

Investigation of Experimental Eel Stocking in Three South-Central Pennsylvania Streams (2018)

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Introduction

In 2015, the Susquehanna River Basin Commission (SRBC) initiated a monitoring project to investigate ecological impacts to streams receiving targeted stockings of American eel elvers. The American eel is a native, diadromous fish species occurring along the Atlantic slope of the United States. The American eel relies on a complex catadromous life cycle which includes a migration into freshwater systems from their spawning grounds in the Sargasso Sea of the central Atlantic Ocean. The juvenile eels, or elvers, ascend into and mature in freshwater systems then migrate back to the ocean to spawn and complete life cycles.

American eels were once an integral component of the fish assemblage in the Susquehanna River Basin (Basin) and were also historically an important resource both as a food source and cultural resource for indigenous peoples and early European settlers. Construction of major hydroelectric dams along the lower Susquehanna River in the early 20th century blocked eel access upriver and effectively extirpated the species from the Basin (Minkinen and Park, 2008).

Restoration of American eel populations throughout the Basin became a focus area of restoration for the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC). In 2013, SRAFRC published an eel-specific addendum to the Migratory Fish Management and Restoration Plan for The Susquehanna River Basin to guide future restoration efforts (SRAFRC, 2013). SRBC has been involved with this effort. This report summarizes the status of the American eel populations at the stocking locations through 2018.

Study Sites and Stocking

American eel elvers were captured at two collection ramps, located on Octoraro Creek in Chester County, PA, and the Susquehanna River immediately below Conowingo Dam in Darlington, MD (Figure 1). The elver ramps are in operation annually from May 1 to September 15.

The three streams in the study were stocked with juvenile American eels during 2016 and 2017 (Table 1). Table 1 shows the timing and quantities of eels stocked at each monitoring location. No additional stockings occurred in 2018.

