WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Plum Creek Watershed Report

HUC 10 Watershed 0705000511, Pierce County

Photo Credit: Kasey Yallaly

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February 2024

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Executive Summary

The Plum Creek watershed is located in the northern Driftless Area in southeastern Pierce County and drains agricultural and forested land within the Western Coulee and Ridges ecoregion. The watershed features a rural landscape and contains excellent coldwater resources due to high connectivity of spring and groundwater sources. The health and status of the fishery within the watershed was assessed in 2023 and prior surveys of the watershed occurred in 2013 and 1999. The fishery upstream of the Nugget Lake impoundment features a coolwater fishery and no trout were detected. Downstream of Nugget Lake to the Pierce and Pepin County line, trout were detected at all stations. Brown trout were the dominant trout species throughout most of the mainstem of Plum Creek and were found in moderate to high densities. Brook trout were present in all stations except one station in low to moderate densities. Natural reproduction of trout was also documented at all stations surveyed. Tributary streams were dominated by brook trout and brown trout were rare within these streams. Brown trout up to 21.5 inches and brook trout up to 12.3 inches were found within Plum Creek. The Plum Creek watershed contains a robust mixed trout fishery and the current Class I classification of the mainstem in Pierce County is correct based on this survey.

MANAGEMENT RECOMMENDATIONS

- Implement a trout harvest regulation of five fish under 12 inches and one over 12 inches may be kept.
- Continue streambank easement acquisition on Plum Creek and tributaries.
- Continue trout habitat improvement work within the mainstem of Plum Creek using techniques similar to those used in Station VH1.

WATERSHED LOCATION

The Plum Creek watershed is located in southeast Pierce County and western Pepin County. The headwaters begin in the Rock Elm township north of STH 72. The stream flows south into Nugget Lake which is a 116-acre warmwater impoundment on Plum Creek. Plum Creek then flows through the town of Plum City and into Pepin County where it enters the Chippewa River.

PURPOSE OF SURVEY

The purpose of this survey was to evaluate the status and health of the fishery within Plum Creek and its major tributaries. This survey documented trout species presence, relative abundance and the size structure of the population. Natural reproduction and survival of trout was assessed to inform management activities including trout regulation effectiveness and appropriateness, habitat improvement needs and stocking within the watershed.

DATES OF FIELDWORK

All stations were surveyed between June 15 and September 15 of 2023.

SPECIES SAMPLED

- Brown trout
- Brook trout
- Mottled sculpin

- White sucker
- Western blacknose dace
- Longnose dace
- Creek chub
- Johnny darter
- Fantail darter
- Brook stickleback
- Central stoneroller
- Bluntnose minnow
- Southern redbelly dace
- Fathead minnow
- Rainbow darter
- Largemouth bass
- Bluegill
- Yellow perch
- Brook lamprey
- Tiger trout
- Walleye
- Burbot

Introduction

The Plum Creek watershed drains a total of 88 square miles with 49 square miles in Pierce County and 39 square miles in Pepin County. Plum Creek is the primary waterway within the watershed and is moderately sized trout stream located in southeastern Pierce County and western Pepin County. The headwaters are considered warm-cool water and flow into Nugget Lake, a warmwater reservoir. Nugget Lake is formed by a base-flow bottom drawn dam designed for flood control. Downstream of Nugget Lake, spring and coldwater tributaries combine to form a coldwater mainstem and the stream flows for 26 miles before entering the Chippewa River. Plum Creek was historically dominated by brook trout. Brook trout populations experienced sharp declines following degradation of the watershed and the stream was then managed as a warmwater forage stream. The construction of Nugget Lake was completed in 1972 and the 50-foot head on the dam of the reservoir created a significant coldwater upwellings downstream of the dam which eventually led to the restoration of the trout fishery downstream of the reservoir. In 1977, Plum Creek (CTH U upstream to Nugget Lake) was classified as a Class II trout stream. The comprehensive watershed survey in 1999 documented major improvements in the trout population in lower Plum Creek and the stream within Pierce County was then reclassified as Class I trout water in 2002. Currently, Plum Creek features 11.7 miles of Class I trout water in Pierce County and 8 miles of Class II trout water in Pepin County. Upstream of Plum City, the stream is dominated by coarse substrates and brook trout are the dominant species. Downstream of Plum City, sand substrates become prevalent and bank erosion is common. Brown trout dominate this portion of stream and have increased in abundance within the last decade while brook trout have declined.

There are several Class II tributaries in Pierce County which include Brunner Valley Creek, Creek 34-3, Creek 22-12, Creek 22-11 and Creek 10-8. Creek 34-3 did not contain water at the time of surveying in 2023.

STOCKING

Approximately 1400 large fingerling brown trout were stocked annually within Pierce County from the 1970s through 2000. Feral brook trout have been stocked periodically in Pepin County since 2002.

REGULATIONS

Current fishing regulations are brown and rainbow trout 12 inches and larger may be kept; brook trout 8 inches and larger may be kept with a total bag limit of three fish daily.

HABITAT IMPROVEMENT

A trout habitat improvement project was completed within the Village of Plum City in 2011 which included 1500 ft of stream. This project featured integrated bank treatment with installation of LUNKERs, root wads, plunge pools, riffles and boulders. The WIDNR recently completed a trout habitat improvement project downstream of CTH U and adjacent to 145th. This project began in 2019 and was completed in 2020 and encompassed approximately 10,000 feet of stream. The project included integrated bank treatment, root wads, boulders, rock V-weirs, modified ERO structures and island creation/enhancement. The project site was divided into 3 distinct sections in which habitat techniques differed between sections. Each section is evaluated annually to detect any differences or changes in the brook and brown trout population responses to the habitat techniques installed in each section. An additional trout habitat improvement project began in late 2023 and is located directly upstream of the 2019-2020 project, upstream of CTH U. Within the past five years, the Pierce County Land Conservation Department has assisted private landowners with the installation of 6.5 acres of grassed waterways, 2 grade stabilization structures (dams), 1 well closure and 4,735 acres of nutrient management plans.

PUBLIC ACCESS

Several large DNR streambank easements are located on Plum Creek south of Plum City. A 7500 ft easement is located upstream and downstream of the upper CTH U crossing approximately 1.5 miles south of Plum City. Access to this easement is from the bridge crossing on CTH U and from a walk-in access located off of 110th Street. A 3500 ft stream bank easement is located upstream of the next bridge crossing downstream on CTH U and a 10,000 ft easement is located downstream of this bridge as well. A parking lot is located at the corner of 145th Avenue and CTH U and a walk-in access off of 145th Avenue provides access to the lower portion of the easement. Several other bridge crossings are present on Plum Creek upstream and within the town of Plum City. A city park within Plum City also offers fishing access to a large section of Plum Creek. Both the Plum City park section and the easement downstream of the intersection of the CTH U and 145th Avenue have received trout habitat improvement work with enhanced fishability and access.

LAND USE

The primary land uses within the Plum Creek watershed are agriculture (43%) and forest (38%) followed by a mixture of grassland (12%) and other uses. The stream is listed as impaired due to nonpoint source runoff impacts and high total phosphorus levels.

Methods

A total of 11 stations were surveyed on Plum Creek and nine stations were surveyed on tributaries to Plum Creek within Pierce County in 2023 (Table 1). Tributaries surveyed included Brunner Valley Creek, Unnamed Creek 10-8, Unnamed Creek 22-11, Unnamed Creek 22-12 and Rock Elm Creek. Sampling was conducted between June 15th and September 15th using a backpack stream electrofishing unit with a single electrode and a stream barge electrofishing unit with up to three electrodes. The length of stations was determined by multiplying the mean stream width by 35. Stations were located upstream of all road crossings. All fish species were collected at selected predetermined stations and were counted and identified to species. All trout were identified to species and measured to the nearest 10th of an inch. Relative abundance as measured by catch rates and expressed as Catch Per Effort (CPE; fish per mile) of brown trout and brook trout were compared to other Class I trout streams within the Driftless Area and percentiles were assigned for each length or age class. Brook and brown trout less than 5 inches in length are considered young-of-year (YOY) or fish that hatched the previous spring and are an indicator of natural reproduction in the absence of small fingerling stocking.

