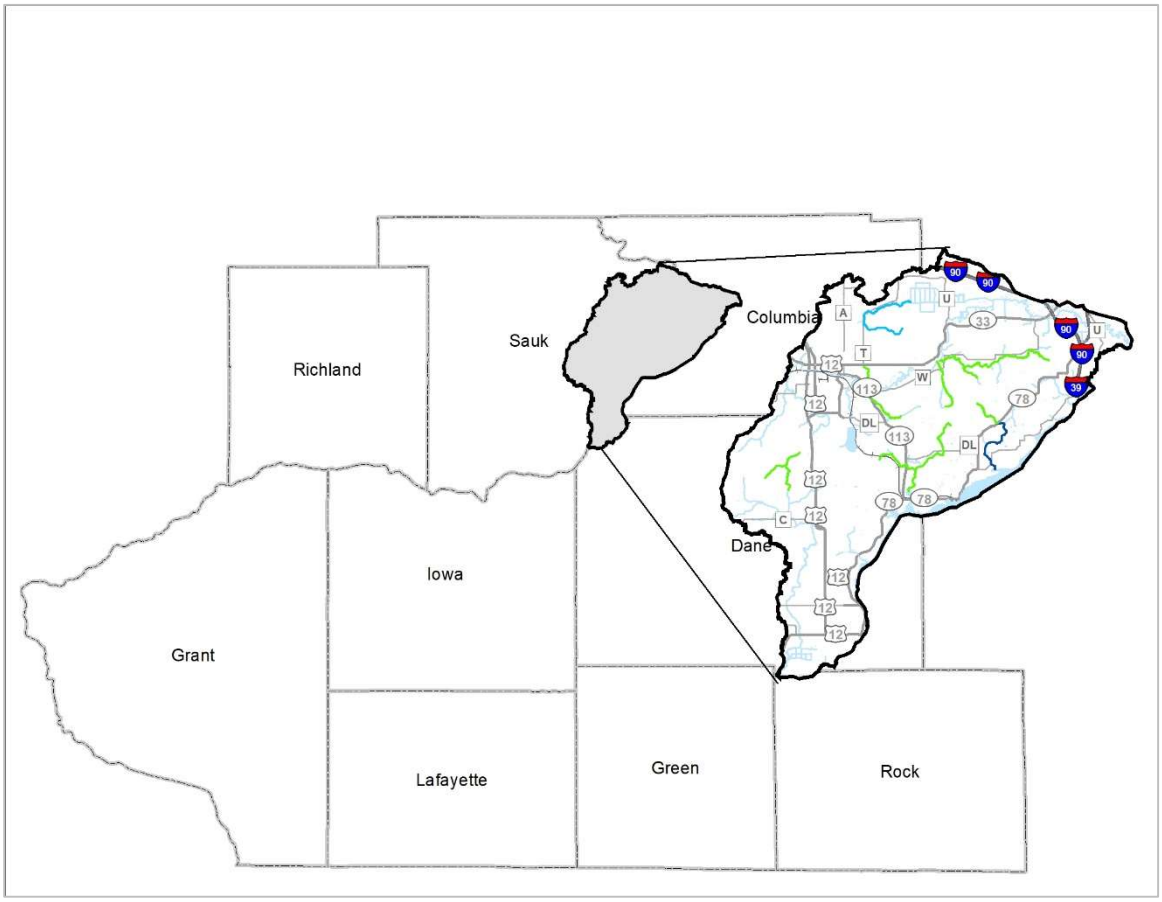
Trout management and status of Baraboo Hills trout streams, Columbia and Sauk counties 2020



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EXECUTIVE SUMMARY

Stream electrofishing surveys occurred at 21 locations on 9 streams in the Baraboo Hills in Columbia and Sauk counties in 2020. No fingerling trout were stocked in the system in 2019 or 2020 to allow for assessment of natural reproduction (age 0; young-of-year) and natural recruitment to age 1 (yearling) in 2020.

At the time of the 2020 surveys, Rowley Creek, an unnamed tributary to Rowley Creek (WBIC 1272200), Boulder Creek, Manley Creek, Parfrey's Glen Creek, Clark Creek, and Prentice Creek upstream of State Highway 78 were Class 1 trout streams. Leech Creek was a Class 2 trout stream. Prentice Creek downstream of State Highway 78 was a Class 3 trout stream. Prior to being suspended for this evaluation, the only existing quotas were large fingerling Brook Trout quotas for Rowley Creek and Leech Creek, and no Brown Trout stocking had occurred in any Baraboo Hills Stream since 2011.

Brook Trout was the only trout species found in Boulder Creek, Manley Creek, Parfrey's Glen Creek, Otter Creek, Prentice Creek, and Clark Creek. Brook trout was the predominant trout species in Leech Creek and Rowley Creek which also had brown trout present. Boulder Creek had the highest mean Brook Trout catch rate including the highest age 0 catch rate. Upper Prentice Creek (upstream of State Highway 78) had the second highest overall Brook Trout abundance including the highest mean catch rate of yearlings and the second highest catch rate of adults. Rowley Creek had the third highest mean total Brook Trout catch rate. Manley Creek had the fourth highest mean total Brook Trout catch rate, but had the highest mean catch rate of adult and preferred length fish. Brown Trout were only found in two streams; Leech Creek had the highest mean total catch rate, followed by Rowley Creek. Leech Creek and Rowley Creek were stocked with Brown Trout in the past but management (including stocking) has switched to favor Brook Trout.

Management Recommendations:

- Retain current trout fishing regulations on all streams in the management group.
- Retain current trout stream classifications on all streams in the group.

  Complete fishery surveys on the lower portions of Rowley, Leech, Prentice, and Parfrey's Glen creeks in 2021.
- Discontinue fingerling Brook Trout stocking in Leech Creek until after the survey on lower Leech Creek that was postponed in 2020 has been completed.
- Discontinue fingerling Brook Trout stocking in Rowley Creek to further evaluate natural reproduction and recruitment and monitor annually through the next evaluation in 2026 to determine if stocking can be discontinued permanently.

- Conduct genetic testing on Brook Trout in Baraboo Hills streams that have not been previously tested to determine domestic vs. native origins.

- Conduct habitat improvement efforts in Manley Creek to address degraded habitat structures upstream of Highway 113 and associated declines in Brook Trout abundance.

- Address nuisance beaver activity in upper Manley Creek to remedy negative thermal impacts to the stream arising from beaver dams.

- Renew efforts to acquire streambank easements along Rowley Creek and lower Boulder Creek.

INTRODUCTION AND CURRENT STATUS

The Baraboo Hills trout stream management and planning group is composed of eight named streams and one unnamed tributary stream across two HUC-10 watersheds. Trout streams in the Lower Baraboo River HUC-10 watershed (LW21) include Boulder Creek, one unnamed tributary to Rowley Creek, Rowley Creek, Leech Creek, and Clark Creek. All named trout streams in LW21 drain directly to the Baraboo River. The Lower Baraboo River watershed drains an area of 144 square miles which in the year 2000 was divided between forested lands (32.1%), agriculture (29.4%), wetland (16.6%), grassland (14.3%), open water (3.1%), development (2.8%), and barren land (1.7%) (Table 1, Ripp et al. 2002). Boulder Creek and Rowley Creek are listed as Exceptional Resource Waters. The Baraboo River is listed as impaired due to high total phosphorous levels (Wisconsin River TMDL 2019; https://dnr.wi.gov/topic/tmdls/wisconsinriver/). None of the other streams in the management group are listed as impaired.

Boulder Creek (WBIC 1273200) is 3.22 miles in length, rises high on the north slope of the Baraboo Range, and drains into the Baraboo River approximately 0.2 mile upstream of the mouth of Rowley Creek. Boulder Creek is Class 1 trout water supporting Brook Trout. Active fishery management has been limited to a single stocking of small fingerling Brook Trout in 2015. There is public access to approximately 0.7 mile of Boulder Creek via the Baraboo Hills Recreation Area at the end of Potter Rd.

One unnamed tributary to Rowley Creek (WBIC 1272200) was surveyed during the evaluation. The stream is 1.46 miles in length with a gradient of 202 feet/mile, draining a watershed of approximately 1.13 miles on the north slope of the Baraboo Range (Ball et al. 1971). The lower 0.95 mile of the stream is Class 1 trout water (Brook Trout), however relatively low base flow and a relative lack of suitable habitat (depth) for trout or any other fish have led to low catches during past surveys. Historically, fish have not been stocked in this stream.

Rowley Creek (WBIC 1272100) is 9.45 miles in length and drains an area of approximately 27.4 square miles, originating high on the north slope of the Baraboo Range in the Town of Caledonia, Columbia County, near Lost Lake. Rowley Creek has a gradient of 29.1 feet/mile and drains into the Baraboo River in Sauk County approximately 0.2 mile downstream from the mouth of Boulder Creek (Poff and Threinen 1965). Rowley Creek was managed for Brown Trout for many years, with stocking occurring from the early 1970s to the early 1980s and later from 1999-2011 when small fingerlings were stocked annually. Brown trout stocking was discontinued in favor of Brook Trout, and large fingerling Brook Trout were stocked from 2012-2018. There is public access to Boulder Creek via one small 650-foot easement on the north bank of the creek upstream of County Highway W.

Leech Creek (WBIC 1271600) is 10.73 miles in length and drains an area of 22.3 square miles, with a gradient of 8 feet/mile (Ball et al. 1971). Leech Creek rises at the base of the Baraboo Range in the Town of Greenfield, Sauk County, and flows north, and then east before crossing into Columbia County and entering the Baraboo River 0.15 mile upstream of Tritz Road. Leech Creek is a Class 2 trout stream, but only about 3.5 miles of the middle portion of Leech Creek are viable trout water. Perennial flow begins at a spring complex just upstream of the lowermost crossing of County Highway T and the stream flow increases dramatically over a short distance due a to sizable spring/seep complex along the stream corridor from County Highway T all the way past Paschen Road. The trout water ends where Leech Creek enters a large muck farm and becomes essentially a straight drainage ditch from that point all the way to the Baraboo River (4.7

miles), collecting water from a grid of drainage ditches that crisscross the flat land of the farm along the way.

Clark Creek (officially unnamed, WBIC 1273700) is 5.25 miles in length and drains a watershed of approximately 4.75 square miles (Ball et al. 1971). Clark Creek rises on the north slope of the Baraboo Range in the Town of Greenfield in Sauk County and has a gradient of 138 feet/mile along its course which terminates where the stream flows into the Baraboo River just upstream of the old Glenville Dam site on the outskirts of Baraboo (Ball et al. 1971). A 2.2-mile segment of Clark Creek is Class 1 trout water supporting Brook Trout. This small, high-gradient watershed also has steep terrain along the stream corridor (narrow valley with high valley walls). As such Clark Creek has the propensity to experience extreme flash floods during heavy rain events which caused serious damage to the land along the stream corridor. This led the WDNR and Sauk County to complete a project aimed at increasing the water holding capacity of the land in the upper part of the watershed. Crop fields were eliminated and replaced with native prairie and wetland scrapes. A second component of the project was incorporating engineered bank revetments along areas of the stream where flood damage to the valley walls (erosion) was the greatest. The revetments also incorporated in-stream habitat improvements for Brook Trout including root wads and constructed step pools, and the project was completed in the late fall of 2013. Stocking in Clark Creek has been limited, with large fingerling Brook Trout stocked in 10 of 12 years from 1998-2009.

Trout streams in the Lake Wisconsin-Wisconsin River HUC-10 watershed (LW19) that were evaluated in 2020 include Prentice Creek (also known as Durward's Glen Creek), Parfrey's Glen Creek, and Manley Creek. The Lake Wisconsin-Wisconsin River watershed drains an area of 199.5 square miles which in the year 2000 was dominated by agriculture (45.9%), followed by forest (26.6%), grassland (14.3%), open water (6.6%), wetland (4.8%), other (1.1%), and development (0.7%) (Table 2, Ripp et al. 2002).

Prentice Creek (WBIC 1262600) is 8 miles in length with a gradient of 22 feet/mile, draining an area of approximately 10 square miles (Poff and Threinen 1965). Prentice

Creek rises high on the south slope of the Baraboo Range in the Town of Greenfield and flows west, then south for the remainder of its course before emptying into Stoner's Bay on Lake Wisconsin. Prentice Creek is Class 1 trout water supporting Brook Trout from the point where it crosses the Sauk-Columbia County line downstream to its crossing of State Highway 78. Downstream of Highway 78, Prentice Creek is Class 3 trout water all the way to the mouth. Stocking of Brook Trout in Prentice Creek occurred from 1954-1957 and again in 1963. Rainbow Trout were stocked from 1955-1957 and Brown Trout were stocked from 1971-1975; no stocking has occurred since 1975.

Parfrey's Glen Creek (WBIC 1261100) is 5.5 miles in length, rising from a spring complex on the north side of the bluff at Devil's Head in the Town of Greenfield, Sauk County on the south slope of the Baraboo Range. The gradient is steep in the upper reaches, measuring 382 feet/mile over a single 1.1-mile segment (Ball et al. 1971). The stream first flows northwest, then turns south and travels through Parfrey's Glen State Natural area for approximately 1.75 miles. It then crosses County Highway DL flowing southwest before entering a marsh complex where it loses its defined channel. The stream eventually re-forms again just east of Marsh Road. At that point, it is a warm water stream and collects the outflow from an impoundment to the north. It flows southwest, then south before collecting Manley Creek which cools the temperature of Parfrey's Glen Creek enough to support trout for the rest of its course which terminates at Gallus Slough, a part of Lake Wisconsin. Parfrey's Glen is a Class 1 stream supporting Brook Trout. The only stocking on file occurred annually from 1947-1954 when Brook Trout varying in size from fingerling to adult were stocked.

Manley Creek (WBIC 1261200) is 3.05 miles in length, rising along the South Bluff in Devil's Lake State Park and draining a watershed of approximately 10.7 miles. The gradient is 22 feet/mile as the stream flows from west to east and crosses State Highway 113 before joining with Parfrey's Glen Creek. The public has access to the entire length of Manley Creek via Devil's Lake State Park and the Riverland Conservancy property owned by Alliant Energy. Manley Creek is a Class 1 stream supporting Brook Trout. There are no stocking records on file for Manley Creek although it is likely that the

stream was stocked at some point, possibly several decades ago. Genetic analysis of the Manley Creek Brook Trout population indicates the trout match genetically with a domestic hatchery strain that was originally brought to Wisconsin from the eastern U.S., propagated in our hatcheries, and was stocked into many waters across the state. Brook Trout were present at low abundance in Manley Creek until three habitat improvement projects between 1997 and 2003 led to a massive increase in numbers, and abundance remains relatively high to this day.

One trout stream in the Otter Creek-Wisconsin River HUC-10 watershed was evaluated in 2020; Otter Creek (WBIC 1258400). Otter Creek is 20.23 miles in length and drains a watershed of 39.8 square miles. Otter Creek rises in Baxter's Hollow in the Town of Sumpter, Sauk County, flowing east until joining with an unnamed tributary (WBIC 1259500) and then flowing south for the remainder of its length until it reaches the Wisconsin River approximately 5 miles southwest of Sauk City. Beginning at the headwaters, Otter Creek is a Class 1 stream with a gradient of 43 feet/mile supporting Brook Trout, and the classified trout water ends where the stream leaves Baxter's Hollow and transitions onto the Sauk Prairie for the remainder of its length, and water temperatures are too warm to support trout. Public access to approximately 2.8 miles of Otter Creek and one mile of the unnamed Class 1 tributary stream comes via Baxter's Hollow State Natural Area which is owned by The Nature Conservancy. Historical records indicate a varied stocking history, including Brook Trout (1947-1965 and 1976-1979, excluding 1952 and 1956), Brown Trout (1972), and Rainbow Trout (1943, 1945, and 1973-1976). However, no trout stocking has occurred in Otter Creek since 1979.

Locations where trout sampling occurred in 2020 are found on the map in Figure 1. The current trout fishing regulation for most streams in the Baraboo Hills stream management group is an 8-inch minimum length limit with a 3 fish daily bag limit and no bait restrictions. This is the county-wide base trout regulation for both Columbia and Sauk Counties. One exception is Leech Creek which has a 12-inch minimum length limit with a 2 fish daily bag limit (Figure 2). Additional exceptions include Manley Creek and Prentice Creek where Brown Trout and Rainbow Trout have no minimum length limit,

only Brook Trout less than 9 inches may be kept, and the daily bag limit is 5 trout in total. Public access for fishing along Baraboo Hills trout streams can be found on the map in Figure 3. Current stocking quotas for Baraboo Hills trout streams are listed in Table 3. Stocking did not occur in Baraboo Hills streams in 2019 or 2020 to facilitate evaluation of natural reproduction and recruitment in 2020.

METHODS

Stream sampling

Summer stream sampling at 6-year rotation sites in 2020 spanned from June 24 through September 3 and the sampling locations, site metrics, and gear used are described in Tables 4 and 5 as well as Figure 1. Timing of sampling attempted to match dates of surveys in previous years as closely as possible. Of the 21 stream sites sampled, 19 were surveyed with a backpack electrofishing unit and two were sampled with a tow-barge utilizing one anode as opposed to the usual two anodes. Work procedures in place to ensure safety during the Coronavirus pandemic prevented sampling that required 3-person crews because social distance could not be maintained. This amounted to one site each on lower Rowley Creek, lower Leech Creek, lower Prentice Creek, and lower Parfrey's Glen Creek.

The backpack electrofishing units consisted of a backpack-mounted control box in which the operator controlled the anode with one hand and dipped fish with the other, while a steel cable cathode trailed behind the operation and completed the electrical field. These were used on small streams that were typically shallow in nature. Tow-behind stream electrofishers were larger units in which the generator was mounted in a barge that was towed by one individual. One individual then introduced electricity into the stream via the anode probe connected to the output box and captured stunned fish with a dip net before transferring them to a holding tank in the barge until processing time. The cathode consisted of a steel rack mounted to the hull of the barge. These units were used in larger wadable streams.

The number of sites varied depending on the stream segment length. One site was sampled on segments less than 1.5 miles, two sites on segments from 1.5-3 miles, and one site per three miles on segments greater than three miles. The length of stream sampled at each location was determined by stream width, with site length being 35 times the mean stream width on segments greater than 3 meters. On streams less than 3 meters wide, a minimum of 100 meters was sampled. All fish were collected at trend sites where gamefish, exotic species, and threatened/endangered species were measured to total length. Only the first 200 fish of a given species were measured if large numbers of gamefish were encountered. Young-of-year were counted and a subsample of 50 fish were measured. Individuals of other fish species were counted to calculate the index of biotic integrity (IBI) score. Other specifics can be found in the Wisconsin DNR Fisheries Management Handbook, chapter 510 (Simonson 2015).

