

Hawker St Lake, Rockingham  
Phytoplankton Ecology Unit  
7 Ellam St  
Vic Park  
WA, 6100  
9<sup>th</sup> May 2005

Reference Numbers: P18170-71

**Attention: David Mort**  
Horticultural Technical Officer  
City of Rockingham  
Phone: 9528 0487  
dmort@rockingham.wa.gov.au

## ALGAL ANALYSES OF HAWKER ST LAKE, ROCKINGHAM, 5TH MAY 2005

Two samples of fresh water from Hawker St Lake, Rockingham were delivered to the PEU by David Mort, City of Rockingham, on the 5<sup>th</sup> of May. Samples from both locations formed a green surface scum. Both samples had distinct cyanobacterial odour. A few dead waterfowl was reported from that Lake. The samples were marked as

Site 1 (in front of the drain at the Hawker Street Lake-opposite 23/25 Reflection Mews)

Site 2 (in front of the drain at the Hawker Street Lake-opposite 10/12 Reflection Mews)

The samples were sub-sampled and fixed with Lugol's Iodine (1%). The samples were grab samples and were analysed on an 'as received basis'.

The enumeration of phytoplankton cells was carried out using a glass 1mL Sedgewick Rafter chamber at X100 and X400 magnification. The entire counting chamber were examined for the presence of Gazetted or potentially toxic cyanobacterial species.

### Results:

#### Hawker St Lake, Rockingham, 5<sup>th</sup> of May 2005

##### Site 1 (in front of the drain -opposite 23/25 Reflection Mews)

The total microalgal density was 472,007 cells/mL and the total cyanobacterial cell density was very high at 447,767 cells per mL.

The benthic narrow cyanobacterium *Oscillatoria* was dominant along with nitrogen-fixing *Aphanizomenon ovalisporum* and non-nitrogen fixing *Microcystis flos-aquae*. *Oscillatoria* was present at a density of 203,683 cells per mL. *A. ovalisporum* and *M. flos-aquae* were present at a high density of 134,667 cells per mL and 101,000 cells per mL respectively. Both of these species were linked to toxins in Australia. Both species exhibit strong buoyancy due the presence of gas vesicles and listed as Gazetted toxic species. Also benthic cyanobacterium *Merismopedia* and planktonic *Planktolyngbya* were noted.

Harmless green algae was also present at a moderate total density of 12,457 cells per mL. Among them, the harmless green flagellate *Carteria* and passive *Oöcystis* were dominant. Other species present

included diatoms, cryptophytes, freshwater dinoflagellates and euglenophytes (Table 1).

The densities of both planktonic and benthic/attached diatoms were moderately low at 6,060 cells per mL.

**Table 1: Algal composition of Hawker St Lake (site 1), 5<sup>th</sup> May 2005**

| Algal groups           | Genus                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Cyanobacteria</b>   | <i>Oscillatoria</i> , <i>Microcystis flos-aquae</i> , <i>Aphanizomenon gracile</i> , <i>Merismopedia</i> , <i>Planktolyngbya</i> |
| <b>Chlorophytes</b>    |                                                                                                                                  |
| • Flagellates          | <i>Chlamydomonas</i> , <i>Carteria</i> ,                                                                                         |
| • Passive              | <i>Oöcystis</i> , <i>Ankistrodesmus</i> , <i>Scenedesmus</i>                                                                     |
| <b>Diatoms</b>         |                                                                                                                                  |
| • Planktonic           | <i>Cyclotella</i>                                                                                                                |
| • Attached/Benthic     | <i>Navicula</i> , <i>Synedra</i>                                                                                                 |
| <b>Cryptophytes</b>    | <i>Cryptomonas</i>                                                                                                               |
| <b>Dinoflagellates</b> | Peridinioid                                                                                                                      |
| <b>Euglenophytes</b>   | <i>Euglena</i>                                                                                                                   |

#### **Site 2 (in front of the drain -opposite 10/12 Reflection Mews)**

The total microalgal density was 550,147cells/mL and the total cyanobacterial cell density was very high at 534,660 cells per mL.

Like site 1, the benthic narrow cyanobacterium *Oscillatoria* was dominant along with nitrogen-fixing *Aphanizomenon ovalisporum* and non-nitrogen fixing *Microcystis flos-aquae*. *Oscillatoria* was present at a density of 283,137 cells per mL. *A. ovalisporum* and *M. flos-aquae* were present at a high density of 186,850 cells per mL and 57,267 cells per mL respectively. Both of these species were linked to toxins in Australia. Both species exhibit strong buoyancy due the presence of gas vesicles and listed as Gazetted toxic species. Also benthic cyanobacterium *Merismopedia* and planktonic *Planktolyngbya* were noted.

Harmless green algae was also present at a moderate total density of 8,080 cells per mL. Among them, the harmless green flagellate *Carteria* and passive *Scenedesmus* were dominant. Other species present included diatoms, cryptophytes and freshwater dinoflagellates (Table 2).

The densities of both planktonic and benthic/attached diatoms were moderately low at 4,713 cells per mL.

