



Copepod grazing on *Gymnodinium catenatum*

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TAFI is a joint venture between the State Government and the University of Tasmania

Gymnodinium catenatum



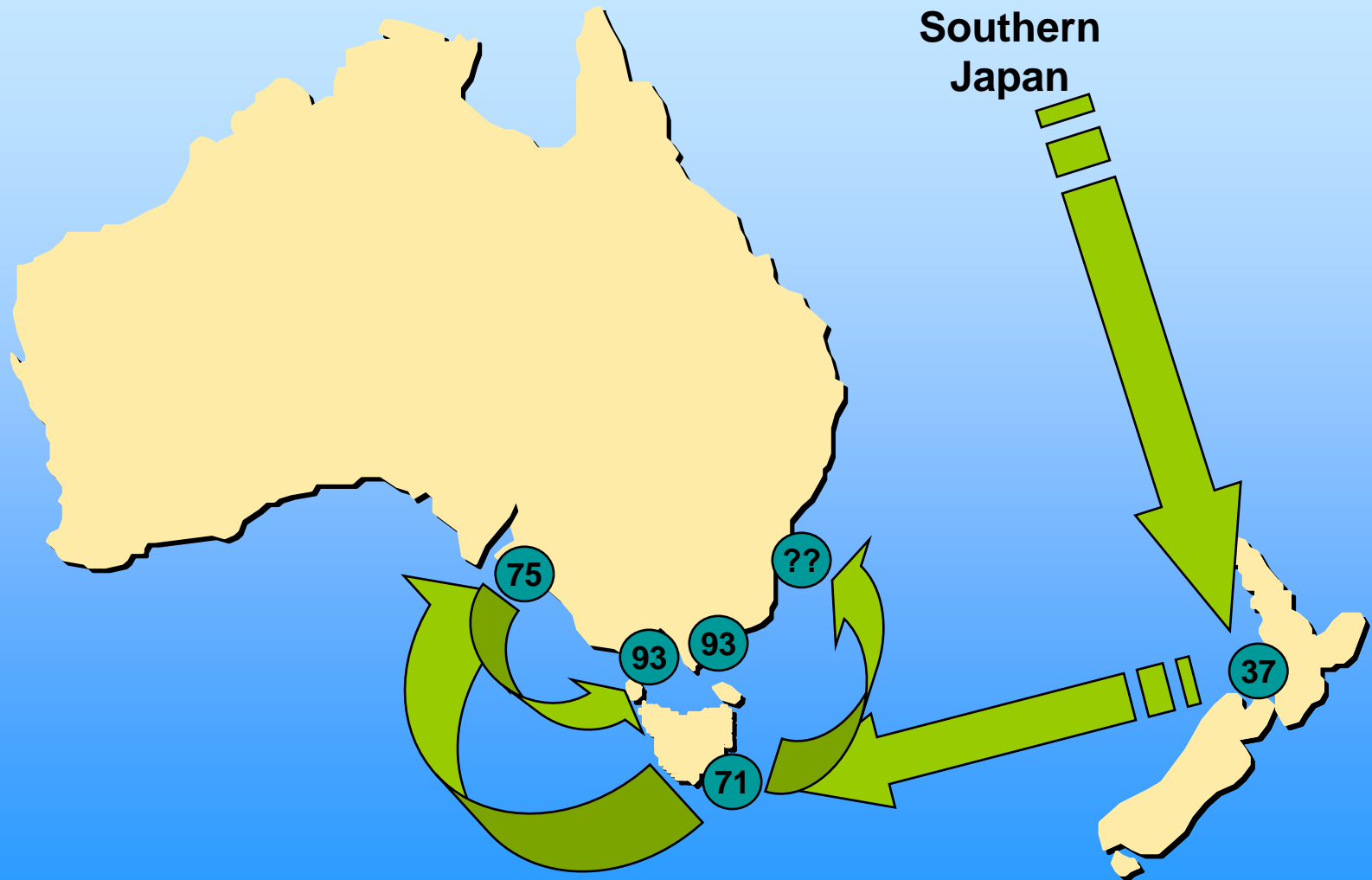
Incorporating sediment dating and historical samples