The Index of Biotic Integrity (IBI) was used as a measure of biological attributes that are influenced by human activities to assess the overall health of the stream. The index uses the species assemblage present to assess water quality and thermal regimes within a waterbody. Coldwater IBI's range in score from 0 to 100 with a high score (90-100) interpreted as an Excellent Integrity rating and 10-20 interpreted as a Poor Integrity rating. Stations 3, 5 and 7 included Coldwater IBI sampling.

Table 1. Guidelines for interpreting Coldwater Index of Biotic Integrity (IBI) scores (from Lyons et al, 1996).

Overall IBI Score	Biotic Integrity Score	Interpretation and Fish Community Attributes
100 – 90	Excellent	Comparable to the best situations with the least human disturbance: mottled or slimy sculpins are usually common; intolerant, native stenothermal coolwater species such as lampreys or redside dace may also be present; brook trout are the primary top carnivores and are present in good numbers; exotic salmonids are absent or uncommon; tolerant species may be present in low to moderate numbers.
80 – 60	Good	Evidence for some environmental degradation and reduction in biotic integrity; either brook trout or sculpins may be uncommon or absent; exotic salmonids often dominate, keeping the abundance of top carnivores high; tolerant species may be common but do not dominate.
50 – 30	Fair	The stream reach has experienced moderate environmental degradation, and biotic integrity has been significantly reduced; total species richness is often relatively high, but intolerant and native stenothermal coldwater species are uncommon or absent; native stenothermal coolwater species and exotic salmonids may be moderately common, but tolerant eurythermal species or warmwater species or both are usually more abundant
20 – 10	Poor	Major environmental degradation has occurred, and biotic integrity has been severely reduced; total species richness may be relatively high, but intolerant species, top

		carnivores, and salmonids are absent; a few native stenothermal coolwater species such as brassy minnows or brook sticklebacks may persist in low numbers; tolerant eurythermal species or warmwater species or both dominate.
0 or no score	Very Poor	Human disturbances and environmental degradation have decimated the natural cold-water fish assemblage of the reach; either only warmwater and tolerant species remain, or fish abundance is so low (<25 individuals captured) that the IBI cannot be calculated.

Table 2. Guidelines for interpreting overall Warmwater Index of Biotic Integrity (IBI) scores (from Lyons, 1992).

Overall IBI Score	Biotic integrity score	Fish community attributes
100 – 65	Excellent	Comparable to the best situations with minimal human disturbance; all regionally expected species for habitat and stream size, including the most intolerant forms, are present with a full array of age and size classes; balanced trophic structure.
64 - 50	Good	Species richness somewhat below expectation, especially due to the loss of the most intolerant forms; some species, especially top carnivores, are present with less than optimal abundances or size/age distributions; trophic structure shows some signs of imbalance.
49 - 30	Fair	Signs of additional deterioration include decreased species richness, loss of intolerant forms, reduction in simple lithophils, increased abundance of tolerant species, and/ or highly skewed trophic structure (e.g., increasing frequency of omnivores and decreased frequency of more specialized feeders); older age classes of top carnivores rare or absent.
29 - 20	Poor	Relatively few species; dominated by omnivores, tolerant forms, and habitat generalists; few or no top carnivores or simple lithophilous spawners; growth rates and condition factors sometimes depressed; hybrids sometimes common.
19 - 0	Very Poor	Very few species present, mostly exotics or tolerant forms or hybrid; few large or old fish; DELT fish (fish with deformities, eroded fins, lesions, or tumors) sometimes common.
No score	Very Poor	Thorough sampling finds few or no fish; impossible to calculate IBI.

SURVEY EFFORT

A total of 3,370 feet of stream was surveyed within the Plum Creek watershed in Pierce County in 2023 for a total of 11 stations on the main stem of Plum Creek and nine stations on tributaries. Stations VH1, VH2, VH3 and Plum 8C were located within previous trout habitat improvement project sites. Brunner Valley Creek enters Plum Creek within Station Plum VH2. Station Plum 6 is located directly upstream and adjacent to Plum VH3. Stations Plum 6 and Plum 7 were located within a wooded riparian corridor and were relatively wide and shallow with sand as the dominant substrate. Station Plum 8 is a trend site and is located within a cattle pasture. This station is also

located downstream of the Plum City wastewater treatment plant. Bank erosion is moderate to severe in this location and substrates consist of gravel and sand. Tributaries 22-11 and 22-12 (Rush Coulee) enter into Plum Creek in Plum City which increase base flow within Plum Creek at this point. Stations Plum 9-13 are located upstream of Plum City and within partially wooded corridors. Substrates within this area consist of cobble, gravel and sand to a lesser degree. Aquatic vegetation is more common within these stations. Unnamed Creek 10-8 enters into Plum Creek between Stations Plum 10 and 11. Unnamed Creek 10-8 is a small, coldwater, high gradient stream that consists of large cobble substrates. Stations Plum 13 and Rock Elm Creek 1 and 2 are located upstream of Nugget Lake.

Table 3. Number and location of stations surveyed in the Plum Creek watershed in Pierce County in 2023.

STATION	STATION LOCATION/NAME	STATION LENGTH (FT)	MEAN STREAM WIDTH (M)
Plum VH1	Downstream of CTH U (lower)	204	5.8
Plum VH2	Downstream of CTH U (middle)	331	9.4
Plum VH3	Downstream of CTH U (upper)	287	8.2
Plum 6	Upstream of CTH U	245	7
Plum 7	Upstream of CTH U	263	7.5
Plum 8	Plum City sewage treatment plant	260	7.1
Plum 8C	Upstream of Pine Avenue	157	4.5
Plum 9	Upstream of CTH S	227	6.5
Plum 10	Upstream of 330th Avenue	237	6.8
Plum 11	Downstream of Dam Road	159	4.6
Plum 13	Upstream of CTH HH	100	2.7
Brunner Valley C	Confluence of Brunner Valley and Plum	100	4.8
Brunner Valley 1	Upstream of CTH U	100	3
Brunner Valley 2	Upstream of private driveway on 90th Street	100	3.7
Creek 10-8 1	Upstream of 150th Street	100	3.4
Creek 10-8 2	Upstream of 130th Street	100	2.2
Creek 22-11 1	Upstream of 1st Street	100	1.3
Creek 22-12 1	Upstream of CTH S	100	2.2
Rock Elm 1	Upstream of 450th Street	100	2.1
Rock Elm 2	Upstream of 490th Street	100	2.7

Results

PLUM CREEK

Trout were detected at all stations surveyed on lower Plum Creek (below Nugget Lake) in moderate to high densities. No trout were detected at stations upstream of Nugget Lake. Plum Creek features a mixed fishery throughout it's length in Pierce County. Brown trout are currently the dominant trout species within lower Plum Creek in Pierce County. Previously, brook trout were the dominant species prior to and in the early 2000s. Brown trout densities have increased throughout the stream. Brook trout densities have remained stable within the reaches upstream of Plum City but brown trout densities have increased dramatically in those locations as well. Brook trout were found at all stations except for Station 7, in low to high densities. Total relative abundance or catch rates of brook trout ranged from 26 per mile (15th percentile) at Station 6 to 1,543 per mile (90th percentile) at Station 10 (Table 4). Brook trout densities have declined in all stations except

for Stations VH2, 10 and 11 in which densities are stable. All other stations downstream of Plum City have experienced sharp declines in brook trout densities since 1999. For example, within the trend site at Station 8, brook trout catch rates have declined from 5,934 per mile in 1999 to 160 per mile in 2023 (Figures 1 & 2). However, the 1999 survey detected abnormally high densities of brook trout and the long-term mean density from 2005 to 2023 is 910 per mile which places current total densities of brook trout well below the long-term average. Stations upstream of Plum City have documented stable densities of brook trout through time and the majority of brook trout present in these stations are YOY.

Brown trout were present in moderate to high densities throughout the stations and catch rates ranged from 263 per mile (25th percentile) at Station 11 to 4,955 per mile (95th percentile) at Station 10 (Table 5). The mean catch rate of brown trout throughout all stations on Plum Creek in 2023 was 1743 per mile. The majority of brown trout at Station 11 were YOY fish (3790 per mile). Brown trout densities have increased at all stations throughout the past two decades (Figure 3). Brown trout were not detected at Station 11 in 1999 and were found in low densities at this location in 2023 (263 per mile). Long-term trend data at Station 8 has also shown a steady increase in brown trout densities since 1999 (Figure 2). Total relative abundance at Station 8 in 2023 was 2025 per mile which is above the long-term mean at that site of 1425 per mile. The highest densities of brown trout were found at Stations 8, 9, 10, VH1 and VH2 (Table 5).

