



A bloom of *Chrysosporium ovalisporum* the Murray River, 2016.

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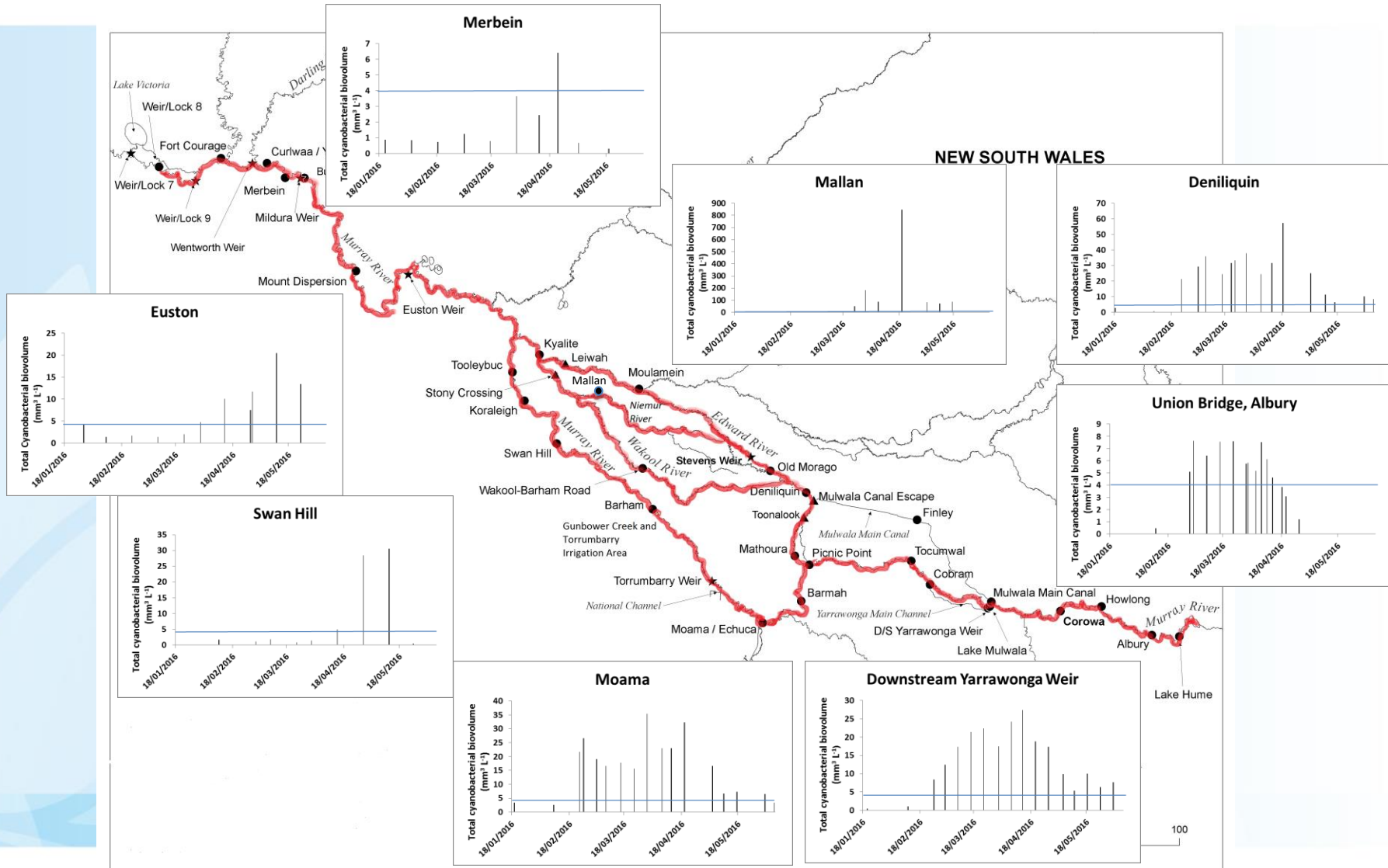
***Current address: Water NSW, Albury**



