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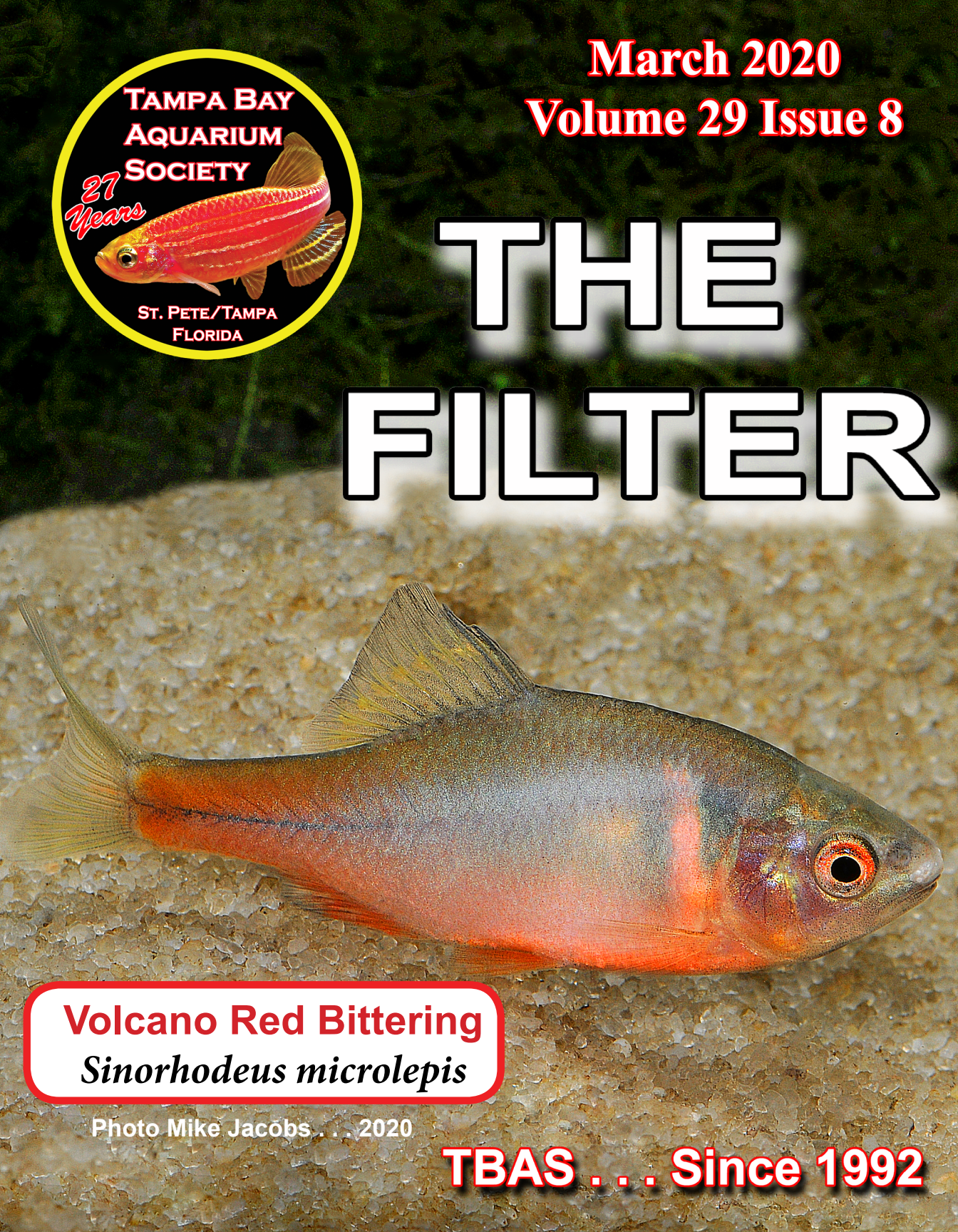
Tampa Bay Aquarium Society
27 Years
St. Pete/Tampa Florida