**Table 2: Algal composition of Hawker St Lake (site 2), 5<sup>th</sup> May 2005**

| Algal groups           | Genus                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Cyanobacteria</b>   | <i>Oscillatoria</i> , <i>Microcystis flos-aquae</i> , <i>Aphanizomenon gracile</i> , <i>Merismopedia</i> , <i>Planktolyngbya</i> |
| <b>Chlorophytes</b>    |                                                                                                                                  |
| • Flagellates          | <i>Chlamydomonas</i> , <i>Carteria</i> ,                                                                                         |
| • Passive              | <i>Oöcystis</i> , , <i>Scenedesmus</i>                                                                                           |
| <b>Diatoms</b>         |                                                                                                                                  |
| • Planktonic           | <i>Cyclotella</i>                                                                                                                |
| • Attached/Benthic     | <i>Navicula</i> , <i>Synedra</i> , <i>Amphora</i> , <i>Fragilaria</i>                                                            |
| <b>Cryptophytes</b>    | <i>Cryptomonas</i>                                                                                                               |
| <b>Dinoflagellates</b> | Peridinioid                                                                                                                      |

## Discussion

### Hawker St Lake

Both sites had high bacterial cells (rod and spiral shaped).

The cyanobacterial density in both sites is considered environmentally and recreationally **very high** and **well above** the Recommended Guidelines for the Recreational Use of Water Potentially containing Cyanobacteria of **20,000 cells per mL** by the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ, 1995).

The floating green scum was predominantly the toxic cyanobacteria *Microcystis flos-aquae* and *Aphanizomenon ovalisporum* and they do indicate a eutrophic waterbody. The presence of benthic *Oscillatoria* within surface samples indicates disturbance of bottom sediments.

Australian Water Authorities adopted a three level alert system summarised below (Australian Centre for Water Quality Research: Author MD Burch, 1992-under review). The total composite cyanobacterial density for the lake would be at Alert Level 3- if toxic.

**Table 3: Summary of Alert Levels for Cyanobacteria in Drinking Water**

| Alert Level    | Toxic Cyanobacteria Density                                                  | Response                                                                                                                        |
|----------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Level 1</b> | 500-2,000 cells per mL                                                       | water authorities alerted and sampling frequency increased                                                                      |
| <b>Level 2</b> | 2,000-15,000 cells per mL (when toxicity test is carried out)                | authorities alerted and sampling increased plant operators take precautionary action                                            |
| <b>Level 3</b> | >15,000-20,000 cells per mL of toxic blue-green algae in a persistent bloom. | consultation between health and water supply authorities to ensure safe domestic and recreational water and warnings are issued |

*A. ovalisporum* has been reported to produce the water soluble hepatotoxin (liver toxin) *cylindrospermopsin* (Shaw *et al.*, 1999). Due to lack of adequate data, no guideline value has been set for concentrations of *cylindrospermopsin* in drinking water. There are no reports in the literature of impairment of water quality by *A. ovalisporum* due to the production of taste and odour compounds. It is found in artificial lakes and reservoir sporadically throughout the temperate and sub-tropical Australia

where it prefers warm, stratified, high alkalinity/conductivity waters. It has been reported as monoculture “blooms” forming brown surface scums from a number of artificial lakes adjoining housing estates.

*Microcystis* is known to produce hepatotoxic *microcystins* and has the ability to form surface scum as observed at Hawker St Lake. It can cause liver damage and can be a serious problem in terms of drinking water contamination. In three successive summers 1998-2000 the Torrens Lake (in the centre of the city of Adelaide) had heavy blooms of *Microcystis*, believed to be the cause of waterfowl deaths (Hallegraeff, 2002). Sometimes blooms of blue-green algae are washed onto shore of a waterbody. They may dry and form crust of dead algae. In this form the toxin may be active for weeks or months. Consumption of such material by animals may cause illness and even death. Other problems associated with blue-green algae can include ecological effects-“blue-green algae have been implicated in the poisoning of wild animals including Kangaroos, rodents, amphibians, fish, bats, waterfowl and zooplankton (NRM website on blue-green algae)”.

It is also considered that the presence of a *Microcystis* and *Aphanizomenon* scum in the Hawker St Lake could lead to the accidental ingestion of cyanobacteria algae by water birds-especially if the public are feeding the birds with bread as this encourages them to feed at the surface.

Most cyanobacteria have potentially irritant lipopolysaccharides and therefore contact with any cyanobacterial scum could result in skin irritation and other allergic responses and/or gastro enteritis. The impact of cyanobacteria on the public is variable and depends on individual's sensitivity to this lipopolysaccharides and the type of activity contact that people may have. The risk to consumption by humans and animals depends on the toxicity of the algae. The actual toxicity of any cyanobacterium can only be confirmed by specific (*microcystin* and *cylindrospermopsin*) toxin analysis, however based on the very high levels of cyanobacteria present on the 5<sup>th</sup> May 2005, it is recommended that the City of Rockingham advise the HDWA and that approved warning signage be installed around the Lake.

It should be noted that algae can rapidly multiply and the results are only indicative for the time of sampling. Also cyanobacterial scums are highly mobile when affected by breezes and may accumulate as dense shoreline scums that should be avoided. Ideally consecutive sampling is recommended as a safety precaution for high use water, particularly following consecutive days of fine still weather conditions.

## Recommendation

- The HDWA (Bree Abbott, 9388 4999) be informed of these high levels of potentially harmful cyanobacteria and that warning signs be installed in Hawker St lake, Rockingham.
- The warning signs should remain in place until two consecutive sampling result provides satisfactory low results and there is no surface scum present on calm days and no longer poses a potential threat to public or animals.
- It is suggested that any physical contact should be avoided and Public access.

If you have any queries regarding this matter please contact the PEU on 6250 8061/64. In all correspondence on this matter, please quote sample P18170-71 Hawker St lake, Rockingham 5<sup>th</sup> of May 2005.

The samples are considered as “freebies” as they are first samples and in future it will incur cost (per sample \$80 + GST).

Yours faithfully

**Ashrafi Begum**

Phytoplankton Ecology Unit

Aquatic Science Branch, Department of Environment (DoE), 9<sup>th</sup> of May 2005