WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Fishery Survey Report For The South Fork Hay River, Barron County, Wisconsin 2023

Waterbody Identification Code: 2070100

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Introduction

The South Fork Hay River, situated in the scenic southwest region of Barron County, is a moderate-sized, Class I, coldwater trout stream. The stream originates at Long Lake (45.287, -92.146) and flows southward for approximately 33 miles until it meets the Hay River in Dunn County. Only the southernmost 2 miles of stream are classified as trout water in Barron County, and the stream remains small (stream width approximately 4 m) until it reaches Dunn County. The South Fork Hay River flows mainly through hilly agricultural and forested lands in Barron County. Gravel and cobble are the primary substrates and provide adequate spawning substrate for brook trout. The stretch of the South Fork Hay River that is designated as trout water is accessible at three road crossings in Barron County.

There have been four surveys on the South Fork Hay River in Barron County prior to the start of the fisheries assessment trout trend site during 2005. The earliest surveys during the late 1950s and 1960s documented a low-density brook trout population with poor in-stream habitat (Brasch 1958; Parker 1967). It was noted that this portion of stream was heavily grazed due to substantial streambank pasturing of livestock, which resulted in degraded habitat. White sucker, creek chub and other forage fishes were abundant and thought to be indicative of warmer water conditions. In 1967, county streambank easements were established on 1.5 miles of river upstream of the Barron–Dunn County line. Cattle were excluded from the stream via streambank fencing, which appeared to improve the quality of habitat. These streambank easements enabled public access for fishing, as well as vegetation and habitat management. Additionally, brook trout stocking occurred during 1965–1976 to supplement the existing population (Appendix Table 1). Improvements in the brook trout population followed as natural recruitment and adult densities increased during the 1976 survey compared to previous surveys (Cornelius 1976). The adult population continued to improve through the mid-1990s in terms of adult densities, population size structure and natural recruitment (Cornelius 1994). Indications of water quality improvements were indirectly evident. Non-game fish present were primarily mottled sculpin, a coldwater indicator species, with lower abundances of white sucker and creek chubs compared to the earliest surveys.

Since 2004, the South Fork Hay River has been used as the brood source for the northwest Wisconsin wild strain brook trout. These fish are stocked in the Chippewa and St. Croix River basins as part of Wisconsin's wild trout stocking program. The South Fork Hay River was selected because of the high densities of wild brook trout with high genetic diversity, no recent history of stocking and no brown trout present (although a few are present downstream).

Prior to 2006, adult fish were collected via electrofishing each fall and transported back to state hatcheries for spawning. However, with the discovery of Viral Hemorrhagic Septicemia (VHS) in Wisconsin, it was no longer possible to bring wild fish into state hatcheries. To continue the wild trout stocking program, each fall since

2008 adult brook trout were collected (n = 400–500 adults), transported and held within in-stream holding pens (Figure 1). Then trout were spawned streamside weekly over a three-week period, and fertilized eggs were disinfected and transported to the Osceola State Fish Hatchery. Adult brook trout were released at the spawning location a few miles upstream of the original capture site. This process has occurred annually through 2023.

Figure 1. In-stream holding pens for adult brook trout in the South Fork Hay River, Barron County, Wisconsin.

The trout fishing season in Wisconsin opens the first Saturday in May and closes Oct. 15. There are no gear restrictions for the South Fork Hay River and no minimum length limit with a 5 fish daily bag limit.

The goal of this report was to evaluate the status of the brook trout fishery in the South Fork Hay River. We assessed catch rates and size structure relative to previous surveys and Barron County averages, fish community responses to historic habitat enhancements and if spawning operations had any discernable effects on population dynamics.

Methods

One station located at 1450th Ave. on the Barron-Dunn County line was sampled on Aug. 7, 2023. This site serves as a fisheries assessment trout trend site and has been sampled annually since 2005. Sampling occurred upstream along a 0.09 mile transect, which was determined by multiplying the mean stream width by 35. Sampling was conducted using a barge stream electrofishing unit with three electrodes and dip

netters. All brook trout were measured to the nearest 0.1 inch and immediately released following completion of the transect. Catch per unit effort (CPUE; index of relative abundance) was estimated as catch per mile. The CPUE of brook trout was compared to previous surveys and to species-specific averages for Barron and Polk counties. Size structure was assessed using the proportional size distribution (PSD) indices (Neumann et al. 2013). The PSD value for a species is the number of fish of a specified length and longer divided by the number of fish of stock length or longer, multiplied by 100.

