

Measuring the Recovery of Fish Communities in a First Order Stream to Tar Creek After Implementation of Two Passive Treatment Systems¹

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Abstract: Two artesian discharges of metals-contaminated mine drainage have impacted an unnamed tributary to Tar Creek in northeast Oklahoma since 1979. Prior to any intervention, in-stream concentrations of Fe, Zn, Pb, and Cd were elevated above recommended water quality criteria. Two passive treatment systems (PTS) were constructed and are operating in the tributary watershed: i) the Mayer Ranch PTS, (since 2008 and located 0.6 km from the start of the study reach) and the Southeast Commerce PTS (since 2017 and located at the headwaters of the study reach). Mean metal removal efficiencies for these systems are >99% and 95% for Fe and Zn, respectively, with Pb and Cd effluent concentrations below practical quantitation limits. This study investigated the impacts of improved water quality discharged from these PTS on fish community recovery in the 1.6 km study reach of the receiving unnamed tributary, Tar Creek main stem and four reference streams. Fish collections began in 2005 and have continued through 2018. Prior to PTS construction, mean fish species richness values were 6 immediately below mine drainage inputs and 8 just above the confluence of the unnamed tributary with Tar Creek. Post-MRPTS, species richness values were 11 and 10 at these locations, respectively. Fish densities have also increased, with, for example, catch per unit effort values for a common sunfish (bluegill, *Lepomis macrochirus*) increasing from 1.0 to 6.6 and 0.3 to 4.4, respectively, at these locations. Overall, as in-stream water quality improved post-PTS, the limited fish community in the unnamed tributary showed a trajectory away from the original condition. Since 2016, the return of beavers (*Castor canadensis*) resulted in deep water impoundments inhibiting fish collections. In addition, completion of the Southeast Commerce PTS in early 2017 resulted in addition of new sampling locations and documentation of fish recolonization directly below the new outfall.³

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 3. Work reported here was conducted near 36°55'30.24"N, 94°52'15.85"W.