

# Detection and pathogenicity of yellow head virus genotypes one and seven

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# Australian Centre for Disease Preparedness

Advanced high containment laboratory that helps to protect Australia's multi-billion dollar livestock and aquaculture industries, and the general public, from emerging infectious disease threats.

## ACDP Fish Diseases Laboratory

- Diagnosis of exotic and emerging diseases of aquatic animals (fish/molluscs/crustaceans)
- Technical advice and training
- Research and Development
- OIE Reference Laboratory
  - AbHV
  - EHNV
  - Ranavirus
  - YHV1



# Yellow Head Viruses

**2020 October - ICTV *Roniviridae* update**

Family *Roniviridae* (subfamily *Okanivirinae*)

Genus *Okavirus* (subgenus *Tipravirus*)

Three species of virus

\***Gill-associated virus** = yellow head virus genotype 2

**Yellow head virus 1**

**Okavirus 1** = yellow head genotype 8

Yellow head virus genotypes 3-7  
have not yet been classified  
(complete genome sequences not available)

## *Roniviridae*

Walker, P.J., Cowley, J.A., Dong, X., Huang, J., Moody, N., and Ziebuhr, J

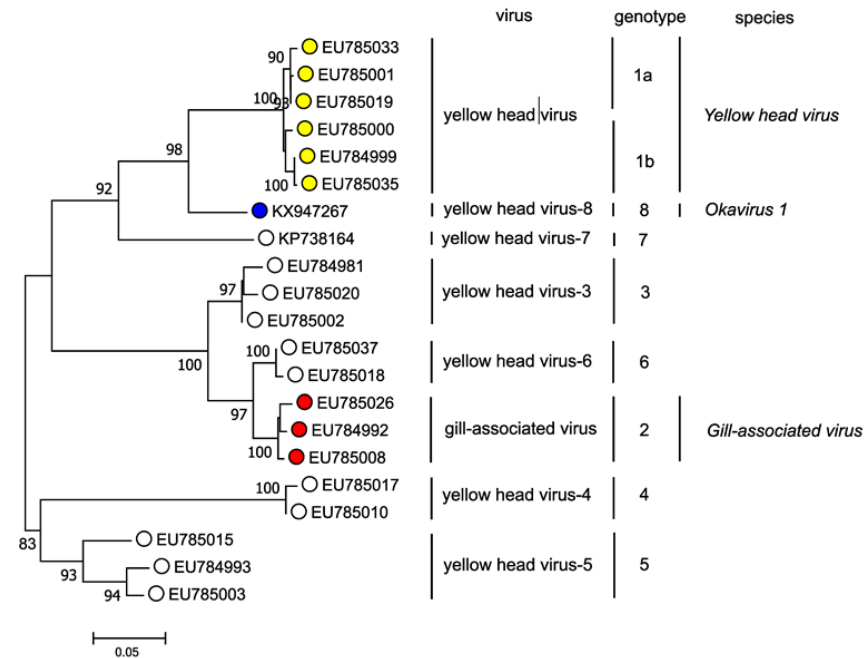
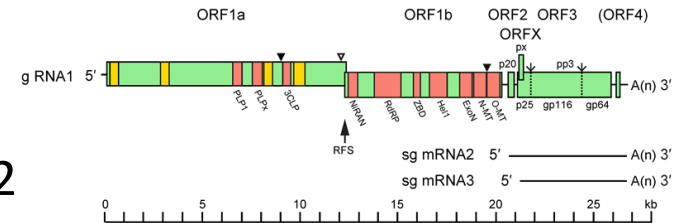
The citation for this ICTV Report chapter is the summary published as Walker et al., (2020):  
ICTV Virus Taxonomy Profile: *Roniviridae*, Journal of General Virology, (In Press)

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Edited by: Nick J. Knowles and Stuart G. Siddell

Posted: October 2020

yellow head virus, YHV (26,662 nt)



<https://talk.ictvonline.org/ictv-reports>

# OIE Aquatic Manual – YHV-1

Manual of Diagnostic Tests for Aquatic Animals

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PDF

CHAPTER 2.2.9.

## INFECTION WITH YELLOW HEAD VIRUS GENOTYPE 1

### 1. Scope

Infection with yellow head virus genotype 1 means infection with the pathogenic agent yellow head virus genotype 1 (YHV1) of the Genus *Okavirus* and Family *Roniviridae*.

## Molecular Techniques (ORF1b PCRs)

Protocol 1 YHV-1 RT-PCR

Protocol 2 YHV-1/GAV differentiation RT-nPCR

Protocol 3 YHV RT-nPCR

- Analytical specificity issues for each PCR amongst various YHV genotypes.
- No real-time PCR for YHV-1 listed.

