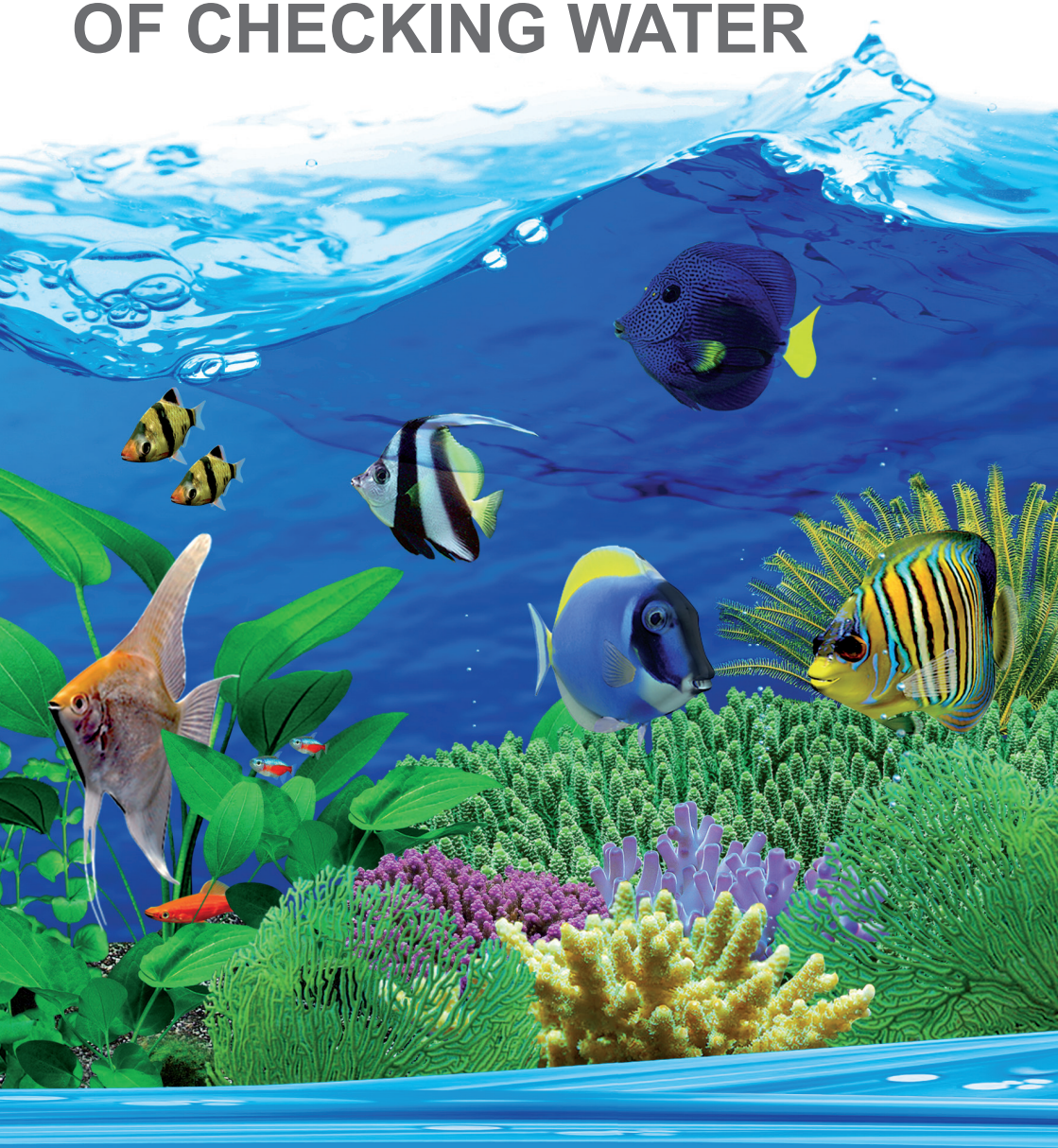
THE IMPORTANCE OF CHECKING WATER



PRODAC International

Providing Aquatic Solutions

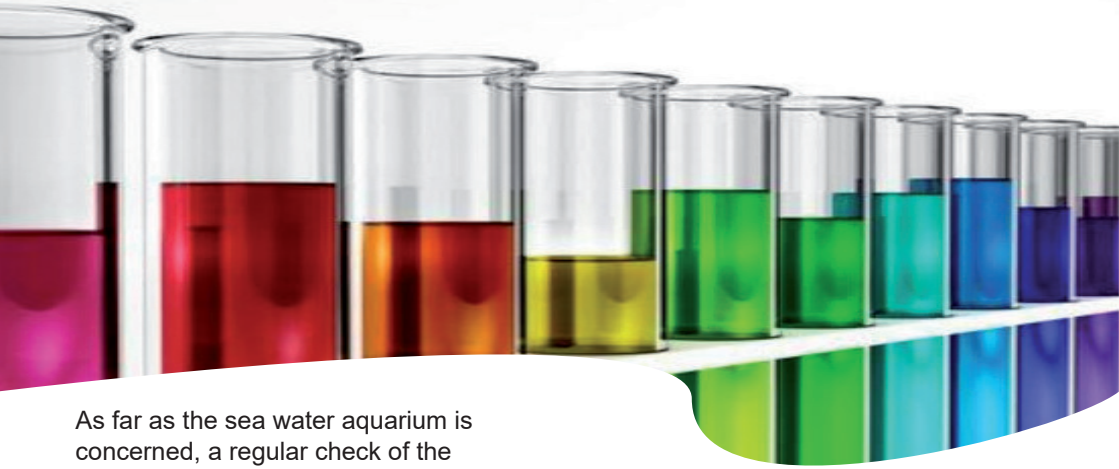
QUALITY PRODUCTS MADE IN ITALY

MEASURE WHEN REQUIRED

Checking the chemical features of water becomes an increasingly vital operation for any aquarium lover.
The main values of potable water should be checked at least every 2-3 months to see whether it should be pretreated before it is used in the aquarium, whether it be fresh or sea water.

In a fresh water aquarium with especially sensitive plants and fish the pH values and the concentration of nitrates should be checked fairly regularly (about once every 15 days).
Water hardness can be checked at longer intervals, but more frequently if a strong evaporation is noted. Iron should be checked when fertilizers are administered or when a poor growth of plants is noticed.

When there is a proliferation of seaweed, on the other hand, phospates, nitrates and the ammonium/ammonia complex should be checked.



As far as the sea water aquarium is concerned, a regular check of the pH values is indispensable (about once a week) and of nitrates (about every 15 days). Depending on the delicateness of the living species (especially invertebrates) it will also become important to regularly check the carbonate hardness and the presence of limestone deposits as Ca^{2+} (at least every 15 days). Other values, like those of iron, of phosphates, of nitrates and of the ammonium/ammonia combination, should be checked when problems in the behavior of the species are observed (irregular octopus opening; strange fish behavior, etc.).

