Tampa Bay Aquarium Society

25 Years

St. Pete/Tampa Florida

THE FILTER

TBAS . . . Since 1992

June 2017
Volume 26 Issue 11

Pterophyllum scalare
Silver Veil Angelfish

Photo Mike Jacobs . . . 2016

June Meeting
Dave Parks
Segrest Farms

June Bowl Show
1) Corydoras
2) Anabantoids: no Bettas

TAMPA BAY AQUARIUM SOCIETY

"THE FILTER"

Tampa/St. Pete, Florida

TBAS

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Hello friends!

I truly hope everyone is keeping cool lately (fish included). Remember, as we enjoy a nice fan during these hot days, our fish might benefit from a nice air stone if they live in a hot area of your home.

Our Annual Swap Meet was nice. I myself bought a couple handy items and had an enjoyable time conversing with our club members. Look out for a date for our Annual Auction. We will be finalizing it soon.

This month's Bowl Show is: Corydoras & Anabantoids (other than Male Betta splenden).

Don't miss this month's guest speaker, Dave Parks from Segrest Farms. He will be sharing some of the inner and outer workings of Segrest. Segrest Farms is one of the "Big Boys" in the aquarium industry, if not the biggest! It will be definitely a great talk.

See you at our next meeting (not really, I'll be in Jamaica with the wife and kids)!

Dharmesh

Dharmesh Patel, President, TBAS

Carassius auratus
Gold Ryukin

R/O: All You Need to Know Part 1

by Joe Gargas

Reverse osmosis has recently become a very popular technique for aquarists wishing to purify and desalinate their water for their aquariums. It has been found to be particularly useful for breeders of species which require low ionic strength water for successful fertilization and egg development, examples of which are killifish, members of the genus *Apistogramma* and *Symphysodon discus*. Reverse osmosis has also been employed by marine aquarists to produce high quality water to use for mixing synthetic sea water and to replace water to replace water lost by evaporation.

This article will attempt to clear up some current misconceptions about reverse osmosis and introduce the reader to the design and operation of reverse osmosis systems. A review of water chemistry and alternative water treatment methods will also be discussed.

WATER CHARACTERISTICS

Water chemists use certain terms to designate the important chemical characteristics of water. Among the most important parameters describing fresh water are pH, total hardness, ionic strength, and alkalinity. An understanding of these is essential.

pH

The pH is a measure of the acidity of water; it is the negative log of the hydrogen ion concentration. Increasingly increasing acidic water will have lower pH. The pH of the water affects the chemical state of weak acids and bases dissolved in water. It is commonly appreciated that molecular ammonia (a weak base) is much more toxic to fish than the ammonium ion; these are related to each other by an equilibrium reaction. Over the range of pH values common in aquaria, for every unit the pH rises,

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the concentration of the toxic molecular ammonia increases tenfold.

HARDNESS

Total hardness is the total sum of the concentration of bivalent cations expressed as milligrams per little calcium carbonate, $CaCO_3$. The calcium ion Ca^{+2} and the magnesium ion Mg^{+2} are the only common bivalent cations. Hardness is important since many fish will not spawn if the water is too hard, and even if they do, the hatching of the eggs will rarely be successful. Furthermore a high hardness is always accompanied by a high buffering capacity so that the addition of acid does not drop the pH very much but does increase the conductivity.

Alkalinity

Alkalinity is the expression of the sum of the anions capable of neutralizing acid. For freshwater aquaculture the most important contributors to alkalinity are the carbonate and bicarbonate ions. The hydroxide ion becomes a significant contributor to alkalinity only at very high pH and borate contributes significantly to alkalinity in some synthetic sea water formulations. Carbonate ions (CO_3^{+2}) are significant in freshwater only above pH of 9. At lower pH values, most of the alkalinity is present in the form of bicarbonate ions ($HC0_3^-$). These two buffering ions are related to each other and to carbonic acid (H_2CO_3) and carbon dioxide ($C0_2$) by a series of linked equilibrium reactions.

If acid is added to a highly alkaline sample, protons are absorbed by carbonates and first become part of bicarbonate ions. As the carbonate alkalinity is exhausted, bicarbonate will then absorb more protons and be converted to carbonic acid. Carbonic acid is hydrated carbon dioxide and converts between the dissolved gas and acid forms.

Based on my experience, freshwater fishes have respiratory difficulties in elimination of $C0_2$ from their blood if the $C0_2$ content of the water is higher than 25 ppm. For this reason, it can be seen that the pH of water for fish such as discus should not be dropped quickly down to 5.5 unless the bicarbonate concentration is less than 25 ppm, which is approximately 40 ppm as $CaC0_3$. If the alkalinity is much higher than this, the pH should be dropped slowly with heavy aeration so that the free $C0_2$ does not exceed 25 ppm. Hard water will almost always be high in carbonates also.