# Yellow Head Viruses

## Yellow head virus genotypes

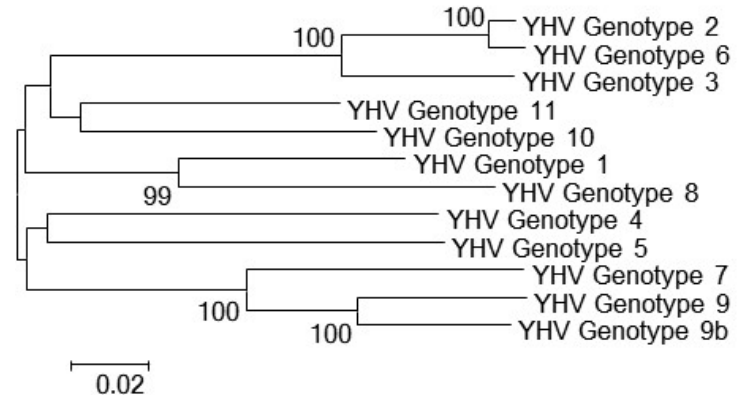
- Lack of standardised criteria to naming
- YHV-7 to YHV-11 identified due to YHV PCR assay specificity issues

Vol. 115: 263–268, 2015 doi: 10.3354/dao02894	DISEASES OF AQUATIC ORGANISMS Dis Aquat Org	Published August 20
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NOTE



**New yellow head virus genotype (YHV7) in giant tiger shrimp *Penaeus monodon* indigenous to northern Australia**



Genotype	Year	Distribution	Health Status
YHV-1 (YHD)	1990s	Chinese Taipei, Indonesia, Malaysia, Philippines, Thailand, Taiwan, Mexico...	Yellow head disease (OIE listed)
YHV-2 (GAV)	1990s	Australia, Thailand, Vietnam...	Healthy and associated with disease
YHV-3	2000	Indonesia, Thailand, Malaysia...	Healthy
YHV-4	2002	India...	Healthy
YHV-5	2003	Malaysia, Philippines, Thailand...	Healthy and slow growth
YHV-6	2004	Mozambique, Australia...	Healthy
YHV-7	2012	Australia...	Associated with diseased broodstock
YHV-8 (Okavirus 1)	2012	China...	Associated with APHND-like disease
YHV-9	2014	Imported commodity prawns...	Unknown
YHV-10	2014	Imported commodity prawns...	Unknown
YHV-11	2016	Imported commodity prawns...	Unknown

# YHV PCR – Analytical Specificity Issues

## FRDC Project No 2013/036 (included)

- Development of YHV-1 specific real-time and conventional PCR assays
- Development of YHV-7 specific real-time and conventional PCR assays
- Assess distribution of YHV-7 in wild and farmed *P. monodon*

Genotype	Real Time (TaqMan) qPCR					Conventional PCR						
	CSIRO YHV RT-qPCR	Arunguren/Tang YHV RT-qPCR	de la Vega GAV RT-qPCR	AFDL YHV1 RT-qPCR	CSIRO YHV7 RT-qPCR	OIE YHV Protocol 1 RT-PCR	OIE YHV/GAV Protocol 2 RT-nPCR	OIE YHV Protocol 3 RT-nPCR	Consensus 1/2 RT-nPCR	YH30m/YH31m RT-nPCR	AFDL YHV1 RT-nPCR	CSIRO YHV7 RT-nPCR
YHV-1	POS	POS	Neg	POS	Neg	POS	POS	POS	POS	POS	POS	Neg
YHV-2	POS	POS	POS	Neg	Neg	Neg	POS	POS	POS	POS	Neg	Neg
YHV-3	Neg	Neg	POS	Neg	Neg	Neg	Neg	POS	POS	POS	Neg	Neg
YHV-4	Neg	POS	POS	Neg	Neg	Neg	Neg	POS	POS	POS	Neg	Neg
YHV-5	Neg	Neg	POS	Neg	Neg	Neg	Neg	POS	POS	POS	Neg	Neg
YHV-6	Neg	Neg	POS	Neg	Neg	Neg	POS	POS	POS	POS	Neg	Neg
YHV-7	Neg	POS	POS	Neg	POS	POS	POS	POS	POS	POS	Neg	POS
YHV-8	NA	NA	NA	NA	NA	NA	POS	NA	NA	NA	NA	NA
YHV-9	POS	Neg	Neg	Neg	Neg	Neg	Neg	POS	POS	POS	Neg	Neg
YHV-10	POS	Neg	Neg	Neg	Neg	Neg	Neg	Neg	POS	POS	Neg	Neg
YHV-11	POS	NA	Neg	Neg	NA	NA	NA	NA	POS	POS	NA	NA

- New YHV-1 and YHV-7 assays appear to be performing as designed
- Need further validation, especially for apparently healthy infected prawns

# YHV-1 and YHV-7 Pathogenicity Studies

## FRDC Project No 2015/015 (included)

- Establish experimental model with YHV-1 infection of *Penaeus monodon* and *P. merguensis*
- Determine the susceptibility of *P. monodon* and *P. merguensis* to YHV-7



# YHV-1 and YHV-7 – IM 25°C

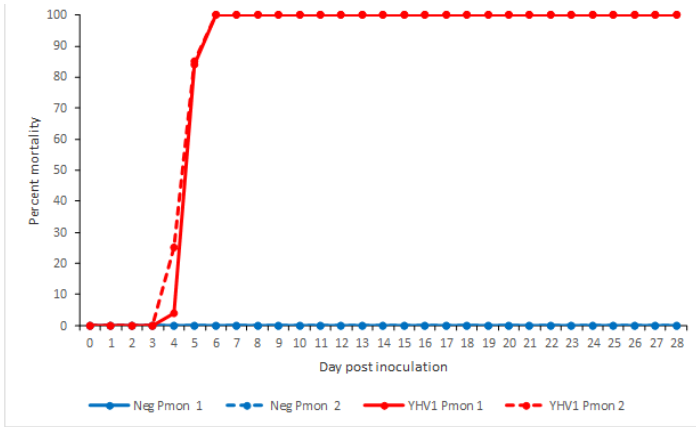


Figure 1a. Cumulative mortality in *P. monodon* after inoculation with YHV genotype 1.