- 1971 - Spring Bay, Tas
- 1975 - Port Lincoln, SA
- 1980 - Derwent/Huon, Tas
- 1993 - Port Phillip Bay, Vic
- 1993 - Victorian coast
- 1996 - Hawkesbury R., NSW

Gymnodinium catenatum rDNA-its genotype distribution



Australian *Gymnodinium catenatum*



Gymnodinium catenatum in Tasmania

- Paralytic shellfish toxins (saxitoxins)
- Harmful algal blooms (HAB)
- Blooms (10^4 – 10^6 cells) from December until July
- Toxic and non-toxic strains
- Chain length up to 32 cells
- Cultured cells have similar morphology and size range as wild cells

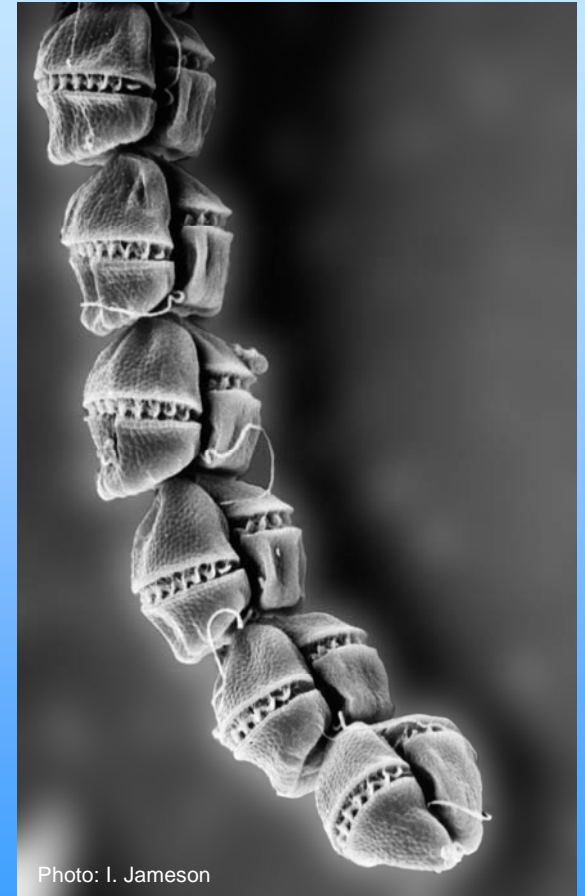


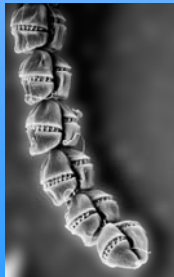
Photo: I. Jameson

Toxic dinoflagellates in the food chain

Shellfish



Fish



Do Tasmanian copepods graze on introduced *Gymnodinium catenatum*?

