

BRINGING NATIVE FISHES INTO THE CLASSROOM: THE BIOMA PROJECT

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Getting kids interested in native fishes seems difficult at best and impossible at worst. In the era of flashy video games and a myriad of social media, why would young people care about some drab gray fish living in a ditch behind their houses? As a high school senior interested in preserving America's native fish species, I sometimes get quizzical stares from my friends when I describe my hobby of catching fish from local lakes and streams and raising them in the fish tanks in my bedroom.

However, my experience starting and growing my environmental education nonprofit, the Bioma Project, taught me that youth were actually some of the best audiences for outreach. In the Bioma Project, aquariums stocked with up to 11 species of native plants and animals are brought to schools in Maryland and Washington, DC (Figure 1). Because each species has its unique needs, my team and I include a diversity of organisms to better simulate a local stream system. Faced with a seemingly daunting task, the students nevertheless will take the initiative and set up and maintain thriving aquatic communities in their classrooms, often with minimal oversight from their teachers, including self-organizing weekly feeding and water change schedules. When committed and given purpose, young people can accomplish great things, including becoming future stewards of our native fishes.

My journey in native fish conservation started in seventh grade. My town, Columbia, Maryland, was growing and, as I progressed from elementary to middle school, I could see how forests and streams that my friends and I used to play in were being destroyed and replaced with new development. I went to trash clean-up events,

but whenever we cleaned up a trail, we would sometimes return to find even more trash. Very few people I knew shared my concern.

I realized that for people to care, I had to bring them outside and show them what needed to be preserved. Some of the staunchest conservationists I knew were fishermen and hunters, people who saw why they had to take action. If people understand the importance of preserving the outside world, we can finally have long-term solutions. We wouldn't have to pick up trash at the same trails again and again. We have to target the problem of environmental apathy from its root instead of merely dealing with its symptoms.

Within this mission, I realized that it was crucial to target kids because of the political socialization theory, which explains how people acquire their values as they grow up through a variety of factors, including family, religion, and education. Adults have already found their own values; thus, they are less likely to create a new attitude about the environment. On the other end, children still have moldable minds, and they likely will be much more receptive to new lessons about the environment.

In seventh grade, I started taking groups of my friends out on hikes and fishing trips. Their parents were happy that they were out of the house and not playing Minecraft. I would teach kids around the neighborhood to fish. Many friends left after the first trip, but some stayed and even started bringing their friends along, joining me in my volunteer activities (Figure 2).

I realized the need to scale-up my efforts to create more young conservationists. In eighth grade, I reached out to Philip Herdman, a teacher at my school, Clarksville Middle, as well as three students: Vedaant Shah, Omar Niazi, and David Balakirsky. They all agreed with my idea and, together, we set up the Fishery Science Club to take students out of classrooms and into the outdoors (Figure 3). I negotiated with local landowners and set up fishing events and hikes on their property. We would wade into rivers and ponds, netting small fishes and macroinvertebrates and bringing them back to school to identify and observe. The club was one of the most popular extracurriculars at Clarksville, with over 50 students joining on the first day, even though participating meant they would have to make up missed schoolwork later. The club even had to be divided up by grade level on some days, simply because of the large number of students present.

I contacted a national organization, Trout Unlimited, and asked if they could install one of their trout tanks at our school for free (usually schools had to buy equipment). They agreed and gave Clarksville a wonderful learning tool, a 50-gallon aquarium with 200 Rainbow Trout *Oncorhynchus mykiss* eggs (Figure 4). Students would come in daily to help maintain the tank, feed the trout, and test parameters such as pH, nitrate, nitrite, and ammonia to monitor water quality.



Figure 1. Teaching students at Gaithersburg Elementary School in Gaithersburg, MD, about Eastern Blacknose Dace *Rhinichthys atratulus*.

Photos by Peter Mirnitchenko.



Figure 2. Cleaning up invasive Asian clams *Corbicula fluminea* in the Patuxent River with my friends.

Some of our members had old aquariums in their garages and brought them in. We stocked them with fish we caught from local streams, such as Bluegills *Lepomis macrochirus*, Creek Chubs *Semotilus atromaculatus*, and Tessellated Darters *Etheostoma olmstedii*, and we prepared lesson plans for each fish. Soon, science teachers in the school began bringing classes to view the tanks.

These tanks were a huge hit at our school and often were one of the first things visitors wanted to see. Each year, Clarksville Middle School holds an enrichment fair in May for all of the clubs to showcase the work they have accomplished during the school year. Even though the Fishery Science Club was holding its presentation in the media center—which is more than double the size of the classrooms that other clubs were in—there were still so many people that we had to create a line outside. Because of this success at Clarksville, I got the inspiration for the Bioma Project tanks a few years later.