THE FILTER



Volcano Red Bittering
Sinorhodeus microlepis

Photo Mike Jacobs . . . 2020

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TAMPA BAY AQUARIUM SOCIETY

"THE FILTER"

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Joe Gargas gave me a long article this month . . . 10 pages!!! It's a wonderful article that EVERY member of TBAS should read . . . but I would rather not take up 10 pages of 1 bulletin! So I am going to split it up into 2 months. It's that kind of article . . . **DEFINITIONS**!!! So make sure you start to read the article and you will see what I mean . . . you don't have to read it ALL AT ONCE! It's the kind of article kinda made to be read and read and re-read!!! You'll see!

You guys know what I think of Joe . . . he may be the best **WATERMAN/BREEDER/WRITER** I know of!!! I would wish everyone, including myself could do the things he does with tropical fish!

Take your time and really plan on going back and back and back to this article . . . I promise you that you will learn stuff you haven't known, and should!

Have a great month and I'll see you folks at the next meeting!

Mike

Mike Jacobs, Editor TBAS Filter

Hepsetus odoe
African Pike Characin
Photo by Mike Jacobs 2020

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Aquaticc Chemistry Terms Explained - Pt1

by
Joe Gargas

Alkalinity, Hardness, and pH . . .

What Difference Do Definitions Make?

Many times when I read aquarium magazines, I come across incorrect statements that are made that cause quite a bit of confusion. What I can remember in particular was a question and answer column in a popular aquarium magazine. The reader questions the noted author regarding the needs of one of the species of fish from Lake Tanganyika, Julidochromis transcriptus. The reader goes on to question the noted author to find out what are the best conditions for keeping this species. The writer replied that these fish require hard, alkaline water, which he defined as having a pH range of 7.5 to 8.5 and a water hardness of at least five degrees carbonate hardness (dKH). The problem I have with this is the writer does not specify between carbonate hardness and hardness or between pH and alkalinity. This prompted me to write this article, which will hopefully eliminate some of the confusion in the hobby. I will append a lengthy list of chemistry terms you are likely to encounter, with definitions.

Isn't All Hardness the Same Thing?

So, why do I object to what this noted author said?

Carbonate hardness means only one thing and that is alkalinity. Alkalinity is the measure of the capacity of water to neutralize strong acid. In natural water the major alkalinity component is the hydrogen carbonate ion.

Hardness is the sum of the divalent cations - chiefly calcium and magnesium.

The author did not differentiate between alkalinity and hardness. This is a common occurrence in the hobby, but it leads to confusion among hobbyists and breeders. The term carbonate hardness is used quite a bit. First of all carbonates are not present if the pH is below 9-the buffer will be bicarbonate. In essence, the hardness is not measured at all but just the alkalinity. The term (dKH) is a measurement in degrees which is a German scale for water parameters. To convert degrees to parts per million or more correctly milligrams per liter each (dKH) or degree is multiplied by 17.8. So 17.8 x 5 = 89 parts per million or more correctly 89 milligrams per liter. So, in this case the alkalinity was 89 ppm. For the species of fish mentioned I would recommend the alkalinity to be maintained 120 parts per million or more. This can be achieved by adding any of the products that

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increase pH. The author did not speak about the hardness requirement for this species at all. I would recommend this species be kept in a hardness of 250 parts per million or more. Since hardness is often misunderstood as it was here. I will briefly attempt to explain it in layman's terms.

A Hardness Primer

First of all, total hardness can vary depending upon the origin of the water. Very hard water exceeding 350 ppm total hardness is found in limestone, chalk, gypsum or dolomite regions. My well water that I use has a hardness exceeding 800 parts per million! One will find very soft water with only 20 to 40 parts per million total hardness, for example in areas with basalt, granite, gneiss or sandstone. Very soft water that is less than 20 parts per million is found in the tropical rain forests. By no means are all tropical waters soft! There are also chalk regions in the tropics with water in excess of 350 parts per million total hardness.