Natural reproduction of both brook and brown trout was detected at all stations on lower Plum Creek in 2023, excluding Station 7 in which no YOY brook trout were found. Catch rates of YOY brook trout ranged from 21 per mile at Station VH3 to 1395 per mile at Station 10 which resulted in catch rates within the 35th percentile to the 95th percentile. Brook trout natural reproduction was highest at Station VH2 (204 per mile) and Station 10 (1395 per mile). Catch rates of YOY brook trout at the trend site at Station 8 were well below the long-term mean (417 per mile) in 2023 at 86 per mile. Natural reproduction of brook trout has declined at all stations except for Stations 9 and 10. Catch rates of YOY brown trout were moderate to high at all stations surveyed on lower Plum Creek and ranged from 30 per mile at Station 11 to 3,790 per mile at Station 10 with an average of 747 per mile throughout all stations (Table 5). Stations 7, 8, 9 and 10 contained YOY brown trout in densities above the 85th percentile for Class I brown trout streams in the Driftless Area. Catch rates of YOY brown trout at the Station 8 trend site was 806 per mile which is well above the long-term mean at that site of 598 per mile.

Catch rates of adult brook trout were low to moderate and ranged from 14 per mile at Station 9 to 486 per mile at Station 11. Brook trout larger than 8 inches were found at all stations on Plum Creek excluding Station 7, with the highest catch rates at Station 11 with 81 per mile. Brook trout ranged in length from 1.5 to 12.3 inches throughout all stations (Figure 5). Brook trout larger than 10 inches were only found at three stations in moderate to high densities (Table 4). Catch rates of adult brown trout ranged from low to high throughout Plum Creek with catch rates ranging from 233 per mile at Station 11 to 1750 per mile at Station 8C. Brown trout ranged in length from 1.8 to 21.5 inches throughout all stations (Figure 4). Several stations exhibited excellent size structure of brown trout with Stations VH1, VH2, 8 and 8C containing brown trout larger than 12 inches above the 90th percentile for catch rates within this size range. Within these stations, approximately 24% of fish were larger than 12 inches in Station VH1, 17% in Station VH2, 21% in Station 8 and 13% in Station 8C. A total of 7 out of the 10 stations surveyed on Plum Creek held trout larger than 15 inches (Figure 4). Stations VH1 and 8C exhibited the highest catch rates for fish larger than 15 inches at 32 per mile and 61 per mile, respectively (Table 5).

IBI surveys conducted at Stations 7, 8C, 10, 11 and 13 resulted in ratings ranging from Poor with a rating of 10 at Station 13 to Excellent with a rating of 90 at Station 10. Stations 7, 8C and 11 received ratings of Good with scores of 60. Station 13 did not contain trout and contained a diverse coolwater fish assemblage (Table 6). Station 11 was also relatively diverse while Station 8C only contained trout species and white sucker.

Table 4. Relative abundance of total, young-of-year (YOY), adult (≥5.5 inches), ≥ 8 inch, and ≥ 10 inch brook trout at 20 stations in the Plum Creek watershed in Pierce County in 2023. Percentiles of catch rates (fish per mile) are denoted in parentheses. Percentiles were assigned from catch rates of Class I brook trout streams in the Driftless Area in Wisconsin.

STATION	TOTAL CPE	YOY CPE	ADULT CPE (≥ 5.5 INCHES)	CPE ≥ 8 INCHES	CPE ≥ 10 INCHES
Plum VH1	95 (35)	55 (45)	39 (25)	8 (25)	8 (60)
Plum VH2	311 (60)	204 (65)	107 (45)	39 (55)	0
Plum VH3	89 (35)	21 (35)	45 (25)	28 (45)	0
Plum 6	26 (15)	20 (35)	125 (50)	33 (50)	7 (60)
Plum 7	0	0	0	0	0
Plum 8	160 (45)	86 (50)	74 (35)	43 (55)	0
Plum 8C	123 (40)	51 (45)	72 (35)	21 (45)	0
Plum 9	57 (25)	43 (40)	14 (10)	28 (45)	0
Plum 10	1543 (90)	1395 (95)	149 (55)	7 (25)	0
Plum 11	597 (80)	111 (55)	486 (80)	81 (70)	41 (85)
Plum 13	0	0	0	0	0
Brunner Valley C	182 (45)	163 (60)	10 (10)	10 (30)	0
Brunner Valley 1	628 (80)	628 (85)	0	0	0
Brunner Valley 2	129 (40)	16 (30)	113 (45)	0	0
Creek 10-8 C	242 (55)	0	242 (60)	48 (55)	32 (80)
Creek 10-8 1	177 (45)	64 (45)	113 (45)	64 (65)	0
Creek 22-11 1	692 (80)	209 (65)	402 (75)	113 (75)	0
Creek 22-12 1	16 (10)	0	16 (15)	0	0
Rock Elm 1	0	0	0	0	0
Rock Elm 2	0	0	0	0	0

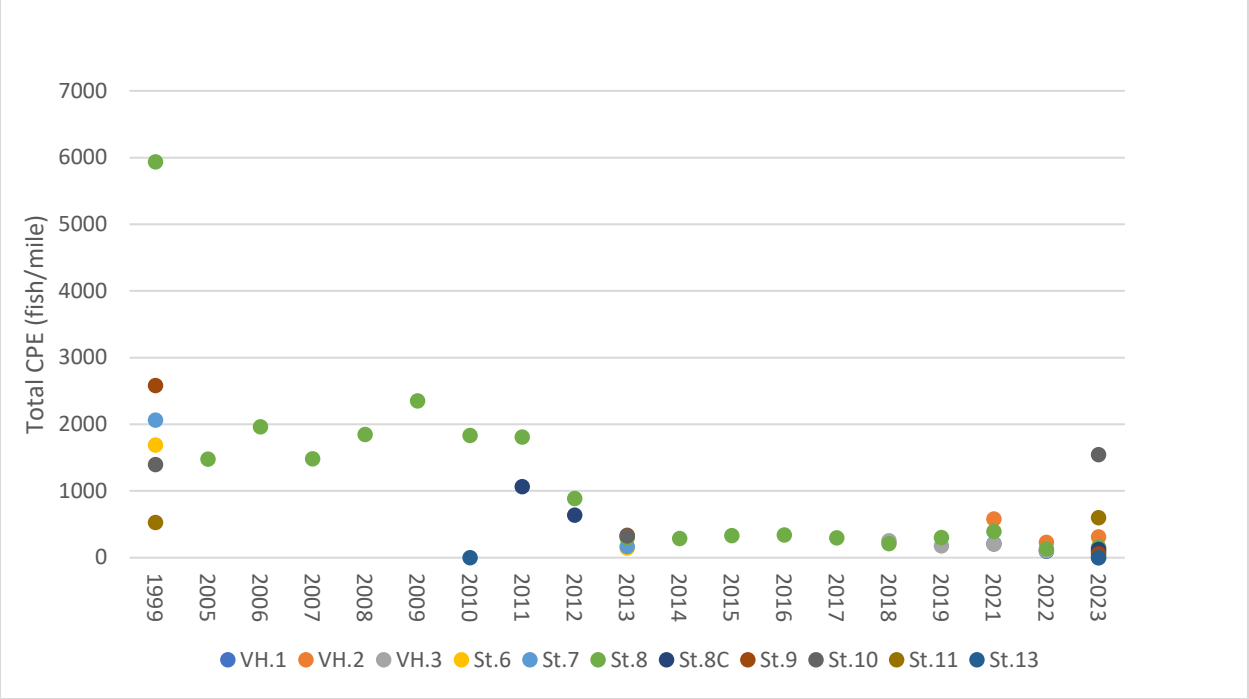

Figure 1. Total relative abundance of brook trout as expressed by catch per effort (CPE; fish per mile) collected from 11 stations in Plum Creek in 2023.

