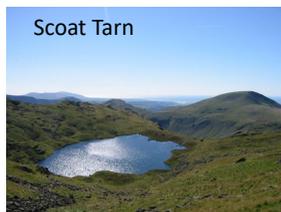


## Natural waters getting more acidic by Leslie Webb

Last year, I wrote a series of short pieces about the work of the Loweswater Care Programme on trying to improve the water quality in Loweswater. We hear a lot about climate change in relation to CO<sub>2</sub> emissions, but much less about one of its other insidious effects - aquatic acidification.



When I was a young chemist, the subject of acid rain was often in the news, with Scandinavians often claiming that their lakes and rivers were being acidified by emissions of sulphur and nitrogen oxides exported from UK power stations. There was some truth in this, but it was also acidifying our own natural waters. A good example is Scoat Tarn in Wasdale, where the pH had declined to 5.0 by 1990, but has since increased to 5.5 due to the substantial reduction in sulphur dioxide emissions since then.

At the same time as this was going on, another source of acidity was increasing. Carbon dioxide is much weaker in acidity terms than sulphur dioxide, but the quantity emitted is much greater and, despite ongoing efforts to curb it, is still increasing. It is sometimes difficult to separate the effects on water bodies of rising temperatures and rising acidity levels, but any change (up or down) in some parameters causes problems if they happen too quickly for the environment to adapt.

The main aquatic effects of rising CO<sub>2</sub> levels are seen in the world's oceans rather than in fresh waters like the Cumbrian lakes. Ocean pH varies somewhat with location, but is typically 8.2 today, a decrease of 0.1 in recent times, which sounds small, but the actual increase in acidity is 30%, a big change over a small timescale. This contributes to the so-called "bleaching" effects on ocean corals caused by increased ocean temperatures and makes it difficult for many marine organisms to make their calcium carbonate shells (as shown here).



Ocean waters are quite well-buffered against pH changes, but many fresh waters aren't. For example, Loweswater has an alkalinity (a measure of its buffering ability) less than 10% of that of sea water. It can be calculated that the "normal" pH at the surface of Loweswater at 10°C used to be 7.6, but is now around 7.4. However, the actual pH of Loweswater fluctuates widely, particularly when algae are growing strongly, sometimes reaching above pH 9. There may be a better ability to withstand pH shifts due to such regular stresses. Our ongoing monitoring will hopefully tell us something about this.