The total hardness is sometimes designated as the sum of all the so called "earth" ions that are dissolved in water. Primary among these are calcium and magnesium ions, while strontium and barium ions are generally only present in trace quantities. In most natural waters, calcium and magnesium comprise the bulk of the cations - 8O percent, more or less, depending on the water source. (A little shortcut: any mineral that ends in "ium" is a cation.) The total hardness provides a good estimate of - guess what? - yes, conductivity! Calcium is essential for fish to build their bony skeletons; snails and mussels also require it for their shells. Aside from this, calcium plays an important role in cell wall formation, cellular division, in the nervous system, and throughout the entire organism. Plants require only very small amounts of calcium and are often difficult to keep in harder waters. Signs of calcium deficiency among aquarium plants even in very soft water are unknown. Magnesium is only required by animals as a trace element; it activates sugar synthesis, and it can influence the excitability of nerves and muscles. Magnesium is most essential for plants. It activates among other things the fundamentally important citric acid cycle, and it exists as the central atom in chlorophyll, the life essential green coloring of leaves. We are fortunate to have multitudes of resources in our aquatic industry. One can walk into any pet store and purchase a number of kits to determine the alkalinity, pH, and total hardness. I would recommend that the hardness kit that is purchased should be able to measure calcium hardness thus you can determine your magnesium hardness by subtracting the calcium hardness result from your total hardness. Just remember pH, alkalinity and hardness are different and they mean different things. If you are interested in the meaning of other aquatic chemistry terms, you can take advantage of the following list to test and improve your knowledge.

Absorption is the uniform retention of dissolved substances throughout a solid. A good example of absorption is the biological process by which plants absorb water and nutrients through their leaves. Human skin and tissue can absorb as well. I will note here that when using activated carbon the process is not an

absorption, but adsorption, which will be defined later.

Acidity is a measure of the capacity to neutralize strong base. In natural waters the major contributor to the acidity is carbonic acid from dissolved C02 (carbon dioxide). It is important to note that in a natural ecosystem carbon dioxide is produced on a continual basis. Fish give off carbon dioxide through respiration, but another large contributor to the production of carbon dioxide are plants, which, like animals, give off carbon dioxide as a waste product. So, at night, they add to the total carbon dioxide. During the day, when they use greater amounts of carbon dioxide as a raw product for photosynthesis, they reduce the concentration. This can be observed by taking a water sample from an area that is loaded with plants-in the morning, the pH will be quite low, but as soon as daylight arrives, the pH will increase quite a bit as C02 is used up. This really blows the idea of “pH shock” right out the window. In the natural state, fish are often subjected to dramatic shifts in pH. Carbon dioxide can be added to the aquarium in small amounts to buffer the pH, as is popular in Europe for planted aquariums.

Activated Carbon a highly porous form of carbon which absorbs and retains organic molecules; it can be found in both granular and powdered forms. Carbon removes organic matter by the process called physical adsorption which will be defined later.

Active Transport is the pumping molecules through a cellular membrane against a concentration gradient by expenditure of cellular energy. This is an osmotic process. Remember the salt water fish keeping in freshwater and eliminating the salts!

Adsorbate is the material retained upon the surface of an adsorbent. This is what would be adsorbed on the carbon.

Adsorbent material that retains a dissolved substance or gas upon its surface. Carbon is an adsorbent.

Adsorption is the attachment and retention of a compound on a solid surface (or gas interface). This is what carbon does through the process of physical adsorption.

Aerobic means requiring the presence of oxygen to live; all aerobic life forms use molecular oxygen from the atmosphere or water for metabolism. The nitrogen cycle is an aerobic cycle. Denitrification is anaerobic (usually).

Alkaline Rebound is the tendency of pH to rise back up to a value of around 7.5 after being reduced by acid due to the bicarbonates and solid carbonates present. This is what happens when a aquarist tries to lower the pH, but within days, or maybe even hours, it is back up again. First of all, the buffering capacity

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(alkalinity) needs to be monitored to determine how strongly the water is buffered. If the alkalinity is above 120 parts per million, then more acid will be needed to lower the pH.