Acartia tranteri



Photo: A. Alexander



Centropages australiensis



Photo: A. Alexander

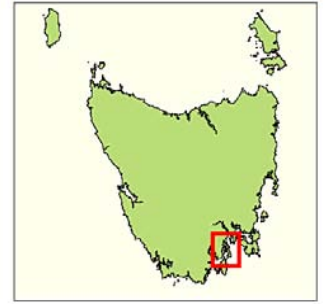
Paracalanus indicus



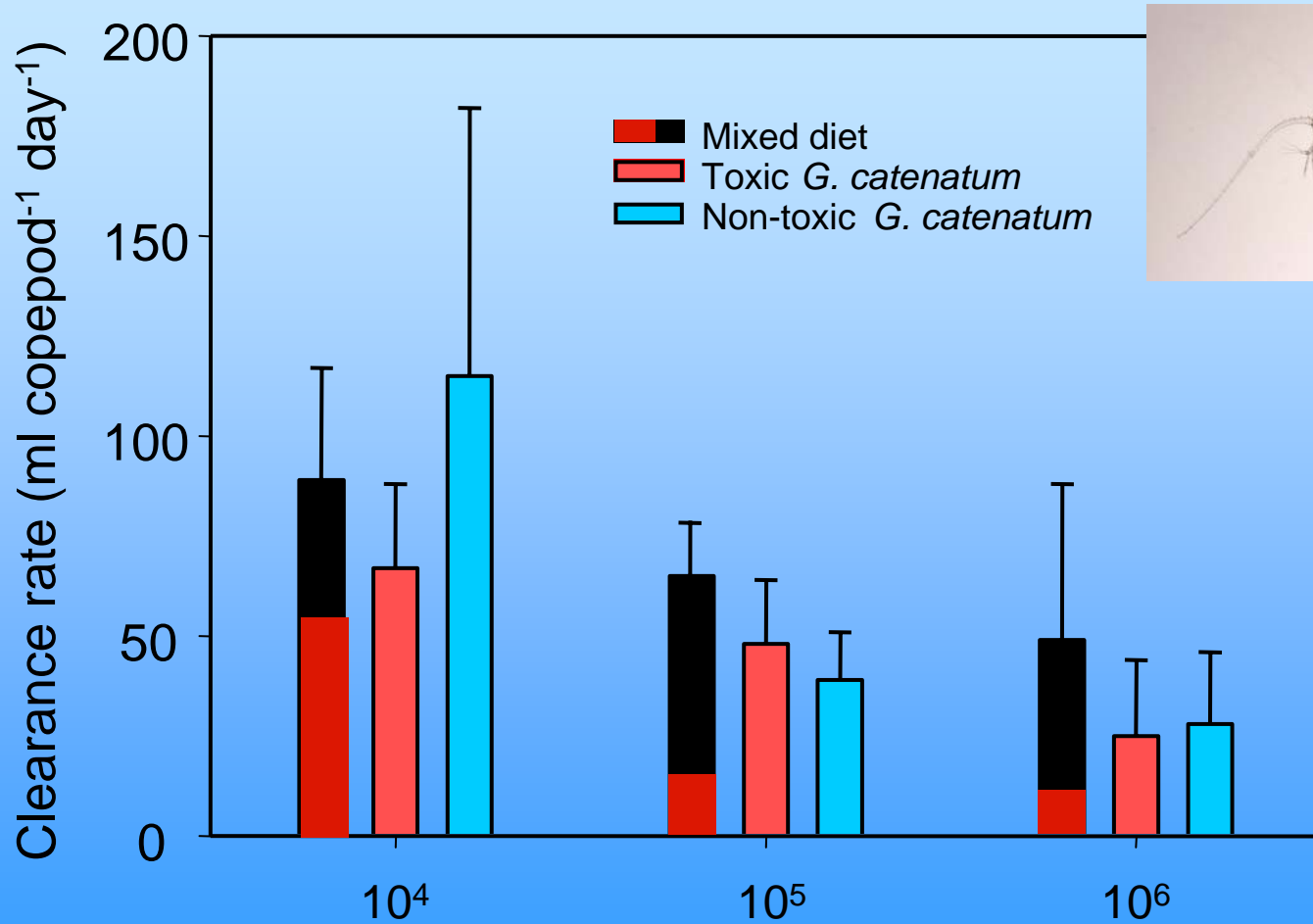
Photo: A. Alexander

Grazing experiments

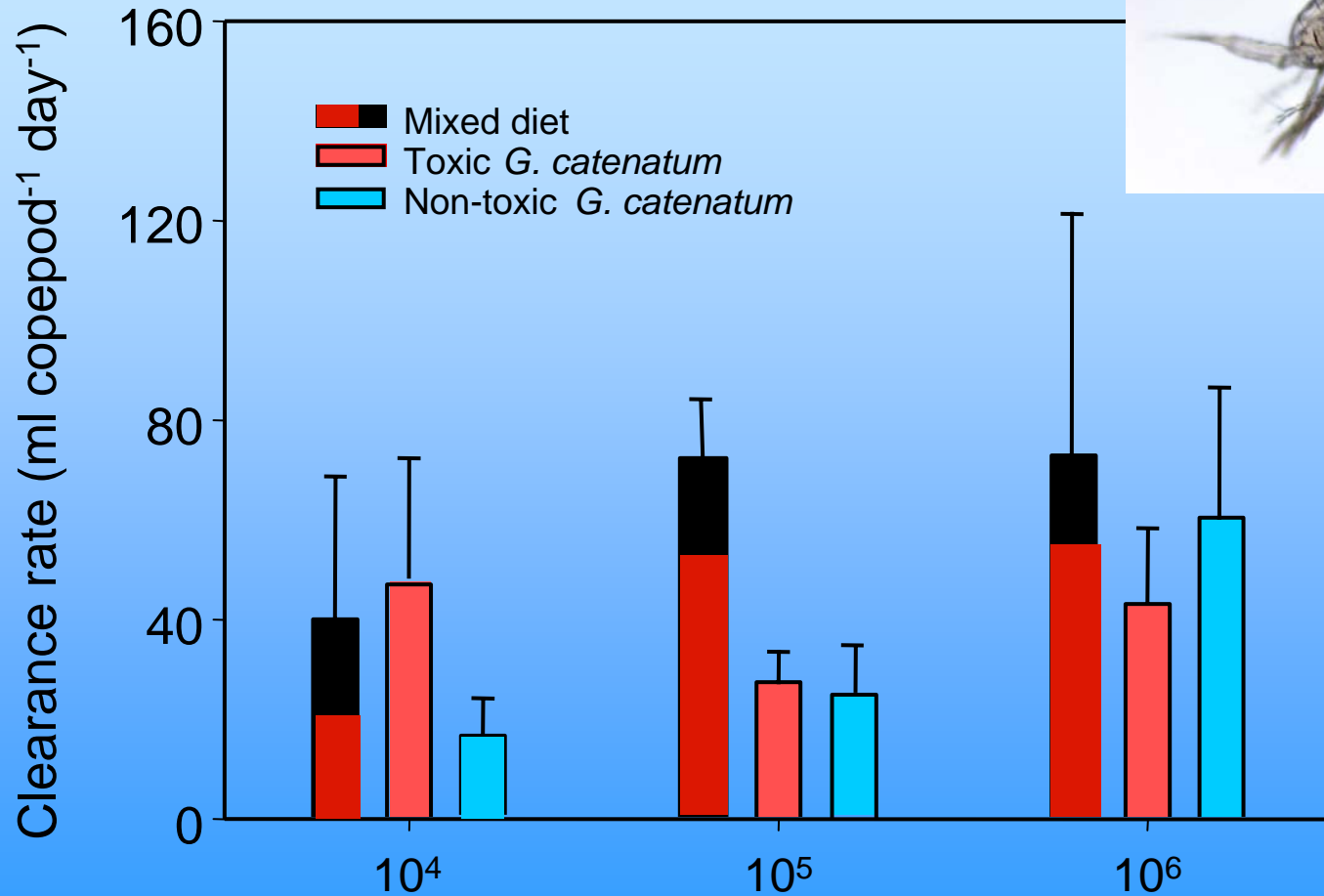
- Single prey: toxic strain, non-toxic strain (densities: 10^6 , 10^5 , 10^4)
- Mixed prey: toxic strain with *Isochrysis*
- Copepods collected from Huon Estuary
- 24 acclimation period
- Bottle clearance methods
- Incubated for 24 hours on plankton wheel (<1 rpm)
- Triplicate treatments : Triplicate controls