In any case it is important to keep a diary and to write down the values observed; by doing so a certain experience will be acquired in time to learn when these checks really need to be done.

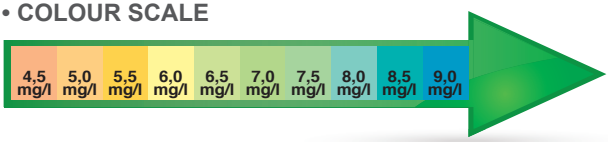
THE pH VALUES IN FRESH WATER

To explain: pH means “hydrogeneionic concentration” and derives from the Latin words pondus Hydrogenii which translated means “weight of the hydrogen ions”. If there are many acids and little basic substances dissolved in water, acid water will result; if the contrary is the case, an alkaline type water will result.

A pH value between 0 and 6.9 indicates acidity, a value between 7.1 and 14 alkalinity; 7 is a neutral value. This is a theoretical outline but from a practical point of view the aquarium lover should keep in mind that all water organisms, whether they be fish, plants or microorganisms, are used to living in water with precise pH values. Depending on the sensitivity of the single organisms, even a slight variance from the “ideal” value could negatively influence their survival. Attention: there is a great difference between two different pH values; a water value with a pH value of 5 is 10 times more acid than a water value with a pH 6 value.

