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TOXICITY ASSESSMENT OF LIMED AND PHOSPHORUS AMENDED MINE PIT LAKE WATER

Presenter
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smart mine lakes

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Contents

- Mesocosm study aims and objectives
- Introduction to Collie and coal mining
- Materials and methods
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Aims and objectives

- To assess untreated (I), limestone (L), phosphorus (P) and limestone & phosphorus (L&P) treated Lake Kepwari water for aquaculture by;
 1. monitoring and assessing changes to physical and chemical parameters over an 8 month period
 2. assessment of water toxicity changes to *Ceriodaphnia cf. dubia* and *Chlorella protothecoides* over an 8 month period

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Lake Kepwari site location

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Introduction

- Coal mining Collie; mining started 1880's
- Location; Lake Kepwari, Collie, WA
- Lake Kepwari background; Revegetated landscape, rapid river filled void
- Lake Kepwari water parameters include; metal contamination (Al, Mn & Zn), low pH (approx pH 5), low phosphorus (restricting primary production)

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Lake Kepwari


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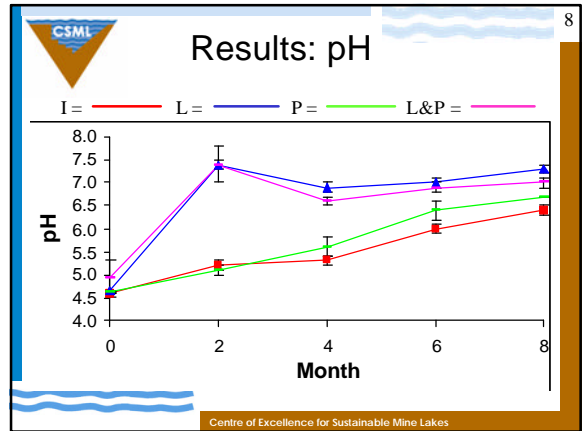
Mesocosms

Treatments

- Untreated (control)
- Limestone
- Phosphorus
- Limestone & Phosphorus
- Three replicates of each treatment



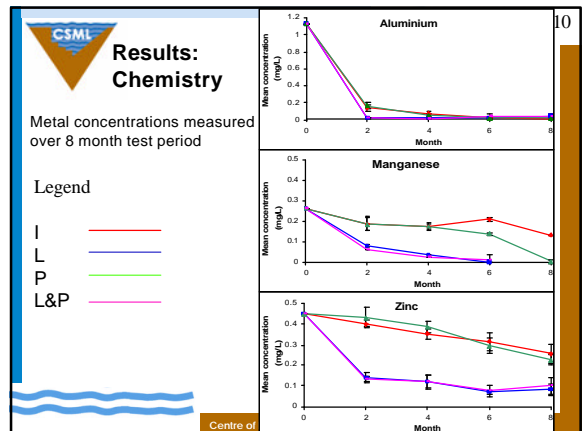
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Metals exceeding ANZECC/ARMCANZ (2000) freshwater aquaculture guidelines

Metal	Guideline (mg/L)	Measured (mg/L)
Aluminium	<0.010 at pH <6.5	1.125
Manganese	<0.010	0.265
Zinc	<0.005	0.450

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Final metal concentrations

Parameter	Guideline (mg/L)	Initial measured concentration (mg/L)	Guideline (mg/L)	Treatment	Month 8 mean concentration ± SE (mg/L)
Aluminium	<0.010 (at pH <6.5)	1.125	<0.030 (at a pH >6.5)	I	0.016 ± 0.00
				L	0.043 ± 0.02
				P	0.020 ± 0.01
				L&P	0.043 ± 0.02
Manganese	<0.010	0.265	<0.010	I	0.132 ± 0.03
				L	<0.01
				P	<0.01
				L&P	<0.01
Zinc	<0.005	0.450	<0.005	I	0.257 ± 0.05
				L	0.081 ± 0.03
				P	0.227 ± 0.02
				L&P	0.100 ± 0.04

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Bioassays

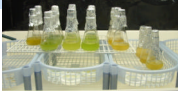


- *Ceriodaphnia cf. dubia*
 - 48 h static acute mortality
 - 5 sub-replicates of 12 mesocosms, 10 neonates/replicate (50 neonates/mesocosm)
 - No feeding
 - controls; filtered collie river water (NC), synthetic high hardness combo (H)

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Bioassays

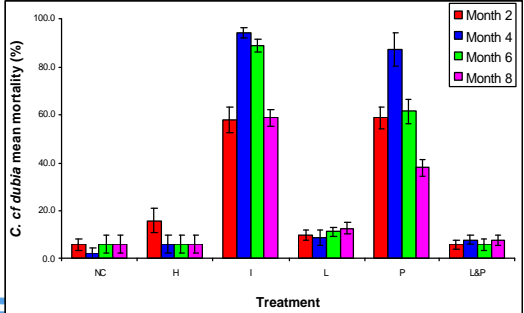


- Chlorella protothecoides* (microalgae)
 - 72 h static, chronic, algal growth, 3 sub-replicates of 12 mesocosms
 - synthetic control (C), neutralised control (N)
- Nutrient addition (*C. protothecoides*)
 - Trial 1 no nutrient addition to treatments
 - Trial 2 nutrient addition to treatments (NaNO_3 & K_2HPO_4)

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Results: *C. cf. dubia* mortality



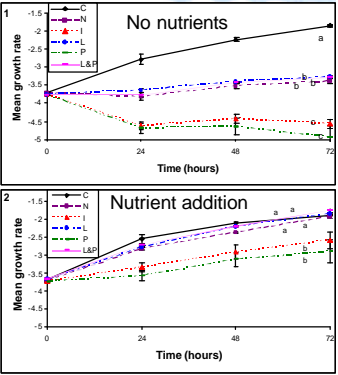
Treatment	Month 2	Month 4	Month 6	Month 8
NC	~5	~5	~5	~5
H	~15	~5	~5	~5
I	~55	~95	~90	~60
L	~10	~10	~10	~10
P	~55	~85	~60	~40
L&P	~5	~5	~5	~5

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Results: *C. protothecoides* growth

Month 2 data



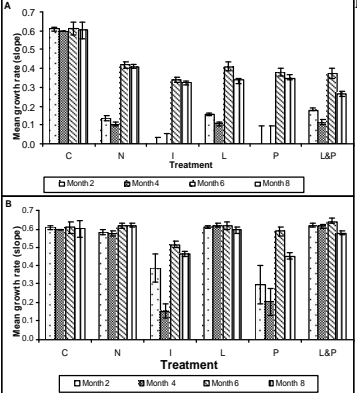
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Results: *C. Protothecoides*

No nutrients →

Nutrient addition →



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Summary

- Currently untreated Lake Kewari water is unsuitable to sustain aquatic biodiversity
- Limestone addition quickly remediates toxicity to aquatic life through increased pH and consequently reduced metal concentrations
- Addition of phosphorus does not significantly change toxicity when compared to untreated Kewari water

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Further research

- Ongoing study is indicating additions of phosphorus have increased mesocosm macroinvertebrate biodiversity and abundance.
- Further studies will look at phytoplankton and zooplankton community responses to liming and phosphorus amendment

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Questions

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