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Project Overview

Western Pennsylvania Conservancy (WPC) staff conducted fifty-five electrofishing surveys in four different HUC-10 drainages (Blacklick Creek, North Branch Blacklick Creek, Yellow Creek, and Two Lick Creek) that comprise the northern section of the Conemaugh River watershed (Figure 1). Funding for this project was provided by Conemaugh Valley Conservancy (CVC). The goals and objectives of the project were to gather baseline data of current fish populations and water quality in these drainage basins, which prior to this summer, contained 545 unassessed streams according to the Pennsylvania Fish and Boat Commission (PFBC) database. The work completed for this project was in concert with the PFBC Unassessed Waters Initiative, a program that has been gathering baseline biological data in unassessed streams since 2010. All data was collected to the PFBC protocol standard and will be submitted to PFBC using the Scientific Collectors Permit database (PFBC, 2023). Results varied throughout the surveys completed including dry streams, streams with poor water chemistry, and streams where wild and native trout species were found. Overall, these data will help to increase baseline knowledge of biological communities and fish resilience in an area considered to be heavily impacted by acidic mine drainage (AMD). In addition, these surveys will act as a benchmark for biological recovery due to the extensive AMD remediation efforts that are being undertaken in this watershed by a number of conservation partners.

Methods

WPC staff completed detailed water chemistry and fish population sampling at fifty-five sites in the Blacklick Creek, North Branch Blacklick Creek, Yellow Creek, and Two Lick Creek watersheds. Sampling was conducted between May 16, 2023 and July 6, 2023. At each site, water quality parameters were measured and recorded, including pH, dissolved oxygen, conductivity, water temperature, alkalinity, and total dissolved solids (TDS) utilizing hand-held meters and field titration methods. Next, a 100-m minimum electrofishing survey was conducted using a single Smith Root LR-24 backpack electrofisher. At several streams WPC staff extended surveys in an attempt to qualify a particular stream which needed to have at least three native or wild trout collected that were either young of the year fish, or represented by two size classes. All fish collected were identified to species and tallied, and any trout caught were additionally measured in length and organized into size class bins of 25-mm intervals per the PFBC sampling protocol. All collected fish were then released back into the stream. Sites were chosen based on accessibility (public vs private property), and locations of interest after discussions with members of the CVC and Blacklick Creek Watershed Association. With over 545 sampling locations in these four drainages, there was a contractual goal to survey at least 50 sites that would be spread out throughout the focal geography. The map below shows where each survey began (green dots) and each stream that was surveyed (bolded blue lines) (Figure 1). Public land surveys were conducted on Pennsylvania Game Commission (PGC) State Game Lands (SGL) 79, 185, 248, 273, and 276, as well as Yellow Creek State Park (Department of Conservation and Natural Resources). Additionally, numerous streams were surveyed with landowner permission on private property.

2023 Sampling Overview - Blacklick, Two Lick, Yellow Creek



Figure 1. Sampling overview of the project with HUC-10 watersheds color-coded.

Results and Discussion

Each of the fifty-five survey sites include water quality parameters (pH, dissolved oxygen, conductivity, water temperature, alkalinity, and TDS) and fish population data. The most notable findings with water chemistry values were three sites with pH values less than 4.0 which is considered to be too low to support aquatic life (Table 1). Additionally, alkalinity values varied significantly with values ranging from 0 to 216 mg/L (Table 2). Many of the sites with low pH values also had elevated levels of TDS and Conductivity which often are found in AMD streams (Daniels, LaBar, and McDonad 2021). Overall, eight sites were dry upon arrival preventing an electrofishing survey from being completed. With sites that had flow, nineteen had no fish and twenty-five had fish present, including five sites where WPC found wild trout populations. In total, twenty-three different species of fish were captured during 2023 surveys in the focus area watersheds.

Table 1.	Fish presence	and absence a	cross the fifty-fiv	ve surveys completed i	n 2023.
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Dry	pH low, no survey	No Fish Found	Fish Present	Wild Trout Present
8 sites	3 sites	19 sites	25 sites	5 sites

Water Quality/Chemistry

Table 2. Water quality values for each stream surveyed. Orange indicates streams with pH too low to support aquatic life. Yellow indicates low pH where the stream is unlikely to support aquatic life.

