ONE MEMBER'S ROAD TO PERCIDAE HUSBANDRY

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First, let me warn you; I haven't written an article for any newsletter for a couple decades. Because of numerous requests on both the NANFA website and in the Percidae Husbandry group on Facebook, I've decided to give it a shot. But let me state now that this isn't an article to tell you how you should keep or breed darters, only how I do it. It is to give you ideas that may work for you. Just remember, your first "perfect plan"… isn't.

Here's just a bit about myself:

So as not to give away my age, I'll just say that I started in the aquarium hobby the year the last President to get assassinated was elected into office. My first attempt at keeping natives was at 7 years old, digging a hole out in my Grandparents backyard, filling it with water with a garden hose, and dumping in a bucket of left-over minnows from a fishing trip my Grandfather and I had taken. Needless to say, it didn't work out so well. And except for the years I focused on girls, partying, and Rock & Roll, I have since kept fish of one kind or another.

In the mid-80s I joined the Eastern Iowa Aquarium Association, became a two-term President a few years later, received my Master Breeder's Award from FAAS (Federation of American Aquarium Societies), and had my own business breeding and selling Australian rainbowfish.

It was through the business that I was reintroduced to native fish for the aquarium instead of the skillet. One of my customers wanted some rainbowfish and asked if I'd be willing to trade for some darters. I told him I might consider it but I wanted to do a bit of research first to see if I could meet the requirements the fish would need. After going through a couple of books at the local library I decided I'd give it a try. I had a metal-framed 100-gallon tank that I decided to put them in and while I waited for the fish I took a dorm fridge that I had, drilled a couple holes in the side and ran coils of plastic tubing in it to use as a poor man's chiller. When I received the fish (Greensides, Logperch, and Rainbows) in the mail I couldn't stop admiring them. I began wondering what I might find in my own creeks. It wasn't long before I started catching a few darters around my own area.

Though I kept darters, I didn't really dedicate myself to breeding them until 2010 when my wife decided I was going to remodel our basement. I told her I would but wanted to dedicate a portion of the basement to keeping fish. After a bit of convincing "no fish, no remodel," I was able to put together my first 9' x 11' fishroom. OK, more like a fish closet but it was mine! It didn't take long before I realized that because of the size and location of the new shower for her bathroom, my fishroom was going to shrink to 7' x 11' ... ugh!

Being a Libra, I couldn't decide between the two decidedly different types of fish I wanted to work with. I had spawned and raised seahorses (*Hippocampus erectus, H. reidi, and H. zosterae*) years ago and considered giving them a go again. But I also liked darters and to breed them seemed like a challenge calling me. Each species came with its own requirements. Maintenance, food, temperature, and so forth. would need to be considered. When it came time to decide, I did what most Libras would do and let my wife choose. She really liked darters, especially Rainbow and Banded, since I had taken her seining early in our relationship and she got to catch and keep some herself. The seahorses she felt would take up too much room. Hah! Little did she realize (or I for that matter) the number of varieties of darters versus seahorses that would be available to me.

So we decided that darters would be the fish of choice. I knew from my past reading that there were certain fish in Iowa that were protected. Hoping I could sell progeny if I was successful to help cover the costs it would take to keep the fish, I contacted the Iowa Department of Natural Re-

Photos by the author unless otherwise indicated.

Ken Glackin grew up with a fondness for native fish, whether rolled in beer batter for his stomach or swimming around in an aquarium. Ken has been a member since 2010 and serves NANFA as its Iowa Representative. Some of the activities he enjoys are enlightening students from high schools and ISU of the fish diversity of various creeks in the state, working with the DNR doing surveys, cleaning creeks, presenting programs at local fish clubs, setting up displays at functions such as local fish shows to educate and recruit new NANFA members.

sources explaining what I was hoping to do. After a number of contacts, both by email and phone, it was clear I could move ahead but needed to stay within certain guidelines. Not that I agreed with them all but they were there and I had a clearer understanding of how to proceed. Now I knew what fish-specific issues I needed to consider prior to the start of the remodel.

First, I needed to do some measuring to determine how many and what size tanks I would use. So after doing measurements several times and considering the tanks I had available, I decided to build shelves three high and use six 20 highs, five 10s (as grow-out tanks), and a 33-gallon tank.

