LIVE FEED IN SHRIMP CULTURE

EFFECT OF LIVE ARTEMIA FEED RATIO ON SHRIMP CULTURE YIELD

status summary GSLA study

IWAN 2026, Chennai

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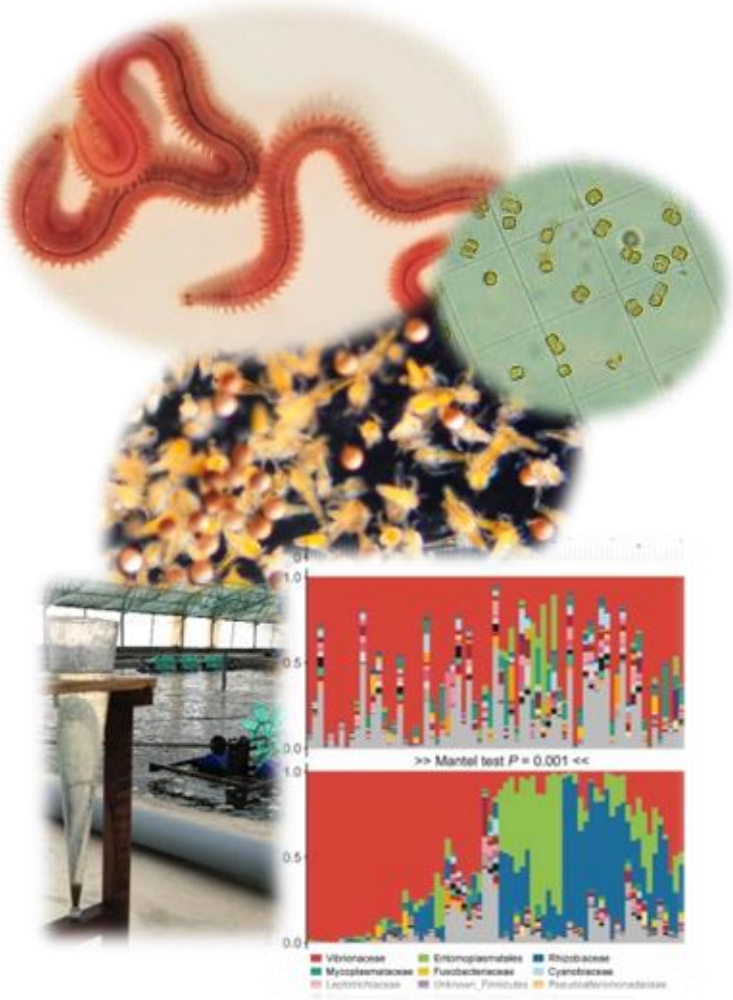
GREAT SALT LAKE ARTEMIA



LIVE FEED in SHRIMP HATCHERIES

Polychaete

Balance between performance and biosecurity risk:

- GENETICS → broodstock supply
- HATCHERY → shrimp nauplii

Microalgae

- production of postlarva → essential
- nursery and growout production → beneficial

Artemia

- production of postlarva → essential
- nursery and growout production → beneficial

Biofloc

initiation + maintenance + control of a healthy community of a nutritious mix of microorganisms and organic matter

* separate chapter

POLYCHAETE

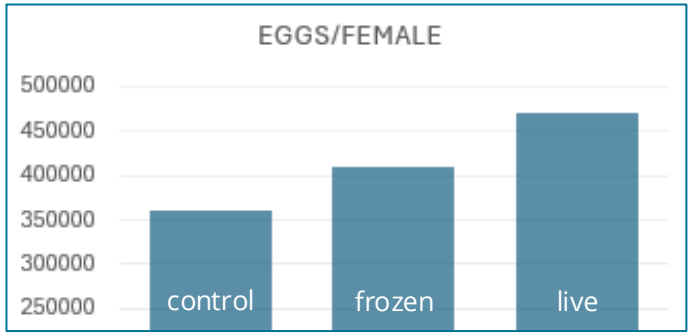
P. monodon

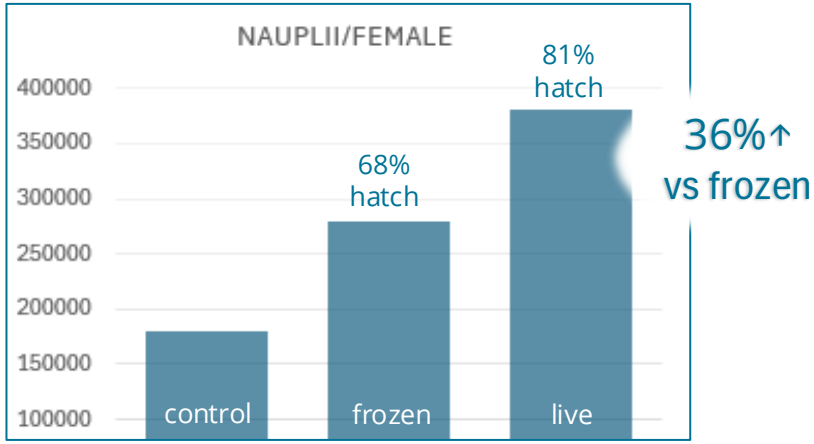
120 females + 210 males [2:3]
25-ton tanks
3 replicates

data: Sarker et al 2025

"LIVE FOOD FACTOR"

live SPF worms





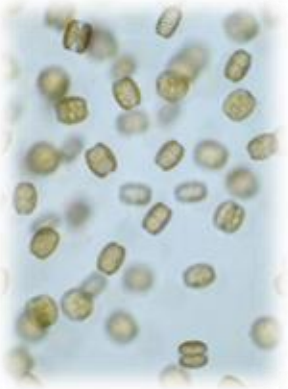
LIVE

- significantly enhances nauplii production

STORAGE

- breakdown of important nutrients
- degradation of crustacean hormones (+ precursors)
  → ovarian maturation
- digestion

