Patapsco River Monitoring Summary (2009-2024)

Experts
Maryland Biological Stream Survey (MBSS)
Maryland Geological Survey (MGS)
U.S. Geological Survey (USGS)
Smithsonian Environmental Research Center (SERC)
University of Maryland Baltimore County (UMBC)
National Oceanic and Atmospheric Administration (NOAA)
U.S. Fish and Wildlife Service (USFWS)

Biological Monitoring

The biological monitoring for this project was conducted by Maryland Biological Stream Survey (MBSS) and Smithsonian Environmental Research Center (SERC). For the past fifteen years, MBSS researched the behavior patterns of migratory fish species, resident fish species, and benthic macroinvertebrates. SERC collected data on the presence of river herring eggs and larvae, environmental DNA (eDNA— these are little bits of genetic material that living things leave behind in the water), sonar imaging, otolith (i.e., ear bone) aging and scale spawning marks, and Passive Integrated Transponder (PIT) tag (i.e., microchip, like with your dog) tracking.

MBSS and SERC have seen evidence that some species of migrating fish, including alewife and blueback herring, are making their way above the former Bloede Dam and spawning. MBSS noted that nine species known previously to only be observed downstream of the Bloede Dam were observed upstream. These species included alewife, blueback herring, chain pickerel, gizzard shad, Northern snakehead, quillback, striped bass, white perch, and yellow perch. Many of these species are migratory and were traveling upstream of the former dam during their respective spawning seasons when observed.

SERC's egg/larvae sampling results further verified that blueback herring actively spawned in the restored reach above Bloede Dam in 2024. Both alewife and blueback herring eDNA was detected at sites upstream of Bloede Dam after the dam's removal, but not before. Although individual fish were tagged and tracked using PIT telemetry, no tagged fish were detected moving upstream of the dam site. Run counts indicated that river herring populations are in the thousands to tens of thousands of fish in the Patapsco River and that the dam removal did not have a negative impact on the population. Based on otolith ageing, scale spawning mark analysis, and PIT telemetry, SERC found that river herring in the Patapsco River typically start spawning at age 3 or 4 and return annually for up to 2 to 3 additional years. It remains too early to detect whether river herring populations are increasing due to the dam removal because only the first generation of fish spawned after the dam removal started returning during the run counts (by 2022 or 2023). It will likely take several generations for the population to increase substantially enough to detect the change. Overall, removing Bloede Dam increased the extent of river herring spawning habitat at least to the base of Daniels Dam.

MBSS found that American eels are utilizing the river and tributaries to the Patapsco upstream of the former dam sites following removal in droves. Prior to the removal of Bloede Dam, the

Daniels Dam eel ladder upstream averaged 28 eels per year captured. However, following the removal of Bloede Dam, in 2022, the eel ladder captured 36,594 eels, a 1300% increase (while a comparative increase was not observed at Conowingo Dam on the nearby Susquehanna River). MBSS also saw that the American eels seemed to be spreading out more consistently across the reconnected habitat once the Bloede Dam was removed.

MBSS observed changes in resident fish and benthic macroinvertebrate communities as the river adjusted to the release of sediment and change in impounded habitat. Biomass, species richness, and diversity index values for resident fish all increased the first year after removal and were found to remain significantly higher throughout the post-removal period. Benthic macroinvertebrate communities came to more closely resemble the community of non-impounded river areas. There were no detectable differences in riffle, run, and glide habitat types in the post-removal period, further suggesting that benthic macroinvertebrate communities have recovered quickly in the Patapsco River after Bloede Dam removal.

Physical Monitoring

The physical monitoring for this project was conducted by Maryland Geological Survey (MGS), University of Maryland Baltimore County (UMBC), and U.S. Geological Survey (USGS). MGS collected data on the movements of sediments out of some areas (like the former Bloede Dam impoundment) and gathering in other areas in and along the river downstream. They took repeat photos at stations along the river to visually document changes. They also looked at changes in the composition of sediments in different areas. For example, perhaps prior to dam removal, a certain location had mostly sand and silt and following dam removal perhaps it had cobbles and gravels. MGS documented all of those changes.

UMBC utilized experimental structure-from-motion (SFM) aerial drone technology to conduct baseline aerial surveys of sediment movement throughout the river while also mapping changes in sediment types. Their goal was to see if they could collect data using drone photography that would produce similar results as the data being collected by MGS, but with a significant reduction in effort and time. UMBC's results were compared to the ground-truthed data collected by MGS to refine aerial drone survey technology for physical monitoring surveys. UMBC's results appear to support the utility of SFM for augmenting information obtained through field sampling, even as they highlight some of the limitations of aerial surveys. Such limitations included the need to avoid inclement weather, the need for relatively clear water and adequate views of the channel, the impacts of bridges and overhanging vegetation, and the critical need for precise ground control points for orientation from the air.

USGS has stream gages all over the country that monitor factors such as discharge (i.e., the flow rate of water), turbidity (i.e., sediment volumes), and other factors. USGS used their stream gage data to assess the spatial extent of sediment movement and storage across the lower Patapsco River corridor. They found that there was a significant spike in downstream sediment deposition following the Bloede Dam removal, which was confirmed by observations during site visits. They analyzed these changes over time and across gage sites and compared them to normal patterns and storm event patterns. This allowed them to "watch" the sediment move through the system that was released during the dam removal project.

The monitoring team found that the physical (or geomorphic) changes to the river followed what was predicted by researchers based on site-specific modeling and monitoring results at other dam removal sites. The sediment composition of the impoundment changed from more fine grain (i.e., silt/sand) to more coarse grain (i.e., cobble/boulder). Larger boulders and cobbles were revealed once the finer grained material evacuated.

The physical monitoring team found that the vast majority of sediment within the Bloede Dam impoundment evacuated within the first year post-removal. The sediment was observed moving downstream relatively quickly and causing no significant problems downstream. The river came to resemble a more natural system once again.

The UMBC aerial research confirmed the patterns seen on the ground by MGS and USGS.