I already knew I wanted to have a central filtration system that would filter all of my tanks instead of individual filters for each tank. After all I'm not a rich man. Because my preference of filtration leans towards biological versus mechanical or chemical, I felt using an algae scrubber setup would suit my needs quite well. I'll go into a bit of detail about the algae scrubber shortly. I also had determined how I wanted to incorporate plumbing to be able to do water changes the easiest way possible. Enlisting my brother's help and expertise, we routed plumbing from the floor drain to hook up directly to the system with the turn of a valve. Adding a sink to the room gave me a way to connect a hose directly to the filter to replace water for water changes. No more buckets! I decided to use another 33-gallon tank for the algae scrubber since a 55-gallon wouldn't fit under the lower shelf.

Controlling water temperature with a chiller that was quite undersized would be a challenge. So after giving it quite a bit of thought, weighing out the pros and cons (that Libra in me again), I decided the best way for now was to let nature help out. Again, with my brother's help, insulation was added prior to placing the drywall in the ceiling and internal walls. A vent fan was added into the ceiling to draw out heat from the room. Because my future fishroom was where the dryer used to sit, a vent already existed and all we had to do was add the fan.

To avoid any problems with potential water getting on the floor (or as most aquarists call "flooding") and humidity issues, we used treated studs, mounted the drywall off the floor two inches, and used four-inch baseboard made out of resin and mold-resistant paint.

While all this was going on, I again started researching darters but in more depth than I ever had before. I wanted to understand their requirements: environments, foods, spawning habits, geographical ranges, and anything else I could. Now, unlike before, not only did I have books and magazines to refer to but the Internet was also available. With that being said, I also learned a lot by going to creeks, making notes of what I caught, and the environments I found them in.

To save money I decided I'd try my hand at drilling tanks so I could use bulkheads to plumb water from the tanks to the drains. I didn't want to deal with siphon breaks that are typical when using overflow boxes. I had never drilled tanks before so I watched some videos on YouTube. It seemed simple enough, so I ordered the bits. Though I was quite nervous drilling the first one, after doing 30+ of them (yes, there were a few mistakes) I feel that I have got a good handle on it. All were drilled near the top far corner on the back glass. That would change later.

When the room was finished, we built the shelves so that the lights would fit up in them to give me as much clearance possible for netting fish, doing aquascaping, etc.

I couldn't wait to get the tanks set up but first I had to determine how I wanted to run the plumbing. I placed all of the tanks on the shelves facing me and started marking out the drain. Because I wanted to spot any leaks and to make assembly easier, the main drain laid along the top of the shelves behind the tanks instead of running under the shelves as I originally envisioned.

Once the drain was completed, I started working on the plumbing to feed the tanks. Running it along the front edge of the shelves I placed "Ts" at the front corner opposite of the bulkhead and ran the PVC up over the edge of the tank with a downsized 1/8-inch outlet to help produce more current. Because I knew some darters like current more than others, I installed valves at each tank to control individual flow rates.

It was now time to build the algae scrubber. I had never used one before and had only read about its application in saltwater tanks. As with many items commonly used in saltwater, I figured if it will work for salt it will most likely work in fresh water. The style I chose to go with in the 33-gallon tank used a dump bucket versus the standup constant flow since the authors felt an intermittent "dumping" of water over the growth area or plate produced more hair algae at a faster rate. This is beneficial for removing ammonia and nitrates from the water. After running the filter long enough for it to mature I think they were probably right.

Already having a Danner Supreme Aqua-Mag 18 rated at 1,050 gph, or about a turnover of five times per hour, I needed something I could use as a dump bucket. What I found was a smaller old hang-on-the-back filter box that had already served its usefulness as a filter. Using a jigsaw I removed excess material so that the box eventually looked from the side like a scalene triangle. After finishing up the shaping of the bucket, the next step was to find the tipping point on each side to mount the rollers from a shower door. The rollers worked for quite a while before wearing out and needing replacing. Once I had figured out where to mount the rollers to the bucket using bolts and nuts, I turned to making the plate to promote

Figure 1. Front fishroom showing tank setups and the "Twin Towers."

