Aquasafra Tilapia grow-out suggestions. This document is a draft of an ongoing project to provide a grow-out manel for Aquasafra customers. It is currently in just in two parts, but more will be added over the next few months.

<u>Section 1:</u>

1.1, Water quality is a critical factor when culturing any aquatic organism. Optimal water quality varies by species and must be monitored to ensure growth and survival. The quality of the water in the production systems can significantly affect the organism's health and the costs associated with getting a product to the market. Water quality parameters that are commonly monitored in the aquaculture industry include temperature, dissolved oxygen, pH, alkalinity, hardness, ammonia, and nitrites. Depending on the culture system, carbon dioxide, chlorides, and salinity may also be monitored. Some parameters such as alkalinity and hardness are fairly stable, but others like dissolved oxygen and pH fluctuate daily. It is important to establish a standardized water quality testing protocol for your particular situation. Know the tolerance range for your culture species, establish critical levels, and be prepared to act if a problem occurs. The document below indicates the water quality Standards for Aquasafra's Tilapia.

<u>Aquasafra Water Quality Standards for Tilapia (***Table 1***)</u>

1. **Temperature - Ideal growth at 82º**

90+	Stressed – expect beginning of mortalities over 95º if in this range for several days.
85 to 89	Slower growth- Limit handling/ moving of fish in this range.
81F to 83F	**Ideal for grow out,** 82 is optimal.
80 to 75	Slower growth- Limit handling/ moving of fish in this range.
60 to 55	Stressed – expect beginning of mortalities if in this range for several days.

2. Ammonia – Ideally less than 0.03 ppm NH3

0.04 to 0.05 – reduce feed by 1/4
0.05 to 0.06 – reduce feed by 1/2
0.07 or higher – stop feeding
0.09 or higher – danger!!! lower pH to 7.0 by adding phosphoric acid or other available acid

3. Nitrite - ideally less than 0.4 ppm (if Chloride /Cl^-/ is below 10ppm**)**

0.5 to 0.6 ppm – reduce feed by 1/4
0.6 to 0.7 ppm – reduce feed by 1/2
1 ppm – danger!!! Stop feeding

If nitrite level does not decrease to 0.6 ppm after 5 days at 1/2 feed – salt to 100 ppm NaCl (if no plants in system**) as a temporary fix, and resume feeding at a rate that will keep nitrite below 2 ppm**
Check that O2 is above 6, pH has been at least 7.4 or higher, Check carbonate – should be above 200 ppm. Check Biofilter is circulating properly (no stagnant dead zones)**– add more beads/biomedia if everything else has been tried.**

4. pH – OK range between 7.2 to 7.7,
Optimum level is 7.6, - unless biofilter and NH3 levels are Unstable,
("Unstable" = NH3 levels testing above 0.05 , or spiking up and down every few days)

If unstable, desired pH level is 7.3
If NH_3 above 0.09 to 0.1 – lower pH to 7 (or as low as 6.5 to get NH_3 to safe level)

For RAS systems: If pH is Lower than 7.4 – Raise the pH by Adding lime/bicarb/ (CAOH/ CAO) or some form of Hydroxide (OH) to the biofilter bead area at the rate of ~1/8 lb. of lime per pound of the total daily amount of feed fed. If one treatment keeps pH in desired range after one day then stop adding lime. If pH keeps dropping each day, keep adding each day until the pH rises to a pH of 7.6

7.4 to 7.5 - cut lime/bicarb by 1/2 (add $1/8^{th}$ lb. of lime / pound of daily total of feed)
7.6 or above - stop adding lime/bicarb.
7.7 or higher add enough phosphoric acid (or equivalent) to the beginning of the Biofilter, to bring the pH back to 7.4

If amount of buffer needed to keep pH constant is increasing relative to feed rate, likely is a CO_2 problem. If the amount of buffer needed to keep pH constant is decreasing, generally means biofilter is deactivating.