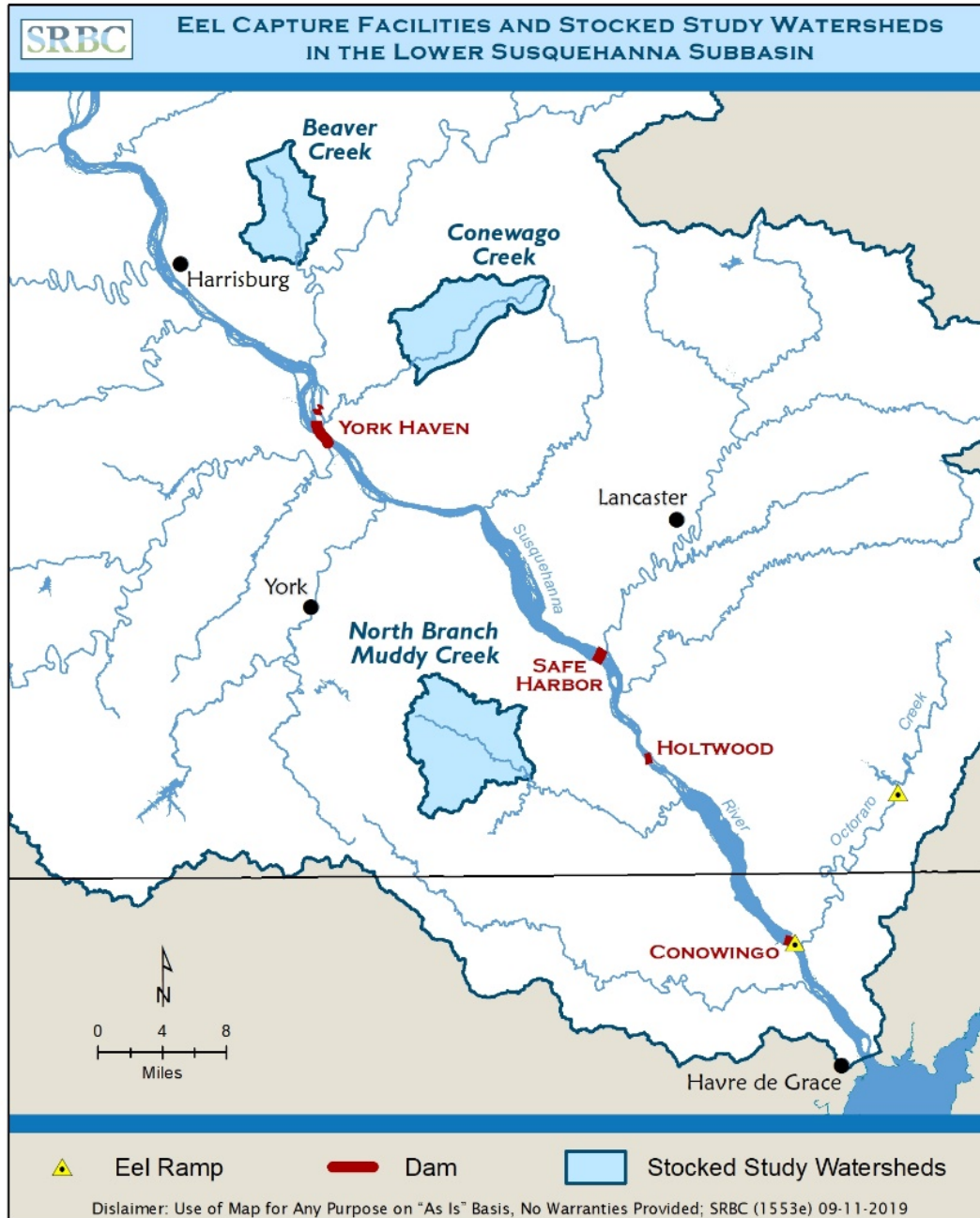


Figure 1. Map of Lower Susquehanna Subbasin Study Watersheds Stocked with American Eel

Table 1. Cumulative Elver Stocking By Year at SRBC Study Sites

Waterbody	Total Planned Stockings	2016 Stocking	2017 Stocking	Total Stocked
North Branch Muddy Creek	22,000	22,004	0	22,004
Conewago Creek	16,850	1,563	15,317	16,880
Beaver Creek	9,400	0	9,738	9,738

Results

American eels were detected at Conewago Creek and North Branch Muddy Creek during electrofishing surveys in 2018. No American eels were encountered in Beaver Creek in 2018 despite receiving a stocking in 2017. Two additional surveys were performed on Beaver Creek by a private consulting firm in the summer of 2018, and neither survey captured American eels. Capture rates of American eel varied across sites (Table 2), but were highest at North Branch Muddy Creek and lowest at Beaver Creek, proportional to the number of eels that were stocked in each location. In Conewago Creek, no eels were captured after the first stocking event but were captured after the second, and much larger, stocking event.

Table 2. Catch Per Unit of Effort (CPUE) for American Eel (Eels Per Minute) in the Study Streams Where Stocking Occurred (Red star indicates timing of stocking events.)

American Eel CPUE (n/min)	2015	2016	2017	2018
North Branch Muddy Creek	0.00	★ 1.70	0.17	0.21
Conewago Creek	0.00	★ 0.00	★ 0.88	0.11
Beaver Creek	0.00	0.00	0.03	0.00

North Branch Muddy Creek

Data collected in 2018 from North Branch Muddy Creek represents biological conditions following two full years after American eel reintroduction. Sampling occurred in 2016 shortly after eel stocking in the watershed had been completed. While eel abundance declined from 2016 to 2017, eel size and weight increased from 2017 to 2018.

More notable, however, is the American eel's contribution to overall community biomass. American eel biomass increased from 2.9% of the community biomass in 2017 to 22.9% in 2018, even though eels never ranked higher than being the 9th most abundant species (2018). Annual growth of eels in North Branch Muddy Creek is represented by mean length and weight of individuals as presented in Table 3.

Table 3. Mean Length and Mass of American Eel in North Branch Muddy Creek

NB Muddy Creek			
Year	n	avg. length (mm)	avg. mass (g)
2016	87	130	NA
2017	13	205.1	19.3
2018	14	349	85.2

The eels collected in the annual survey at North Branch Muddy Creek are assumed to be of the same cohort since no additional eels were stocked in the watershed, and volitional access is still precluded by Conowingo Dam. Individual length and weight data for eels caught in North Branch Muddy Creek as well as the other two study watersheds are shown in Figure 3.