algae growth. I took a piece of egg crate originally intended to cover florescent lights in a ceiling and marked out the most surface area that I needed to reduce it to. Again, using a jigsaw, I slowly cut each of the tabs until I had trimmed off the excess. Next I took some splashboard, normally mounted on the wall behind a sink or stove to protect the wall, and cut it to the size of the egg crate. To connect the egg crate and splashboard together I used nylon nuts and bolts at each corner. Having completed these pieces, I next needed to determine the highest level within the filter I could mount the bucket so it had room to tip but water would not splash outside the confines of the tank. After locating the height to mount the bucket allowing water to go into the bucket, I siliconed a holder formed into a "V" from wall corner protectors, for the rollers to sit in on both the front and back glass of the filter. After the silicone cured I sat the bucket in its place and tipped it to see at what point the water would pour out completely. Once I found where that point was, I marked the side of the tank just below that point at several spots on each side to the end of the tank. It was at this level, again using wall corner protectors I'd mounted the growth plate with silicone. After everything dried and was in place, it was time to test it with a pitcher of water… it worked just as I had hoped! Time to move on to the next step. Always thinking, I wanted to also add bioballs to the filtration system to add more oxygen to the water as well as an added benefit of extra filtration from bacteria. So the "twin towers" were born, ok… built. I took 4-inch diameter PVC and cut it into 18-inch sections. After a little shaving, I fitted drain grids two inches up from the bottom of each section. Under each grid I then drilled a ¾-inch hole and inserted a PVC right angle elbow to allow air into the tower. As I put a tower together I would fill each section with bioballs. I was surprised how few bioballs it actually took to fill them both up since they

Figure 2. Initial room setup.

each stood 6-feet tall. Now needing a place to put the twin towers, I found an old 30-gallon aquarium for the TT sump. To connect the TT and algae scrubber sumps I drilled 1-inch holes in one end of both sumps, connecting them with flexible tubing. Another Mag Drive rated at 610 gph (considering height) would feed the towers from the algae scrubber's sump using PVC and a couple valves (Figure 1).

Lastly, I thought it would be beneficial to add reverse-flow undergravel filters to each tank. I figured it would keep detritus and cooler water closer to the top of the gravel. So I made plates, mountings, and plumbed the water to go under the plates. Because I didn't want water to siphon back through, I added a hole above the water surface to also create waves on the surface. I would later realize that reverse-flow undergravel filtration on a central-filtration system wasn't such a good idea.

With the filters completed, gravel, and flat limestone pieces collected from a nearby creek stacked in the back of the tanks, I held my breath as I filled up the system with water and turned it on. Everything worked great… for

about three minutes until I noticed water on two of the shelves where it shouldn't be. Off went the system and I proceeded to tighten bulkheads a bit tighter, avoiding cracking the glass, which was always a concern. Finally, turning on the system again, everything seemed to be working just fine. Even the bucket on the filter was dumping the way it should (Figure 2).

After setting up more of the tanks with gravel and flat stones, I decided it was time to add fish... fish I didn't have. I figured groups of eight with a 3:5 male-to-female ratio would work best. So out to the local creeks I went. After collecting groups of Fantail, Johnny, and Rainbow darters, I thought I had a good start. I would save the other species for later.

That first winter of 2011 seemed to last forever. I wanted to simulate the season as temperatures dropped in my tanks so I also shortened the light cycle to about 10 hours per day. I only allowed the temps to drop into the mid-40s that first winter.

During this time I remembered a native fish group that I had briefly joined back when I first started getting darters and wondered if I could find them on line. Eureka! A quick Google search and I found NANFA's website. I met a number of helpful people, including the person who introduced me to a number of darters I had no idea existed. Thanks Dustin! That March he was kind enough to send me several species of darters.

As the temperature started to rise in my system, I increased the light cycle and started feeding the fish heavily. In preparation for breeding conditioning, I purchased two pounds of blackworms. After placing a small handful into each tank I didn't see any reason why I couldn't just place the rest of them in one of the ten gallons devoid of fish.

Late April 2012 came, the system temps had climbed into the mid-60s, and I was pleasantly surprised when I saw Johnny Darter fry swimming around their tank. Then panic set in and I started chasing them all over the tank with a turkey baster. Oh what fun!!! While moving piles of limestone trying to suck up the tiny buggers, I noticed more eggs under one of the rocks. Hmmm… I thought: Why not try and artificially hatch these by taking the rock, leaning it against the glass in the grow-out tank like I used to do with angelfish eggs, placing an airstone close but not touching the eggs, and see what happens? Sounded good to me. As I removed a piece of limestone with eggs, I replaced it with a similar one. And to keep fry alive in the grow-out tank, I fitted sponge filters to the bulkhead.