Earlier surveys suggested that enhancements to deteriorated in-stream habitat and water quality, initiated in the late 1960s, led to increased brook trout abundance and a reconfiguration of the fish community. Although habitat data were not available, we evaluated how fish community structure changed over time, guided by the assumption that alterations in stream habitat and thermal conditions would correlate with subsequent shifts in fish community structure. Statistical approaches, such as an analysis of similarity or permutational multivariate analysis of variance, that test for temporal variation in fish community structure could not be used due to low within-year sample sizes (n = 1). Thus, we used a graphical approach, non-metric multidimensional scaling (NMDS), to visually depict how fish community structure responded temporally to the presumed improvements in habitat conditions and water quality.

In addition, we aimed to determine if the spawning operation had any measurable effects on brook trout population dynamics in the South Fork Hay River. 2008 was chosen as the treatment year as this was when current collection methods began. We used a before-after-control-impact design (BACI) to determine whether the impact of collection and spawning operations (treatment) on adult abundance (CPUE of fish ≥ 5 inches), population size structure (PSD – 8) and recruitment (CPUE of fish ≤ 3 inches) differed before and after 2008 between the South Fork Hay River site and a similar control site (Dorrity Creek). Specifically, analysis of covariance (ANCOVA) tests were used to evaluate if the dependent variables within treatment and control sites responded differently over time. By including the covariate (control site) and its interaction with time (factor of interest in BACI designs), we assessed the treatment effect while considering the influence of the control site and its potential variation over time. The recruitment year class of 2009 was considered an outlier (z-score > 3) and removed from the BACI analysis.

Results

A moderate density, naturally reproducing brook trout population was present in the South Fork Hay River. There were 86 brook trout collected during the 2023 survey with a CPUE of 961 fish/mile. Brook trout CPUE was well below the historic average (2,444 ± 380 fish/mile; standard error; 2005 - 2023) but greater than the Barron and Polk counties mean CPUE (623 ± 88 fish/mile; standard error; indexed using 39 survey sites across 22 streams within the past decade). The CPUE of brook trout ≥ 5 inches (index

of adult abundance) was 469 fish/mile, which was lower than the historic mean (1,018 ± 76 fish/mile; standard deviation) but remained stable through time with high inter-annual variation (P > 0.05; simple linear regression; Figure 2).

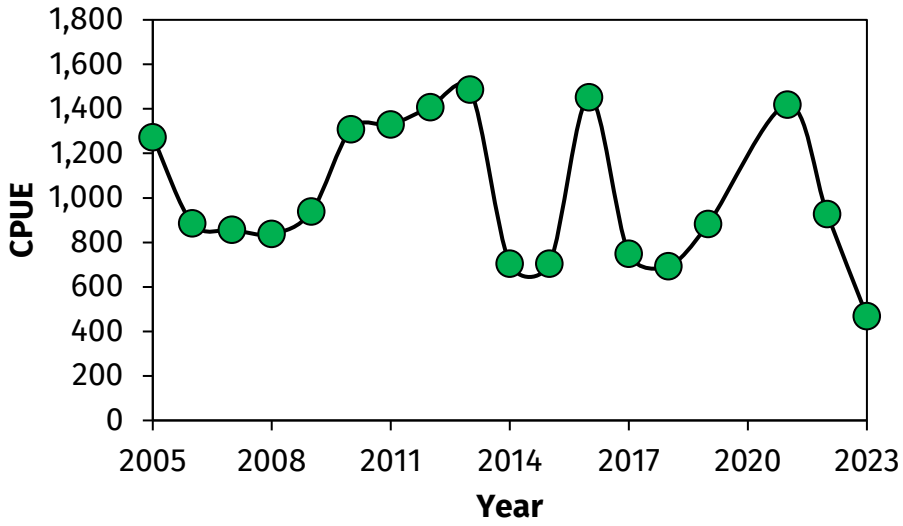


Figure 2. CPUE (catch per mile) of brook trout ≥ 5 inches sampled from the South Fork Hay River, Barron County, WI during 2005 - 2023.

