Aquaculture in the Classroom Newsletter
Volume 6, No. 3, March 2018

Dear Aquaculture Enthusiasts:

I am writing this on Pi Day and St. Patrick's Day. The weather has been warmer and then cold and then warmer and then… My fish in the ponds do not know what to do. You have about 75 production days left to plump up your fish. This newsletter will address that as well as the option to do some tilapia spawning. Spawning should be possible any time you can keep the water consistently between 82 and 90F. These articles are revised from articles written in 2014 – 2016.

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How much growth is possible with my tilapia for one school year?

A tilapia fish farm plans on their fish growing about 3 grams per day. Some farms grow tilapia at a rate of 5 g/day. Naturally you would like to have large fish by the end of the school year. A rule of thumb is egg to plate in 9 months. Plate means 1-1.25 lbs. Beyond that size, more time is needed; time you don't have. If you received 13g fish September 1, you can expect them to be 40g by October 1 and 80g by November 1. At this size, the fish can gain 3g/day. If they do, you will add 90g to each fish each month. So, December 1 they will be 120g, January 1 they will be 210g, February 1 they will be 300g, March 1 they will be 390g, April 1 they will be 480g (1 pound is 454g), May 1 they will be 570g (1.25lbs), and June 1 they will be 660g (1.45lbs). Now you can have the fish fry, impress the administration, and the kids have a good meal. How often does this happen? Rarely. Why? You have a classroom, not a commercial enterprise.

Did you feed 7 days a week? Probably not. If you fed 6 days per week, you lost 100 grams of production. If you fed 5 days per week, you lost 200 grams of production. That still leaves you with a 460g or 1lb fish. But there were those days from December to February when the temperature did not get above 26C (78F), so you lost a gram of production each of those days, another potential loss of 90g. Our fish is now 370g (0.8lb). And then there was the concern about overfeeding the fish so you lost another 0.5g per day for a total of 195g. The fish are now 175g or 0.4lb fish. Smaller than you hoped, but you kept the fish alive and your students saw the entire cycle, and that's not bad. Two schools received fish close to February 10, 2018. One received 220g fish and the other received 32g fish. Assuming feeding 5days/week and 3g/day growth, each has the possibility to add 225g/fish.

The closer the water is to 82F (28C), the better the fish will grow. The more feed they eat, the more flesh they can add. Keeping up with water chemistry testing will tell you if you are pushing the fish too hard. You can also wait for fish behavior to demonstrate this (e.g. sucking air from the top of the tank, aimlessly milling around near the top of the tank, slowing down on feeding, dying), but you will lose less production by using your water quality data to guide you. The more stable the water quality is maintained, the less likely to lose production. This

means keeping the pH, total ammonia nitrogen (TAN), nitrite, and dissolved oxygen (DO) in check. See (http://www.uapb.edu/sites/www/Uploads/AQFI/Ext/Classroom/11RecirculationGuidelinesChecklist.pdf and http://www.uapb.edu/sites/www/Uploads/AQFI/Ext/Classroom/13Tilapia_Quick_Fact_Sheet.pdf).

How much growth might I expect from my tilapia from now to the end of school?

A tilapia fish farm plans on their fish growing about 3 grams per day. Some farms grow tilapia at a rate of 5 g/day. It is difficult for this to happen until the fish are at least 50 grams in size. For those of you who received your fish this semester, the fish are probably not that big, but you can count on 1 g/day until they reach 50 g.

You can run the calculation with your class to see what the possibilities are between now and the end of school.

1. Use a net to capture some fish. 20-25 would be nice.

You may also use a cast net.

