How can we more effectively predict and monitor algal toxins in the environment and in seafood?

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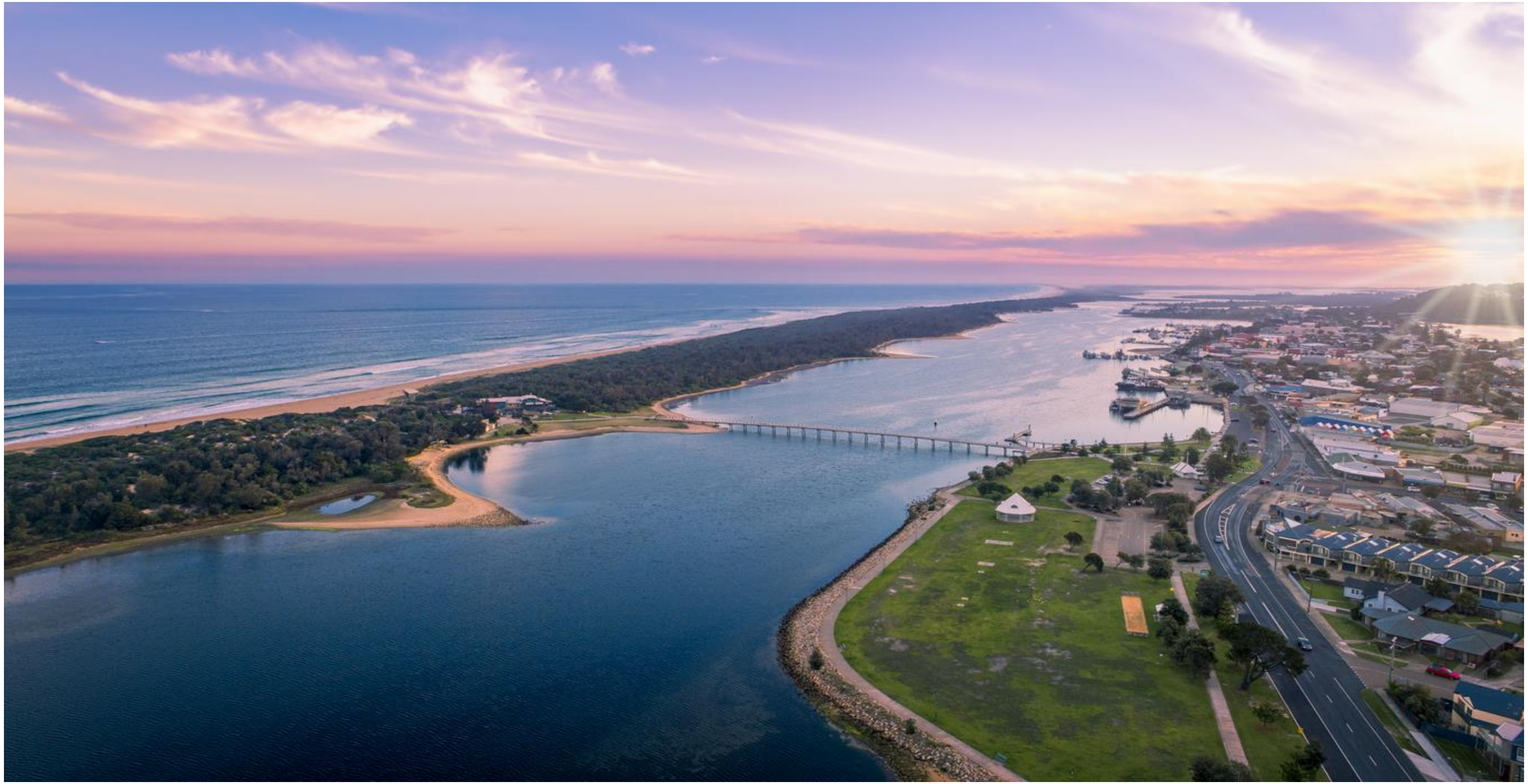
Department of Health

Overview

- Background of recurring algal blooms in Gippsland Lakes
- Environmental factors contributed to the severity of the 2020 and 2022 blooms
- Toxin accumulation and persistence in seafood
- Knowledge gaps

The Gippsland Lakes



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Environmental factors contribute to severity of blooms