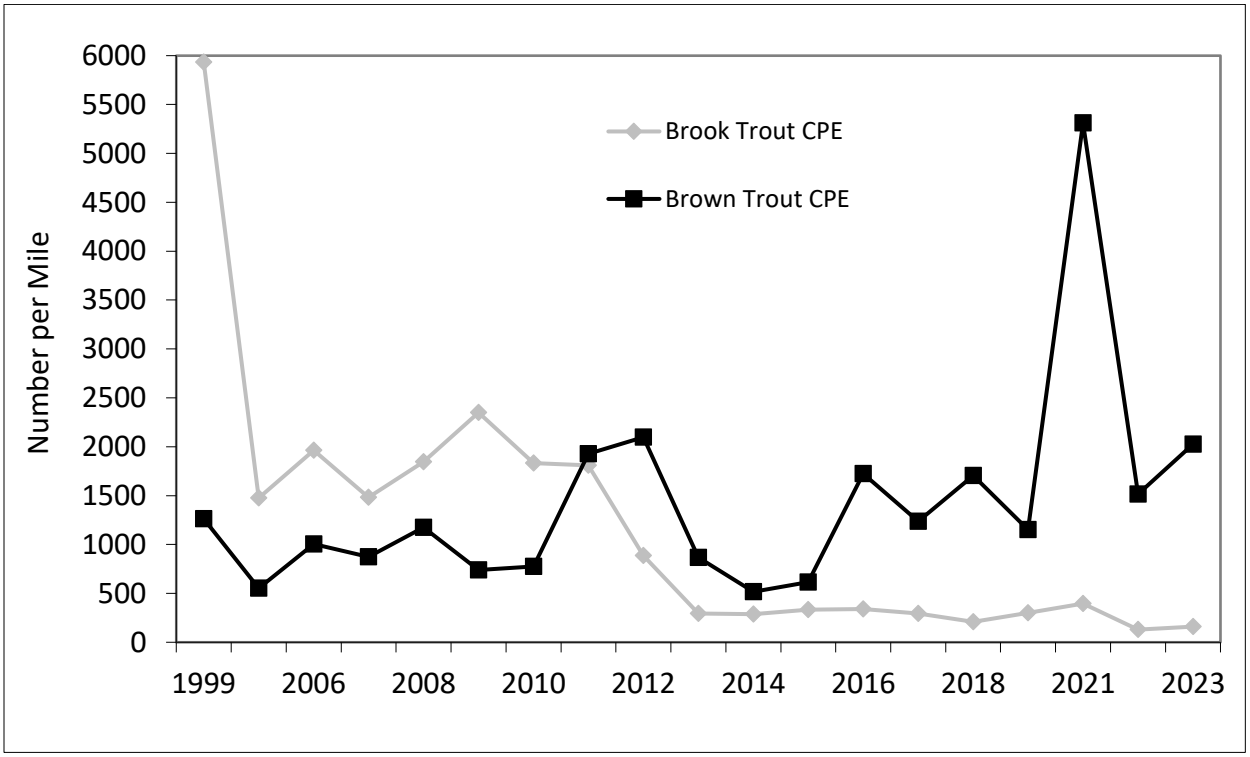

Figure 2. Total relative abundance of brook trout and brown trout at Station 8 on Plum Creek from 1999 to 2023.

Table 5. Relative abundance of total, young-of-year (YOY), adult (≥5.5 inches), ≥ 12 inch, and ≥ 15 inch brown trout at 20 stations in the Plum Creek watershed in Pierce County in 2023. Percentiles of catch rates (fish per mile) are denoted in parentheses. Percentiles were assigned from catch rates of Class I brown trout streams in the Driftless Area in Wisconsin.

STATION	TOTAL CPE	YOY CPE	ADULT CPE (≥ 5.5 INCHES)	CPE ≥ 12 INCHES	CPE ≥ 15 INCHES
Plum VH1	1789 (85)	158 (60)	1631 (85)	386 (95)	32 (90)
Plum VH2	1229 (75)	78 (45)	1151 (75)	194 (90)	10 (70)

Plum VH3	1151 (70)	251 (70)	900 (65)	101 (75)	6 (60)
Plum 6	722 (55)	92 (50)	630 (55)	46 (50)	0
Plum 7	1242 (75)	551 (85)	691 (60)	55 (55)	12 (75)
Plum 8	2025 (90)	806 (90)	1219 (75)	252 (95)	19 (85)
Plum 8C	1832 (85)	82 (45)	1750 (85)	235 (90)	61 (95)
Plum 9	2225 (90)	1630 (95)	595 (55)	99 (75)	7 (65)
Plum 10	4955 (95)	3790 (95)	1164 (75)	108 (75)	0
Plum 11	263 (25)	30 (35)	233 (30)	41 (45)	0
Plum 13	0	0	0	0	0
Brunner Valley C	0	0	0	0	0
Brunner Valley 1	0	0	0	0	0
Brunner Valley 2	0	0	0	0	0
Creek 10-8 C	0	0	0	0	0
Creek 10-8 1	41 (5)	14 (25)	27 (5)	0	0
Creek 22-11 1	10	0	10	0	0
Creek 22-12 1	0	0	0	0	0
Rock Elm 1	0	0	0	0	0
Rock Elm 2	0	0	0	0	0

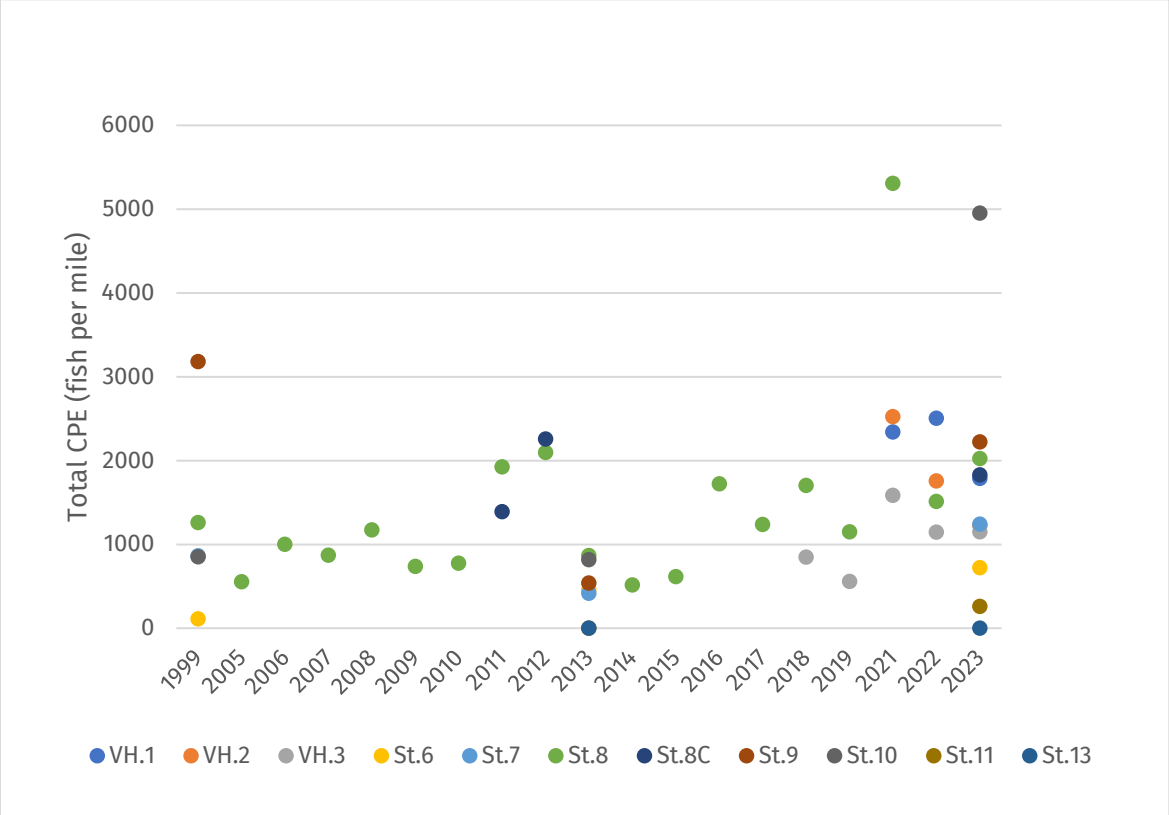

Figure 3. Total relative abundance of brown trout as expressed by catch per effort (CPE; fish per mile) collected from 11 stations in Plum Creek in 2023.