2. Weigh them in a tared bucket of water (you know, the bucket and water are weighed so you do not include that weight with the weight of the fish).
3. Count them
4. Return them to the water.
5. If I had 20 fish and they weighed 1 kilogram, I have 1000g/20fish or 50 g/fish.
6. If I have 20 fish and they weighed 2 lbs, I have 32oz/20fish or 1.6oz/fish (although only a 45 g fish, I am going to consider it able to grow 3 g/day)
7. If I am feeding 5 days/week, and those 50 g fish are growing nicely, I can calculate they will grow 3 g/day x 5 days/week = 15 g/wk.
8. Starting from March 14 and ending on May 29, we have 11 weeks of growth. 11 wks x 15 g/wk = 165g of growth per fish.
9. Add 165g to 50 g for 215 g/fish.
10. 215g per fish / 454g per lb = 0.47 lb per fish. That's almost half a pound and just large enough to eat for the last day of class.
11. For those of you using pounds and ounces, use a growth rate of 0.1 oz/day. So, with 11 weeks left and feeding 5 days per week, we get 0.1oz/day/fish x 5 days/wk x 11 wk = 5.5oz of growth /fish. Add the original 1.6 oz = 7.1 oz or 0.44 lb and possibly edible. What happens if you feed 6 days per week? 7?

If you started off with ¼-½ lb fish this semester, you have a chance to achieve 1 lb by the end of the year. This exercise will allow students to work with the fish; work with scales (fish and mechanical); work with Metric and English conversions; make predictions about future growth (that whole hypothesis thing for STEM folk); and compare their predictions with true results at the end.

If you have students in your class who have trouble with conversions, they may be able to remember that 1 lb equals 454 grams. I was alerted to this when a fellow farm worker asked me why, after I calculated how many pounds per fish for the tilapia fingerlings, I always multiplied the number by a big block Chevy engine. I, of course having no engine sense, asked him "what do you mean?" Now having the upper hand, he said, "You know, a Chevy 454." So, I taught him the conversion and he taught me a little about engines. (Example: 0.05lb/fingerling x 454g/lb = 22.7g/fingerling)

Sexing and Spawning Your Own Tilapia

Soon it will be warm enough for tilapia to spawn and the eggs to hatch. Summer is an excellent time for this to happen, unfortunately, this is not Cuba, so the students are not in school for the summer. Nonetheless, you can prepare an environment for tilapia to spawn in such a way you could have more than you need to restock your system by the time the students come back to school.

You'll need to sex the fish to be sure you have a mix of males and females and you will need an environment that allows the females to get away from the males while they are incubating the eggs. Remember that tilapia are mouth brooders, so the female will hold the eggs in her mouth for several days (see photo) until the eggs hatch. Even then, they stay close to Mom and scurry inside if danger appears. Once they are on their own, the fry will often stay in a school and swim high in the water column and around the perimeter of the tank. This is a perfect time to net them out and put them in an aquarium or other tank until they become large enough to face the big world. If there is not food in the tank for the adult fish, they will use the offspring as snacks, so it is a good idea to remove the fry as soon as they are noticed.

