New regional emergence of cyanobacterial toxicosis

Although blooms of cyanobacteria are common in South Africa, animal deaths due to hepatotoxins were, prior to 1994, confined to the central and northern provinces (1). This pattern changed during the last weeks of 1993 when the first stock losses, attributable to cyanobacterial toxicosis, occurred in the southwestern Cape (2). Subsequently, and until December 1996, 7 stock and domestic animal deaths were recorded in this region and along the southern Cape coast (Fig 1). During the same period a single incident of stock loss was reported from the Northern province. Together, these losses represented a financial loss of 1.1 million SA Rands (1 USD = R4.50).

The first southwestern Cape poisonings occurred between December 1993 and March 1994 in the Malmsbury-Darling area (Fig 1). In both cases the stock losses, 3 cattle plus 5 exhibiting photosensitivity, and 29 sheep, respectively, occurred in camps where animal deaths with identical clinical signs had previously been observed (2). These earlier deaths, however, had not been linked to toxins produced by the cyanobacteria. Nodularia spumigena was found in the drinking water supplies in both incidents. No analyses for the presence of nodularin were performed as appropriate methodology was not available locally at the time. These two incidents have been described in detail elsewhere (2).

During March 1994, a bloom of Nodularia spumigena in Zeekoevlei, a shallow lake near Cape Town (Fig 1) resulted in the death of a bull terrier bitch. HPLC analysis (3) of algal material collected from where the dog drank contained a nodularin concentration of 3479 g g⁻¹ freeze-dried (f-d) material. This incident, described fully elsewhere (1), was interesting in that this was a short-lived appearance of Nodularia in a lake which has been dominated by Microcystis aeruginosa forma flos-aquae for the past five decades.

In May of the same year, a bloom of Microcystis aeruginosa forma aeruginosa near the town of Paarl (Fig 1) resulted in the death of 11 sheep and induced-photosensitivity in a further 20.

The cyanobacterial hepatotoxin, microcystin-LR, was detected in the algal bloom at a concentration of 1340 g g⁻¹ f-d weight, and a second, unidentified, microcystin variant at 585 g g⁻¹ f-d weight. The case history of this incident is detailed in Van Halderen et al (2).

After a lull of more than two years, a Microcystis aeruginosa forma aeruginosa bloom in the George district (Fig 1) resulted in the deaths of three calves and photosensitivity in a further 30. Analysis of lyophilized material from this bloom revealed the presence of the microcystins-LR and -YA at a combined concentration of 1720 g g⁻¹ f-d weight.

The George case was followed by a massive stock loss of 290 in-milk dairy cows on a farm in the Kareedouw district (Fig 1). A further 70 animals presented with acute photosensitivity and
had to be slaughtered. Although the clinical signs and symptoms were consistent with acute hepatotoxicosis, the water supply was flushed out soon after the incident and no toxins could be detected at the scene of the incident. Microscopic examination of the rumen contents of two of the dead animals showed the presence of filaments of *Anabaena*, and a mat of *Oscillatoria* filaments was found growing on the walls of the cement-lined reservoir from which the animals had drunk. HPLC analysis of rumen and bile revealed a hydrophobic, microcystin-like component possessing a UV spectrum closely-typical of the microcysts. The results of further tests on the rumen contents, performed by Professor Geoff Codd (University of Dundee, Scotland), and using ELISA immunonassay and protein phosphatase inhibition, were consistent with the presence of microcystins.

During December 1996 another incident was reported, again from the Malmesbury district. Here three 8-month old lambs died after drinking water containing *Microcystis aeruginosa* forma *aeruginosa*, and containing the microcysts -LR, -YR and LY at a total concentration of 1890 g g⁻¹ dry weight. No clinical signs or symptoms were evident prior to the deaths. Post-mortem of the affected animals showed severe lung congestion and oedema, widespread endo- and epicardial haemorrhages, severe liver damage with yellow colouration, and moderate swelling of the kidneys. There were also widespread haemorrhages in the skeletal muscles. The histopathological examination showed pancreatitis of the liver, and acute nephrosis of the kidneys.

During the period encompassed by these incidents, a case of a death of goats was reported from the Northern Province (Fig. 1). Eighteen four-month old goats died after drinking from a cement-lined trough near the town of Alldays. As was the case at Kareedouw, the causative organism was found to be *Oscillatoria*. Post-mortem examination revealed swollen and congested livers, congestion of the kidneys with some nephrosis, and oedema of the lungs. The results of the histopathological examination were consistent with the effects of acute cyanobacterial poisoning. HPLC analysis of a water sample from this incident contained 71 g g⁻¹ of an unidentified, hydrophobic microcystin.

Although cyanobacterial blooms have long been common in South Africa, the incidents reported on here represent the emergence of related poisonings in the southern and south-western regions of the country. They also indicate the appearance of *Oscillatoria*-related incidents in a country where *Microcystis* and *Anabaena* are the commonly-expected dominants of cyanobacterial blooms. The incidents involving *Oscillatoria* differ from those typical of *Microcystis* or *Anabaena* in that a lesser amount of cyanobacterial biomass appears to be involved, and that the hydrophobic toxins produced appear to have a toxicity greater than equivalent amounts of the more hydrophilic, commonly-encountered microcystins.

The cases reported on here are the first from this region, although others may previously have been incorrectly-diagnosed or the cyanobacterial-link undetected. A heightened awareness of the problem is now emerging amongst the veterinary and stock farming communities, this leading to improved sample collection and incident investigations. The growth of algal mats on the walls of drinking troughs and dams, as opposed to the readily-observed, buoyant scums of algae, indicates a requirement for increased vigilance regarding water supplies if stock losses are to be avoided.

**References**


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**Figure 1:** Map of South Africa illustrating the locations of the poisonings referred to in the text.