Pine and Sand Creeks
Allegan, Kalamazoo, and Van Buren Counties, 1N/13W, 1S/13W, 1S/12W
Kalamazoo River Watershed, Surveyed July 17, 2019

Matthew Diana, Fisheries Biologist

Environment

Pine Creek is a tributary to the Kalamazoo River that drains a 235.8-square-mile watershed in Kalamazoo, Van Buren, and Allegan Counties. The watershed is mainly agricultural (49.6%) but also has good amounts of forest (23.7%) and wetland (15.1%) and only minor components of urban (8.4%), grassland (1.6%), open water (1.5%), and barren (0.2%) land use. Almost all of the watershed is a designated drain and as a result the stream has been straightened for much of the length and has repeatedly been dredged. Pine Creek is designated as a cold stream in the headwaters. The stream is referred to as Sand Creek in Kalamazoo County and flows from the east into Van Buren County where it meets a small tributary and is referred to locally as Mentha Drain (Figure 1). The stream turns north along the Van Buren and Kalamazoo County line and is referred to as Pine Creek throughout the rest of its length. Pine Creek remains cold transitional as it flows downstream until the confluence with Baseline Creek that enters from the west just after the stream crosses the Allegan County border. Downstream of this point, Pine Creek is classified as a warm-transitional small river and continues to flow northward to its confluence with the Kalamazoo River.

Pine Creek was impounded historically by water backing up from Otsego Township Dam on the Kalamazoo River. When the Otsego Township Dam was reduced to sill height, Pine Creek receded into the stream bed. This resulted in some erosion issues and complaints from riparian landowners who lost lakefront property. A new dam was constructed on Pine Creek approximately 300 feet upstream of the Kalamazoo River confluence creating the current Pine Creek Impoundment. A court order mandates that the impoundment be drawn down every five years to flush sediment and control weed growth in the impoundment. The drawdown is executed by the Allegan County Drain Commission by authority of the Department of Natural Resource - Wildlife Division (DNR-WLD) who owns the dam and the impoundment bottomlands. A public boating access site on the western shore of the impoundment is owned by DNR-WLD.

History

Pine Creek and its tributaries have been managed as a coldwater fishery since at least 1884 when the first recorded Brook Trout stocking occurred. Brook Trout were stocked periodically in Pine Creek from 1884 through 1909 (Table 1). Brown and Rainbow Trout stocking began in 1933 and were stocked annually with few breaks until 1963. From 1963 until present only Brown Trout have been stocked in Pine Creek. Brown Trout have been stocked annually in most years at a consistent rate averaging 4,065 fish. Brown Trout stocking locations have varied with fish being stocked at 6th Street, 18th Ave, CR 388, Ave, 2nd Ave, and 101st Ave. Sand Creek has only been stocked with Brown Trout (Table 2). Brown Trout were stocked periodically between 1933 and 1948. Stocking resumed in 1972 and Sand Creek has been stocked annually with few breaks until present at an average of 1,549 fish. Currently Brown Trout are stocked in Pine Creek at CR 388, 5th Ave, and 101st Ave and in Sand Creek at 6th

Street and DE Ave. The target stocking density is 200 fish per acre in Pine Creek and 248 fish per acre in Sand Creek for a total of 5,800 yearling Brown Trout annually. Pine Creek is managed as a type-4 water in the mainstem down to 101st Ave. Pine Creek tributaries including Sand Creek are regulated as type-1 fisheries. The mainstem is open to catch and release fishing all year with a harvest season from the last Sat. in April through September 30 and a minimum size limit of 10 inches for Brown Trout. Pine Creek tributaries and Sand Creek are only open to fishing and harvest from the last Sat. in April through Sept. 30 with a minimum size limit of 8 inches for Brown Trout. No fishing is allowed outside of the harvest season. The bag limit is five fish throughout the mainstem and tributaries, including no more than three trout that are 15 inches or larger.

Pine Creek and Sand Creek were surveyed several times in the 1960s and 1970s. The first survey on record was conducted in 1961 upstream of 101st Ave. No trout were captured. Suckers dominated the catch with some Rock Bass, Grass Pickerel, and various minnow species. The same site was surveyed in 1969. No Brown Trout were captured. Central Mudminnow dominated the catch (n = 28), and 22 sculpins were also captured as well as nine Grass Pickerel, six Johnny Darters, and six White Suckers. Pine Creek was also surveyed in 1969 above 5th Ave. Six Brown Trout were captured (catch per effort [CPE] = 1.8 fish per hour) ranging from 8.9 to 14.2 inches. Sculpins were the most abundant fish observed (n = 15). Two sites were electrofished in 1973: 101st Ave and 102nd Ave. A total of five Brown Trout were observed at 101st Ave (15.0 fish per hour) and none were observed at 102nd Ave. Mottled Sculpin and White Sucker were captured at both sites. Electrofishing surveys were conducted in 1976 above 101st Ave and 21st Street. No Brown Trout were observed. Mottled Sculpin were the most abundant fish at both sites. One Northern Pike was captured at the 21st Street site. White sucker, Grass Pickerel, Central Mudminnow, and Johnny Darter were also caught at 101st Ave.