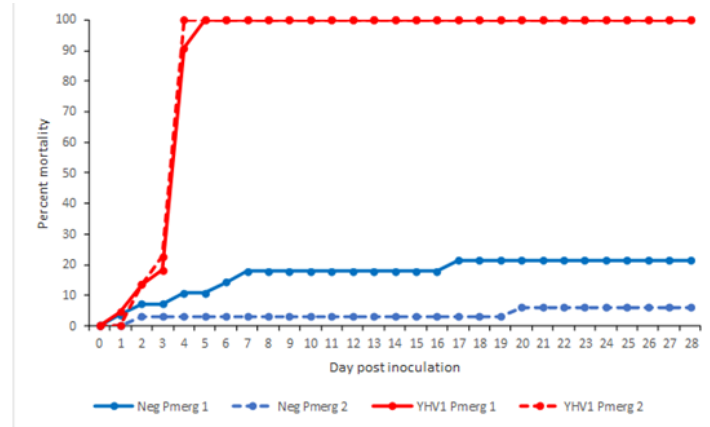


Figure 1b. Cumulative mortality in *P. merguensis* after inoculation with YHV genotype 1.

YHV1 is pathogenic to *P. monodon* and *P. merguensis* by inoculation

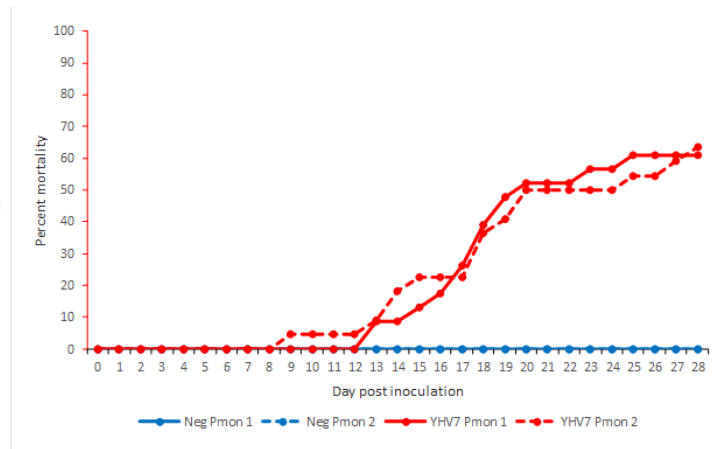


Figure 2a. Cumulative mortality in *P. monodon* after inoculation with YHV genotype 7.

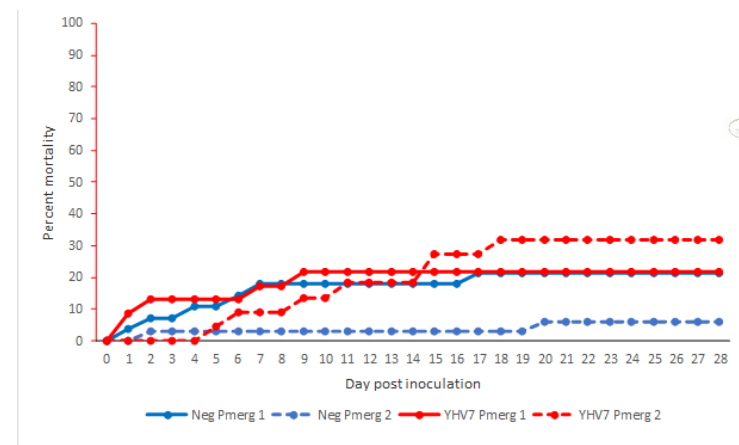
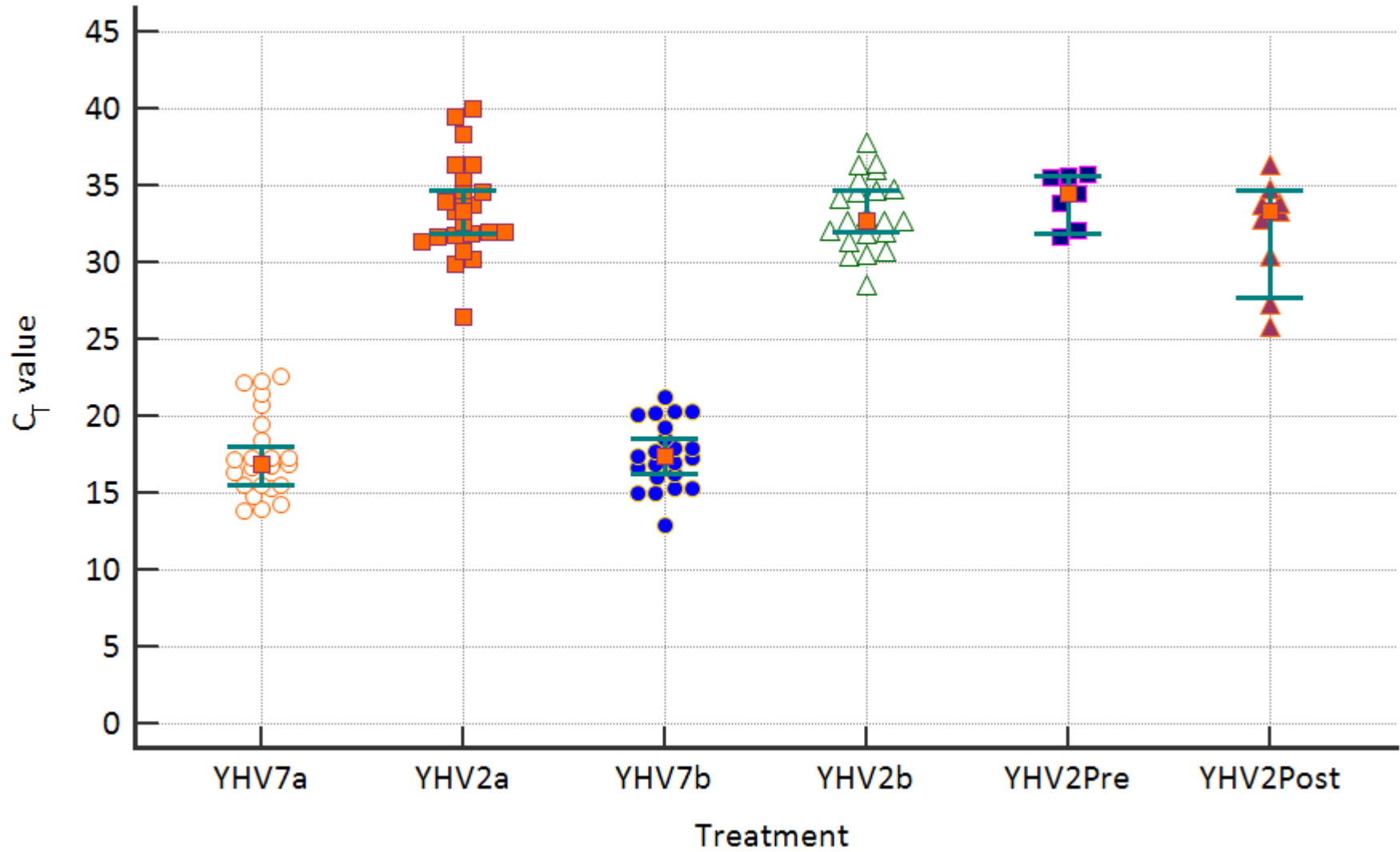