Brook trout size structure remained good with 26.7% of the population ≥ 5 inches (Figure 3). Brook trout ranged in length from < 3 inches to 9.6 inches with many length bins represented. This suggested multiple age classes were present (Figure 3). The PSD-8 was 14, which was below the historic average but within the degree of inter-annual variation (PSD-8 = 21 ± 8; standard deviation; Figure 3). Population size structure remained stable over time with a high degree of inter-annual variation (Figure 4).

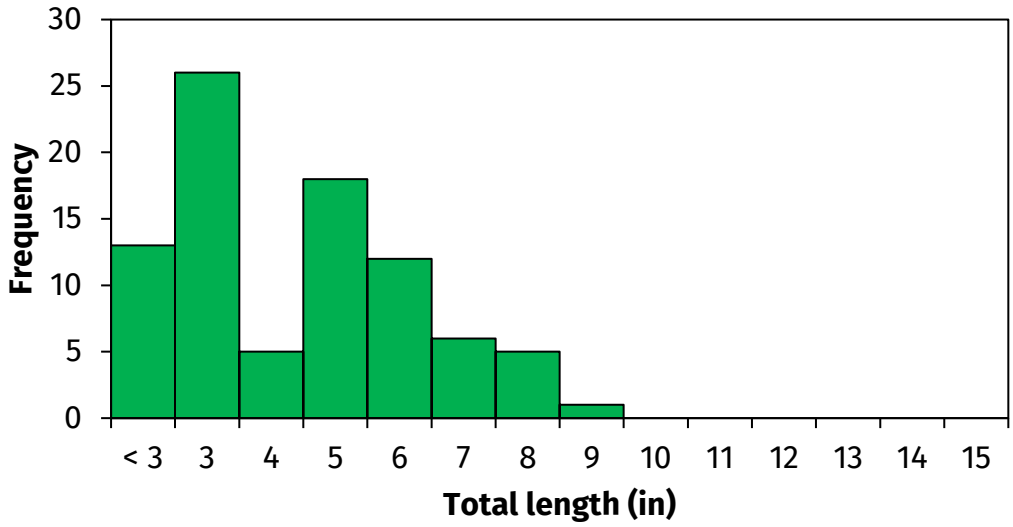


Figure 3. Length frequency histogram of brook trout sampled from the South Fork Hay River, Barron County, WI during 2023.

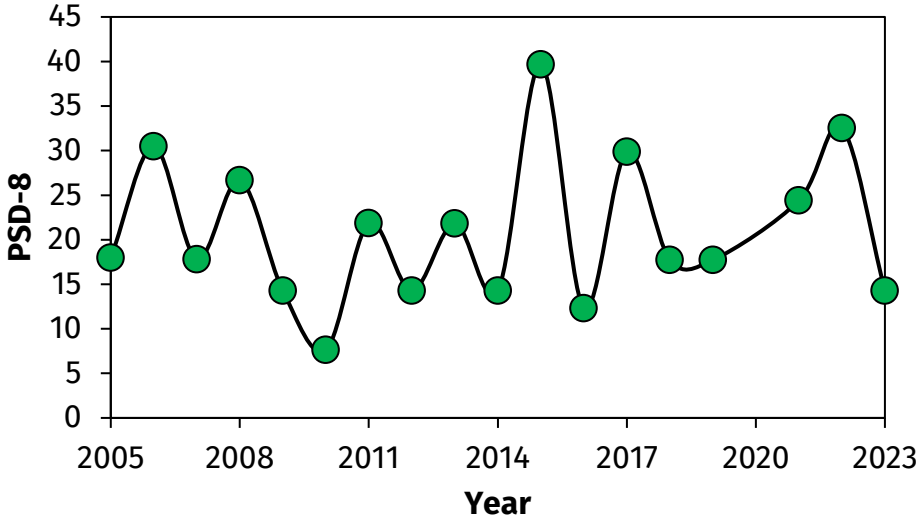


Figure 4. PSD-8 of brook trout sampled from the South Fork Hay River, Barron County, WI during 2005 - 2023.

Brook trout < 3 inches in length represent naturally recruited young-of-year (YOY) fish as stocking does not occur in the South Fork Hay River or within any tributaries of the watershed. The CPUE of YOY brook trout was 156 fish/mile, which was below the historic mean (1,263 ± 348 fish/mile; standard error; Figure 5). Recruitment rates remained stable over the past decade but have declined temporally since 2008 ($P < 0.05$; simple linear regression).