MICROALGAE



"LIVE FOOD FACTOR"
increase live algae biosecurity control

LIVE: observations + facts

- improved larval survival
- faster growth (weight + lenght)
- faster development (metamorhosis)
- better stress tolerance
- improved water quality → reduces disease risk
- better feed efficiency (lower FCR)

\+

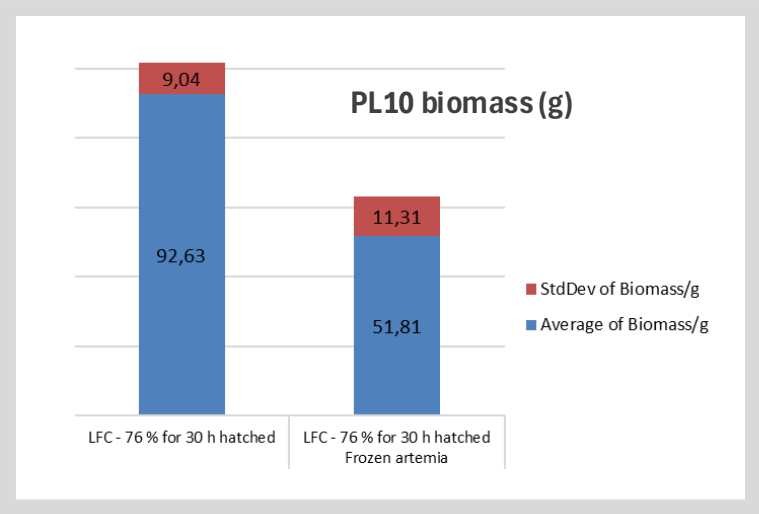
- increases bacterial diversity and stability (data: Yapeng et al 2020)

»

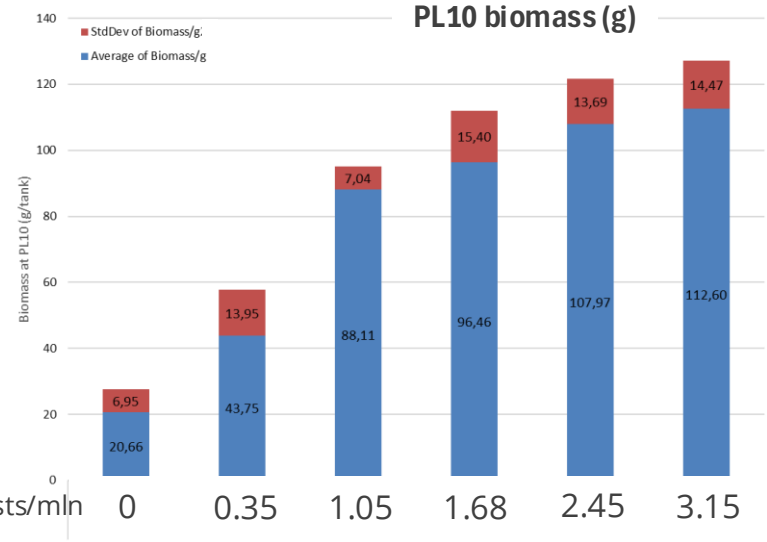
essential for early larval stages

→ nutritious food source
→ efficient water quality management tool ← microbiome

ARTEMIA



"LIVE FOOD FACTOR"



LIVE

- significantly enhances PL production
  - → survival
  - → growth rate
- more synchronous growth

! ARTEMIA QUANTITY

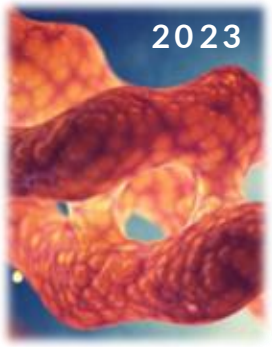
- direct link between shrimp larval biomass and the level of Artemia used
  - → survival
  - → growth rate
- significant potential loss in larval biomass when Artemia use is reduced

ARTEMIA

Nutrition: How to evaluate a diet-
Growth only or also include Immune Expression

	Size mm	CV%	Surv % pl7-17	Stress test	HSP 70 Relative %	Pro Po Relative %
Artemia	31.5	7.0	97.5	98		
Larval feed	29.3	8.7	99	97		
Grow out	28.1	8.8	98	99		
Artemia					100	100
Larval Feed					50	34
Grow out					32	0

Courtesy RobinsMcIntosh, CPF-Thailand



>> 3kg/mlnPL

more Artemia → increased pond production

- CP tested the strength of the immune system when PL7 to 17 where fed different diets (Artemia-Larval Feed – grow out feed)
- Although growth and survival was not very different, **immune expression** was significantly **increased**.
- This resulted in increased pond production when PL's were subsequently stocked in grow out ponds.