Summer Tilapia Spawning

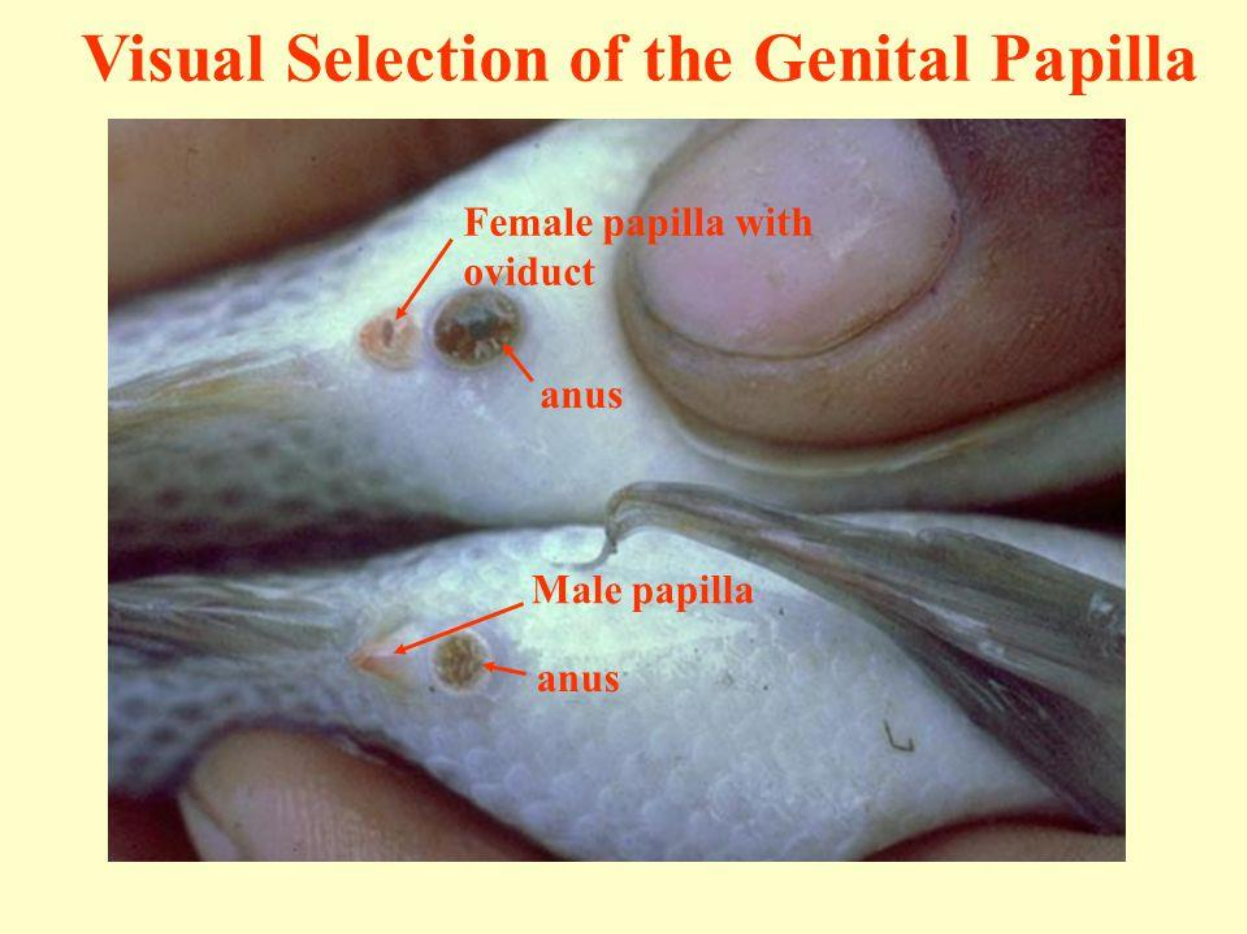
If you are interested in spawning tilapia over the summer, May/June is the time to set up a tank, stock it, and let nature take its course. It is best to use a tank that does not have a biofilter, so the young fish do not get scooped up by the pumps and run through the biofilter.

Rather, a tank with a flat bottom and 18 – 24 inches of water will suffice for spawning. The water may be allowed to turn green. This provides food for newborn fish and reduces water clarity, so the males do not constantly bother the females. Check the tank (a cattle watering trough is a good size) every two weeks to see if fry are swimming around the edges of the tank. If so, net them out and put them in another tank to protect them from hungry adults.

I once had a tilapia in my home aquarium incubating eggs in her mouth and it was quite enjoyable watching that process. I decided to get her a small tank so when she spit out her fry they would not be prime prey for all the other fish in the aquarium, but I was a day too late; alas, her mouth was empty, and the fry could not be found.

If you have an aquarium you can use, take some tilapia out of the main tank and put them in the aquarium. It is possible they will spawn, and you can watch the incubation process.

Some tilapia raise the eggs to fry in their mouths. Some species do not. For most that do, it is the female who is responsible for the incubation work, but in a few species, it is the male. The tilapia you have, *Oreochromis niloticus*, are mouth brooders and the females hold the eggs in the mouth. Depending upon water temperature, it takes about a week for the eggs to hatch and another four days to absorb the yolk sac and become good swimmers. During that period, the female does not eat. This is a contributing factor to males growing faster than females.