Water quality and habitat metrics were also collected at each survey site. Streamflow was calculated at one transect at each site using a Hach FH950.1 handheld flow meter. Dissolved oxygen was measured using a handheld YSI Pro 2030 meter. Stream temperature, specific conductivity, pH, total dissolved solids, and salinity were measured using an Oakton PCS Testr 35 hand-held multi-parameter meter. Stream habitat metrics were collected using a qualitative habitat rating form. For streams less than 10 m wide, ratings included riparian buffer width, bank erosion, pool area, width: depth ratio, riffle: riffle or bend: bend ratio, fine sediments, and cover for fish. All Baraboo Hills stream sites sampled in 2020 met the <10 m stream width criteria (Table 5).

Population Assessment

Per Chapter 1 of Wisconsin Administrative code, specifically NR 1.02(7)(b), Wisconsin trout streams can be classified into one of three groups. A Class 1 stream (or portion thereof) contains trout spawning habitat and naturally produced fry, fingerling, and yearlings in sufficient numbers to utilize the habitat, or the stream contains trout with two or more age groups, above the age of one year, and natural reproduction and survival of wild fish in sufficient numbers to utilize the available trout habitat and to sustain the fishery without stocking. A Class 2 stream (or portion thereof) contains a population of

trout made up of one or more age groups, above the age of one year, in sufficient numbers to indicate substantial survival from one year to the next, and may or may not have natural reproduction of trout occurring; however stocking is necessary to fully utilize the available trout habitat or to sustain the fishery. A Class 3 stream (or portion thereof) requires annual stocking of trout to provide significant harvest and does not provide habitat suitable for the survival of trout throughout the year, or for natural reproduction of trout.

In order to appropriately classify a trout stream or a portion of one into one of these three classes, managers must conduct field surveys to assess the overall population age structure to determine which classification criteria are being met, and to identify impediments to meeting these criteria. Survey results may also indicate that a change in classification is warranted. The two most vital components to assess are natural reproduction and natural recruitment, and this must occur in the absence of stocking to clearly account for naturally produced fish. Natural reproduction is indicated by the presence of age 0 fish, also called young-of-year (YOY), in a non-stocked year. Natural recruitment is indicated by the presence of yearling fish in the year following a non-stocked year; these are fish that were naturally produced and survived for one year. No stocking of fingerling trout occurred in the Baraboo Hills stream management group in 2019 or 2020 to allow for evaluation of natural reproduction and recruitment in 2020. Sampling at sites requiring a 3-person crew may still be completed in 2021 because fingerling stocking in Leech Creek and Rowley Creek will not occur until September which will be after summer stream evaluations have been completed.

The age 0 trout catch rates in 2020 were thus indices of natural reproduction while the age 1 catch rates in 2020 served as indices of natural recruitment to the fisheries of the respective streams. For streams with regular fingerling stocking quotas, adult fish sampled in 2020 were fish $\geq$ 2 years of age that were the product of either natural reproduction or stocking that occurred in 2018 or earlier.

Once fish sampling was complete, trout catch-per-unit effort (CPUE, fish/mile) was calculated for each trout species based on the number of fish collected and the length of stream station sampled. The CPUE will be referred to in the narrative as the catch rate, and in tables and figures as CPUE. This allowed for comparisons of catch rates both within and among streams. Total catch rate, as well size-specific catch rates were calculated for young-of-year (age 0, <4.0 inches), yearlings (4.0-7.9 inches for Brown Trout and 4.0-6.9 inches for Brook Trout), and adults (age ≥ 2 years; ≥7 inches for Brook Trout and ≥8 inches for Brown Trout). Preferred-length trout were Brown Trout ≥ 12 inches and Brook Trout ≥ 10 inches.

Throughout the remainder of the report the results, conclusions, and recommendations for Prentice Creek are framed around the upper and lower reaches of the stream. Upper Prentice Creek included the Class 1 section upstream of State Highway 78 (sites 18 and 19). Lower Prentice Creek included the Class 3 segment (site 20). The habitat in the two sections of Prentice Creek varies greatly, with the upper section having higher gradient, frequent riffles, and common rock and gravel substrate. Lower Prentice Creek has a lower gradient, fewer riffles, sand and silt are the predominant substrates, and banks are steep and badly eroded. Water temperature varies little between the sections, but the lack of rock and gravel substrate and other trout habitat components limits natural reproduction, recruitment, and adult trout abundance in lower Prentice Creek.

Percentile values for size-specific trout catch rates referenced in the narrative, tables, and figures in this paper were generated from summaries of WDNR fishery surveys of Class 1 trout streams in the Driftless Area and Western Corn Belt Plains Ecoregion of Wisconsin (referred to as Driftless Area) as well as statewide from 2007-2014 where at least one trout was collected in the survey (surveys where the catch was zero were excluded). For reference, the Level III Ecoregions of Wisconsin, including the Driftless Area are shown in Figure 4. Please refer to Tables 6 and 7 for reference values for the 10^{th}, 25^{th}, 35^{th}, 50^{th} (median), 65^{th}, 75^{th}, and 90^{th} percentiles for catch rates for various size classes of Brook Trout and Brown Trout from surveys of Class 1 streams in the Driftless Area and statewide. Catch rate values that fall below the 35^{th} percentile indicate low

trout abundance, between the 35th and 65th percentiles indicate medium abundance, and values above the 65th percentile indicate high abundance.

Stream Temperature Monitoring at Trend Sampling Locations, 2015-2020

Stream temperatures are monitored annually at trout trend sampling locations, which for the Baraboo Hills stream group includes two sites on Manley Creek. Site 1 is the monitoring station nearest the headwater, located 69 meters upstream of State Highway 113. Site 2 is the monitoring station nearest the mouth, located 21 meters upstream of the confluence of Manley Creek with Parfrey's Glen Creek. Temperature was monitored at site 1 from July-November 2016, and continuously from March 2017 through the present day. Monitoring at site 2 occurred from March-October 2015 by volunteers from the Aldo Leopold Chapter of Trout Unlimited, and by WDNR staff from May-November 2016, March-November 2017, and continuously from June 2018 through the present day. Monitoring equipment consisted of HOBO Water Temperature Pro v2 data loggers attached to ½-inch steel rebar rods approximately 3 feet in length using hose clamps and a wooden mounting bracket. The steel rods were driven into the bottom substrate at a location near the edge of the thalweg, and to a sufficient depth to ensure the logger would remain submerged even during periods of low flow. Loggers were set to record water temperature every 30 minutes, and data were downloaded twice annually, typically in early spring and late fall.

Genetics Terminology

During later discussion of the genetic makeup of Brook Trout populations in the Baraboo Hills and elsewhere in southern Wisconsin, several terms will be used that are defined here. Domestic trout are fish that came from, or their ancestors came from, a hatchery where they were held for multiple generations and likely lost "wild" genes. Feral or wild trout are fish that were NR or parents were from wild sources (these still may have domestic genetic profile). Native trout are the "original" fish that were here before settlement and are assumed to be better adapted to local conditions than domestic trout. Theoretically native trout would be more resistant to diseases, parasites, or environmental variability.

RESULTS

In total, 21 stream sites were sampled within the Baraboo Hills stream group in 2020. Data were compiled based on both individual stream sites and grouped based on whole streams or stream segments for regional and statewide comparisons; catch rates were averaged for whole streams or stream segments with multiple sampling locations. Results from the warm water portions of Otter Creek (site 17, unclassified) and Parfrey's Glen Creek (site 5, between impoundment and Manley Creek confluence) were excluded from mean CPUE calculations for those streams.

Brook Trout

Brook Trout were collected at 18 of 21 sampling locations in the management group in 2020. Exceptions were one site each on Parfrey's Glen Creek and Otter Creek (sites 5 and 17; zero trout collected, water too warm for trout) and one site on the unnamed tributary to Rowley Creek (site 13; zero fish collected, habitat limitations). Brook trout were the predominant trout species in all streams in the group. Please refer to Table 8 for Brook Trout catch rates for all size classes from all sampling locations as well as averages for each stream or stream segment.

Catch Rates

Boulder Creek had the highest mean total Brook Trout catch rate of all streams in the group at 2,360.5 fish/mile (range 1,384.4-3,336.6 fish/mile) followed by upper Prentice Creek (1,966.2 fish/mile; range 1,678.7-2,253.7 fish/mile), Manley Creek (933.7 fish/mile; range 402.4-1,464.9), Rowley Creek (868.2 fish/mile; range 383.3-1,529.3 fish/mile), Otter Creek (824.5 fish/mile; range 301.0-1,303.1 fish/mile), Clark Creek (515.1 fish/mile; range 273.7-756.6 fish/mile), Leech Creek (386 fish/mile), Parfrey's Glen Creek (233.4 fish/mile; range 80.5-386.3 fish/mile), and lower Prentice Creek (30.7 fish/mile). Brook Trout catch rates for each individual sampling location are presented in Figure 5 while mean catch rates by stream or stream segment are presented in Figure 6.

Age 0 Brook Trout (young-of-year; <4.0 inches) were most abundant in Boulder Creek where the mean catch rate was 1,510.5 fish/mile, followed by Upper Prentice Creek (712.9 fish/mile), Rowley Creek (565.7 fish/mile), Otter Creek (383.6 fish/mile), Clark Creek (330.0 fish/mile), Manley Creek (249.5 fish/mile), Leech Creek (144.9 fish/mile) and Parfrey's Glen Creek (96.6 fish/mile). Age 0 Brook Trout were absent from lower Prentice Creek. Age 0 Brook Trout catch rates are presented in Figure 7.

Age 1 Brook Trout (yearling; 4.0-6.9 inches) were most abundant in upper Prentice Creek where the mean catch rate was 969.7 fish/mile followed by Boulder Creek (569.3 fish/mile), Otter Creek (313.1 fish/mile), Manley Creek (305.9), Clark Creek (144.9 fish/mile), Rowley Creek (69.0 fish/mile), Manley Creek and Leech Creek (both 64.4 fish/mile), and lower Prentice Creek (30.7 fish/mile). Age 1 Brook Trout catch rates are presented in Figure 8.

Adult Brook Trout (≥7 inches) were most abundant in Manley Creek where the mean catch rate was 378.3 fish/mile followed by upper Prentice Creek (283.6 fish/mile), Boulder Creek (280.7 fish/mile), Rowley Creek (233.5 fish/mile), Leech Creek (177.1 fish/mile), Otter Creek (127.8 fish/mile), Parfrey's Glen Creek (72.4 fish/mile), and Clark Creek (40.2 fish/mile). No adult Brook trout were collected from lower Prentice Creek. Adult Brook Trout catch rates are presented in Figure 9. Preferred-length Brook Trout were most abundant in Manley Creek where the mean catch rate was 56.3 fish/mile, followed by Leech Creek (32.2 fish/mile), and Otter Creek (14.8 fish/mile). Preferred-length Brook Trout catch rates are presented in Figure 10.

Brown Trout

Brown Trout were collected at 3 of 21 sampling locations in the management group in 2020 including Leech Creek and two sites on Rowley Creek. Brown trout were most abundant in Leech Creek where the total CPUE was 177.1 fish/mile, followed by Rowley Creek (62.6 fish/mile). Catch rates of all size classes of Brown Trout were higher in Leech Creek compared to Rowley Creek. Please refer to Figures 11-16 and Table 9 for

Brown Trout catch rates for all size classes from all sampling locations as well as averages for each stream or groups of sites within a stream.

Trout CPUE rotational monitoring of Leech Creek and Rowley Creek 2012-2017

The only trout trend monitoring stations in the Baraboo Hills trout stream management group are on Manley Creek with the remaining streams sampled on either a 3-year or 6-year rotation. Prior to the 2020 evaluation, Rowley Creek was sampled on a 3-year rotation with the most recent sampling visits occurring in 2017. Leech Creek was sampled on a 6-year rotation with the most recent sampling occurring in 2012. Data are available from previous rotational visits to stations on lower Rowley Creek (22m upstream County Hwy. W; site 10), and lower Leech Creek (300m downstream of Paschen Road; site 23) that were not sampled in 2020. Brook trout data from 2012, 2014, and 2017 represent the populations in each stream under a normal stocking regime except for age 0 catch rates because the surveys occurred prior to stocking each year and thus represent natural reproduction in all years. Brown trout data collection during previous visits occurred in the absence of stocking for several years; the last Brown Trout stocking at Leech Creek occurred in 2009, and in 2011 at Rowley Creek. Brown Trout data from both streams represent naturally reproducing populations. The data from the 2012, 2014, and 2017 visits are included here as a surrogate for sampling that was not completed in 2020.

Brook Trout

No Brook Trout were found during the previous visit to lower Leech Creek (site 23) in 2012; the catch was composed entirely of Brown Trout. For lower Rowley Creek (site 10) in 2014, the total Brook Trout catch rate was 64.4 fish/mile including 56.4 age 0 fish/mile and 8.0 yearling fish/mile. In 2017, the total Brook Trout catch rate at site 10 was 237.6 fish/mile including 222.3 age 0 fish/mile and 15.3 adult fish/mile. In both 2014 and 2017, stream surveys on Rowley Creek occurred prior to the stocking of large fingerling Brook Trout and age 0 catch rates represent natural reproduction. Brook Trout catch rates from the previous visits to lower Leech and Rowley creeks are presented in Figure 17.

Brown Trout

The total Brown Trout catch rate for Leech Creek at site 23 in 2012 was 1,030 fish/mile including 908.6 age 0 fish/mile, 71.5 yearling fish/mile, and 50.1 adult fish/mile which included preferred-length fish (14.3 fish/mile). Because no stocking of Brown Trout had occurred the previous three years, all age 0 and yearling fish plus many of the adults were naturally produced.

The total Brown Trout catch rate at site 10 on Rowley Creek in 2014 was 660 fish/mile including 265.6 age 0 fish/mile, 289.8 yearling fish/mile, and 104.6 adult fish/mile. In 2017 the total Brown Trout catch rate at site 10 was 1,180.5 fish/mile including 705.2 age 0 fish/mile, 276.0 yearling fish/mile, and 199.3 adult fish/mile which included preferred-length fish (38.3 fish/mile). Brown Trout catch rates for Leech Creek site 23 in 2012 and Rowley Creek site 10 in 2014 and 2017 are presented in Figure 18.

Shift in abundance of Brown Trout and Brook Trout in Middle Rowley Creek

Beginning in 2008, fishery surveys occurred on a 3-year rotation at four locations on Rowley Creek; sites 7, 8, 9, and 10 (Figure 1). Once exception is that no survey occurred at site 10 in 2020. Brook Trout were the predominant trout species at the upstream-most site (site 7) in all years, with Brown Trout collected in only one survey (2011, n = 2 brown trout, CPUE = 32.2 fish/mile). Brook Trout abundance at site 7 was the highest in 2020 of any rotational sampling visits (Figure 19). By contrast, Brown Trout were the predominant trout species at the downstream-most site (site 10) for all years with available data.

The stocking strategy switched from Brown Trout stocking to Brook Trout stocking in 2012, and Brook Trout have been the only species stocked in Rowley Creek since that time. A shift has occurred at the two middle sampling locations (sites 8 and 9) where Brown Trout abundance declined significantly after 2011, and there has been a corresponding increase in Brook Trout abundance, with Brook Trout now being the predominant trout species by a wide margin. Also, of note is the fact that very few trout

of either species were collected at sites 8 and 9 in 2014. Brook Trout CPUE data from sites 8 and 9 are presented in Figures 20 and 21, while Brown Trout CPUE data from the same sites are presented in Figures 22 and 23.

Manley Creek CPUE Trend Data (2008-2020) and Temperature Data (2015-2020)

Trout trend data

Stream surveys have occurred annually at two sampling locations on Manley Creek since 2008; sites 1 and 2. Differences in total Brook Trout catch rates between the two sampling locations are evident across the full time series of data. Site 1 is the upstream sampling location, above State Highway 113 in Devils Lake State Park. The Brook Trout catch rate at that location peaked at 1,545 fish/mile in 2009. Since that time, however, catch rates have been variable but trending downward overall to 402 fish/mile in 2020. By contrast, Brook Trout catch rates at the downstream sampling location near the mouth (site 2) have been variable, but not trending upward or downward overall with total CPUE approaching 1,500 fish/mile during peak years. Brook Trout trend CPUE data for sites 1 and 2 are presented in Figures 24 and 25.

Stream temperature data

The mean July temperature of Manley Creek at the upstream monitoring location (site 1) increased each year from 2016 through 2020. The greatest increase came after 2018, when the mean July temperature increased from 60.6 ºF to 67.5 ºF by 2020. The maximum observed July temperature also increased from 67.5 ºF in 2018 to 74.8 ºF in 2020. A similar trend was noted at the monitoring location near the mouth (site 2) where the mean July temperature increased from 57.8 ºF in 2018 to 63.0 ºF in 2020. The maximum observed July temperature also increased from 65.3 ºF in 2018 to 71.8 ºF in 2020. Stream temperature trend data for sites 1 and 2 are presented in Figures 26 and 27.

DISCUSSION

General

Baraboo Hills trout streams support trout populations exclusively composed of Brook Trout with Leech Creek and Rowley Creek being the exceptions with mixed Brook and

Brown Trout populations. Additionally, all classified streams are currently Class 1 except Leech Creek (Class 2) and lower Prentice Creek (Class 3). No stocking records could be found for Manley Creek or the unnamed Tributary to Rowley Creek. Stocking histories for Parfrey's Glen Creek, Clark Creek, and Boulder Creek indicate that Brook Trout have been the only trout species stocked there. Stocking histories for Otter Creek, Prentice Creek, Rowley Creek, and Leech Creek indicate that Brook, Brown, and Rainbow Trout were stocked in the streams at various times throughout history. Rainbow Trout were stocked in the 1970s and earlier as harvestable-sized trout to create a put-and-take opportunity for anglers and did not persist naturally in any stream after stocking ended. Brown Trout only persisted in streams where consistent stocking of feral small fingerlings for several years led to establishment of self-sustaining populations; Leech Creek and Rowley Creek. In all other streams with a history trout stocking (including Manley Creek which is connected to historically-stocked Parfrey's Glen Creek), Brook Trout were the only species that persisted after stocking ended, or became the predominant trout species after the species stocked switched from Brown Trout to Brook Trout.