(When adding acid – put 50 mL ~ ¼ cup, in five gallons of water mix well, and then pour this acidified water slowly into the biofilter, add ¼ of bucket, wait 15 minuets, check pH, add another ¼ of the bucket, wait 15 more minuets. Keep checking pH and adding acid until pH is in desired range.)
CAUTION: WHEN ADDING ACID – ALLWAYS ADD ACID TO WATER NEVER WATER TO ACID!! <u>Put water in bucket first, then put in the acid</u>.
When handling acid: ***Always ware safety goggles and acid proof gloves.***

5. Carbon Dioxide (when O_2 is at saturation ~7.5 to 8PPM O_2 for 80º water),
Ideally keep below 6 but up to 15 PPM is OK if dissolved CO_2 is at saturation.
Over 15 ppm – reduce feed by 1/4
Over 30 ppm or higher – reduce feed by 1/2
Over 40 PPM – Stop feeding
If O_2 is below saturation, (less than 8.2 ppm at 78 degree's) reduce upper level of CO_2 range by % O_2 levels are below O_2 saturation.
i.e. If O_2 = 6 PPM, reduce CO_2 maximum levels by 25% - Max CO_2 = 11 PPM
If CO_2 is consistently high, *improve aeration to improve CO_2 stripping* / or increase size of stripping tower. If high CO_2, Don't use Calcium Carbonate as a buffer, as it adds CO_2.

6. Electrical Conductivity (EC)
A conductivity meter makes it straightforward to monitor water salinity and levels of total dissolved solids, TDS or total dissolved salts, measured in PPM or Mg/L.
Ideal EC levels are different for RAS vs flow through tank or pond systems.
For RAS systems, generally the higher the better, and levels as high as 300 to 1000 can be OK. Hi EC in RAS is generally reflecting the build up of NO_3 or Nitrate. In RAS systems EC is best used as an indicator of other issues, watching how EC behaves relative to other parameters. Over time EC can be an early indicator of trouble, but since each RAS system can be very different, the ideal EC scale needs to be calibrated for each system. Very Generally a dropping EC level can indicate that a Biofilter is deactivating. (The lowering of the amount of buffer additions needed to keep pH constant is another indication of a deactivating Biofilter.)
For Flow Through tank systems with clear water and no to low algae, EC can be a rough way of determining if TAN levels are getting high without having to do a TAN test and conversion to NH_3.
For fresh water flow-through tanks (with no salt added, and low salinity well's)
EC Below 330 to 350 will generally mean TAN is below 1 PPM
EC Above 360 to 380 will generally mean TAN is above 1 PPM *<u>and a NH_3 test should be done</u>*.
EC Above 400 will almost always mean TAN is above 1 PPM and likely in the 2 to 8 PPM range.

There are many other tests that can be done. The next most productive is ORP, or Oxidative Reduction Potential – and like EC needs to be monitored with other factors, but generally a higher OPP, the healthier a system. Others are Alkalinity, Hardness, P, K, Mg, Cl, Na and others to numerous to get into in this short guide.

Most test kits are clear and simple, testing Ammonia/ NH_3 needs a bit of explaining:

<u>1.2 Testing Ammonia:</u>

A common mistake in measuring Ammonia NH_3/ Ammonium NH_4 in fish tanks is assuming the test kits used are reading out as the toxic form of Ammonia / NH_3. (Ammonia is sometimes referred to as *'un-ionized* ammonia.) The kits are measuring a total of TAN or Total Ammonical Nitrogen, which is a combination of several nitrogen compounds.

A common practice when measuring Ammonia is to assume the TAN # can tell you toxic Ammonia. You can't unless you know the pH. For example a TAN of 2 with a pH of 6.5 is not toxic, but a TAN of 2 with a pH of 8 is very toxic. Some folks get away with just using the TAN # from their basic test kits, if their pH is constant, and have mentally calibrated TAN readings with how their fish are acting. This works to a degree, but they are often putting their fish under small to medium stress levels just using TAN. And remember that Stress is accumulative. A little here, a little there, it adds up to causing disease outbreaks. So, it is important to keep lots of little stresses from adding up to collectively large amounts of stress, that can cause (on good days) slower growth, poor FCR's and (on bad days) disease outbreaks.

One needs to know just the NH_3 levels to know the toxicity and potential stress on ones fish. NH_4 is not toxic in levels as high as 50 ppm and higher, however NH_3 starts being toxic at 0.06 PPM, I.e. a really small tinny amount. NH_3 is quite toxic, which is why it is used as a bathroom/ kitchen cleanser to kill bacteria. (And used as a gas to kill people in war as nitrogen mustard gas.) You need to know your NH_3 levels! Not just TAN. All test kits provide a TAN level, and you then need to know the pH to determine what part of the TAN reading is the toxic part as NH_3.