Figure 2b. Cumulative mortality in *P. merguensis* after inoculation with YHV genotype 7.

YHV7 is pathogenic to *P. monodon* by inoculation

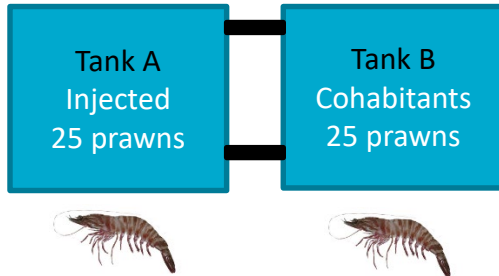


# YHV-7 / *P. monodon* – IM 25°C



# YHV-1 and YHV-7 – Natural routes of infection 30°C

Co-Habitation



25  
Prawns  
Tank C

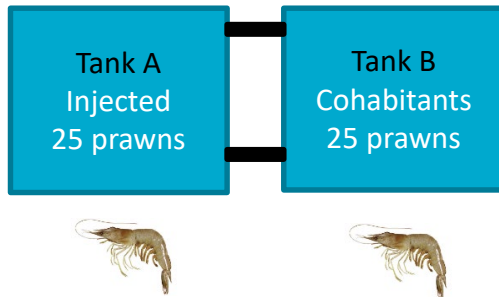


Feeding of  
prawns that  
died in Trial 1

25  
Prawns  
Tank D



Co-Habitation



25  
Prawns  
Tank C

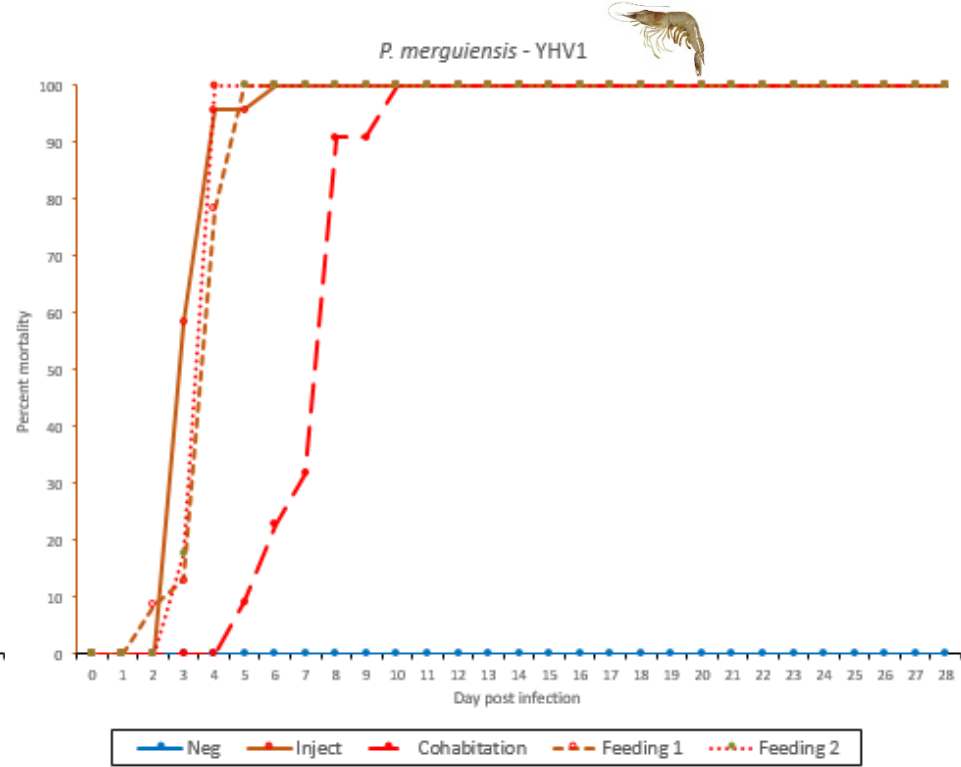
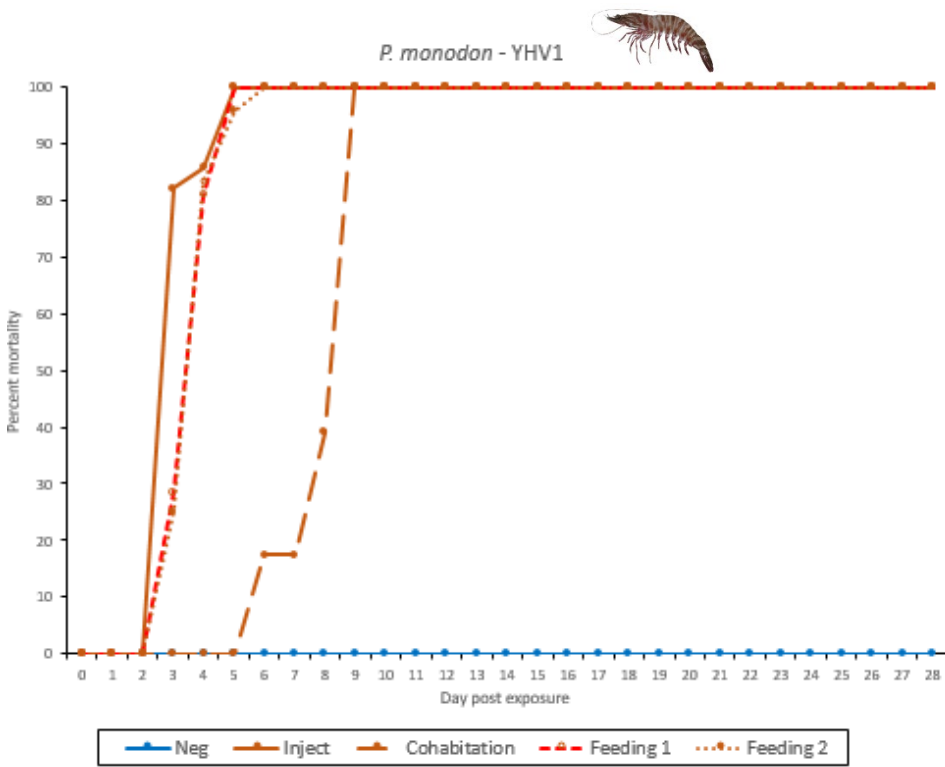


Feeding of  
prawns that  
died in Trial 1

25  
Prawns  
Tank D



# YHV-1 – Natural routes of infection 30°C

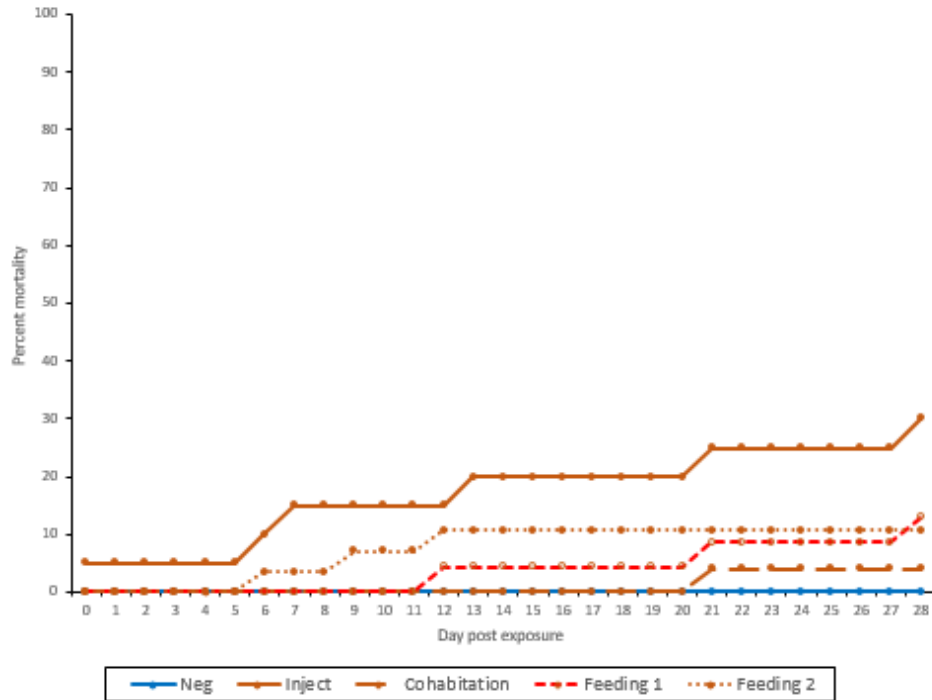


YHV-1 is pathogenic to *P. monodon* and *P. merguensis* by co-habitation and feeding.