Interestingly, of the 9 Baraboo Hills streams surveyed only Rowley Creek and Manley Creek have populations of mottled sculpin, a native coldwater fish typically found in area trout streams. One hypothesis to explain the lack of sculpins is that the fish communities in those streams may have once supported trout and other coldwater species, but lost those populations through some major disturbance, human or otherwise, after which trout were re-established through stocking. However non-game species such as sculpin were not stocked, and without connected source populations from which to re-colonize the Baraboo Hills streams they failed to re-establish themselves. Today, the streams that do not contain sculpins contain Brook Trout (Leech Creek also holds Brown Trout), and the remainder of the fish community is composed of warm or coolwater forage fishes that match what is found in non-trout waters connected to the trout streams. It may also be that those streams never held sculpins due to some artifact of the characteristics of the streams and their habitats such as the high gradient step pool habitats found in many of the streams. It should be noted that Manley Creek and Rowley Creek (which contain

sculpins) have the lowest gradient of any of the Baraboo Hills streams surveyed with the exception of Leech Creek, and the stream characteristics and habitat of Manley and Rowley creeks more closely match other area trout streams with sculpin populations.

Interestingly, genetic testing of Brook Trout collected from Manley Creek in 2015 revealed that their genetics were of uncharacterized hatchery origins, likely related to fish from hatcheries in the eastern United States (Erdman et al., in review). It had been previously thought that Manley Creek was home to a population of Brook Trout with native Wisconsin genetics. Genetic testing yielded similar results for Parfrey's Glen Creek, which was closely related to Manley Creek (Erdman et al., in review). Despite a lack of documented historic trout stocking, Manley Creek's connection to Parfrey's Glen Creek likely accounts for the domestic genetics found there as the genetics of the two streams match closely. It is likely then that other Baraboo Hills streams with a history of Brook Trout stockings from the 1940s-1970s (Otter, Prentice) are dominated by non-native domestic genetics. Elsewhere, Brook Trout stocking that occurred in Clark Creek (1998-2009), Leech Creek (1998-2016), Rowley Creek (2012-2016), and Boulder Creek (2015) utilized feral offspring produced from wild fish collected predominantly from Ash Creek as well as Melancthon Creek and Mill Creek in Richland County, Wisconsin. Genetics of Brook Trout from Clark Creek collected in 2016 and 2017 matched closely with Manley Creek and Parfrey's Glen Creek.

It was previously thought that Ash Creek, Melancthon Creek, and Mill Creek all contained Brook Trout with native Wisconsin genetics. Testing revealed that this was not the case, however, as Ash Creek proved to be of domestic hatchery origin from the St. Croix Falls hatchery strain which originated from hatchery fish from Virginia and New Hampshire (Erdman et al., in review). Mill Creek fish were determined to be of uncharacterized hatchery origins (Erdman et al., in review). Only Melancthon Creek Brook Trout were determined to be of native Wisconsin genetic origins (Erdman et al., in review). Considering the findings of genetic testing that has already occurred on some Baraboo Hills streams as well as the streams used as wild hatchery brood sources for Brook Trout recently stocked in the Baraboo Hills, further testing should be completed to

determine genetic origins of the Brook Trout populations in Otter Creek, Prentice Creek, Boulder Creek, Rowley Creek, and Leech Creek.

Generally speaking, Baraboo Hills streams have some characteristics that will benefit the trout populations in the future. Climate models project that Wisconsin will slowly become warmer over the next 50 years and that trout populations, especially brook trout, will be negatively impacted in many streams due to rising temperatures (Lyons 2020). Baraboo Hills streams or stream segments that currently support Brook Trout have watersheds with relatively low amounts of human disturbance compared to other streams in southern Wisconsin. Large tracts of land in the Baraboo Hills remain forested, and the steep terrain makes vast sections of land unsuitable for intensive agriculture practices, reducing the likelihood that those lands will see significant development in the future. Moving forward, maintaining groundwater inputs into streams will help to counteract the warming climate, protecting trout populations as a result. This is accomplished by maximizing areas where water from rain or melting snow can infiltrate the ground as opposed to running off as surface water directly to streams and rivers. Areas of natural vegetation (e.g. forests, grasslands, wetlands, no till ag lands, etc.) help to maximize infiltration and groundwater recharge, whereas impervious surfaces such as buildings, paved surfaces, and areas of compacted soil reduce infiltration (Lyons 2020). Additionally, shading of the stream channel provided by forest cover helps to limit the warming effect of the sun on the stream.

Boulder Creek

Boulder Creek had the highest mean total Brook Trout catch rate in the Baraboo Hills management group in 2020, far outpacing all other streams in the group except for upper Prentice Creek. The sampling location in the Potter Preserve had a catch rate of nearly 3,400 Brook Trout per mile. On a broader scale, natural reproduction was high in Boulder Creek with the age 0 Brook Trout catch rate placing above the 90th percentile compared to streams in the Driftless region, and statewide. Natural recruitment as measured by age 1 trout abundance was also high, exceeded by only Prentice Creek within the management group. Adult Brook Trout abundance was also high, again

placing between the 75th and 90th percentiles compared to streams in the Driftless region, and statewide. Preferred-length Brook Trout were not found in Boulder Creek; however, this is likely a function of the high density of fish combined with a relative lack of cover for larger trout. Boulder Creek is a high gradient stream that flows through a boulder field with occasional step pools, and by its very nature is limited in its capacity to hold larger trout.

The previous rotational sampling visit to Boulder Creek in 2013 included sampling effort at one of two sites sampled in 2020; site 12 just upstream of County Highway W. The 2013 sampling effort yielded only a single Central Mudminnow and no trout. By contrast, the 2020 visit to site 12 yielded a Brook Trout catch rate of nearly 1,400 fish/mile. In 2013, one hypothesis was that a manure release from an upstream dairy farm may have caused a fish kill that left the stream devoid of fish. However, in the years since 2013, it became evident that there was a period time from 2013-2016 when many trout streams in southern Wisconsin experienced periods of low trout abundance. A drought summer in 2012 followed by two relatively cold winters in 2013 and 2014 may have contributed greatly to this phenomenon. In any case, the only stocking in Boulder Creek between 2013 and 2020 was a single stocking of large fingerling Brook Trout in 2015. Recolonization from other parts of the stream and natural reproduction took care of the rest.

Based on high abundance of Brook Trout in Boulder Creek and the high levels of natural reproduction and recruitment, Boulder Creek is correctly classified as Class 1 and no change is needed. The Boulder Creek watershed including the stream corridor is primarily forested in its upper reaches, and there is a significant amount of public ownership already in place via the Potter tract within the Baraboo Hills Recreation Area. Boulder Creek is a Streambank Easement eligible stream, and acquisition efforts should be focused in the lower part of the watershed where the stream transitions from forested lands to open pasture and row-crop agriculture lands. This is the area of greatest streambank protection need. Fee title acquisitions along the lower reaches of the stream will not be possible unless NRB-approved acquisition boundaries for the Baraboo Hills

Recreation Area are expanded to include more land north of the current boundary. Such expansion is encouraged because it would make it possible to acquire the farm property along Boulder Creek north of the current state-owned lands which would greatly reduce nutrient and sediment impacts arising from the farming operation that are delivered to Boulder Creek during runoff events. Boulder Creek is approved for streambank easement acquisition. If expanded fee title acquisition authority is not possible, streambank easement acquisition is the next best option. Acquiring easements along Boulder Creek would provide increased angler access as well as new opportunities for streambank protection and in-stream trout habitat improvements. For these reasons, streambank easement acquisition efforts should resume at Boulder Creek.

Unnamed Tributary to Rowley Creek

No trout were collected from the unnamed tributary to Rowley Creek in 2020, and only 4 Brook Trout were collected during the previous visit in 2012. This stream is never likely to have high trout abundance due to the characteristics of the stream, specifically extremely high gradient, low flow volume, and near total lack of sufficient water depth for holding trout or any other fish. During base flow conditions the stream is essentially a wide area of water trickling through boulders and cobble with the occasional step pool with depths of one foot or less. Brook Trout may occasionally move up the stream from Rowley Creek to inhabit these step pools, and that would be considered fully utilizing the habitat. Beyond that the stream just has no capacity to support large numbers of trout. Based on the thermal regime of the stream and past records of naturally produced fish, this stream is correctly classified as Class 1. Stocking will not produce a better fishery; therefore, no stocking is warranted. The current trout fishing regulation is sufficient to protect the trout population in the stream which is unlikely to attract much angling pressure.

Rowley Creek

Rowley Creek had the fourth highest mean total Brook Trout catch rate out of 9 streams in the Baraboo Hills management group in 2020. On a broader scale, total Brook Trout abundance was high, with the total catch rate placing between the 75th and 90th

percentiles for the Driftless region and statewide. Abundance of age 0 Brook Trout (age 0 CPUE; natural reproduction) was also high, placing between the 75th and 90th percentiles compared to streams in the Driftless region, and statewide. Natural recruitment as measured by age 1 trout abundance was low relative to several of the other streams in the group. Adult Brook Trout abundance was high, again placing below the 75th and 90th percentiles compared to streams in the Driftless region and statewide. The adult Brook Trout catch rate of 273 fish/mile was well above the minimum fishable population standard of 50 adult trout per mile for stocked Wisconsin trout streams. No preferred-length Brook Trout were collected during the 2020 surveys.

Natural reproduction and recruitment of Brown Trout is also occurring in Rowley Creek, although Brook Trout far outnumbered Brown trout during surveys in 2020 as well as past visits in 2014 and 2017. Brown Trout have not been stocked in Rowley Creek since 2011, and their abundance declined in the upper and middle reaches of Rowley Creek after stocking ended. One exception was lower Rowley Creek (as measured at site 10), where Brown Trout was the predominant species by a wide margin in 2014 and 2017. Natural reproduction and recruitment of Brown Trout in lower Rowley Creek remained high after the cessation of stocking, and this may be due to the habitat present in lower Rowley Creek where there is a section of relatively high gradient with abundant rock and gravel substrate. By contrast, sections of Rowley Creek further upstream that are dominated by Brook Trout have somewhat lower gradient, sand or silt bottom, very little rock or gravel substrate, deeper pools, and coarse woody debris in the stream. These are the areas where Brown Trout abundance dropped precipitously after stocking ended. These differences in stream habitat between upper and lower Rowley Creek are likely to perpetuate the continuation of a mixed Brook and Brown Trout fishery, with Brook Trout dominant in the upper and middle reaches, and Brown Trout dominant in the lower reaches of Rowley Creek. Sampling at site 10 did not occur in 2020 because of Coronavirus work restrictions, but hopefully the survey can be completed in 2021. It will be interesting to see if anything has changed regarding trout species composition at that site since 2017.

Based on overall abundance, natural reproduction, and natural recruitment of Brook and Brown Trout, Rowley Creek is performing at the Class 1 level and no change in classification is needed. A change in management strategy has affected a change in trout species composition over much of the stream, with Brook Trout now the predominant species in all but the lower reaches of Rowley Creek. Brook Trout natural reproduction and adult abundance are high, but naturally produced yearling abundance in 2020 was lower than might be expected. Because observed natural reproduction of Brook Trout was high in 2020 and moderate to high in past years, Rowley Creek should continue to be monitored in the absence of Brook Trout stocking to determine if the stream is now able to fully support itself through natural reproduction and recruitment. To that end Rowley Creek should be surveyed annually through the next watershed evaluation in 2026.

Rowley Creek is approved for streambank easement acquisition, but to date has very little public ownership along its course. Anglers would benefit from increased public access to the banks of this quality trout resource. Increased public ownership would also provide new opportunities for streambank protection and in-stream trout habitat improvements. For these reasons, streambank easement acquisition efforts should resume at Rowley Creek.

Leech Creek

Only one of two planned surveys on Leech Creek was completed in 2020. Total trout abundance (Brook and Brown Trout catch rates combined) was 563 fish/mile. Based on the single completed survey, Brook Trout abundance ranked 7th out of 9 streams in the group. On a broader scale, total Brook Trout abundance was moderate to high, placing between the 65th and 75th percentiles compared to streams in the Driftless region, and between the 50th and 65th percentiles statewide. Natural reproduction was moderate to high, again placing between the 65th and 75th percentiles when compared regionally, and between the 50th and 65th percentiles statewide. Natural recruitment as measured by age 1 Brook Trout abundance was low relative to other streams in the group, tied for 6th out of 9 streams. Adult Brook Trout abundance was high, placing between the 65th and 75th

percentiles compared to streams in the Driftless region, and between the 75th and 90th percentiles statewide. No preferred-length Brook Trout were collected.

Brown Trout abundance in Leech Creek was higher than Rowley Creek, the only other stream in the group where Brown Trout were collected. On a broader scale, Brown Trout abundance was low, placing between the 10th and 25th percentiles compared to streams in the Driftless Region, and between the 25th and 35th percentiles statewide. Natural reproduction was low to moderate, placing between the 25th and 35th percentiles in the Driftless region, and between the 35th and 50th percentiles statewide. Natural recruitment was low, placing between the 10th and 25th percentiles regionally and statewide. Adult Brown Trout abundance was low to moderate, placing between the 25th and 35th percentiles compared to streams in the Driftless area, and between the 35th and 50th percentiles statewide. Abundance of preferred-length Brown Trout was moderate to high, placing between the 50th and 65th percentiles compared to streams in the Driftless region, and between the 65th and 75th percentiles statewide.

Differences were apparent in the trout catch at site 22 in 2020 compared to the previous visit in 2012. Brook Trout abundance increased by more than five-fold from 64.4 fish/mile to 386.0 fish/mile. By contrast, Brown Trout abundance remained nearly the same over that time period, increasing slightly from 161 fish/mile to 177 fish/mile (a difference of one fish in the 100-meter station). The 2012 visit occurred just two years after a switch from stocking both Brook and Brown Trout to stocking exclusively Brook Trout in Leech Creek. The increase in Brook Trout abundance from 2012 to 2020 may simply be reflective of the extended period of exclusive Brook Trout stocking. Completion of the survey at site 23 on the lower part of the classified portion of Leech Creek in 2021 will be critical to fully understanding the trout populations in the stream. The previous visit to site 23 in 2012 found only Brown Trout, with abundance in excess of 1,000 fish/mile and copious amounts of natural reproduction (>900 age 0 fish/mile). If lower Leech Creek remains a stronghold for Brown Trout in 2021, it will be clear that Leech Creek will remain a mixed trout fishery, and Brook Trout will never replace Brown Trout through stocking alone.

Based on total trout abundance, natural reproduction, and natural recruitment at site 22 alone, Leech Creek is not performing at the Class 1 level, and the current Class 2 designation should be maintained. Large fingerling Brook Trout stocking may resume after the survey at site 23 is completed. The current trout fishing regulation is sufficient to protect the population while providing harvest opportunities for adult trout and no regulation change is needed. Extensive segments of the classified portion of Leech Creek already provide public fishing access through WDNR easements. Leech Creek generates itself over a very short distance and flows through an area of numerous springs and seeps, over a bed that is nearly 100% sand. Natural instream trout habitat is relatively good with deep bends, undercut banks, overhanging vegetation, and occasional coarse woody debris providing most of the cover. The stream is a poor candidate for intensive trout habitat improvement projects due to the lowland nature of the stream corridor with its many springs and seeps, and overall unstable substrate (unstable sand fluidized by upwelling ground water).

Clark Creek

Brook Trout abundance ranked 6th out of 9 streams in the group. On a broader scale, total Brook Trout abundance was high, placing between the 75th and 90th percentiles compared to streams in the Driftless region, and between the 65th and 75th percentiles statewide. Natural reproduction was high, placing between the 75th and 90th percentiles when compared regionally and statewide. Natural recruitment as measured by age 1 Brook Trout abundance was in the middle of the pack compared to other streams in the group, tied for 5th out of 9 streams. Adult Brook Trout abundance was moderate, placing between the 35th and 50th percentiles compared to streams in the Driftless region and statewide. No preferred-length Brook Trout were collected.

Based on total Brook Trout abundance and levels of natural reproduction and recruitment observed in 2020, Clark Creek is performing at the Class 1 level. The population is self-sustaining and is fully utilizing the available habitat in this small, high gradient stream. Low numbers of larger adult trout are a function of the small stream size and resultant

limited amount of cover available for larger trout. Stocking is not likely to affect an increase in fishery quality and is not recommended. A significant portion of the upper Clark Creek watershed is currently under state ownership as part of Devils Lake State Park. Much of the stream corridor is forested in its upper reaches, and the shade provided should help to mitigate increasing stream temperatures due to climate change. The state-owned portion of the stream is very remote with respect to access from roads and fishing pressure is likely very limited. The current fishing regulation is sufficient to protect the trout population in Clark Creek and no change is recommended. Based on its remote location, the high gradient of the stream, and the steep nature of the terrain along the stream, Clark Creek is a poor candidate for intensive trout habitat improvements beyond the 2013 flood mitigation and streambank revetment project. Land acquisition along Clark Creek will be limited to lands within the NRB-approved acquisition boundary for Devils Lake State Park.

Prentice Creek

The Class 1 segment of Prentice Creek (upstream of State Highway 78) had the second highest mean total Brook Trout catch rate out of 9 streams in the Baraboo Hills management group in 2020. On a broader scale, total Brook Trout abundance was very high, placing above the 90th percentiles when compared to streams in the Driftless region and statewide. Abundance of age 0 Brook Trout (age 0 CPUE; natural reproduction) was very high, once again placing above the 90th percentiles when compared to streams in the Driftless region and statewide. Age 1 abundance in upper Prentice Creek was the highest of any of the 9 streams in the group at nearly 1000 fish/mile. Adult Brook Trout abundance was high, placing between the 75th and 90th percentiles in regional and statewide comparisons. No preferred-length Brook Trout were collected. The mean total Brook Trout catch rate in upper Prentice Creek was over 800 fish/mile higher in 2020 compared to 2014. This is yet another example of a trout population in southern Wisconsin experiencing a period of depressed abundance in the mid-2010s with a subsequent recovery.

At the single sampling location downstream of Highway 78 (site 20), the only Brook Trout collected were two yearlings. This was not vastly different than the previous visit in 2014 when one yearling Brook Trout was collected. Sampling at the downstream-most location (site 21) was not completed in 2020, but will likely be completed in 2021. The previous survey at site 21 in 2014 yielded zero trout and a fish community indicative of a warm water stream.

Natural reproduction and recruitment of Brook Trout are occurring at high levels in upper Prentice Creek, and adult fish are also present at high abundance. The Class 1 segment of the stream is performing at the high Class 1 level and no change in classification is needed. Lower Prentice Creek is Class 3 water and based on 2020 data this classification is also correct and no change is needed. The current trout fishing regulation provides a harvest opportunity while protecting larger fish, and further protects Brook Trout by encouraging harvest of any Brown or Rainbow Trout caught in Prentice Creek. No regulation change is needed.

Public access to Prentice Creek is limited to road crossings, however the stream is eligible for Streambank Easement acquisition. Easements should be pursued along the Class 1 portion of Prentice Creek for the purpose of providing access for fishing, as well as providing a measure of streambank protection and the ability to undertake trout habitat improvement projects there. Easement acquisition along the Class 3 segment of Prentice Creek would provide badly needed streambank protection along a stretch of stream where row crop agriculture is having a negative impact. However, no effort should be made to acquire easements downstream of Indian Farm road where stream temperatures are too warm to support trout.