From Len Lovshin slide show (entire slideshow at end of newsletter)

If you do take several fish from your grow-out tank and put them in an aquarium (my 30 gallon aquarium has about 15 three-inch tilapia), you may rely upon the law of averages to deliver both males and females, or you can examine the fish before you put them in the aquarium to ensure you have a mix of sexes. Generally, tilapia are stocked at a ratio of one male to three females. The bigger the fish are, the easier it is to sex them. If you look at the diagram above, you can see both males and females have an anus and both have a urogenital papilla. This is a sort of fleshy area below the anus (closer to the tail). For the males, there is a urogenital aperture (aka the pee-hole) at the end of the papilla. Females have this too, but it is not at the very end of the papilla. If you gently squeeze a male (sometimes just pick up a male), a nice stream will often come squirting out similar to the Mannequin Pis sculpture in Brussels, Belgium. Some people use this as a definitive trait to define a male and while it is far more often true that the males do this than the females, the females are similarly equipped and can do the same thing even though they usually do not. It is best to continue and look for the more convincing sexual differentiating apparatus. And that is the oviduct or vent. This is a slit across the papilla (across the width, not the length) that can vary from almost invisible outside the breeding period to a visible slit to an almost round hole that is impossible to miss when breeding is imminent.

Applying more pressure on the male's abdomen with a finger on either side and stroking down toward the tail can push some semen or milt out the urogenital pore. This will be white and viscous. If this happens, you have a male. If you use this procedure and the oviduct opens or eggs or pre-egg material comes out, you have a female. There is an easier way to see that oviduct. If you have a bottle of 0.2% methylene blue, you can put a drop on the papilla area. It will get "caught" in the slit that is the oviduct and by seeing this you will be sure you have a female. You may be less “sciencey” and use blue, green or red food coloring instead of methylene blue. The coloring method reduces the need to squeeze on the fish and you can see this opening between the aperture and the anus far more easily, even in fish as small as 2 inches in length. When sexing fish, I try to make sure I have good light, my glasses and, if possible, one of those nifty magnifying glasses on a goose neck. With the aid of the methylene blue, I can do the job without good light and a magnifying glass, but I still need my glasses.

Aquaculture in the Classroom for 2017-2018

The following schools have received fish for their systems:

Guy Berry College and Career Center	Kyle Tardiff
Valley View Junior High School	Anthony Sanders
Magnet Cove High School	Kristyn Sheets
Tuckerman High School	William Wiggins
Paragould High School	Johnnie Clark
Riverside High School	Marty Wynn
Conway High School	Reed Kelley
Alpena High School	David Good and Amanda Woods
Moody Elementary School	Kim Gober and Janice Rose
Riverview High School	Phillip Thomas

Green Forest High School	Josh Dale
University of Central Arkansas	Emily Harris
Monticello Middle School	Shawn Curtis
Green County Tech Junior High School	Ben Gander
Star City High School	Leanna Britton
Lakeside High School*	Theodore Brown
Nettleton High School	Brian Easton

*Fish harvested from Conway system and delivered to Lakeside

The following schools were visited to diagnose or design a system:

Gentry High School	Wendy Jackson
England High School	Courtani Bell
Star City High School	Leanna Britton
Trumann High School	Caroline Lester, Matt Beegle
Fayetteville High School	Jade Cameron
Oark High School	Sondy Sanders
Hilcrest High School	Alysia Coles

The following schools were visited to deliver presentations:

Conway High School	Reed Kelley
Crossett High School	Sammie Cox

Links to Bauer in Bangladesh

Winrock: https://www.winrock.org/press/uapb-extension-specialist-teaches-young-fish-farmers-in-bangladesh/
Twitter: https://twitter.com/WinrockIntl/status/968631542829461504
Facebook: https://www.facebook.com/winrockinternational/posts/10156093508992207
LinkedIn: https://www.linkedin.com/feed/update/urn:li:activity:6374399065341464576
Instagram: https://instagram.com/p/Bft_hs3n-_5/

Len Lovshin, Ph.D. Tilapia Slideshow: http://slideplayer.com/slide/4186205/

Best Fishes,
Bauer