A GLANCE ON LARVAL PRODUCTION OF *L.vannamei*

EUROSHRIMP
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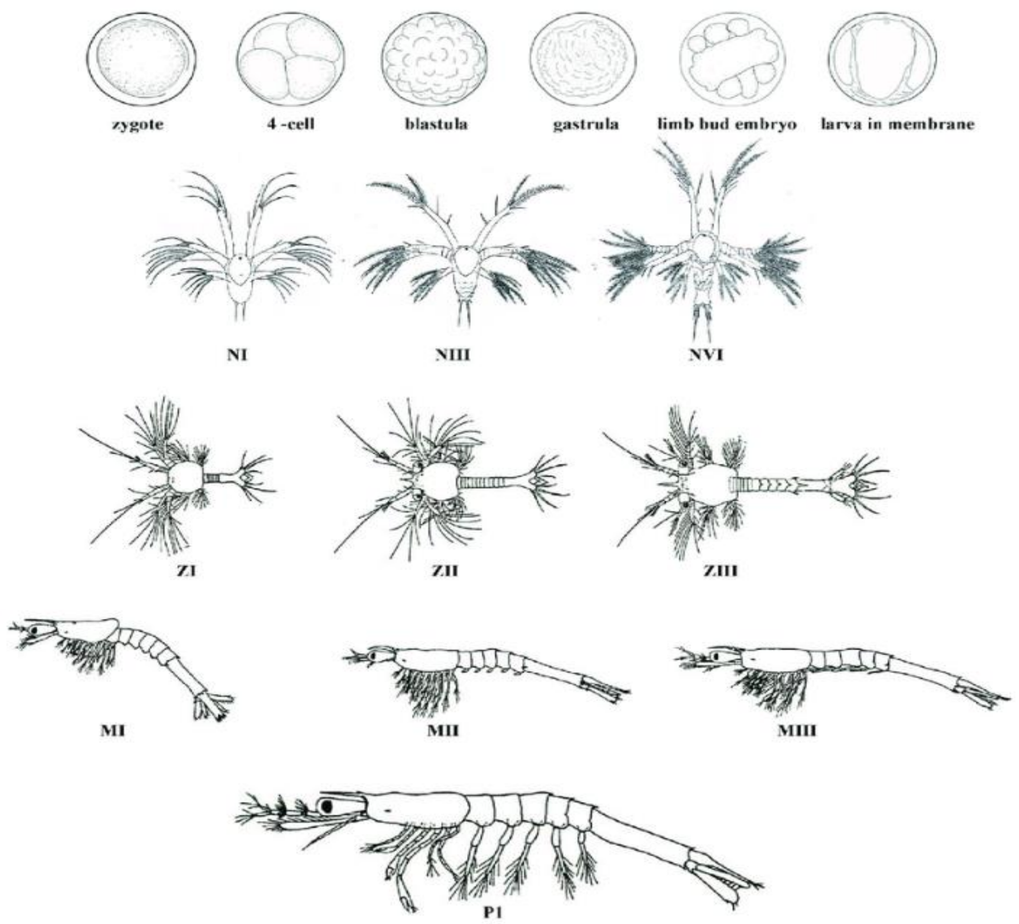
Daniel Arana
Daniel.Arana@adm.com
+32 472913504

Biologics aspects



Embryonic and larval stages during early development of L. vannamei. (Z, M and P are modified from Hertzler PL, 2009). The developmental stages drawn in this figure include zygote, 4-cell, blastula, gastrula, limb bud embryo, larva in membrane, NI, NIII, NVI, ZI, ZII, ZIII, MI, MII, MIII and P1.

Early life stages

By convention the terminology PL means “**P**ost-**L**arvae” and the number means the number of days after the last metamorphosis. So, one PL12 has twelve days as Postlarvae. Subsequently, when becomes a post-larva adopts a benthic lifestyle.

The age of one PL (e.g PL12) doesn’t express the biomass, the best is to identify the postlarvae by using the individual weight .

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Biologics aspects

- According to the appearance of the epidermis, pigmentation, the formation of new setae, and the presence of matrix or internal cones in the setal lumen, the moulting cycle of shrimp can be divided into four recurrent stages:

  inter-moult.
  pre-moult .
  moulting behaviour/ecdysis
  post-moult.

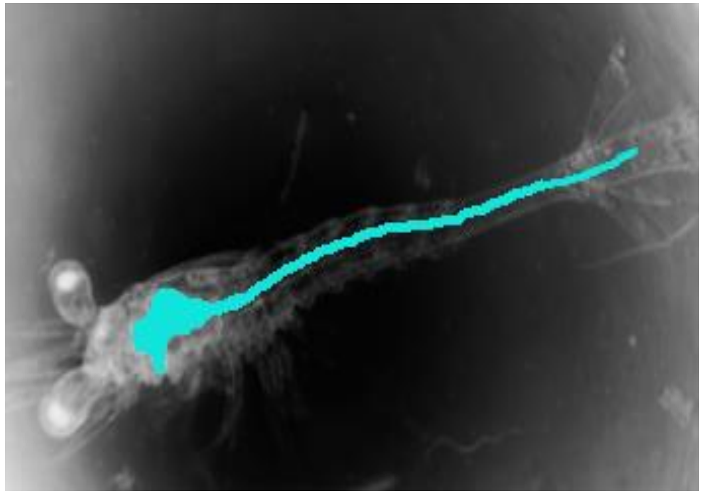
- For growth, *L. vannamei* need to shed and replace their old exoskeletons and synthesize a new one, and this process is frequently repeated during the life cycle.