ARTEMIA

a GSLA study: **Yathish Ramena-** University of Arkansas

Thomas Bosteels– Great Salt Lake Artemia

Nguyen Van Hoa and Chau Tai Tao– University of Can Tho

Ravinder Sangha– Acua Biomar de Mexico

Frank Martorana– Great Salt Lake Artemia

Phil Brown– Great Salt Lake Artemia

Mohamed Mohamed– Great Salt Lake Artemia

ARTEMIA USE RATE TRIALS

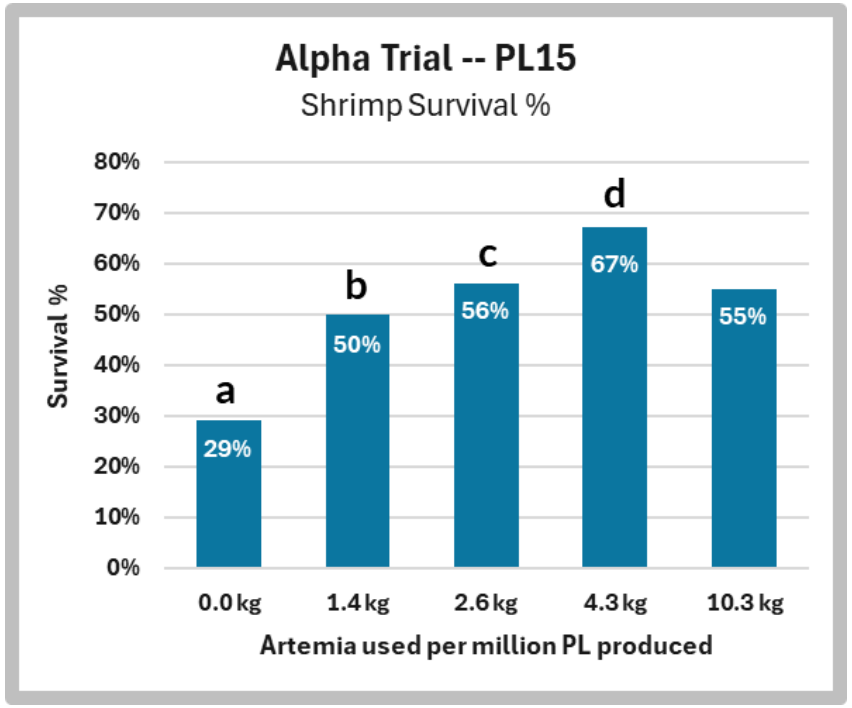
UNIVERSITY OF ARKANSAS

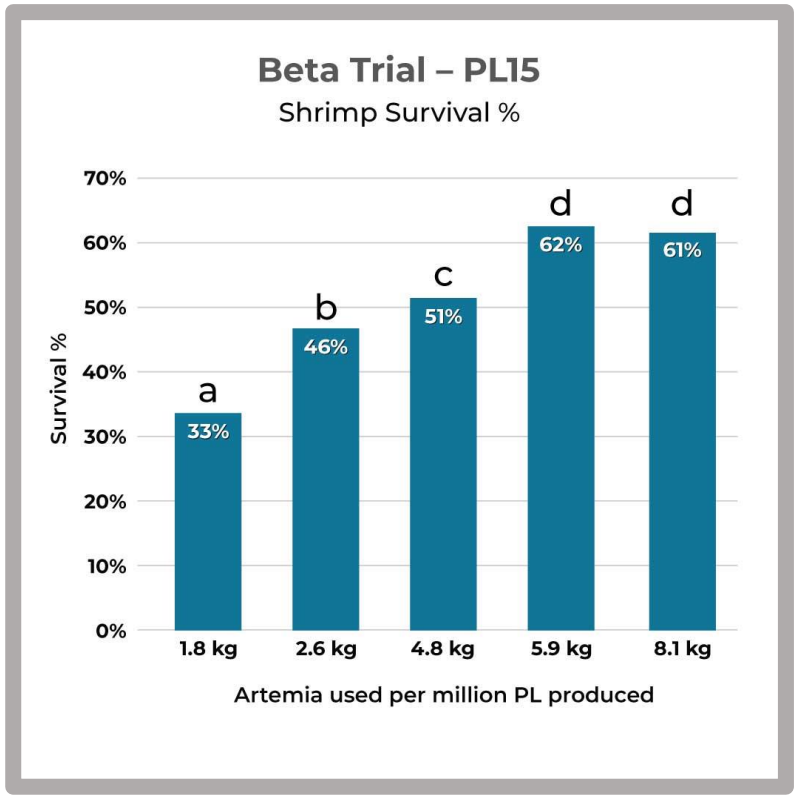
The initial series of tests on optimizing Artemia use in L. vannamei culture

Scoping trial for **hatchery cycle** tests

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

UNIVERSITY TRIAL: HATCHERY





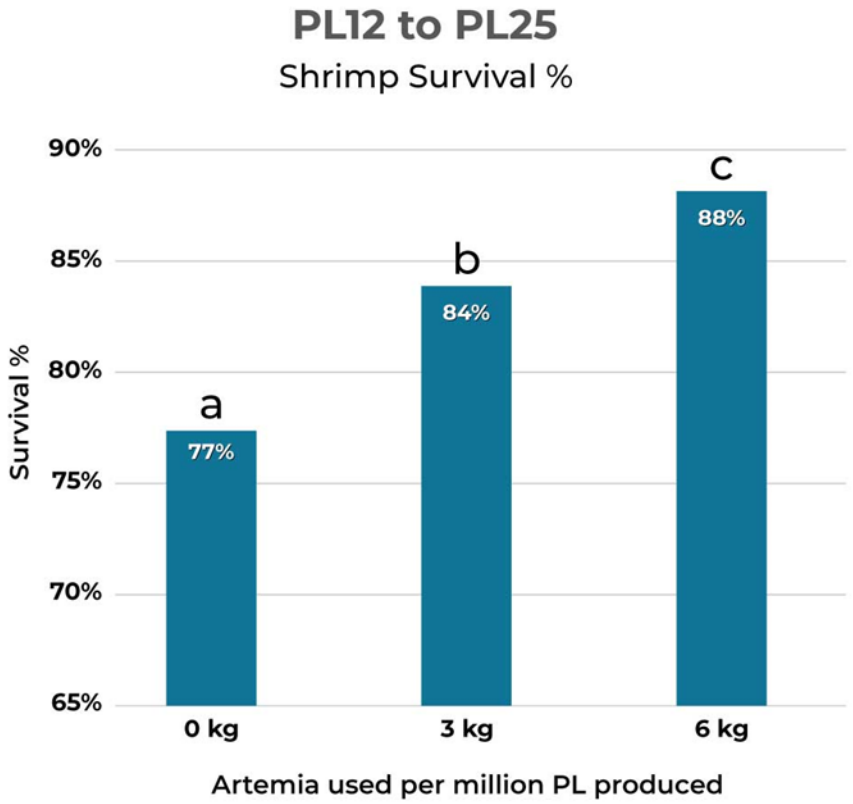
Result:

- 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

Result:

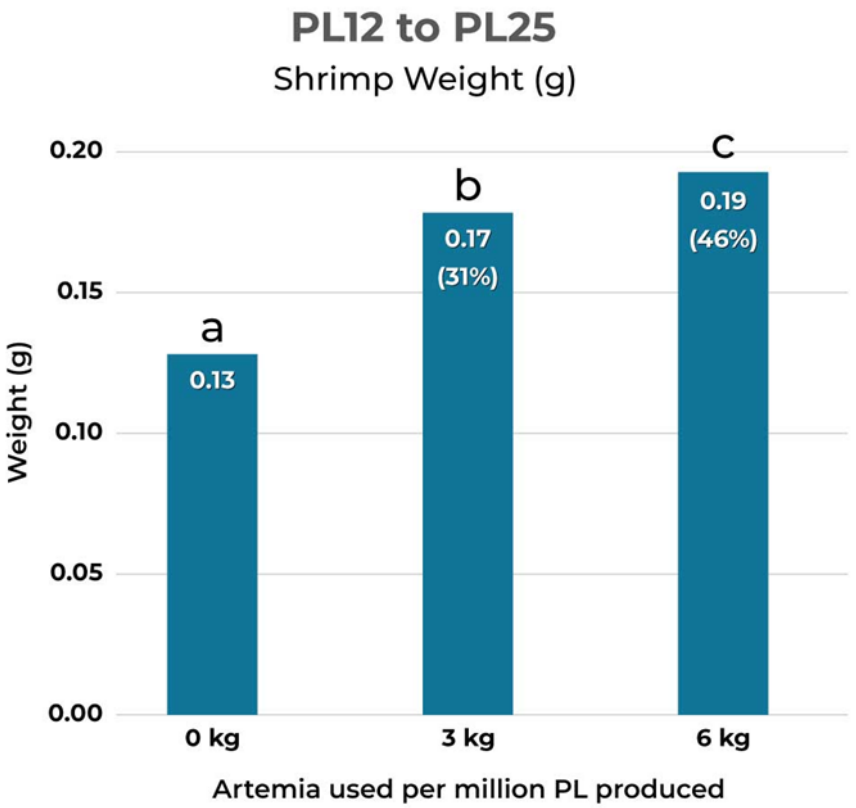
- No difference in PL size, stress tolerance
- Survival again increases with Artemia use rate
  - → peaks at approximately **6kg per million PL**
  - → no further gains above this

UNIVERSITY TRIAL: NURSERY



BIOMASS
6kg Artemia

↑60% vs control
↑17% vs 3kg



Compared to PLs fed no Artemia:
- Survival is **7% higher** for PLs fed **3kg** Artemia/mln
- Survival is **11% higher** for PLs fed **6kg** Artemia/mln

Compared to PLs fed no Artemia:
- PLs fed **3kg** Artemia/mln are **31% larger**
- PLs fed **6kg** Artemia/mln are **46% larger**
- PLs fed 6kg are 12% larger than those fed 3kg

