

How to understand & test water quality in marine aquariums

One of your fish's Five Welfare Needs is a suitable environment and it is often said that fishkeeping is not so much about looking after your fish & invertebrates but looking after their water. To keep our marine tank inhabitants happy and healthy, we need to know what the water in our aquarium should and shouldn't contain so as to avoid problems. We can do this by testing the water quality in our aquariums which is quick and easy to do with test kits. This caresheet aims to help you understand more about water quality: by maintaining a stable environment and preventing any sudden changes which may be harmful, helping your aquarium and your new hobby to thrive.

Just like us, fish must go to the toilet but unlike us, they can't then flush a toilet for their waste to be dealt with by a sewage works. We therefore need to remove this waste to prevent their water becoming polluted and affecting their health. In the marine aquarium, biological filters and live rock fulfil the function of a sewage works (known as biofiltration). To check that this process is working properly in your aquarium, you will need to use water quality test kits. Bear in mind that your OATA retailer can provide guidance on how to do such tests at home.

It's a common mistake that if the water looks clear, then the water quality must be fine. Much of the pollution that a fish may experience is invisible to our eyes. For example, strong acids, bleach and white spirit are all clear liquids but are highly dangerous to us!

What causes problems?

Chlorine/Chloramine

Water companies must by law provide water which is suitable for drinking. They do this by adding chlorine or chloramine to our tap water. However, these chemicals are harmful to all marine aquarium, inhabitants and the beneficial bacteria in your filter. As such, reverse osmosis (RO) water is generally used for marine aquariums. If you intend to have an RO machine at home, ensure it is fitted and maintained correctly to ensure the lowest total dissolved solids (TDS) reading possible.

Ammonia and Nitrite

In your aquarium, ammonia is excreted as waste by your fish and from the breakdown of uneaten food. Ammonia is toxic to fish and invertebrates, but in a mature, healthy aquarium, it is converted almost instantly by beneficial bacteria, first to nitrite (which is also toxic to fish) and then to nitrate (which is relatively non-toxic to fish but still detrimental in high concentrations to some inverts). This is known as nitrification and is part of a process called the nitrogen cycle. However, in a newly set-up or over-stocked aquaria, there will not be enough of these bacteria to enable this process.



Sept 2022

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These bacteria, known collectively as ammonia oxidising bacteria (AOB) and nitrite oxidising bacteria (NOB), will grow on any available surface in your aquarium, but as they require oxygen, they will be found particularly in your aquarium's filter and the surface of your live rock where there is greater movement and oxygenation of water.

In a newly set-up aquarium, ammonia and nitrite levels will initially rise but as the levels of beneficial bacteria increase, these levels will then fall to (and should stay at) zero. Levels of beneficial bacteria can be supplemented via proprietary products, as per the manufacturer's instructions.

Ammonia is especially important to monitor in marine aquariums as the higher pH of saltwater makes the ammonia significantly more toxic than in freshwater aquariums.

Nitrate

Nitrate is the end-product of the breakdown of ammonia, so a rising nitrate level is associated with a mature aquarium filter. Nitrate is then either taken up by algae or by bacterial denitrification to complete the nitrogen cycle or is removed during partial water changes. Frequency and size of water changes may vary according to what species you keep, the aquarium size, the number of fish you have and other factors. If in doubt, seek advice from your OATA retailer. Specialised filters and other proprietary products are also available which can maintain or lower nitrate levels. Corals are especially sensitive to high nitrates and therefore reef aquariums should be regularly monitored to ensure nitrates remain at acceptable levels.

Phosphate

Phosphate can be overlooked; however, it can be detrimental to marine aquariums at high levels. Phosphate enters aquarium water from the breakdown of uneaten food and fish waste. It will cause unwanted algae growth and can stress corals, resulting in decreased growth rates and colour change. Fortunately, it is easy to remove through water changes and specialised resins in filter units.

What else do you need to test for?

Salinity

Perhaps the most important parameter in a marine aquarium is salinity. This is the measure of salt in the water and will affect the chemistry of all elements in the water. Rapid changes can cause severe stress or even death of livestock and so any water used in water changes should match the salinity in the aquarium. Salinity will increase as evaporation causes water to leave the aquarium, but the salt will remain. Therefore,



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it is important to regularly top up the aquarium with fresh reverse osmosis water in an area of high flow. The easiest way to check for evaporation is to mark a full water line in either the tank or the sump and top up when the water level falls below this.

Temperature

Marine livestock have very specific temperature tolerances. Therefore, it is important to regularly check that your aquarium heater is working correctly, especially just before the winter period when heaters have to work harder. Temperatures outside the appropriate range can cause stress which may lead to disease or death. Sudden changes in temperature can cause shock and should be avoided. Unacceptable temperatures indicate a need for either a higher-powered heater (if too low), or a fan/chiller (if too high).

pH

This simply refers to how acidic or alkaline a substance is and is measured on a scale from 1 to 14. As pH 7 is halfway on the scale, it is said to be neutral i.e. it is neither acidic nor alkaline. Substances with a pH value less than 7 are acidic and those with a pH value higher than 7 are alkaline. It is important to know that each whole unit change on the scale represents a factor of ten e.g. pH 4 is 10 times more acidic than pH 5 and 100 times more acidic than pH 6! If pH values change too suddenly, this could make the water too acidic or too alkaline and be stressful for your fish. At high pH levels, such as in marine aquariums, ammonia will become more toxic. Carbon dioxide is acidic and therefore, there will be natural variation in pH throughout the day as photosynthesis reduces the amount of carbon dioxide in the water. Low pH can be harmful to corals and indicates that there may not be enough surface movement or aeration, since improved gas exchange reduces carbon dioxide levels.

