INCREASED *ARTEMIA* USE RESULTS IN IMPROVED HATCHERY, NURSERY, AND GROW-OUT OUTCOMES

A SUMMARY OF RECENT TRIALS ON *L. VANNAMEI*

WORLD AQUACULTURE SOCIETY 2025

INCREASED ARTEMIA USE

A SERIES OF TRIALS

Research Facilities- Greater flexibility in experimental design, greater control of conditions, often more consistent and comprehensive data collection.

Commercial Production Facilities– Real world results. Yet, real world restrictions. Less control of conditions. Replication may be more difficult to achieve. Less consistent data collection.

Region– Culture techniques, broodstock, rearing densities, climate, water quality can vary between country and region

Production cycle – Hatchery, nursery, growout

Additional factors yet to be covered– Seasonality. Variations in culture methods within a region. Specific genetic lines.

INCREASED ARTEMIA USE

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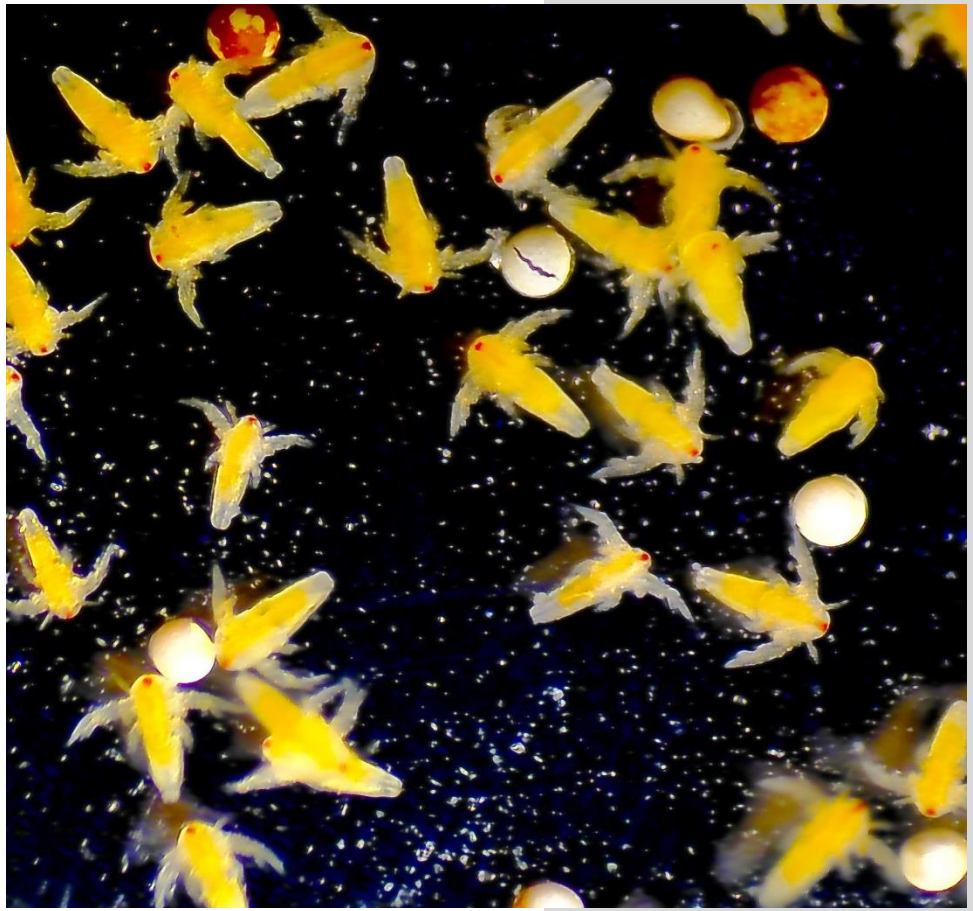


INCREASED ARTEMIA USE

OUTLINE

- **University of Idaho trials**
  - Alpha and Beta trials: hatchery cycle (N to PL15)
  - Nursery phase (PL12 to PL25)
- **Ecuador trials**
  - Commercial hatchery
  - Paired trials (N to PL12)
- **Mexico trial**
  - Commercial facility
  - Hatchery through growout
- **Vietnam trial**
  - University research facility
  - Hatchery through growout

ARTEMIA USE RATE TRIALS

UNIVERSITY OF IDAHO

The initial series of tests on optimizing Artemia use in L. vannamei culture

Scoping trial for **hatchery cycle** tests

Follow up trials on hatchery and **nursery** age PLs

GREAT SALT LAKE ARTEMIA

UNIVERSITY OF IDAHO

ALPHA TRIAL

N to PL15 (Hatchery)

11.4 liter recirculating tanks, 8 replicates per treatment

36 vannamei nauplii per liter

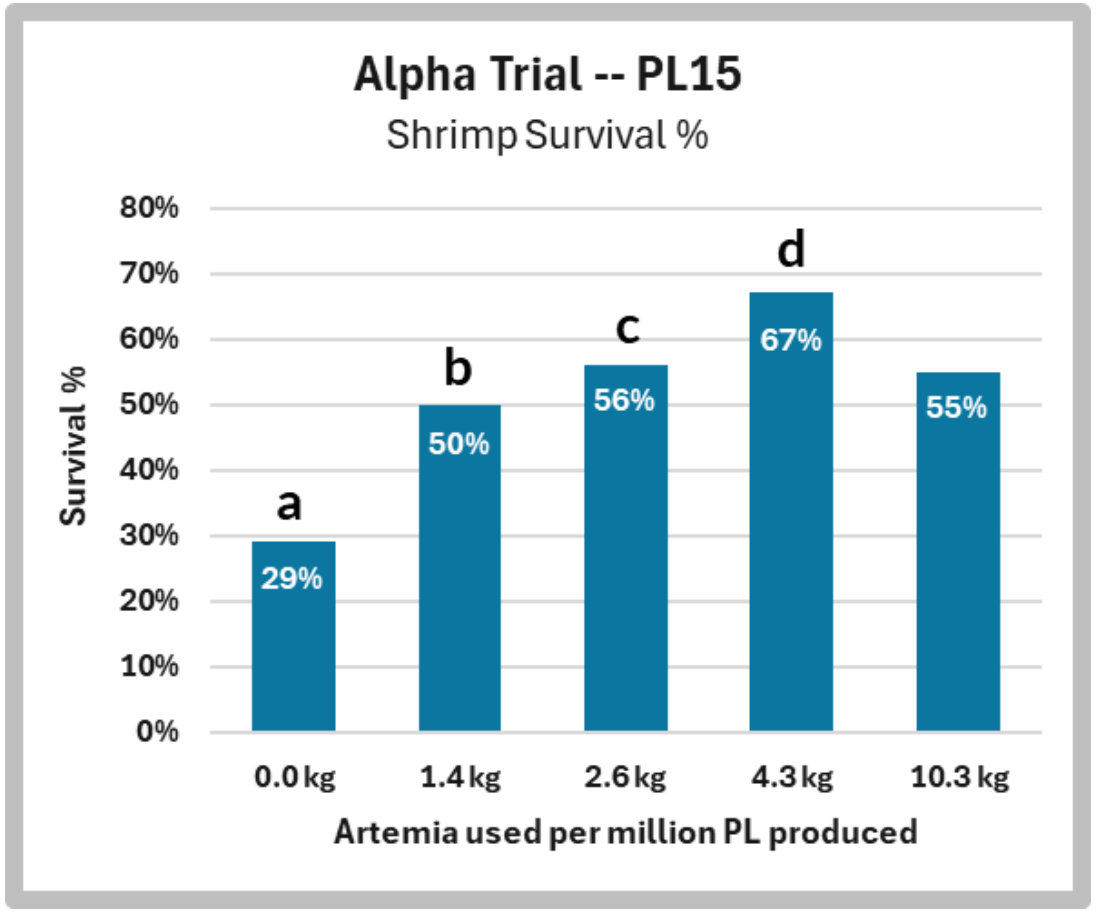
Co-fed to satiation with a higher quality MP diet