Parfrey's Glen Creek

Parfrey's Glen Creek supports a self-sustaining Brook Trout population upstream of County Highway DL, but downstream of DL the stream loses its ability to support trout and ceases to be recognizable as a stream for a significant distance before re-forming as a warm water stream. Upstream of County Highway DL, Brook Trout abundance in

Parfrey's Glen Creek ranked 8th of 9 streams in the group. On a broader scale, total Brook Trout abundance was moderate, placing between the 50th and 65th percentiles for the Driftless region and between the 35th and 50th percentiles when compared statewide. Abundance of age 0 Brook Trout (age 0 CPUE; natural reproduction) was medium, placing between the 50th and 65th percentiles regionally and statewide. Natural recruitment as measured by age 1 trout abundance was low compared to other streams in the group, placing 8th of 9 streams. Adult Brook Trout abundance was medium, placing between the 50th and 65th percentiles regionally and statewide. No preferred-length Brook Trout were collected.

Downstream of the confluence with Manley Creek, Parfrey's Glen Creek is cold enough to once again support trout. The first 400 meters downstream of the confluence underwent intensive streambank and habitat improvement in the winter of 2017-2018, and a survey of that stream segment in 2018 found 493 Brook Trout per mile including 189 age 0 fish/mile, 142 yearling fish/mile, and 162 adult fish/mile which included preferred-length fish (16 fish/mile). The survey planned at that location in 2020 could not be completed but is planned for 2021.

Much of the upper portion of the Parfrey's Glen Creek watershed is under WDNR ownership through Parfrey's Glen State Natural Area. The NRB-approved acquisition boundary for Natural Area includes the land where the springs that form the headwater of the creek are located. Future acquisition of that property is desirable, but any effort to acquire it should be led by the State Natural Areas program.

Parfrey's Glen Creek is a small stream with a relatively low volume at base flow and an extremely high gradient compared to other area streams, especially upstream of Highway DL. Brook Trout abundance and population size structure are not likely to be improved by stocking or habitat initiatives in upper Parfrey's Glen Creek based on the size and gradient of the stream and neither are recommended. The lower portion of the stream below the Manley Creek confluence offers public access for anglers on the Riverland Conservancy property owned by Alliant Energy. Natural reproduction and recruitment

along with emigration of Brook Trout from Manley Creek will sustain Brook Trout in lower Parfrey's Glen Creek moving forward. Downstream of the Riverland Conservancy property, the stream temperature warms up and becomes marginal for trout for the remainder of the length of the stream.

Manley Creek

Manley Creek had the third highest Brook Trout abundance out of 9 streams in the Baraboo Hills management group in 2020. On a broader scale, total Brook Trout abundance was high, placing between the 75th and 90th percentiles compared to streams in the Driftless region and statewide. Abundance of age 0 Brook Trout (age 0 CPUE; natural reproduction) was moderate to high, placing between the 75th and 90th percentiles regionally, and between the 65th and 75th percentiles when compared statewide. Natural recruitment as measured by age 1 Brook Trout abundance was ranked 4th of 9 streams in the group. Adult Brook Trout abundance was the highest of any stream in the group and high on a broad scale, placing between the 75th and 90th percentiles regionally and above the 90th percentiles statewide. Manley Creek had the highest abundance of preferred-length Brook Trout of any stream in the group, and abundance was high on a broad scale placing above the 90th percentile regionally and statewide. The 9-inch maximum size limit has been effective at increasing the abundance of preferred-length Brook Trout.

High total Brook Trout abundance combined with high natural reproduction and recruitment indicate that Manley Creek is performing at the Class 1 level and no change in classification is needed. Stocking is not needed to maintain the trout population in the stream. One exception is stocking of Brook Trout to restore the native genetic profile of the population. Testing of Brook Trout from Manley Creek indicated that the genetic makeup of the population matched genetics that came to the stream via stocking of a domestic hatchery strain of Brook Trout brought to Wisconsin from the eastern United States many years ago. Future stocking of Brook Trout in Manley Creek would be allowed for the purpose of phasing out domestic genetics over time by repeatedly stocking native-strain fish. This management activity would be part of a larger effort

occurring on 18 streams across southern Wisconsin aimed at assessing the effectiveness of stocking to restore the native genetic profile.

The goal for Manley Creek is to maintain a Class 1 Brook Trout fishery with an adult catch rate ≥ 200 fish/mile which is above the 75th percentile for streams in both the Driftless region and statewide. The current trout fishing regulation allows for the harvest of smaller Brook Trout which reduces population density and improves growth while protecting size structure by protecting larger adults from harvest. Under this regulation, size structure may also be improved through cannibalism where larger protected Brook Trout utilize small Brook Trout as prey. The regulation further protects Brook Trout by allowing the harvest of any Brown or Rainbow trout caught in Manley Creek. No regulation change is needed.

Annual sampling at Manley Creek has revealed a trend of decreasing Brook Trout abundance upstream of State Highway 113 since 2009. By contrast, downstream of Highway 113 the trend sampling indicated that although variable, trout abundance was stable overall and was neither trending upward nor downward. The cause for the slow steady decline in abundance upstream of Highway 113 is habitat related. Habitat projects implemented from 1997-2002 transformed Manley Creek from a stream with very low trout abundance to a stream with nearly the highest Brook Trout abundance in the area. During the summer of 2000, a WCC youth crew installed log habitat structures by hand (vortex weirs, cross-channel weirs) into 2,200 feet of Manley Creek upstream of Highway 113. Habitat structures in this segment of Manley Creek affected significant increases in brook trout abundance from less than 100 trout/mile prior to project completion to a high of 1,545 brook trout per mile at the peak in 2009. Since 2009, however, brook trout abundance, while variable from year to year, has steadily declined to 402 fish/mile as of 2020. This is largely a result of reduced effectiveness of the habitat structures. Over time these structures have begun to fail, and many are no longer serving their intended purpose of creating scour to maintain pool depth (overhead cover). On-site inventory in January 2021 found several structures experiencing some degree of failure.

In January 2021, Staff also observed that the stream channel was incised with vertical banks generally approaching 3 feet in height.

To remedy this, a new habitat improvement project is planned for the summer of 2022 which will remove the failing (displaced and rotten) wooden structures and replace them with equivalent rock structures (cross channel or v-notch vortex weirs). Weirs will be reconstructed or reconfigured and associated pools below the weirs may be excavated to increase depth. Scouring action provided by the weirs will then maintain pool depth once the project is complete. Coarse woody debris (root wads or logs anchored into the bank) will be installed in pools to create additional overhead cover by mimicking the natural process of recruitment of wood into the stream. Another part of the project is to slope the incised banks back to 3:1 along approximately 1,500 linear feet of stream, giving the stream more relief during flood events by giving it immediate access to the floodplain as opposed to pinning the stream in the incised channel until it reaches bank-full height. Increased energy within the incised channel during high water events has contributed to the failing of habitat structures by eroding banks around and over the rock that was anchoring the structures, thereby dislodging the structures and pushing them out of place.

Another recent cause for concern is the increasing temperature of Manley Creek as indicated by continuous temperature monitoring at locations on upper and lower Manley Creek. The mean July temperature increased by nearly 7 degrees from 2018 to 2020 in upper Manley Creek, and by more than 5 degrees in lower Manley Creek over the same time period. Land use in the watershed has not changed during that time, and the watershed remains largely protected and undisturbed. The increase in temperature is likely a result of beaver activity in the uppermost reach of Manley Creek. A large area of beaver activity including at least one large dam was discovered approximately 0.5 mile upstream of State Highway 113 in January 2021. This area is not frequently visited by fisheries staff or anglers which likely led to the beaver activity going undetected for an extended period. Beaver activity near Highway 113 was a problem in the fall of 2017 and again in spring 2019, but those areas were within sight of the road and easy to detect and address. Impoundment of the stream caused by the dam or dams located far

upstream of Highway 113 likely has led to the significant warming of the stream since 2018. The beaver activity will be addressed by USDA APHIS staff in early spring 2021 and hopefully the temperature monitoring reveals a return to the normal temperature regime in summer 2021.

The entire length of Manley Creek is publicly accessible, and the entire watershed is owned by either the State of Wisconsin or the Riverland Conservancy. For these reasons, additional land acquisition efforts on Manley Creek are not needed.

Otter Creek

Otter Creek had the fifth highest mean total Brook Trout CPUE out of 9 streams in the Baraboo Hills management group in 2020. On a broader scale, total Brook Trout abundance was high, placing between the 75th and 90th percentiles compared to streams in both the Driftless region and statewide. Abundance of age 0 Brook Trout (age 0 CPUE; natural reproduction) was high, again placing between the 75th and 90th percentiles when compared regionally and statewide. Natural recruitment as measured by age 1 Brook Trout abundance was high relative to other streams in the management group, placing third out of 9 streams. Adult Brook Trout abundance was also high, placing between the 65th and 75th percentiles when compared both regionally and statewide. Abundance of preferred-length Brown Trout was high, placing between the 65th and 75th percentiles when compared regionally, and between the 75th and 90th percentiles statewide.

Like several other Baraboo Hills streams, Otter Creek had dramatically higher trout abundance in 2020 compared to the previous sampling rotation visit, which for Otter Creek was in 2015. Two of the sites sampled in 2015 matched sites sampled in 2020; sites 15 and 16. Mean total Brook Trout CPUE at those two sites in 2015 was 53.5 fish/mile compared to 1,086 fish/mile in 2020. The habitat in Otter Creek is similar to other streams in the Baraboo Hills like the upper part of Boulder Creek and the unnamed Tributary to Rowley Creek. The stream essentially flows through a bed of boulders and cobble at a depth of a few inches, with occasional step pools with depth of approximately one foot. Smaller trout live among interstitial spaces in the rocks, with larger trout

occupying the step pools. Flow rates at the three sites in the classified portion of Otter Creek sampled in 2020 averaged 0.8 cfs (range 0.4-1.4 cfs), which was the lowest of any stream in the Baraboo Hills group except for the unnamed Tributary to Rowley Creek. The low flow rates of Otter Creek combined with the physical habitat along the stream course likely make the trout population in the stream more sensitive to changes in flow, leading to the large fluctuations in trout abundance such as was observed from 2015 to 2020. Low flow rates are also the most likely explanation for why Otter Creek quickly loses the ability to support trout once leaving the Baraboo Hills and transitioning onto the Sauk Prairie. Groundwater inputs are not enough to keep the stream cold once it leaves the dense forest cover and enters open, flat agricultural land. Moving forward, the classified portion of Otter Creek is may be more sensitive to the impacts of climate change than other area streams that benefit from greater amounts of groundwater input evident from their higher base flows. However, the high proportion of forested land in the upper Otter Creek watershed may help to offset the impact of reduced groundwater input by shading the stream, helping to keep temperatures low.

Currently, most of the upper portion of the Otter Creek watershed, including over 90% of the length of the classified portion of the stream are under public ownership by the Nature Conservancy (Baxter's Hollow SNA). This ensures that the classified portion of Otter Creek will remain well protected in the future from major disturbances that could impact the trout population. Otter Creek is not currently eligible for streambank easement acquisition. While increased public ownership in the stream corridor would be desirable from a streambank protection perspective, the low base flow of Otter Creek and its limited capacity to support trout after leaving Baxter's Hollow make it questionable as to whether the trout water could be expanded through streambank protection alone. The current land use in the Sauk Prairie area centers on row crop agriculture and large dairy operations. The large number of high-capacity wells found there undoubtedly put significant strain on the groundwater resource in the area. Without large-scale land use changes and a massive reduction in groundwater withdrawals, Otter Creek is not likely to support trout where it flows through the Sauk Prairie.

MANAGEMENT RECOMMEDATION SUMMARY

- Retain current trout fishing regulations on all streams in the management group.
- Retain current trout stream classifications on all streams in the group.
- Complete fishery surveys on the lower portions of Rowley, Leech, Prentice, and Parfrey's Glen creeks in 2021.
- Discontinue fingerling Brook Trout stocking in Leech Creek until after the survey on lower Leech Creek that was postponed in 2020 has been completed.
- Discontinue fingerling Brook Trout stocking in Rowley Creek to further evaluate natural reproduction and recruitment and monitor annually through the next evaluation in 2026 to determine if stocking can be discontinued permanently.
- Conduct genetic testing on Brook Trout in Baraboo Hills streams that have not been previously tested to determine domestic vs. native origins.
- Conduct habitat improvement efforts in Manley Creek to address degraded habitat structures upstream of Highway 113 and associated declines in Brook Trout abundance.
- Address nuisance beaver activity in upper Manley Creek to remedy negative thermal impacts to the stream arising from beaver dams.
- Renew efforts to acquire streambank easements along Rowley Creek and lower Boulder Creek.

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TABLES AND FIGURES

Table 1. Land cover breakdown for the Lower Baraboo River-Wisconsin River HUC-10 watershed (LW21) in the Lower Wisconsin River basin.

Land Cover	Percent of Watershed (2000)[1]
Forest (total)	32.1%
Broad-leaf deciduous	*30.3%*
Coniferous	*1.2%*
Mixed Deciduous/Coniferous	*0.6%*
Agriculture	29.4%
Wetland (total)	16.6%
Forested	*10.1%*
Emergent/wet meadow	*3.9%*
Lowland Shrub	*2.6%*
Grassland	14.3%
Open water	3.1%
Development	2.8%
Barren	1.7%

1. Ripp et al. 2002

Table 2. Land cover breakdown for the Lake Wisconsin-Wisconsin River HUC-10 watershed (LW19) in the Lower Wisconsin River basin.

Land Cover	Percent of Watershed (2000)[1]
Agriculture	45.9%
Forest (total)	26.6%
Broad-leaf deciduous	*23.5%*
Coniferous	*1.6%*
Mixed Deciduous/Coniferous	*1.5%*
Grassland	14.3%
Open water	6.6%
Wetland (total)	4.8%
Forested	*1.8%*
Emergent/wet meadow	*1.6%*
Lowland Shrub	*1.4%*
Other	1.1%
Development	0.7%

1. Ripp et al. 2002

Table 3. Stocking quotas for Baraboo Hills trout streams prior to the 2020 evaluation.

Waterbody	Trout Class	Species[1]	Strain[2]	Age Class[3]	Base Quota	Mark[4]
Leech Creek	2	BKT	SWF	LGF	665	U
Rowley Creek	2	BKT	SWF	LGF	1,336	U

1. BKT=Brook Trout
2. SWF=Southwest Feral
3. LGF=large fingerling, approximately 3.5 inches, stocked in September
4. U=Unmarked

Table 4. Description of trout sampling locations for Baraboo Hills streams during the 2020 evaluation. Refer to Figure 1 for the mapped location of each site.

Waterbody	WBIC	Site number (Map)	Trout class	Location name	Start Latitude	Start Longitude	End Latitude	End Longitude
Manley Creek	1261200	1	1	21m US mouth	43.39476	-89.66501	43.39503	-89.66587
Manley Creek	1261200	2	1	69m US Hwy 113	43.39838	-89.67594	43.39842	-89.67712
Parfrey's Glen Creek	1261100	3	1	22m US DNR Access Trail	43.41145	-89.63666	43.41215	-89.63668
Parfrey's Glen Creek	1261100	4	1	46m US CTH DL	43.40965	-89.63641	43.41051	-89.63645
Parfrey's Glen Creek	1261100	5	1	130m DS Marsh Rd.	43.39715	-89.66187	43.39737	-89.66071
Rowley Creek	1272100	7	2	20m US Exo Driveway	43.48073	-89.57319	43.48087	-89.47255
Rowley Creek	1272100	8	2	20m US Owen Park Rd.	43.47585	-89.58176	43.47600	-89.58097
Rowley Creek	1272100	9	2	27m US Luebke Rd.	43.47564	-89.60034	43.47529	-89.59978
Boulder	1273200	11	1	Potter Preserve 206m DS Culvert	43.46388	-89.63756	43.46528	-89.63733
Boulder	1273200	12	1	30m US CTH W	43.47105	-89.63855	43.47098	-89.63706
UNT Rowley Creek	1272200	13	1	20m US Konkel Mill Rd.	43.46831	-89.61073	43.46817	-89.60983
Otter Creek	1258400	14	1	Last Bridge on Stone's Pocket Rd.	43.40039	-89.79806	43.40144	-89.79773
Otter Creek	1258400	15	1	Second Stone's Pocket Bridge	43.39402	-89.79600	43.39455	-89.79537
Otter Creek	1258400	16	1	First Stone's Pocket Bridge	43.38550	-89.79890	43.38650	-89.79850
Otter Creek	1258400	17	1	14m US Kings Corner Rd.	43.37260	-89.79620	43.37360	-89.79630
Prentice	1262600	18	1	38m US McLeish Rd.	43.43565	-89.59224	43.43636	-89.53954
Prentice	1262600	19	1	122m DS Durward's Glen Rd.	43.43063	-89.58044	43.43053	-89.58160
Prentice	1262600	20	3	53m US Indian Farm Rd.	43.41485	-89.58028	43.41525	-89.58028
Leech Creek	1271600	22	2	120m DS Pilger Farm Lane	43.51709	-89.70094	43.51686	-89.70158
Clark Creek	1273700	24	1	25m US 2013 Machine Crossing	43.43719	-89.69241	43.43667	-89.69305
Clark Creek	1273700	25	1	DS end of 2013 Revetment Project	43.43484	-89.69116	43.43412	-89.69070
Not completed								
Parfrey’s Glen Creek	1261100	6	1	408m DS Manley Creek	43.39282	-89.66556	43.39483	-89.66475
Rowley Creek	1272100	10	2	22m US CTH W	43.47796	-89.63415	43.47931	-89.63255
Prentice Creek	1262600	21	3	27m US CTH U	43.39926	-89.58701	43.40001	-89.58694
Leech Creek	1271600	23	2	300m DS Paschen Rd.	43.51951	-89.68249	43.52036	-89.68424

1. Sites 6, 10, 21, and 23 were not completed due to COVID-19 work restrictions.

Table 5. Sampling station metrics for Baraboo Hills trout streams during the 2020 evaluation. Refer to Figure 1 for the mapped location of each site.