Alkalinity is the capacity of water to neutralize strong acid. In natural water, the major alkalinity component is the hydrogen carbonate ion. Alkalinity is determined by titrating the water sample to a methyl orange endpoint-in the pH range of 4.5 to 4.8.

Amines are nitrogen containing compounds, usually organic. They can act as ligands.

Ammonia NH_3 is the simplest amine. a toxic gas. In water it converts to a non toxic cationic form, NH4+. The lower the pH, the more will occur as the non toxic cationic form.

Anaerobic means occurring without molecular oxygen present. Anaerobic metabolism is limited to certain bacteria such as nitrate, phosphate, and sulfate reducing bacteria, which use the oxygen in these anions as oxidant instead of 02 in their metabolic process.

Angstrom is a unit of measurement equal to 10-10 meter (a billionth of a meter).

Anion is a negatively charged ion.

Anion Resin, Strong Base is a polymer resin with an ammonium functional group, having a positive charge, which retains anions.

Anion Resin, Weak Base the standard anion resin used in general use; it will not remove anions of weak acids such as silicates and bicarbonates.

Basicity a measure of the amount of hydroxide ion, OH^- in solution; bases react with acid to produce water. $H^+ + OH^- = H_20$. Basicity can be calculated from pH.

Bicarbonate ion, $HC0_{3-}$ is the main buffer in water. It does not exist above pH of 9.0. At higher pH readings, the buffer is carbonate.

Biodegradable means capable of being decomposed by biological activity.

Biofilm is a thin layer of microscopic organisms, mostly bacteria, growing on a wet or submerged surface.

Biological Oxygen Demand, BOD is the amount of oxygen required to biologically oxidize the organic matter in a water sample in five days at 200C. Most oxygen tests do not explain this. When you do an oxygen test, you should record your result,

then take another sample in the same vial and keep it in the aquarium under a rock or buried in the gravel. The most important thing is that the vial needs to be sealed. Five days later, run an oxygen test on the kept sample. Subtract the result from the first sample, and the result is your Biological Oxygen Demand.

Brackish Water is water with 10,000 ppm total dissolved solids-a salinity of 0.1 to 1.0 percent.

Brine is a concentrated solution of one or more salts with total dissolved solids exceeding 100,000 ppm.

Buffer is a substance which maintains a constant pH.

Calcium, Ca^{++} is one of the major cations of natural waters, a principle hardness component, and essential to life.

Carbonate Hardness, KH is a fraction of the alkalinity which is in stoichiometric equivalence with divalent cations. 1 KH = 17.8 mg/1 of alkalinity measured as calcium carbonate. Carbonate Hardness is an incorrect way to explain alkalinity. Hardness refers to cations, whereas alkalinity refers to anions. Alkalinity is basically the amount of carbonates **CO^3** and bicarbonates **$HC0_{3-}$** found in water. Hardness is chiefly the amount of calcium **Ca^{++}** and Magnesium **Mg^{++}**, which are both cations.

Calcium Carbonate, $CaC0_3$ is a non water soluble salt existing in two crystalline forms, trigonal calcite and orthorhombic aragonite. Quite a few titration tests are always expressed in ppm of calcium carbonate. This had led to much confusion, not only in our hobby, but among water quality experts as well. The following test results are always expressed as ppm **$CaC0_3$**: total hardness, calcium hardness, magnesium hardness, and alkalinity. The best way to avoid confusion is if one will look at this comparison the same way foreign currency is compared to the US dollar - it is just a point of reference meaning “the same as” or “equivalent to” so many parts per million calcium carbonate.

. . . continued in the April bulletin

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MEMBERSHIP DUES!!!!

Membership Dues for TBAS are due on the anniversary of your sign-up date every year. Please make sure you check the "sign-in" list on the table at every meeting to check your "Dues-Date" . . . Thanks!!!

USE PAYPAL ON THE TBAS WEBSITE . . . TBAS1.COM . . . !!!!!

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Attack of the Slime Creatures!!!