For a fresh water aquarium, therefore, it is important to keep in mind the following: a value ranging between 6.8 and 7.2 is what is indicated for breeding the majority of fish and cultivating aquarium plants.
If, on the other hand, one only wants to breed fish, many species require a more acid pH value (between 6 and 6.5). Some fish species (Pecilides, Cyclides) require a higher pH value than 7; in this case it is important to check whether there is a sufficient amount of free CO2 and ammonia.
A pH value which is lower than 5.5 is extremely dangerous for all fish species (even for species which originate in acid type waters). With a pH value of 7.5 and over, the largest majority of plants suffers the lack of CO2 and does not grow any longer (see “KH value”). In sea water, on the other hand, the pH value should always exceed a 8.0 pH value; while a value ranging between 8.2 and 8.4 is the ideal.

• **COLOUR SCALE**



TOTAL HARDNESS - GH

In the Italian aquarium world, water hardness is measured following the so called German system. The presence of calcium cations (Ca) and magnesium (Mg) is measured, while for carbonate hardness, ions with a negative charge (anions) are considered. The old indication “total hardness = carbonate hardness + non carbonated hardness” is wrong. The non carbonate hardness, also called “permanent hardness” (because it cannot be removed from water through boiling as occurs instead with the carbonate hardness), should be indicated as “hardness of sulphates”, since it mainly consists of calcium and magnesium sulphates. In the aquarium world, to ensure the precise check of water hardness, it is important to measure total hardness (GH) as well as carbonate hardness (KH) and to consider both of these independent indicators.
The total hardness of fresh water should be 3-4 times higher than the carbonate hardness, reaching values ranging between 5 and 10° GH. For fish coming from hard waters, the value should be higher than 12° GH.

In marine water, the total hardness is always extremely high.

MUTACAL is the most suitable resin whose characteristic is to hold the ions which cross it, it can diminish the total water hardness till it reaches the ideal values for tropical fish life (only to be used in fresh water).

CARBONATE HARDNESS - KH

Carbonate hardness (expressed in °KH) indicates the presence of carbonates and calcium and magnesium bicarbonates and constitutes a part of the so called total hardness (expressed in °GH). A more modern and correct indication, which however is not so widespread in the aquarium world, designates, instead of carbonate hardness, this value as “buffering capacity of acidity up to pH 4.3” in mmol/l, where 1 °KH is equal to 0.36 mmol/l.

Carbonate hardness holds special importance in the chemical equilibrium of water due to its tight relation with the pH value and carbon dioxide.

Due to this reason, checking it becomes most important both in fresh water for plant cultivation and for the breeding of delicate fish or those coming from soft water, while it holds special importance in sea water not only for the pH stability over 8, but also as an essential component for the nutrition of invertebrates.

In fresh water, carbonate hardness should possibly reach 4° (lower values render the pH value extremely unstable, while a higher value could create problems to plant cultivation). In sea water, carbonate hardness should reach about 8° KH till about 10° KH.
In order to lower the carbonate hardness in fresh water (often necessary because drinking water is always harder) it is possible to filter it through peat or through a treatment with synthetic resins (it is possible to use MUTACAL PRODAC directly in the filer) or a reverse osmosis system.

Usually, the opposite problem occurs in sea water: after a certain amount of time the carbonates which have been consumed will need to be reintegrated through the addition of special chemical products (i.e.: MAGIC KH PLUS and MAGIC CALCIUM PLUS).

AMMONIUM - NH_4

Each aquarium always contains organic waste due to fish excrement, to the metabolism of microorganisms and deriving from food scraps and parts of plants and seaweed in decomposition.

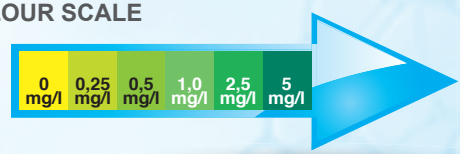
All of this material pollutes water, but is also useful for the life of numerous types of bacteria and other microorganisms which in turn are part of the indispensable aquarium biological cycle called “nitrogen cycle”. In order to guarantee a perfect environment for all organisms living in the aquarium, this cycle should take place without toxic substances being produced during this course of action, meaning the decomposition of organic products.

The first step is the transformation of protein substances in ammonium/ammonia by specialized bacteria. Depending on the pH value of water during this process, ammonium is produced (NH_4) when the pH value is around 7 or less, while with a pH value higher than about 7.5, besides ammonium, ammonia (NH_3) is produced as well.

