

Elizabeth Panner
CNRC Intern
October 1, 2020

Elizabeth Panner posed this list of questions to Tyler Frankel, Assistant Professor of Earth and Environmental Sciences at the University of Mary Washington (UMW) regarding his and Associate Professor Abbie Tomba's research project assessing nutrient and microplastic pollution in Accokeek Creek at and adjacent to the Crow's Nest Research Center. Professor Tomba teaches Biological Sciences. Together, they will supervise several UMW undergraduates who will conduct the onsite research in summer 2021.

1. Why did you choose the Accokeek Creek and CNRC as the location for this research?

We selected this site after initial samples by UMW students and other local groups like Friends of the Rappahannock indicated that there were unexpectedly low dissolved oxygen (DO) levels in the pond on the CNRC property as well as in Accokeek Creek. We are interested in looking into what factors might be causing these low DO levels.

2. Why is it important to know about nutrient pollution in the Accokeek Creek and nearby areas?

Nutrient pollution can result in dead zones - areas at the bottom of water bodies with low or no oxygen. Dead zones leave areas of the stream uninhabitable for organisms like fish and invertebrates. The lack of dissolved oxygen in water in turn affects the availability of fish, shellfish, and other invertebrates, both for human consumption and for the ecosystem as a whole.

3. How are you able to investigate the presence of microplastics?

Because microplastics are a potential contaminant of concern, a variety of techniques have been developed to isolate and identify them from water, sediment, and soil samples. For instance, for water samples we will run a very fine net through the water column and carefully count and identify what is captured using light microscopy. For the sediments, we will use a "density separation" method that allows us to separate the microplastics from the undesired organic and inorganic particulate matter.

4. Why did you decide to add the microplastics aspect to your research?

There are several microplastic-based research endeavors currently underway at the University of Mary Washington that are examining 1) the presence of these particles in Virginia freshwater ecosystems, 2) the uptake of microplastics in waterfowl, and 3) their impacts on aquatic invertebrates. Results from these studies so far have shown that microplastics are ingested by these organisms and, in the case of aquatic invertebrates, cause mortality at higher concentrations and decreases in locomotor behaviors. As such, it made perfect sense to include this as an aspect of the CNRC research study.

5. What does the presence of microplastics and excess nutrients mean for people who use the waterways?

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The fact that excess nutrients can cause dead zones means that especially in summer there may be fewer fish and crabs to catch because there are large sections of river or creek bottom that are uninhabitable due to reduced oxygen. Microplastics accumulation in fish tissue and what effect consuming these fish could have on human health are several other areas of new research.

6. How can citizens reduce the presence of these pollutants?

Common sources of nutrient pollution are from fertilizer and other organic waste (like pet and livestock waste) that wash into waterbodies. On a personal level, citizens can responsibly clean up pet waste and reduce or avoid using fertilizers on their lawns. If you must fertilize, doing so in fall rather than spring is also helpful. Citizens also can support agricultural practices that are more sustainable and result in less nutrient run-off. Planting trees on your property or supporting organizations the reforest watersheds is also very helpful.

7. What action will others be able to take as a result of this study?

We will be creating a publicly available report detailing our findings that will serve to 1) better inform local residents of the health status of Accokeek Creek, and 2) provide suggestions on how individuals can minimize their own pollutant footprint.

8. What are some of the ecologically, recreationally, or commercially important fish and macroinvertebrate species present in Accokeek Creek and CNRC?

Economically and recreationally important organisms include Blue Crabs, Large Mouth Bass, sunfish and catfish. These species are important ecologically as well as large numbers of macroinvertebrates such as dragonfly and midge larvae, clams, and worms which are an important food source for other organisms such as fish and birds.

9. Are there aspects of water health that the UMW study is *not* taking into consideration that could be interesting for the local community?

One of the other classes of contaminants that are of concern are **endocrine-disrupting chemicals** (EDCs) which mimic or disrupt the body's natural hormone functions. These chemicals are used in a myriad of household products and industrial processes and have been found to enter the environment from a variety of sources (wastewater treatment plants, industrial discharge pipes, agricultural runoff, etc.). While this is not something that we are currently investigating, it is an avenue of interest for future research projects.

10. Should or could this study be conducted on a long-term basis to build the data base of information?

Longer term ecological data can be very helpful to show how environments are changing over time (for example, are nutrients / microplastics increasing) and to show if interventions

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can help alleviate problems, but longer-term studies require considerably more resources - both people and funding so those aspects are key determinants to the length of any research.

How do the roles of the students recruited for data collection and analysis differ from the professors' roles on the project?

This project is an excellent opportunity for students to gain research skills as they will be involved in the whole process. However, the main role of the professors is to design the study, including how and where to sample, as well as to teach students how to collect, analyze, and present their data. Students will be primarily responsible for collecting and processing samples, analyzing data, and presenting their results at local and national scientific conferences with guidance from Drs. Tomba and Frankel.