ARTEMIA USE RATE TRIALS

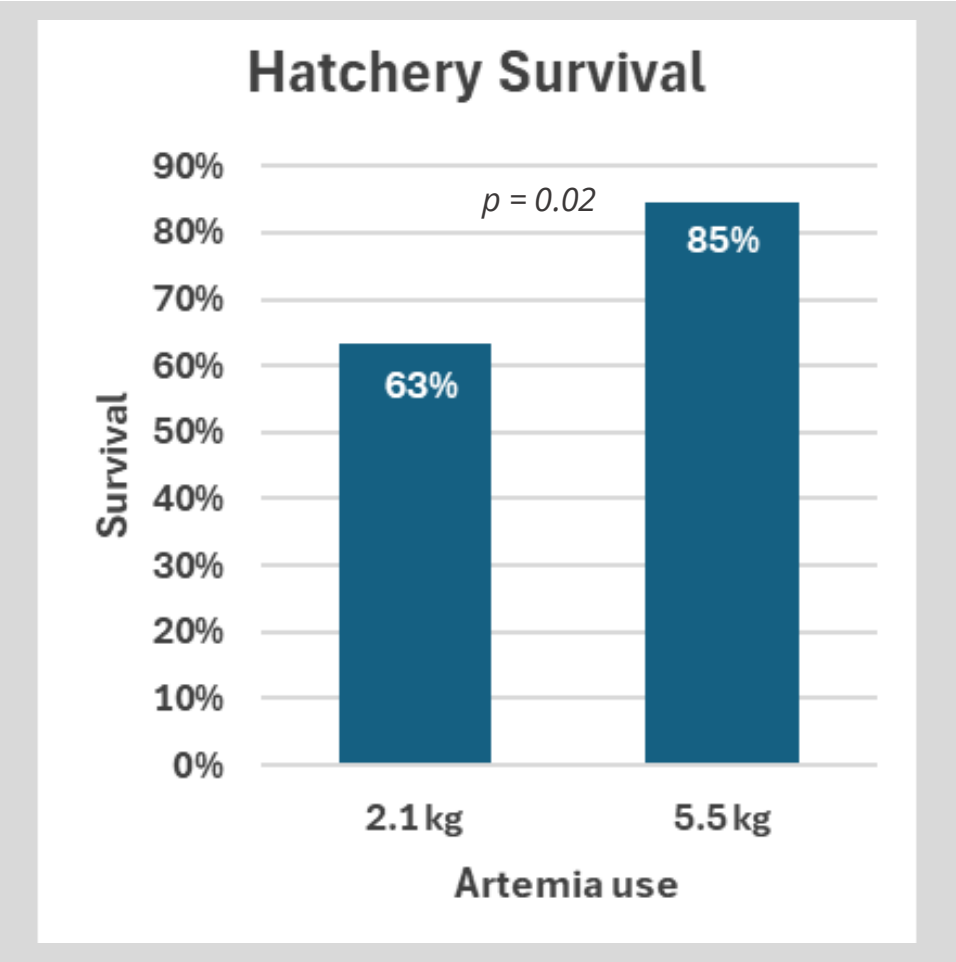
ECUADOR COMMERCIAL

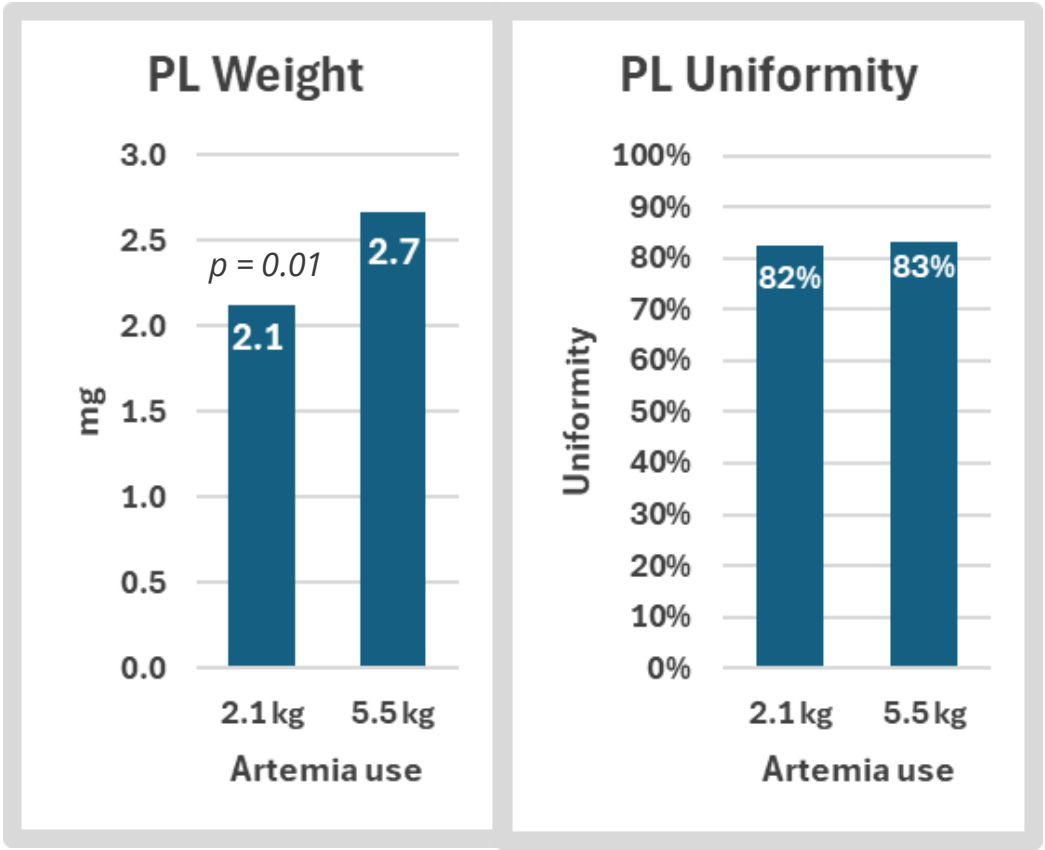
Bringing university results to a commercial scale