The toxicity of Nitrogen as TAN is in equilibrium between NH_3 (ammonia – toxic) and NH_4 (ammonium – not toxic). I.e. some part of TAN is NH_3, and some part is NH_4. The equilibrium that controls the % that is NH_3 and the % that is NH_4 is pH. The higher the pH the higher the % of TAN is toxic NH_3.

<u>How to Convert a TAN Reading into Ammonia/NH3:</u>

Start by following the directions in the Ammonia test kit to calculate TAN (Total Ammonical Nitrogen). As an example, let's say you get a TAN reading of 2. Then using the pH and temperature look up on Table

2. what is the % of TAN that is NH_3. Multiply TAN times the % to get NH_3.

For example, assuming a TAN of 2, and temperature for the day was 79.1 and pH 7.5 you would use the top row on table 2., look for the closest temperature to 79.1. You will see the closest value is 82.4 for the top temperature column on (rounding up from 79.1 to the next highest reading on the temperature scale which is 82.4). Then go down to the side pH column. Again you will see there is not a 7.5, so use 7.6 the next highest number (always round up). The intersecting row of 7.6 with column of 82.4 you will see gives you the number 0.271 This is the % of TAN that is NH_3 reported as a decimal. I.e. 27% is the %, since the number is given as a decimal to make it easier to do math with. (Some tables report in %, and then you need to divide by 100 to convert to a decimal).

Now, this will give you the value as NH_3-N, but does not account for the weight of the Hydrogen Ions, to account for pure Ammonia as NH_3, one needs to multiply by 1.2 to account for the weight of the H ions. If this is confusing, as it gets into a bit of real chemistry, just know you need to multiply by 1.2 for most test kits. If you aren't sure ask the manufacture of your test kit if this is needed. If the agent you get on the phone does not know about this 1.2 correction factor, ask for someone that knows enough chemistry to explain it.

The formula is:

<u>TAN times % Ammonia/NH3 times 1.2 to = NH3</u>
<u>or TAN X %NH23 X 1.2</u>

<u>Putting in some numbers</u>:

TAN X 0.271 Or in this example 2 X 0.271 = .542
.542 X 1.2 **= 0.65 NH3** – (*this is quite high, NH3 should be below <u>0.06</u> !)*

If TAN was 1: 1 X 0.271 X 1.2 **= 0.33** (*this better but still above <u>0.06</u>*)

If TAN was 1, and the pH was 7 then:
Looking up on the table with a temperature of 82.4 and pH of = the percent TAN = 0.0069
TAN of 2 times % of 0.0069 times 1.2 = NH2
2 X 0.0069 X 1.2 **= 0.017** (not rounding up it is 0.01656) 0.017 This is quite good, *well below the limit of <u>0.06</u>*
<u>Table 2</u>.:

pH	Temperature													
	42.0 (°F)	46.4	50.0	53.6	57.2	60.8	64.4	68.0	71.6	75.2	78.8	82.4	86.0	89.6
	6 (°C)	8	10	12	14	16	18	20	22	24	26	28	30	32
7.0	.0013	.0016	.0018	.0022	.0025	.0029	.0034	.0039	.0046	.0052	.0060	.0069	.0080	.0093
7.2	.0021	.0025	.0029	.0034	.0040	.0046	.0054	.0062	.0072	.0083	.0096	.0110	.0126	.0150
7.4	.0034	.0040	.0046	.0054	.0063	.0073	.0085	.0098	.0114	.0131	.0150	.0173	.0198	.0236
7.6	.0053	.0063	.0073	.0086	.0100	.0116	.0134	.0155	.0179	.0206	.0236	.0271	.0310	.0369
7.8	.0084	.0099	.0116	.0135	.0157	.0182	.0211	.0244	.0281	.0322	.0370	.0423	.0482	.0572
8.0	.0133	.0156	.0182	.0212	.0247	.0286	.0330	.0381	.0438	.0502	.0574	.0654	.0743	.0877
8.2	.0210	.0245	.0286	.0332	.0385	.0445	.0514	.0590	.0676	.0772	.0880	.0998	.1129	.1322
8.4	.0328	.0383	.0445	.0517	.0597	.0688	.0790	.0904	.1031	.1171	.1326	.1495	.1678	.1948
8.6	.0510	.0593	.0688	.0795	.0914	.1048	.1197	.1361	.1541	.1737	.1950	.2178	.2422	.2768
8.8	.0785	.0909	.1048	.1204	.1376	.1566	.1773	.1998	.2241	.2500	.2774	.3062	.3362	.3776
9.0	.1190	.1368	.1565	.1782	.2018	.2273	.2546	.2836	.3140	.3456	.3783	.4116	.4453	.4902
9.2	.1763	.2008	.2273	.2558	.2861	.3180	.3512	.3855	.4204	.4557	.4909	.5258	.5599	.6038
9.4	.2533	.2847	.3180	.3526	.3884	.4249	.4618	.4985	.5348	.5702	.6045	.6373	.6685	.7072
9.6	.3496	.3868	.4249	.4633	.5016	.5394	.5762	.6117	.6456	.6777	.7078	.7358	.7617	.7929
9.8	.4600	.5000	.5394	.5778	.6147	.6499	.6831	.7140	.7428	.7692	.7933	.8153	.8351	.8585
10.0	.5745	.6131	.6498	.6844	.7166	.7463	.7735	.7983	.8207	.8408	.8588	.8749	.8892	.9058
10.2	.6815	.7152	.7463	.7746	.8003	.8234	.8441	.8625	.8788	.8933	.9060	.9173	.9271	.9389