It took a couple days before I started seeing eggs eyeing up. Soon after I guessed there were at least 50 fry in the tank though there were probably many more but I couldn't count them all. Since I wasn't sure what size foods they'd eat, feeding commenced with green water, microworms, and walter worms.

A couple days later I noticed fry in the Fantail tank and felt like it was déjà vu all over again. Turkey baster chasing and rocks flying. The Fantail fry were 2–3 times larger than the Johnnies. As with the Johnny Darter fry, I fed green water and micro worms but added *Moina* (a small crustacean) and *Paramecium* throughout the day.

About a week later came a new learning experience. As I went to the fishroom I could tell something was wrong. Even before entering, a terrible smell permeated the air. And once I did enter I could barely see any fish in their tanks as the water was so dark and cloudy. Immediately I realized my ingenious idea of placing so many blackworms in a bare 10 gallon wasn't such a good idea. They'd crashed the system and I went into panic mode. After shutting off the feed valve to the tank with the blackworms and not wanting to risk shocking the fish, I did multiple water changes of 30% throughout the day. After cleaning out the blackworms as soon as I could, I started looking to see how bad the results were. There were casualties... most of the Johnny fry and all the eggs that were on another rock, gone. But that was it... I didn't know how everything else made it but I was grateful.

As that year progressed I added more fish like Blackbanded, Savannah, Turquoise, and Seagreen darters to the system (Figure 3). Now, most of the tanks in the fishroom were occupied and the few fry I raised ended up going in with the parents.

I couldn't wait to see what might spawn the spring of 2013. It felt like winter once again took forever to come and lasted even longer that year, but using the same process I did the previous year, I enjoyed seeing and again chasing fry. I got my money's worth from the turkey baster that spring. Besides Fantail and Johnny fry I also had Blackbanded, Turquoise, and Seagreen fry. But there was a problem. I expected to see more fry than there were. Except for the Johnnys and Fantails, the numbers were quite low. I figured the parents were eating them before I could get to them. It got me to thinking that there had to be a better way to get to the fry before the parents, but how? I didn't want to have to dig for eggs. And I certainly couldn't stay up watching tanks 24/7 for weeks on end.

The answer to that question came a few months later quite by accident. While feeding fish one day I noticed some movement in an aquarium where no movement should be. It was under one of the undergravel filters and it was not one but three fry. I couldn't understand how they got there. It didn't take long before I spotted more fry under other filters also. After a few weeks I started to realize they were Johnny Darter fry under all of them. They had to

Figure 3. From top: Savannah Darter (*Etheostoma fricksium*), Murph Mill, SC; Turquoise Darter (*E. inscriptum*), South Fork Edisto River tributary; Seagreen Darter (*E. thalassinum*), Lincoln County, NC. (Photos by Dustin Smith) Turquoise Darter (*E. inscriptum*), Athens, GA. (Photo by Michael Wolfe)

have traveled through the system! Sadly they'd eventually died from starvation because I wasn't going to pull up the undergravel filter plates for a few fry.

But I started to wonder: what if I plumbed a grow-out tank directly to the spawning tank and made it so the fry couldn't get past the grow-out tank? I decided to plumb a couple five-gallon tanks between the spawning tanks and drain pipe to see if my idea would work. To keep the fry in the grow-out tanks, I decided to use sponge filters plumbed into the bulkheads. After completing this, the only problem was that I'd have to wait through another winter to find out my answer.

In the spring of 2014 I saw there was some merit to my idea as both grow-out tanks had tiny fry swimming in them. One had three Banded and the other had six Blackbanded fry.

As the fry grew I decided I would set up all of my tanks with five-gallon grow-out tanks plumbed into the system. But how could I? I didn't have enough room. Out came the measuring tape. A couple weeks later I finally came to the conclusion that the only way I could accomplish what I wanted was to turn all of the tanks sideways. But that also meant I'd have to make the middle and top shelves wider to accommodate the extra length. So I proceeded to break down tanks, moving fish etc. one shelf at a time, and broke out the saw and drill.

After finally completing the shelves I started to reposition the tanks. As I thought, in the same space instead of 12 tanks, I ended up with 14 fifteen-gallon spawning tanks and 13 five-gallon grow-out tanks placed parallel and directly next to the spawning tanks. I liked that! Oh, the 14th aquarium is used as a refugium, housing *Gammarus* and black worms, etc.