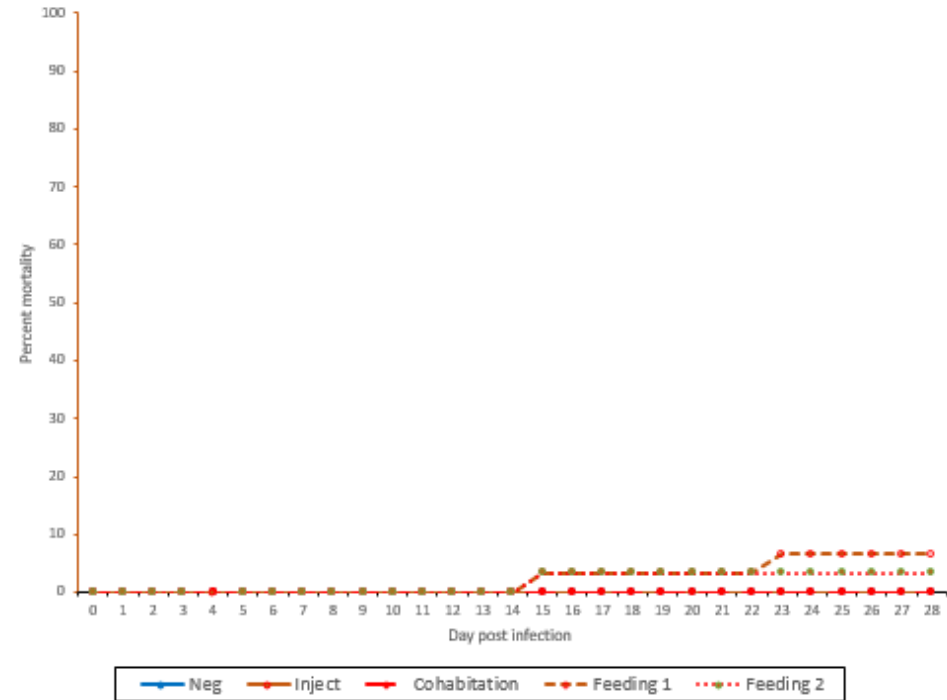
# YHV-7 – Natural routes of infection 30°C