Failure of moulting in the metamorphosis is one important reasons for production reduction in hatcheries and nurseries, which are all closely related to the formation and reconstruction of the exoskeleton.

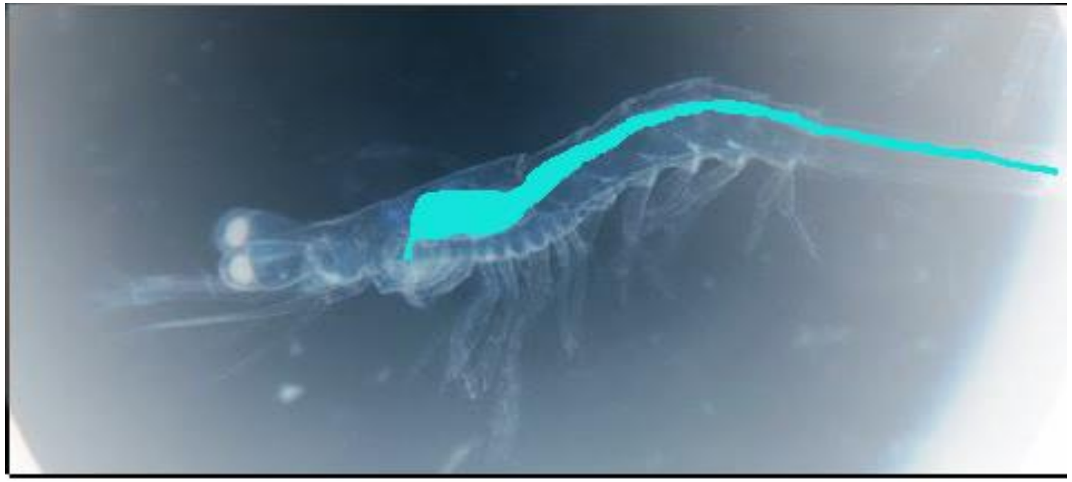
https://www.researchgate.net/publication/316440662

