WMU students turn fish waste into food

By: Sam Meads

Western Michigan University's Office for Sustainability has created an aquaponics project that turns fish waste into fertilizer.

In the back room of Western Michigan University's Office for Sustainability, is an unassuming aquagarden.

Western Michigan University's Office for Sustainability has sponsored a project that allows fish waste to be turned into fertilizer through a process called aquaponics.

Max Hornick, a WMU undergraduate student and aquaponics intern at the Office for Sustainability, defined aquaponics as the combination of aquaculture, which is the raising and farming of aquatic life, and hydroponics, which is when plants are grown in water instead of soil.

"Hydroponics uses water 90 percent more efficiently," Hornick said.

This aquaponics project began in Spring 2012. The aquaponics system at the Office for Sustainability uses tilapia from Africa and the Middle East, which is one of the top five most consumed fish on the globe, Hornick said. The tilapia create an ammonia-rich waste that is sent through the system where bacteria breaks the ammonia down into nitrites and then into nitrates, Hornick said. The plants then absorb these nitrates through their roots and use it as nutrition, and it acts as a fertilizer to help them grow, Hornick said.

"By doing this, they clean the water before it's sent back to the fish," Hornick said.

The WMU aquaponics project uses 15 adult fish in the main system, 14 adolescent tilapia in one of the 20 gallon aquaria and 200 smaller, younger tilapia in another 20-gallon aquarium, Hornick said.

Carlos Daniels, a WMU graduate and manager of the aquaponics project, said that fish are in this system for about nine months. It takes the fish about four months to move to the juvenile stage, and then when the fish in the main tank are ready to be replaced, the juvenile fish move into the main tanks, Daniels said. The adult fish that are replaced are eventually eaten, Daniels said.

"It's a good model for the future of aquaculture," Hornick said.

The Office for Sustainability uses three different watering systems for the project. All three are some of the most commonly used hydroponic plant growing systems, Hornick said. The first system is the deep water culture system or DWC. The DWC involves a floating raft on which the plants grow on and the roots hang down into a deep pool of water, Hornick said. This system is easy in terms of maintenance and the roots have a lot of accelerated growth because they have a lot of room to grow, Daniels said.

The second water system is an Ebb and Flow or E&F system. This system includes expanded clay pebbles that provide a large surface area for the bacteria to grow on, Hornick said. In this system plants get a lot of aeration, and you are able to use heavier plants than the other two systems because of the density of the system, Daniels said.

"The other element of what we are doing in our system, and people are starting to pick up on this is, we have worms in there that further break down that waste into nutrients that can be readily available for the fish," Daniels said.

The third system used at the Office for Sustainability is the nutrient film technique or NFT. This system has channels that water is constantly flowing through and the roots of the plants hang down into these channels and absorb nutrients as water passes over them, Hornick said. The NFT system is a commonly used method for people working with small spaces, Daniels said. The downside to this method is that it's only four inches deep so the plants don't have much room to grow, Daniels said.

"We have basically been using the three different types of systems to kind of test the performance and compare the performance of each of the systems to see which systems are growing our plants more effectively and what's giving us the most bang for our buck," Hornick said.

"We have been successful with all three systems, but if we were to choose, we would go with the deep water culture," Daniels said.

As of now, people hesitate to invest in aquiculture and aquaponics because they don't know much about it, Hornick said. People involved with aquaponics are going to try and push it for the next five to 10 years, Hornick said.

The Office for Sustainability is really starting to push the use of aquaponics across the entire campus at WMU. For example, for the past couple months the Office for Sustainability has been providing produce to Campus B, Daniels said. If their project is able to expand out to the Gibbs House where they will have more space to produce more, they could offset the costs of a few cafeterias on campus, Daniels said.

"We have been providing about two pounds a week to Campus B and we have gotten great feedback from them, and I have tasted some of the meals they cooked and they are really tasty," Daniels said.

Fifty percent of the cost of the associated cost with aquaculture is the feed, Daniels said. If people continue to innovate with aquaponics this cost could be reduced significantly with the waste and produce from aquaponics, Daniels said. One example is if this project could expand throughout the whole university where they could use the waste from the cafeterias, they could produce food from that waste, Daniels said.

"One of the things we hope to engage students with in the project is that we want to offer an opportunity for them to get a visual and tangible example of sustainability," Daniels said.

Students have a hard time understanding what sustainability means so when they see a project like this they can understand the environmental impacts of how it helps the environment, the social impacts on how we could feed the nine billions people in the world and the economical impact on how this project can save money, Daniels said.