More recent surveys on Pine Creek were conducted in 1983, 1989 and 1995. Three sites were surveyed using electrofishing gear in 1983 and catch rates averaged 24.1 Brown Trout per hour. Seven sites were electrofished in 1989 and catch rates were similar averaging 22.0 Brown Trout per hour (Dexter 1991). Several age-2 fish were collected with 50% of trout caught being larger than 8 inches. The largest fish observed were 15 inches. Few age-0 wild Brown Trout were caught, and they were only found in the upper reaches. Trout catch rates were much lower in 1995 at 8.7 fish per hour. Five sites were electrofished and only 20 Brown Trout were collected. Almost all fish were age-1 individuals (89.5%) that averaged 7.5 inches. The only other Brown Trout captured were one age-0 fish (3.3 inches) and one age-3 fish (15.0 inches). Growth rates were above average with an index score of +1.7. No fish surveys were conducted between 1995 and 2019.

Current Status

The Southern Lake Michigan Management Unit (SLMMU) of DNR - Fisheries Division conducted a fish survey in 2019 to evaluate Brown Trout stocking success and natural recruitment at three sites. The most downstream station started at the 101st Ave crossing and proceeded 800 feet upstream. The middle site was located at the CR 388 road crossing and proceeded 800 ft upstream. The most upstream site was located on Sand Creek starting at the 5th Street bridge and extending 600 feet upstream to the footbridge. All three sites were surveyed using a barge electrofisher with two probes. The stream was electrofished in an upstream direction and all species were collected, identified, and measured for total length. Brown Trout were measured to the tenth of an inch, and scales or anal spines were collected for age analysis.

Habitat sampling was also conducted at each site during the 2019 survey using Status and Trends Program (S&T) protocols (Wills et al. 2011). Thirteen cross-sectional transects were evaluated within each sampling station. Stream (wetted) width and general habitat type (run, riffle, or pool) was recorded for each transect. Riparian vegetation class and bank stability rating (1 = <25% bare soil; 2 = 25-50% bare soil, 3 = 51-75% bare soil, 4 = >75% bare soil) was assessed for the left and right banks and if an undercut was present, water depth and undercut length (perpendicular to stream flow) was measured. Water depth, dominant substrate, and percent coverage of wood (within a 1-foot x 1-foot square) were recorded at five evenly spaced intervals along each transect. Data for lineal and areal counts of woody structure were obtained using the methods outlined by Wills et al. (2011). Water depth and current velocity were measured at 1-foot intervals along a single transect within the sampling station and used to calculate discharge.

Brown Trout CPE was calculated as the number of fish captured per 1,000 feet of stream. CPE was compared data from DNR surveys conducted from 2011 through 2021. Catch rates were calculated for streams where Brown Trout were collected for SLMMU (n = 34) and statewide surveys (n = 214). CPE was also compared across years for surveys conducted in Pine and Sand Creek. Habitat variables for Pine and Sand Creeks were compared across sites and to values from a summary of stream surveys conducted using random S&T protocols from 2002 through 2009. CPE and habitat variables were considered high if above the 75th percentile and low if below the 25th percentile.

A total of 560 fish were collected across the three sites. Brown Trout and Mottled Sculpin were the most common fish captured at each site (Table 3). A total of 15 species were caught across sites. Fish classified as coldwater species dominated the catch by number (76.3%) and by biomass (81.7%). Transitional fish made up 17.1% of the catch and warmwater fish made up 6.6% of the catch. The cold stream classification of Pine and Sand Creek is supported by the fish species present. Brown Trout were most abundant at the CR 388 site with a catch rate of 141 fish per 1,000 feet of stream (108.5 fish per hour). Sand Creek site had the next highest abundance with a catch rate of 80 fish per 1,000 feet of stream (100 fish per hour). The catch rate at CR 388 and Sand Creeks sites were well above the median for Brown Trout CPE in SLMMU (46 fish per 1,000 feet of stream) and statewide surveys (37 fish per 1,000 feet of stream), but both fell below the 75th percentile (86 and 100 fish per 1,000 feet of stream respectively). Only four Brown Trout were captured at 101st Ave resulting in a catch rate of 5 fish per 1,000 feet of stream (5 fish per hour).

Brown Trout generally were growing well at all three sites. Mean lengths at age were comparable to or above the statewide averages (Figure 2). Mean growth indices were slightly above average for sites where enough fish were captured to calculate with CR 388 being +1.1 for ages 1-3 and Sand Creek being +1.0 for age-1 trout. Forty-eight scale samples from the CR 388 and Sand Creek sites were not suitable for age determination because the scales were regenerated. This commonly occurs with hatchery fish and is more notable in streams where the resident Brown Trout are primarily hatchery stocked fish. Fish from 6 to 10 inches were most common at all sites making up 82% of Brown Trout captured (Figure 3). Fish over 10 inches made up 29% of the catch at CR 388 and 20% of the catch in Sand Creek. Fish up to 15 inches were caught at all three sites. Brown Trout captured in Sand Creek were primarily age-1 fish (55%) averaging 6.8 inches although age-2 and age-3 fish were well represented at 30.1% and 11.8% of the catch respectively. All age classes age-1 through age-5 were captured at CR 388. Age-1 fish were the most common making up 56% of the catch, followed by age 2 (35%) and age3 (6%). Two of the four Brown Trout captured at 101st Ave were age2 that averaged 8.8 inches with one age-3 (12.0 inches)

and one age-4 fish (15.6 inches) being captured. Age-5 fish were captured at each site and the length of these fish were slightly below the state average. Although too few older fish were captured to rigorously assess growth, there is some evidence that growth rate of Brown Trout declines after age 2. Only one age-0 fish was captured and it was at the most upstream site in Sand Creek.