*P. monodon* - YHV7

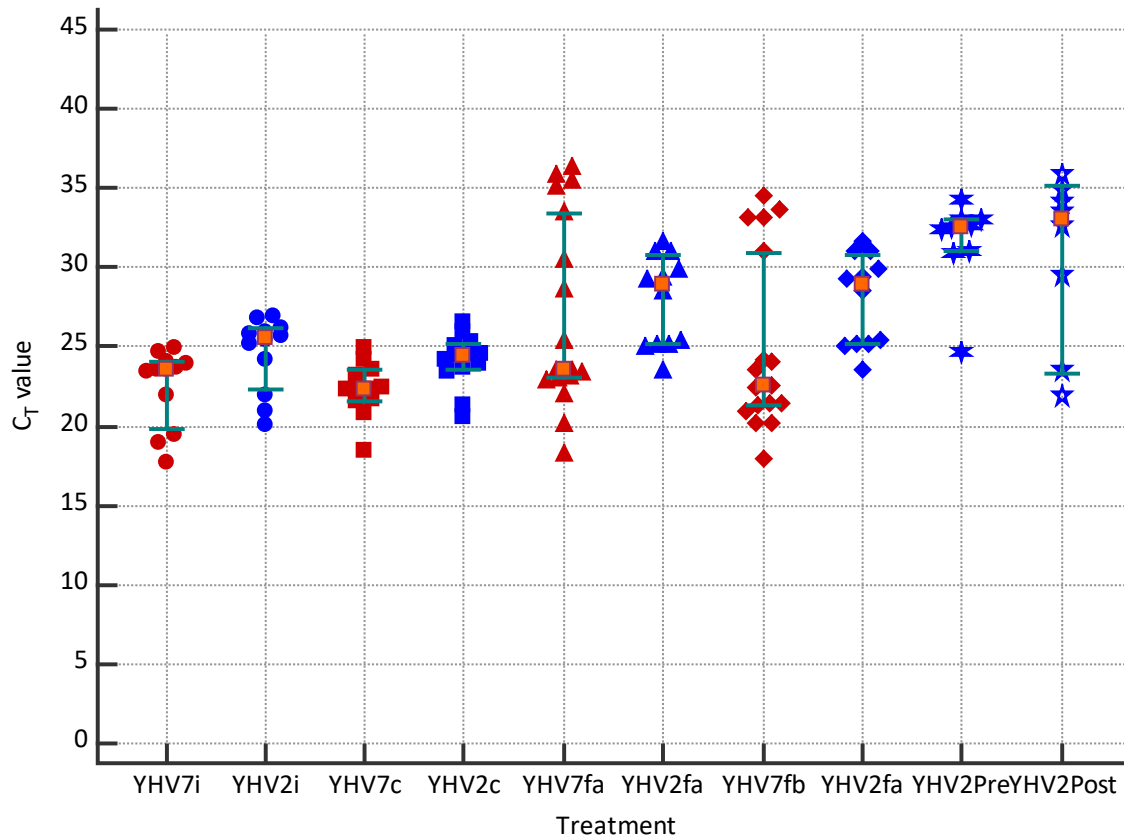


*P. merguensis* - YHV7

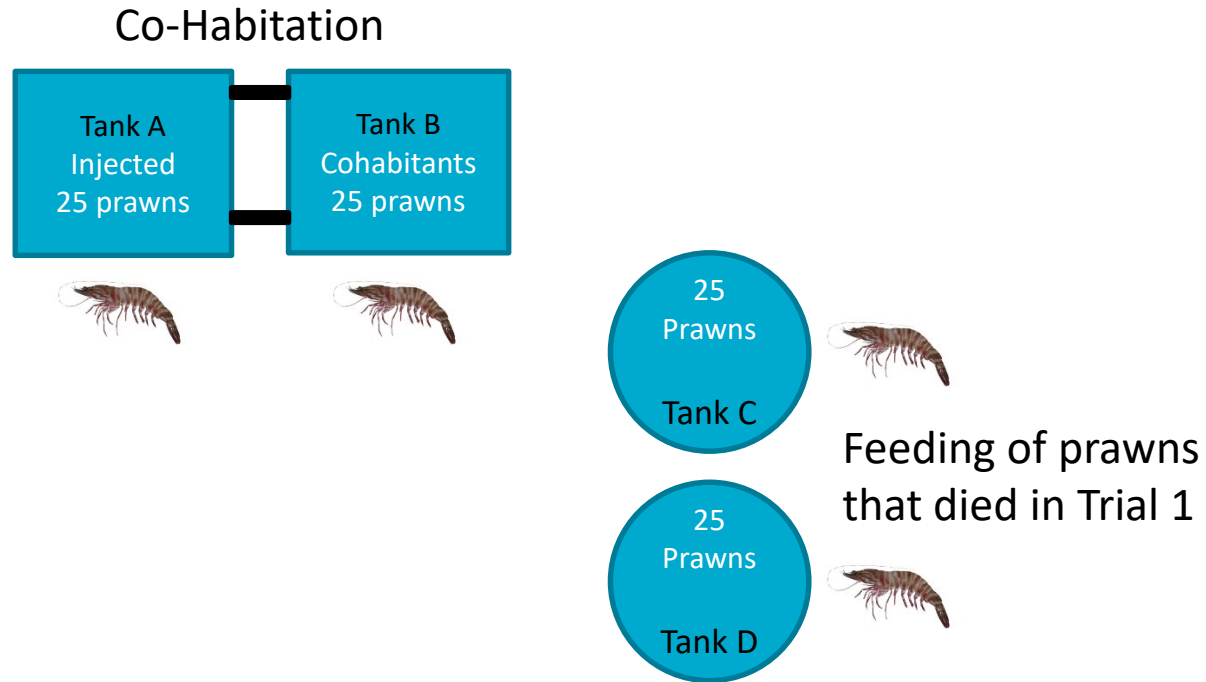