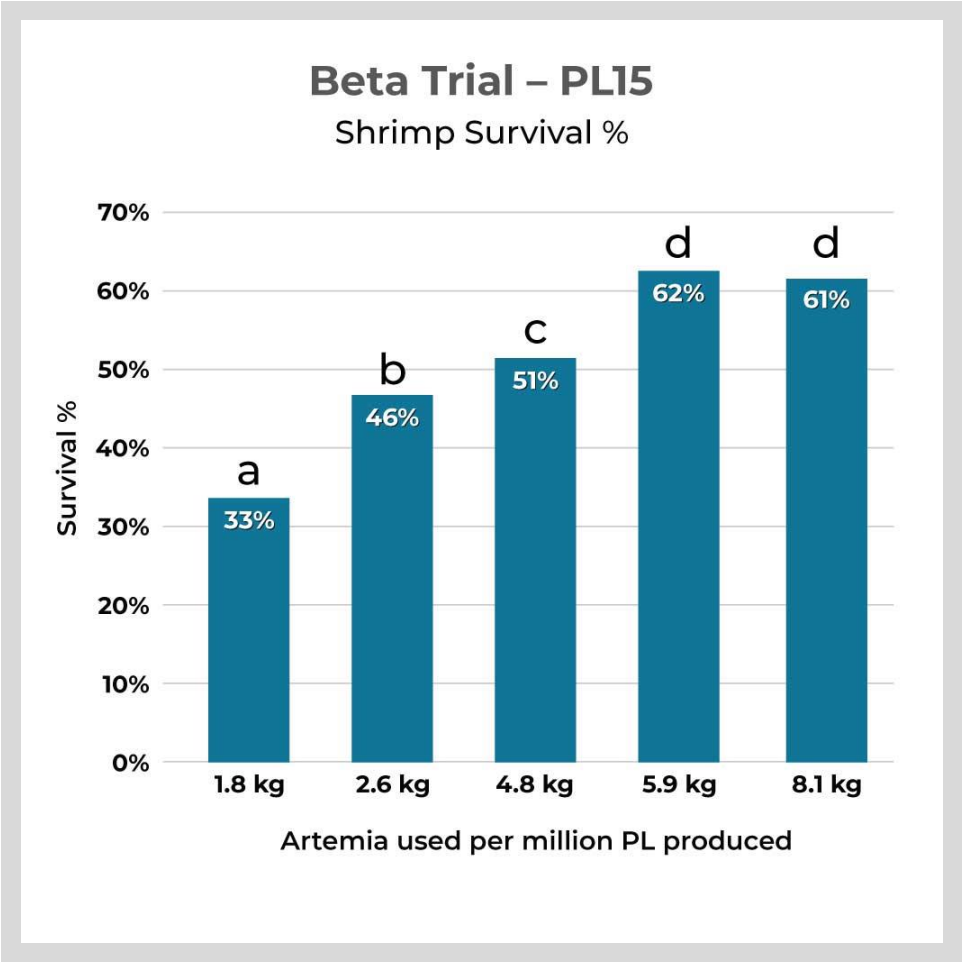
Results:

Survival rate increases with Artemia use rate

No difference in PL size, stress tolerance, muscle gut ratio

Greater resolution between 4kg and 10kg is needed





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BETA TRIAL

N to PL15 (Hatchery)

Stocking density increased to 57 vannamei nauplii per liter

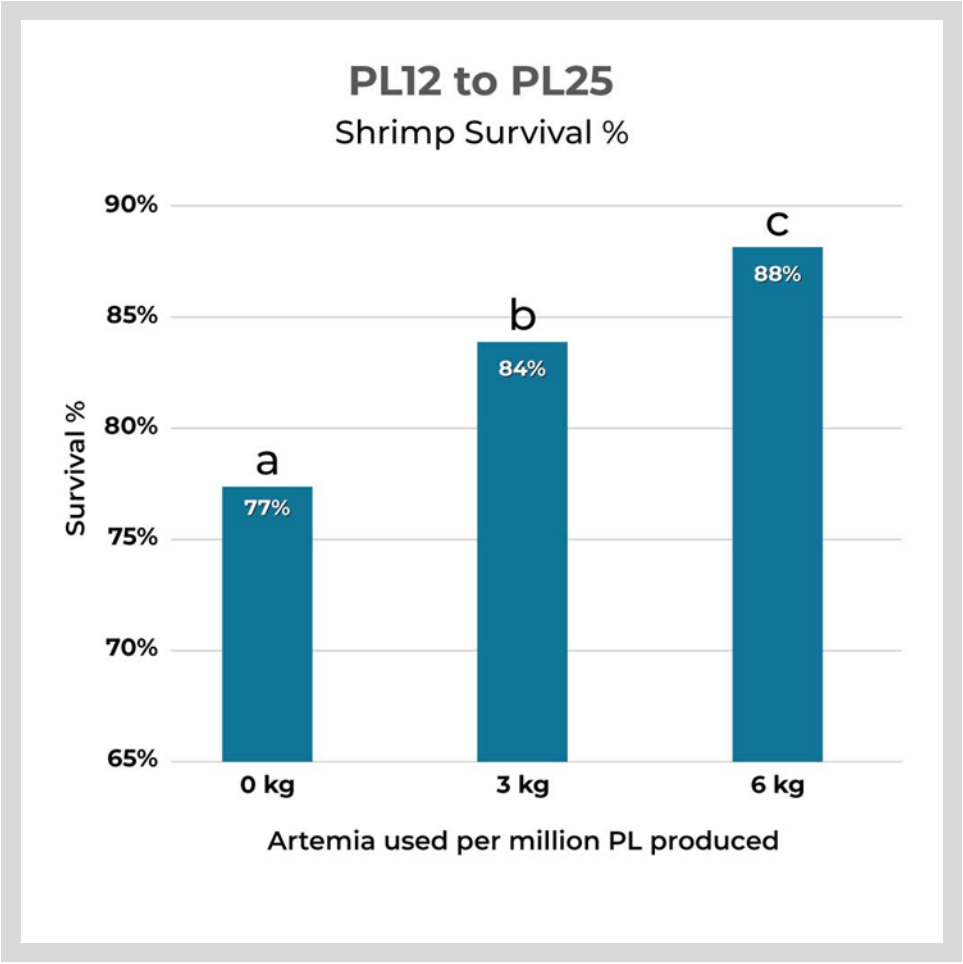
Artemia feeding rates to define response in the 2kg to 8kg per million range