As I set the tanks back up, because of the height of the five gallons, I placed the 15 gallons on 2x4 boards that ran the length of each side so the bulkheads would clear the top of the grow-out tanks. To avoid a repeat of the Johnny fry fiasco, I removed the reverse-flow undergravel filter plates.

Because of the placement and addition of tanks, I did have to add and relocate a few inlets and the return plumbing from the grow-out tanks to the drain. More measuring and cutting PVC and did I mention purchasing bulkheads for each grow-out tank? Three days later, everything had been moved and the grow-out tanks were re-incorporated into the system. To keep the fry from getting past the grow-out tank, I purchased more sponge filters to attach to the bulkheads.

I also decided to stack the limestone lengthwise in the center of each tank instead of against the back glass so males could claim territory on each side of the stack. The water would then enter on one side of the stack, circle around, and exit on the other side. It seemed to work well as each male would soon settle down into a specific area of the tank. The water, as well as the frozen food, flowed well around the rocks.

That fall, because I was starting to acquire more fish, I decided I wanted a larger algae scrubber. After some searching I purchased a 7-foot acrylic frag tank that was on eBay. After making a larger plate for the algae to grow on and customizing a vegetable crisper drawer, I had a new filter almost four times as large as the original (Figure 4).

The next couple of seasons were disappointing. I had acquired various other darters and had limited success. Sure, I had spawned and raised quite a few, like Christmas and Headwater, as well as the regulars like Blackbanded, Banded, and Johnny, but the numbers were very low. I was starting to second guess myself.

Then one night this last spring, while shining a flashlight into the tanks after the lights had gone off, I noticed fry were coming towards the light. I had noticed this in the past but never gave it much thought. But this time I also noticed they were coming up off the gravel. Then I asked myself if there was a way I could use light to attract the fry from the gravel to the surface and out the bulkhead? This one question was all I thought about for the next couple of weeks. Finally, it dawned on me. Why not move the bulkhead to the bottom of the tank? And if I cycled the lights to the filter opposite the tanks I could use that light to attract fry to the bulkhead.

Knowing that changing the placement of the bulkhead meant once again I'd be breaking down tanks, I decided to take a step back and see if there would be any other changes I thought I should make. And, of course, there were. I no longer liked the limestone stacked in the center. I had noticed that some individual darters seemed to enjoy the riffles and yet others of the same species liked a bit deeper water and I wanted to try and accommodate them too. I also wondered if current might play a role in spawning. After all, the creeks flow a lot more with snow melt and rains. And because I had so much light over the tanks, more than these fish probably received in nature, I decided I would back off on the amount they got. All of these would be easy to accomplish.

So again, the ritual of breaking down tanks began. After plugging the original bulkhead holes I marked the new placement of the bulkhead as close to the tank's bottom trim as possible, on the side of the tank where the grow-out tank would be located and as close to the front as I could get it.

After mounting the bulkhead and replacing each tank to its original spot, I started adding limestone to the rear corner of the tank to about 3/4s of the height of the tank with a thin layer of gravel between each rock. Once that was completed I added gravel over the top of it to fill any voids and covered the front bottom area up to the bulkhead. The tank would then have water flow to the high corner and then flow down towards the bulkhead.

Next I plumbed to the grow-out tank. Because of the bottom location of the bulkheads, I wanted to avoid any potential siphoning that could lead to flooding all over the floor if the filter overflowed. So as the PVC climbed over the top of the grow-out tank I added a "T" fitting in place of the corner as it entered the tank to break any siphon.

After completing the tanks and liking what I saw, I decided to ask the wife if I could expand my fish room into the next room. After all, we weren't really using it for anything. To my surprise she said I could. After building more shelves two high and incorporating most of what I had used in the fish room I added six 20 highs, two 33s, and two 44s as well as 10-gallon grow-out tanks (Figure 5). These would house the larger darters.