Waterbody[1]	Site number (map)	Survey date	Gear used	Mean stream width (m)	Station length (m)	CPUE factor	Flow rate (cfs)	Stream temp (F)	Dissolved oxygen (ppm)	n species	Coldwater IBI score
Manley Creek	1	07/08/2020	Backpack	1.8	100	16.1		65.3	7.59	2	100 (Excellent)
Manley Creek	2	06/24/2020	Backpack	1.8	100	16.1		57.0	9.95	4	100 (Excellent)
Parfrey's Glen Creek	3	07/06/2020	Backpack	2.0	100	16.1	1.1	62.0	9.52	1	40 (Fair)
Parfrey's Glen Creek	4	06/29/2020	Backpack	2.3	100	16.1	1.4	60.4	10.10	1	90 (Excellent)
Parfrey's Glen Creek	5	06/29/2020	Backpack	1.5	105	15.3	2.1	69.6	2.76	7	0 (Very Poor)
Rowley Creek	7	06/30/2020	Backpack	2.6	100	16.1	2.1	60.0	8.83	10	60 (Good)
Rowley Creek	8	06/30/2020	Backpack	2.8	100	16.1	4.9	59.0	9.76	8	80 (Good)
Rowley Creek	9	08/24/2020	Backpack	3.2	105	15.3	6.4	59.0	9.90	6	80 (Good)
Boulder Creek	11	08/21/2020	Backpack	4.7	165	9.8	1.1	55.6	10.10	2	90 (Excellent)
Boulder Creek	12	08/04/2020	Backpack	2.0	100	16.1	1.4	53.6	10.30	3	80 (Good)
UNT Rowley Creek	13	07/06/2020	Backpack	2.7	100	16.1	0.4	56.1	9.80	0	No Fish Collected
Otter Creek	14	09/03/2020	Backpack	3.5	123	13.1	0.4	58.6	9.02	7	40 (Fair)
Otter Creek	15	07/07/2020	Backpack	5.9	100	16.1	0.7	66.0	8.91	6	60 (Good)
Otter Creek	16	07/07/2020	Backpack	5.0	105	15.2	1.4	65.0	9.89	6	60 (Good)
Otter Creek	17	08/11/2020	Backpack		108	14.9	0.7	63.3	7.52	10	10 (Poor)
Prentice Creek	19	06/25/2020	Backpack	3.5	105	15.2	2.5	62.1	10.70	1	90 (Excellent)
Prentice Creek	18	06/25/2020	Backpack	3.1	140	11.4	3.2	60.6	9.76	3	90 (Excellent)
Prentice Creek	20	06/25/2020	Backpack	3.2	105	15.2	3.2	57.0	10.40	4	30 (Fair)
Leech Creek	22	07/09/2020	Backpack	2.4	100	16.1	6.7	63.0	8.67	6	50 (Fair)
Clark Creek	24	08/03/2020	Backpack	2.4	100	16.1	2.1	51.6	8.19	5	60 (Good)
Clark Creek	25	07/14/2020	Backpack	2.4	100	16.1	NA	55.4	10.60	2	80 (Excellent)
Not completed											
Parfrey’s Glen Creek	6		Barge	3.2	408	3.9					
Rowley Creek	10		Barge	6.3	210	7.7					
Prentice Creek	21		Barge	2.9	105	15.3					
Leech Creek	23		Barge	5.5	225	7.2					

1. Sites 6, 10, 21, and 23 were not completed due to COVID-19 work restrictions.

Table 6. Brook Trout CPUE percentile breakdown for stream surveys conducted on Class 1 trout streams in the Driftless Area and statewide where at least one trout was collected, 2007-2014.

	CPUE total	(All sizes)	CPUE age 0	(<4.0 inches)	CPUE age 1	(4.0-6.9 inches)	CPUE adult	(≥7 inches)	CPUE preferred	(≥10 inches)
Percentile	Driftless Area	Statewide	Driftless Area	Statewide	Driftless Area	Statewide	Driftless Area	Statewide	Driftless Area	Statewide
10	16.5	21.1	0.0	0.0			0.0	0.0	0.0	0.0
25	50.0	81.8	0.0	0.0	NA	NA	16.7	16.7	0.0	0.0
35	88.8	134.5	10.3	16.7	NA	NA	33.3	33.3	0.0	0.0
50 (median)	185.7	251.7	42.0	66.7	NA	NA	60.0	57.9	0.0	0.0
65	341.7	416.7	127.3	161.9	NA	NA	111.1	100.0	10.0	4.4
75	466.7	583.3	211.1	288.6	NA	NA	188.3	155.6	16.7	11.1
90	1,153.5	1,150.0	721.7	842.4	NA	NA	382.4	339.3	46.0	33.3

Table 7. Brown Trout CPUE percentile breakdown for fishery surveys conducted on Class 1 trout streams in the Driftless Area and statewide where at least one trout was collected, 2007-2014.

	CPUE total	(All sizes)	CPUE age 0	(<4.0 inches)	CPUE age 1	(4.0-7.9 inches)	CPUE adult	(≥ 8 inches)	CPUE preferred	(≥12 inches)
Percentile	Driftless Area	Statewide	Driftless Area	Statewide	Driftless Area	Statewide	Driftless Area	Statewide	Driftless Area	Statewide
10	57.1	33.3	0.0	0.0	15.7	12.5	16.7	0.0	0.0	0.0
25	220.0	138.9	5.6	0.0	55.6	50.0	86.2	31.7	8.3	0.0
35	353.9	249.3	16.7	12.4	108.3	95.7	150.9	66.7	22.2	7.7
50 (median)	576.0	427.3	75.0	50.0	213.9	188.5	300.0	155.6	44.4	24.0
65	868.8	714.9	180.0	154.0	363.6	325.0	460.0	300.0	70.0	48.4
75	1,173.3	1,000.0	350.0	310.4	503.0	472.0	650.0	433.3	100.0	66.7
90	2,038.9	1,709.5	1,133.3	993.0	984.7	927.5	1,292.1	882.9	177.8	135.7

Table 8. Brook Trout catch-per-unit effort (CPUE) for all sampling locations in Baraboo Hills streams in 2020.

Waterbody	Site number (Map)	Date	CPUE-total	Age 0 (<4 inches)	Age 1 BKT (4.0-6.9 inches)	Adult total (≥7 inches)	Adult<Preferred (7.0-9.9 inches)	Adult Preferred (≥10 inches)
Manley Creek	1	07/08/2020	402.4	16.1	193.2	193.2	177.1	16.1
Manley Creek	2	06/24/2020	1,464.9	482.9	418.5	563.4	466.8	96.6
Parfrey's Glen Creek	3	07/06/2020	80.5	80.5	0.0	0.0	0.0	0.0
Parfrey's Glen Creek	4	06/29/2020	386.3	112.7	128.8	144.9	144.9	0.0
Parfrey's Glen Creek	5	06/29/2020	0.0	0.0	0.0	0.0	0.0	0.0
Rowley Creek	7	06/30/2020	692.2	563.4	48.3	80.5	80.5	0.0
Rowley Creek	8	06/30/2020	1,529.3	949.8	112.7	466.8	466.8	0.0
Rowley Creek	9	08/24/2020	383.3	184.0	46.0	153.3	153.3	0.0
Boulder	11	08/21/2020	3,336.6	2,361.0	848.8	126.8	126.8	0.0
Boulder	12	08/04/2020	1,384.4	660.0	289.8	434.6	434.6	0.0
UNT Rowley Creek	13	07/06/2020	0.0	0.0	0.0	0.0	0.0	0.0
Otter Creek	14	09/03/2020	301.0	39.3	235.6	26.2	13.1	13.1
Otter Creek	15	07/07/2020	869.3	482.9	289.8	96.6	80.5	16.1
Otter Creek	16	07/07/2020	1,303.1	628.6	413.9	260.6	245.3	15.3
Otter Creek	17	08/11/2020	0.0	0.0	0.0	0.0	0.0	0.0
Prentice	19	06/25/2020	2,253.7	1,103.8	858.5	291.3	291.3	0.0
Prentice	18	06/25/2020	1,678.7	322.0	1,080.8	276.0	276.0	0.0
Prentice	20	06/25/2020	30.7	0.0	30.7	0.0	0.0	0.0
Leech Creek	22	07/09/2020	386.3	144.9	64.4	177.1	144.9	32.2
Clark Creek	24	08/03/2020	756.6	499.0	257.6	0.0	0.0	0.0
Clark Creek	25	07/14/2020	273.7	161.0	32.2	80.5	80.5	0.0
Mean Catch Rates								
Manley Creek			933.7	249.5	305.9	378.3	322.0	56.3
Parfrey's Glen Creek			233.4	96.6	64.4	72.4	72.4	0.0
Rowley Creek			868.2	565.7	80.5	273.7	273.7	0.0
Boulder Creek			2,360.5	1,510.5	569.3	280.7	280.7	0.0
UNT Rowley Creek			0.0	0.0	0.0	0.0	0.0	0.0
Otter Creek			824.5	383.6	313.1	127.8	113.0	14.8
Prentice Creek (Upper)			1,966.2	712.9	969.7	283.6	283.6	0.0
Prentice Creek (Lower)			30.7	0.0	30.7	0.0	0.0	0.0
Leech Creek			386.3	144.9	64.4	177.1	144.9	32.2
Clark Creek			515.1	330.0	144.9	40.2	40.2	0.0

Table 9. Brown Trout catch-per-unit effort (CPUE) for all sampling locations in Baraboo Hills streams in 2020.

Waterbody	Site number (Map)[1]	Date	CPUE-total	Age 0 (<4 inches)	Age 1 (4.0-7.9 inches)	Adult total (≥8 inches)	Adult<Preferred (8.0-11.9 inches)	Adult Preferred (≥12 inches)
Manley Creek	1	07/08/2020	0.0	0.0	0.0	0.0	0.0	0.0
Manley Creek	2	06/24/2020	0.0	0.0	0.0	0.0	0.0	0.0
Parfrey's Glen Creek	3	07/06/2020	0.0	0.0	0.0	0.0	0.0	0.0
Parfrey's Glen Creek	4	06/29/2020	0.0	0.0	0.0	0.0	0.0	0.0
Parfrey's Glen Creek	5	06/29/2020	0.0	0.0	0.0	0.0	0.0	0.0
Rowley Creek	7	06/30/2020	0.0	0.0	0.0	0.0	0.0	0.0
Rowley Creek	8	06/30/2020	80.5	0.0	32.2	48.3	32.2	16.1
Rowley Creek	9	08/24/2020	107.3	15.3	30.7	61.3	30.7	30.7
Boulder	11	08/04/2020	0.0	0.0	0.0	0.0	0.0	0.0
Boulder	12	08/21/2020	0.0	0.0	0.0	0.0	0.0	0.0
UNT Rowley Creek	13	07/06/2020	0.0	0.0	0.0	0.0	0.0	0.0
Otter Creek	14	09/03/2020	0.0	0.0	0.0	0.0	0.0	0.0
Otter Creek	15	07/07/2020	0.0	0.0	0.0	0.0	0.0	0.0
Otter Creek	16	07/07/2020	0.0	0.0	0.0	0.0	0.0	0.0
Otter Creek	17	08/11/2020	0.0	0.0	0.0	0.0	0.0	0.0
Prentice	19	06/25/2020	0.0	0.0	0.0	0.0	0.0	0.0
Prentice	18	06/25/2020	0.0	0.0	0.0	0.0	0.0	0.0
Prentice	20	06/25/2020	0.0	0.0	0.0	0.0	0.0	0.0
Leech Creek	22	07/09/2020	177.1	16.1	32.2	128.8	64.4	64.4
Clark Creek	24	08/03/2020	0.0	0.0	0.0	0.0	0.0	0.0
Clark Creek	25	07/14/2020	0.0	0.0	0.0	0.0	0.0	0.0
Mean Catch Rates								
Manley Creek			0.0	0.0	0.0	0.0	0.0	0.0
Parfrey's Glen Creek			0.0	0.0	0.0	0.0	0.0	0.0
Rowley Creek			62.6	5.1	21.0	36.5	21.0	15.6
Boulder Creek			0.0	0.0	0.0	0.0	0.0	0.0
UNT Rowley Creek			0.0	0.0	0.0	0.0	0.0	0.0
Otter Creek			0.0	0.0	0.0	0.0	0.0	0.0
Prentice Creek (Upper)			0.0	0.0	0.0	0.0	0.0	0.0
Prentice Creek (Lower)			0.0	0.0	0.0	0.0	0.0	0.0
Leech Creek			177.1	16.1	32.2	128.8	64.4	64.4
Clark Creek			0.0	0.0	0.0	0.0	0.0	0.0

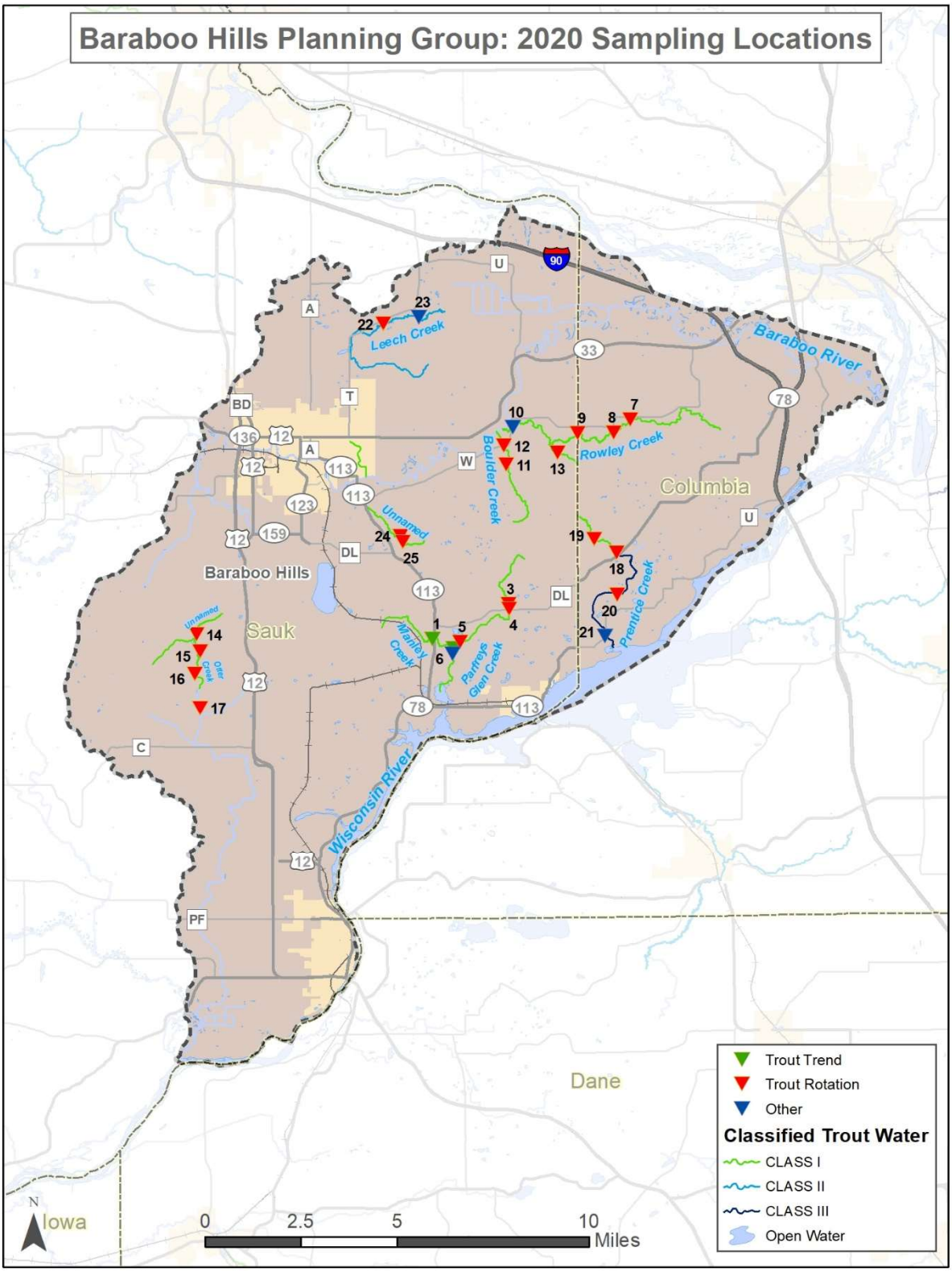

Figure 1. Trout class designations and 2020 fishery survey locations within the Baraboo Hills stream management group. Sampling locations represented by blue triangles were not completed in 2020 due to Coronavirus-related work restrictions.

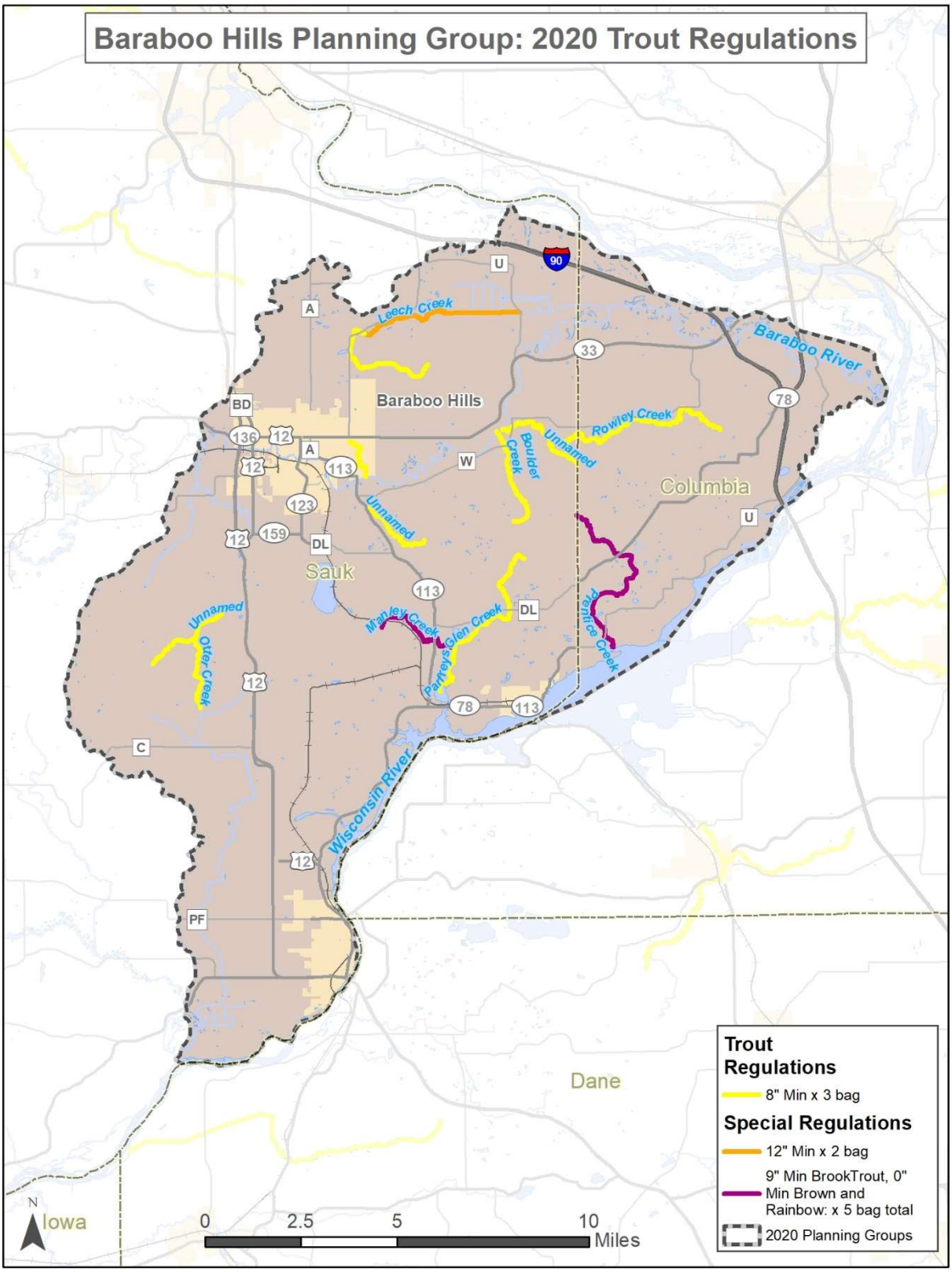

Figure 2. Current trout fishing regulations for classified trout streams in the Baraboo Hills stream management group.