<u>Table 3.</u>
Table 3 is a less accurate, but faster way to calculate NH3 levels. It's color coding also give a good visual indication of how pH impacts the toxicity of TAN as NH3.
This is simplified chart that does the calculations converting TAN into NH3. It is a bit less accurate, (*and #'s disagree by a little bit with Table 2.*) but unless you are using very accurate test kits, (like a HACH or equivalent reagents, not lower quality API reagents or equivalent) the error/ difference between Table 2 and Table 3, is not worth the accuracy Table 2. provides. But if using good reagents use Table 2.

Table 3:

TOTAL AMMONIA CONCENTRATION (ppm NH_4, N)											
pH	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
6.0	.001	.001	.002	.002	.003	.003	.004	.005	.005	.006	
6.2	.001	.002	.003	.004	.005	.005	.006	.007	.008	.009	*A
6.4	.002	.003	.004	.006	.007	.009	.010	.011	.012	.014	
6.6	.002	.005	.007	.009	.011	.014	.016	.018	.020	.022	
6.8	.004	.007	.011	.014	.018	.021	.025	.028	.032	.035	
7.0	.006	.011	.017	.022	.028	.034	.039	.045	.050	.056	*B
7.2	.009	.018	.027	.035	.044	.053	.062	.071	.080	.088	
7.4	.014	.028	.042	.056	.070	.084	.098	.112	.125	.139	
7.6	.022	.044	.066	.088	.110	.131	.152	.175	.197	.219	*C
7.8	.034	.069	.103	.137	.171	.206	.240	.274	.308	.343	
8.0	.053	.107	.160	.213	.266	.320	.373	.426	.479	.533	
8.2	.082	.194	.246	.327	.409	.419	.573	.655	.737	.818	
8.4	.124	.248	.371	.495	.619	.743	.866	.999	1.114	1.238	
8.6	.183	.366	.549	.732	.915	1.098	1.281	1.463	1.646	1.829	*D
8.8	.262	.524	.786	1.048	1.310	1.571	1.833	2.095	2.357	2.619	
9.0	.360	.720	1.08	1.44	1.80	2.160	2.52	2.88	3.24	3.599	

*A = SAFE *B = STRESS *C = SLOW DEATH *D = RAPID DEATH

Chart of fish ammonia toxicity

In Table 3, the top row (#'s 1 through 10) is you TAN number. The side column is pH.

Using the above example of a TAN of 2 and a pH of 7.6 this chart says NH3 = 0.44. Not the same as Table 2, but still good enough to say your NH3 is too high (*it's above 0.06*)

You can use Table 3 to see how pH impacts toxic NH3. Look at the TAN column of 2, at pH of 7, the NH3 is reported as 0.011 – which is good *It's below 0.06*, and it is shaded as light Blue – OK.
But if you continue down the pH Column, look at when pH is 7.6, with TAN at 2 NH3 is now 0.044 – just barley OK, but is shaded in a darker blue (*Table 3 chart is more conservative as it is for aquarium fish, not Tilapia, so they have a lower standard for toxic NH3 than 0.06*) At a pH of 7.8, with TAN at 2, Table 3 shows NH3 as 0.69, Shaded as dark blue – *Stressed!* At a pH of 8, NH3 is 0.107, now light purple - *Slow Death!*

Play with the chart – look at different TAN's and pH and see the range you need to keep your system/ tanks in. Sometimes people will have TAN levels at 8, which means, to not be killing your fish, you need to have the pH be no higher than 6.8 to not be stressed, or below 7.4 to not be in the "Slow Death" zone.