Results:

No difference in PL size, stress tolerance

Survival again increases with Artemia use rate

- Peaks at approximately **6kg per million PL**
- No further gains above this



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NURSERY PHASE

PL15 to PL25

PL12 reared using flake feed and a low Artemia use rate

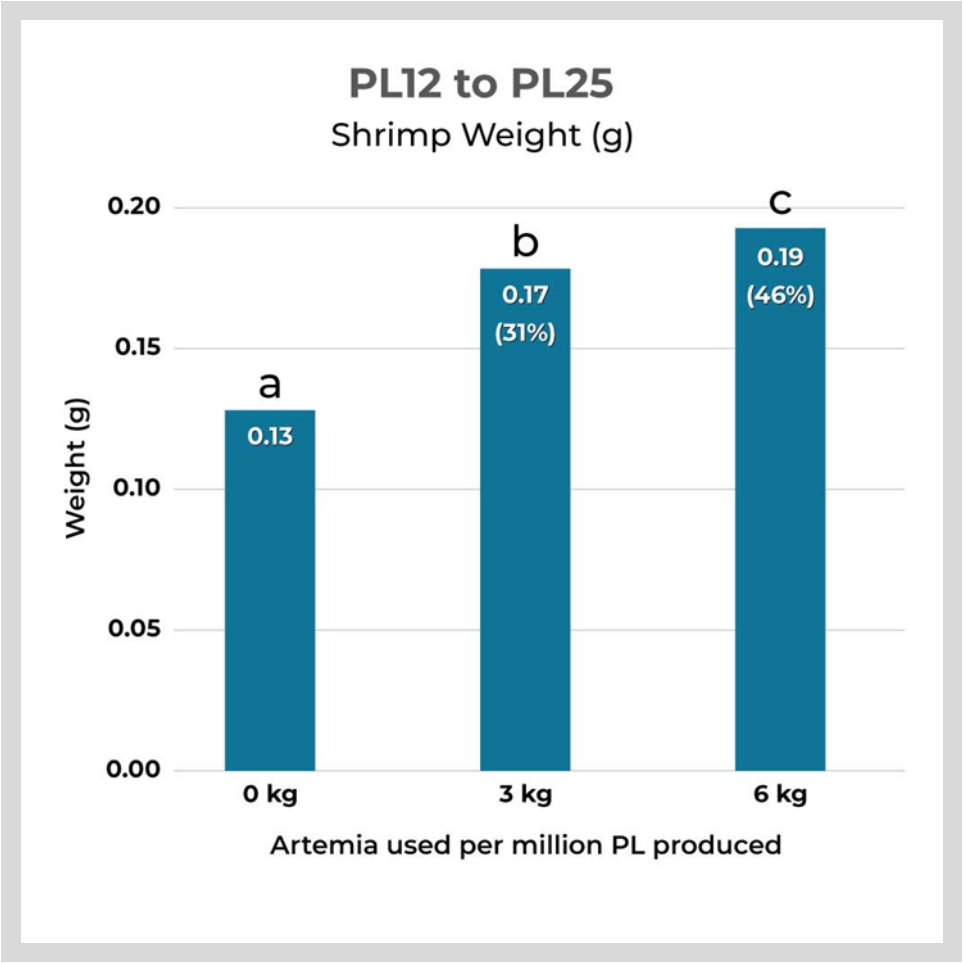
17.5 PL per liter

Co-feeding of MP feeds with 0, 3, or 6kg Artemia per million PL

Results:

Compared to PLs fed no Artemia in nursery cycle:

- Survival is **7% higher** for PLs fed **3kg** Artemia per million
- Survival is **11% higher** for PLs fed **6kg** Artemia per million



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NURSERY PHASE

PL15 to PL25

Compared to PLs fed no Artemia in nursery cycle:

- PLs fed **3kg** Artemia per million are **31% larger**
- PLs fed **6kg** Artemia per million are **46% larger**
- PLs fed 6kg are 12% larger than those fed 3kg

The resulting biomass at PL25 is 60% higher for the 6kg treatment than control, 17% higher than the 3kg treatment.

