



GREAT SALT LAKE
ARTEMIA



EXPERIMENTAL RESULTS OF 3 FEED TRIALS PERFORMED AT CAN THO UNIVERSITY

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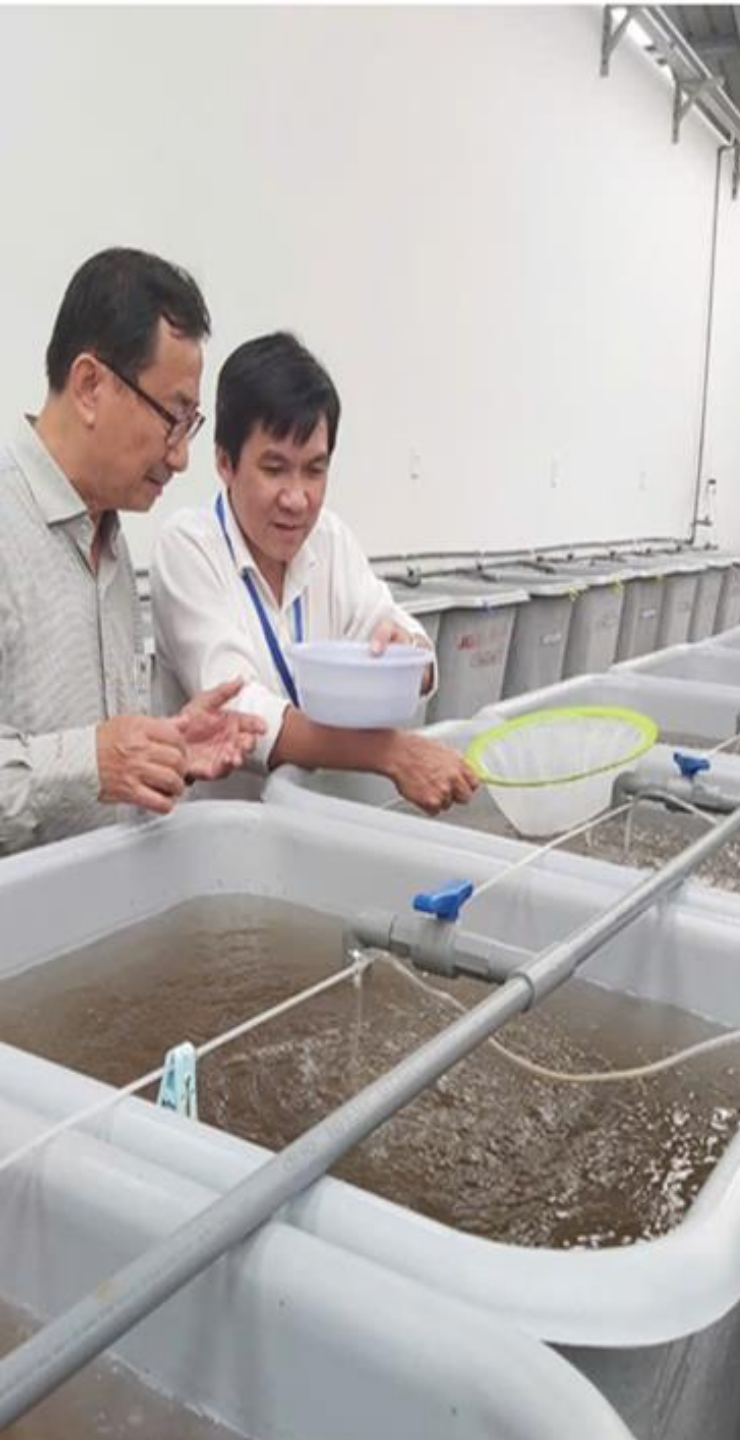
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GSLA MASTER TEMPLATE

AGENDA SLIDE

- Trial 1: screening of GSLA Mackay MP feeds compared to leading competitors
- Trial 2 :
 - A. CTU Vietnam standard compared to Mackay MP and Mackay MP probiotic with increased replication
 - B. Continued rearing to PL 40 and challenge testing
- Trial 3: Testing of GSLA Mackay MP feeds in mudcrab