Ammonia is quite toxic, while ammonium is less dangerous and in addition it is partially removed by plants and seaweed which use it as a source of nitrogen. A 0.10-0.50 mg/l concentration of ammonium in fresh water is normal and not dangerous. In the case of ammonia, an amount higher than 0.02 mg/l is dangerous and with a 0.20 mg/l amount, fish and invertebrate death rates have been reported. A high level of ammonium/ ammonia is due to an insufficient filtering system (damaged bacterial flora or not mature enough), overpopulation in the tank, exaggerated food supply.

In order to quickly lower the concentration of ammonium, a partial change of water is advisable together with the use of NITRIDAC, a solution which contains bacteria for the transformation of ammonia into nitrites and for its complete removal.

• **COLOUR SCALE**



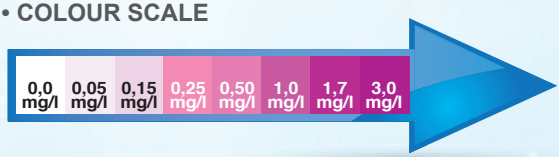
NITRITES - NO_2

Nitrites constitute the second “small step” of the nitrogen cycle and derive from the transformation of ammonium/ammonia by the Nitrobacter bacteria.
In fresh water there is normally no concentration between 0.05 and 0.15 mg/l, a 0.20 mg/l concentration (if not deriving from an already “polluted” drinking water) is already an indication that the filtering system is not working perfectly; values higher than 0.50 mg/l are clear warning signs.

Sometimes, certain fish species do anyhow tolerate even 0.20 mg/l concentrations.
In sea water, especially where invertebrates are concerned, a 0.05 mg/l, concentration should not be exceeded, indeed 0.10 mg/l are lethal for certain delicate sea organisms.

As for too high concentrations of ammonium/ ammonia, it is especially important to remove the cause (by powering the filtering system, checking the population density, limiting food supply); in an emergency case it is important to partially change water; even in this case, the proper help will derive from the use of NITRIDAC.

• **COLOUR SCALE**



NITRATES - NO_3

The third transformation stage (mineralization) of the organic substances in the water of an aquarium produces nitrates. Thanks to these salts, the nitrogen cycle tied to the presence of oxygen ends (without this, bacteria cannot complete the nitrification process).

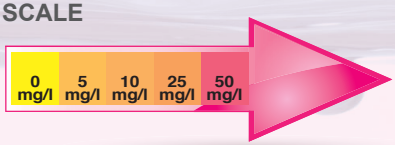
Theoretically speaking, transformation (through dissimilation) by denitrated bacteria in anaerobic environments (without oxygen) can continue, thus reaching gassy nitrogen which can be easily dispersed in the air. Anaerobic environments can sometimes be found in certain filter areas (especially compact material), in the material lying in the bottom, inside living rocks in sea aquariums or can be created in special “denitrated” filters.

Nitrates have a limited toxicity for fish but their presence considerably eases seaweed proliferation. A certain concentration of nitrates is always present (drinking water, for example, can contain up to 50 mg/l according to European laws). It is advisable not to exceed 80 mg/l in fresh water, but delicate fish should be bred in water with a concentration lower than 20 mg/l.

Even in sea water fish are rather tolerant, especially if they slowly get used to a growing concentration, but it is important not to exceed 50 mg/l. Sea invertebrates, especially certain corals, have different requirements, i.e. the maximum value is already reached with 20 mg/l.
The nitrates can be removed with the use of special filters or partial water replacements.

Often the high initial value of the drinking water could lead to the need to immediately treat this water (reverse osmosis system, filtering with MUTACAL synthetic resins).

• **COLOUR SCALE**



IRON - Fe

Iron is indispensable for any animal and for plants. In natural waters, iron concentration is quite different depending on the various biotopes, but is anyhow always present. Iron in water is available in two different forms, depending on the electrical charge of ions: as bivalent iron (Fe^{2+}) or as trivalent iron (Fe^{3+}). Bivalent iron can be dissolved in water, while trivalent iron usually cannot be dissolved.