Digestion in shrimps

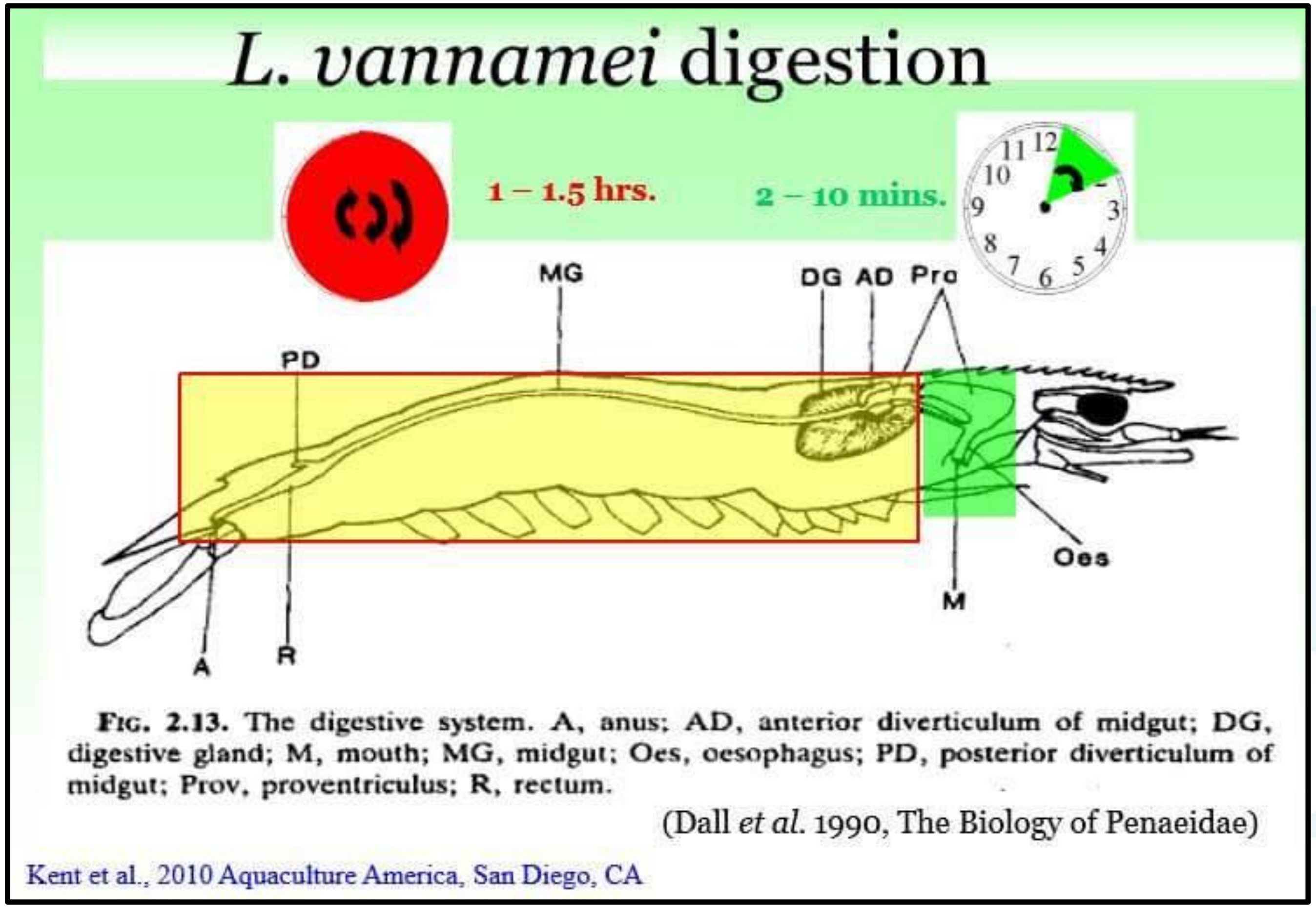
- Larvae: 15-30 minutes



- Post-larvae: 30-40 minutes



- Adult



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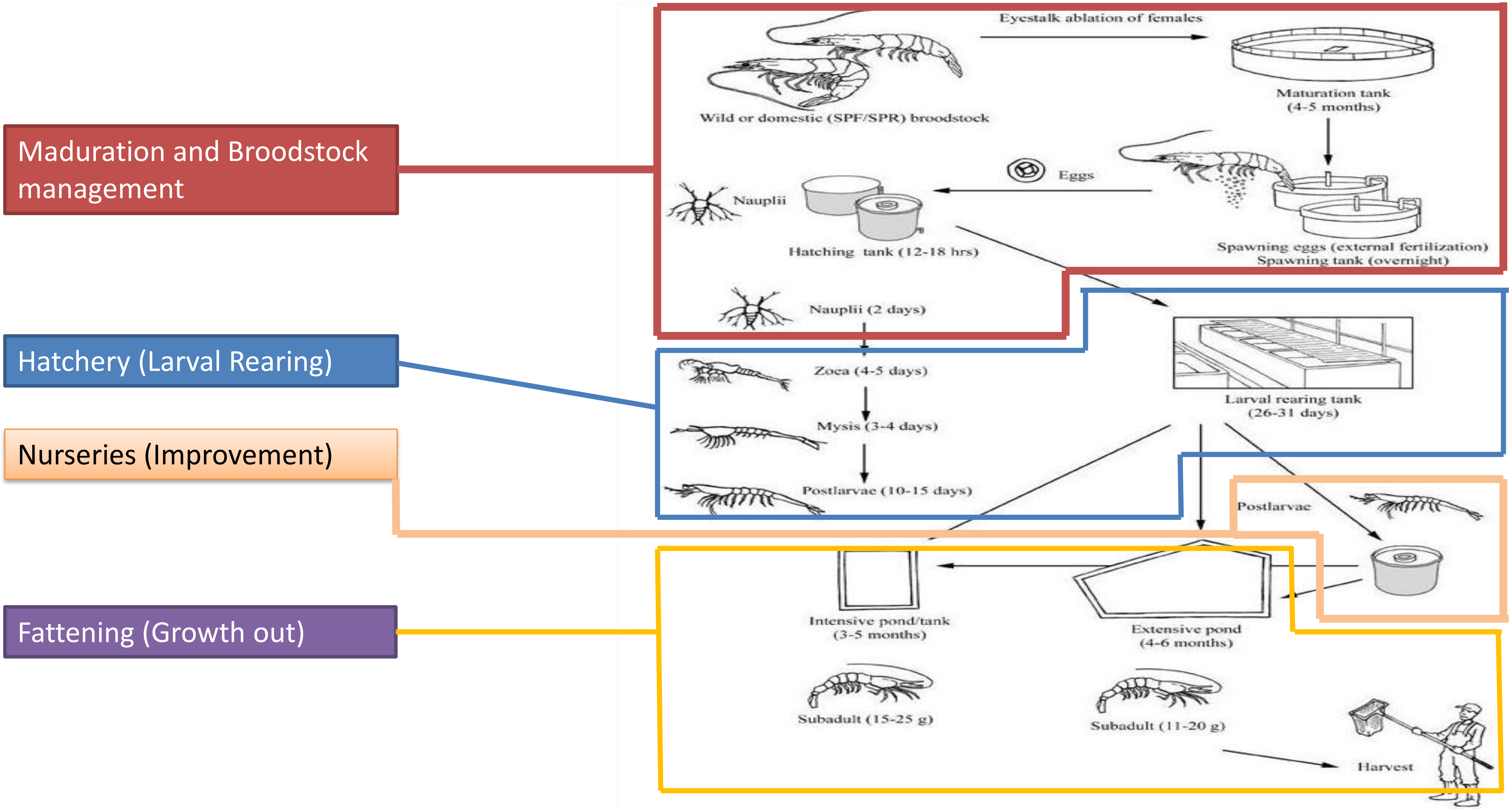
Classic Structure of Production