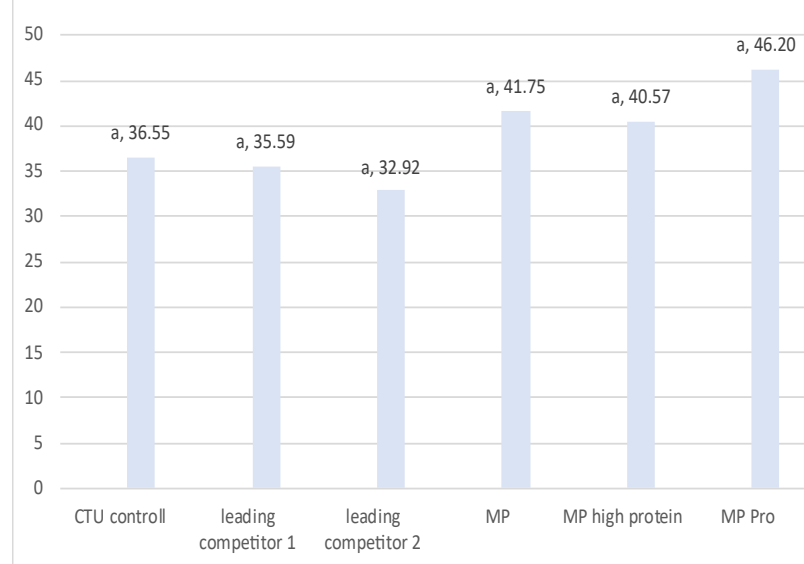


EXPERIMENT 1 NAUPLII 5 TO PL11

CTU STANDARD – FRIPPAK – BIOMAR – MACKAY – MACKAY HIGH PROTEIN – MACKAY PROBIOTIC

- 200 l tanks - 5 replicates - 200 N/l – bioflock based system
- Feeding
 - N5 to Zoea3 *Thalassiosira* 30,000/ml
 - Feeding 8*/day
 - Artemia 1kg per million PL based on 50% survival
 - Particle feed at satiation
- Survival – growth (wet weight) – length - productivity – stress – muscle to gut ratio – bacterial count – vibrio count

