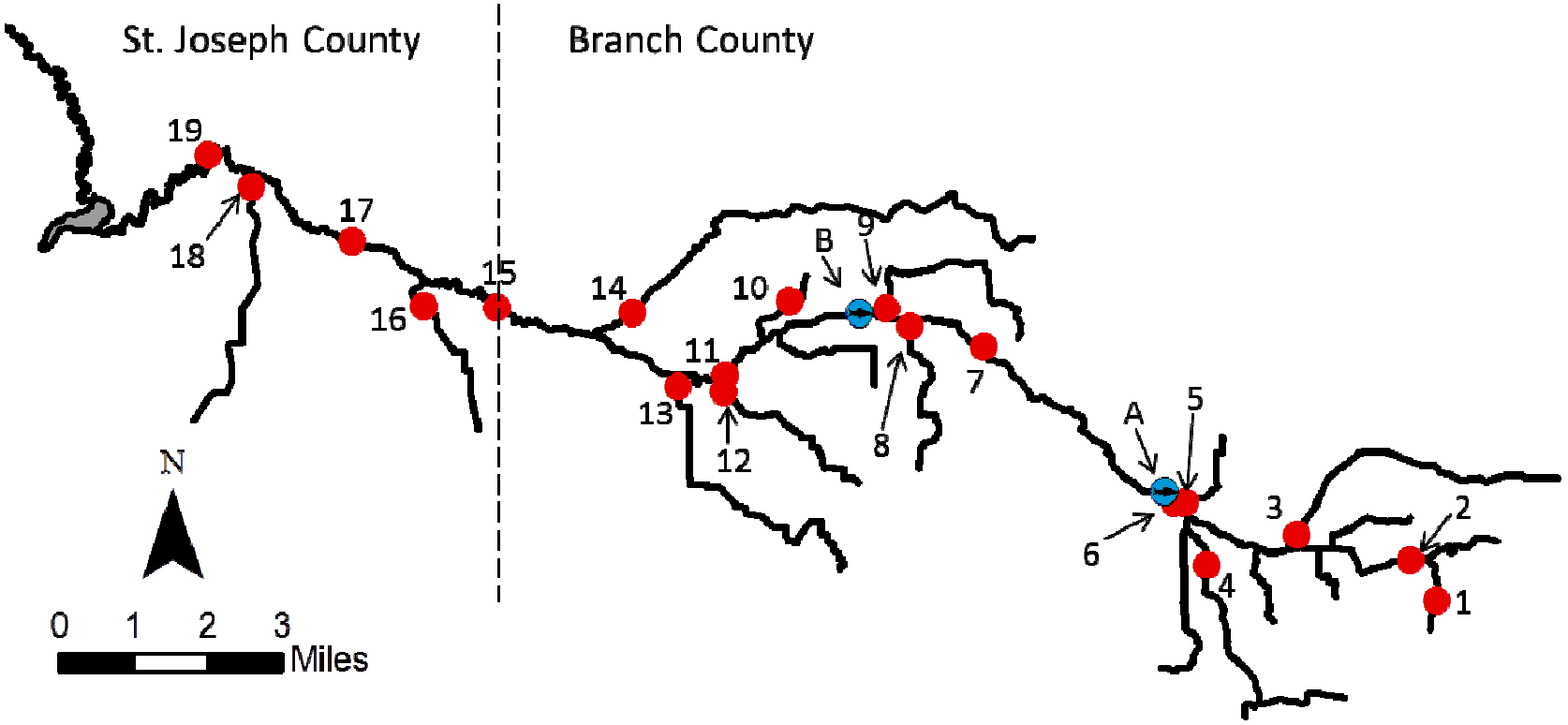

Figure 1.–Sampling locations in the Prairie River watershed. Red dots indicate sites where temperature loggers were deployed during March-December, 2012. The blue dots (A = Orland Road and B = Bowers Road) indicate locations where electrofishing was conducted during 2012. (See Table 3 for descriptions of temperature logger deployment sites.)