A temperature logger was deployed in Sand Creek at the 5th Street bridge from May 30 through November 18, 2019. Hourly water temperature was monitored using an Onset Hobor Water Temp Pro v2 temperature logger that was deployed within the sampling station. Temperature in Sand Creek ranged from 39.7 F in November to 73.7 F in August (Figure 4). In general temperatures were quite cool with a mean July temperature of 65.4 F and a mean August Temperature of 57.8 F. The temperature regime is cold enough to support both Brown and Brook Trout. The thermal classification of a cold stream is appropriate based on the readings recorded in summer of 2019.

The 101st Ave site was entirely run habitat. The average width was 25.6 feet with a mean thalweg depth of 2.4 feet. The substrate was almost all sand (98%) with only 2% being embedded gravel. Bank stability was not good with 38% of banks being rated as poor or very poor. Log jams and brush deposits were common covering 252 (118.5 square feet per acre) and 240 square feet (510.5 square feet per acre), respectively. Discharge was 30.6 cfs with an average velocity of 0.9 feet per second. Large and small trees covered much of the floodplain and banks (62%) with grassland (27%) and alders (11%) covering the remaining banks.

The site at CR 388 was also 100% run habitat. It was somewhat wider (30.5 feet) than at 101st primarily due to past dredging leaving the channel oversized. The mean thalweg depth was 1.9 feet. Discharge was 20.4 cfs with an average velocity of 0.6 feet per second. CR 388 had more wood than 101st with 530 square feet of brush deposits (945.6 square feet per acre) and 1,827 square feet of log jams (1,024.0 square feet per acre). Dead ash and fallen trees were common at the site. The substrate was primarily sand (94%) with some silt (6%). The banks were more stable with 73% rated as good and the remaining as fair. Large and small deciduous trees were the most common vegetation type along the bank making up 62% with equal part grassland and tag alders covering the remaining banks.

Sand Creek was also 100% run habitat. The stream is much smaller here with an average width of 14.5 feet and mean thalweg depth of 1.4 feet. Sand still dominated the substrate (77%), but some gravel (20%) and small cobble (2%) was present along with a small amount of silt. Gravel was primarily embedded with only 8% clean. Brush and log jams were prevalent with 384 square feet (1,922.6 square feet per acre) and 1,364 square feet (6,829.4 square feet per acre) present respectively. Discharge at this site was only 8.1 cfs with a mean velocity of 0.79 feet per second. Banks had intermediate stability with 62% being rated good or fair. Tag alders (58%) and deciduous trees (35%) made up most of the riparian vegetation.

Pine and Sand Creek are primarily run habitat dominated by sand substrate. Runs made up 100% of cross sections in this system. This is the same as the 75th percentile for statewide sites (100%) and higher than the 75th percentile for SLMMU streams (98%). Sand and finer substrates averaged 90% across sites which is higher than the 75th percentile for statewide (80%) and SLMMU (55%) surveys. Gravel and coarser substrate was much lower at 7% compared which is between the 25th percentile (2.6%) and the median for statewide surveys but below the 25th percentile for SLMMU (20%).

Analysis and Discussion

Pine and Sand Creek are successfully providing a Brown Trout fishery through continued stocking. Very little reproduction was documented, and stocking is required to maintain the fishery. Brown Trout are surviving well with fish up to age 5 observed at all sites. Catch rates at CR 388 and Sand Creek sites were average indicating good density of Brown Trout. Growth rates are above the state average, resulting in fish up to 15 inches being captured in the 2019 survey. There is a potential to catch big fish and anglers report catching fish well above 15 inches. Brown Trout populations appear to have rebounded from the 1995 survey when few fish were caught. Catch rates were much higher than historic surveys, and older fish were caught in 2019. Mean catch rate jumped from 24.1 fish per hour in 1983, 22.0 fish per hour in 1989, and 8.7 fish per hour in 1995 to an average of 71.2 fish per hour across sites in 2019. Previous surveys only reported fish up to age 3. Although age-1 and age-2 fish were the most abundant in the 2019 surveys, several older fish were captured at each site. As a result, there is a greater potential to catch larger fish in Pine and Sand Creeks now than in the past due to longer living fish with good growth rates being present. The fishery appears to be in the best condition it has been throughout the survey history.