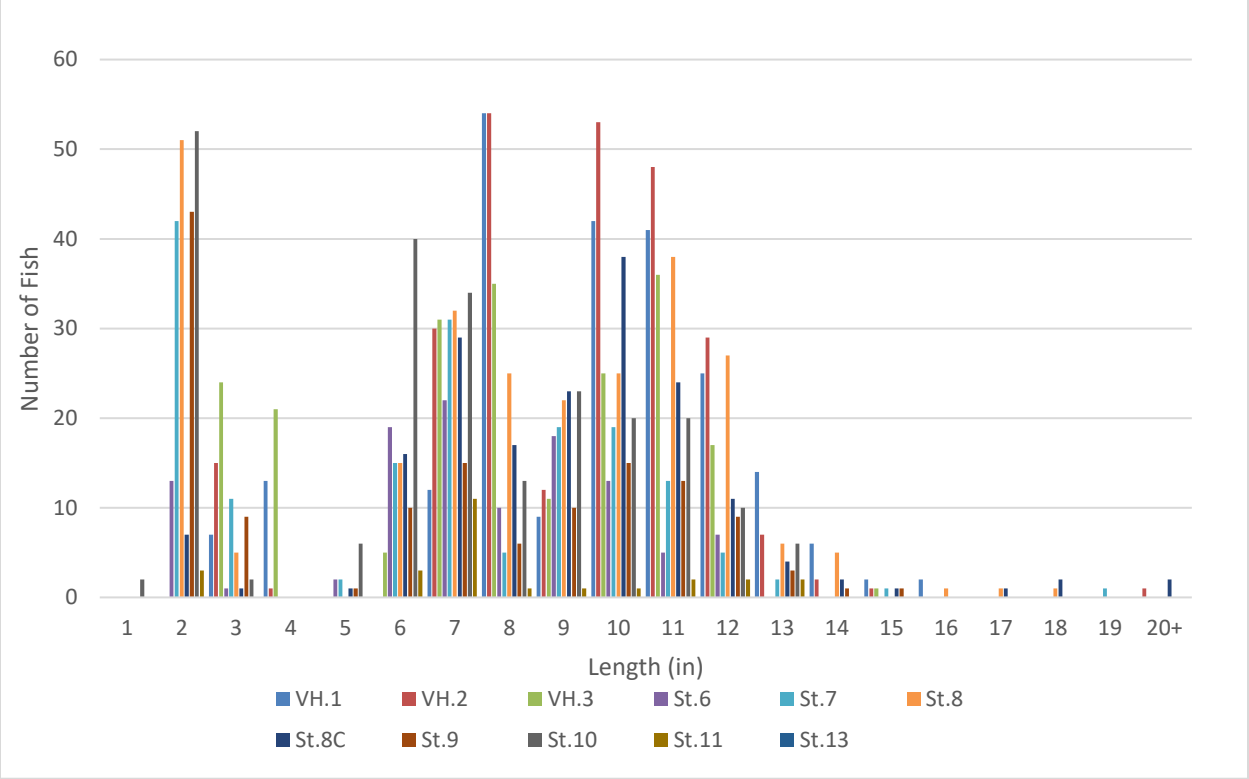

Figure 4. Length distribution of brown trout collected from Plum Creek in 11 stations in 2023.

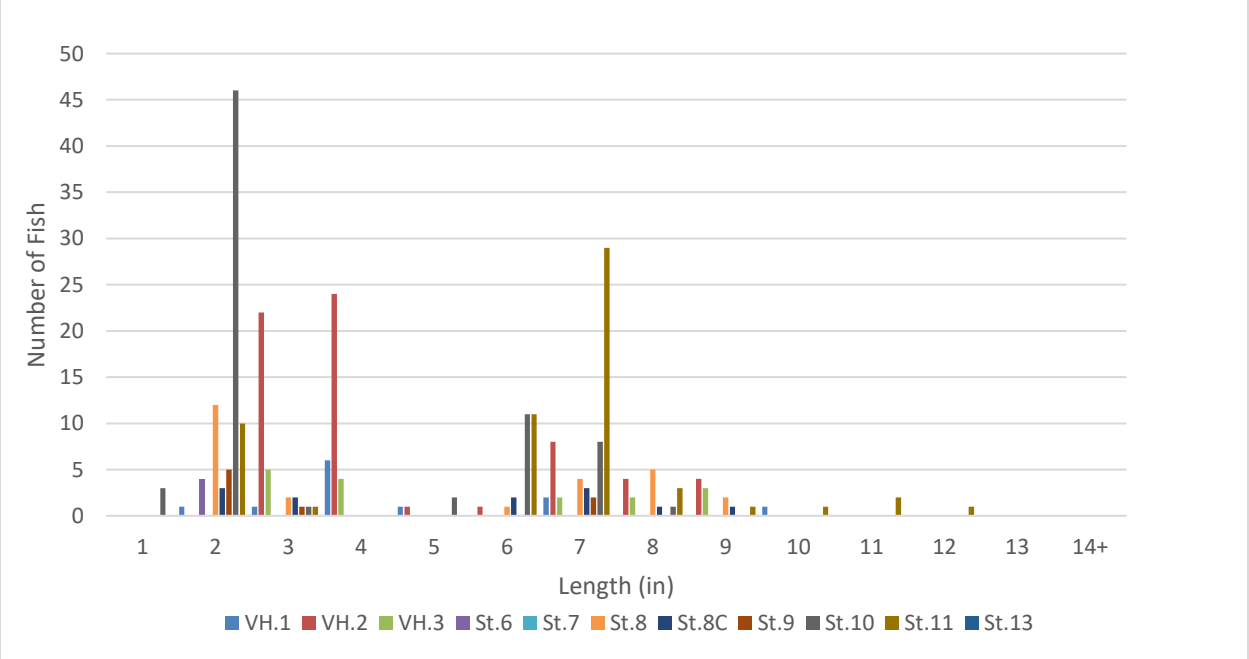

Figure 5. Length distribution of brook trout collected from Plum Creek in 11 stations in 2023.

Table 6. Total number of each species captured at 11 stations on Plum Creek, summer 2023. (. Indicates species were not targeted).

SPECIES	VH1	VH2	VH3	6	7	8	8C	9	10	11	13
Brown Trout	227	253	206	110	203	329	179	314	732	26	0
Brook Trout	12	64	16	4	0	26	12	8	228	59	0
Mottled Sculpin	.	.	.	.	0	.	0	.	0	0	0
Burbot	2	0	2	0	0	.	0	.	0	0	0
Western Blacknose Dace	.	1	.	.	0	.	0	.	0	0	20
White Sucker	.	1	.	4	0	.	47	.	0	33	20
Ammocete	.	.	.	1	0	.	0	.	2	0	0
Tiger Trout	0	0	2	0	0	1	0	0	1	0	0
Walleye	.	.	.	.	0	1	0	.		0	0
Johnny Darter	.	0	.	.	0	.	0	.	1	17	26
Brook Stickleback	.	0	.	.	0	.	0	.	10	17	0
Fathead Minnow	.	0	.	.	0	.	0	.	0	17	7
Bluegill	.	0	.	.	0	.	0	.	0	2	0
Largemouth Bass	.	0	.	.	0	.	0	.	0	14	0
Rainbow Darter	.	0	.	.	0	.	0	.	0	1	1
Yellow Perch	.	0	.	.	0	.	0	.	0	1	0
Bluntnose Minnow	.	0	.	.	0	.	0	.	0	0	52
Creek Chub	.	0	.	.	0	.	0	.	0	0	21

BRUNNER VALLEY CREEK

Brook trout were detected at all three stations surveyed on Brunner Valley Creek in 2023. No brown trout were detected at any station in 2023. A single YOY brown trout was found at Station C and five YOY brown trout were found at Station 1 in 2020. Total relative abundance of brook trout as measured by catch rates ranged from 129 per mile at Station 2 to 628 per mile at Station 1 (Table 7). Brook trout catch rates declined at Station C and Station 1 when compared to surveys conducted in 2020 in which catch rates were 773/mile at Station C and 1223 per mile at Station 1 (Figure 6). A survey did not occur at Station 2 in 2020.

Lengths of brook trout ranged from 1 to 8 inches in all stations (Figure 7). No adult trout were collected at Station 1. Adult brook trout were present at Station C in low abundance and present at Station 2 in moderate abundance for Class II brook trout streams in the Driftless Area. Brook trout larger than 8 inches were only present at Station C in low densities. Evidence of natural reproduction of brook trout was documented at all stations and YOY brook trout were in low to high densities (Table 7). The highest densities of YOY were found at Station 1 and resulted in densities in the 85th percentile.