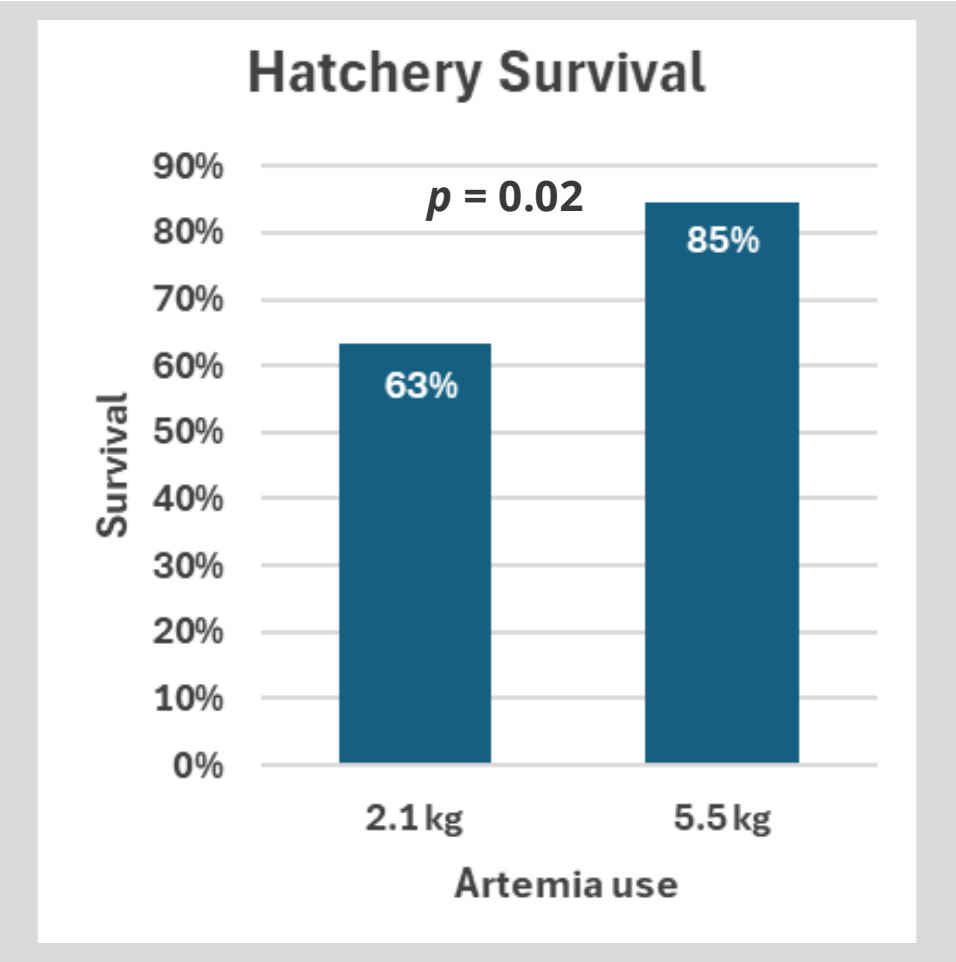
ARTEMIA USE RATE TRIALS

ECUADOR COMMERCIAL

Bringing university results to a commercial scale

2 trials in 2025 in the **hatchery cycle**

Ecuador hatcheries typically employ a low Artemia use rate



ECUADOR COMMERCIAL TRIALS

HATCHERY, MARCH 2025

Commercial hatchery

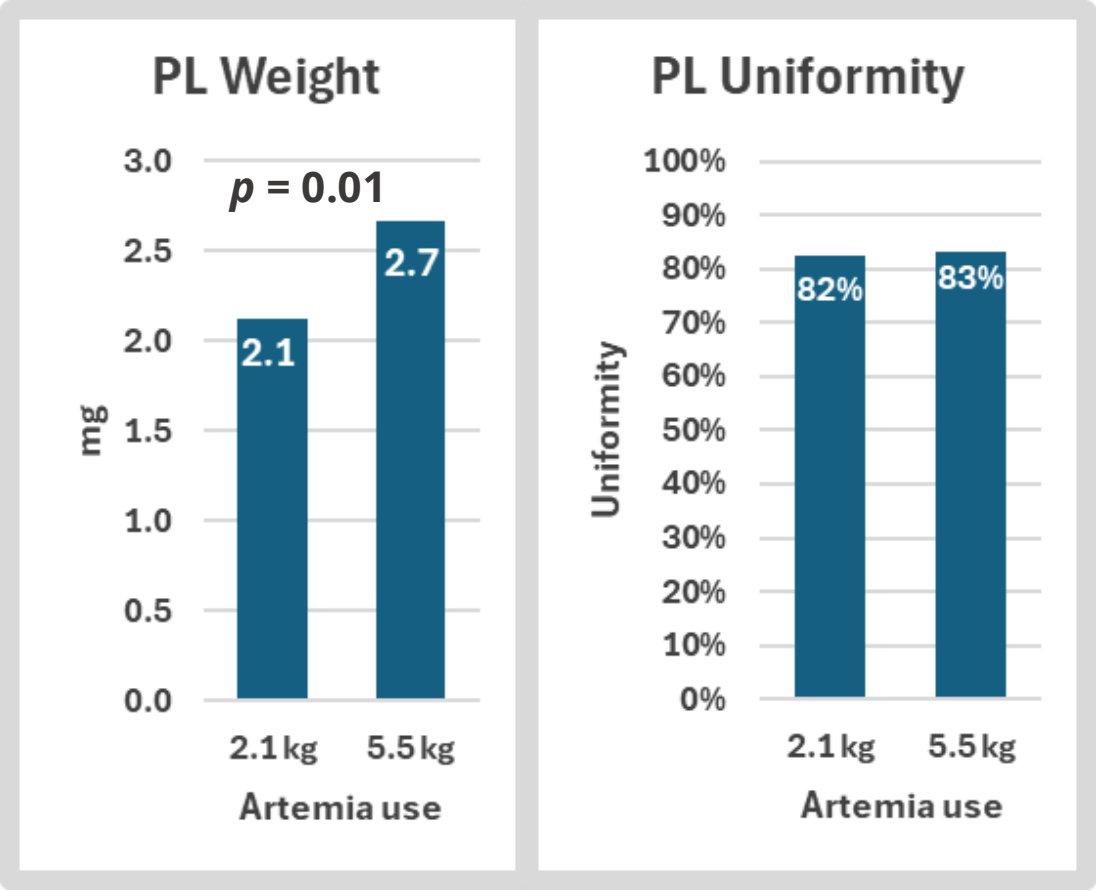
2.1kg Artemia per mill (control group)

5.5kg Artemia per mill

6 replicate tanks per treatment. 20,000 liter tanks.

Results:

22% increase in survival



ECUADOR COMMERCIAL TRIALS

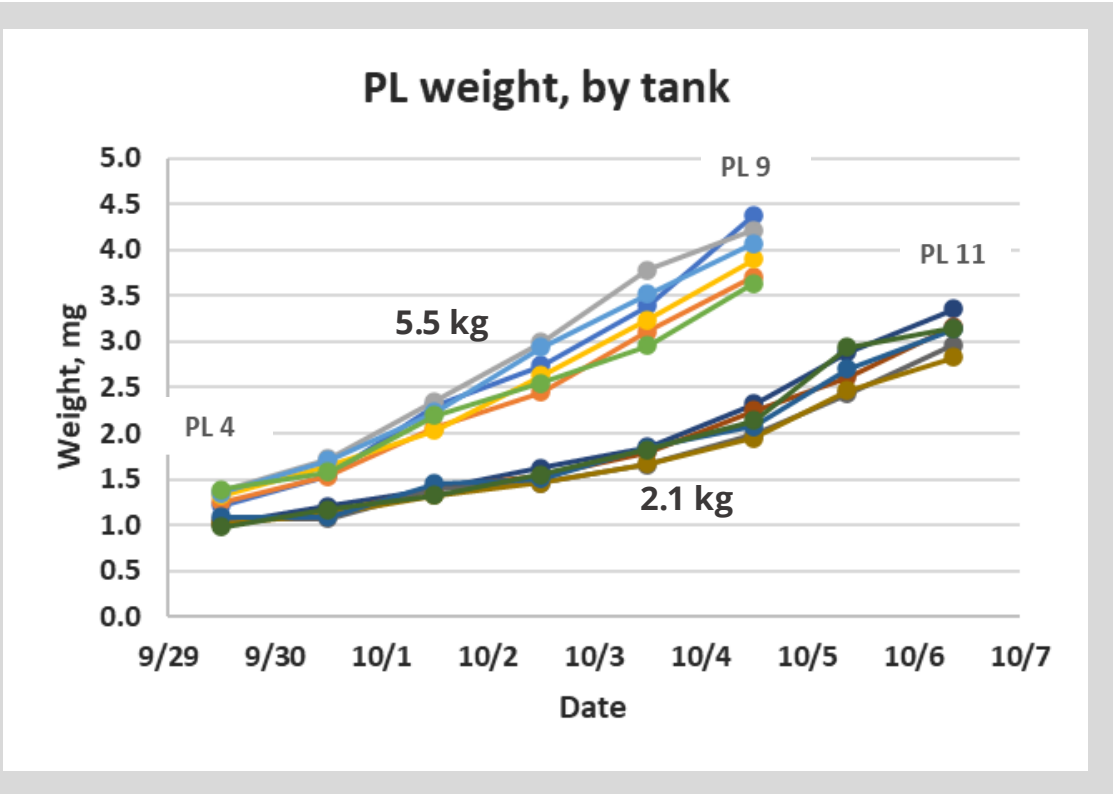
HATCHERY, MARCH 2025

Results:

PLs at harvest were longer and had significantly higher weight

Uniformity of the PLs were not compromised to achieve this

Harvest could occur **2 days earlier** for the 5.5kg Artemia group



ECUADOR COMMERCIAL TRIALS

HATCHERY, OCTOBER 2025

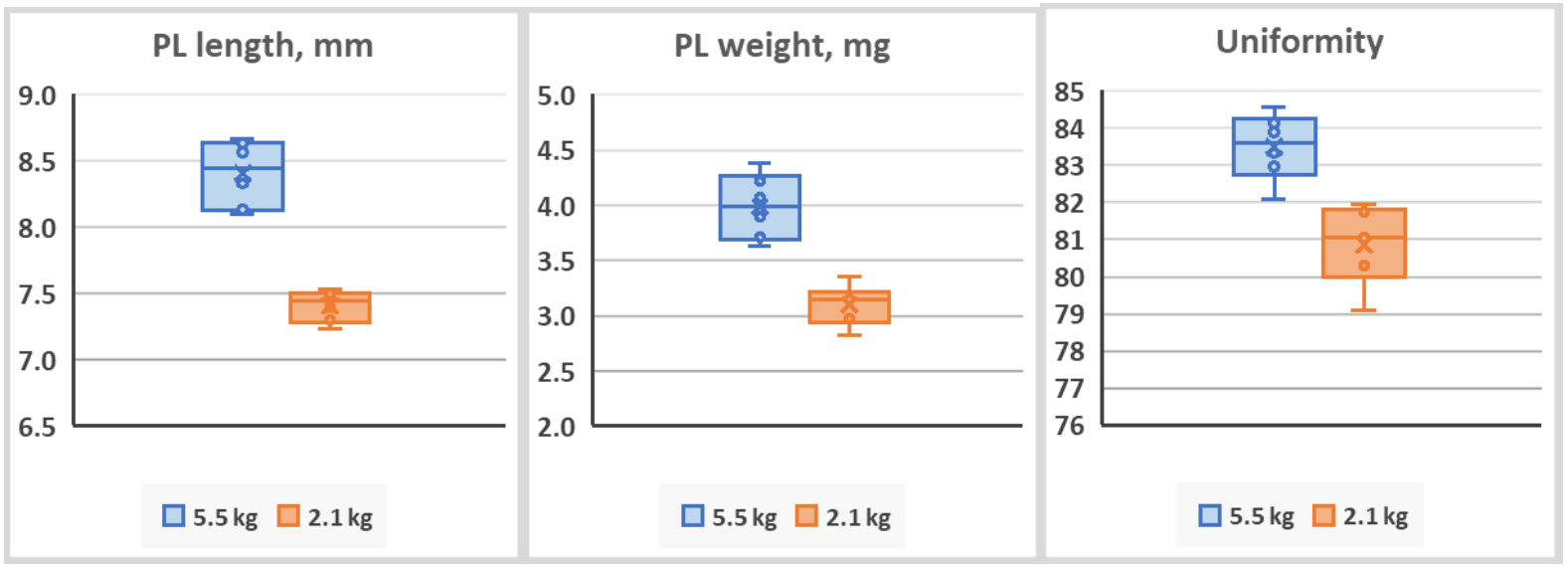
Daily measurements of PL size and weight from PL4 to harvest

- Large and significant PL size advantage in the 5.5kg Artemia group on every date. No overlap.
- PLs fed 5.5kg Artemia were **nearly twice as large** by PL9 and could be **harvested 2-3 days earlier** than the 2.1kg.
- Hatchery staff and managers took notice
- Significantly more PLs and biomass at harvest than expected

GREAT SALT LAKE ARTEMIA

ECUADOR COMMERCIAL TRIALS

HATCHERY, OCTOBER 2025



PL metrics on the day of harvest

The control group was unable to catch up to the 5.5kg Artemia group by day of harvest

5.5kg Artemia PLs still nearly **30% larger** at harvest, and slightly higher uniformity

Economics

PL harvest worth thousands of dollars more

Thousands of dollars in daily costs saved by early harvest

Hatchery now considering increased Artemia use

ARTEMIA USE RATE TRIALS

MEXICO COMMERCIAL HATCHERY TO GROWOUT

GREAT SALT LAKE ARTEMIA

Hatchery Cycle: Four (4) dietary treatments replacing a fixed percentage of the standard microparticulate diet with Artemia nauplii ranging from 25% to 100% replacement.

Pond Production: Three (3) of the dietary treatments were transferred to ponds for grow out. No additional Artemia provided

GREAT SALT LAKE ARTEMIA

MEXICO COMMERCIAL TRIAL

HATCHERY

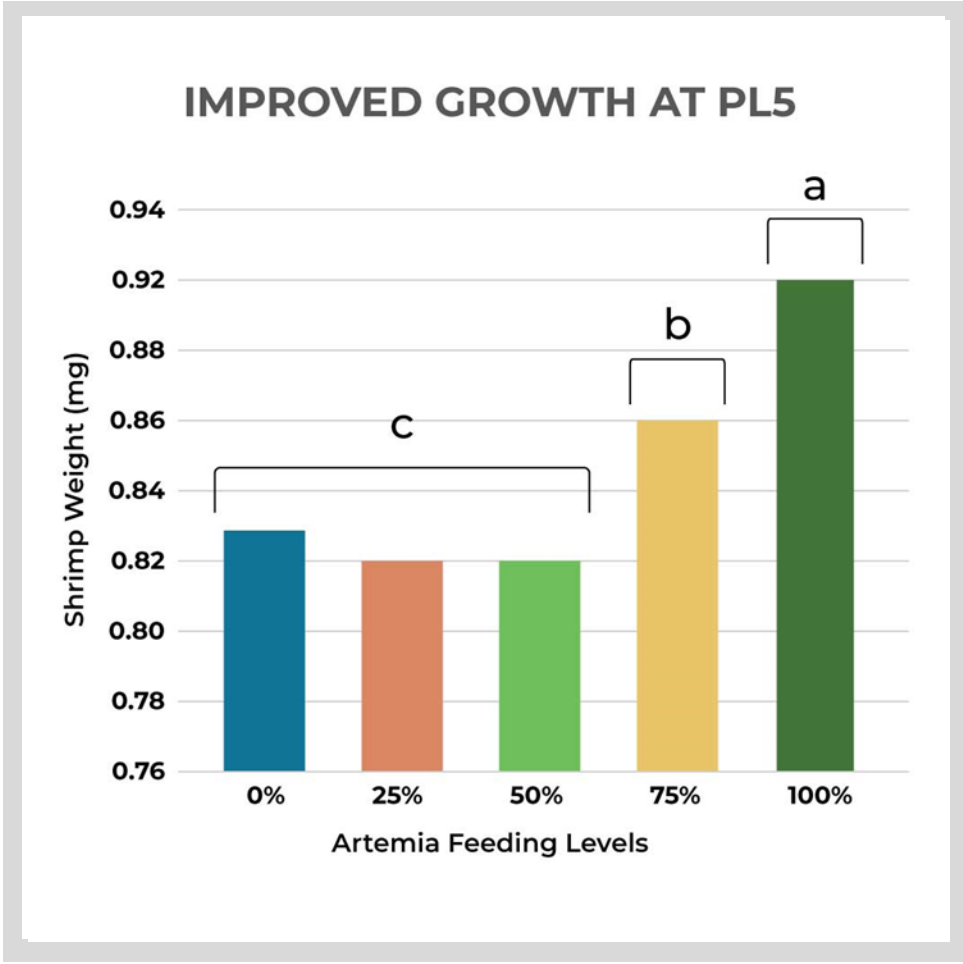
- Eight (8) randomized replicated tanks of 30,000 L per treatment.
- Stocked to 200 zoea per liter
- MP feed rates static--not adjusted to satiation