Pine and Sand Creeks are most limited by available habitat. Wood is abundant, but the substrate is mostly sand. Sandy substrates dominated habitat in past surveys as well, indicating this is not a new issue. Sand is easily mobilized during high flows and coarser substrates in shallow riffles are exposed due to increased velocities as a result of smaller bankfull cross section area. Riffles were generally absent through Pine and Sand Creeks. This is likely because of continued ditching and widening of the stream through traditional drainage practices. Increasing the bankfull cross sectional area allows for more flood water to be contained in the channel but causes low velocity at normal flow and deposition of sediment such as sand. Greater cross section area also required greater flows to mobilize smaller particle sizes. Sand and silt deposition is common in overly wide channels resulting in poor sediment mobilization, constant filling of the channel (and subsequent dredging), and lack of exposed coarser substrate. This covers the gravel stream bed and leaves little spawning habitat available in Pine Creek. The Sand Creek site had the highest prevalence of gravel substrate and was the only location young-of-year Brown Trout were captured.

Wood is providing adequate habitat for Brown Trout at two of the sampling sites. The site at 101st Ave was lacking habitat and was also the location that yielded the fewest Brown Trout. Wood not only creates cover for fish but is substrate for macroinvertebrates that are important food sources for Brown Trout and other fish. Minnows and other fish species were abundant providing prey for larger predatory Brown Trout and are likely contributing to the good growth rates observed. No Northern Pike were captured, but they are present in the Pine Creek Impoundment. Anglers report catching Northern Pike especially in years where the impoundment is drawn down and fish move upstream seeking refuge habitat. Northern Pike can prey on Brown Trout reducing survival. Predation may be suppressing Brown Trout populations at 101st Ave as catch rates have traditionally been low. This does not appear to be the case upstream at CR 388 and Sand Creek as older age classes of Brown Trout were captured and catch rates were high. Pine Creek Impoundment was drawn down in 2021 and Largemouth Bass and Northern Pike were captured in electrofishing surveys below the dam indicating many of these fish are moving downstream when the impoundment is drawn down. Drawdowns will continue to be evaluated to determine if there is a risk to the upstream Brown Trout management.

Management Direction

Brown Trout will continue to be stocked in Pine and Sand Creek and manage it as a coldwater fishery. Stocked Brown Trout are surviving well but little natural reproduction was observed. Stocking is required to maintain this fishery. Stocking sites will be reduced to limit the number of stops required by stocking trucks. Currently five sites are stocked that are relatively close together. This can be reduced to two sites, CR 388 and DE Ave. Fish should distribute from these locations and provide a fishery throughout the watershed.

DNR Fisheries will monitor and look for opportunities to improve public access. Public access is available on Sand Creek through Alamo Township Park, but the remaining length of stream is only accessible at road crossing and with landowner permission. Stocking sites will be adjusted to avoid stocking water if it becomes apparent that a site is not accessible by the public.

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Table 1. Stocking history for Pine Creek. Fish were stocked as yearlings except when indicated by the following letters: a – fry; b – fingerling; or c – legal size.

Year	Brook Trout	Brown Trout	Rainbow Trout
1884	9,000[a]	-	-
1889	6,000	-	-
1890	3,000	-	-
1890	3,000	-	-
1890	6,000	-	-
1895	9,000	-	-
1896	9,000	-	-
1897	3,000	-	-
1898	3,000	-	-
1905	3,000[a]	-	-
1909	3,000[a]	-	-
1933	-	10,000	1,500[b]
1934	-	10,000[b]	5,000[b]
1935	-	2,000[b]	500[b]
1936	-	102,500[b]	-
1940	-	3,000[b]	1,000
1941	-	2,000/10,000[b]	4,000
1942	-	13,000b/500	500
1943	-	2,500b/3,500	500
1944	-	-	5,000[b]
1947	-	2,500b/500	200
1948	-	1,200	600
1949	-	12,100	500
1950	-	3,700	200
1951	-	1,350	-
1952	-	800	650
1953	-	100	350
1954	-	600	350
1955	-	300[c]	350[c]
1956	-	450[c]	150[c]
1957	-	500[c]	150[c]
1958	-	1,570[c]	1,100[c]
1959	-	300[c]	600[c]
1960	-	800	550[c]
1961	-	800[c]	400[c]
1962	-	800[c]	500[c]
1963	-	300[c]	300[c]
1965	-	6,000	-

Table 1 Cont

Year	Brook Trout	Brown Trout	Rainbow Trout
1966	-	3,000	-
1967	-	750	-
1968	-	1,500	-
1971	-	1,863	-
1972	-	4,540	-
1973	-	4,500	-
1974	-	4,500	-
1975	-	4,500	-
1976	-	4,500	-
1977	-	4,500	-
1978	-	2,600	-
1979	-	2,500	-
1980	-	2,500	-
1981	-	3,000	-
1982	-	4,050	-
1983	-	4,340	-
1984	-	4,500	-
1985	-	2,360	-
1986	-	3,670	-
1987	-	3,880	-
1988	-	5,330	-
1989	-	4,900	-
1990	-	4,200	-
1991	-	4,404	-
1992	-	4,139	-
1993	-	4,090	-
1994	-	4,480	-
1995	-	3,900	-
1996	-	4,239	-
1997	-	4,718	-
1998	-	4,080	-
1999	-	4,200	-
2000	-	4,960	-
2001	-	4,320	-
2002	-	4,240	-
2003	-	4,200	-
2004	-	4,550	-
2005	-	4,260	-
2006	-	5,140	-
2007	-	3,870	-

Table 1 Cont

Year	Brook Trout	Brown Trout	Rainbow Trout
2008	-	4,280	-
2009	-	4,680	-
2010	-	5,140	-
2011	-	4,005	-
2012	-	5,510	-
2013	-	4,150	-
2014	-	3,850	-
2015	-	4,620	-
2016	-	4,200	-
2017	-	4,400	-
2018	-	4,620	-
2019	-	4,200	-
2020	-	3,960	-
2021	-	4,190	-

Table 2. Brown Trout stocking history for Sand Creek. Fish were stocked as yearlings except when indicated by an asterisk when age-0 fish were stocked.

