Acid Sulphate Soils, Currency Creek, South Australia, June 2009 photos by Ken Jury

BEWARE BROWN TOMATOES AND RED DOT MULLET

by Andrew Cribb

This article was published in Western Angler magazine in 2002, when the issue of acid sulphate soils (ASSes) was only just emerging (literally) in Western Australia. At the time – and it is still true now – bureaucrats talked about water chemistry, governments sat on their hands – and no-one really understood that the release of ASSes strikes at the very fabric of the web of life itself.

It isn't just about the fish – it's about the essence of ecologically sustainable living.

The tragedy that is afflicting Lake Alexandrina is a national and international disgrace. Unfortunately, the Lake is only one example of a threat that lurks in most of coastal Australia. Let's hope our elected representatives don't just cover their ASSes and pick the "do nothing" option. As the Chinese proverb says – the solution is in their hands.

Sometimes writing for Wangler feels a bit like watching Pandora open the fabled box of good and ill. The stream of nasties just keeps on coming – and Hope has yet to emerge.

Our Editor, Ian Stagles has flagged a series of environmental issues that are likely to do long term damage to the health of fish nurseries and habitats in his editorials over the years – so here's another sleeper to add to the list.

The beasts below the surface are acid sulfate soils. Anyone who has lived in New South Wales or Queensland would be familiar with the problem. But in southern WA we have been blissfully complacent – until now, that is.

The WA the story goes a bit like this. One morning in December 2001 a bloke who had being growing vegies up near Lake Gwelup for years woke up to find that his entire crop of summer tomatoes had turned brown and died. What's worse most of his garden has also gone brown and looked mighty sick.

Having had a bore in for years, and being naturally a bit annoyed, he rang the City Council, who checked it out, thought there might be a problem and passed the complaint on to the Waters and Rivers Commission (now DEWCAP).

At the same time, the same council were having a lot of trouble keeping their nice public-open-space grassed areas green. In fact they were quite brown and seemed to get browner every time they got watered.

These grassed areas surrounded new ornamental lakes that had until recently been part of the chain of coastal plain wetlands and swamp areas than runs north from Lake Herdsman almost as far as Yanchep.

The property boom and increase in higher density housing developments had caused the area in question to be rezoned from “low density residential” and ”rural” to “residential”.

After various earthworks and the shifting of mounds of peat two new housing developments, complete with “the lakes” looks and appellations, were finished and flogged off to happy punters.

The water in the lakes was nice and clear – not a shred of green algae to be seen – and no-one complained about the lack of ducks, frogs, gambusia or even carp that such waterbodies often support.

Back to our vegie gardener. A few weeks later a couple of Government types rocked up to test this guy’s borewater. That’s when the red flag went up. At a pH of 2, the bore in question had been pumping high grade sulphuric acid onto the aforementioned tomatoes. That’s 100,000 times more acidic that the stuff we normally drink and wash in.

What’s worse the water had very high levels of aluminium and iron. Further testing darkened the scenario. More tests revealed other bores in the area were not only highly acidic, but contained concentrations of arsenic 114 times higher than the maximum for human health laid down by the National Health and Medical Research Council as the national standard.

Not many fish involved so far, I hear you ask (though you might be thinking seriously about property values and the health benefits of organically home grown vegetables).

The fishy bit comes in next. Far away in Queensland and New South Wales they have had massive problems in their rivers and estuaries every time it rains after a decent dry spell. Some years are worse than others.

Cane growing, delving for housing developments, flood drains, dredging and a myriad of other human digging activities have disturbed the beast within – and its biting back.

Acid sulfate soils (let’s call them ASSes) form naturally through a bacterial process in areas which have been inundated or waterlogged for long periods of time. In Australia they are most common in areas less than five metres above sea level – and were mostly laid down after the last major sea level rise about 10,000 years ago.

Most of the Swan coastal plain and all our estuaries fall into this category. So does most of the Pilbara and Kimberley coast, parts of the south coast including the once famous bream waters of the Scott River and some inland parts of the wheatbelt.