Stream Name	Temp (°C)	рH	Alkalinity	Conductivity	Dissolved Oxygen	TDS
Ferrier Run	11.0	7.09	36	352.0	10.40	249.0
Trib 44126 to Ferrier Run	10.8	7.43	22	174.9	10.47	122.0
Trib 44127 to Yellow Creek	14.0	6.73	36	159.8	8.16	105.0
Trib 44128 to Yellow Creek	11.2	7.03	4	78.5	10.41	55.4
Trib 44135 of Yellow Creek	DRY	DRY	DRY	DRY	DRY	DRY
Trib 44136 to Yellow Creek	10.6	5.80	8	75.5	9.95	52.7
Trib 44140 of Yellow Creek	16.6	6.53	14	50.5	9.24	35.1
Trib 44141 of Yellow Creek	16.2	6.56	26	88.4	9.30	62.1
Trib 44142 of Yellow Creek	14.8	7.45	50	105.8	9.46	74.4
Trib 44148 to Little Yellow Creek	11.0	6.41	10	61.7	10.28	43.2
Trib 44149 to Little Yellow Creek	13.7	7.15	26	87.2	9.46	60.7
Trib 44154 to Gillhouser Run	15.3	7.20	8	50.9	8.82	34.5
Trib 44176 to Little Yellow Creek	13.9	6.70	148	321.0	8.53	250.0
Trib 44177 of Trib 44176 to Little Yellow Creek	23.8	6.85	16	125.0	0.83	122.0
Trib 44190 to Yellow Creek	14.8	6.68	34	208.0	8.11	136.0

Trib 44191 of Yellow Creek	25.3	6.73	60	405	2.94	268.0
Trib 44215 to Leonard Run	DRY	DRY	DRY	DRY	DRY	DRY
Trib 44265 of Two Lick Creek	DRY	DRY	DRY	DRY	DRY	DRY
Trib 44266 of Two Lick Creek	DRY	DRY	DRY	DRY	DRY	DRY
Trib 44270 to Two Lick Creek	DRY	DRY	DRY	DRY	DRY	DRY
Trib 44271 to Two Lick Creek	14.1	6.63	70	242.0	9.03	159.0
Trib 44287 to Penn Run	14.6	7.14	76	250.0	9.31	175.0
Trib 44381 to Repine Run	12.5	6.98	216	507.0	10.61	303.0
Trib 44391 to South Branch Two Lick	11.7	6.20	10	65.0	4.10	12.4
Trib 44392 to South Branch Two Lick	11.7	0.20	10	03.9	4.10	43.4
Creek	DRY	DRY	DRY	DRY	DRY	DRY
Trib 44395 of South Branch Two Lick	11.7	6.41	32	97.9	9 57	64.5
Trib 44407 of Blacklick Creek	12.2	5 79	18	177.9	9.38	138.0
Trib 44408 to Blacklick Creek	13.2	3.66	0	320.0	5.41	250.0
Trib 44409 to Blacklick Creek	12.9	2 70	0	955.0	8.91	748.0
Trib 44411 to Laurel Run	11.1	7 29	35	260.0	10.03	203.0
Trib 44412 to Laurel Run	11.1	6.86	16	134.5	9.16	105.0
Trib 44413 to Laurel Run	11.2	5 29	0	369.0	10.18	288.0
Trib 44419 of Blacklick Creek	14.2	4.04	0	535.0	9.06	434.0
Trib 44473 to Mardis Run	14.4	8 54	138	592.0	9.78	412.0
Trib 44474 to Mardis run	16.6	8 51	88	329.0	9.70	230.0
	16.6	0.01	150	329.0	9.27	215.0
Trib 444/5 of Mardis Run	164	841	170	310.0	894	2150
Trib 444/5 of Mardis Run	16.4	8.41 2.90	0	310.0 1045.0	8.94 7.47	724.0
Trib 444/5 of Mardis Run Trib 44495 of Rummel Run Trib 44498 to Rummel Run	16.4 14.6 10.5	8.41 2.90 4.32	0 0	310.0 1045.0 33.4	8.94 7.47 10.25	215.0 724.0 23.1
Trib 44495 of Rummel Run Trib 44495 to Rummel Run Trib 44498 to Rummel Run Trib 44499 to Rummel Run	16.4 14.6 10.5 15.5	8.41 2.90 4.32 6.40	0 0 10	310.0 1045.0 33.4 133.7	8.94 7.47 10.25 10.45	215.0 724.0 23.1 88.0
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Six of the survey sites had low pH values. As per the PFBC protocol, sites with pH values below 4.0 do not need to be surveyed as it can be assumed the water is too acidic to support fish populations. pH values below 5.0 are also unlikely to support fish populations although WPC has found fish at sites with a pH between 4.0-5.0 during previous projects. Three sites in this project had pH values below 4.0 and as a result no survey was conducted (Table 2). Three additional sites had pH values below 4.5 (Table 2), and the electrofishing survey at these locations yielded no fish present. All of the watersheds of focus for this project are known to contain impaired waters due to low pH from historical mining activities. Several passive AMD treatment systems have been constructed in the region, but there are still many AMD seeps that have not been treated due to the large number that exist. Some of the streams surveyed, including Rummel Run and tributaries to the North and South Branches of Blacklick Creek, are considered impaired by DEP due to AMD. However, WPC found that several of these sites had more neutral pH values and even supported some wild trout populations.