This should clearly show why one of the easiest ways to prevent a system that has a high NH3, is to lower the pH. If you have a TAN of 8, and a pH of 7.6, (Slow Death) you should put some acid in your tanks to lower the pH down to the range of 7.2, to quickly get out of Slow Death, and just into a zone of Stressed.

Putting in Acid will solve the immediate problem of high NH3, but not why the TAN was high in the first place. TAN will be high because either not enough water is being flushed through tanks, or for a RAS the Biofilter is not handling the amount of feed being fed. It is best to calculate NH3 each day to at least three times a week, and not let it spike by reducing feed or increasing flushing before NH3 is at a Stressed level (*NH3 above 0.06 ppm*).

In a RAS system (over the long-run, other than an emergency) it is counterproductive to lower the pH because biofiolters perform much less efficiently at lower pH. So by putting in Acid to lower the pH to reduce NH3 toxicity one is making the sort term problem better (reducing high NH3) but making the long term issue worse, making the filter less efficient there will be more NH3. The long-term solution is to reduce the pH for a temporary fix and reduce feeding until TAN comes down to well below 0.06 ppm. Then raise the pH back up to a level just below pushing NH3 into the Stressed zone (below 0.06). Then start raising feed levels back up until NH3 starts getting close to 0.06 ppm. Established biofilters can adjust to higher feed within 3 to 6 days. So raise feed every 4 to 5 days to allow the biofilter bacteria to grow to higher densities to handle more NH3 the additional feed will generate. The higher the pH the more efficient a biofilter will run, can handle more feed. But if at an ideal pH of 7.4 to 7.6, the TAN keeps spiking and NH3 exceeds 0.06 then the biofilter needs more media to make more surface area. (And lots of other areas could be causing issues like to many solids/ poor drum filter performance, two low of a tank water turnover rate to name just a few.)

For flow-through tank systems, Lowering the pH is less effective because often the flushing rate flushes out the acid to quickly to be effective, or alkalinity in well water counteracts/ nuteralizes the acid requiring a lot of acid. In pond systems with algae, the algae will drive the pH up, requiring a huge amount of acid until the sun goes down. In the case of tanks or ponds, the best option is to just not let the TAN/ NH3 get too high in the first place by not over feeding. But in an emergency, if NH3 is in the Rapid Death zone, and fish are visibly stressed and dying, then throwing in lots of acid to lower the pH is worth trying.

In any of the above cases – having some quantity of inexpensive acid on hand can be essential to stop an NH3 stress or slow death event, until NH3 can drop to a safe, non-stressed level. The best acid/ most effective is Phosphoric Acid (H3PO4), but it is expensive. The next best is Hydrochloric Acid / HCL, or less pure, commercial forms of HCL, or Muriatic acid. Having a few 35 to 55 gallon barrels around, just in case, can be a life saver.

One other comment: Tilapia are tough, and often can handle high NH3 for some time, sometimes months or years (if they get that old before harvest), and not show any visible signs of stress. But they are stressed! And this stress will show up in other non-visible ways like slower growth, and lower feed utilization (higher FCR). They can handle this stress over a long time, but if other stressors are added, like low O2, or low Temperatures, or high NO2 or high dissolved CO2, then the stressors add up, and the rate of Mort's can slowly or rapidly increase. In worst cases other diseases like strep and a range of parasites can become much larger problems. It can seem like these issues 'came out of no-whare', but they were building all along, and if the NH3 is kept below 0.06 then at least toxic Ammonia/ NH3, will not be part of the problem.

Additional Conversion Factors Table 2.2.

The Conversion needed for some TAN to NH3 calculations of multiplying by 1.2, is often needed for other tests like Nitrite, or NO2. In the case of NO2/ Nitrite, many test kits require results to be multiplied by 3.3 to be accurate. Be sure to check with the manufacturer of your Nitrite reagents to see if this is necessary.