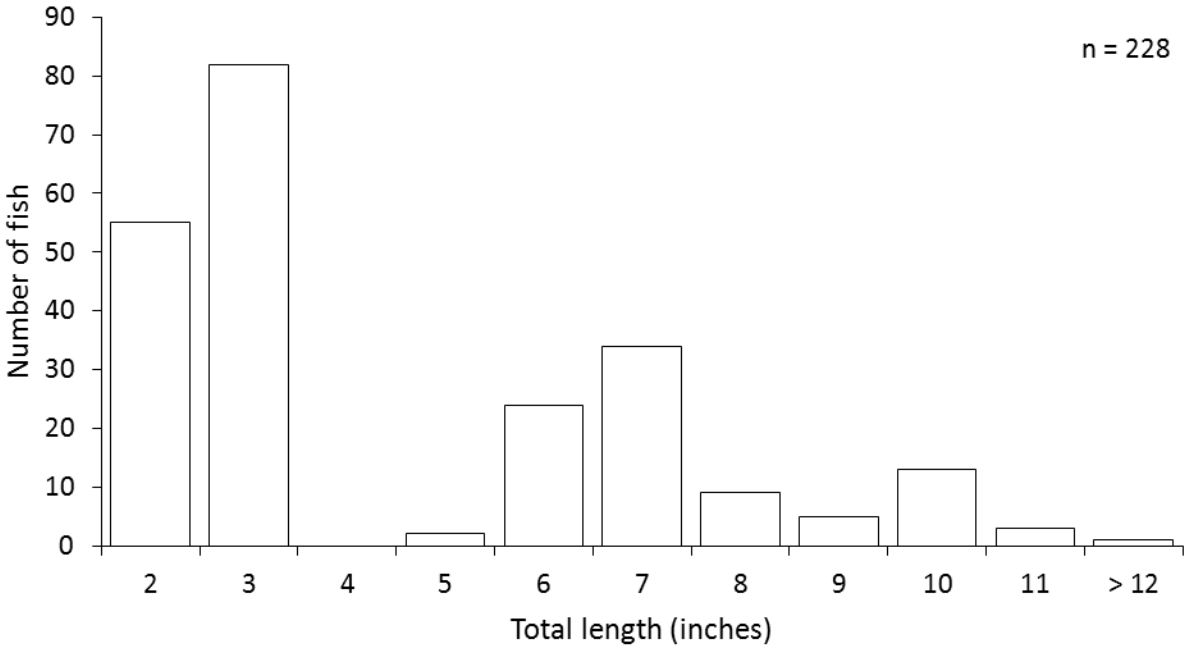

Figure 2.–Length frequency distribution for brown trout captured at the Orland Road sampling station on the Prairie River on July 20, 2011.

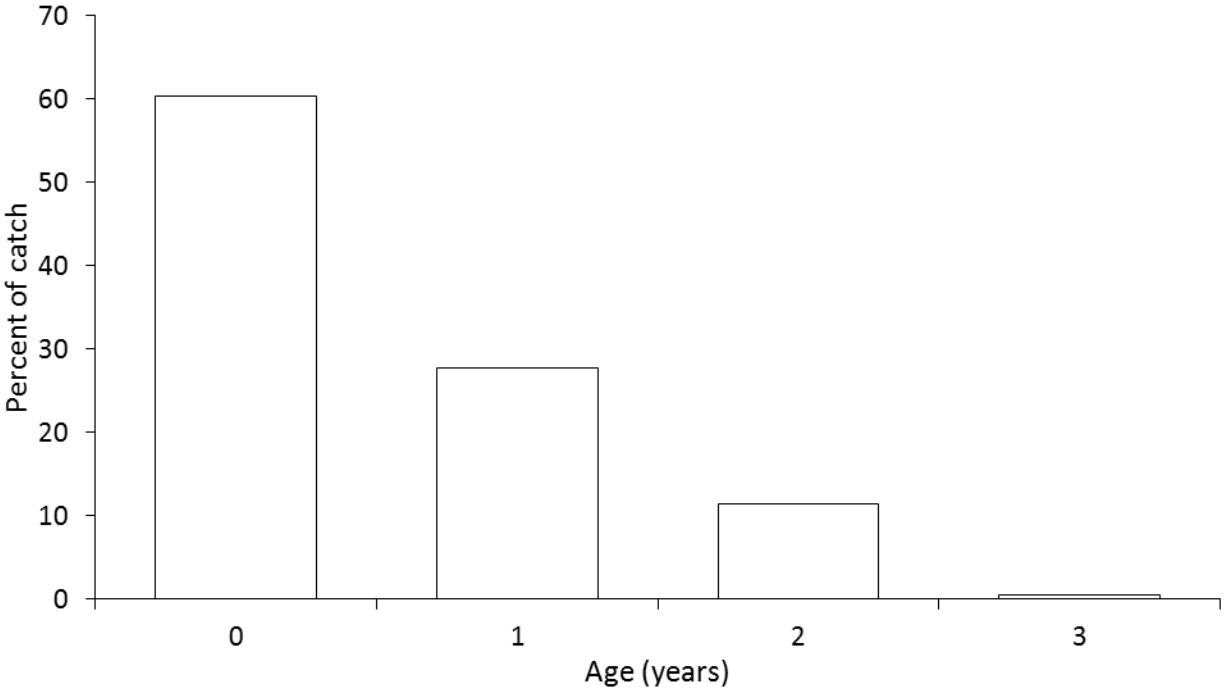

Figure 3.–Age frequency distribution for brown trout captured at the Orland Road sampling station on the Prairie River on July 20, 2011.