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

Ecuador hatcheries typically employ a low Artemia use rate

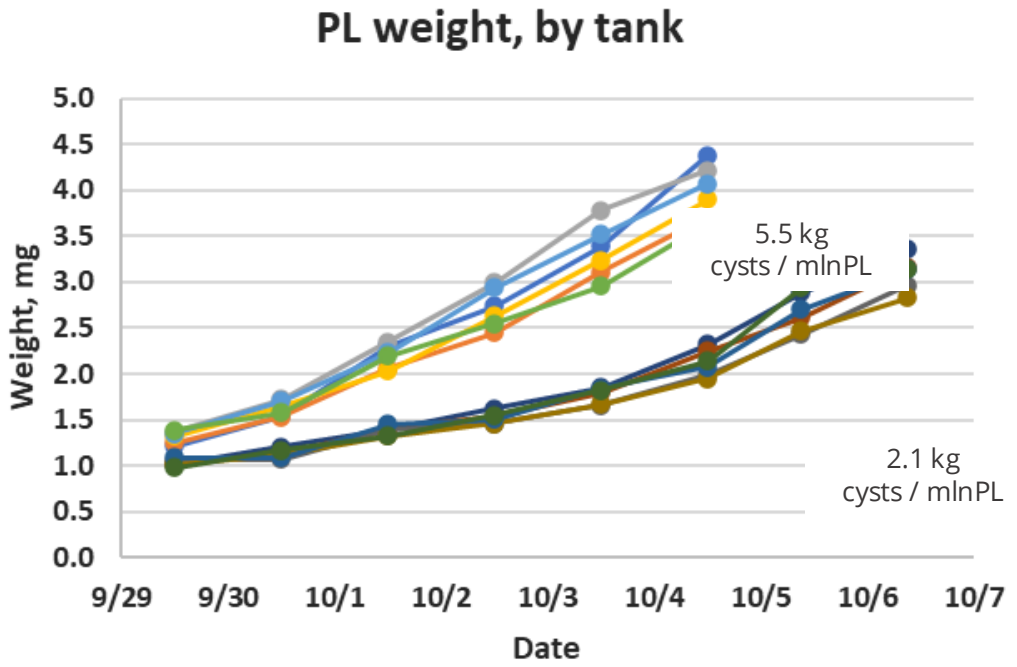
COMMERCIAL TRIAL: HATCHERY 1





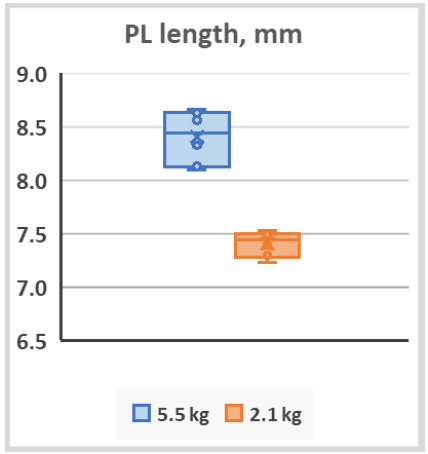
- PLs at harvest were longer and had significantly higher weight
- Uniformity of the PLs were not compromised to achieve this
- Harvest could occur **2 days earlier** for the 5.5kg Artemia group

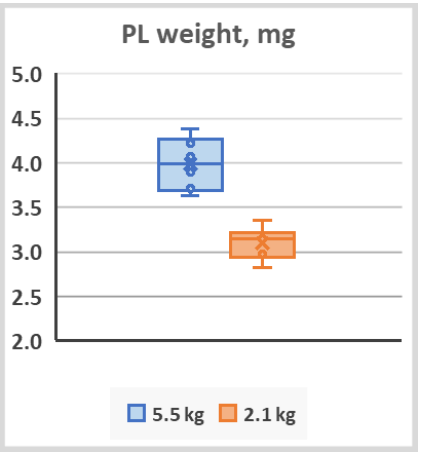
COMMERCIAL TRIAL: HATCHERY 2

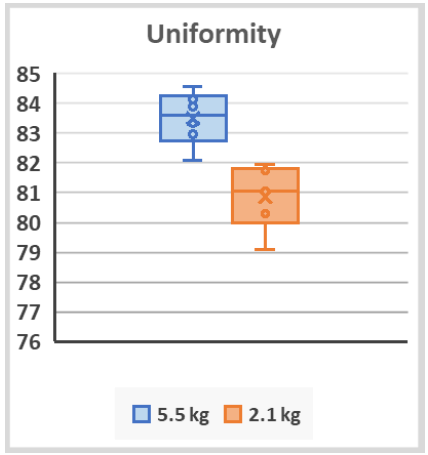


Daily measurements of PL size and weight from PL4 to harvest

- 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.







PL metrics on the day of harvest

- The 2.1kg 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

ARTEMIA USE RATE TRIALS

MEXICO & VIETNAM COMMERCIAL-SCALE HATCHERY TO GROWOUT

GREAT SALT LAKE ARTEMIA

Mexico Hatchery Cycle: 4 Dietary treatments replacing a fixed percentage of the standard microparticulate diet with Artemia nauplii ranging from 25% to 100% replacement.
Static diet feeding rate → uncertain yield data.

Mexico Growout Production: 3 Dietary treatments were transferred to ponds for grow out. No additional Artemia provided.

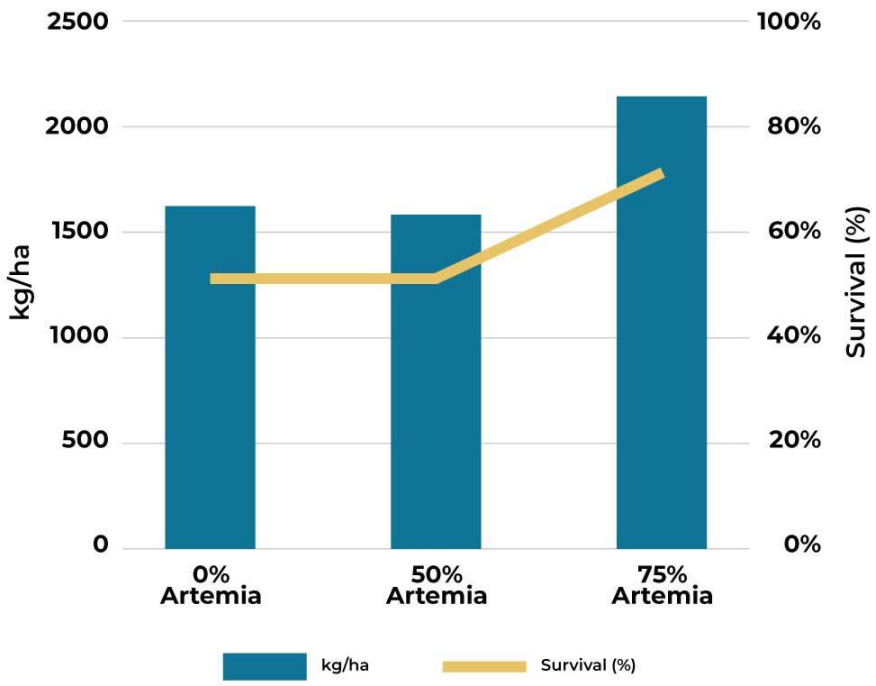
Vietnam Hatchery Cycle: 3 replicate 4,000-liter tanks per treatment. 3kg and 6kg Artemia per million PL.

