National Environmental Research Program

TROPICAL ECOSYSTEMS hub

CARING FOR OUR COUNTRY

Projects NERP 4.2 & RRRD038

The chronic effects of pesticides and their persistence in tropical waters

Andrew Negri

Australian Institute of Marine Science

Australian Government

Australian Institute of Marine Science

National Environmental Research Program

TROPICAL ECOSYSTEMS hub

RELEVANCE OF WORK

Risk = *f:* *Exposure* (concentration ; duration) ; *Toxicity* (to relevant species)

- Concentration in river mouths
- Dilution and dispersal
- Persistence
- Proportion bound to sediments

Foundation species

- Seagrass
- Corals
- Mangroves
- Algae

Contribute to:

- cumulative **risk models**
- **pollution targets**
- **policy development** to protect the GBR from the effects of pollution and climate change

National Environmental Research Program

TROPICAL ECOSYSTEMS hub

RESULTS: PERSISTENCE

Up to 8 herbicides tested in 12 month experiments

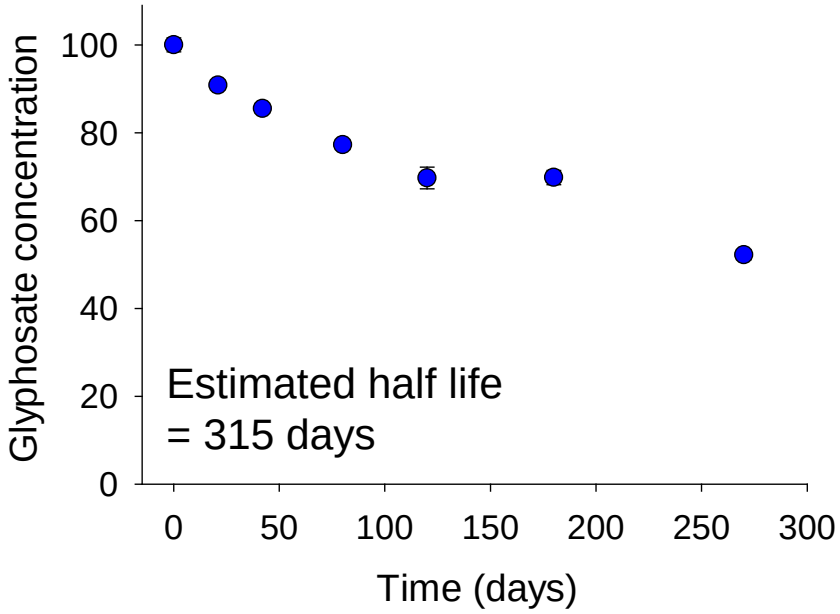
Experiment 1: *Standard flask*
Filtered water
Dark

Experiment 2: *Standard flask*
Unfiltered water
2 temperatures
Light and dark

Experiment 3: *Outdoor pond*
Unfiltered water
±Sediments
Light and dark

RESULTS: PERSISTENCE

Example results



- Processing continues
- The majority of herbicides detected in the GBR have very long half lives of 120+ days in tropical seawater.

Preliminary half-lives for common herbicides in pond experiments

NOTE: These data are taken from only two time points and may change significantly once all the data has been analysed.

	Diuron	Atrazine	Hexazinone	Tebuthiuron	2,4-D	Metolachlor
No Sediment	300	270	690	1160	690	70
Sediment	120	120	260	530	190	20

National Environmental Research Program

TROPICAL ECOSYSTEMS hub

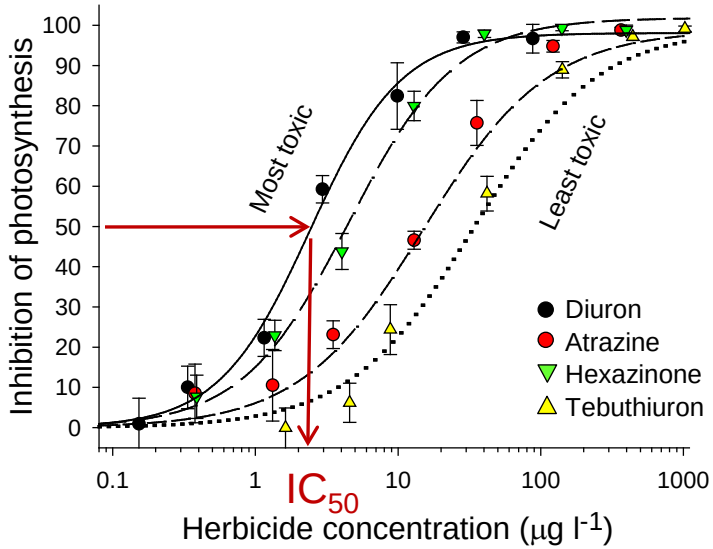
RESULTS: SEAGRASS

- How rapidly PSII herbicides affect seagrass (**complete**)
- Effects of herbicides on seagrass (72 h) – Diuron, Atrazine, Hexazinone, Tebuthiuron (**complete**)
- Chronic effects of herbicides on seagrass (**underway**)