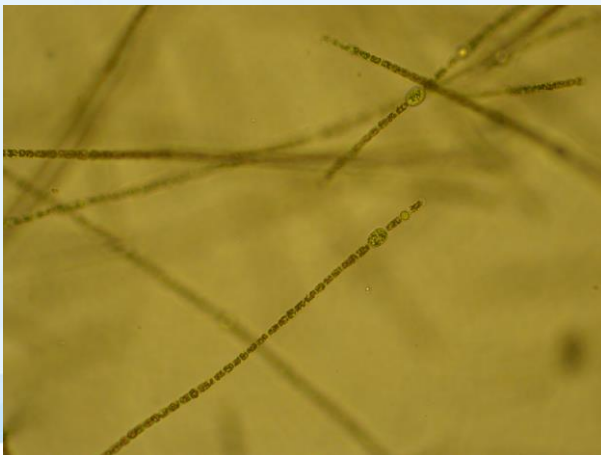
Overview of the bloom

- Blooms in excess of $4 \text{ mm}^3 \text{ L}^{-1}$ first detected in river in mid February.
- Maximum extent in April and May
 - Murray River from Lake Hume to Lock 8
 - Edward, Wakool and Niemur Rivers in NSW
 - Total river length ca. 2360 km
 - Distributary systems (e.g. Gunbower Creek) in Victoria.
- Decline commenced in late April in upper Murray
- Persisted downstream (e.g. Echuca, Mildura), Edward River until early June.
- The bloom was comprised predominantly of *Chrysosporium ovalisporum* (often >99% of biovolume) at most locations sampled.

Maximum extent of the bloom



C. ovalisporum in the Murray River





Optimal ecophysiological conditions for *C. ovalisporum*

As reported in the literature:-

- Optimal temps often 25-30°C (but range 15°C - 35°C)
- Slight to moderate salinity (350 – 3500 $\mu\text{S cm}^{-1}$)
- Slight to moderate alkalinity, pH from 7.2 – 9.0
- Low to moderate light intensities
- Deep stratified lakes and reservoirs and in shallow ponds

Optimal ecophysiological conditions for *C. ovalisporum*

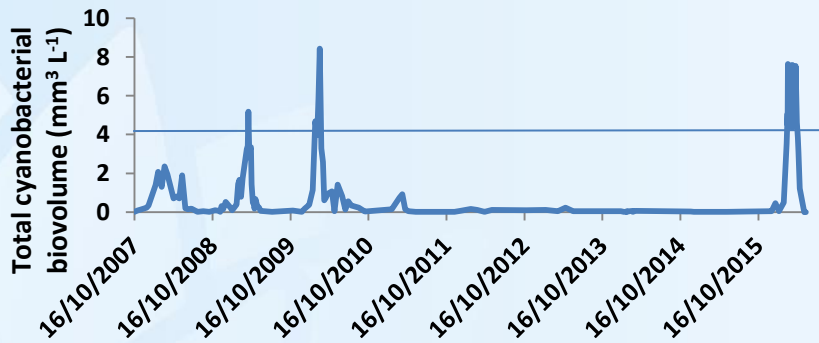
- Occurs in both eutrophic conditions but also in soluble nutrient deficient waters
- Nitrogen fixation, an advantage in N deficient waters
- Efficient P scavenging mechanisms, can grow under low inorganic P levels
- Has carbon concentrating mechanisms, utilises HCO_3^- as a C source
- Considered a potentially invasive species in Europe, especially if summer water temperatures increase by 4°C due to climate change

Previous reports of *C. ovalisporum*

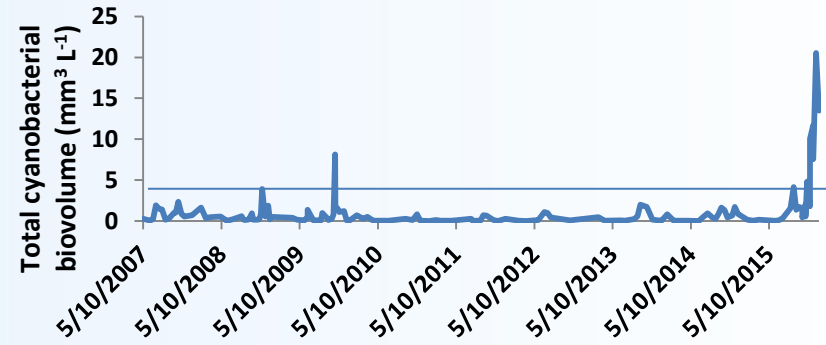
- Previously reported from wide range of sites in rivers and reservoirs across NSW
- Reports infrequent (once or twice in past 12 years)
- Usually at low abundance, as a minor component of the total cyanobacterial community
- One bloom at Cobaki (Tweed valley, NSW) and at Hervey Bay (Qld).
- Frequent blooms in Lake Kinneret (Israel)
- Reports of blooms from Lebanon, Turkey, Greece, Italy and Spain