Vietnam Nursery and Growout Production: 500 m^2 ponds replication preserved. 0kg and 3kg additional Artemia in nursery.

COMMERCIAL TRIAL: HATCHERY → GROWOUT

MEXICO

INCREASED POND PRODUCTION



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.

Result:

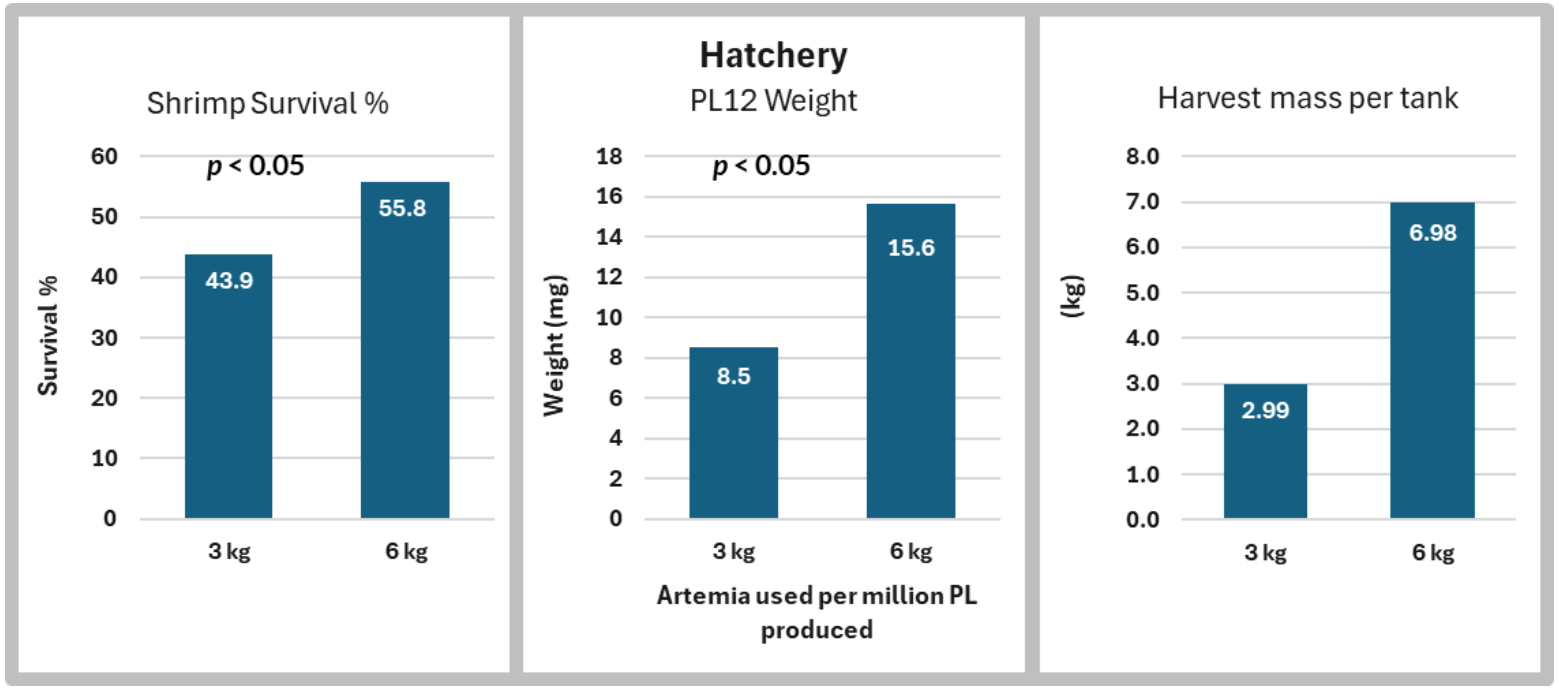
- Replication and tests of statistical significance not possible.
- Survival improved from 50% to 70%.
- Pond production per unit area increased.

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

COMMERCIAL TRIAL: HATCHERY → GROWOUT

VIETNAM

Hatchery cycle results (PL12)



Survival
- 27% higher

PL weight
- 83.5% higher

Harvested biomass per tank
- 133% higher

No change in formaldehyde or salinity stress tests

COMMERCIAL TRIAL: HATCHERY → GROWOUT

VIETNAM Nursery and Growout production results

Nursery (4 weeks) - 500 PL/m^2 - 0kg or 3kg Artemia/mln
Growout (8 weeks) - 500 m^2 ponds, triplicate - 180 pcs/m^2