pH < 4.5	рН 4.5-6.0	pH > 6.0
6 sites	3 sites	38 sites

The six stream sites with pH values below 4.5 show a strong negative trend with conductivity. The most acidic waters with pH values of 2.7 and 2.9 had extremely high conductivity values of 955 uS/cm and 1,045 uS/cm respectively. Generally speaking, across the most acid-impacted streams that were surveyed, as pH increased, the conductivity values were lower (Figure 2). This is a common trend in acid-impaired waters as there are high concentrations of metals dissolved or suspended in the water column of these streams. Metals are great conductors of electricity and therefore a higher concentration of metals will in turn increase the conductivity numbers. Conductivity is a parameter that acts as a proxy for more specific concentrations of elements dissolved in the water column. Conductivity will increase with essentially anything in the water that can carry an electrical current which could be any number of metals, iron, or salt. Generally speaking, a high conductivity value can indicate poor water quality, which in this case makes sense as the concentrations of metals in these low pH streams is preventing aquatic life from being able to survive there. With the new Wehrum active AMD treatment plant being constructed, water quality in the Blacklick Creek watershed should see significant improvement in the future.



Figure 2. Scatter plot showing the negative correlation between pH and conductivity across the most acid-impacted sites surveyed by WPC in 2023.

Outside of the heavily acid-impacted streams with low pH, most of the other survey sites showed good to excellent water quality with chemistry values that should be able to support diverse aquatic communities (Table 2). Water temperatures varied across sites demonstrating that some streams in this area support warmwater fish while others are suitable for coldwater species (Figure 3).



Figure 3. Histogram of water temperature values measured across 55 surveys demonstrating the majority of sites as coldwater streams.

With a wide range of water temperatures $(10^{\circ}\text{C} - 25.3^{\circ}\text{C})$ it is evident that these four watersheds can support both cold and warmer water fish communities. WPC staff collected 23 fish species over the course of this project, showing a high diversity. The vast majority of the streams surveyed (36 streams between 10-16°C) would fall into the colder water category. Coldwater habitat is important for some of the more temperature-sensitive fish species such as eastern Brook Trout. A major focus of fish conservation is often protecting and restoring coldwater habitat, especially as the climate continues to change. However, warmwater habitat is also important for many fish species and often supports a greater diversity of fish than the colder water headwater streams. Some of the warmer water sites that WPC surveyed for this project yielded a high number of species, including several types of shiners and darters as well as sunfish and bass (Table 4). It is important to note that stream temperatures change greatly with the seasons of the year and the air temperature fluctuations. Most of WPC's surveys took place in a two-week span in late May and early June, but a few more surveys took place in July. It would be expected to see water temperature increases as the summer goes on.