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Health guideline values

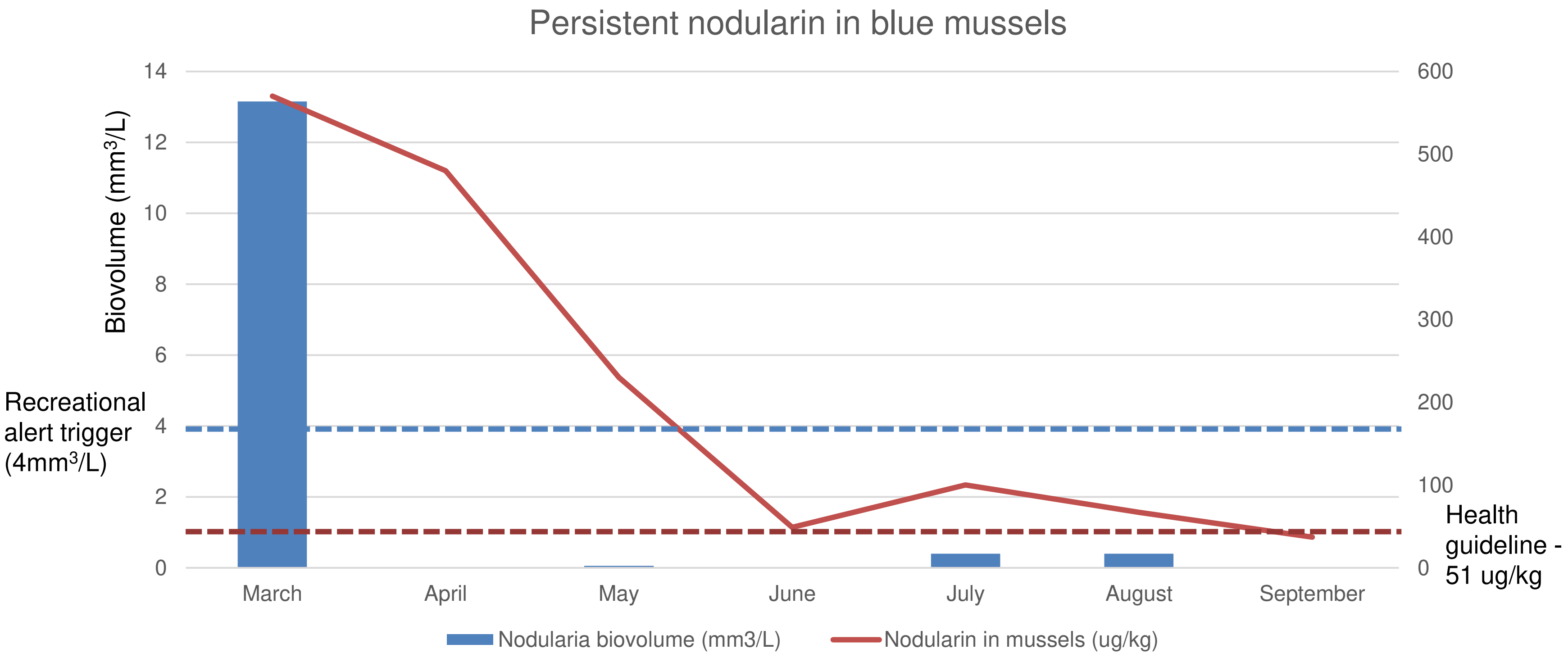
Toxin	Health guideline value (µg/kg of whole organism sample)*		
	Fish	Prawns	Mussels
Cylindrospermopsin	18	24	39
Microcystin/ Nodularin	**24**	**32**	**51**
Saxitoxin	800	800	800

*Mulvenna et al 2012 Health risk assessment for cyanobacterial toxins in seafood

Nodularia spumigena

- *N. spumigena* is a filamentous nitrogen-fixing cyanobacteria
- Prefers brackish waters
- Produces harmful hepatotoxin, nodularin which can cause illness and potentially liver damage if ingested.
- Has been a persistent and recurrent cause of harmful algal blooms in the Gippsland Lakes for many years

Nodularin in mussels remains above HGVs post 2020 bloom collapse



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2022 harmful algal bloom

- *N. spumigena and Microcystis aeruginosa* blooms detected in Gippsland Lakes mid-February 2022
- Advisories: avoid contact with water, gut and gill finfish, do not eat shellfish or crustaceans, commercial harvesting suspended
- Seafood samples sent to NZ as limited capacity to test for both nodularin & microcystin in Australia - nodularin high in mussels and crabs
- *M. aeruginosa* bloom collapsed, *N. spumigena* bloom continued and expanded significantly prior to collapsing in June 2022