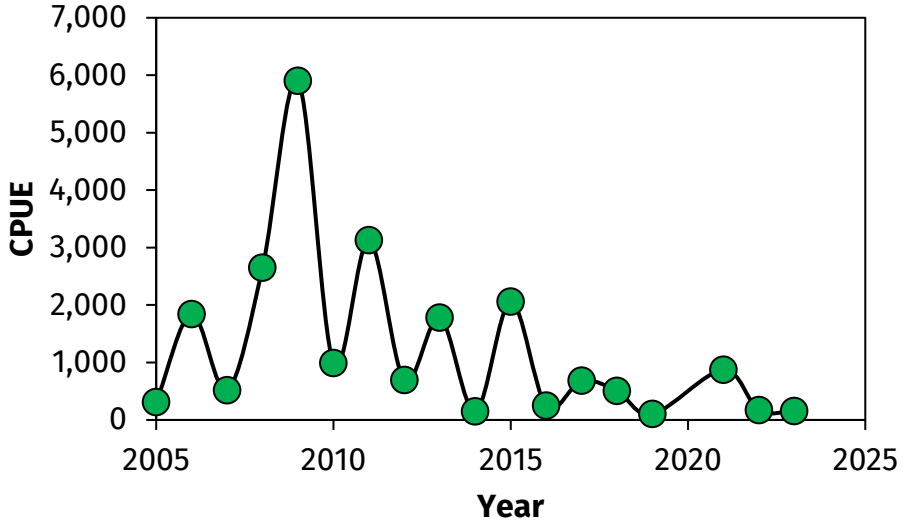


Figure 5. CPUE (catch per mile) of young-of-year (< 3 inches) brook trout sampled from the South Fork Hay River, Barron County, WI during 2005 - 2023.

Fish community structure in the South Fork Hay River visually exhibited temporal changes (Figure 6). In the mid-1970s, the community was predominately composed of warm–cool water species, including various shiner, sucker and dace species. In contrast, during the mid-1990s and 2010s, a shift occurred characterized by increased abundances of primarily coldwater species, such as brook trout, brook lamprey, mottled sculpin, burbot and darter species.

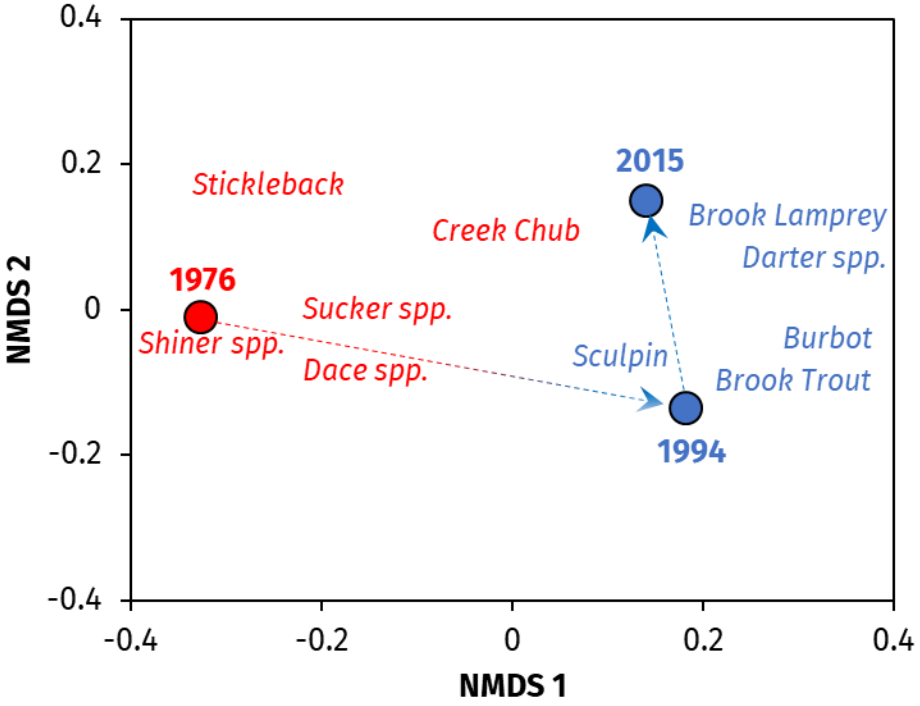


Figure 6. NMDS ordination based on Bray-Curtis dissimilarity of fish community structure indexed during the 1976, 1994 and 2015 surveys. Fish group locations (species group names) indicate their relative importance in separating fish communities in ordination space. Warm-cool water species are represented in red while coldwater species are blue.