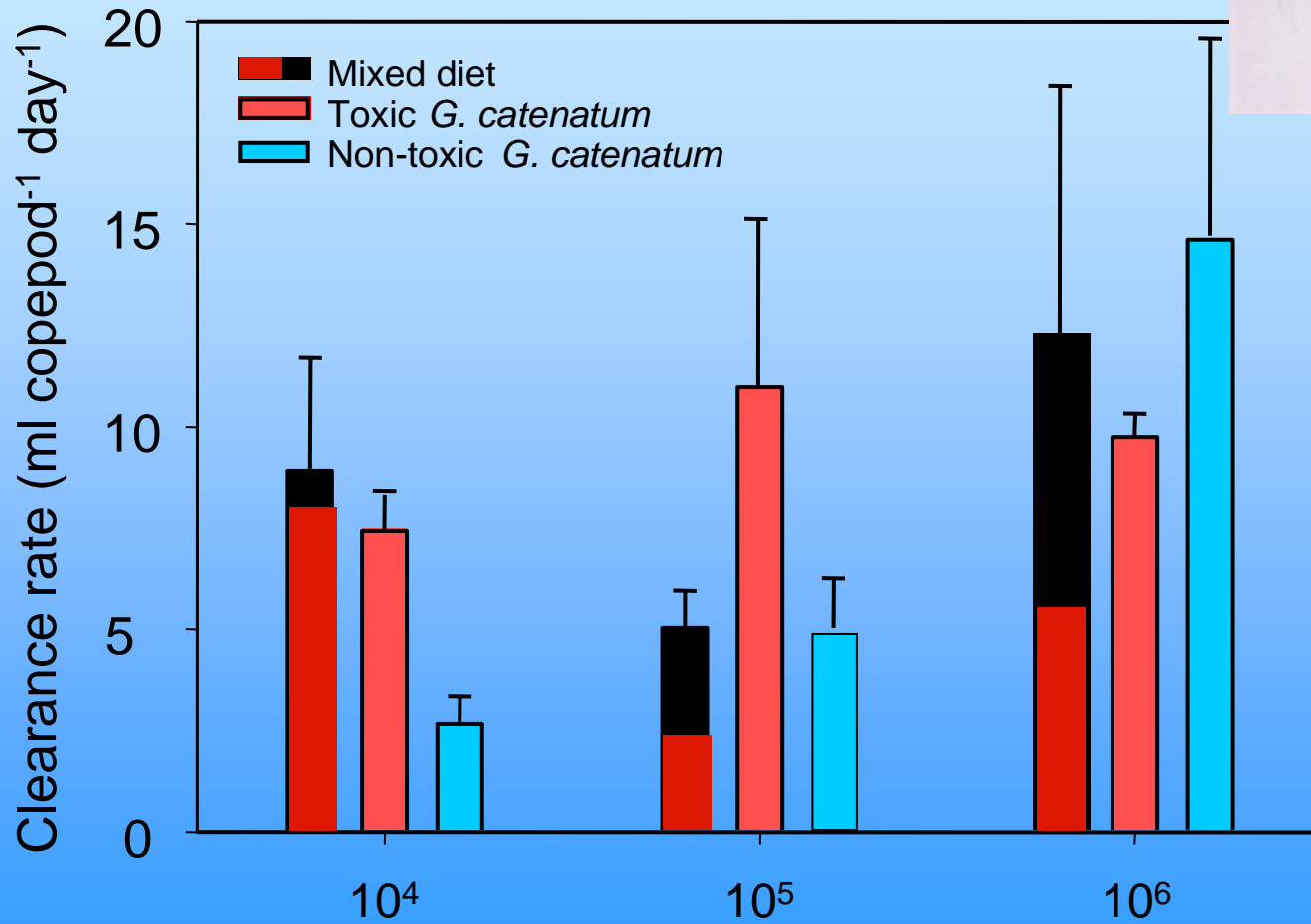
Centropages australiensis



Paracalanus indicus



Acartia tranteri





Egg Production

- Within 2 hours of being caught females were isolated in 50 ml chambers and incubated overnight at ambient temperature then diet changed to:
 - *Isochrysis*
 - Toxic *G. catenatum*
 - Non-toxic *G. catenatum*



Eggs female⁻¹ d⁻¹

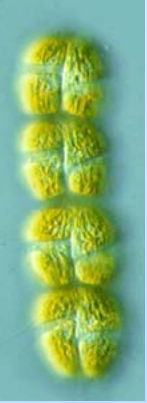
Gymnodinium catenatum

	Ambient	Iso	Non-toxic	Toxic
<i>Centropages</i>	56	48	51	9
<i>Paracalanus</i>	20	31	16	11
<i>Acartia</i>	34	16	3	4