Hmmm???

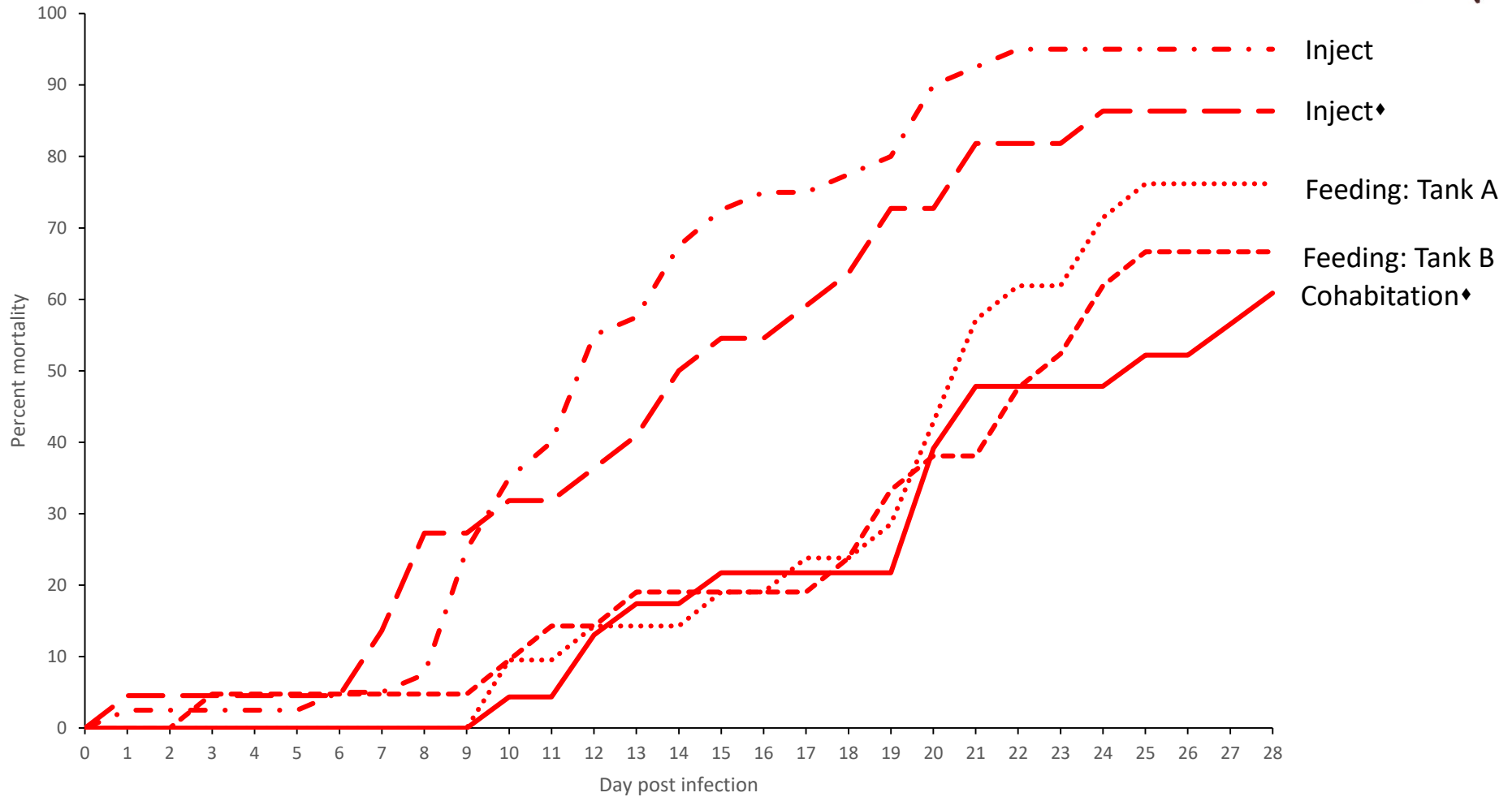
# YHV-7 – Natural routes of infection 30°C