Fish collection and spawning operations since 2008 did not discernably impact the brook trout population in the South Fork Hay River. Adult abundance, population size structure and recruitment were not considered different before and after 2008 between the South Fork Hay River (treatment site) and Dorrity Creek (control site; BACI ANCOVA interaction effect, $P > 0.05$ for each comparison; Appendix Figures 1 - 3). In other words, spawning operations did not influence adult abundance, population size structure or recruitment beyond what could be explained by natural, environmental variation observed within the control site.

Discussion

A quality brook trout fishery occurs in the South Fork Hay River. Adult abundance and size structure were moderate but both temporally stable, which suggested the population may be at carrying capacity. Population abundance and size structure are commonly inversely related and, in the absence of any environmental or anthropogenic changes, we expect the South Fork Hay River brook trout population to remain stable into the future. Management will continue to focus primarily on maintaining a quality brook trout population.

Natural recruitment of brook trout at the trend survey site in the South Fork Hay River has significantly declined since 2008, despite high annual variation. However, spawning operations did not appear to influence recruitment beyond what could be attributed to environmental variation. Rather, one possibility could be that changes in stream habitat conditions reduced recruitment or the availability of suitable habitat for YOY brook trout. Anecdotally, sections within the trend site have shallowed temporally due to sedimentation and natural re-routing of the stream channel, which has reduced availability of in-stream and streambank cover. Additionally, approximately 400 - 500 post-spawned adult brook trout are released 0.5 miles upstream at the in-stream holding and spawning site, well within travel distances documented for adult brook trout (Hartman and Logan 2010; Mollenhauer et al. 2013). This could directly (predation) or indirectly (competition) influence site-specific YOY abundances. However, multiple year classes were represented in the population size structure, which is indicative of sustained annual recruitment. Additionally, further downstream at Thatcher Park (0.5 miles from the Barron trend site) recruitment rates have remained temporally stable ($P > 0.05$; simple linear regression), although highly variable annually. It is likely natural recruitment remains sufficient to sustain a quality population at the stream scale but remains highly variable annually at the site-specific scale.

Earlier studies indicated that this portion of stream near our trend site was heavily grazed and highly eroded due to substantial streambank pasturing of livestock resulting in degraded trout habitat. Streambank easements were established during the late 1960s when cattle were excluded from the stream and brook trout responded positively in the following surveys. Unfortunately, habitat data were not available to quantify these remediation efforts. However, earlier surveys suggest that water quality and streambank cover improved as streambanks stabilized with the re-growth of vegetation. This improved stream-scale conditions for brook trout and other coldwater fish species.

The DNR designates Class I trout streams as having sufficient natural reproduction, sustaining populations near carrying capacity and not requiring stocking. However, these streams are typically small, cold headwaters with slow-growing trout. The brook trout population in the South Fork Hay River remains a high-quality fishery and

well within the Class I designation, as natural reproduction was sufficient to support a population with moderate abundance and size structure. Reclassification of the South Fork Hay River trout population would not be considered at this time.

The South Fork Hay River stands out as one of the larger streams in Barron and Polk counties that supports good abundances of brook trout. Its conditions are conducive to producing numbers of quality-sized brook trout exceeding 12 inches in length. Creel data were not available to assess angling effort but, anecdotally, fishing effort is likely moderate-high for Barron and Polk counties. The existing fishing regulation, a daily bag limit of five trout with no minimum length limit, will be maintained to support sustainable harvest opportunities for anglers.

The wild brook trout spawning operation, spanning nearly two decades, has left no discernible impact on the brook trout population in the South Fork Hay River. Despite extensive fish collections and spawning operations, the population remains robust and resilient, suggesting its capability to sustain a high-quality population into the future. Notably, wild trout originating from the South Fork Hay River serve as the northwest Wisconsin brook trout strain for stocking initiatives in the Chippewa and St. Croix River basins. This highlights their ongoing significance as a pivotal resource for fisheries management efforts across northwest Wisconsin.

Recommendations

1. Maintain a stable adult (≥ 5 inches) brook trout population near the historic average of 1,018 ± 76 fish/mile (± standard deviation). This population benchmark should continue to support a moderate density population.
2. Continue to monitor catch rates of age-0 brook trout annual trend surveys.
3. The current fishing regulation, a daily bag limit of five trout with no minimum length limit, should be maintained.
4. Following the 2030 summer survey, analyses of recruitment and population demographics should be revisited.
5. Habitat enhancement efforts are encouraged and should be explored if possible.

