



Water disinfection for influent water biosecurity on prawn farms. Trichlorfon.

FRDC project 2021-026

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Trichlorfon – the crusticide

How can farms continue growing prawns in high White Spot Disease (WSD) risk zones?
Can modified biosecurity practices make farms viable?

The challenge

- White Spot Syndrome Virus (WSSV) has a broad host range
- Decapods have highest risk (prawns, crabs, shrimps, crayfish)
- WSSV can remain viable in/on a range of vectors
- Farm influent water contains macro and micro hosts and vectors

Overseas - shrimp production in high WSD prevalence areas

- Trichlorfon highly effective crusticide – water pretreatment
- High specificity, relatively short life, low effective dose

Minor Use Permit (MUP) - issued after 1st outbreak in SE Queensland

- Destruction of carrier crustaceans; Destruction of infected farm stock



Trichlorfon project

Confirm safety and efficacy - Australian prawn farm use conditions

1. Monitor outcomes on 2x Logan River prawn farms (whitespot control zone)
2. Tank experiments – water quality parameters affecting rate of degradation



Experimental tank array



Logan River estuary



Farm 1 – pre-filled reservoir



Farm 2 – continuous dose of influent

Farm results

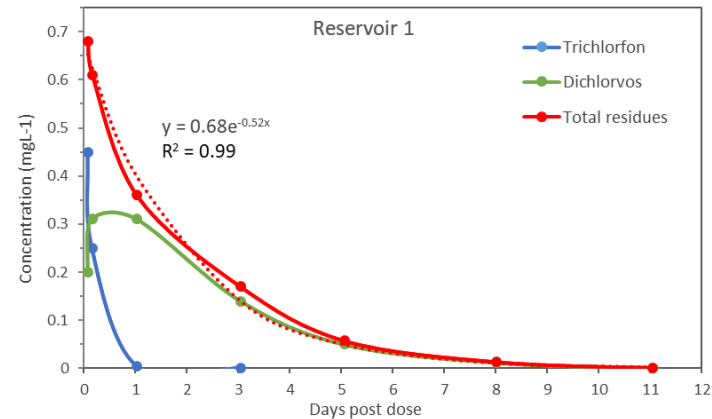
On both monitored farms...

Typical pattern of trichlorfon exponential decay

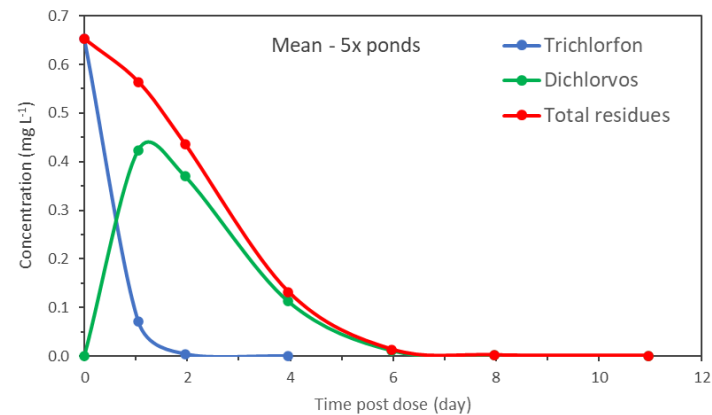
1. Trichlorfon quickly transforms to dichlorvos
 - Dichlorvos is similarly toxic to crustaceans
 - Lab testing should always measure trichlorfon and dichlorvos
2. Dichlorvos degrades to non-toxic compounds
 - Hydrolysis reaction driven by pH (OH⁻/H⁺ ion ratio)

Degradation rate – described by half-life value

- Time taken for concentration to halve
- Under constant conditions half-life is consistent and not affected by concentration



Farm 1



Farm 2

Half-life matters

Trichlorfon / dichlorvos highly toxic to prawns

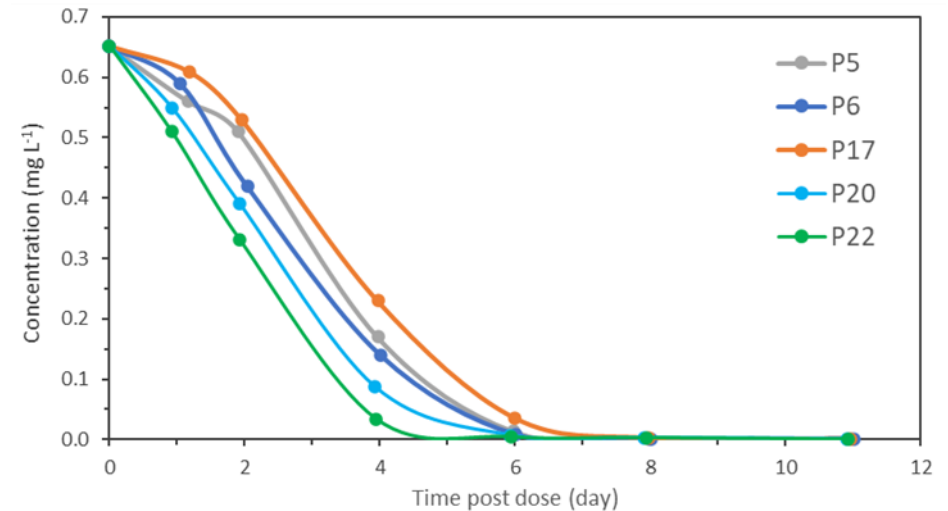
- Acute effect – mortality
- Sub-lethal effect – ongoing health impact