Overall Fish Population Data

WPC staff completed electrofishing at 44 out of 55 sites which contained 1,375 fish represented by 23 different species (Table 4). This included four surveys (three streams) where native Brook Trout were found (Table 5). Two of these three streams were also unlinked for wild trout, meaning their receiving waters downstream are not currently known to contain wild trout populations. The goal of PFBC's Unassessed Waters Initiative since its inception in 2010 has been to document wild trout populations, thereby qualifying those streams for proper permitting protections from the Department of Environmental Protection (DEP). PFBC does this through a process called tributary linkage where all flowing waters upstream of a wild trout stream receive protection as well and are considered linked streams. At this point in 2023 it is fairly uncommon to find wild trout in locations that are not already linked to wild trout waters downstream. Two of the streams where WPC found native Brook Trout (Trib 44499 to Rummel Run and Trib 44505 to North Branch Blacklick Creek) were unlinked and should meet the minimum criteria necessary for being classified as wild trout waters. These two streams are currently considered impaired due to acid mine drainage, but surprisingly they were found to have good water quality and native Brook Trout. In addition to native Brook Trout, non-native, but naturally reproducing wild, Brown Trout and Rainbow Trout were found in Trib 44381 to Repine Run and Trib 44126 to Ferrier Run respectively (Table 5).

Table 4. Total numbers of fish caught by species at all 55 survey sites.

Species	Number
Brook Trout (Native)	19
Brown Trout (Wild)	5
Rainbow Trout (Wild)	1

Blacknose Dace	410
Mottled Sculpin	268
Creek Chub	513
Johnny Darter	10
Fantail Darter	8
Blackside Darter	1
Redside Dace	23
Bluntnose Minnow	4
Emerald Shiner	41
Golden Shiner	1
Rosyface Shiner	16
White Sucker	27
Northern Hogsucker	5
Rainbow Trout (Hatchery)	2
Bluegill	4
Pumpkinseed	10
Green Sunfish	3
Largemouth Bass	1
Yellow Bullhead	2
Lamprey Sp.	1

Table 5. Native and wild trout distribution in the northern Conemaugh River basin.

Stream	# BKT	# BNT	# RBT present	# Size Classes
	present	present		
Trib 44499 to Rummel Run	16	0	0	4
(2 sites)				
Trib 44639 to Stewart Run	1	0	0	1
Trib 44505 to North Branch	2	0	0	2
of Blacklick Creek				
Trib 44381 to Repine Run	0	5	0	5
Trib 44126 to Ferrier Run	0	0	1	1

Despite there being 23 different fish species found across the 55 survey sites, the vast majority of the 1,375 individuals caught are represented by a few common fish species. A total of 86% of the fish collected were Blacknose Dace, Creek Chub, and Mottled Sculpin (Figure 4). Through years of doing fish survey work across the Commonwealth, WPC has found that these three species are extremely common and can persist in a wide range of water quality conditions, often occupying the same stream communities as trout, although they can tolerate poorer water quality conditions as well. It is not uncommon to see a high percentage of fish in an area be dominated by a few species. Overall, 12% of the fish population is represented by 17 different species which demonstrates a fairly high degree of diversity (Figure 5). WPC identified a population of Redside Dace in Trib 44142 of Yellow Creek, which is a Pennsylvania State Wildlife Action Plan

(SWAP) species of greatest conservation need. In addition to the Redside Dace, the other SWAP species found throughout these surveys were the native Brook Trout which was found in several locations in the northern Conemaugh River basin (Table 5).



Figure 4. Percentage of fish individuals caught based on species in the northern Conemaugh River basin.

In addition to 86% of the fish collected belonging to only three species, the vast majority of the fish found were only caught at a few sites. Blacknose Dace, Mottled Sculpin, and Creek Chub were found at between 11-20 sites showing their dominance in the watershed considering 25 sites that were surveyed had a fish present. Of the other fish species collected the vast majority were only found in 1-5 sites surveyed. Overall this study demonstrates the high diversity but low evenness of fish distribution across the survey sites.



Figure 5. Distribution of fish species based on occurrence among sites.

Blacklick Creek HUC-10 Watershed



Figure 6. Overview of fish sampling results in the Blacklick Creek HUC-10 watershed.