These soils are rich in iron pyrites, usually sludgy, and in their most neutral form are dark grey and soft. As they oxidise they get yellowish. When pyrites react with oxygen they produce – you guessed it – sulphuric acid.

Currency Creek, SA, 2009 photo by Ken Jury

Left alone they are fairly harmless. The water, swamp, mangrove or topsoil layers above them stop them oxidising, or at least slow the process down considerably.

When they get exposed to air by people digging up stuff or draining wetlands they get really nasty. The stuff actually starts to fizz and rise in temperature as all that oxygen gets to work. Before too long the sulphides become sulfates and the next shower of rain - or deliberate wetting - washes sulphuric acid into the water table, or directly into drains, streams, creeks and estuaries. A tonne of pyrite rich soil can produce a tonne and a half of sulphuric acid.

When this hits the estuary several things happen to the entire web of life. First, if the concentration is high enough it kills with nuclear efficiency. Anyone who has kept fish in a tank knows that fish can’t handle pH levels much lower (more acid) than 6.

In the East massive fish kills are commonplace when the first rains after periods of drought hit the waterways. Low water tables mean exposure of the ASSes to air, and rapid production of sulphuric acid.

Crustaceans are particularly susceptible, but so is almost anything else in the food chain – including juvenile fish, fish larvae, molluscs, river worms and other invertebrates.

When the acidic and highly metallic water hits the less acidic streamwater clouds of brown iron particles precipitate out of the water column, coating riverine algae and estuarine seagrasses with a smothering layer. The phenomenon is called flocculation – and flocculate it does.

As it runs downstream fish attempt to swim away from the acidified water, and eventually when it meets the salt it rises up in a freshwater layer over a deeper saltwater wedge.

The runoff also damages the mucous coating on the scales of fish that survive, and opens them to attack by viral, bacterial and fungal infections. “Red spot” disease, which forms ulcers then allows a secondary infection by a parasitic fungus, are a common sight on species from mullet to bream.

Damage to the gills and skin also reduces the ability of fish to "breathe" and maintain their internal fresh/salt water balance.

A more insidious and less visible effect is the impact on fish breeding success. Acid water flows not only have an immediate impact, but repeated cycles can take out whole generations of fish eggs, larvae and very young juveniles, leaving large gaps in the population structure.

Over a period of time repeated acid sulphate runoff can reduce the productivity of entire estuary systems - lowering fish breeding success in repeated generations, reducing growth rates and removing critical areas of breeding and nursery habitat.

Acid runoff also destroys or changes water plant communities to favour acid-tolerant species, and can seriously reduce the number, abundance and diversity of species throughout the estuarine food-chain.

On a human level they also have some very unpretty effects. Acidic water erodes concrete and metal jetties, pipes and bridges and in high concentrations is not good on the skin, eyes - or the engine of your boat.

But perhaps least obvious of all they dissolve and carry aluminium and heavy metals such as cadmium and arsenic - all really good for - into the food chain. Maybe this is why river anglers find it hard to remember their best catches?

So how come we haven’t seen this in WA yet? Well the answer is we have – but we probably haven’t seen much of it yet.

The key word is seen. Unless there is a big event the effects are hard to spot. Red spot and fish kills occur in the Kimberley in Ord and Dunham Rivers fairly regularly - they're the ones we can see.

But there have been a growing number of fish kill reports from the upper reaches of the Swan, Canning, Peel and other southern estuaries in recent years. The standard explanation up to now has been de-oxygenation caused by run-off - but I'm starting to seriously wonder.

Just to chuck another speculation into the beaker, acid sulphate run-off also changes water conditions to favour particular forms of algae.

So on balance I'm guessing that the missing river prawns in the Swan, reduced total productivity in the system, and changes in species composition have got to be linked to serious ecological disruption at an almost invisible level - and somewhere in the mix acid sulfate soil is doing its bit.