At the end of the year, we stocked the trout (with Maryland DNR's permission, of course) in the Patuxent River. In the summer, I reached out to the Washington Suburban Sanitary Commission and received permission to hold a fishing tournament at Triadelphia Reservoir. We wanted young outdoorsmen to meet each other and involve them in conservation. Fifty youth anglers came, including the famous YouTube 1Rod1ReelFishing, who did



Figure 4. A student changes the filter using the tank installed by Trout Unlimited.



Figure 3. I held a fishing day for children at a pond next to Clarksville Middle School. This event was similar to the original trips I had with my friends.

a feature on our group. We also got the sponsorship of Lew's Fishing, Hoo Rag, Reelsnot, and Angler's Express for our youth fishing program. We sent volunteers to help out at Baltimore's City Catch program, where we mentor inner-city students and teach them fisheries conservation and how to fish for trout.

In high school we created fishing teams, training students to become tournament fishermen. We organized meets between different high schools in Howard County, Maryland, sending the winners to the Howard County fishing tournament and to statewide events. YouTube fisherman 1Rod1ReelFishing presented to our high school fishing assembly, and we gave out free rods to students who couldn't afford them (Figure 5). I was selected to attend Trout Unlimited's National Teen Summit, where young conservationists nationwide came to discuss how to mobilize youth to preserve America's fisheries.

At the summit, I remembered the enormous success I had with the aquariums at Clarksville Middle School. And I wondered how to reach youths, especially in the low-income areas who lack the resources and time to get outside and enjoy nature. I wondered about the possibility of, instead of bringing students to nature, bringing nature to the students.

One of my friends had purchased a virtual reality (VR) headset and invited me to try it out. I realized that we could leverage VR in our lessons and take the students on trips to places they would not otherwise go and learn about the outdoors and nature (Figure 6). The textbook-based learning that comprises sciences classes at schools doesn't inspire as much interest in students and doesn't



Figure 5. Fishing celebrity Michael Hsiao, "1rod1reelfishing" (fourth from right) at one of the Bioma Project's fishing tournaments.



Figure 6. A student at Maury Elementary School in the District of Columbia uses a virtual reality headset to look at the Everglades and its fish life.

fully capture the significance of topics being taught. Many students are auditory and visual learners, so worksheets and articles aren't the best way for them to learn, but VR might easily improve their learning.

I sent an exploratory email with my lesson plans to elementary and middle school teachers across Maryland and DC. To my surprise, dozens showed interest. In between my busy high school schedule and other extracurriculars, I met with teachers and administrators across Maryland, discussing their students' learning needs and their expectations for the program. After recruiting them, we spent our sophomore years writing a curriculum, gathering plants and fishes for the tanks, recruiting volunteers, and writing permit applications. We fundraised by selling Pokémon cards and old video games at neighborhood yard sales.

We stocked up to 11 species of native plants and animals into each tank to simulate a local stream ecosystem and to show the complex relationships that occur between ecological niches. Usually students study only a portion of the whole, whether it be a specific organism or a section of the ecological community. What makes the Bioma Project program unique is that it shows the entire relationship of life as a whole. Before our tanks, students could only experience such a system by going out into rivers and forests. Schools often cannot support field trips for these purposes, and if they do, it is usually only once a year. Our program allows the students to experience the same ecosystems that exist in their local creeks, but students could now do it in the classroom, thus making everything more accessible.

In the summer before our junior year, the Bioma team delivered critters to our pilot schools. Teachers shared tanks between classes, and students from all grades participated in studying the tank's critters and keeping them alive. By taking care of the different plant and animal species, students learned about the needs of ecosystems and how they could help sustain them. They also got a closeness with nature from daily interaction with the tank that would otherwise be very hard in a school setting. Our curriculum, developed throughout the year with feedback from teachers, guides lessons and gives students an unconventional approach to learning, shifting them to more hands-on activities and crafts instead of paper and pencil (Figure 7). Hands-on, independent projects results in students being more invested in their work.

The program was hugely popular among the schools; whenever we presented at a school, we saw student engagement almost unheard of in a classroom setting. Whole classes raised their hands to help us test the pH of water. When a fish died, all the students



Figure 7. Students at Manor Woods Elementary School in Howard County, MD, play a game where they matched predator and prey species in Maryland streams.

wrote letters and made a memorial for the fish and passed out commemoration keychains to members of their community.

After this year, I will graduate from high school, along with most of my team. We would all like to continue our mission even though our paths will likely take us in different directions. As such, we are committed to passing on the legacy of the Bioma Project to younger high school students by acting as mentors for them. This not only ensures that the Bioma Project will continue, but it also allows the program to improve based on our own experiences, successes, and shortcomings.

For photos of our project, visit: biomaproject.org/timeline

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