Year	Number	Year (Cont)	Number (Cont)
1933	10,000*	1992	1,578
1937	3,800*	1993	1,600
1937	2,000*	1994	1,870
1938	15,000*	1995	1,480
1938	15,000*	1996	709
1939	6,000*	1997	1,740
1939	3,000*	1998	1,560
1939	,5000*	1999	1,600
1939	300	2000	1,980
1948	4,000*	2001	1,660
1972	2,000	2002	1,620
1973	1,200	2003	1,600
1974	1,200	2004	1,750
1975	1,200	2005	1,620
1976	1,200	2006	1,960
1977	1,400	2007	1,470
1978	1,000	2008	1,630
1979	800	2009	1,800
1980	3,000	2010	1,970
1981	1,100	2011	1,440
1982	1,350	2012	2,120
1983	1,400	2013	1,600
1984	1,400	2014	1,600
1985	500	2015	1,760
1986	1,300	2016	1,600
1987	1,360	2017	1,670
1988	1,700	2018	1,760
1989	1,600	2019	1,600
1990	1,600	2020	1,530
1991	1,660	2021	1,580

Table 3. Fish capture data for Pine and Sand Creek surveys conducted in 2019. Thermal classifications are from Lyons et al. (2009).

Species	Number	Estimated Weight (lbs)	Length Range (inches)	Average Length (inches)	Temperature Tolerance
			CR 388		
Am. Brook Lamprey	2	0.04	5 - 7	6.5	Trans
Blacknose Dace	1	0.02	3 - 3	3.5	Trans
Brown Trout	113	31.47	4 - 15	8.7	Cold
Central Mudminnow	41	0.41	1 - 4	2.7	Trans
Grass Pickerel	5	0.31	2 - 8	6.3	Warm
Green Sunfish	5	0.05	1 - 3	2.3	Warm
Hybrid Sunfish	1	0.06	4 - 4	4.5	Warm
Johnny Darter	20	0.09	1 - 3	2.4	Trans
Largemouth Bass	2	0.01	1 - 2	2.0	Warm
Mottled Sculpin	129	1.46	1 - 4	2.6	Cold
White Sucker	5	2.72	7 - 14	10.5	Trans
			101st Ave		
Am. Brook Lamprey	2	0.03	4 - 6	5.5	Trans
Blackside Darter	2	0.01	2 - 3	3.0	Warm
Brown Trout	4	2.44	8 - 15	11.3	Cold
Central Mudminnow	6	0.05	2 - 3	2.7	Trans
Grass Pickerel	1	0.12	8 - 8	8.5	Warm
Green Sunfish	13	0.13	1 - 3	2.3	Warm
Mottled Sculpin	54	0.61	1 - 3	2.7	Cold
Rock Bass	3	0.31	4 - 5	5.2	Warm
White Sucker	3	3.85	14 - 15	14.8	Trans
			Sand Creek		
Am. Brook Lamprey	3	0.05	6 - 6	6.5	Trans
Bluegill	1	0.01	2 - 2	2.5	Warm
Brown Bullhead	1	0.14	6 - 6	6.5	Warm
Brown Trout	64	14.97	2 - 15	8.2	Cold
Central Mudminnow	1	0.01	2 - 2	2.5	Trans
Creek Chub	8	0.91	4 - 8	6.6	Trans
Green Sunfish	2	0.04	2 - 3	3.0	Warm
Largemouth Bass	1	0.01	2 - 2	2.5	Warm
Mottled Sculpin	63	0.75	1 - 3	2.7	Cold
White Sucker	4	2.23	9 - 13	11.0	Trans