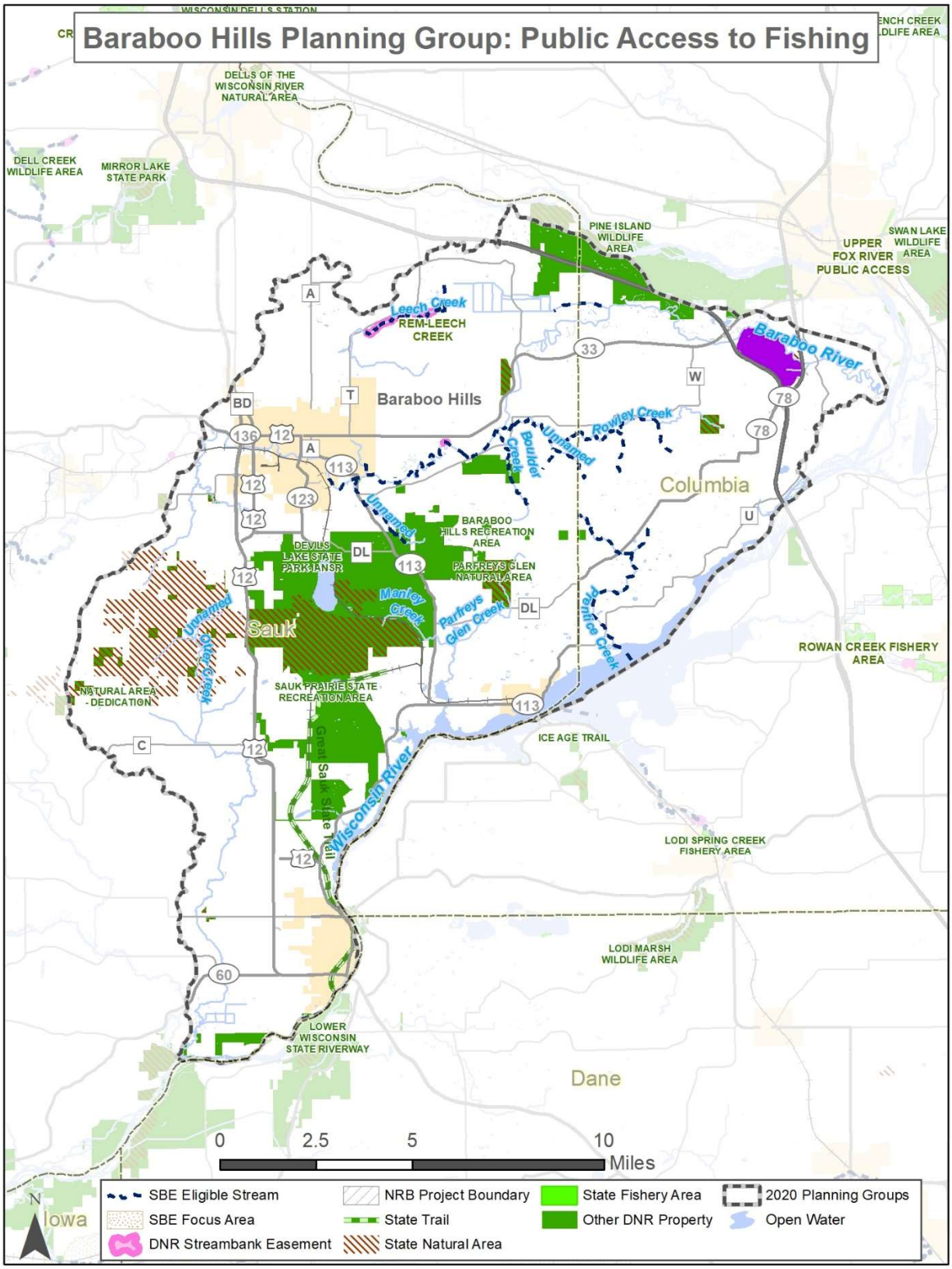

Figure 3. Public land access within the Baraboo Hills stream management group.

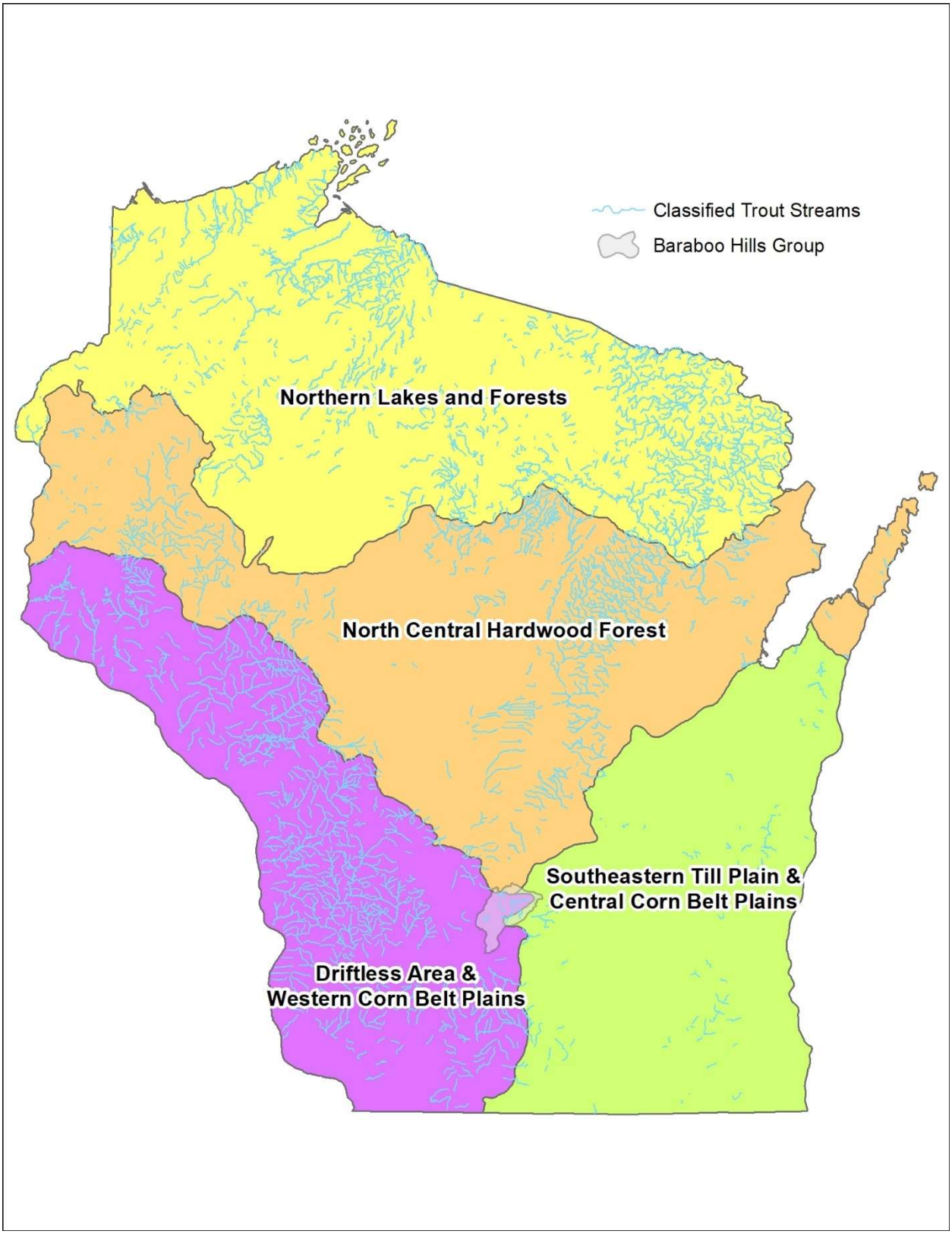

Figure 4. Level III Ecoregions of Wisconsin. The Baraboo Hills stream management group is in the Driftless Area & Western Corn Belt Plains Ecoregion.

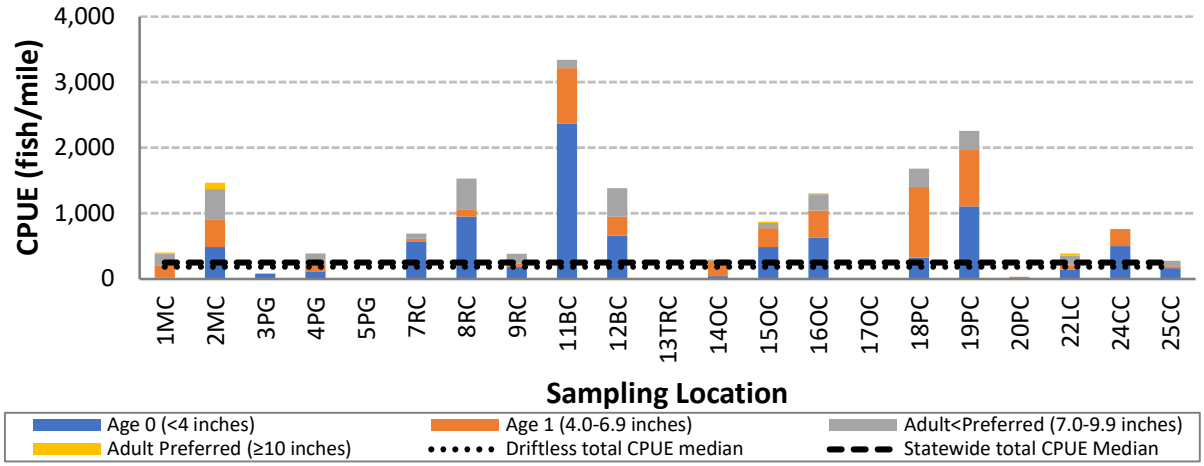

Figure 5. Brook Trout catch-per-unit effort (CPUE) for all sampling locations in the Baraboo Hills stream management group in 2020.

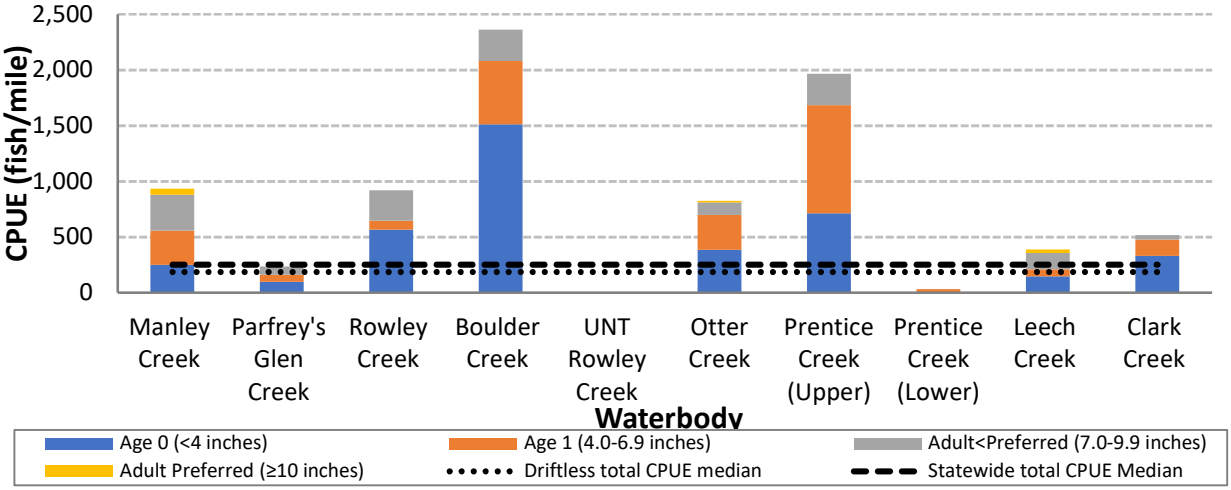

Figure 6. Mean Brook Trout catch-per-unit effort (CPUE) by stream or stream segment in the Baraboo Hills stream management group in 2020.

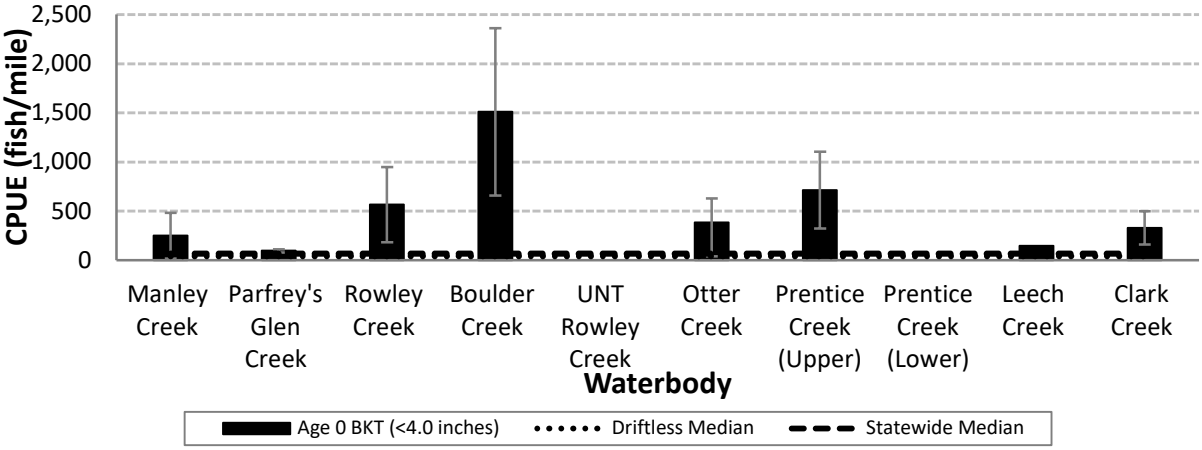

Figure 7. Mean age 0 Brook Trout catch-per-unit effort (CPUE) by stream or stream segment in the Baraboo Hills stream management group in 2020. Error bars represent the range of CPUE values observed for each stream or stream segment.

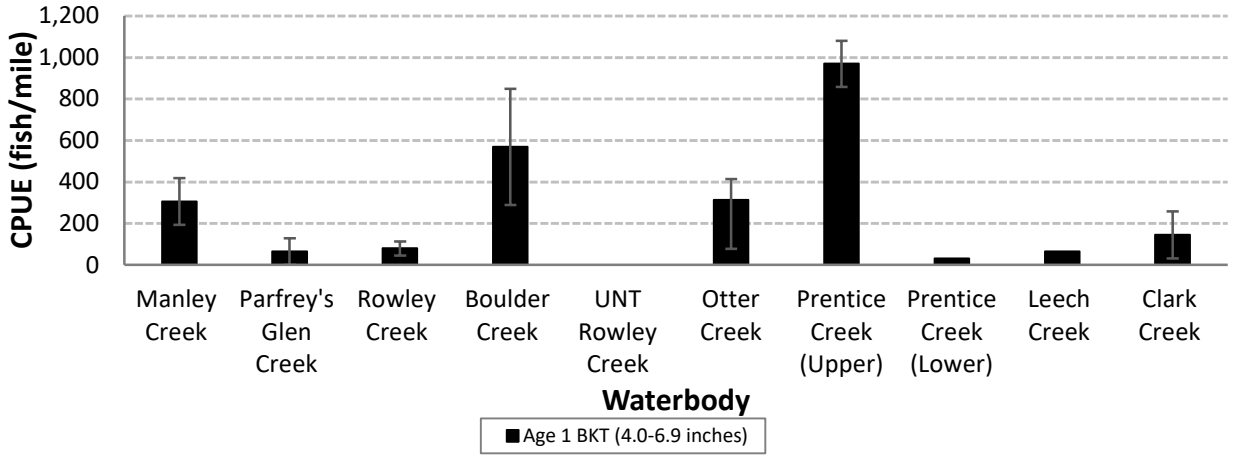

Figure 8. Mean age 1 Brook Trout catch-per-unit effort (CPUE) in the Baraboo Hills stream management group in 2020. Error bars represent the range of CPUE values observed for each stream or stream segment.

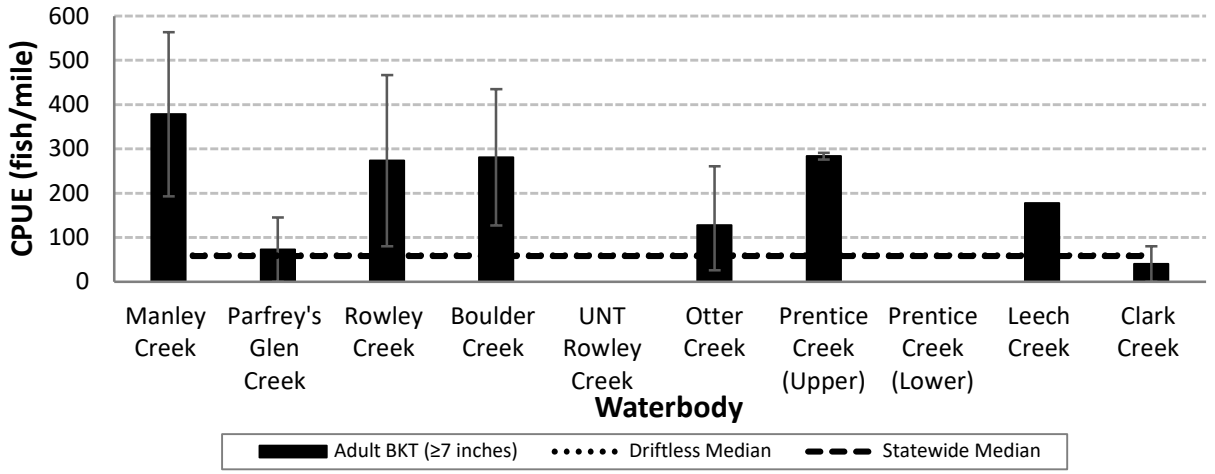

Figure 9. Mean adult Brook Trout catch-per-unit effort (CPUE) in the Baraboo Hills stream management group in 2020. Error bars represent the range of CPUE values observed for each stream or stream segment.

