AQUAPONIC STRESS FACTORS

We’ve all heard about how gardening of all types can be a great stress-buster for us humans, but what about for the fish that live in our aquaponic systems?

By Sylvia Bernstein
Aquaponic gardening is a fascinating way to grow two food products—vegetables and fish—together in an organic, symbiotic ecosystem. And while growing vegetables is a familiar process for most of us, growing game fish for food is unfamiliar to many gardeners and can be a somewhat intimidating activity. Even for experienced aquarium hobbyists, growing a plate-sized tilapia is a whole different animal. The key to growing fish for food (or any fish, for that matter) in aquaponics is to consider what stresses the fish experience in a captive environment and then lessening or eliminating them. There are three categories of fish stress: physical, chemical and biological.

**PHYSICAL STRESS**

Physical stress includes all the environmental conditions that we control for our fish, the most important of which is temperature. All fish have a temperature range within which they will thrive, and a wider range within which they will survive. Fish are cold-blooded animals; thus, they do not have the ability to expend energy to maintain a constant internal body temperature like we do. They are completely at the mercy of the temperature of their surrounding water. If that water temperature goes outside of their optimal (or, thriving) range, fish will eat less, or stop eating altogether, and they become more susceptible to disease. That said, this is sometimes carefully employed as a technique called cold banking to slow down their growth rate. Cold banking is especially effective with fingerlings when you are trying to stagger your fish production.

Another form of physical stress is sudden exposure to light and vibration. Fish are alarmed when we flip on a light switch and take their world instantly...
from night to day. They will sometimes even bang against the walls of their tank to escape the light. However, just like with cold banking, this sensitivity to light can be used to the aquaculturalist’s advantage by employing a technique called phase shifting, whereby you trick the fish into thinking that it is spawning season (or not) by timing the amount of light they get during the day to mimic the season in which they normally spawn (or not). And because they “hear” vibrations with their entire bodies, rapping against the wall of a tank feels like yelling to them and will also cause them undue stress.

Interestingly, another form of physical stress can be water velocity. Fish originating from still lake waters, such as tilapia and perch, do not like much movement in their tank water. However, river fish like trout find it stressful not to have a current present in their tank.

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Chemical stress is mostly centered on maintaining the quality of the water. Escalating ammonia and nitrite levels stress our fish. This can easily happen at the beginning of an aquaponic system’s life if the fish are introduced to the system before the nitrifying bacteria have been fully established (A.K.A fully cycled). If you see ammonia levels approaching 8 ppm or nitrite levels approaching 1 ppm, you should do a one-third water change to dilute the level of unconverted toxic waste matter in your tank and allow the bacteria to catch up.

Once you are fully cycled, the most common reason for a spike in ammonia and nitrite levels in an established system is that something is decaying somewhere in your system. Usually, this is an indication of a dead fish. While dead fish usually float to the surface and are easily detected, this isn’t always true and a rotting fish carcass can very quickly spike your ammonia and endanger the rest of your fish. The next most common reason is that there is an anaerobic zone somewhere in your grow beds. This describes an area of your beds where material has built up and is not decomposing aerobically, i.e. with oxygen, but has instead become stagnant. It probably also smells badly, and typically nothing will grow there. Anaerobic zones are easily remedied by simply agitating the media with a stick and allowing the stuck, rotting material to wash out of the grow bed.

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Note that in contrast to ammonia and nitrite, nitrate levels can go as high as 500 to 700 ppm without harming the fish.

Maintaining a very low pH (below 6.0) can also be stressful. If you see your pH dropping to 6.4 or below, you will want to take immediate action to buffer it back up using a calcium or potassium compound. Finally, insufficient filtration of the solid waste and not enough dissolved oxygen (less than 4 ppm) are, not surprisingly, other forms of chemical stress.

**BIological Stress**

This last category refers to viruses, bacteria, fungi and parasites. Just like in our world, most of these pathogens are often present but only fully express themselves when the right conditions occur. For fish, this likely means that some of the stress factors listed above must also be in place for biological threats to have an impact.

In aquaponics we have adopted the technique of salting fish—that is, adding salt (sodium chloride) to the water to help them ward off disease. But this practice can be harmful to our plants because they may be sensitive to sodium. Also, I've recently heard that it is the chlorine, not the sodium, which helps the fish. So, you can actually get the same effect with a more plant-friendly treatment such as potassium chloride or magnesium chloride.

So, just think like a fish and give them a relatively stress-free environment and they will live long in your aquaponics system—and be delicious at harvest!