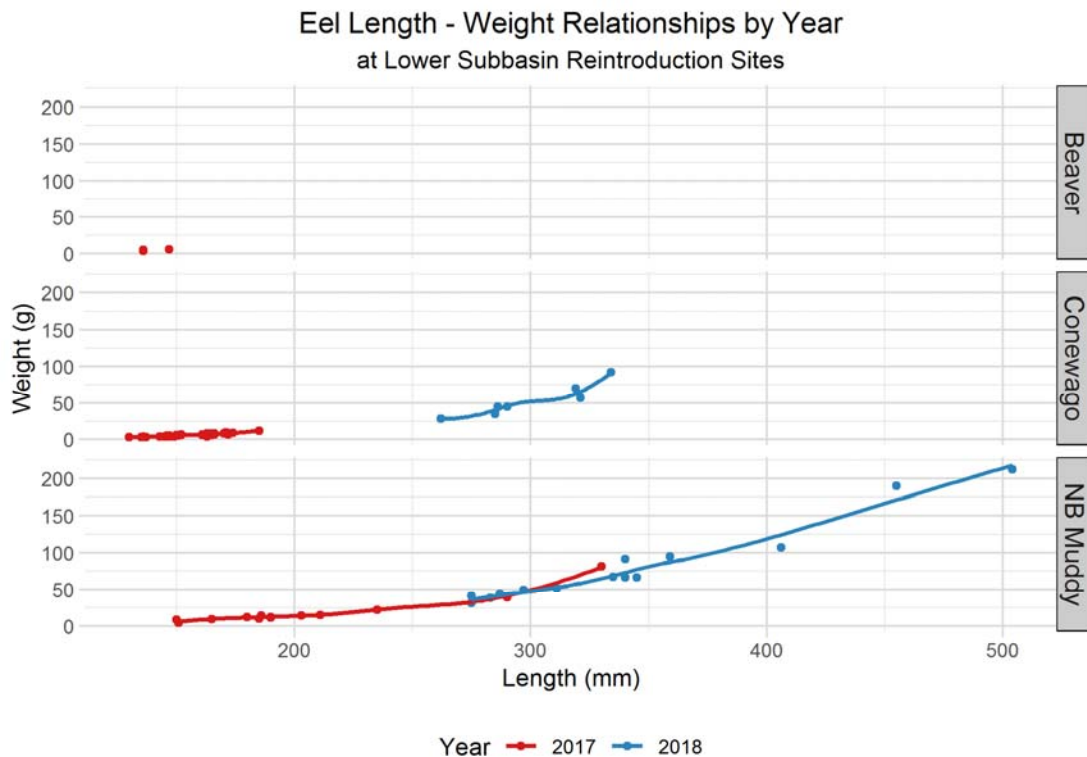


Figure 3. Length-weight Relationships of American Eel at All Reintroduction Sites, 2017-2018 (Single cohorts are assumed at Beaver and North Branch Muddy creeks, but more than one cohort may exist at Conewago Creek.)

Conewago Creek

American eel stocking occurred over two years in Conewago Creek with 16,880 elvers released between August 2016 and June 2017. Of those, 1,563 (9%) were stocked in 2016, and 15,317 (91%) were stocked in 2017. Eels captured during sampling in 2018 were presumed to have been stocked in 2017 and were classified as one-year post stocking for this summary. Table 4 summarizes mean length and weight data collected from American eels in Conewago Creek.

American eel was the 8th (of 25) most abundant species in the 2018 survey, contributing 5.1% of the overall biomass. Capture rates of American eel, as expressed by catch per unit of effort, decreased from 2017 to 2018, but capture rates of all fish also decreased from 2017 (19.7/min) to 2018 (12.6/min). Increased streamflow in 2018 relative to 2017 was a likely factor in decreased capture rates.

Table 4. Mean Length and Mass of American Eel in Conewago Creek

Conewago Creek			
Year	n	avg. length (mm)	avg. mass (g)
2016	0	NA	NA
2017	37	156.8	6.1
2018	8	297.9	52

Beaver Creek

Beaver Creek was stocked with a total of 9,738 elvers between June 16 and June 20, 2017. A follow-up electrofishing survey was performed at the release site on September 28, 2017, capturing only three elvers. In 2018, electrofishing surveys were conducted at three separate locations: at the original stocking site, at 4.2 kilometers upstream of the stocking site, and at 1.8 kilometers downstream of the stocking site. No eels were found at any of these sites. The reason for the apparent disappearance of American eel from Beaver Creek is undetermined.

Dispersal within Watersheds

The reintroduction of American eels into the North Branch Muddy Creek and Conewago Creek watersheds has been successful. Electrofishing surveys conducted by other parties independent of this study have documented the wide distribution of American eel throughout both watersheds, both upstream and downstream of the stocking locations. The observations documenting successful reintroductions of eels in these watersheds mirror the rapid growth and vast dispersal of eels in the Basin’s larger watersheds.

Future Work

SRBC will continue to monitor the fish communities of the three streams in this study on an annual basis via electrofishing. Additionally, any eels in excess of 200mm encountered in future surveys will be implanted with an 8-mm PIT (passive integrated transponder) tag. PIT tagging of American eels within these systems will allow for detailed examination of growth and movement of the individual animals.

References

Minkkinen, S. and I. Park. 2008. American Eel sampling at Conowingo Dam 2008. United States Fish and Wildlife Service. Maryland Fisheries Resource Office.

Susquehanna River Anadromous Fish Restoration Cooperative. 2013. American Eel Restoration Plan for the Susquehanna River Basin – Addendum to the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC) 2010 Migratory Fish Management and Restoration Plan for the Susquehanna River Basin.