Survivorship

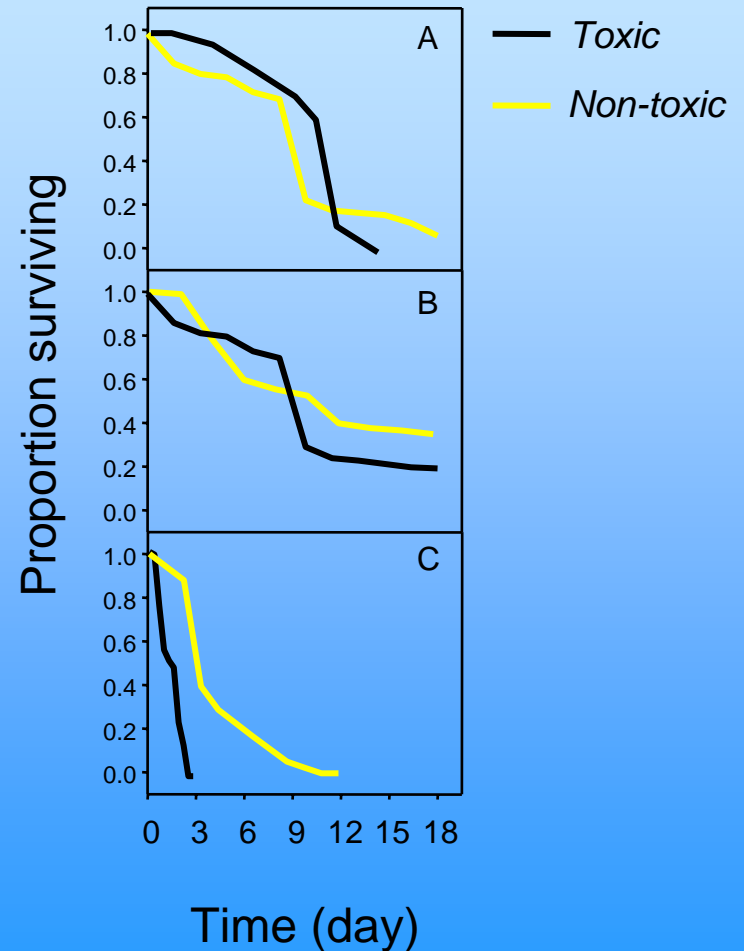
- Eggs were counted and incubated in 1 L bottles
- Incubated 24 h on a plankton wheel
- Nauplii of each species were split into 2 groups
- Group 1 fed on *Isochrysis* and toxic *G. catenatum*
- Group 2 fed on *Isochrysis* and non-toxic *G. catenatum*
- Development and survivorship were monitored for 18 days





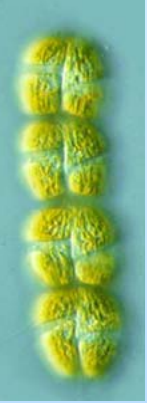
Survivorship

- High initial mortality
- No species developed past CIII
- *Centropages australiensis* had slightly longer survival on the non-toxic strain
- *Paracalanus indicus* had somewhat better survival on non-toxic strain
- *Acartia tranteri* showed poor survivorship overall and did not develop past the naupliar stages



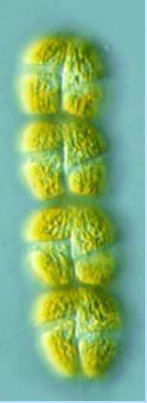
Summary

- Copepods ingested both toxic and non-toxic strains of *Gymnodinium catenatum*, alone and in mixed prey
- *Centropages australiensis*: highest CR, highest EPR, but low survivorship
- *Paracalanus indicus*: moderate CR, EPR and survivorship (generally better on non-toxic strain)
- *Acartia tranteri*: lowest CR, EPR and very poor survival on both strains



Conclusions

- While the copepods have probably only co-existed with *G. catenatum* for the last 40 years they do not avoid grazing on this toxic dinoflagellate
- There were different responses from the three species
Centropages > *Paracalanus* > *Acartia*
- Poor survivorship overall indicates that factors other than *G. catenatum* toxins were influencing copepod development





Future plans

- Measuring toxicity in prey and grazers
 - Looking further up the food chain?
- Grazing on a natural *Gymnodinium catenatum* bloom
- Time travelling