Only iron dissolved in water can be absorbed by plants, seaweed or mircroorganisms (not counting exceptions which are unimportant for the aquarium). Unfortunately, when there is oxygen (indispensable in an aquarium) the iron solution is transformed into trivalent iron and is linked to other substances, becoming useless. Often it precipitates forming an ochre colored patine in the filter. To avoid this disadvantage, iron is administered to the aquarium water in a special form, meaning tied to chelators which form compact chemical complexes, rendering iron soluble even in water and therefore accessible to the various water organisms. Usually, liquid indicators to measure iron only measure bivalent iron; in order to check for the presence of all iron (even chelate iron) certain meters contain reagents which “break” the chelate rendering the hidden iron “visible”.

In fresh water iron should range between 0.03 e 0.10 mg/l to guarantee a healthy plant growth. A higher range than 0.2 mg/l is dangerous both for plants and many fish.
Thanks to the PRODACTEST Fe you can check your aquarium and take the necessary precautions. In sea water iron concentration should range between 0.05 and 0.1 mg/l.

It is hard for an aquarium to have an iron concentration which is too high (except when iron based fertilizers are added without control).

A concentration increase, on the other hand, occurs with special integrators specifically designed for aquarium use. See NUTRON FERRO for fresh water and MAGIC FERRO AND MANGANESE for sea water.

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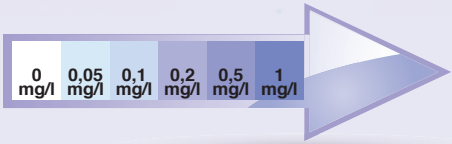


CALCIUM - Ca

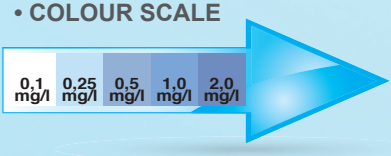
While in fresh water, despite a few exceptions (for example in tanks for breeding African Cyclides of the great lakes) a calcium-poor environment is usually created, things are quite different in a sea aquarium set up to breed invertebrates. These organisms need the continuous presence of limestone substances in water in order to grow.
For this reason, in similar aquariums the carbonate hardness should always reach a 8-10° KH concentration, while calcium (as Ca^{2+}) should be around 450 mg/l.
Often in sea aquariums with many invertebrates these values rapidly fall and it is important to immediately reintegrate the concentration of the limestone substances. There are various methods, amongst the most efficient: MAGIC CALCIUM PLUS, which increase the carbonate hardness or the administration of calcium through special diffusers, or the addition of “limestone water”.

In any case the control of limestone substances in sea water should always be combined with the pH value check (the latter tends to fall below pH 8 if limestone substances are lacking).
A way to remedy the lack of limestone substances consists in the partial change of water with fresh sea water, but this remedy is often not enough to meet the high consumption requirements of invertebrates.

PHOSPHATES - PO_4

Like iron, even certain phosphates are vital for animals and plants, but normally aquarium water contains a concentration of phosphates which is too high, deriving from the feed administered and especially from excrement. From an aquarium point of view, phosphate as poliphosphate PO_4^{3-} is especially important; this salt is available in nature in fairly low concentrations, and is indispensable for water life. In fresh water it is important not to fall below a 0.02 mg/l concentration to guarantee a proper plant growth: concentrations higher than 0.50 mg/l are non toxic, but should not be exceeded to avoid seaweed proliferation. On the other hand, sea water should not have a concentration higher than 0.10 mg/l, especially when delicate invertebrates are being bred. In order to reduce the presence of phosphates in the water you can use special resins NO PHOSPHATES or partially replace the existing water and to add NITRIDAC (solution containing a bacteria mix of the NITROSOMAS and NITROBACTER type).
It should be said that often drinking water contains a high quantity of phosphates (even higher than 5 mg/l); in these cases it is important to adequately treat water in advance before introducing it into the aquarium (reverse osmosis, special resins).

• COLOUR SCALE



FORM FOR LISTING IDEAL AQUARIUM VALUES

	DATE	DATE	DATE	DATE	DATE	DATE	DATE
	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE
pH							
GH							
KH							
NO_2							
NO_3							
NH_3/NH_4							
Fe							
Ca							
PO_4							

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