Carbonate hardness

Carbonate hardness is the measure of carbonate and bicarbonate anions in the water. These help to resist changes in pH and will provide material for hard corals to use as they grow. It is especially important to monitor in aquariums with lots of hard coral growth. It can be easily dosed using proprietary products, but any changes must be slow so as to avoid shock to the inhabitants. Your OATA retailer can provide guidance dependent on tank size and stocking levels.

Calcium

Calcium should be monitored in reef tanks as it is used by corals to build their skeletons. Again, it is useful for hard coral growth but is equally important for invertebrates who may extract it from the water for their shells. It can be increased using proprietary products or with the addition of a calcium reactor, but any alterations should be done slowly.



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Magnesium

Magnesium is similar to calcium in that it is used as hard corals grow and it is important for other invertebrates. It can become depleted if the water changes are not providing magnesium as quickly as it is taken up by the invertebrates. It can be increased using proprietary products, but any changes should be done slowly.

Testing your aquarium water

Routine testing of water quality in your aquarium is quick and easy to do and can highlight any changes before they cause problems for your inhabitants. You should regularly monitor your water quality, ideally at least once a week to make sure parameters are at suitable levels for your livestock. You should also test the water if you notice your fish or invertebrates behaving unusually. When the aquarium is first set up, you may wish to test the water more frequently. If you're unsure of when you should test your aquarium water, do ask your OATA retailer who will be happy to provide guidance.

Test kits are available which will separately test the levels of pH, ammonia, nitrite, nitrate, phosphates, calcium, magnesium and carbonate hardness. When testing water, take it from the main body of the aquarium, rather than the filters. Test kits are available as either liquids or tablets. All work on the same principle in that they will change colour of the water sample, which you then compare to a colour chart to obtain the result. Some brands are more accurate than others, with marine specific test kits being better suited for marine aquariums. ICP tests are also available which involves taking a sample of your aquarium water that is then posted to a laboratory for more accurate analysis.

Ammonia and nitrite levels should always be zero. Nitrate levels in saltwater aquariums should not exceed 20 mg per litre if keeping just fish, or 5-10 mg per litre (depending on the species) if keeping invertebrates. For more information, please see our "Marine water chemistry" caresheet.

What to do if there is a problem?

If your water test kits indicate a problem e.g. ammonia or nitrite levels are too high, these can be reduced by carrying out partial water changes and maintaining good husbandry e.g. not overstocking, over-feeding etc. If other parameters such as phosphate are too high, it might indicate that the resin used is depleted. There are other products which can be dosed to increase elements as required. Your OATA retailer can provide further help and guidance as necessary.

One important factor to consider is the stability of water parameters in the aquarium. Marine aquariums will thrive if conditions are stable and any changes that need to be made are performed slowly. Rapidly changing conditions or chasing "ideal" parameters can sometimes do more harm than good.



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What to watch out for

All fish will have slight variations in their behaviour or appearance, but keeping an eye on any changes in the following will help to identify any potential problems before they become a real health issue:

- » swimming behaviour – hanging at the surface, sitting on the bottom or erratic swimming
- » colour – turning a darker or paler colour than normal
- » temperament – changes in level of aggression or hiding more than normal
- » breathing – gill covers moving at a slower or faster rate than normal
- » appearance – development of white spots or fluffy growths, loss of fins or scales
- » condition – increase or decrease in body weight and condition
- » feeding – reduced intake or lack of interest in food

If you are concerned about the health of any of your livestock, then test your water quality and contact your OATA retailer for further guidance.

Five Welfare Needs Checklist:

The Animal Welfare Act 2006 states that all pet owners have a legal duty of care to their pets. Anyone who is cruel to an animal or is found not to be providing the five animal welfare needs, as listed below, can be prosecuted.

- » A **suitable environment** e.g. appropriately sized tank (with water heater if tropical set up) within a suitable location in your home.
- » A **suitable diet** which meets the needs of your chosen fish.
- » **Behaviour** - Fish are able to exhibit their normal behaviour e.g. hiding places for timid fish, enough room for fish to swim freely.
- » **Companionship** - Ensure you know whether your chosen fish need to be kept with, or apart from, other fish.
- » **Health** - Protected from pain, injury, suffering & disease e.g. you are aware of the daily, weekly and monthly maintenance that your aquarium will need.

- » **Water quality test kits are a necessity not an optional extra**
- » **You must be prepared to look after your fish properly for the duration of their life and provide an aquarium which can accommodate your fish when fully grown**



*Never release your aquarium animals or plants into the wild. It is illegal and for most fish species this will lead to an untimely and possibly lingering death. Any animals or plants that do survive might be harmful to our native countryside. Take care to properly dispose of any soiled substrate (e.g. sand or gravel) water or decorations so that non-native organisms do not enter natural watercourses.

Visit ornamentalfish.org to find a full range of how to guides and species-specific care sheets to help you look after your fish successfully.



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