Table 2.2 **Summary of water quality equations**
Equation 1: Un-ionized ammonia (NH_3) from total ammonia ($NH_3 + NH_4^+$) Total ammonia (from test) × fraction of un-ionized ammonia (from **Table 2.1**) = NH_3
Equation 2: Un-ionized ammonia (NH_3) from total ammonia nitrogen (NH_3^--N + NH_4^+-N) Total ammonia nitrogen (from test) × fraction of un-ionized ammonia (from **Table 2.1**) × 1.2 = NH_3
Equation 3: Nitrite-nitrogen (NO_2^--N) to nitrite (NO_2^-) NO_2^- -N × 3.3 = NO_2^-
Equation 4: Nitrate-nitrogen (NO_3^--N) to nitrate (NO_3^-) NO_3^- -N × 4.4 = NO_3^-
Equation 5: Equivalency of gr/gal to mg/L 1 gr/gal = 64.79891 mg/gal ÷ 3.785 L/gal = 17.1 mg/L
Equation 6: Total alkalinity in gr/gal (drops) to mg/L Drops of titrant (= gr/gal) × 17.1 = Total alkalinity in mg/L
Equation 7: Total alkalinity in dKH to mg/L Drops of titrant (= dKH) × 17.86 = Total alkalinity in mg/L
Equation 8: Total hardness in gr/gal (drops) to mg/L Drops of titrant (= gr/gal) × 17.1 = Total hardness in mg/L
Equation 9: Total hardness in dGH to mg/L Drops of titrant (= dGH) × 17.86 = Total hardness in mg/L
Equation 10: Calculation of % N_2 $\%N_2 = [\%TGP - (\%DO \times 0.2095)] \div 0.7808$

<u>Section 2: Stocking, Feeding, and Grading</u>

<u>2.1: Recommended Feeding Rate Based on % of Body Weight:</u>

Multiply % feeding range for the size of fry times the # of fry in a tank

Example: For a tank with 10,000 fry, that are 5 grams in size are fed at 15% of their body weight. So, for a tank with 10,000 fry = 10,000 X 5 X 0.15= 7,500 grams of feed fed per day

7,500g divided by 454 to convert from grams to pounds. 7,500g / 454 = 16.5 pounds. This should be split up by at least 3 feedings / day, ideally 5 or 6 feedings/ day.

The range of 15% to 10% is based on size range noted on the chart, feed less to the smaller size, more to the larger sizes

Fish size should be sampled at least every month but ideally every 2 weeks to determine average size of fish. ** See description below on ways to sample fish size

Stocking Rate (Number/m3)	Weight (grams) Initial	Weight (grams) Final	Growth Period (days)	Feeding Rate (%)
8,000	0.02	0.5-1	30	20 to 15
3,200	0.5-1	5	30	15 to 10
1,600	5	20	30	10 to 7
1,000	20	50	30	7 to 4
500	50	100	30	4 to 3.5
200	100	250	50	3.5 to 1.5
100	250	450	70	1.5 to 1
55	450 (1 lb)	700 (1.5 lbs)		1.5 to 1

Fish should be graded into different batches at least twice but ideally three times as they grow.

Best times to grade are at the 5g size and again at the 60g size. Ideally a third grading at 1/2 lb. or 227 grams.

<u>2.2 RECOMMENDED GRADER WIDTHS:</u>

- 25/64 of an inch for tilapia greater than 5 grams
- 32/64 of an inch for tilapia greater than 10 grams
- 44/64 of an inch for tilapia greater than 25 grams
- 89/64 of an inch for tilapia greater than 250 grams/.55 lbs

<u>Sampling fish in a tank to determine average size:</u>

Using an average size net - 2'X1' - sneak up on tank and net out as many fish as possible - ideally 20 fish or more

Weigh the net (excluding the weight of the net)

Count the # of fish in the net as you through them back into the tank one by one

Divide weight of Net by number of Fish = average fish size. Use this number to calculate feed amount for tank.

Do this for at least three nets per tank

Do this at least every month, ideally every 2 weeks.

2.3 Example of Tilapia Tank Volumes & Stocking Density:

	Cubic Foot (ft3)	**Gallons (gal)**	**Cubic Meter (m3)**	**Liters (l)**	**# Fish to Stock to 1.5**
40 ft x 80 ft x 4 ft	12,800	95,750	363	362,455	20,000-21,000
53 ft x 97 ft x 4 ft	20,564	153,829	582	582,307	32,000-34,000

Stocking Densities:

- 1 lb of tilapia will need 3 gallons of water
- 1.5 lb tilapia will need 4.5 - 5 gallons of water
- 3 to 5 gallons of water for 1 lb - 1.5 lbs of tilapia