River Murray Phytoplankton Monitoring Program (PMP)

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Content

• Murray-Darling Basin and the River Murray Phytoplankton Monitoring Program (PMP)
• Key observations and links identified for algal blooms
• Conceptual model showing factors responsible for phytoplankton growth
• Murray-Darling Basin Algal Management Strategy
• Conclusions
• Future research needs
Fast facts of the Murray-Darling Basin

- Population: 2 million
- Provides water for 3 million people
- Diverse communities
- $18.6 billion agricultural production
- Aboriginal & European history
- Wetlands: 30,000
- 4 states + one territory
- 40+ Aboriginal nations
- 35+ endangered bird species
- 16 endangered mammal species
- 46 native fish species
- 14% of Australia's irrigated farms
Hydrology: River and major storages

**River and Major Storages**

- DARLING: 2740 km
- MURRAY: 2530 km
- MURRUMBIDGEE: 1690 km
- CONDAMINE–CULGOA: 1375 km
- LACHLAN: 1370 km
- MACQUARIE: 950 km
- WARREGO: 830 km
- NAMOI: 700 km
- PAROO: 640 km
- BOGAN: 600 km
- GOUldburn: 560 km
- GWYDIR: 560 km
- CASTLEREAGH: 550 km
- LODDON: 390 km
- WIMMER: 290 km
The PMP plays a crucial role for the Murray-Darling Basin Authority – it fulfils statutory responsibilities of Clauses 44-46 of the Murray-Darling Basin Agreement, Schedule 1.

No other program monitors the broader phytoplankton community, as the sampling undertaken by States overwhelmingly monitor cyanobacteria only.
Blue-green algae in Murray River, 2016

Started in Lakes Hume and Mulwala in mid-February and by April it extended to 1700 km downstream of Hume dam.

Picture: Victorian Government
## History of sampling sites for Phytoplankton Monitoring Program

<table>
<thead>
<tr>
<th>Original Sites 1980/Weekly sampling</th>
<th>Discont early</th>
<th>Extant currently</th>
<th>Altered Dec 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murray – Jingellic</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitta - Tallandoon</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray – Heywoods</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray – Yarrawonga</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray – Torrumbarry</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barr Ck – Capels Flume*</td>
<td>X</td>
<td></td>
<td>Removed</td>
</tr>
<tr>
<td>Murray – Swan Hill</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murrumbidgee–Balranald</td>
<td>X</td>
<td></td>
<td>Made monthly</td>
</tr>
<tr>
<td>Murray – Euston</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray – Merbein</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Darling – Burtundy</td>
<td>X</td>
<td></td>
<td>Made monthly</td>
</tr>
<tr>
<td>Murray – Lock 9</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray – Lock 5</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray – Morgan</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray – Tailem Bend</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goolwa - SA</td>
<td>X</td>
<td></td>
<td>Discontinue in Jun 2016</td>
</tr>
<tr>
<td>Milang–Lake Alexandrina</td>
<td>X</td>
<td></td>
<td>Wkly sampling start July</td>
</tr>
</tbody>
</table>
Map showing sites for River Murray Phytoplankton Monitoring Program
Taxa into which phytoplankton data had been aggregated

<table>
<thead>
<tr>
<th>Cyanobacteria</th>
<th>Algae</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anabaena</strong> <em>(Dolichospermum)</em></td>
<td>Actinastrum</td>
</tr>
<tr>
<td>Anabaenopsis</td>
<td>Cryptophyceae</td>
</tr>
<tr>
<td>Aphanizomenon</td>
<td>Ankistrodesmus</td>
</tr>
<tr>
<td><em>Cylindrospermopsis</em></td>
<td>Euglenophyceae</td>
</tr>
<tr>
<td><em>Cylindrospermum</em></td>
<td><em>Aulacoseira distans</em></td>
</tr>
<tr>
<td><em>Microcystis</em></td>
<td><em>Melosira varians</em></td>
</tr>
<tr>
<td>Nodularia</td>
<td><em>Aulacoseira granulata</em></td>
</tr>
<tr>
<td>Nostoc</td>
<td>Other Chlorophyceae</td>
</tr>
<tr>
<td><strong>Other Cyanophyceae</strong></td>
<td>Centric diatoms</td>
</tr>
<tr>
<td><em>Cylindrospermopsis sp.</em></td>
<td>Other Phytoplankton</td>
</tr>
<tr>
<td>Planktothrix</td>
<td>Chlamydomonads</td>
</tr>
<tr>
<td></td>
<td>Pennate diatoms</td>
</tr>
<tr>
<td></td>
<td>Chrysomonadales</td>
</tr>
<tr>
<td></td>
<td><em>Planctonema</em></td>
</tr>
<tr>
<td></td>
<td>Chrysophyceae</td>
</tr>
<tr>
<td></td>
<td><em>Scenedesmus</em></td>
</tr>
</tbody>
</table>
Uniqueness of the PMP

Planning & Specifications

Sampling
(Undertaken by states)

Analysis
(NATA Lab)

Reporting
(Lab to MDBA)
Conceptual model - relationships among variables affecting phytoplankton growth

- Solar radiation
- Air temp
- Storage releases
- Rainfall
- Water temp
- Floodplain inundation
- River height
- Current velocity
- Light availability
- Turbidity
- Lake Hume (height)
- Other nutrient sources (e.g., towns)
- Soluble nutrients (N, P, C, Si)
- Phytoplankton
Current management strategies

The MDB Algal Management Strategy, (MDBC 1994)

– Point source nutrients
– Phosphates in Detergents
– Riparian Zone management
– Protecting ecosystems
– Flow and reservoir management
– Pest Species
Current management strategies

Multiparty coordination committee responsible for reporting Algal Blooms

RACC (Regional Algal Coordinating Committees)

- Media Releases
- Household Notices
- Notices to recreational users
- Notices to farmers and diverters
- Public notices in Public Places
  - Tourism Centres
  - Holiday destinations
  - Police stations
  - Road signs
  - Web
Murray River is open for Business

 www.murrayriver.com.au

Official Murray River Travel Website

About 117,000 visitors per month

/Avoid contact with water
What do we want from Murray river management perspective?

No Bloom; specially during Easter

No Fish Kills ……etc
Conclusions

- The program has a sufficient period of record and built reliable understanding of phytoplankton growth along the river and over time.
- Phytoplankton data has been a useful indicator of short- and long-term changes in environmental conditions.
- There are no other programs that monitor the broader phytoplankton community.
- In 2016, a new species *Chrysosporum ovalisporum* bloomed for the first time in the Murray even when flow was high.
- Continued monitoring is required in the face of continuing change, particularly under changing species and climates.
Future research needs

• Reliable, quick detection of blooms & toxins
• Reliable forecasting for future: both short & long-term (e.g., remote sensing)
• Opportunistic management to prevent or reduce extreme events
  — Reduction of frequency, extend and toxins by managing: flows, stratification (Lake Hume), nutrients, biological predators …..
Collaborators

Murray Regional Algal Coordinating Committee
NSW: Department of Primary Industry – Water and NSW-Water
Victoria: Goulburn Murray Water; Dept of Env, Land, Water & Planning
South Australia Water
Murray Darling Freshwater Research Centre
Commonwealth Scientific & Industrial Research Organisation
Australian National University