Results:

Survival increased 15% at a 75% replacement rate

Modest but significant gain in PL size

Uncertainty due to particulate feeding schedule



GREAT SALT LAKE ARTEMIA

MEXICO COMMERCIAL TRIAL

HATCHERY

Freshwater stress test of PL5

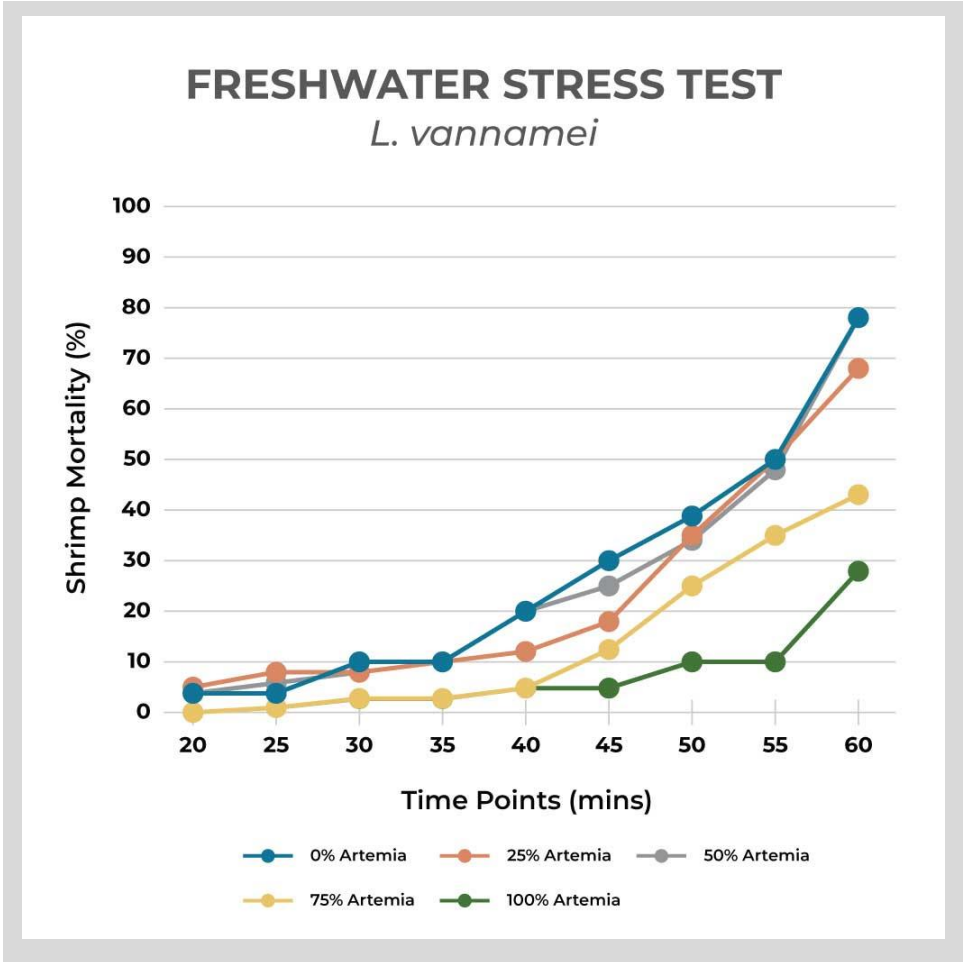
26ppt to 0ppt

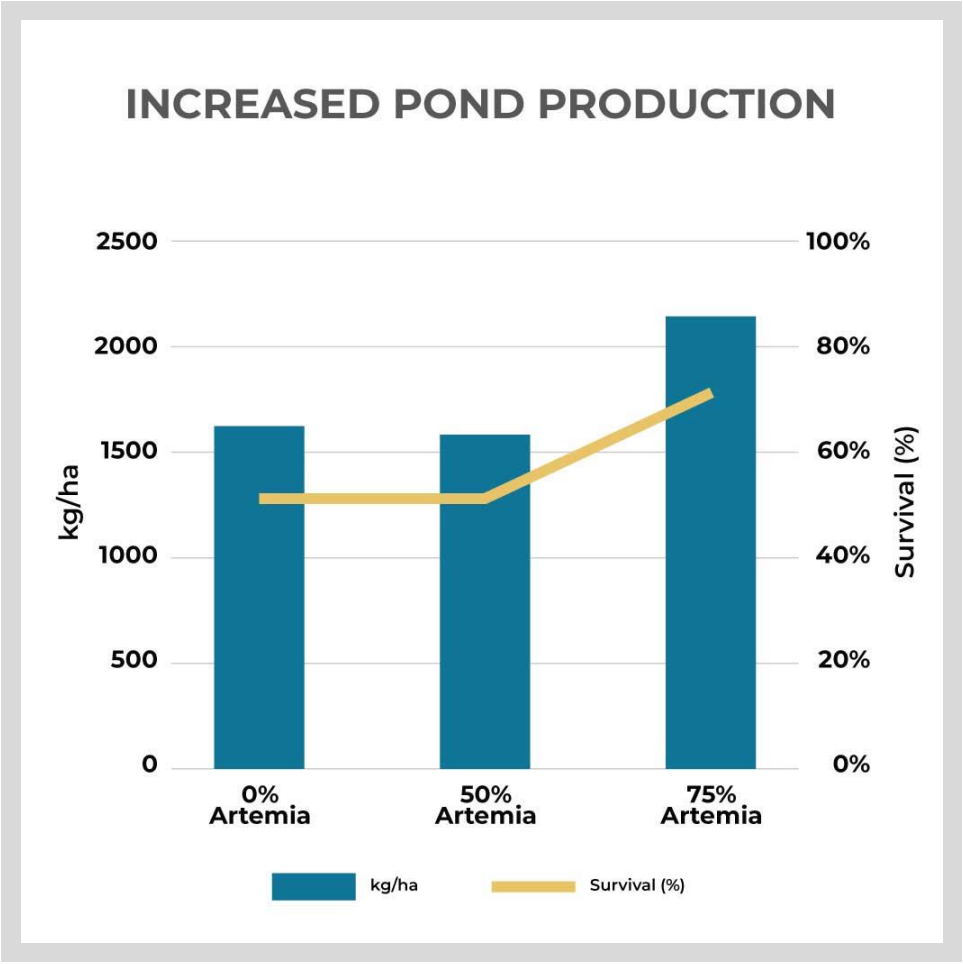
3 replicates per treatment

100 PLs per replicate

Results:

- 78% mortality for PLs at 0% Artemia feeding rate
- 43% mortality for PLs at 75% Artemia
- 28% mortality for PLs at 100% Artemia





MEXICO COMMERCIAL TRIAL

GROWOUT

3 of the Artemia treatment groups transferred to growout

Eleven ponds ranging from 3.1 to 24 hectare (ha)

Semi-intensive. 27 PLs per m^2

No additional Artemia given beyond the hatchery cycle

Results:

Replication and tests of statistical significance not possible

Survival improved from 50% to 70%

Pond production per unit area increased

Suggests a **legacy effect** of Artemia use in the hatchery

VIETNAM UNIVERSITY TRIAL

HATCHERY AND GROWOUT

GREAT SALT LAKE ARTEMIA

Hatchery

3 replicate 4,000 liter tanks per treatment. 200 nauplii per liter.

- 3kg and 6kg Artemia per million PL

Nursery & Growout

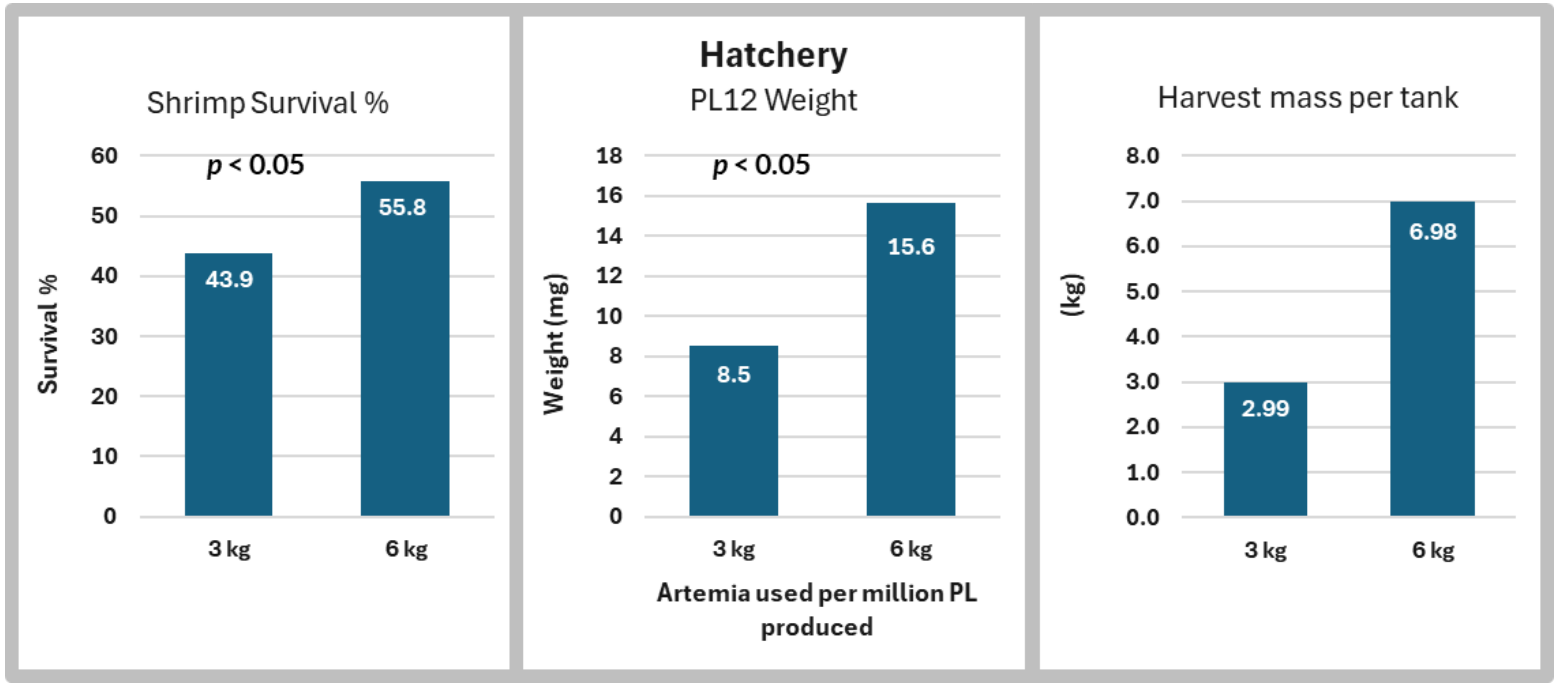
500 m^2 ponds, replication preserved

- 0kg and 3kg additional Artemia in nursery

GREAT SALT LAKE ARTEMIA

VIETNAM HATCHERY AND GROWOUT

PRELIMINARY RESULTS



Hatchery cycle results (PL12)

Survival

- 27% higher, relative to 3kg

PL weight

- 83.5% higher

Harvested biomass per tank

- 133% higher

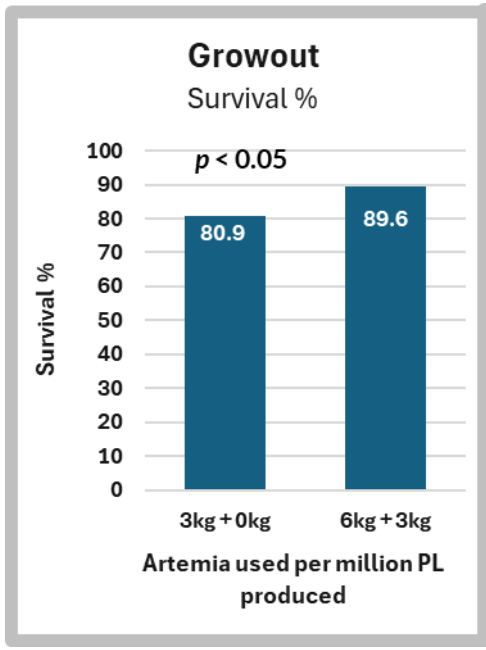
No change in formaldehyde or salinity stress tests