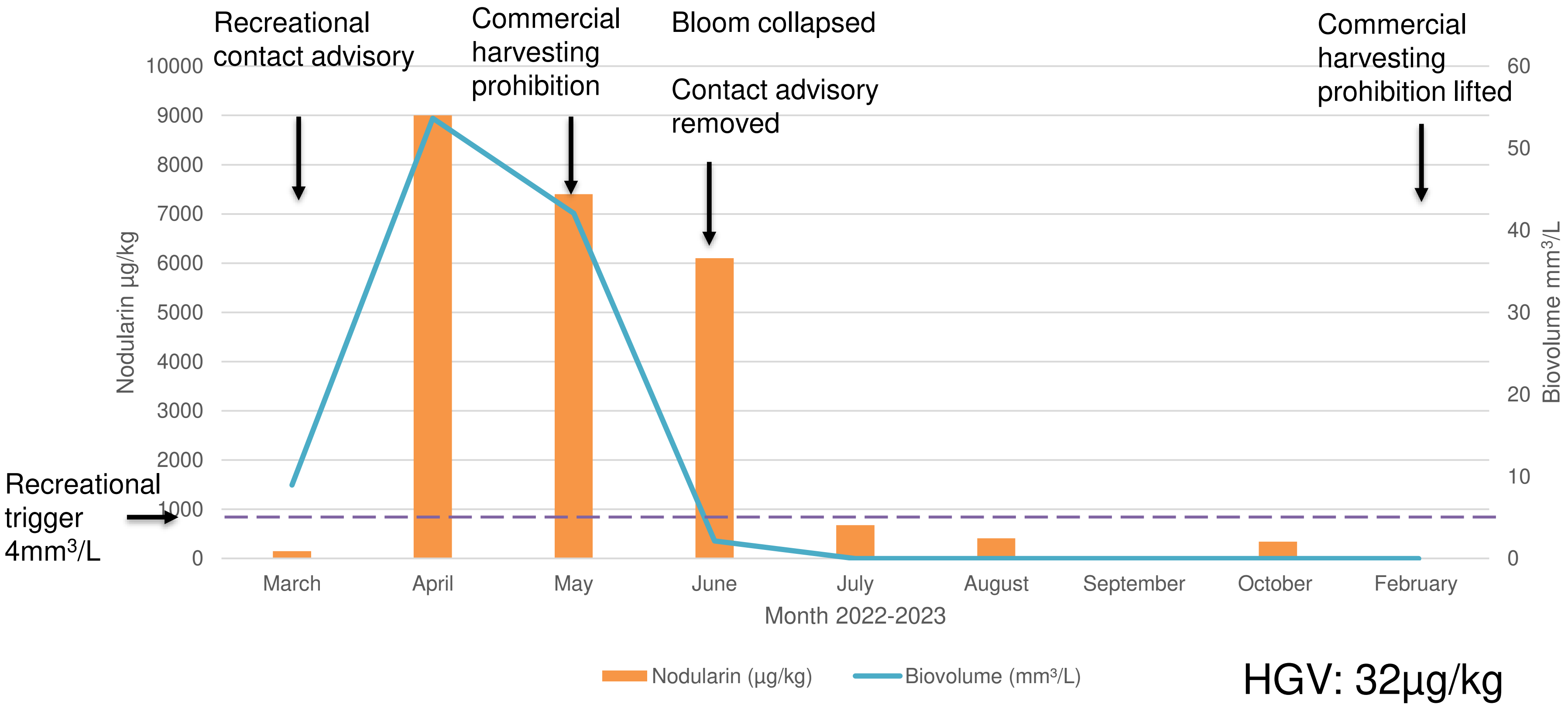
Nodularin in both flesh and hepatopancreas of crustacea

- Crabs collected from inside Lakes Entrance, eastern end of Lake King
- Low biovolumes in Lake King ~8 March
- Flesh and hepatopancreas/viscera tested separately 23/03 and 28/03
- Large increase in toxin detected between March and April (biovolume also increased dramatically)
- Toxin detected in flesh
- High variability in toxin levels between specimens

Table 2. Nodularin results from crab samples (µg/kg)

Date	Composite	Flesh	Hepatopancreas/ viscera
08/03	16		
	43		
23/03		1.2	6.9
		3.4	23
		1.5	9.4
		7.3	150
28/03		3.4	20
		2.7	47
		1.3	14
		4.5	40
		12	35
		13	71

Nodularin accumulates significantly and persists in crustacea after bloom collapse



HGV: 32µg/kg

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Key messages

- Difficult to predict toxin uptake
- Biovolume is not a good indicator of algal toxin presence and persistence in the environment
- Nodularin accumulates rapidly and persists in seafood for many months after the collapse of a bloom
- Need better tools to more accurately predict public health risk

Knowledge gaps

- What is the fate of nodularin toxin in the environment?
- What are the mechanisms of toxin accumulation in various seafood species, and how do these mechanisms differ among species?
- What is the relationship between the duration and intensity of algal blooms and the accumulation of toxins in seafood, and how can this be quantified and predicted?
- Are there any methods or technologies that can be employed to monitor the distribution of algal toxins within a water body and their uptake in seafood?

Acknowledgements

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Thank You!