

## General Hardness

### *An important water parameter*

General Hardness is probably the most important, unchecked water parameter. General Hardness (GH) refers to the amount of Calcium and Magnesium salts (mineral salts - Sulphates, Carbonates, and Bicarbonates) present in the water. General Hardness has a considerable effect on pH and the ability of pH buffers that keep the pH stable as these mineral salts have a carbonate or bicarbonate component, they may also affect the Carbonate Hardness (KH) or Alkalinity. While KH can be tested, it only provides a measure of the buffering capacity of water, it does not measure all mineral salts present. When monitoring your hardness, GH is the preferred parameter to check as it is more complete than KH.

#### How does GH affect fish?

The chemical nature of water has a profound effect on the physiology of fish. The concentration of mineral salts affects fish in two important ways; osmotic regulation (equilibrium of the internal salt concentration) and blood calcium levels. Being open systems, fish are affected by the makeup of the surrounding water. As a consequence of osmosis, freshwater fish are subject to a continuous influx of water, while marine fish have to live with a continuous outflow of water. Fish have to maintain a constant internal body fluid concentration – a process called **osmoregulation** with the gills and kidneys playing a major role in this. The greater the difference in concentration between the fish's body fluids and the surrounding water – the greater the osmotic effect and the harder the fish has to work to maintain suitable levels of water and mineral salts within the body. If these concentrations are not correct then cells within body tissues risk bursting (due to too much water) or shrinking (not enough water, chemically 'drying-up'). Incorrect water conditions will also affect the ability for fish to maintain adequate blood calcium levels which can lead to problems with the functioning of many systems

within the body.

As this process consumes a lot of energy, it is important to maintain water conditions near to what fish have evolved in. This becomes more important under commercial conditions where fish may be kept in a 'high stress' environment where they are kept in high stocking densities, fish are constantly being moved in and out of tanks. Any of these stress factors can compromise the ability of fish to osmoregulate with energy that would normally be used to osmoregulate being diverted to deal with the stress response and immune responses.

Our general recommendations for GH are:

Fish Type	pH	GH in ppm
Goldfish and Coldwater species	7.0 – 7.5	150
Miscellaneous species	7.0	100 -150
Tetras and Discus	6.5 – 7.0	50 - 100
Livebearers, Brackish and Rift Lake Cichlids	7.0 – 7.5	250 - 300