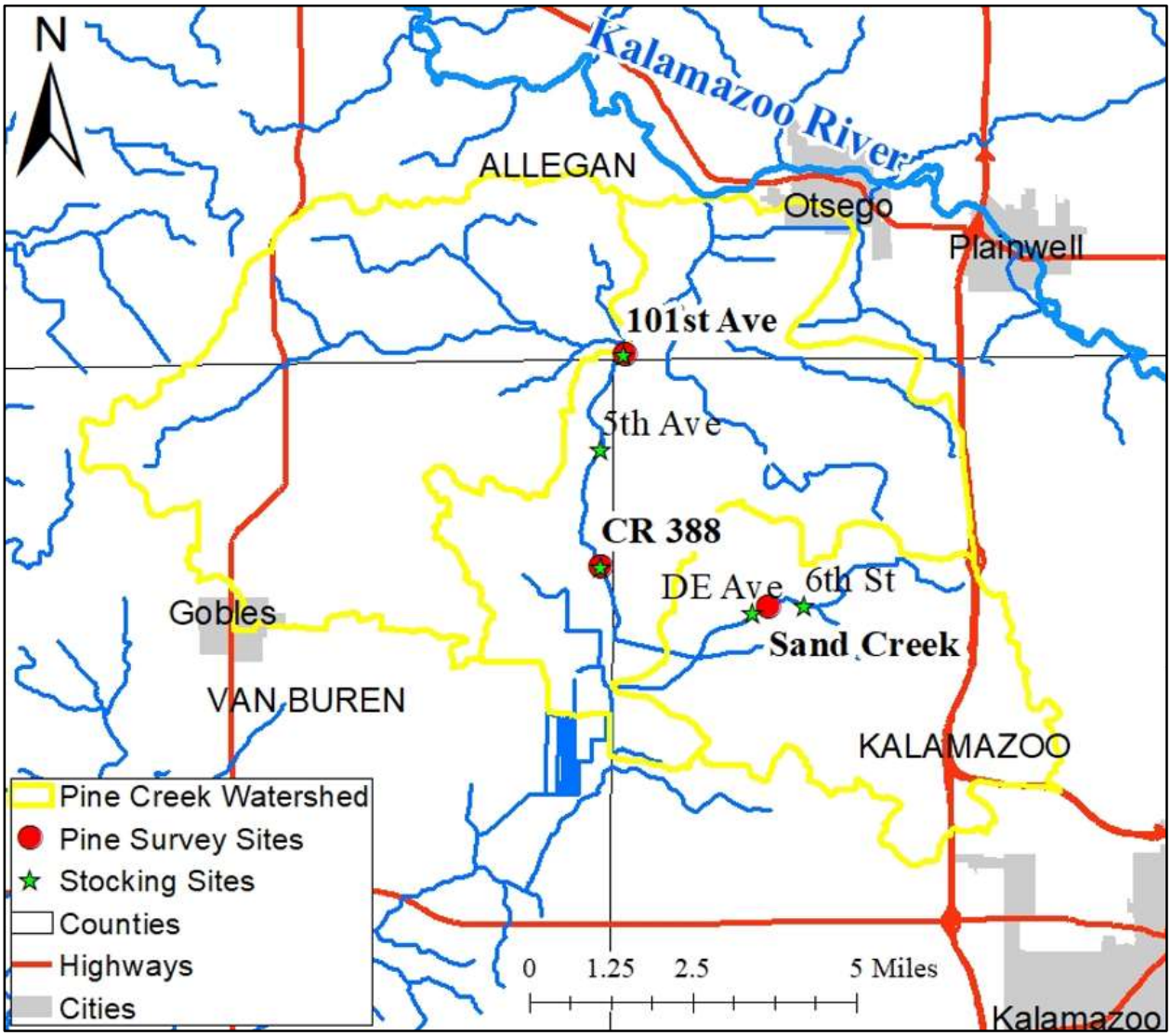

Figure 1. Map of the Pine Creek watershed. Fish survey sites from 2019 are marked as red circles and current stocking sites are marked as green stars. A temperature logger was also deployed at the Sand Creek site.