Table 7. Relative abundance of total, young-of-year (YOY), adult (≥5.5 inches), ≥ 8 inch, and ≥ 10 inch brook trout at 3 stations on Brunner Valley Creek in Pierce County in 2023. Percentiles of catch rates (fish per mile) are denoted in parentheses. Percentiles were assigned from catch rates of Class II brook trout streams in the Driftless Area in Wisconsin.

STATION	TOTAL CPE	YOY CPE	ADULT CPE (≥ 5.5 INCHES)	ADULT CPE ≥ 8 INCHES	ADULT CPE ≥ 10 INCHES
Brunner Valley C	182 (45)	163 (60)	10 (10)	10 (30)	0
Brunner Valley 1	628 (80)	628 (85)	0	0	0
Brunner Valley 2	129 (40)	16 (30)	113 (45)	0	0

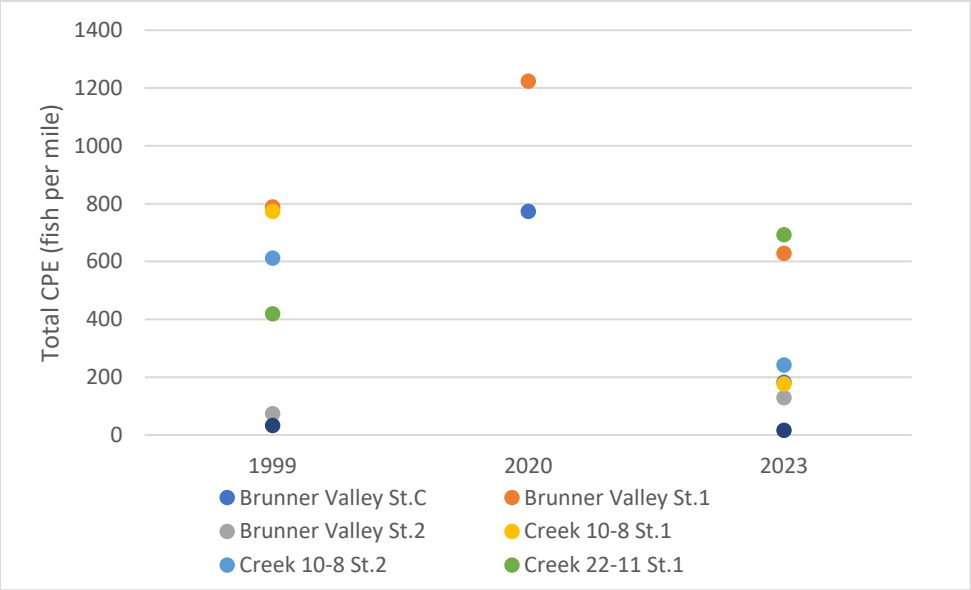

Figure 6. Total relative abundance of brook trout as expressed by catch per effort (CPE; fish per mile) collected from 6 stations on Plum Creek tributaries in 1999, 2020 and 2023.

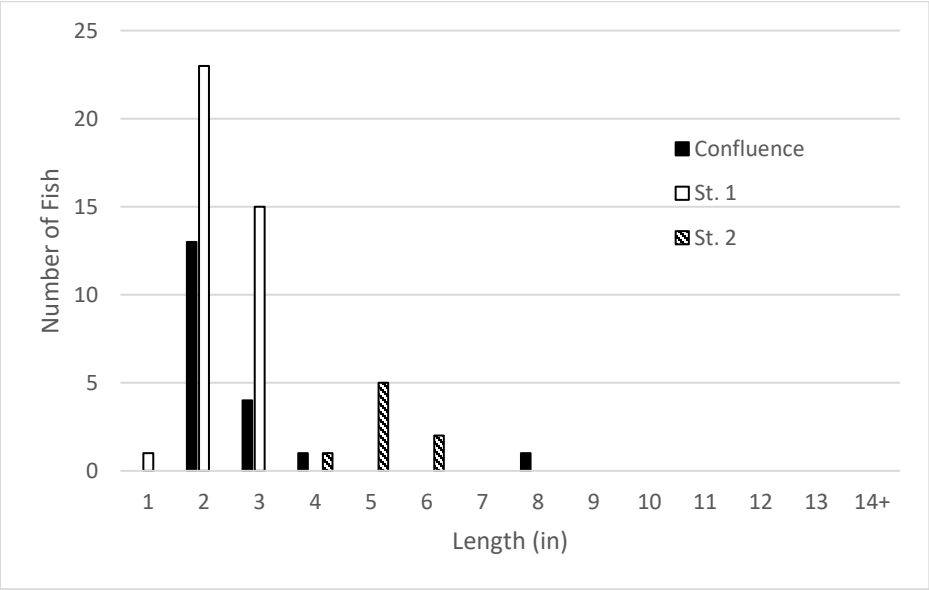

Figure 7. Length distribution of brook trout collected from 3 stations on Brunner Valley Creek in 2023.

UNNAMED CREEK 10-8

Brook trout were found at both stations surveyed in moderate abundances ranging from 177 per mile at Station 1 to 242 per mile at Station C (Table 8). Brown trout were not detected at Station C

but were found at Station 1 in low densities (41 per mile). Brook trout densities were considerably lower compared to the previous survey in 1999 at both stations (Figure 6). Brown trout were not found at either station in 1999. Natural reproduction of brook trout was only documented at Station 1 where YOY were found in moderate densities. YOY brown trout were also detected at Station 1. No natural reproduction was evident at Station C for either species. Adult brook trout were present at both stations in moderate densities ranging from 113 per mile at Station 1 to 242 per mile at Station C. Brook trout ranged in length from 2 to 10 inches (Figure 8). Brook trout larger than 10 inches were found at Station C in high densities (80th percentile) when compared to Class II brook trout streams in the Driftless Area. No brook trout larger than 8 inches were found at Station 1.

The coldwater IBI survey at Station 1 resulted in a rating of Fair with a score of 40. Species present at this station included western blacknose dace, brook stickleback, white sucker and johnny darter.

Table 8. Relative abundance of total, young-of-year (YOY), adult (≥5.5 inches), ≥ 8 inch, and ≥ 10 inch brook trout at 3 stations on Unnamed Creek 10-8 in Pierce County in 2023. Percentiles of catch rates (fish per mile) are denoted in parentheses. Percentiles were assigned from catch rates of Class II brook trout streams in the Driftless Area in Wisconsin.

STATION	TOTAL CPE	YOY CPE	ADULT CPE (≥ 5.5 INCHES)	ADULT CPE ≥ 8 INCHES	ADULT CPE ≥ 10 INCHES
Creek 10-8 C	242 (55)	0	242 (60)	48 (55)	32 (80)
Creek 10-8 1	177 (45)	64 (45)	113 (45)	64 (65)	0

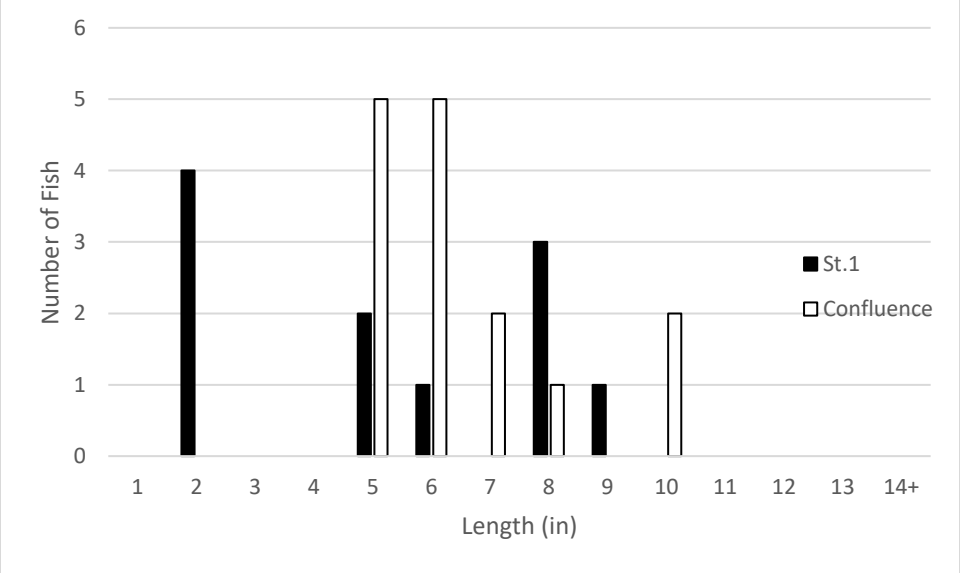

Figure 8. Length distribution of brook trout collected from 2 stations on Unnamed Creek 10-8 in 2023.