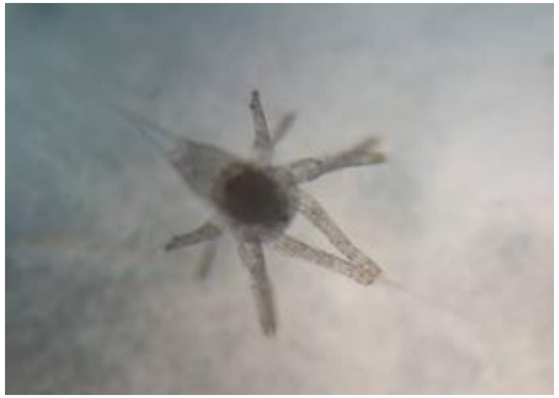


Classic Structure of Hatcheries

1. Maduration facilities (opcional).
2. Aclimatation area and deliverance
3. Water Intake and Treatments
4. Larval Rearing Tank (1st Phase)
5. Postlarvae Rearing Tanks (2nd Phase)
6. Artemia Room
7. Microalgae Department
8. Wet Laboratory (Quality PL, Fresh Analysis)
9. Dry Laboratory (Microbiology, PCR, etc)

Maturation Generalities

- Maduration operates in same facilities than hatcheries.
- Females with or without eyestalk ablation.
- Use of Fresh frozen food on maturation to enhance quality and quantity of Nauplius, also performance of broodstocks.
  - Polychaetes
  - Mussels
  - Oysters
  - Artemia Biomass
  - Squid
  - Krill
  - Formulated feeds
- 4-5 months of productivity per female
- 10-15% mating per day
- 180 - 250 K Nauplios per female per spawning



Pictures from Acuacultura de Centroamerica

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Photo: Daniel Arana

Nauplii harvesting in Ecuador, individuals spawning

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Maturations

20131025152128.gif

Broodstock`s backup in Venezuela (females and males separated)

Quality Parameters in Maturations

Acclimation and sampling of Nauplius in Cuba.

Deformity: max 10%
Transport density: max 20.000 N/Lt
Ph: 7-8,5
Oxigen: Saturation
Phototaxis: Positive
Temperature Transport: Depend of distances.
Aclimation Time (Temp): max 4 ^{o}C/hour.
Aclimation Time (Salinity): Delivered at same salinity

Photos: Daniel Arana

Hatchery phase

TEMP ºC	Nauplii	Zoea I	Zoea II	Zoea III	Mysis I	Mysis II	Mysis III	PL`s
28-30	36-51 h	36-48 h	36-48 h	36-48 h	24-32 h	24-32 h	24-32 h	24 h
30-33	< 48 h	24-28 h	24-28 h	24-32 h	24-28 h	24-28 h	24-30 h	24 h
FEED	**Nauplii**	**Zoea I**	**Zoea II**	**Zoea III**	**Mysis I**	**Mysis II**	**Mysis III**	**PL`s**
Microalga	No	Yes	Yes	Yes	Yes	Yes	Yes	No/Yes
Artemia	No	No	No/Yes	Yes	Yes	Yes	Yes	Yes PL6
Artificial	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size (µm)	N/A	5-50	5-50	5-50/50-100	50-100	50-100	50-100/100-200	100-500

Photos: https://www.slideshare.net/ibnusahidhir/advances-in-hatchery-and-growout-of-pisang-shrimp and https://slideplayer.es/slide/10785575/

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Hatchery phase

	Nauplii	Zoea I	Zoea II	Zoea III	Mysis I	Mysis II	Mysis III	PL`s
Nylon Mesh (µm)	N/A	100	100	200	300	300	300	300-500
Avg. Size (µm)	500	1000	1700	2500-2600	3000-3500	3800-4000	4000-4500	> 4600
pH	7 - 8,5	7 - 8,5	7 - 8,5	7 - 8,5	7 - 8,5	7 - 8,5	7 - 8,5	7 - 8,5
Salinity (SPU)	32-35	32	31	29-30	27-28	26-27	24-25	23 – 20 (Pl3)

Photos: https://www.slideshare.net/ibnusahidhir/advances-in-hatchery-and-growout-of-pisang-shrimp and https://slideplayer.es/slide/10785575/