Acknowledgements

Special thanks to Craig Landes for assisting with field collection and data entry.

References

Brasch, J. 1958. Management of the South Fork Hay River (West Branch), Barron County. Intra-Department Memorandum, October 31st, 1958. Wisconsin Conservation Department.

Cornelius, R. 1976. Basic Survey – South Fork Hay River, Barron County – 1976. Intra-Department Memorandum, December 9th, 1976. Wisconsin Conservation Department.

Cornelius, R. 1994. Fish Survey – South Fork Hay River (2070100), Barron County – 1994. Wisconsin Department of Natural Resources, Internal Fisheries Management Report. Barron Field Office.

Hartman, K. and M. Logan. 2010. Movement and habitat use by transplanted adult brook trout in an Appalachian headwater stream. Northeastern Naturalist 17(3):357-372.

Mollenhauer, R. T. Wagner. M. Kepler and J. Sweka. 2013. Fall and winter movement and habitat use of wild brook trout. Transactions of the American Fisheries Society 142:1167-1178.

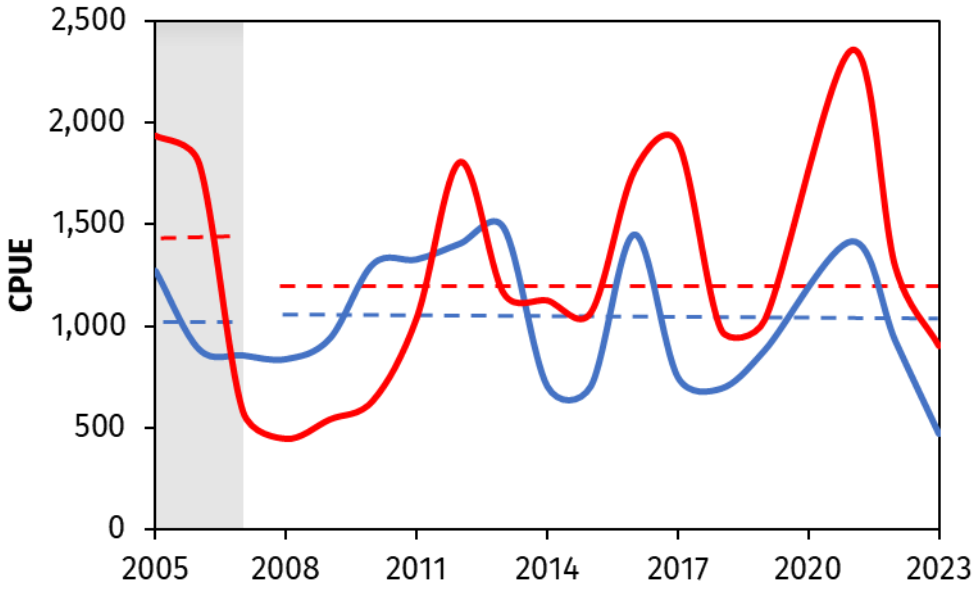
Neumann, R.M., C.S. Guy, and D.W. Willis. 2013. Length, weight, and associated indices. Pages 637-676 in A.V. Zale, D.L. Parrish, and T.M. Sutton, editors. Fisheries techniques, 3rd edition. American Fisheries Society, Bethesda, Maryland.

Parker, J. 1967. Stream Survey, South Fork Hay River, Barron County. Stream Assessment File, December 22nd, 1970. Wisconsin Conservation Department.