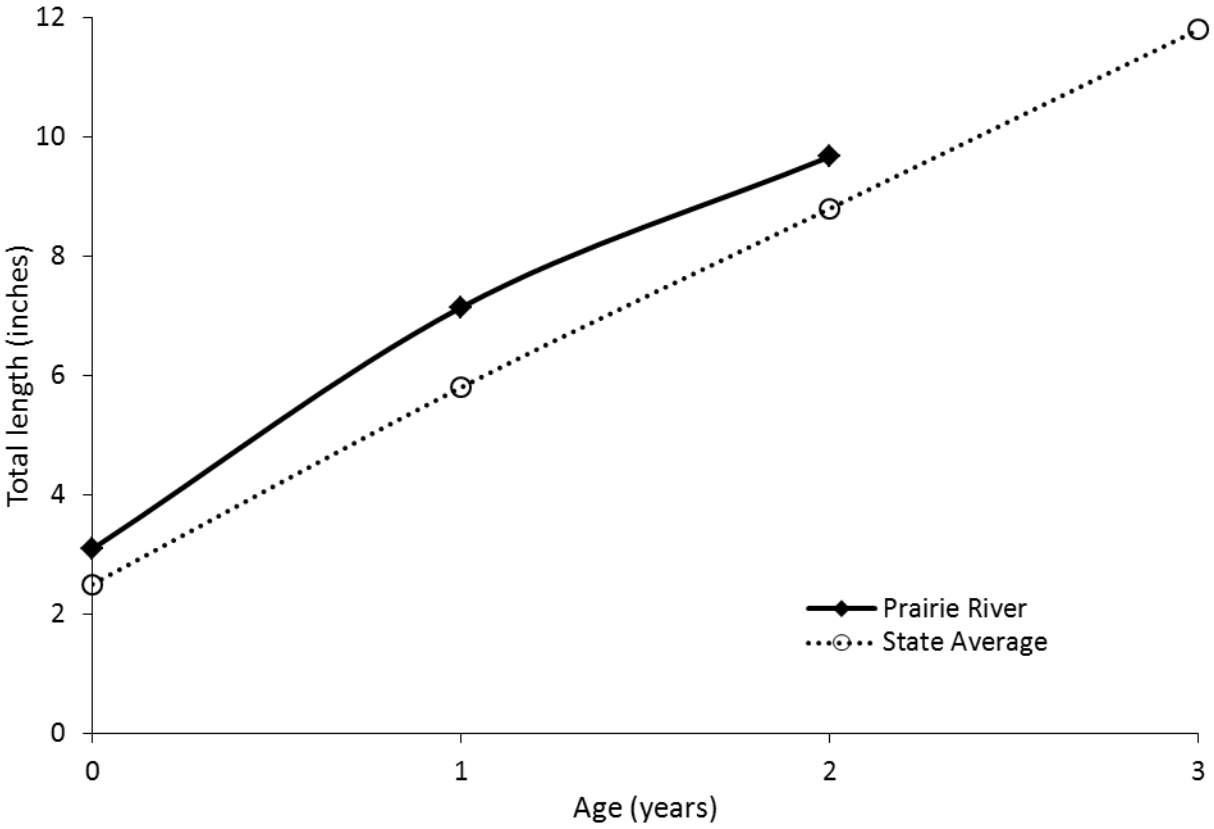

Figure 4.–Growth of brown trout in the Prairie River, as determined from scale samples collected at the Orland Road sampling station on July 20, 2011. State average lengths for June-July are from Schneider et al. (2000a).

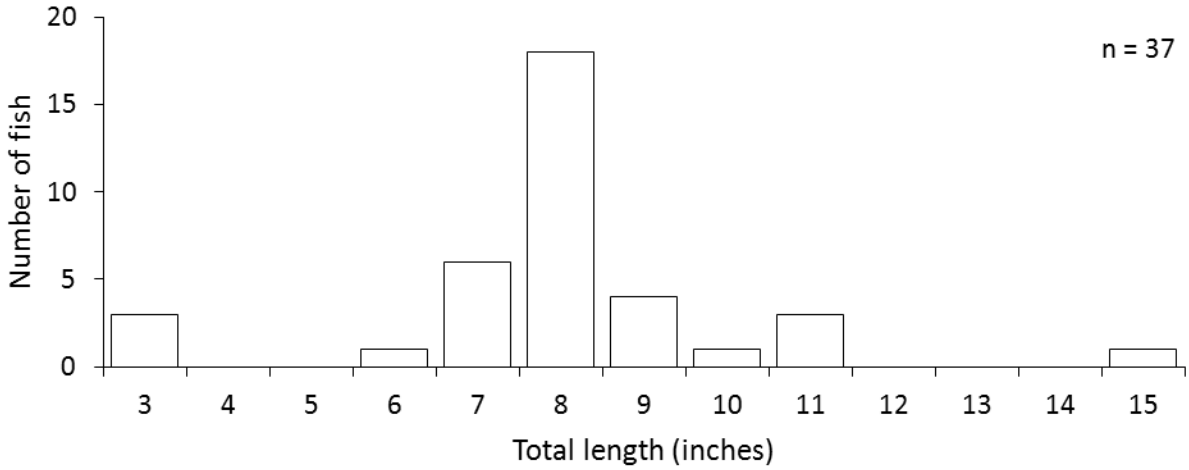

Figure 5.–Length frequency distribution for brown trout captured at the Bowers Road sampling station on the Prairie River on September 12, 2012.