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ZOEA I

Eyes covered by carapace

Carapace anteriorly rounded

Furcal lobes with semicircular space between them

Each lobe of caudal furca with 7 setae

ZOEA II

Presence of rostrum

Bifurcated supraorbital spines

Stalked compound eyes

Carapace more elongated

Each lobe of caudal furca with 7 setae

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ZOEA III

Presence of rostrum

Carapace more elongated and compressed laterally

5^{th} and 6^{th} abdominal segments with posterolateral spines

Furca with articulating appendix

8 pairs of furcal setae

MYSIS I

Rostrum long and
extending beyond

Thoracic appenda
developed

Pleopods becomi
Swim backdown

ore similar with an
imp

nal segments 3-6
somedian spines

roader distally with
n notch, each lobe
2 lateral and 6
setae

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MYSIS II

Pleopods short and one segmented. Swim backdown

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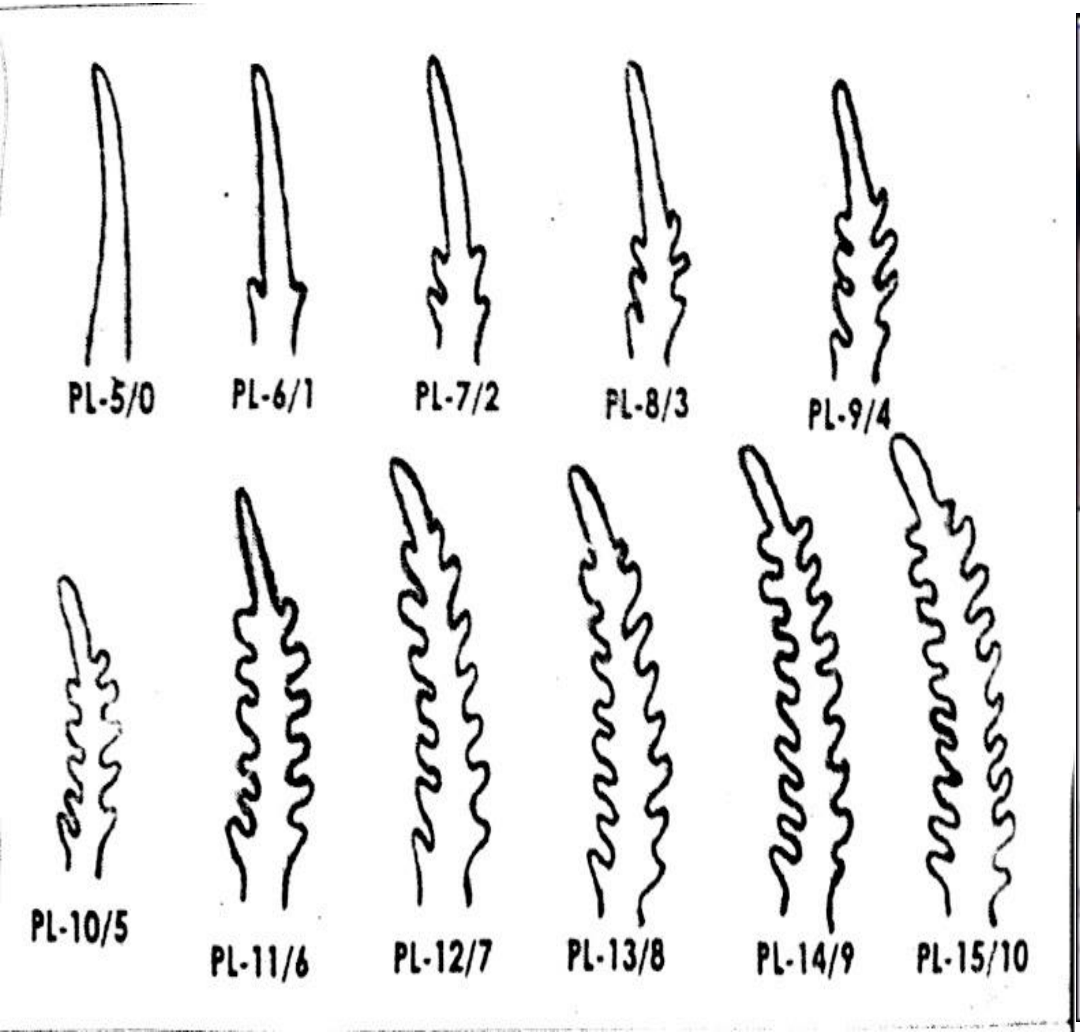
MYSIS III