Ionic Strength

Ionic strength is a quantity related to both the number of salt ions in water and the net charges on these ions. and is expressed on the molar concentration scale. The formula for determining the ionic strength of a

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solution of a known composition is given below. Ionic strength is related to the electrostatic charge density of a solution. Since it is usually prohibitively expensive to determine the concentration of each individual type of ion in solutions, some individuals make use of empirical relationships between the more easily determined total dissolved solids (TDS) or conductivity and ionic strength.

Total Dissolved Solids

TDS is the most accurate measure of all solids, salts, and other non-volatile chemicals dissolved in water. TDS is a gravimetric test. A container is accurately weighed before a known volume of the filtered water to be tested is added to it, and weighed after this water has been evaporated in an oven of defined temperature. Different temperatures will recover somewhat different materials - for example, one common method is to dry at 103° to 105°C, which will maintain bicarbonates and carbonates in the sample and some moderately volatile organics (total residual). Subsequently heating the same sample to 550°C will give the fixed residue, and the difference between the total residue and fixed residue is the volatile residue, part of which will be the carbon dioxide driven off from the carbonates and bicarbonates.

The formula for experimentally determining any of these is given by:

mg/l (ppm) residue = 1000 x (weight of residue, in mg) / ml sample

For example, 50 ml of filtered water are placed in a dish and dried to 103°C. The difference in the weight of the dish before and after drying the sample is 8mg . The total dissolved solids would be 160 PPM.

The so-called TDS electronic pens cannot accurately measure TDS, for several reasons. These pens actually measure the capacity of the liquid sample to conduct electricity. Some dissolved substances do not contribute to conductivity, and not all ions are equal in their contribution to conductivity. Additionally, the pens are calibrated in the nonstandard unit of parts per million NaCl. An actual conductivity meter reading in the standard units given below would better serve the aquarist.

Conductivity

By definition, conductivity measures the ability of a solution to carry electrical current. This ability depends on the presence of ions - positively charged cations and negatively charged anions - the mobility of the various types of ions present in the sample, their net charge, and the temperature of the solution. Solutions of most inorganic compounds are good conductors

because the ions composing the inorganic compound dissociate to varing degrees in aqueous solution and conduct electricity. Some organic compounds also contribute to the conductivity of the solution. An example would be deprotonated carboxylic acids, such as the acetate ion. On the other hand, some uncharged organic compounds do not contribute to the conductivity of the solution; an example would be ethanol.

The conductance of any solution is measured in a conductivity coil where the solution fills the space between two spatially fixed and chemically inert electrodes. To avoid polarization at the electrode surfaces, the conductance measurement is made with alternating current.

Conductivity is the inverse of resistivity. Most readers will know that the SI unit of resistance is the ohm. The inverse of resistance is conductance and the SI unit for this quantity is the Siemen (S) and is often less properly denoted mho (ohm spelled backwards). The SI unit of conductivity is S/m (Siemens per meter), and is typically reported in the literature describing freshwater as uS/cm (microSiemens per centimeter). The conductivity of very pure water is sometimes reported in "megohms/cm."

The limiting conductivity of absolutely pure water at room temperature is about 18 megohms/cm (0.05 uS/cm). This limit is set by the autoionization of water to form hydrogen ions and hydroxide ions. The conductivity of very pure water will increase shortly after exposure to the air, as both carbon dioxide and to a lesser extent ammonia dissolve in it. Simply exposing extremely pure water to a container can also cause it to become more conductive, as pure water is extremely aggressive in nature and many substances that are exposed to it can and will dissolve in it. The conductivity of potable waters in the United States range from 50 to 1,500 uS/cm (umho/cm). The aquarist would be well served to obtain a conductivity meter reading in standard units (microSeimens or milliSeimens).

Empirical Relationships

At this point it is appropriate to note some relationships among ionic strength, TDS, and conductivity. These relationships are only approximate and are for freshwater samples, and are taken from Snoeyink and Jenkins (1980).

Ionic Strength and TDS

Ionic strength in moles is approximately equal to 2.5×10^{-5} divided by the Total Dissolved Solids in milligrams per liter:

$$\frac{2.5 \times 10^{-5} M}{\text{COND uS/c}}$$

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Ionic Strength and Conductivity

Ionic strength in moles is approximately equal to 1.6×10^{-5} divided by the conductivity in microSiemens per centimeter:

$$\frac{1.6 \times 10^{-5} M}{\text{COND uS/c}}$$

TDS and Conductivity

Total Dissolved Solids in parts per million is approximately equal to 0.64 times the conductivity in microSiemens per centimeter:

TDS mg/l = 0.641uS/cm

It should be noted that all these factors vary based on the types of ions found in the water, and often you can obtain the appropriate empirical conversion between conductivity and TDS from the local city water lab. When I lived in Chicago and used Lake Michigan water, the conversion factor was 0.58 mg/1 (umho em). There is also an empirical conversion factor between mg/l NaCl and standard conductivity units. It is approximately:

1 mg/l NaCl = 1.9 uS/cm

This is based on a conductivity of approximately 5,600 uS/cm for 0.05 M NaCl.