While peering in my tank I noticed large holes in my dwarf lilies. This usually means the snails are back. They don't eat my Cryptocorynes which take up most of the tank. I have used freshwater puffers in the past to control them, but the last one I had in my tank seem to like the marble angels. I moved the puffer to my small backyard pond to control the mosquito larva and he does a great job. Now back to the problem of snails in my tank.

A number of methods can be used for controlling snails. First, there are several chemicals sold that will kill them, but if a large number of snails are present, a mass die-off will pollute the water.

Another way is to use bait. Feed the fish very lightly or not at all. Snails eat a lot of fish food. Wait till a few hours after the lights are off and then take a saucer and place it upside down at the bottom of the tank. On the center of the inverted saucer place a sinking food tablet of any kind and wait about one hour. Then carefully pick up the saucer and throw away the snails that went for the bait. Doing this once a week will help keep them under control.

An easier way to control snails is to keep fish that eat them. I have already mentioned the freshwater puffers such as the Figure 8 and the Green Spot, but these can be too aggressive for some tanks. Other fish, including several members of the Botia family, like clown loaches and skunk loaches, also work well. In my 55 gallon live plant tank I keep clown loaches and have not a snail in sight. The other tank is another story. I will be adding several skunk loaches to this tank soon. There are several cichlids that also eat snails, but some of these can be very aggressive and eat plants too.

One of the more time consuming methods is to remove them by hand. The best time to get them is first thing in the morning when the lights come on. They are hungry and are usually close to the top of the tank.

Not all snails are bad. The Malaysian Trumpet snail doesn't each the plants and burrows through the gravel keeping it open and breathing. You can control these by regulating the amount of food they get. Some snails sold at the local retailer are sought after, such as the Apple and Ramshorn, but if you have a snail overpopulation problem try one of these methods to control them. **Until next month, happy fish keeping.**

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Killifish . . . *Nothobranchius kilomberoensis* VIDEO:

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Top 5 Centerpiece Fish for Smaller Tanks - Below 29 Gallons

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USGS Looks at FLORIDA

One team's varied catch of non-native fish found in South Florida waterways during a 2018 Fish Slam.

In early November 2019 USGS scientists explored three Florida counties, Miami-Dade, Broward, and Palm Beach, leading experts in the semi-annual "Fish Slam", a scientific scavenger hunt for non-native freshwater fishes. Biologists and natural resource managers from USGS, U.S. Fish and Wildlife Service, Florida Fish and Wildlife Conservation Commission, and several universities and museums are working in teams to sample fresh-

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water bodies using nets, traps, seines, hook and line, and electrofishing (which temporarily stun the fish so they are easier to catch). The two-day Fish Slam event helps monitor new non-natives and documents the possible expansion of known non-native fish species.

A Mayan cichlid collected in a 2019 Fish Slam event in Indian River and St. Lucie counties.

All non-native fishes collected during Fish Slams are recorded in the USGS Nonindigenous Aquatic Species database, and select specimens are preserved and sent to the Florida Museum, the Virginia Institute of Marine Science, Florida Atlantic University and other museums and academic institutes, where scientists use them for research purposes. Learn more about Fish Slam: http://ow.ly/c9wF50x5emH

TBAS reminds our readers that stories like this serve as a constant reminder to never release unwanted fish, plants or pets into the wild. Talk to your local fish stores and clubs like ours willing to assist in rehome unwanted fish.

Source: US Geological Survey (USGS)

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Angels Plus
www.angelsplus.com

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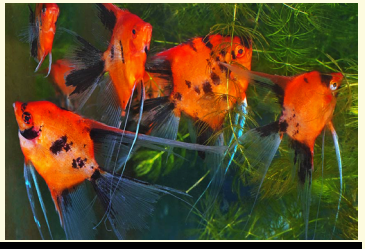
to See Video



THE BEST KOI ANGELFISH IN THE UNIVERSE

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***Catlocarpio siamensis*. . . Siamese giant carp (very young)**

photo: Mike Jacobs 2020

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