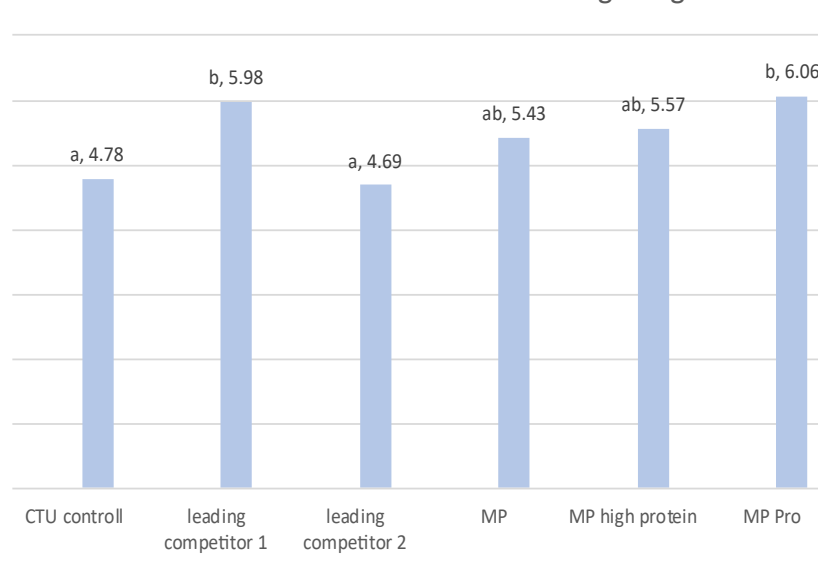
P. vannamei Trial Vietnam % survival



SURVIVAL

No significant difference

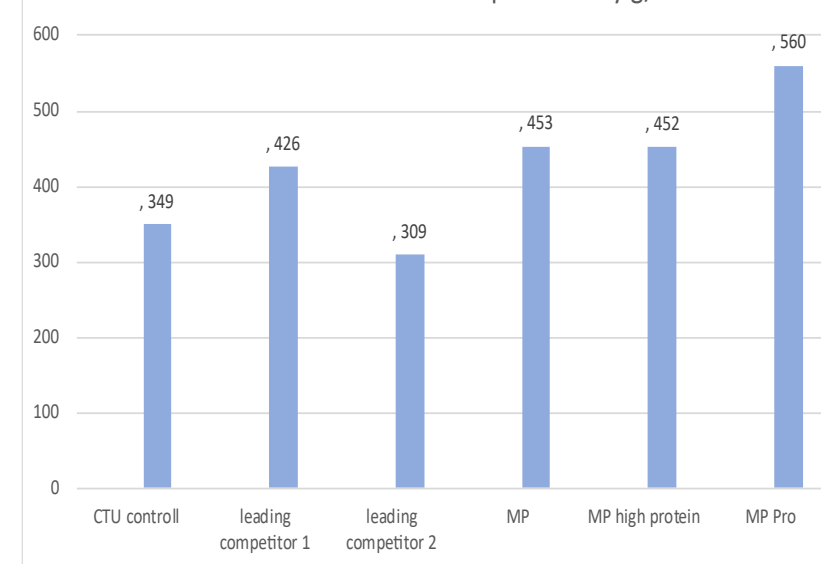
P. vannamei Trial Vietnam wet weight mg



WEIGHT IN MG

Mackay MP Pro performs better than CTU control (INVE)

P. vannamei Trial Vietnam productivity g/m3



TANK BIOMASS IN GRAM PER M3

CTU EXPERIMENT 1



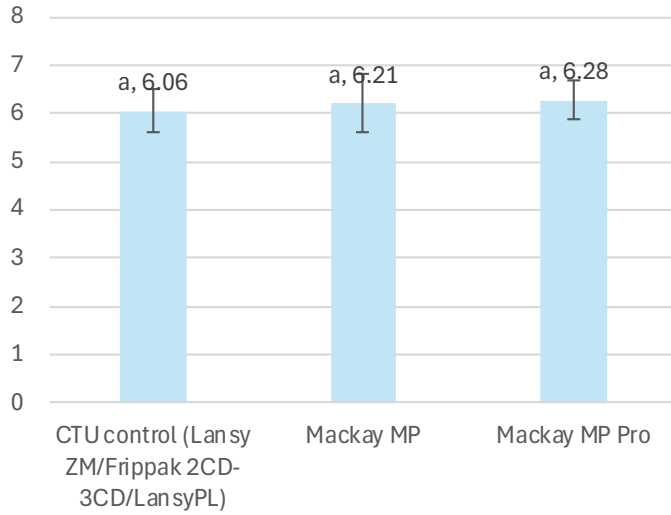


EXPERIMENT 2,A : NAUPLII 5 TO PL12

CTU STANDARD -- MACKAY - MACKAY PROBIOTIC

- 200 l tanks - 10 replicates - 200 N/l – bioflock based system
- Feeding
 - N5 to Zoea3 Thalassiosira 30,000/ml
 - Feeding 8*/day
 - Artemia 1kg per million PL based on 50% survival
 - Particle feed at satiation
- Survival – growth (wet weight) – length - productivity – stress – muscle to gut ratio – bacterial count – vibrio count

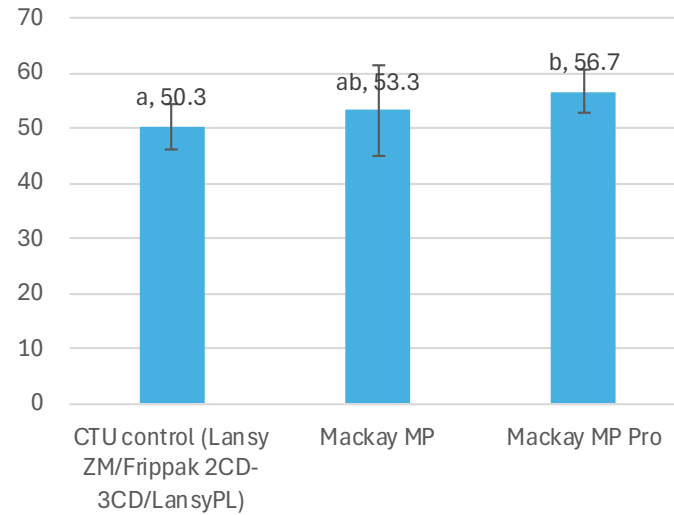
Weight (mg)