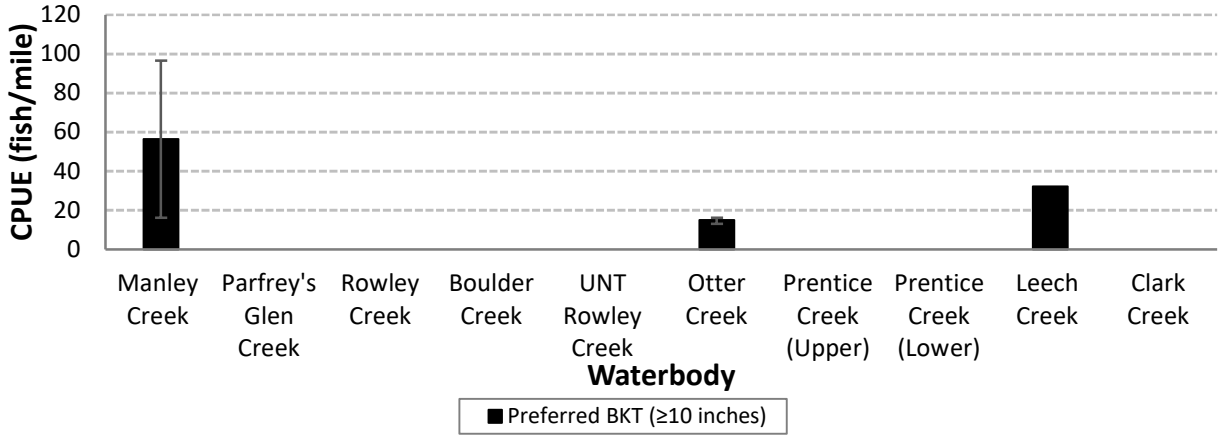

Figure 10. Mean preferred-length Brook Trout catch-per-unit effort (CPUE) in the Baraboo Hills stream management group in 2020. Error bars represent the range of CPUE values observed for each stream or stream segment.

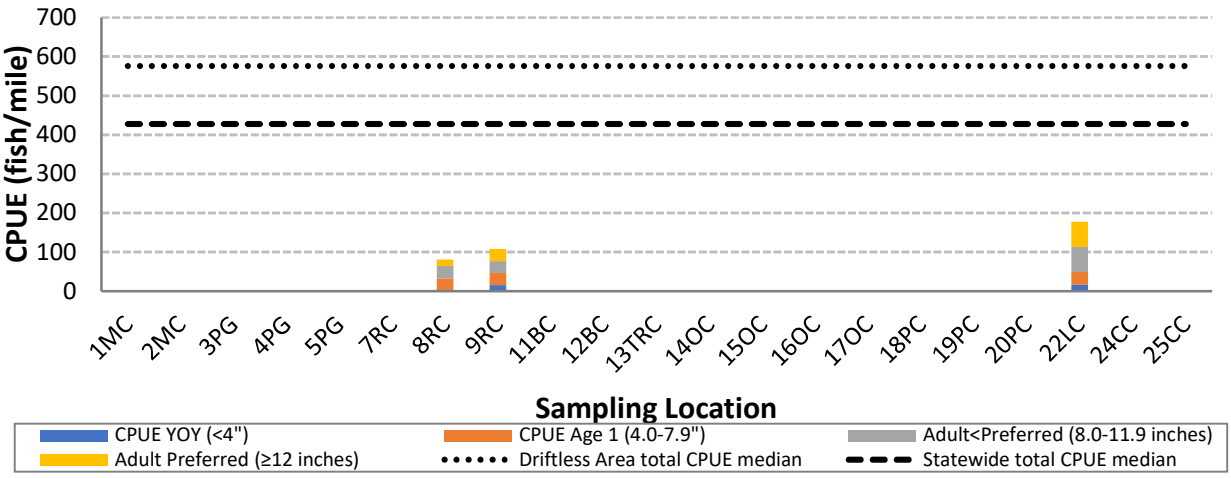

Figure 11. Brown Trout catch-per-unit effort (CPUE) for all sampling locations in the Baraboo Hills stream management group in 2020.

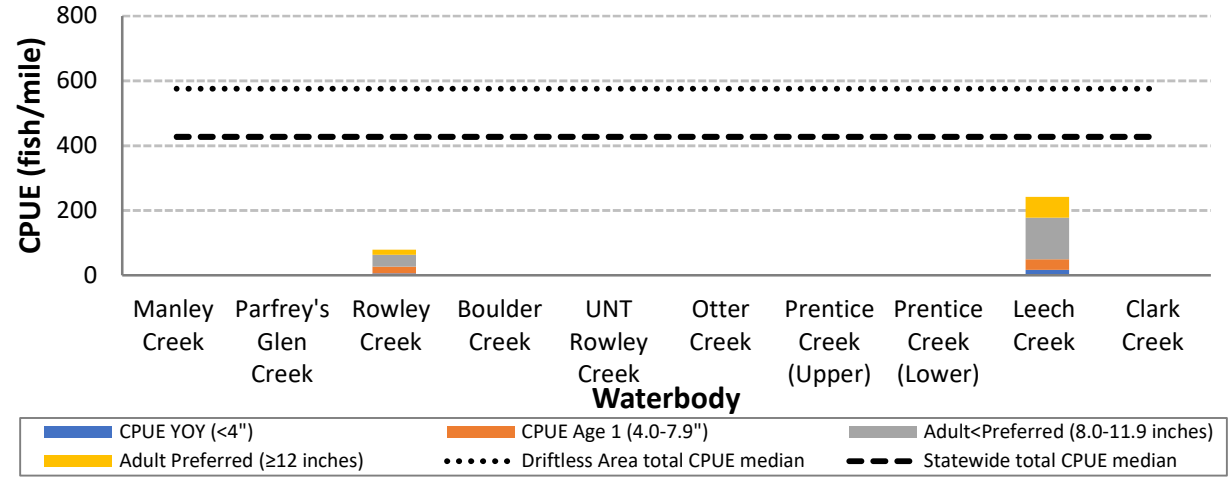

Figure 12. Mean Brown Trout catch-per-unit effort (CPUE) by stream or stream segment in the Baraboo Hills stream management group in 2020.

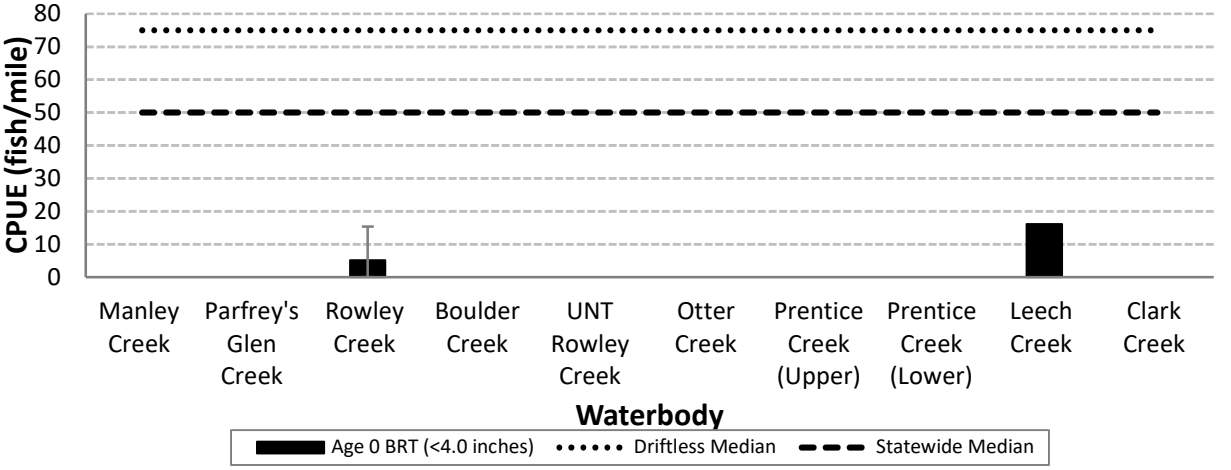

Figure 13. Mean age 0 Brown Trout catch-per-unit effort (CPUE) by stream or stream segment in the Baraboo Hills stream management group in 2020. Error bars represent the range of CPUE values observed for each stream or stream segment.

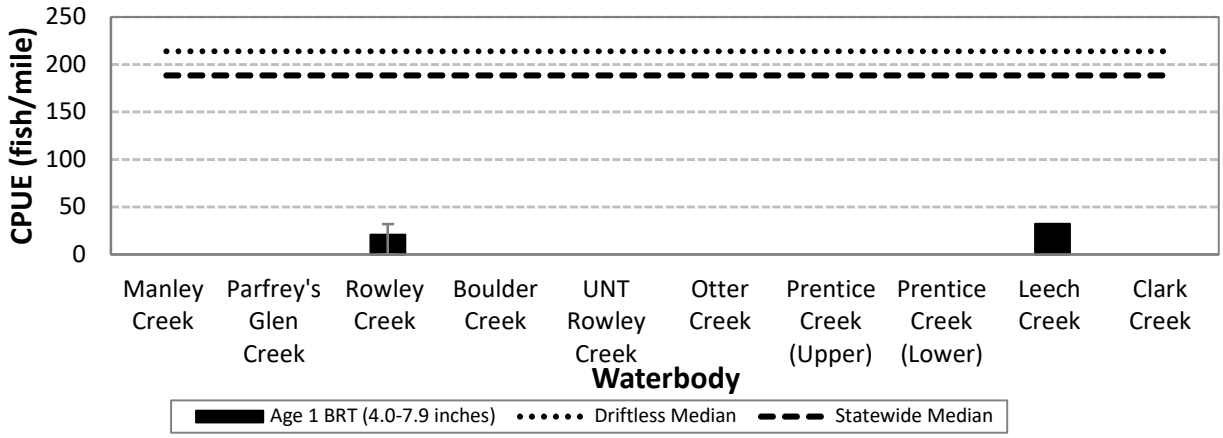

Figure 14. Mean age 1 Brown Trout catch-per-unit effort (CPUE) in the Baraboo Hills stream management group in 2020. Error bars represent the range of CPUE values observed for each stream or stream segment.

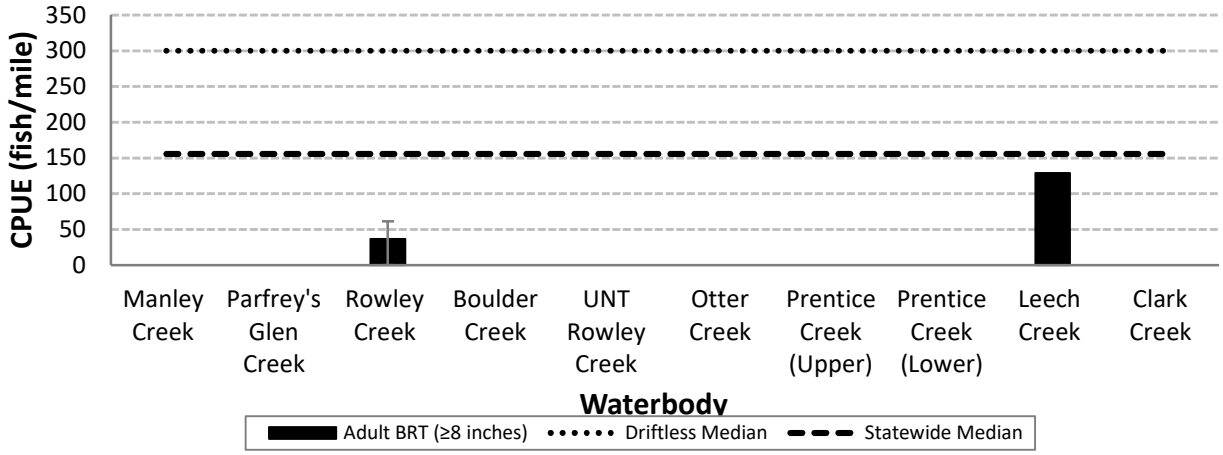

Figure 15. Mean adult Brown Trout catch-per-unit effort (CPUE) in the Baraboo Hills stream management group in 2020. Error bars represent the range of CPUE values observed for each stream or stream segment.

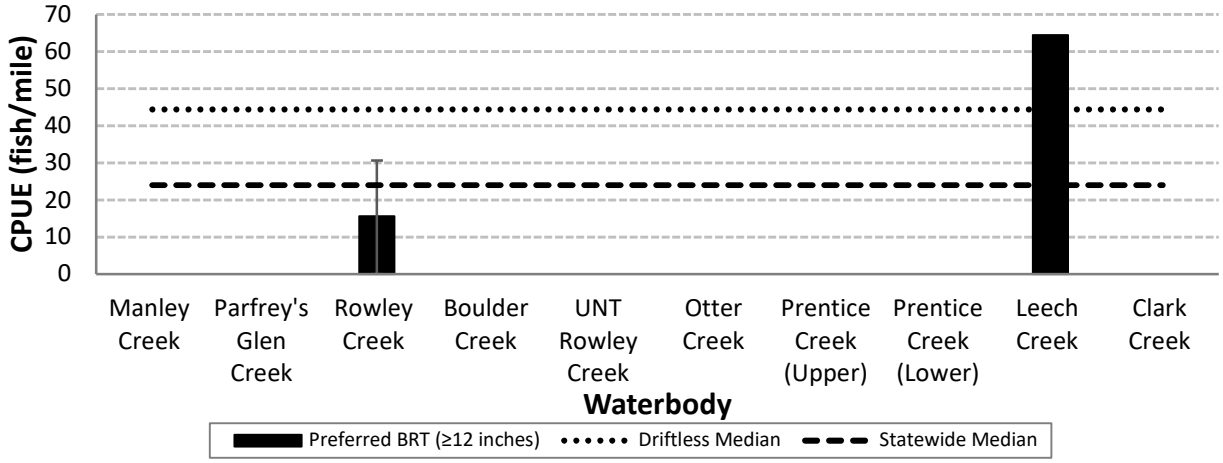

Figure 16. Mean preferred-length Brown Trout catch-per-unit effort (CPUE) in the Baraboo Hills stream management group in 2020. Error bars represent the range of CPUE values observed for each stream or stream segment.

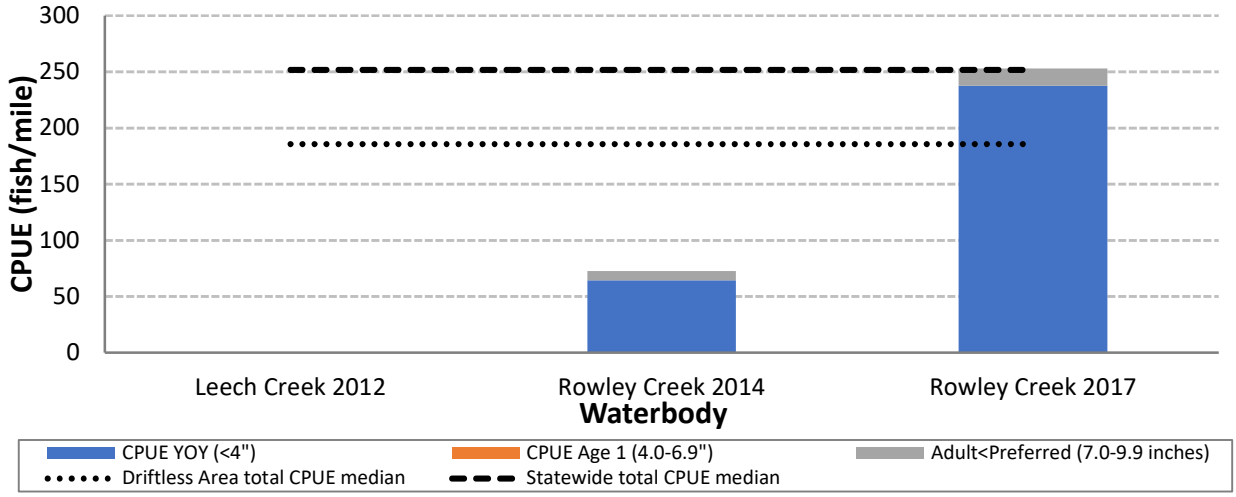

Figure 17. Brook Trout catch-per-unit effort (CPUE) on previous visits to sampling locations on lower Leech Creek (site 23) in 2012 and lower Rowley Creek (site 10) in 2014 and 2017.

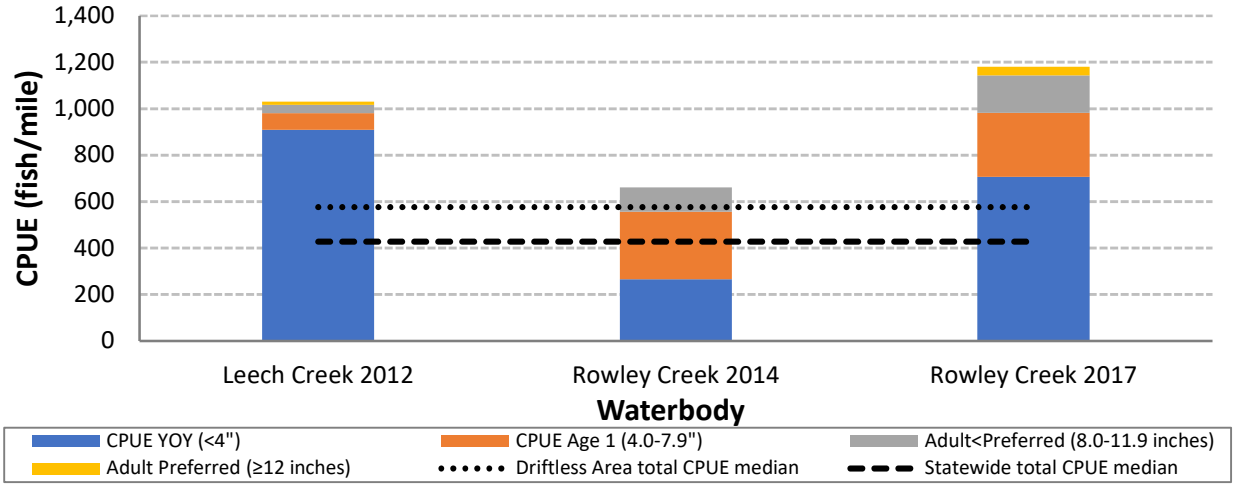

Figure 18. Brown Trout catch-per-unit effort (CPUE) on previous visits to sampling locations on lower Leech Creek (site 23) in 2012 and lower Rowley Creek (site 10) in 2014 and 2017.