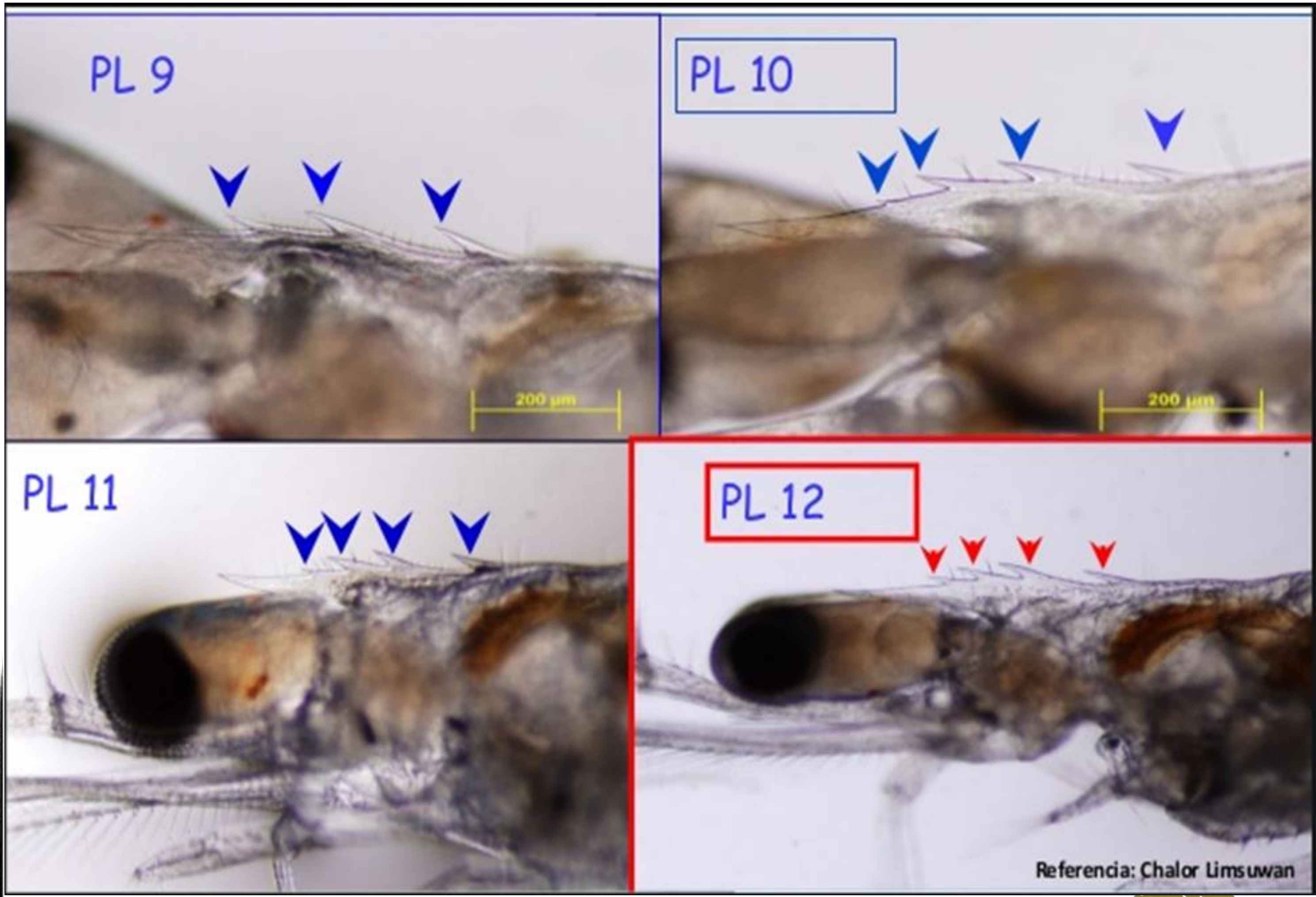
Pleopods long, 2 segmented without setae. Swim backdown

POSTLARVAE 1 (PL1)

Pleopods with setae.
Swimming forward

Characteristics PL 9 – PL 12 (Left: Gill development. Right: Spines in rostrum)



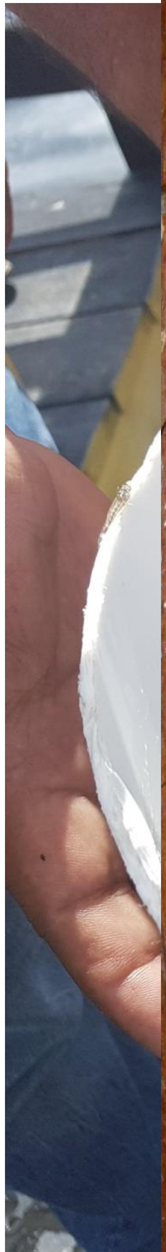


Most common problems in production

Size variations:

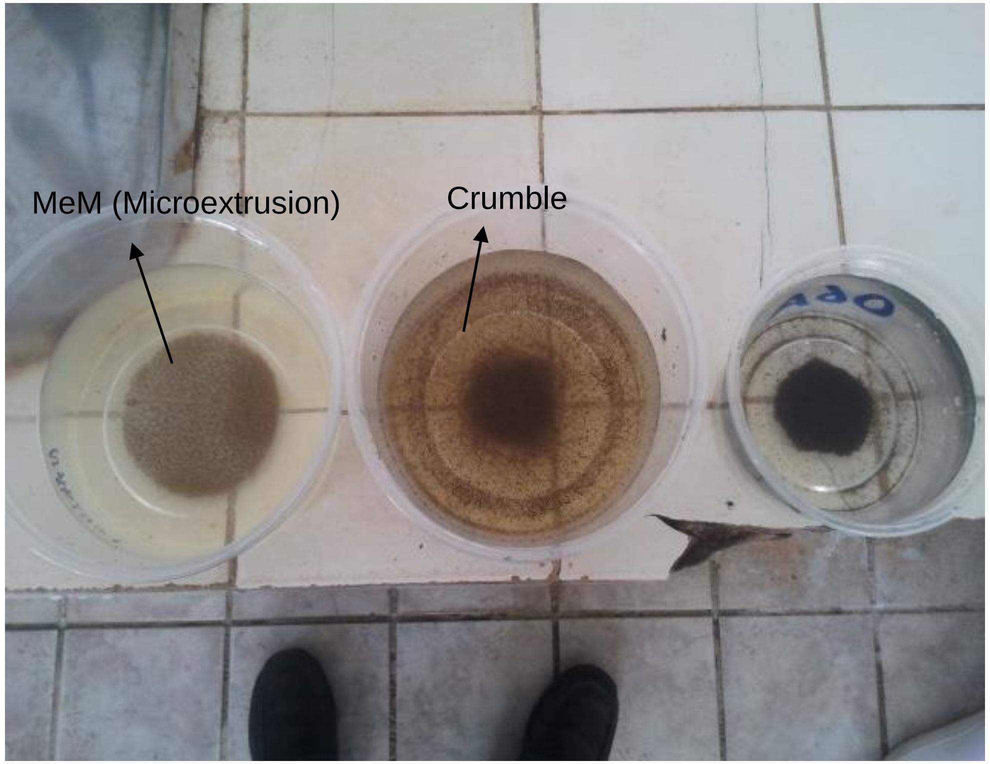
<u>Possible Causes</u>:

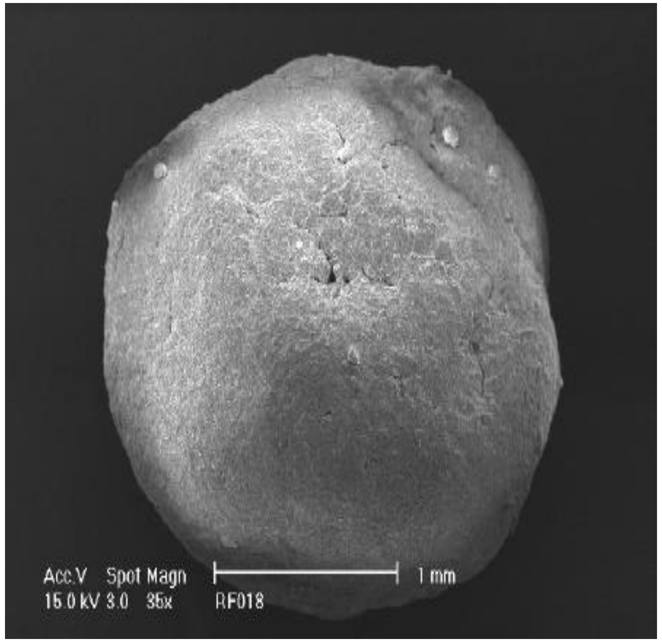
- Bad temperature control
- Genetic causes
- Bad feed management
- Bad Water management
- Diseases (IHNNV…)