National Environmental Research Program

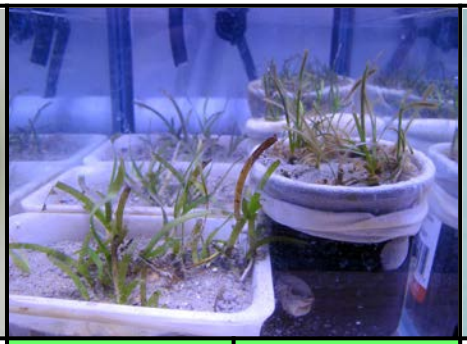
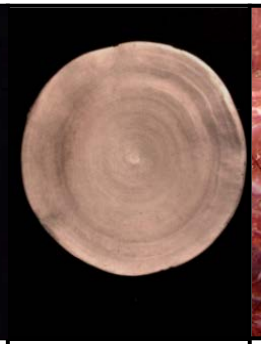
TROPICAL ECOSYSTEMS hub

RESULTS SEAGRASS



72 h exposure laboratory experiments

- Two seagrass species were shown to be as sensitive as corals and algae to four priority herbicides found in the GBR.
- Diuron affects photosynthesis at flood plume concentrations

Species							
IC_{50} (µg/l)	Green algae 2.1	Halodule 2.4	Zostera 2.5	Diatom 2.6	Coral (zooxanthellae) 2.9	Foraminifera 2.9 - 20	Crustose algae 8.5

more sensitive

National Environmental Research Program

TROPICAL ECOSYSTEMS hub

APPLICATION OF WORK

Direct communication with Key Stakeholders (IG and direct)

- DSEWPaC: Chem. Assessment Section
- APVMA: Reviews + Adverse Experience Reporting
- GBRMPA: WQ guidelines, cumulative impacts, exposure maps
- Canefarmers and WWF


NERP Tropical Ecosystems Hub Project Factsheet

The chronic effects of pesticides and their persistence in tropical waters

Project leader: Dr Andrew Negri (AIMS)

Project summary

Why this research is needed

Research-user focus

Outcomes

Pesticides working group formed (Meetings: Sep 2012, April 2013)


National Environmental Research Program TROPICAL ECOSYSTEMS hub

PESTICIDES AND THE GREAT BARRIER REEF WORKING GROUP

Meeting 2 | 24 April 2013 | ATSIP building | JCU, Townsville
09:00 – 16:00

As part of the National Environmental Research Program Tropical Ecosystems (NERP TE) Hub Water Quality projects and the NERP Te Hub Communication Plan, we have been discussing the formation of a Great Barrier Reef (GBR) water quality pesticide working group, which would bring together researchers, managers and industry people who are working specifically on pesticide research, monitoring and management in the GBR.

This forum aims to bring managers and industry together for participants to briefly outline and update on the latest information from their projects. The scope is not limited to outputs of the NERP and also includes other programs such as *Reef Rescue R&D*, the Paddock to Reef Program and the Reef Protection Package Science Program and the associated policy initiatives.

Fostering communication between researchers, **regulators, managers, industry and NGOs**. (AIMS, JCU, UQ, UTS, CSIRO, DERM, GBRMPA, SEWPaC, APVMA, Terrain, SRDC, WWF, Davco Farming, BSES, DAFF, Farmacist, NQ Dry Tropics and more..)

- Science updates
- Presentations by SEWPaC, APVAMA and more
- Communication and extension
- Emerging issues & chemicals
- Minutes are available – email Michelle Devlin or myself

Incorporation of results into Risk Assessment process for the Reef Plan Scientific Consensus Statement


Synthesis of evidence to support the Scientific Consensus Statement on Water Quality in the Great Barrier Reef

National Environmental Research Program

TROPICAL ECOSYSTEMS hub

FUTURE DIRECTIONS

- Long-term effects of herbicides on seagrass growth
  - Test combined effects of herbicides with low light or high temperatures
- Analyse all persistence samples
  - Commence tests on toxicity of herbicide breakdown products
- Continue to integrate the current data into risk assessments
- Work with SEWPaC towards standard toxicity tests relevant to the GBR

National Environmental Research Program

TROPICAL ECOSYSTEMS hub

Australian Government

THANK YOU

Team: Phil Mercurio (UQ-AIMS)
Florita Flores (AIMS)
Catherine Collier (JCU)
Jochen Mueller (UQ)

RRRC: esp. Michelle Devlin

JCU Partners: Jon Brodie
Steve Lewis

NERP
Caring for our Country

Australian Institute of Marine Science

James Cook University Australia

The University Of Queensland Australia

National Research Centre for Environmental Toxicology