UNNAMED CREEK 22-12 (RUSH COULEE)

A single five inch brook trout was captured at Station 2 on Rush Coulee in 2023 (Table 9). No other fish were captured at this station. A 9- and 10-inch brook trout were captured during the 1999 survey at Station 2.

UNNAMED CREEK 22-11

Brook trout were found in high abundance at Station 1 and total catch rate was 692 per mile (90th percentile; Table 9). A single 8-inch brown trout was also detected which resulted in a catch rate of 10 per mile. Total brook trout densities were higher than during the 1999 survey in which relative abundance was 419 per mile. Natural reproduction of brook trout was documented by the presence of YOY and catch rates resulted in 209 per mile (80th percentile) which was similar to 274 per mile in 1999. Relative abundance of adult brook trout was 402 per mile (85th percentile) in 2023 and 145 per mile in 1999. Adult brook trout were found up to 9 inches in length (Figure 9).

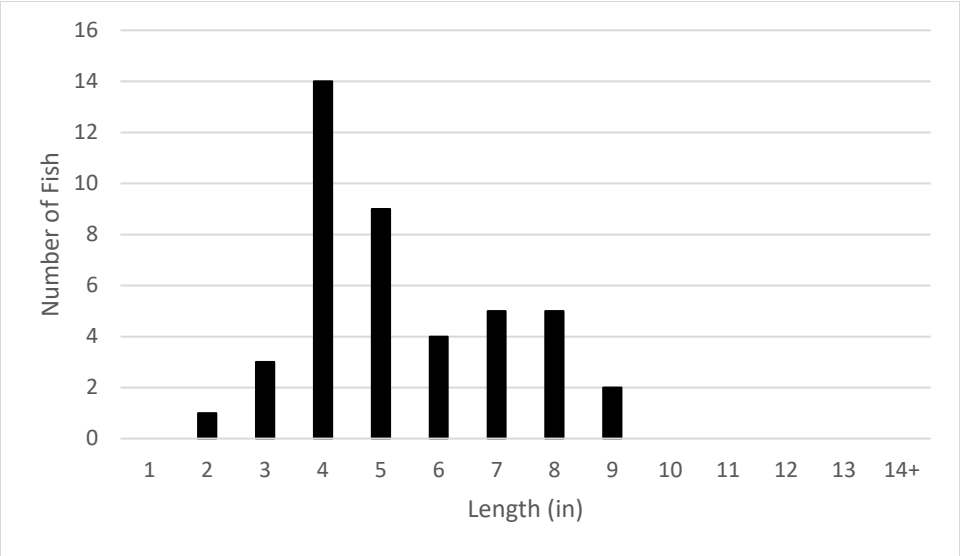

Figure 9. Length frequency distribution of brook trout collected from Station 1 in Unnamed Creek 22-11 in 2023.

Table 9. Relative abundance of total, young-of-year (YOY), adult (≥5.5 inches), ≥ 8 inch, and ≥ 10 inch brook trout at 2 stations on Unnamed Creek 22-11 and 22-12 in Pierce County in 2023. Percentiles of catch rates (fish per mile) are denoted in parentheses. Percentiles were assigned from catch rates of Class II brook trout streams in the Driftless Area in Wisconsin.

STATION	TOTAL CPE	YOY CPE	ADULT CPE (≥ 5.5 INCHES)	ADULT CPE ≥ 8 INCHES	ADULT CPE ≥ 10 INCHES
Creek 22-11	692 (90)	209 (80)	402 (85)	113 (80)	0
Creek 22-12	16 (15)	0	16 (20)	0	0

ROCK ELM CREEK

Trout have not been detected in previous surveys of Rock Elm Creek and were not detected in 2023. Station 2 contained a diverse fish assembly that included 10 coolwater and warmwater species (Figure 10). A total of eight species were captured in 1999. Bluntnose minnow and fathead minnow were present in high abundance in 2023 but were not found during the 1999 survey. Southern redbelly dace were also found in 2023. Western blacknose dace and creek chub declined in abundance from 1999 to 2023. Bluegill and brook stickleback were found in 1999 but were not detected in 2023. The coldwater IBI rating for Station 2 was Very Poor while the Cool Cold IBI resulted in a Good rating and Cool Warm IBI survey resulted in a rating of Fair.

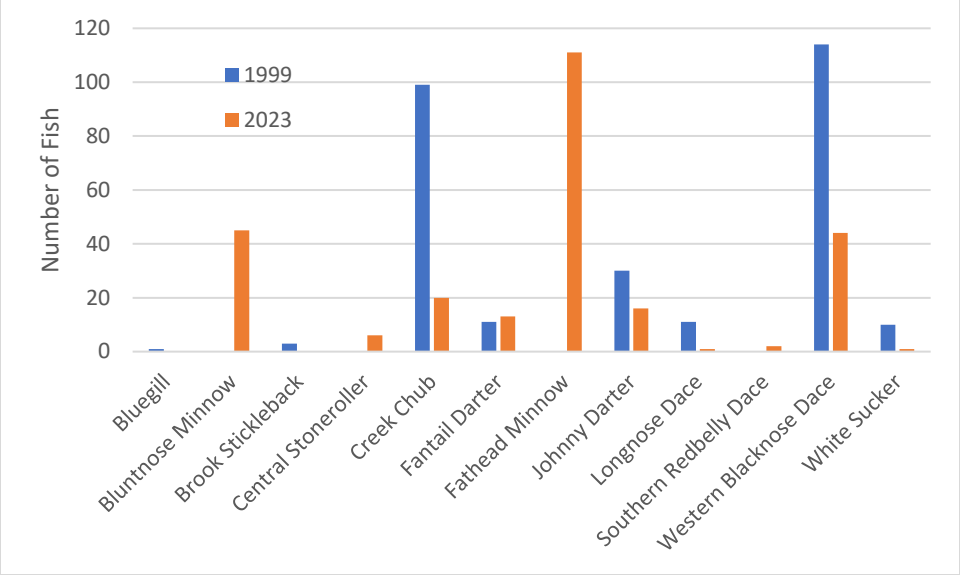

Figure 10. Number of each fish species captured at Station 2 on Rock Elm Creek in Pierce County, WI 2023.

Discussion

Coldwater resources within the Plum Creek watershed have experienced significant changes in the past half century. Historically, brook trout were the only trout species present in what once was a pristine spring fed stream with a deciduous forest mixed with prairie as the riparian corridor. Degradation of the watershed occurred throughout the late 1800's and early 1900's in the form of deforestation, increases agricultural activity, wastewater treatment plants and milling dams. Brook and brown trout stocking occurred to reintroduce and maintain trout populations. Improvements in land use through the implementation of conservation practices aided in restoring the land and streams to the point where coldwater streams can now support fully self-sustaining trout populations. These practices have led to reduced flooding, increased groundwater infiltration rates, runoff reduction, reduced erosion and reductions in stream temperatures and improvements in trout habitat. At the time of the previous watershed survey in 1999, only 5.2 miles of stream within the watershed was classified as a Class II stream. Following that survey, 11.7 miles were classified as Class I water in Pierce County and 8 miles of stream were classified as Class II water in Pepin County (Engel and Peavey 2001). Trout stocking simultaneously ceased in Pierce County at that time because of increases in natural reproduction of trout.