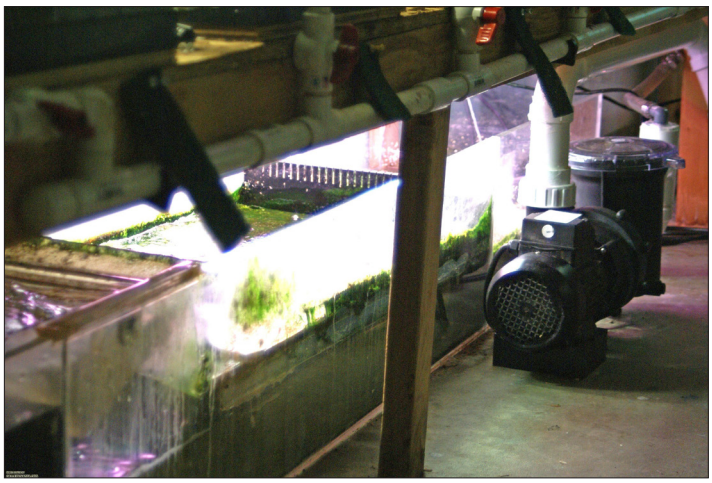

Figure 4. Algae scrubber made from frag tank.

Figure 5. Initial setup used on tanks in second room.

It was easy to see that with the new additions I was going to need a larger pump to move as much water as I would need. So I replaced the Mag drive with a 6,500-gph pump. To distribute the water more evenly, I purchased a six-way manifold with each way dedicated to its own row of tanks. The sixth one runs to the chiller. To increase the effectiveness of the chiller, I rerouted the chilled water back to the front of the pump to cycle at least some of it through the chiller again. It keeps the system at least 10 degrees lower than the ambient temperature.

Because the chiller is small, I also use a small window in the basement that I can open more or less depending on what the outside temperature is and how low a temperature I want my system to be.

This winter, like usual from November to March, I cycled my lights down by four hours, the water temperature dropped

into the low 40s, and I cut back water flow by ½ in the riffle tanks. I also reduced the amount of light above the tanks to half of what they normally get by removing one bulb.

This spring I finally was able to see some more positive results. Not only did I get fry from some darters I had never spawned before, but I got pretty good numbers from some species. I'm still not where I want to be but I'm getting closer. And I believe I have figured out why my numbers were so low on some of them though there are a couple exceptions.

On a few tanks, instead of having the screen come straight out from the bulkhead, I ran PVC so I could create two drains, one in the low area and one in the high area of the tank. So instead of being parallel to the gravel, they were vertical. This created less of an area for the fry to enter near the gravel. I am in the process of changing this. Another change I intend to make is to switch out the 10-gallon grow-out tanks with 5-gallon ones. This keeps the food more condensed and it is easier to spot fry sooner.

Here is a list of what spawned this year:

- *Etheostoma blennioides*
- *Etheostoma burri*
- *Etheostoma caeruleum*
- *Etheostoma flabellare*
- *Etheostoma inscriptum*
- *Etheostoma jimmycarter*
- *Etheostoma lawrencei* (F1 second year) and F2
- *Etheostoma nigrum*
- *Etheostoma rufilineatus*
- *Etheostoma thalassinum*
- *Etheostoma variatum*
- *Etheostoma zonale*
- *Percina caprodes*
- *Percina roanoka*

I have successfully raised fry of all of these except *Percina caprodes, Etheostoma variatum,* and *Etheostoma jimmycarter.*

To raise the fry, I did not clean the detritus on the bottom of the tanks out of fear of sucking up unseen fry. But it seems to have been beneficial. It's not uncommon to see some fry foraging in it. Something else I did was to add dried leaves to the grow-out tanks for bacteria to grow. I don't know how beneficial it was initially but it didn't hurt. One of my fears was having *Gammarus* in the grow-out tanks but it was unfounded. In fact, there is a nice supply in each grow-out tank for the fry to feed on once they are big enough. Some of the first foods I feed the fry are various worms like banana, walter, and micro. As they grow I add decapsulated brine shrimp eggs, golden pearls, and so forth. Because of the way water enters the tank, it keeps frozen foods like bloodworms moving but it isn't so strong the fry get worn out trying to get food. Now most get fed bloodworms, mosquito larvae, and black worms.

After about five years of using the algae scrubber, I decided I wanted to try something different so I wouldn't have to keep cleaning the algae plate. So I removed all the internal parts that did the scrubbing and I replaced them with 4 inches of gravel and nine Common Rush, *Juncus effusus*. So far it has been working out great.

I hope that my experiences will be helpful and provide food for thought.

Editor's Note: If you have specific, technical questions for Ken, he can be contacted at: naa@imonmail.com