MUP specifies

- Dose for vector control is 0.5 mg/L
- For use or discharge residues < detectable level (0.02 µg/L)
- Withholding period 17 days as standard, unless
- Test the water and confirm not detected

Half-life is critical metric for safe use

- Half-life in ponds is variable and affected by water quality
- WQ varies considerably between and within ponds over time
- 10x ponds – range 0.64 to 1.33 days (Av. – 0.95 days)



Concentration of total-Trichlorfon residues over time for 5 monitored ponds at Farm 2.

Efficacy

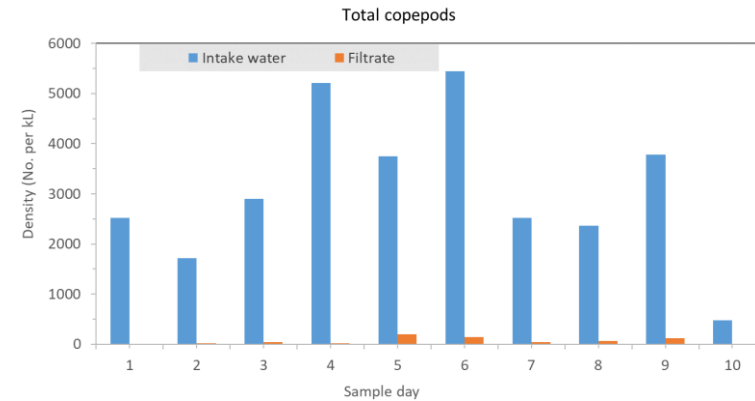
Monitored crustacea in intake and pond water of farms

- Copepods, nauplii, other early life stages
- Abundance change indicator of treatment efficacy

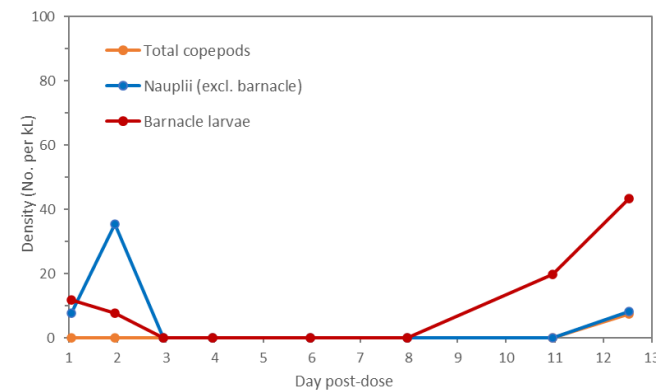
Farm 2

Combined filtration (50 μm) with trichlorfon treatment

- Filtration alone performed similarly to trichlorfon
- Ponds started with very low population
- Main crustacean groups not detected over successive samplings
- Not eliminated all crustaceans
- Remnant population remained present and viable