Out of the fifty-five surveys conducted by WPC, 18 of them occurred within the Blacklick Creek watershed, which constitutes the lower part of the focus area for this project. Sites included tributaries to mainstem Blacklick Creek, as well as tributaries to Laurel Run, Shuman Run, Mardis Run, and Rummel Run (Figure 6). Most of these surveys were completed on public land in SGL 276 near Blacklick Township and SGL 79 near Vintondale and Nanty Glo. Private land tributaries to Mardis Run were also surveyed. Sites on SGL 276 revealed heavily impaired waters in that area. Two of the sites had pH values below 3.0 which is extremely acidic, and another two had values just above 4.0 which is also very acidic. No fish were found at any sites in that area, as the streams are clearly suffering from AMD impacts nearby. State Game Lands 79 proved to be a bit surprising as this is where WPC found native Brook Trout in streams that were unlinked to any known trout populations downstream. The most robust population was in Trib 44499 to Rummel Run in which 16 brook trout across four size classes were captured at two different sites (Table 5). This watershed showed a range of water quality conditions from streams that are severely impacted by AMD to streams with high water quality and native Brook Trout populations. It is worth noting, that although the Brook Trout were found in neutral pH waters, native Brook Trout is one of the more acid-tolerant fish species and can be found in lower pH waters as well. Two stocked rainbow trout were also caught in a tributary of Mardis Run.



Figure 7. Fish species caught by percentage of total individuals in Blacklick Creek watershed.



Figure 8. Adult native Brook Trout caught in a tributary to Rummel Run.

North Branch Blacklick Creek HUC-10 Watershed



Figure 9. Overview of fish sampling results in North Branch Blacklick Creek watershed.

Ten sites were surveyed in the North Branch of Blacklick Creek watershed with varying results. Half of the sites were located on or near State Game Lands 79 adjacent to Vintondale and Nanty Glo (tributaries to North Branch of Blacklick Creek, Downy Run, and Elk Creek), and the other half were in and around Duman Lake near Blacklick Township (Crooked Run and tributaries to Crooked Run) (Figure 10). The lower grouping of sites were coldwater streams whereas the group of sites near Duman Lake represented a warm water system, demonstrating diversity within this particular watershed. One stream proved to have no channel present where the stream coordinates were located. In the lower five sites, WPC found no fish at four of them, and found native Brook Trout in the other one: Trib 44505 to North Branch Blacklick Creek (Table 5). This stream also contained four other species of fish commonly found alongside Brook Trout including Blacknose Dace, Mottled Sculpin, Creek Chub, and Fantail Darter. Similarly, to the sites located in the Blacklick Creek watershed, this was an unlinked site, meaning no known populations of Brook Trout downstream of this tributary had been previously identified by PFBC. Finding an unlinked trout stream in the Unassessed Waters Initiative is one of the most important results that can occur for a particular stream survey.



Figure 10. Fish species distribution across 10 sites in North Branch Blacklick Creek watershed.



Figure 11. Fish species distribution in Crooked Run, surveyed on 7/6/2023.

The northern grouping of sites generally had higher species richness, with one site in particular Crooked Run, containing eleven different species. In fact, most of the fish caught in this watershed came from the one Crooked Run mainstem site which was surveyed on 7/6/2023 (Figures 11 & 12). Out of the fifteen species caught in the watershed as a whole (Figure 11), seven of them were only present in Crooked Run (Figure 12), which had excellent diversity with several fish species, a few of which are good indicators of a warmwater fish community, such as Largemouth Bass, Yellow Bullhead, and Green Sunfish. The Crooked Run sites each had water temperatures above 20°C with Crooked Run mainstem measuring at 24.1°C which is representative of a warm water fishery. Crooked Run contained several species of fish including Blackside and Johnny Darters found in the watershed overall. In addition, there was a robust population of Emerald Shiners, a fish species that WPC does not typically see that often when electrofishing small tributaries (Figure 13). In totality, the sites surveyed in the North Branch of Blacklick Creek demonstrated good water quality with habitat present for both coldwater and warmwater fish species.



Figure 12. Top Left: Blackside Darter caught in Crooked Run. Top Right: Emerald Shiner caught in Crooked Run. Bottom Left and Middle: Yellow Bullhead with distinct yellow barbels, Bottom Right: massive 13-inch Brook Trout caught in mainstem Elk Creek (not during official UAW survey).

Yellow Creek Watershed



Figure 13. Overview of fish sampling results in the Yellow Creek watershed.