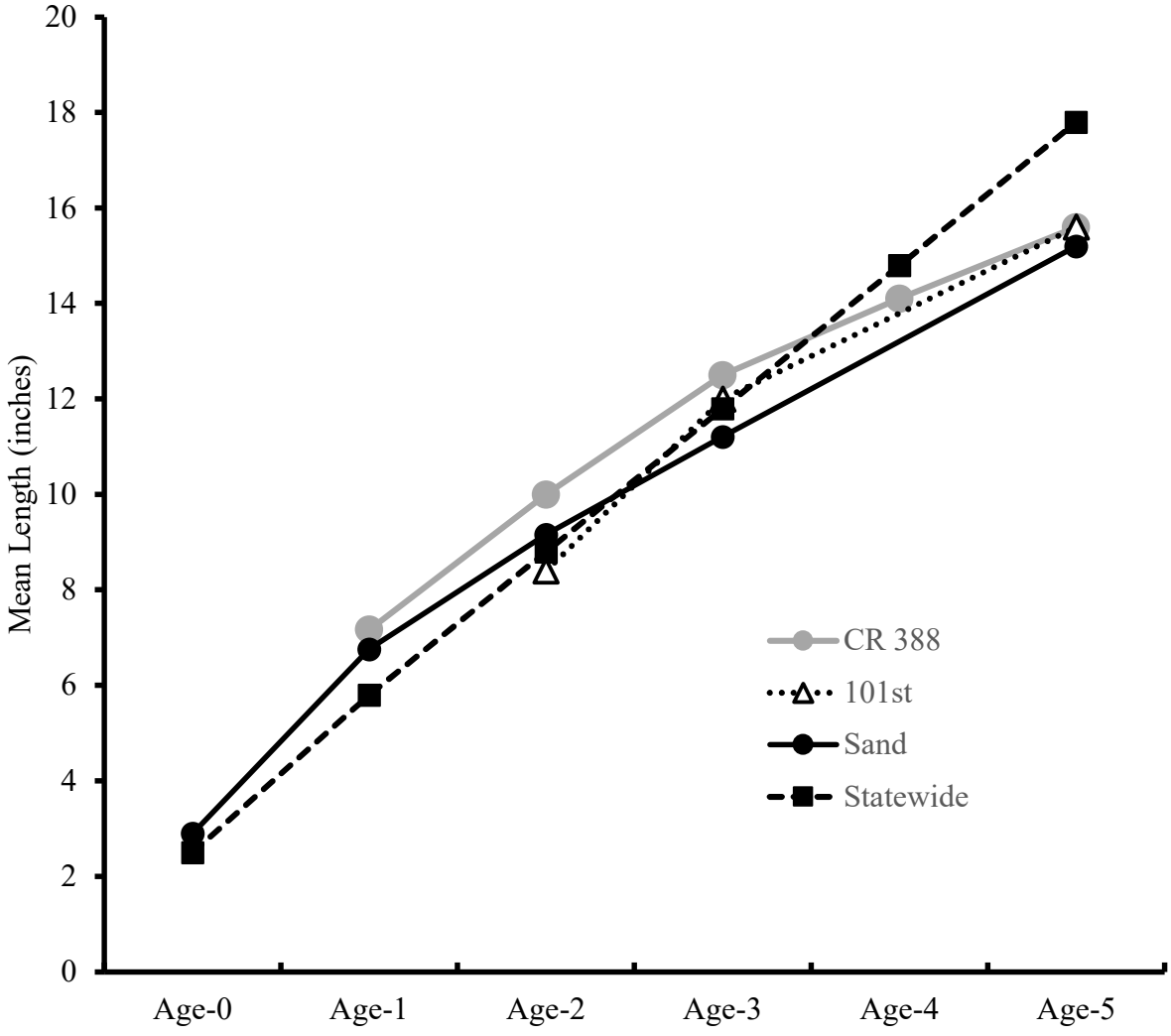

Figure 2. Mean length-at-age for Brown Trout caught at three sites in Pine Creek compared to the statewide average.