WEIGHT IN MG

No significant difference

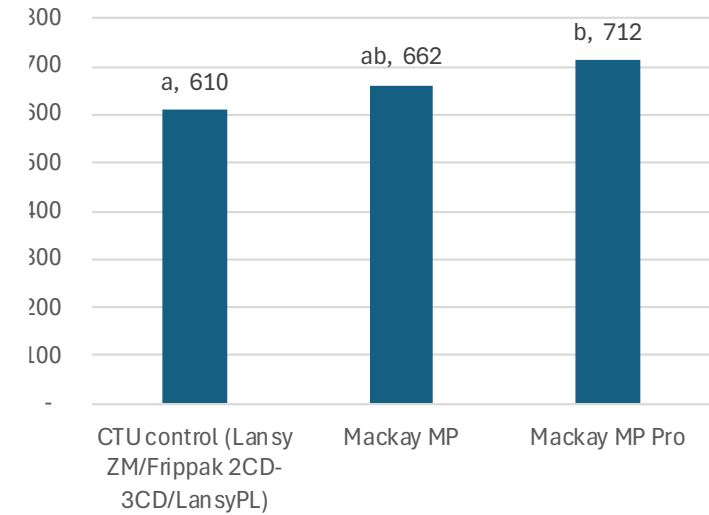
Survival (%)



SURVIVAL %

Mackay MP Pro performs better than CTU control (INVE)

tank biomass g/m3



TANK BIOMASS IN GRAM PER M3

CTU EXPERIMENT 2





EXPERIMENT 2,B: PL12 – PL 40

CTU STANDARD – MARINE GOLD – MARINE GOLD PROBIOTIC

- 200 l tanks - 10 replicates – 800 PL12/tank– bioflock based system
- Feeding
 - Particle feed at satiation
- Survival – growth (wet weight) – length - productivity – stress – muscle to gut ratio – bacterial count – vibrio count – microbiome – proximate composition
- Challenge with vibrio parahaemolyticus

PL 40 results

Table 9: Growth in weight

Parameter	Treatment		
	1(control)	2(D2s)	3(D3s)
Mean initial weight (g)	0.006±0.001 ^a	0.006±0.001 ^a	0.007±0.001 ^a
Mean final weight (g)	0.44±0.04 ^a	0.62±0.07 ^b	0.66±0.06 ^b



PL 40 results

Table 10 : Survival (%), Productivity (PL/m³), Biomass productivity (g/m³)

	Treatment		
	1(control)	2(D2s)	3(D3s)
Survival (%)	90.1±3.9 ^b	81.7±2.8 ^a	79.9±2.6 ^a
Productivity (PL/m³)	3,603±157 ^b	3,269±110 ^a	3,195±106 ^a
Biomass productivity (g/m³)	1,549±160 ^a	2,017±240 ^b	2,133±210 ^b

Values in the same rows with different letters are significantly different ($p < 0.05$)