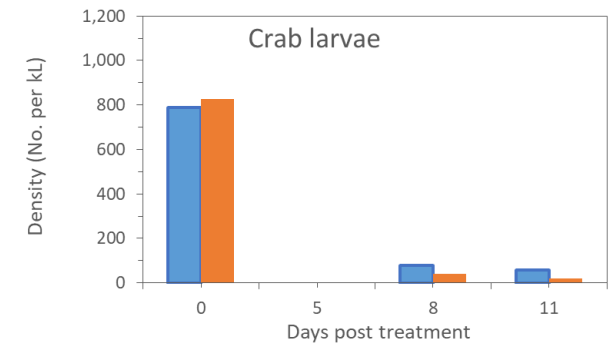
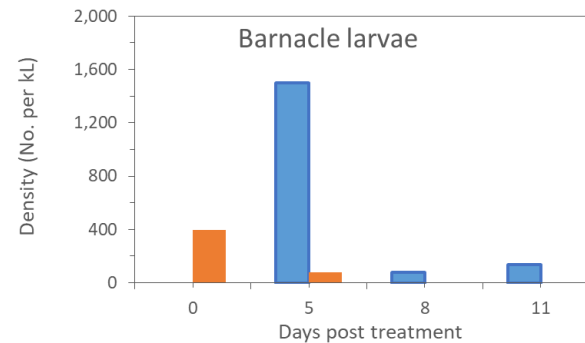
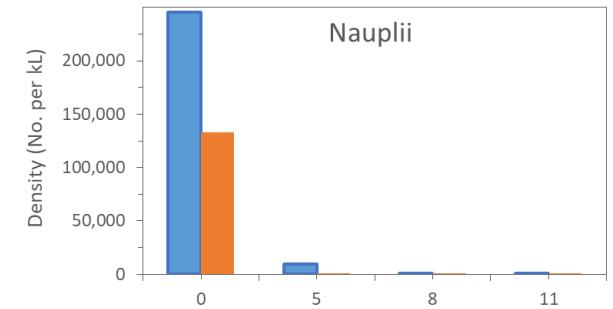
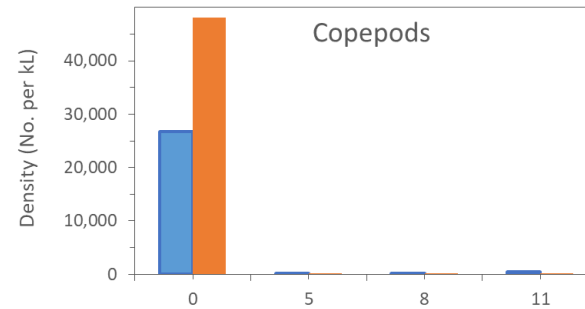
Larger crustaceans detected in intake water but not the filtrate (penaeid stages, crab larvae, amphipods)



Efficacy

Farm 1

- Two reservoirs supported crustacean population
- Huge decline, but not eliminated
- Barnacles are known to be relatively resistant to trichlorfon
- Crabs inhabiting the pond margins may have hatched eggs post-treatment
- Crustaceans not eliminated
 - hard to find but present



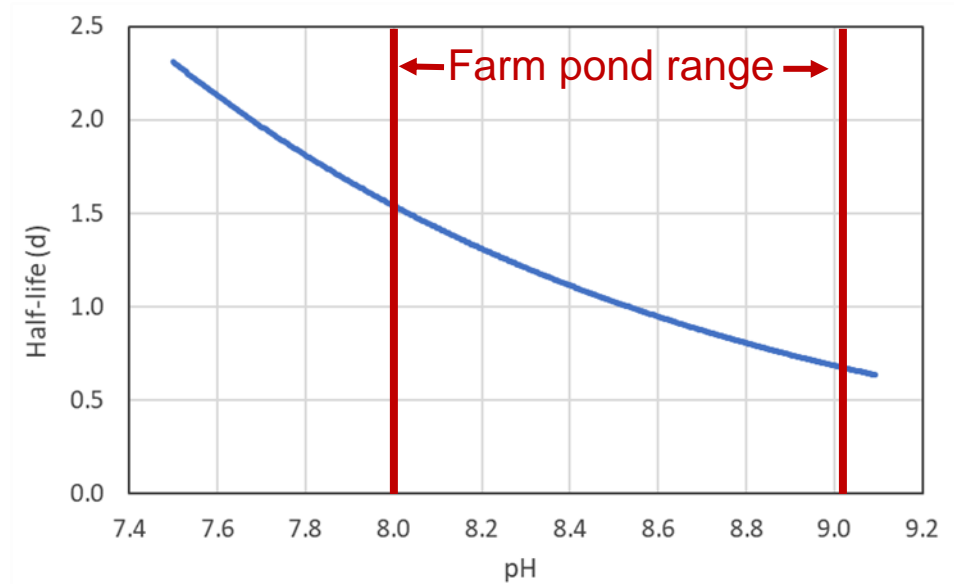
Water quality effect

Tank experiments

- pH, salinity, organic load, inorganic turbidity (clay)
- Temperature (post-hoc)
- pH dominant influence
- Temperature and salinity further modify effect
- At high temperature (>29°C) pH effect relatively low

pH manipulation

- Strong pH effect means this can potentially be used to reduce the withholding period
- Lime can be added to create pH 9 and significantly reduce the half-life (percarbonate also effective)
- Note MUP use conditions require testing to confirm safe level actually achieved



Relationship between pH and trichlorfon residuals half-life at a temperature 20-22 °C and salinity 30-35 psu.

Sourcing information

Trichlorfon MUP is primary reference for using trichlorfon on prawn farms

- Current version – Permit No. PER91178
- Can be located on APVMA website

Project documents

- Guide to using trichlorfon as a biosecurity control measure on prawn farms
- Final project report

Acknowledgement

Outcomes of this project were made possible by the assistance of farms who contributed to data gathering as they explored ways to regain a viable production system.