A total of eighteen streams were surveyed in the Yellow Creek watershed, most of which were located on public land. The vast majority of them (14 sites) were tributaries to Yellow Creek or Little Yellow Creek in and around Yellow Creek State Park and State Game Lands 273. Ferrier Run and a tributary to Ferrier Run were surveyed on State Game Lands 273 near Lucerne Mines, and a tributary to both Gilhouser Run and Leonard Run were also surveyed (Figure 13). Similarly to the North Branch of Blacklick Creek watershed, the Yellow Creek watershed yielded a fairly high species richness and diversity across sites (Figure 14). Trib 44190 was the most diverse, with nine species of fish, including Golden Shiners. Trib 44142 of Yellow Creek had seven, including a population of Redside Dace which is a SWAP species of greatest conservation need in Pennsylvania, and a population of Rosyface Shiners, an uncommon species in most small stream surveys. In addition, a wild Rainbow Trout was captured in Trib 44126 to Ferrier Run. A few of the sites represented a warmwater community, which is not surprising given their proximity to Yellow Creek Lake. At these sites there were Pumpkinseeds and Green Sunfish which are both warmwater species. Overall, there were no major water quality concerns

at any of the Yellow Creek watershed sites, and fish communities appear to be healthy in most places.



Figure 14. Fish species distribution in the Yellow Creek watershed by total number of individuals caught across all 18 sites.



Figure 15. Online image of Redside Dace. WPC collected 23 in a tributary of Yellow Creek during this project.

Two Lick Creek Watershed



Figure 16. Overview of fish sampling results in the Two Lick Creek watershed.

WPC surveyed nine streams in the Two Lick Creek watershed as a part of this project. Four surveys were located on State Game Lands 248, one was a tributary to Penn Run in the town of Penn run, one was a tributary to the South Branch of Two Lick Creek on Game Lands 185, and the other three were located just southwest of there and north of Grisemore (Figure 16). Four of the nine sites were dry upon arrival and therefore no survey was conducted. Three of those dry sites were on Game Lands 248, and the fourth site there had no fish present. Fish were only found at three sites (tributary to Penn Run, tributary to Repine Run, and tributary to South Branch Two Lick Creek). Overall, the sites surveyed in this watershed by WPC had much lower fish species diversity and richness than the other watersheds. Other than one individual of White

Sucker and Rosyface Shiner, the rest of the fish captured were the more common Blacknose Dace, Mottled Sculpin, and Creek Chub. Wild Brown Trout were found at Trib 44381 to Repine Run, including two massive fish measuring 14 and 16 inches (Figure 17). Lower numbers of total fish and fish diversity are likely due to natural variability in addition to a higher percentage of dry streams compared to the total.



Figure 17. Fish species distribution in the Two Lick Creek watershed by total number of individuals caught across all nine sites.



Figure 18. Large wild Brown Trout caught in Trib 44381 to Repine Run on 6/1/2023.

Conclusions

Over the course of 55 stream surveys completed in the four HUC-10 watersheds (Blacklick Creek, North Branch of Blacklick Creek, Yellow Creek, and Two Lick Creek), all found in the Conemaugh River basin, there were a wide array of physical and biological water quality conditions. Sites were surveyed on both public and private lands in an attempt to survey as many streams as possible during this project. Many of the private landowners were excited to learn about the work being completed in their respective watersheds. WPC staff encountered everything from extremely low pH values below 3.0 in heavily impacted AMD areas, to pristine water quality in both cold and warmwater streams. Wild and native trout were found in a few unexpected locations, particularly in the Blacklick Creek watershed, where it was not previously known that their populations were connected to wild trout populations downstream. The warmwater streams in particular contained a high diversity and richness of fish species in comparison to other areas in the watershed. Ultimately, where poor water quality conditions were encountered, it was due to low pH in areas impacted by the mining history of this region. Many active and passive treatments systems have been put into place, and it will continue to be

important for remediation work to be conducted in these watersheds so that the impacted streams can recover and support healthy populations moving forward. In addition to the completed fish surveys for this region, documenting the aquatic connectivity in these focal watersheds is a logical next step in the restoration process. WPC has conducted numerous stream crossing surveys across the Commonwealth using the North Atlantic Aquatic Connectivity Collaborative (NAACC) developed protocol to evaluate aquatic organism passage (AOP). Climate change is negatively impacting coldwater fisheries and having the ability for native Brook Trout to migrate higher into the watershed is of utmost importance. Evaluating the stream crossings in a watershed can set the stage for further restoration work in locations where AOP is inhibited by failing infrastructure. All fisheries data collected during this project will be reported to the PFBC to be incorporated into the PA Scientific Collectors' permit database which will inform future survey work in the region.

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