While trout populations remain robust within Plum Creek, dramatic shifts in trout species composition have occurred. Brook trout populations have experienced declines throughout the mainstem of Plum Creek. According to continuous trend site data at Station 8, declines began in 2010 and 2011. Simultaneously, brown trout began to dramatically increase in abundance and are currently the dominant trout species throughout most of the mainstem of Plum Creek. Station 11 was the only station in which brook trout densities exceeded brown trout densities in 2023. Station 11 is located within 1 mile of the Nugget Lake dam. Brook trout densities are highest upstream of Plum City and the presence of brook trout in Plum Creek downstream of Plum City is generally related to the proximity of connected coldwater tributaries. All stations experienced declines in brook trout densities except for Stations 10 and 11, in which they have remained stable. Brown trout were the dominant species in all stations except for Station 11 and were found in high densities in the majority of stations surveyed. The highest densities of brown trout were found at

Stations 8 and 10 and the lowest densities were found at Station 11. Adult brown trout were present in low to moderate densities upstream of Plum City and the high densities found at Station 10 were mostly composed of YOY brown trout. The reasons for changes in trout species composition are unknown but may be related to drought conditions that persisted in 2009-2010. Drought conditions were also present in 2013 and 2014. Increasing maximum summer temperatures were shown to result in decreases in brook trout recruitment and increases in brown trout recruitment in the northern Midwestern states (Maitland and Latzka 2022). Additionally, increases in summer precipitation was positively related to brook trout recruitment (Maitland and Latzka 2022). With drought conditions present in 2009 and 2010, brook trout recruitment, in terms of relative abundance of YOY was low in 2009, 2012 and 2013. After several consecutive years of low recruitment, adult brook trout densities declined and brook trout recruitment has not recovered since that time. Temperatures taken during stream surveys at the Station 8 trend site revealed high water temperatures in July of 2010 of 71° F. Simultaneously, brown trout recruitment increased in the years following the severe summer droughts and has been strong since that time.

While brown trout densities have increased in the mainstem of Plum Creek, the small coldwater tributaries continue to support strong brook trout populations. Brook trout were the dominant trout species in all coldwater tributaries that were surveyed. Most tributaries offer excellent brook trout spawning and rearing habitat and are likely used by adult brook trout that migrate into these tributaries in the fall for spawning purposes. The majority of tributaries contained low densities of adult brook trout and moderate to high densities of YOY with the exception of Unnamed Creek 22-12, indicating that a large proportion of brook trout production within the Plum Creek watershed results from these small coldwater streams. Station 1 on Unnamed Creek 22-12 (Rush Coulee) is located within a previously ditched portion of stream with reed canary grass restricting the flow of water. The degraded conditions at this station are likely the reason for low trout abundance. Brunner Valley Creek, Unnamed Creek 10-8 and Unnamed Creek 22-11 are high quality brook trout streams with excellent water quality and habitat. YOY brook trout densities were highest at Station 1 on Brunner Valley Creek likely due to the excellent cover for YOY trout in the form of native aquatic vegetation. Brown trout were rare in all stations surveyed on tributary streams. Low densities of YOY brown trout were found at Stations C and 1 in Brunner Valley Creek in 2020 but none were captured in any station in 2023. Brown trout use of these streams is likely limited due to stream size and suitable habitat for brown trout spawning (Witzel and MacCrimmon 1983).

While the majority of brook trout natural reproduction occurs in tributaries, the majority of brown trout reproduction occurs within the mainstem of Plum Creek both upstream and directly downstream of Plum City. YOY densities for both trout species was very high at Station 10. Stations 8 and 9 also contained high densities of YOY brown trout. Natural reproduction of trout within the watershed is strong but appears to be shifting to more favorable conditions for brown trout. Stream temperatures and habitat has improved greatly throughout the years and has resulted in healthy streams and fish populations.

Along with high rates of natural reproduction, survival and recruitment of trout is also high. Within the past decade, high survival of trout has resulted in relatively poor size structure of adult trout. The majority of trout in annual surveys are within the 6-12 inch range with relatively few fish larger than 12 inches. This has been a common occurrence within nearby trout streams as well. With excellent natural reproduction, high survival and high densities of small trout, the current harvest regulation of 12-inch minimum length limit for brown trout with a three fish bag limit is currently not appropriate for Plum Creek and nearby streams. The 12-inch minimum length limit focuses any

harvest that occurs on larger, rarer fish and protects abundant small trout that are likely experiencing density dependent effects (Bohlin et al. 2002; Vollestad et al. 2002; Klemetsen et al. 2003; Lobon-Cervia 2005). Density dependence in trout populations has been well documented and has explained variation in size at age and revealed that intraspecific competition for food and space can result in reduced growth when trout are in high densities (Bohlin et al. 2002; Klemetsen et al. 2003). Therefore, it is recommended that bag limits are increased and size limits aim to focus harvest on smaller abundant trout which will aid in reducing densities and thus improving growth rates.

In addition to changes in harvest regulations, management actions in the form of trout habitat improvements have resulted in improvement in the fishery within project sites. Habitat improvement projects have been completed at Stations VH1 and 8C. These stations contained the highest densities of adult brown trout and best size structure of all stations surveyed. Total average densities of brown trout at Station VH1 increased from an average of 704 per mile prior to the project to an average of 2212 per mile after project completion. Increases in the density of brown trout larger than 15 inches has also been documented with densities increasing from an average of 7 per mile to 16 per mile at Station VH2 and 26/mile at Station VH1. YOY trout densities have remained similar to pre-project densities at Station VH1 and VH3 and have declined at Station VH2. Brook trout YOY densities have remained similar to pre-project levels at Station VH2 but have declined at Stations VH1 and VH3. Habitat techniques used in Station VH2 appear to allow brook trout to persist within habitat project sites. The proximity of this station to Brunner Valley Creek has a large impact on the presence and abundance of brook trout. While brook trout abundance is low throughout Plum Creek in Pierce County downstream of Plum City, future habitat projects should focus on increasing habitat diversity and providing multi-age class habitats within project sites. Habitat practices and techniques used in Station VH1 appear to provide excellent habitat for YOY and adult trout and contain an excellent size structure of brown trout. Non-game species habitat is also present within this station.

The habitat improvement project completed in 2011 at Station 8C has resulted in sustained high densities of adult brown trout. Pre-project densities of YOY have declined from 868 per mile to 82 per mile in 2023. Brook trout densities experienced sharp declines after project completion. Pre-project total brook trout densities were 1066 per mile while current densities are 123 per mile. Overall, this project has resulted in high quality adult brown trout habitat with a high size structure of brown trout.

According to IBI surveys, water quality conditions in Plum Creek have remained stable or improved since the 1999 survey. Improvements in IBI ratings occurred at Stations 10 and 11 on Plum Creek and at Station 2 on Unnamed Creek 22-12. Best management practices and improvements in land use have likely played a role in maintaining surface water conditions for trout. The wastewater treatment plant located downstream of Plum City has likely improved operations as evidenced by increasing trout densities and natural reproduction at Station 8. Additionally, the current trout stream classifications of Plum Creek and its tributaries appears to be correct based on this survey. Plum Creek features a high-density trout population with multiple year classes present, excellent natural reproduction and habitat that is occupied by trout. The Class II tributaries contain more than one year class of trout and support natural reproduction; however, habitat limits the abundance of adult trout within these streams and multiple year classes of adults are not present annually.

Plum Creek features a diverse fish community and robust trout population in Pierce County. Excellent water quality and thermal conditions are apparent based on results from the 2023 survey. Small coldwater tributary streams contain excellent brook trout spawning and rearing habitat which likely allow brook trout to persist within this watershed despite high density brown trout populations. The majority of brown trout natural reproduction and brook trout reproduction to a lesser extent, occurs in the mainstem of Plum Creek upstream of Plum City. Downstream of Plum City features adult trout habitat with reduced densities of YOY trout. Rock Elm Creek and Plum Creek upstream of Nugget Lake remain as coolwater and warmwater streams and contain a diverse fish community. Trout habitat in the form of overhead cover is lacking in Plum Creek downstream of Plum City and high sand loads remain an issue. Stream bank erosion is prevalent in most areas as well which contributes sand to the stream and further increases sedimentation. Plum Creek is classified as a Brook Trout Reserve Stream and efforts to maintain and protect brook trout habitat is a priority. Overall, the health of Plum Creek has continued to improve and further improvements of land use practices and in-stream habitat are recommended in order to successfully manage the watershed and fishery.

Management Recommendations

Trout harvest regulations changes are recommended for Plum Creek to improve the size structure of brown trout by focusing harvest on abundant, small trout and protecting larger trout from harvest. Streambank easement acquisition is a high priority within the watershed to provide protection in perpetuity and enhance and maintain trout habitat and increase angler access. Trout habitat improvement work should continue to be a priority on the mainstem of Plum Creek which will reduce bank erosion and sedimentation and improve in-stream fish habitat. No improvement work is recommended on tributary streams to reduce the likelihood of brown trout colonization from changes in habitat or disturbance.

1. Implement a trout harvest regulation of five fish under 12 inches and one over 12 inches may be kept.
2. Continue streambank easement acquisition.
3. Continue trout habitat improvement work within the mainstem of Plum Creek using techniques similar to those used in Station VH1.

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