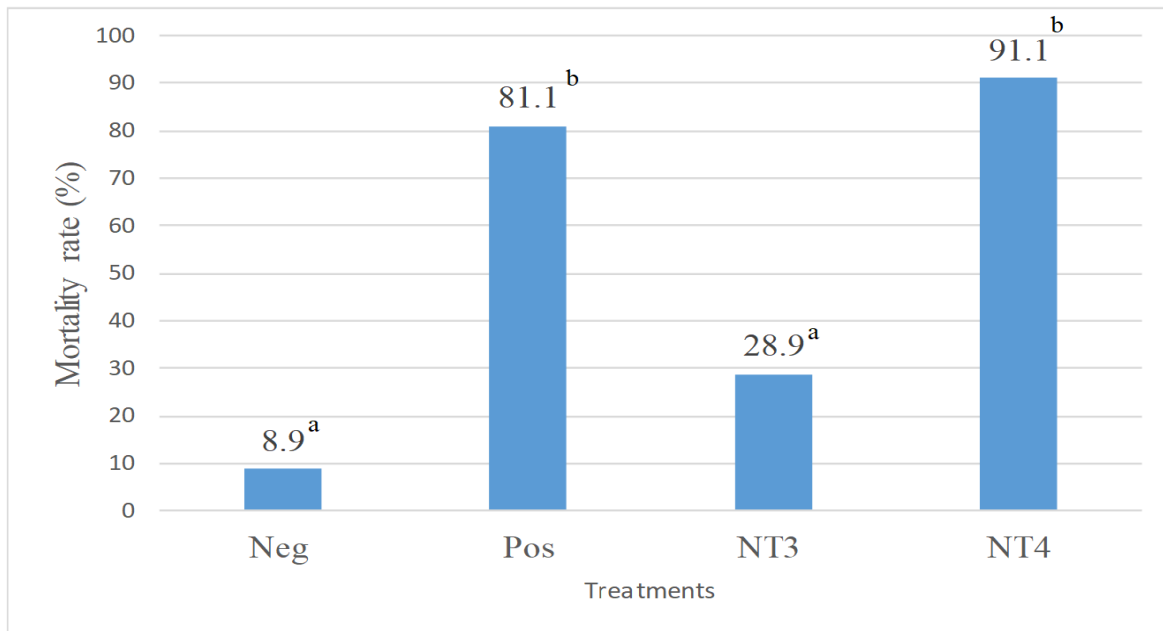


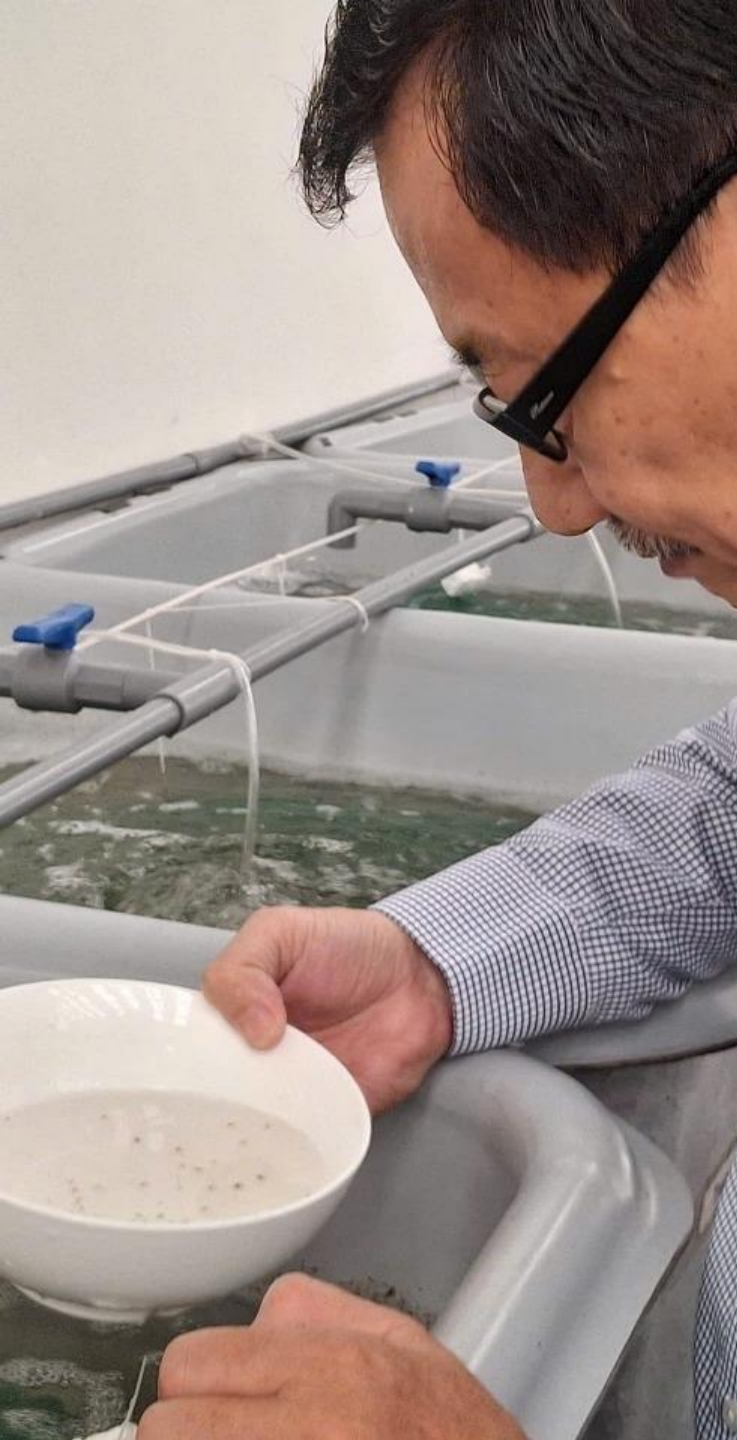
Fig 9: Cumulative mortality of experiment shrimp challenged with *V. parahaemolyticus* after feeding experiment

PL 40 challenge testing



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EXPERIMENT 3 ZOEAE 1 TO CRABLET