Previous cyanobacterial blooms in the Murray River

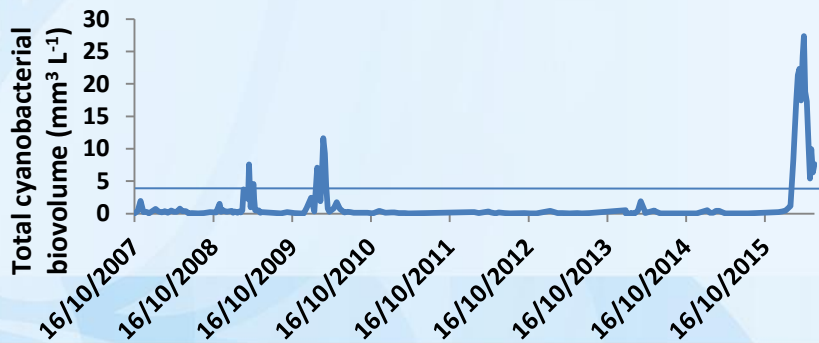
Union Bridge, Albury



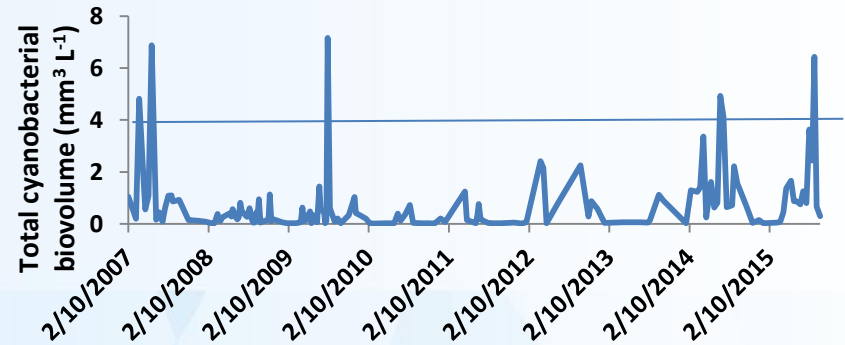
Euston



Downstream Yarrawonga

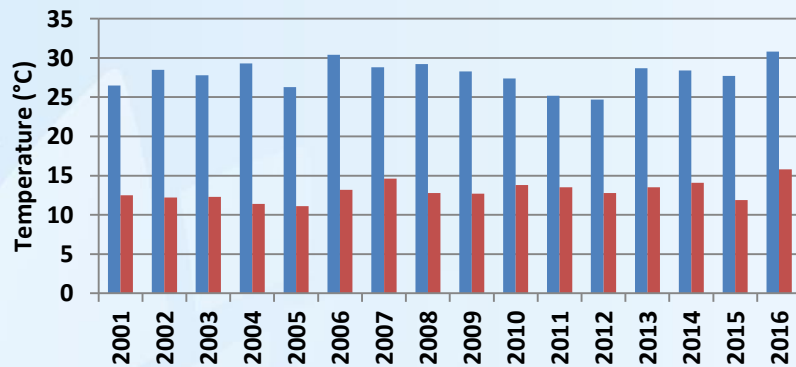


Merbein

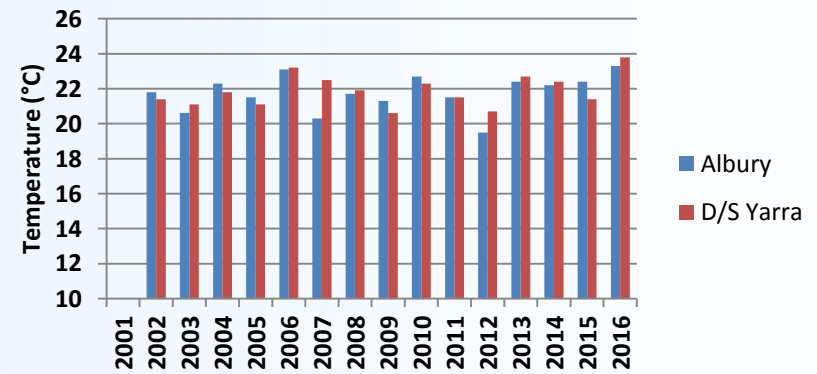


Why *C. ovalisporum* in 2016?