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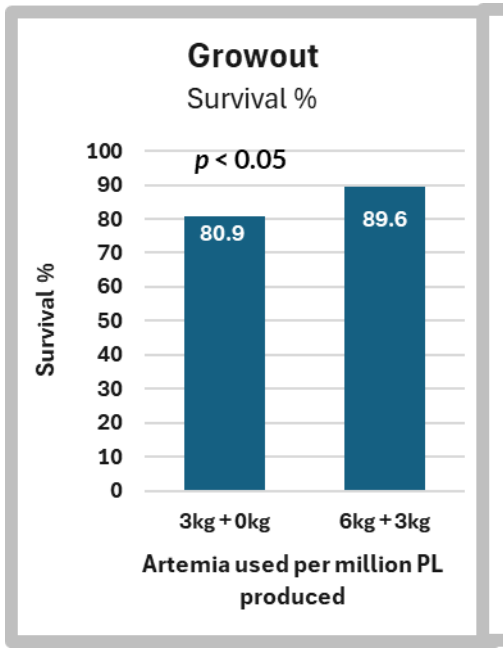
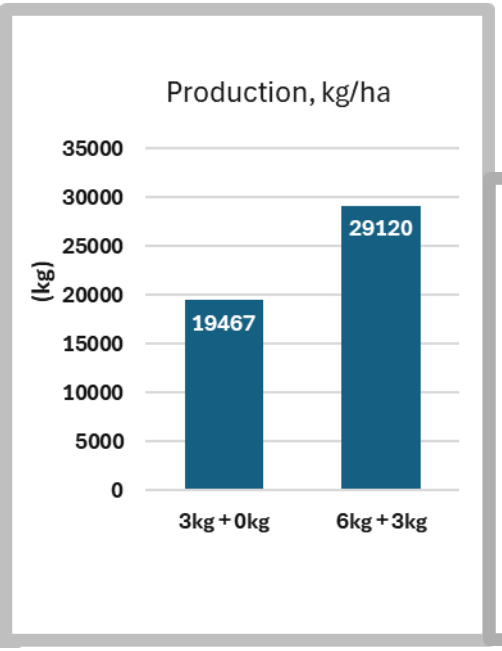
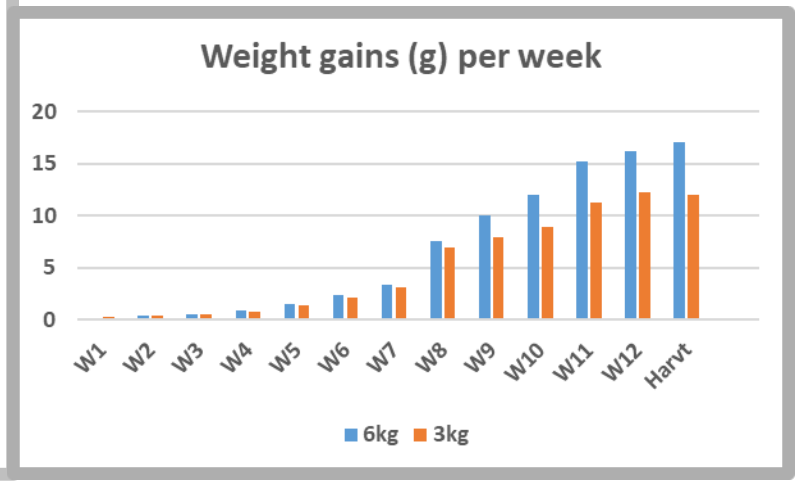






Survival:
Modest but significant gain

Growth and production
Much faster growth
50% higher production per unit area

THE LIVE FEED FACTOR

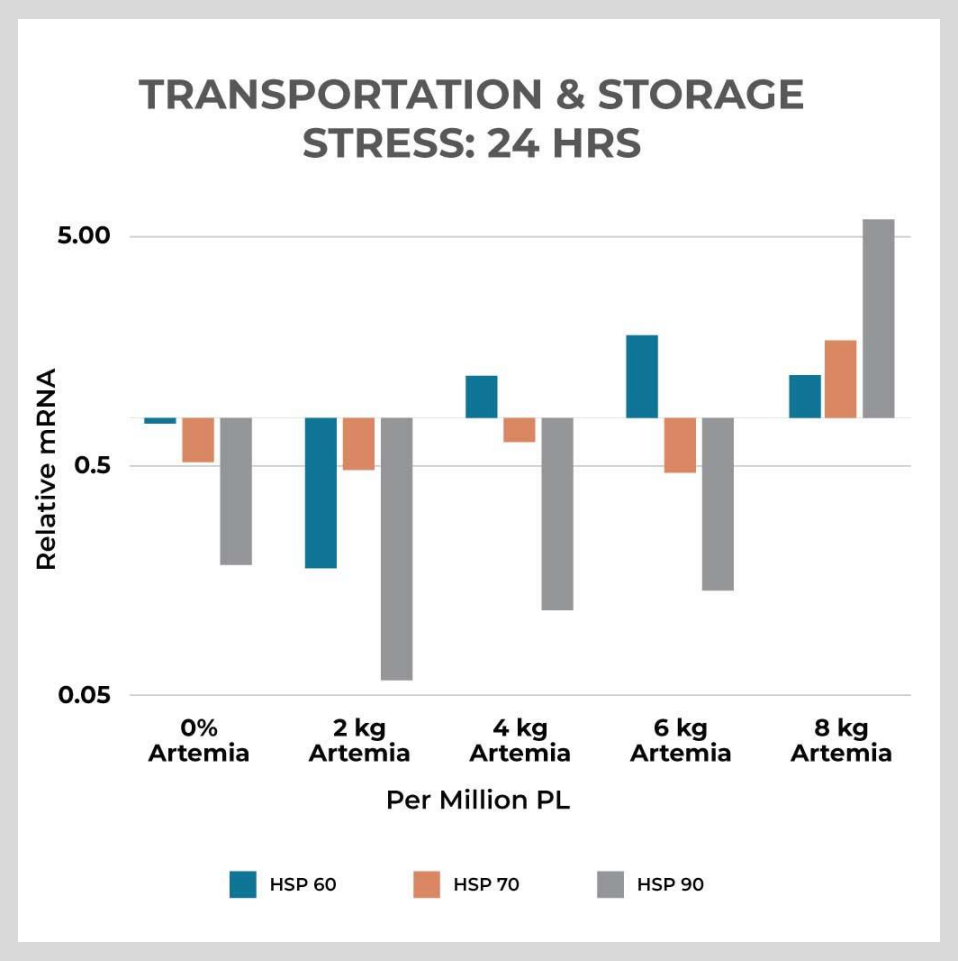
HEAT SHOCK PROTEINS

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.

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

ARTEMIA

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

POLYCHAETE AND ALGAE

→ ...