CTU STANDARD – MACKAY– MACKAY PROBIOTIC

- 200 l tanks - 10 replicates – bioflock based system
- Stocking density:
 - Z1-5 300/l
 - Z5+ 100/l
- Feeding
 - Z1 to Z3 1-2 g/m³/day oc VC cysts
 - Z3 to Crab1, 3-5 g/m³/day VC cysts + 2-5 g/m³/day commercial feed
 - Feeding 8*/day 4* cysts. 4* commercial feed
 - From megalopa 4mm nylon substrates in the tank
 - Digestive enzyme (TZ002, mineral (Mirano), and probiotic used
 - Survival – growth (wet weight) – length - productivity –LSI – bacterial count – vibrio count

Table 4. Metamorphosis index (LSI) of mud crab larvae

LSI (day)	Treatment		
	1 (control)	2 (MP)	3 (MP Pro)
3	1.60±0.00 ^a	1.60±0.00 ^a	1.60±0.00 ^a
6	2.50±0.00 ^a	2.50±0.00 ^a	2.50±0.00 ^a
9	2.76±0.21 ^a	2.86±0.15 ^a	2.93±0.21 ^a
12	3.28±0.53 ^a	3.39±0.52 ^a	3.66±0.50 ^a
15	4.30±0.43 ^a	4.58±0.60 ^{ab}	4.95±0.51 ^b
18	4.51±0.50 ^a	4.79±0.53 ^{ab}	5.14±0.37 ^b
21	5.55±0.47 ^a	5.58±0.51 ^{ab}	5.92±0.44 ^b
24	6.46±0.37 ^a	6.49±0.39 ^{ab}	6.85±0.36 ^b

Values in the same rows with different letters are significantly different ($p < 0.05$)

Mudcrab metamorphosis index

$$LSI = \frac{N_1.n_1 + N_2.n_2 + \dots + N_i.n_i}{n_1 + n_2 + \dots + n_i}$$

In which: $N_1, N_2, \dots, N_i$ are larval stages, and $n_1, n_2, \dots, n_i$ are number of larvae at the corresponding stage.



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Table 6. Weight (mg), Survival (%) and Productivity (Crab 1/m³)

	Treatment		
	1 (control)	2 (MP)	3 (MP Pro)
Weight (mg/Crab 1)	36.1±5.2 ^a	40.0±4.5 ^b	45.5±1.7 ^c
Survival Zoea 5 (%)	62.76±4.77 ^a	67.72±3.73 ^b	72.81±3.81 ^c
Survival Crab 1 (%)	5.43±0.99 ^a	7.37±0.51 ^b	8.65±0.53 ^c
Productivity (Crab 1/m ³)	5,430±993 ^a	7,372±512 ^b	8,649±532 ^c

Values in the same rows with different letters are significantly different ($p < 0.05$)

**Mudcrab
Growth
Survival
productivity**



Table 3: Vibrio (CFU/ml in water and CFU/g Crab 1)

	Treatment		
	1 (control)	2 (MP)	3 (MP Pro)
7 day	24.4±3.5 ^a	23.9±6.0 ^a	20.9±2.5 ^a
14 day	50.3±6.4 ^b	53.0±7.8 ^b	40.9±6.3 ^a
21 day	82.8±7.1 ^b	84.1±7.6 ^b	72.8±10.8 ^a
The end of experiment	159.7±25.3 ^b	149.8±15.4 ^b	130.0±7.8 ^a
Crab 1	307.3±34.4 ^b	277.4±36.6 ^b	242.2±27.4 ^a

Values in the same rows with different letters are significantly different ($p < 0.05$)

Mudcrab Vibrio count



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% Relative fat	Treatments		
	1(control)	2 (MP)	3 (MP Pro)
Sum of omega-3	313.2±10.1 ^c	211.6±9.2 ^a	256.2±25.9 ^b
Sum of omega-6	114.9±3.6 ^a	173.2±19.6 ^b	278.3±30.1 ^c
Sum of omega-9	302.9±8.0 ^a	292.8±13.1 ^a	318.3±33.0 ^a
Sum of Trans fat	8.9±0.3 ^a	8.3±2.1 ^a	6.8±1.7 ^a
Saturated fatty acids	427.2±4.2 ^b	367.0±20.4 ^a	397.2±41.5 ^{ab}
Monounsaturated fatty acids (MUFA)	478.8±8.8 ^a	432.4±13.5 ^a	446.0±47.1 ^a
Polyunsaturated fatty acids (PUFA)	433.0±12.8 ^a	388.9±12.1 ^a	538.9±56.3 ^b