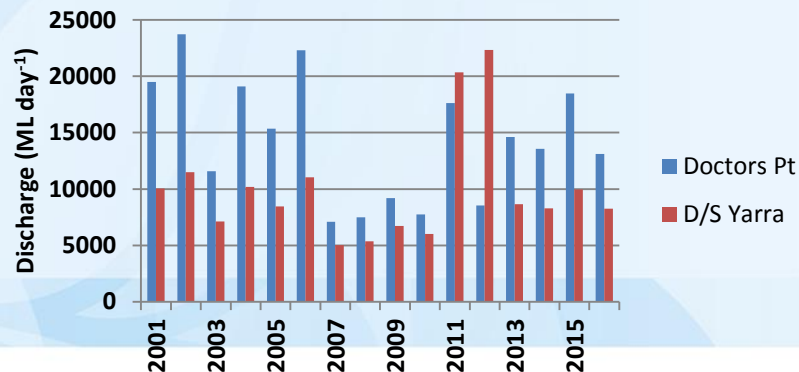
Max and Min Temp, March, Albury



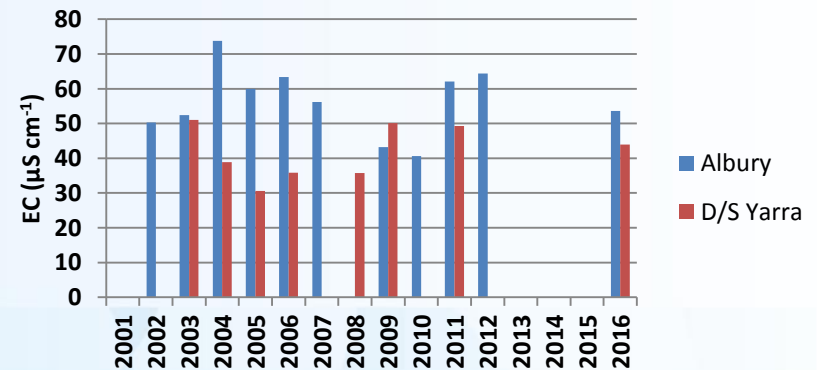
Mean Water Temp, March



Mean monthly discharge, March

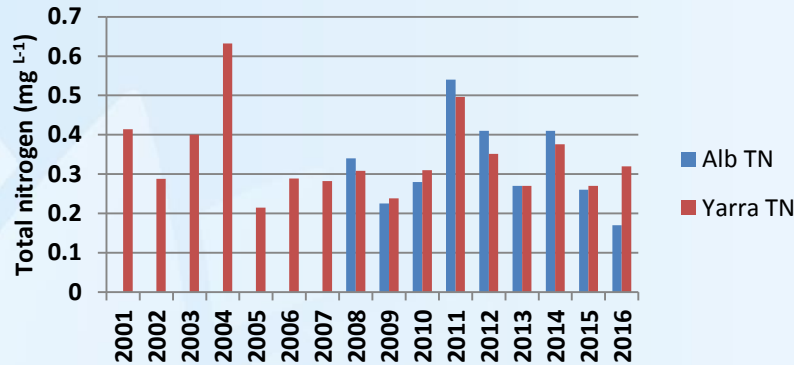


Electrical conductivity, May

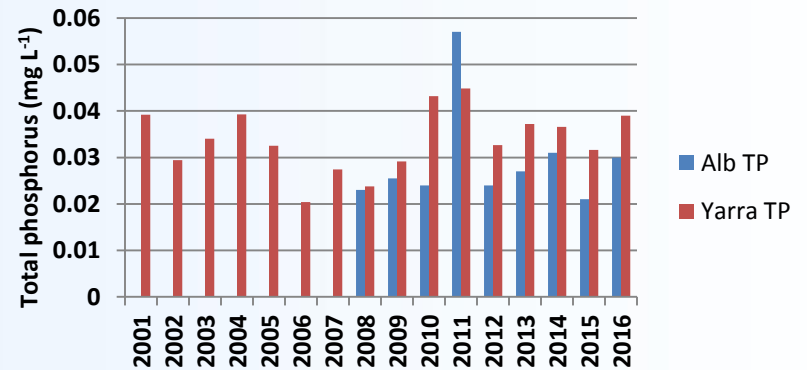


Why *C. ovalisporum* in 2016? Nutrients,

TN Jan



TP Jan



Toxicity testing of the Murray River *C. ovalisporum* bloom

- Most reported blooms elsewhere produced cylindrospermopsin.
- The Murray River bloom was almost non-toxic:
 - 50% of samples positive from *cyrA* genes, but copy numbers mostly below level of quantification
 - 33% positive for *stxA*, most below quantification, no *mcyE* genes detected
 - Toxicity testing (early March, early April) showed cylindrospermopsin, saxitoxins and microcystins all below detection limits.
- Note non-toxin producing strains have been isolated from urban ponds in Adelaide (South Australia).



Conclusions

- Cannot determine why 2016 was different and produced a *Chrysochloris* bloom, rather than blooms of *Dolichospermum* and *Microcystis* species.
- Mean maximum and minimum air temperatures were highest recorded in March, February temperatures when bloom commenced were similar to previous years.
- River water temperatures were higher than normal, but still below those considered optimal for *C. ovalisporum* growth.
- May water temperatures were $<15^{\circ}\text{C}$, yet blooms persisted in much of the river system.
- Some instream growth or concentration evident, especially in Edward-Wakool-Neimur rivers.
- River flow was higher than in 2009 and 2010 when last major blooms occurred, likely to have assisted disperse the bloom downstream.
- Nutrients, pH and turbidity were little different to some previous years.



Acknowledgments

- Andy Wise, Gordon Honeyman and Gerhard Schulz from DPI Water undertook the field work and collection of samples.
- Sarah McGeoch extracted historical water quality data from the DPI Water data base.

Thank you