Phew!

If you're still with me, you've earned a break. Next month I'll go into the actual process of reverse osmosis water treatment. You can see that a measurement of TDS or conductivity gives a crude approximation of ionic strength. Reverse osmosis drops the ionic strength of the feed water by removing ions of the dissolved salts. In Part 2 I'll take you on a tour of the innards of an RO unit.

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Should I Give My Fish Vitamins?? - That depends on how well you feed your fish and how you give them their vitamins. We often stress variety in their diets, but sometimes a fish will only eat one thing. Or maybe you only have one small tank and a lot of different foods is not feasible. I would always recommend using vitamins in these cases. If your fish is sick or injured, using a vitamin supplement can help speed up the recovery process (as long as a proper treatment program is used). Another time I recommend vitamins is after a fish has been moved or severely stressed. If you keep good water quality and feed a variety of foods proper for the species you are keeping, then you don't need to use vitamins on a regular basis. However, keep them handy for when you do need them (keep an eye on the expiration date since vitamin C decomposes quickly).

How you use the vitamins is different depending on the type of tank you have, fresh or salt. The main difference is in the fish. Freshwater fish have blood that is saltier than their environment. This allows for free passage of water into the fish via their skin and gills, therefore they never swallow water. Putting vitamins in their water is virtually useless because it takes so long to seep in. For freshwater fish, it is better to put drops of vitamins n dry foods or feed some to your live food before feeding to your fish. Saltwater fish on the other hand, are in water that is saltier than their blood and they tend to become dehydrated, so they always swallow water. Putting vitamins in the water is more effective for marine species, especially if they are not eating. However, rapid degradation of vitamins in water, either through spontaneous reactions, metabolism by bacteria, or other processes, makes incorporation into food a much more effective method overall.

It is also important to realize what exact vitamin and mineral requirements for each and every species kept in the hobby are not known. Some species may have greater requirements for certain supplements than others. More research needs to be done.

Carbon can remove some of the vitamins, so try not to add to the water for several days after a carbon change (or remove the carbon). As always, never overuse a product. High doses of vitamin A may cause problems. Until next month, keep those fish happy and healthy.

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MONTHLY BOWL SHOW

January
1)
2) None - Plant Auction

February
1) Male Betta Splenden (single fish)
2) Open

March
1) Tetras, Barbs, Rasbora
2) Cichlids

April
1) Platies
2) Guppies

May
No Bowl Show
Swap Meet

June
1) Corydoras
2) Anabantoids no Bettas

July
1) Arts & Crafts (hand made)
2) Fish "T" Shirt (must be worn)
3) Aquatic Photos (personally taken)

August
1) Mollies
2) Rainbows

September
1) Swordtails
2) Pleco/Sucker type fish

October
1) Dwarf Cichilds
2) Angelfish

November
1) Goldfish & Koi
2) Invertebrates (Fresh or Salt)

December
No Bowl Show . . . Christmas Party and the 2016 Results of the Bowl Show!!!

NAME	JAN-MAR	APRIL	TOTAL
Kent Sheets	14	28	42
Ethan Skidmore	25	14	39
Elaine Thyner	6	0	6
Joshua McWilliams	0	6	6
Missina Rurcaw	5	0	5
Danielle Lee	4	0	4
Grant Eder	1	0	1

***Leptobotia elongata* . . . Royal Clown Loach**
photo: Mike Jacobs 2017

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Supporters of TBAS

Tampa Bay Wholesalers: Tropical Fish

alphabetical order

1) 5D Tropical Fish
2) Segrest Farms

Tampa Bay Tropical Fish Farmers:

alphabetical order

1) Amazon Exotics
2) BioAquatix
3) Carter's Fish Hatchery
4) FishEye Aquatics
5) Golden Pond
6) Imperial Tropicals
7) Lile's Tropical Fish
8) V-W Tropicals

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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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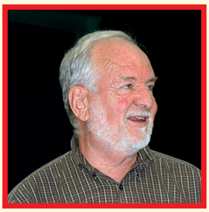

Hank Darin

Joe Gargas

Mike Jacobs

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Tampa Bay Aquarium Society
St. Pete/Tampa, Florida

Website: www.tbas1.com

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