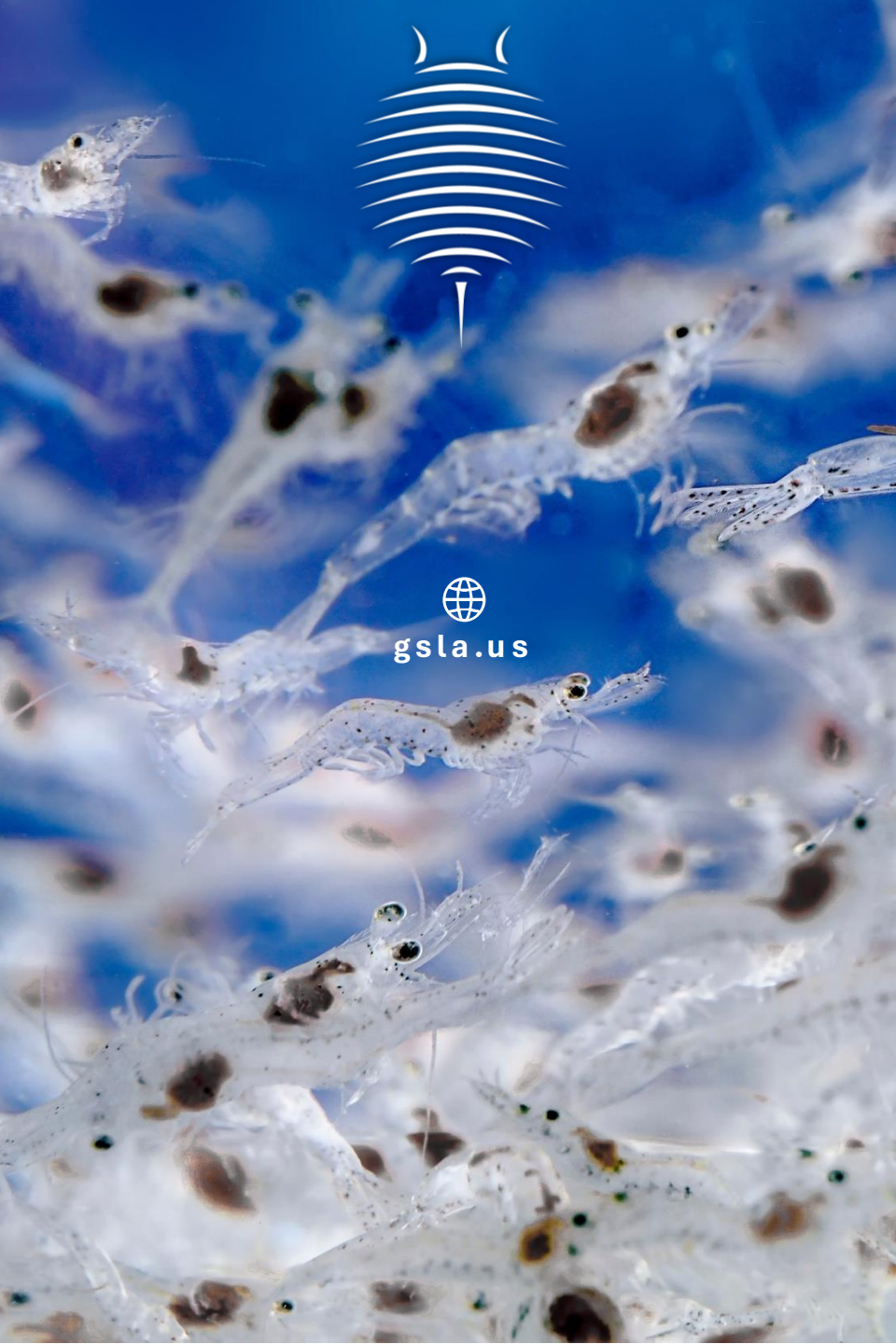
Values in the same rows with different letters are significantly different (p<0.05)

Mudcrab Fatty acid analysis



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FINAL THOUGHTS

- GSLA Mackay MP and Macay MP pro (probiotic) is competitive with other leading brands in the hatchery culture of *L.vannamei* (whiteleg shrimp) and *S.paramamosain* (mudcrab)
- Incorporating an effective probiotic inside the feed particle further improves hatchery results in both species
- The effectiveness of probiotic feeding post hatchery cycle did not result in improved survival during challenge testing