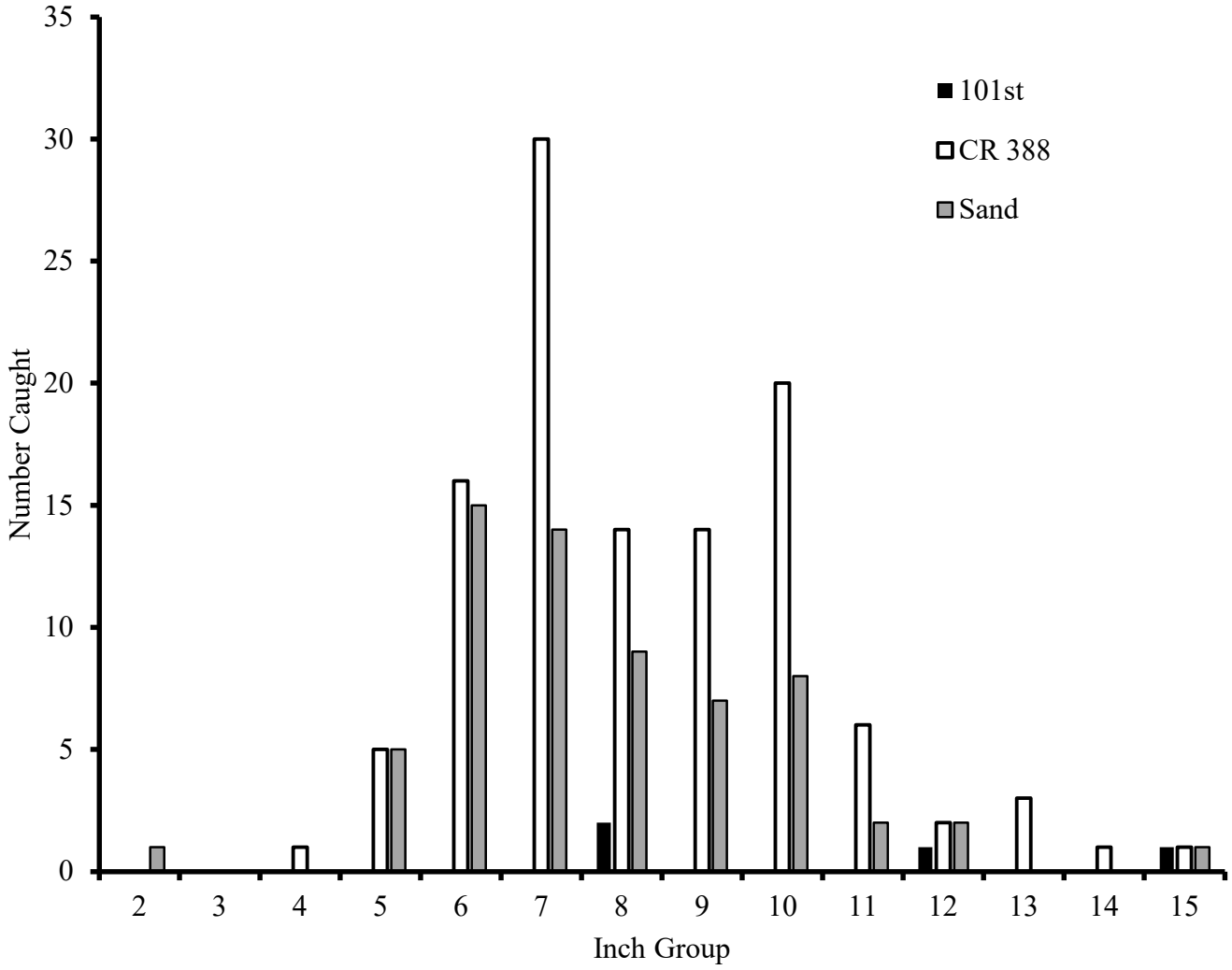

Figure 3. Length frequency of Brown Trout caught in electrofishing surveys at three sites in 2019 in Pine and Sand Creek.

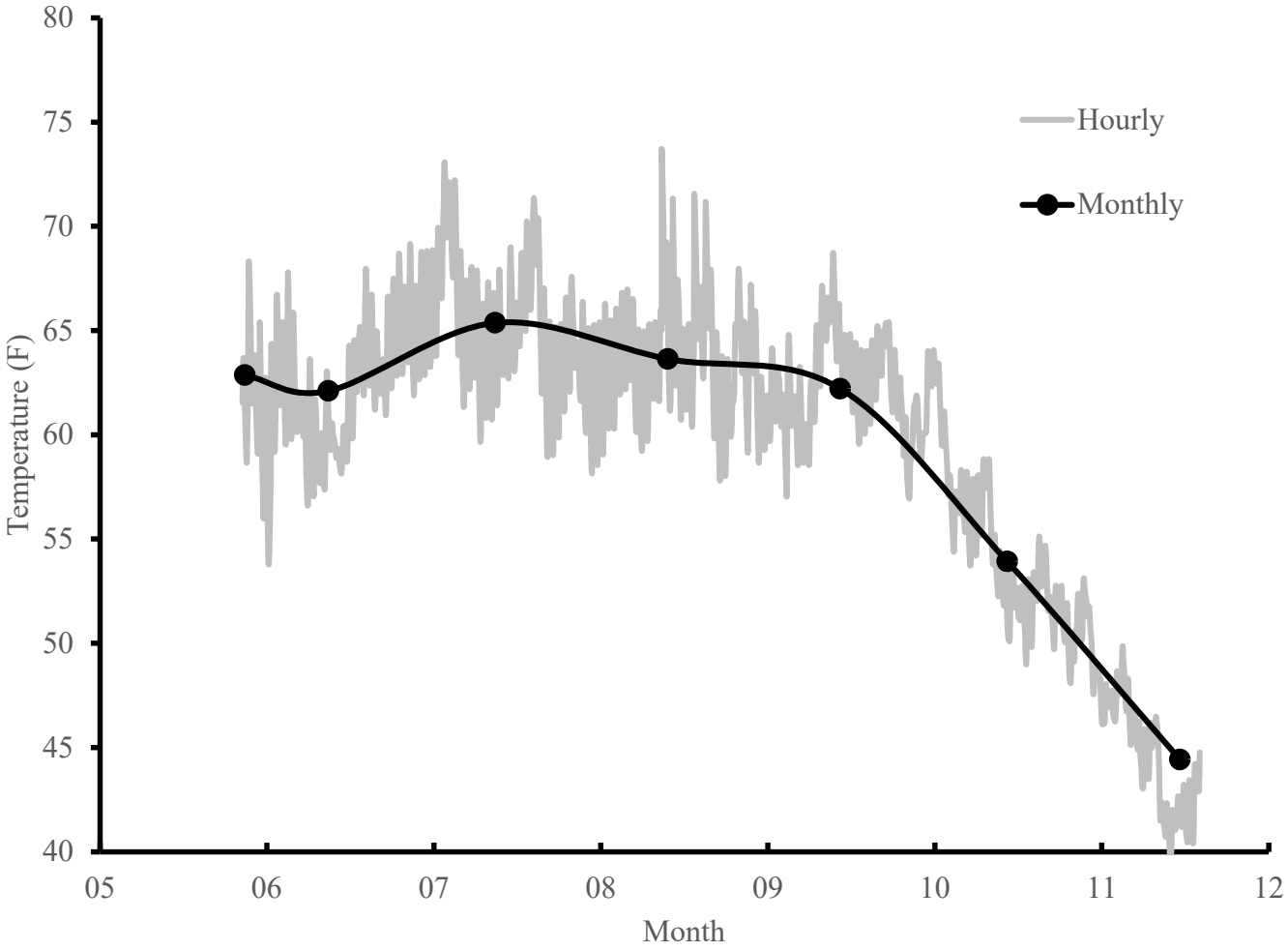

Figure 4. Hourly and monthly mean temperature from a temperature logger deployed in Sand Creek in 2019.

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Brian Gunderman, Unit Review and Approval

David Caroffino, External Reviewer

Tim Cwalinski, SFR Facilitator

Randall M. Claramunt, Desktop Publisher and Approval