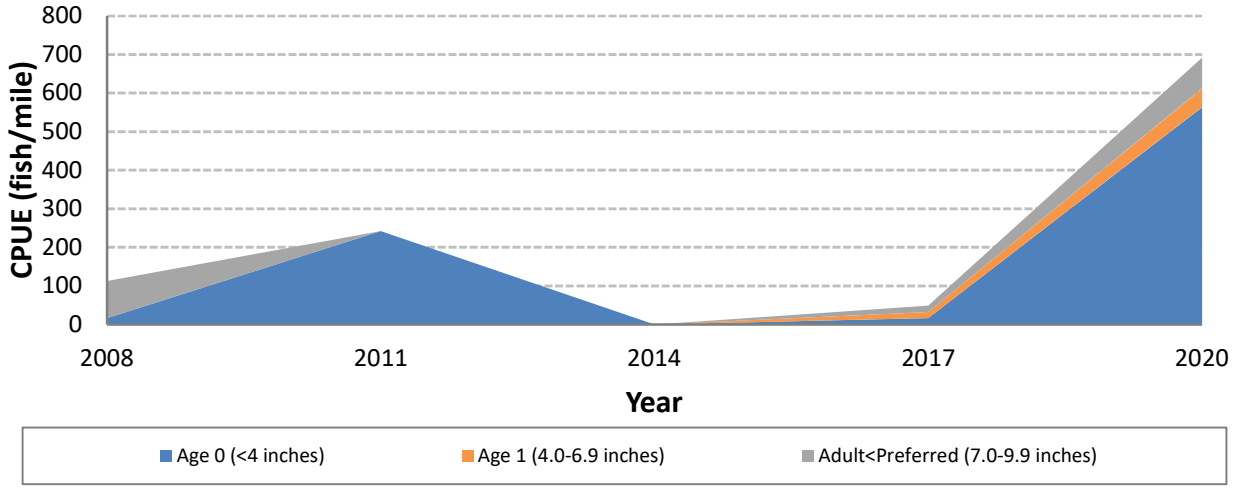

Figure 19. Brook Trout catch-per-unit effort (CPUE) from rotational sampling visits to upper Rowley Creek (site 7), 2008-2020.

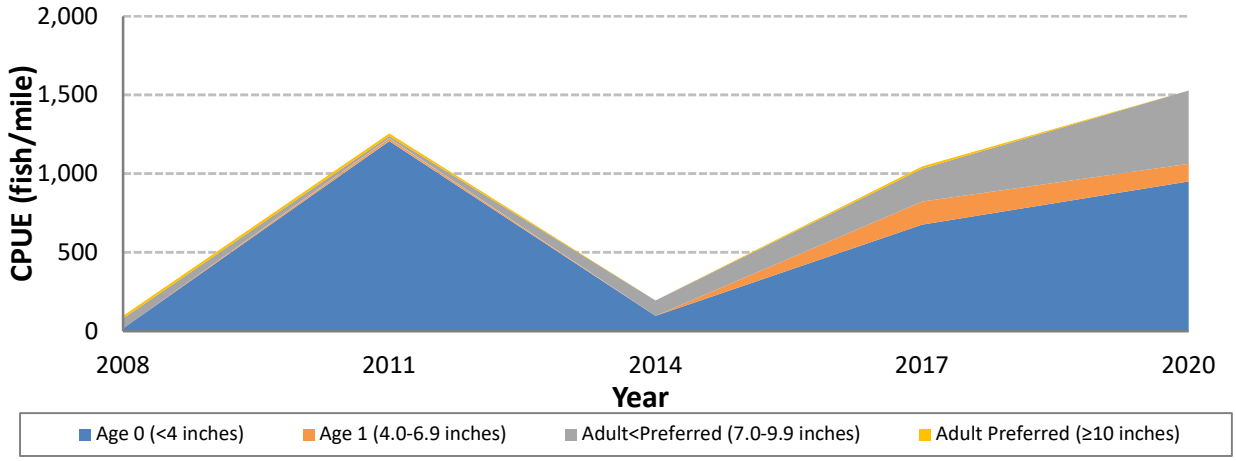

Figure 20. Brook Trout catch-per-unit effort (CPUE) from rotational sampling visits to middle Rowley Creek (site 8, 20m upstream Owen Park Rd.), 2008-2020.

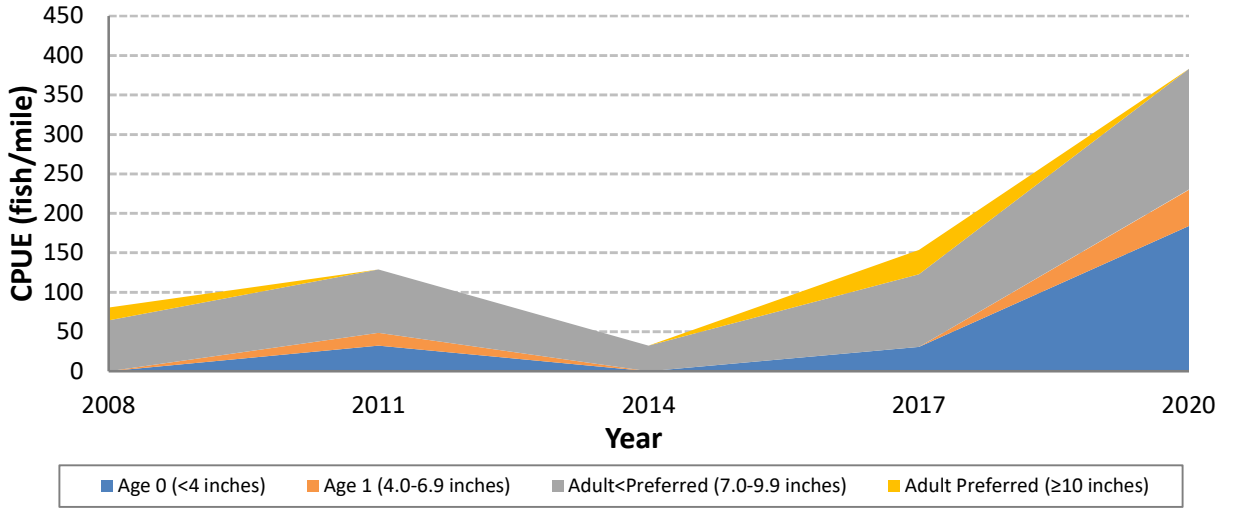

Figure 21. Brook Trout catch-per-unit effort (CPUE) from rotational sampling visits to middle Rowley Creek (site 9, 27m upstream Luebke Rd.), 2008-2020.

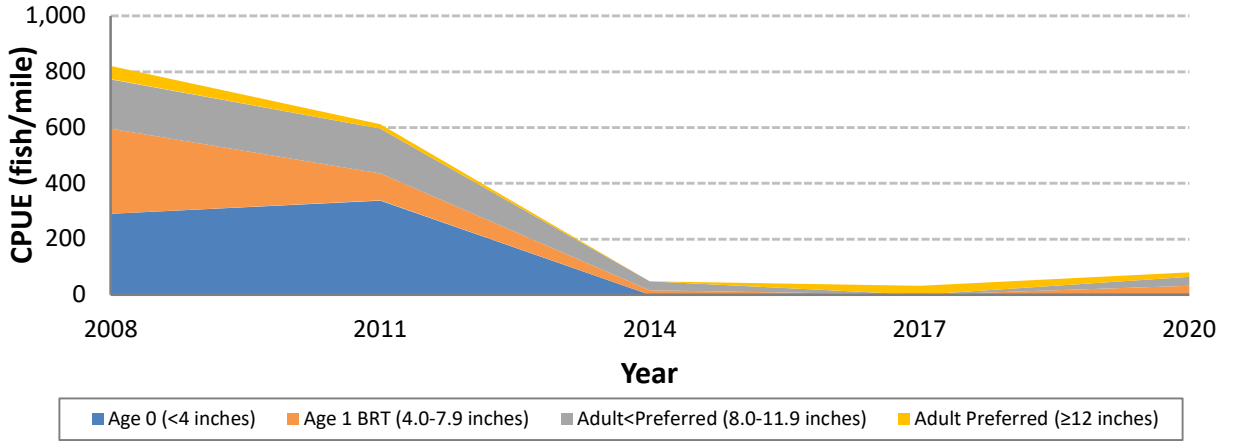

Figure 22. Brown Trout catch-per-unit effort (CPUE) from rotational sampling visits to middle Rowley Creek (site 8, 20m upstream Owen Park Rd.), 2008-2020.

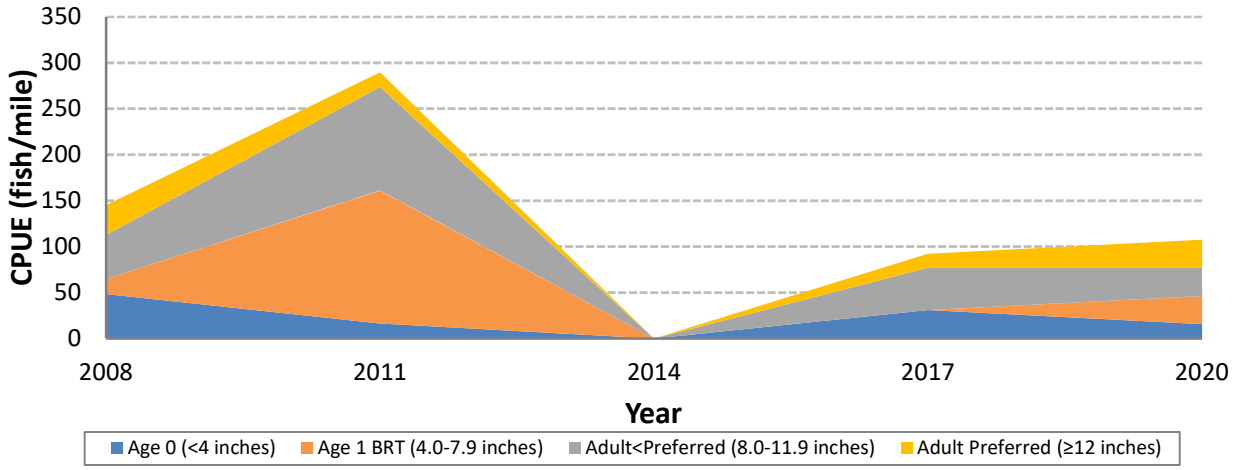

Figure 23. Brown Trout catch-per-unit effort (CPUE) from rotational sampling visits to middle Rowley Creek (site 9, 27m upstream Luebke Rd.), 2008-2020.

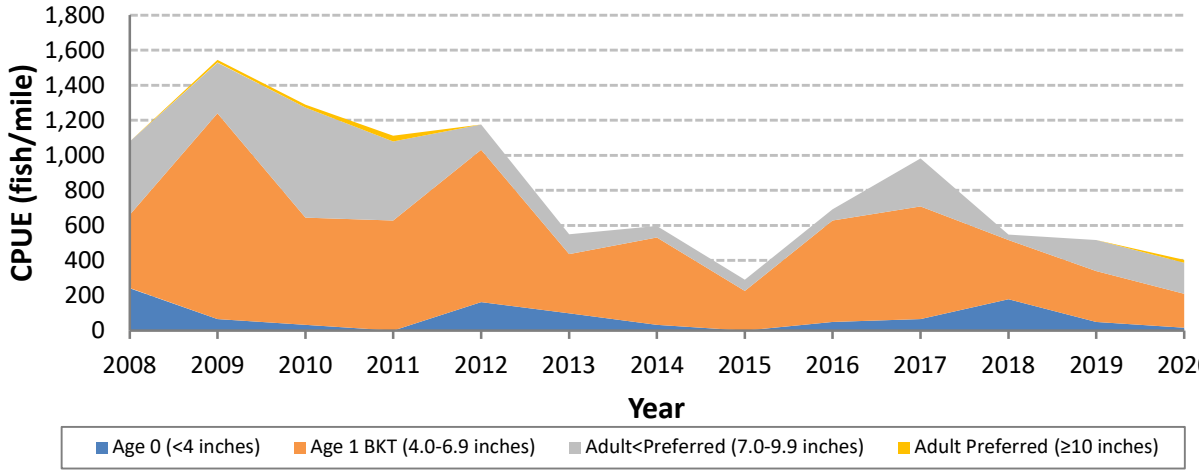

Figure 24. Brook Trout catch-per-unit effort (CPUE) from trend sampling of upper Manley Creek (site 1, 69m upstream State Hwy. 113), 2008-2020.

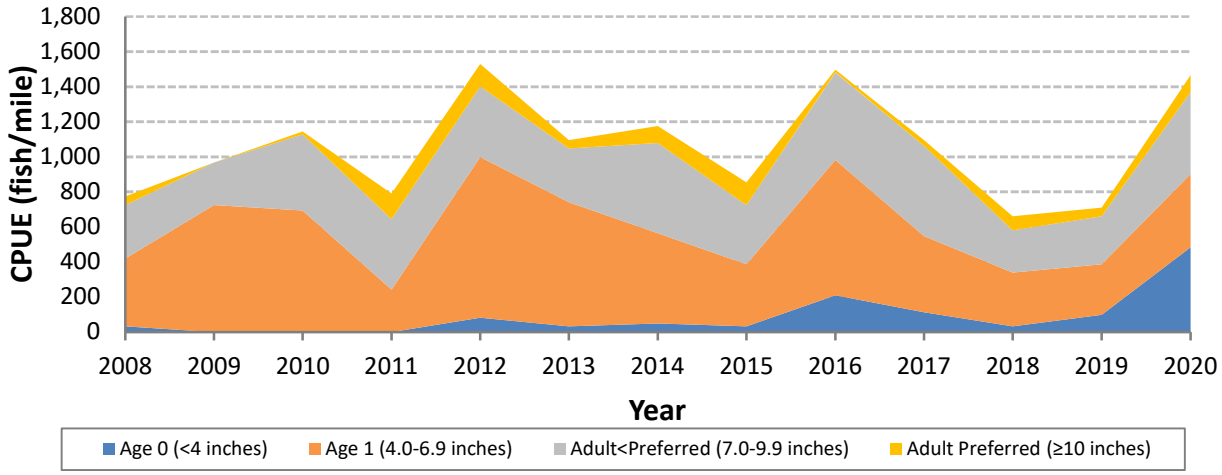

Figure 25. Brook Trout catch-per-unit effort (CPUE) from trend sampling of lower Manley Creek (site 2, 21m upstream of the mouth), 2008-2020.

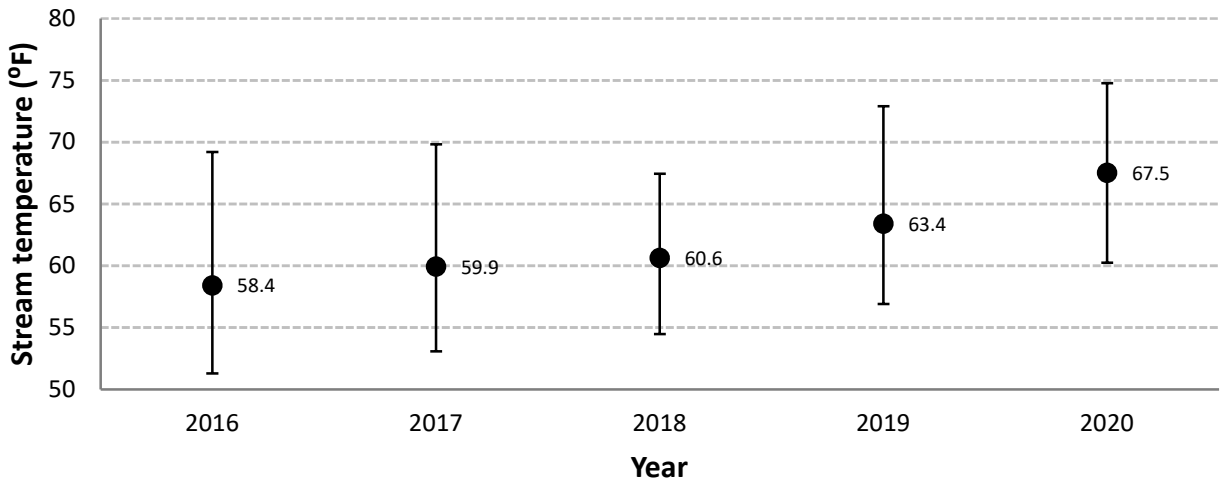

Figure 26. Mean July temperature of upper Manley Creek (site 1, 69m upstream State Highway 113), 2016-2020. Error bars represent the range of temperatures recorded in July of each year.

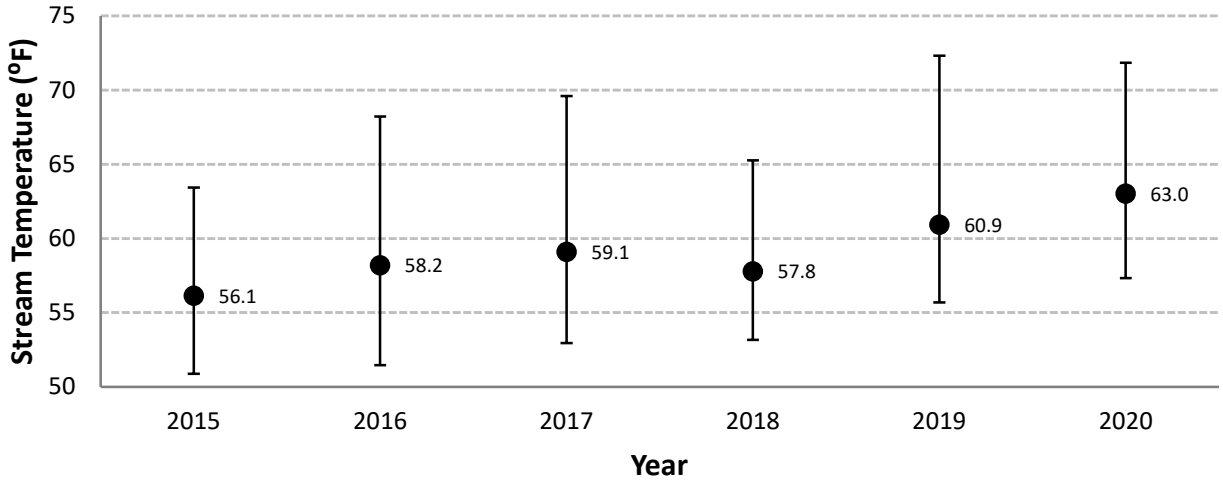

Figure 27. Mean July temperature of lower Manley Creek (site 2, 21m upstream of the mouth), 2015-2020. Error bars represent the range of temperatures recorded in July of each year.