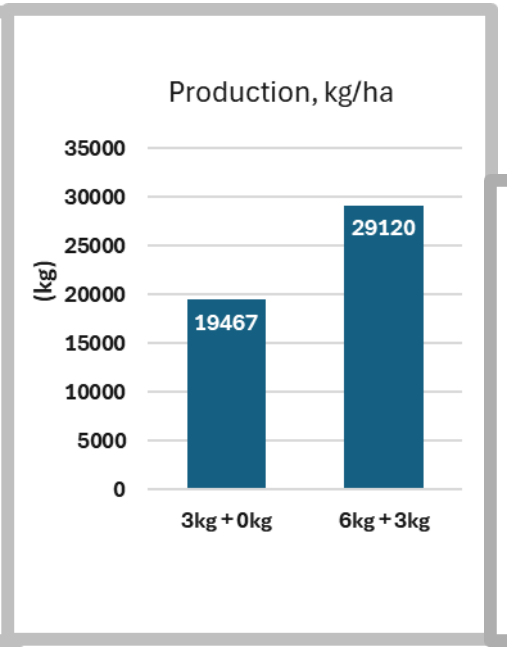
- Survival 98-100%

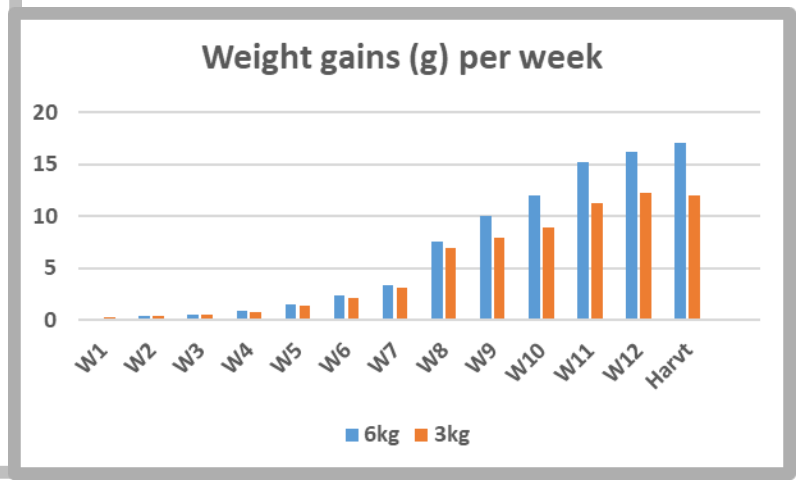
GREAT SALT LAKE ARTEMIA

VIETNAM HATCHERY AND GROWOUT

PRELIMINARY RESULTS







Nursery (4 weeks)

500 PL/m²

- 0kg or 3kg Artemia per million

Growout (8 weeks)

- 500 m² ponds, triplicate. 180 per liter.

Survival

- Modest but significant gain

Growth and production

- Much faster growth
- 50% higher production per unit area

THE LIVE FEED FACTOR

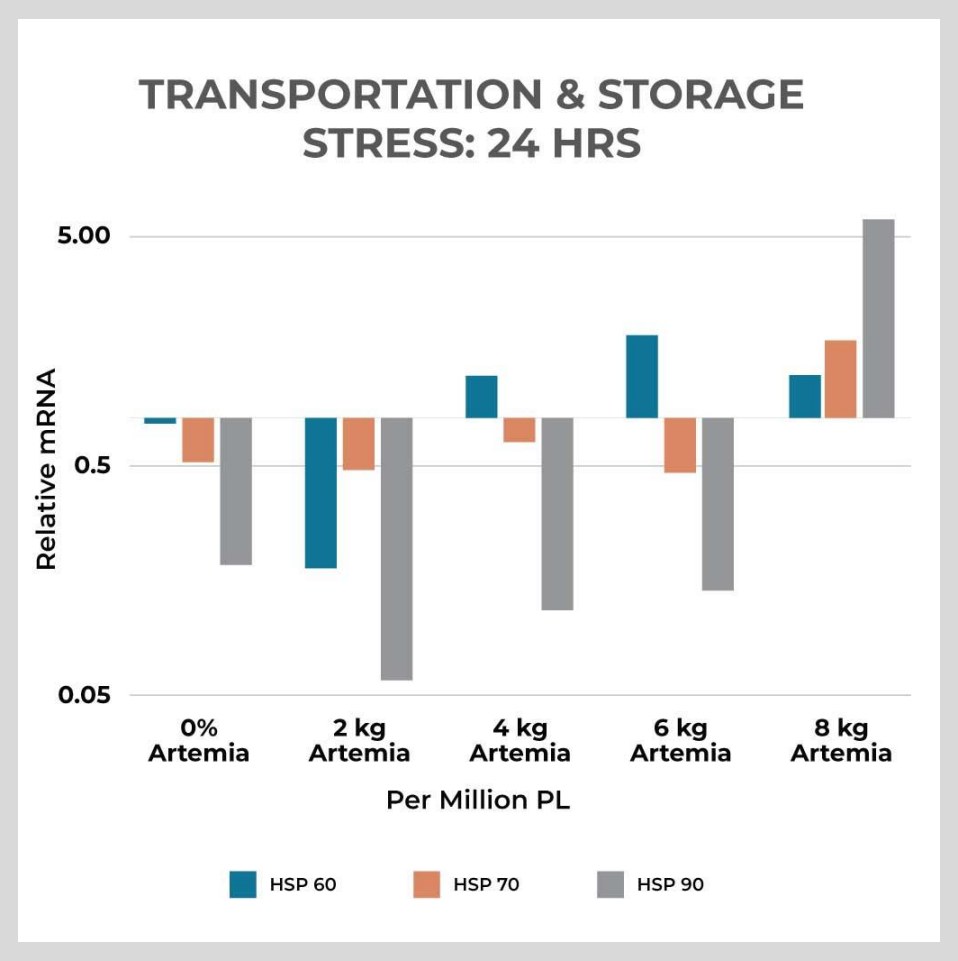
HEAT SHOCK PROTEINS

Molecular chaperones aiding in protein folding, preventing protein damage, and enhancing stress tolerance and immune response.

Preliminary evidence of increased Artemia use promoting upregulation of mRNA expression of HSP60, 70, 90.

A future avenue of study

GREAT SALT LAKE ARTEMIA



HEAT SHOCK PROTEINS

The Heat Shock Protein study, conducted at UAPB, reveals a **positive correlation** between Artemia feeding and the upregulation of mRNA expression of heat shock proteins, commonly known as molecular chaperones.

HSP60, HSP70 and HSP90 all show **significant improvement** (PL1–PL15 stages) when more Artemia is used in the feed regimen – improving cell protection and defense against stress.

FINAL

THOUGHTS

Hatchery - Multiple trials show significant shrimp survival and growth increases at PL12-15 stage when using up to 6 kg of Artemia per million PL produced.

Nursery – Including Artemia in the nursery cycle significantly improves survival and weight gain

Growout – The benefits of Artemia use in the nursery and hatchery cycle carry through the grow out cycle, showing a legacy effect of Artemia use in earlier culture stages

Cost:benefit ratio at growout– As the value and investment into each shrimp increases along the production cycle, gains in survival and size become more valuable

Further research– Detailed economic analysis, HSPs, stress tolerance, and immune response