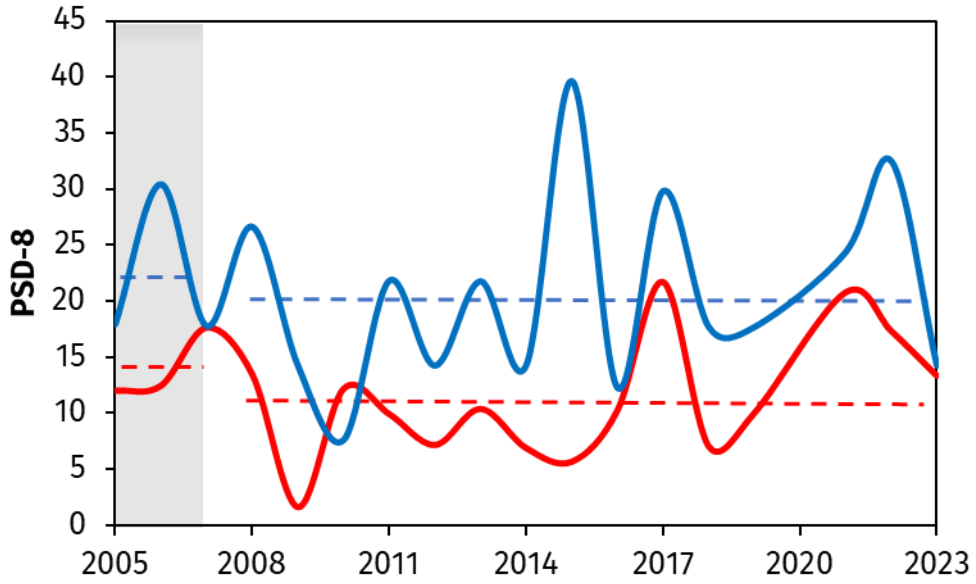
Appendices

Appendix Table 1. Brook trout stocking records for the South Fork Hay River, 1965 - 1976.

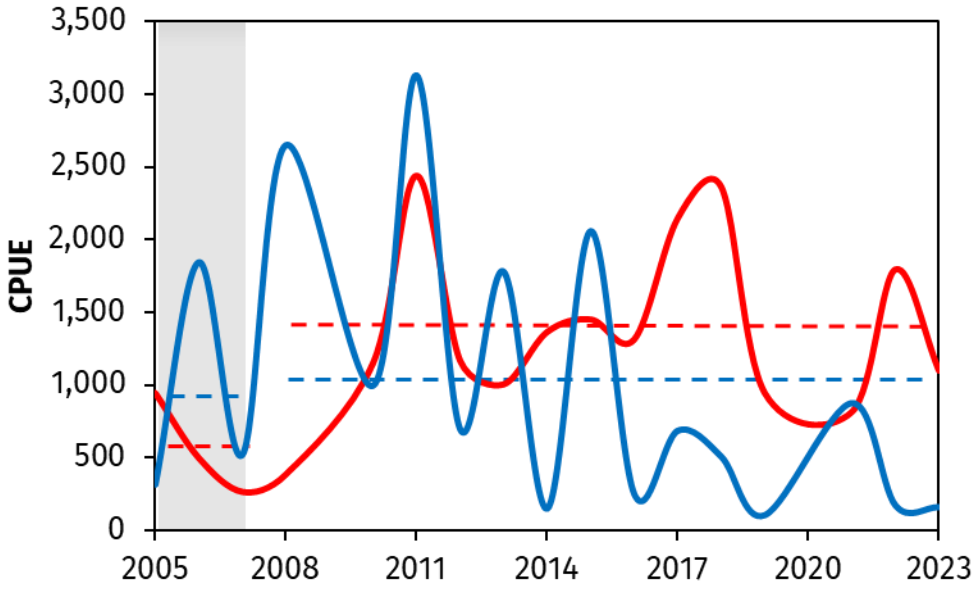
YEAR	NUMBER STOCKED	AVG. LENGTH (IN.)
1965	500	7.0
1966	500	7.0
1967	500	7.0
1968	500	7.0
1970	500	7.0
1976	1,000	3.0



Appendix Figure 1. Adult (≥ 5 inches) brook trout CPUE (catch per mile) in the South Fork Hay River (treatment site; blue line) and Dorrity Creek (control site; red line). Dashed lines represent the mean CPUE during pre-treatment (2005 – 2007; shaded area) and post-treatment (2008 – 2023; non-shaded area) time periods.



Appendix Figure 2. Brook trout PSD-8 in the South Fork Hay River (treatment site; blue line) and Dorrity Creek (control site; red line). Dashed lines represent the mean PSD-8 during pre-treatment (2005 – 2007; shaded area) and post-treatment (2008 – 2023; non-shaded area) time periods.



Appendix Figure 3. CPUE (catch per mile) of YOY brook trout in the South Fork Hay River (treatment site; blue line) and Dorrity Creek (control site; red line). Dashed lines represent the mean CPUE during pre-treatment (2005 – 2007; shaded area) and post-treatment (2008 – 2023; non-shaded area) time periods.