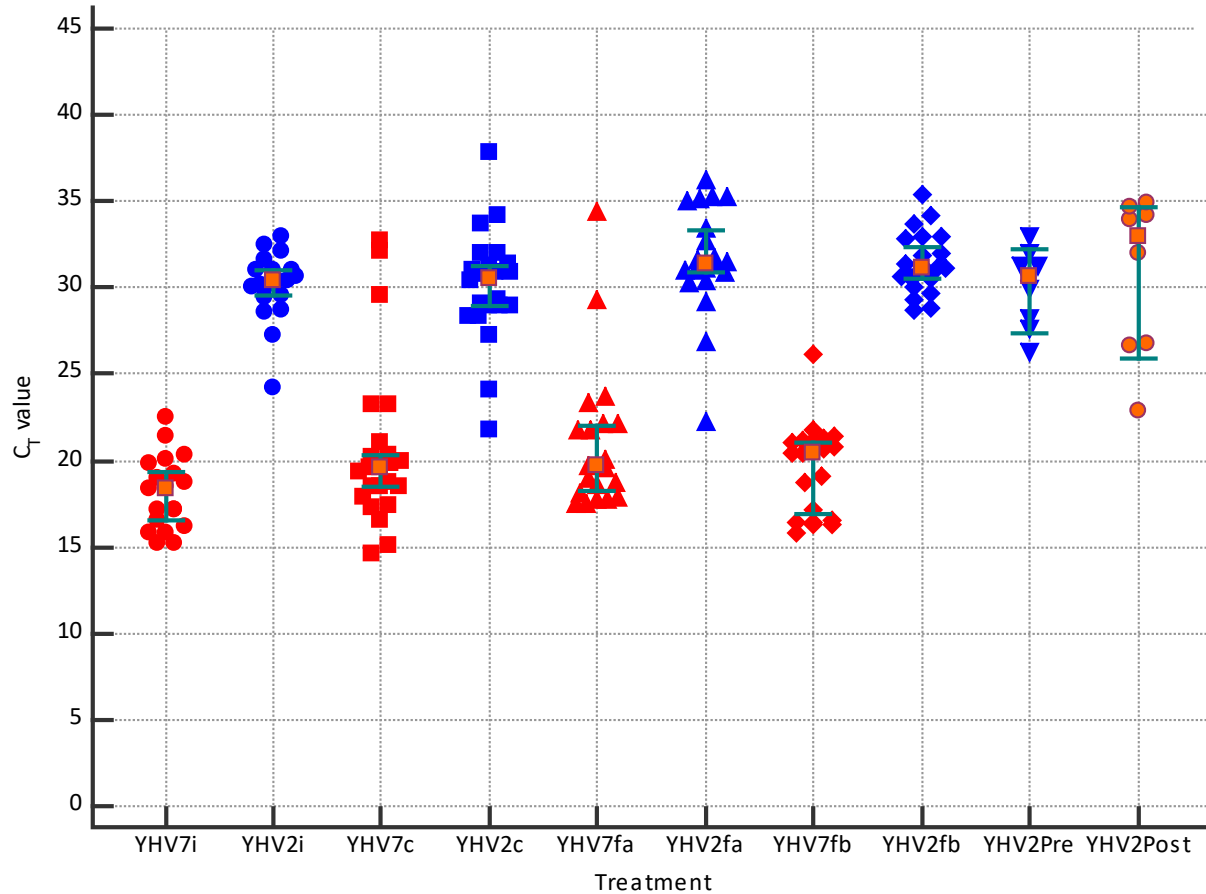
# YHV-7 – Natural routes of infection (25°C)



# YHV-7 – Natural routes of infection (25°C)



# YHV-7 – Natural routes of infection (25°C)





# Summary YHV-7 / *P. monodon*

	Temperature	Mortality
<u>Trial 1</u> Injection	25°C	62%
<u>Trial 2</u> Injection	30°C	30%
Co-habitation	30°C	6%
Feeding	30°C	15%
<u>Trial 3</u> Injection	25°C	91%
Co-habitation	25°C	61%
Feeding	25°C	71%

# Acknowledgements

- CSIRO ACDP Fish Diseases Laboratory
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# THANK-YOU

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