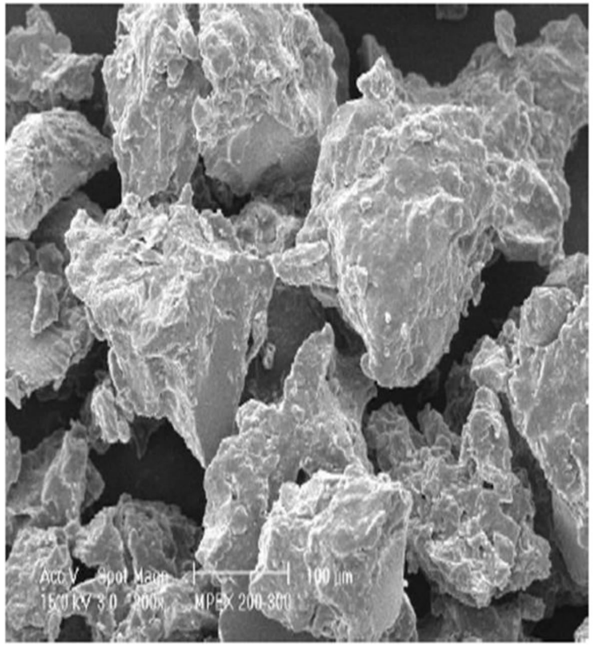


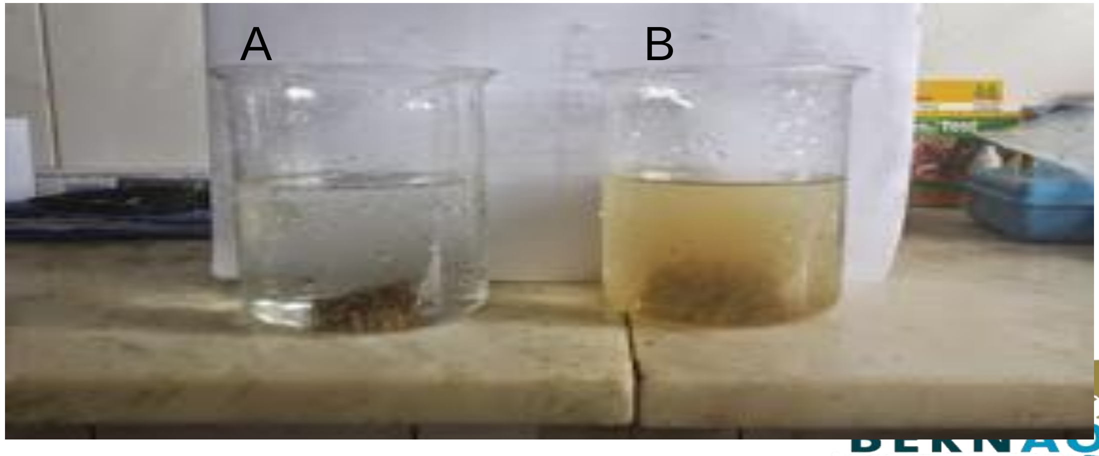
Leaching and Water Quality

The technology involved to produce the feed and the quality of ingredients in the formula, will have one big impact in the water quality and performance on the production.



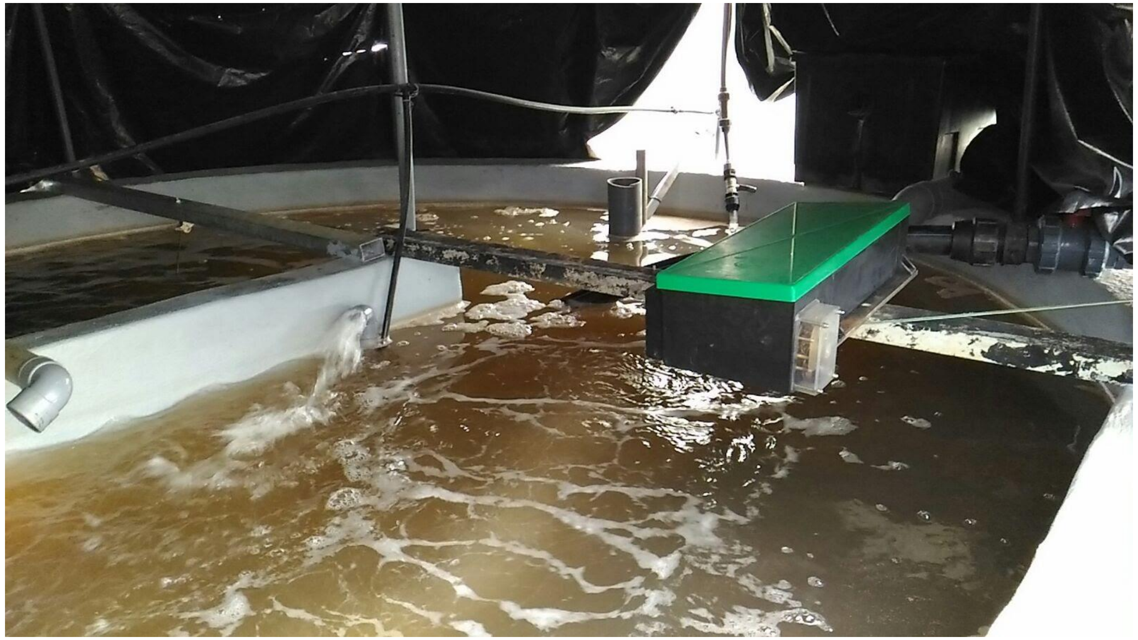






Controlling Size Variation

- Improve Water Management
- Control Size of feed according size of larva and PL
- Control feed consumption
- Use health and certified Postlarvae
- Use of technology as sensors of temperatures



Most common problems in production

Cannibalism:

<u>Causes</u>:

- Size variations (moulting not syncronized)
- Bad feed management
- Bad Water management

<u>Solutions</u>:

- Improve sizes control (prev Slide)
- Set adequate feeding table
- Review water management

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Most common problems in production

Bacterial & Water Quality:

Causes:

- Bad water intake
- Bad water management
- Bad feed management

Solutions:

- Improve filtration system
- Set adequate feeding table
- Review water management
- Improve use of probiotics

Most common problems in production

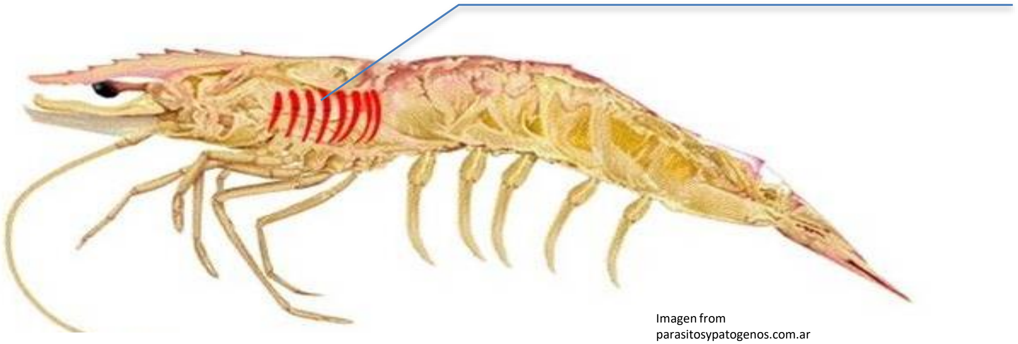
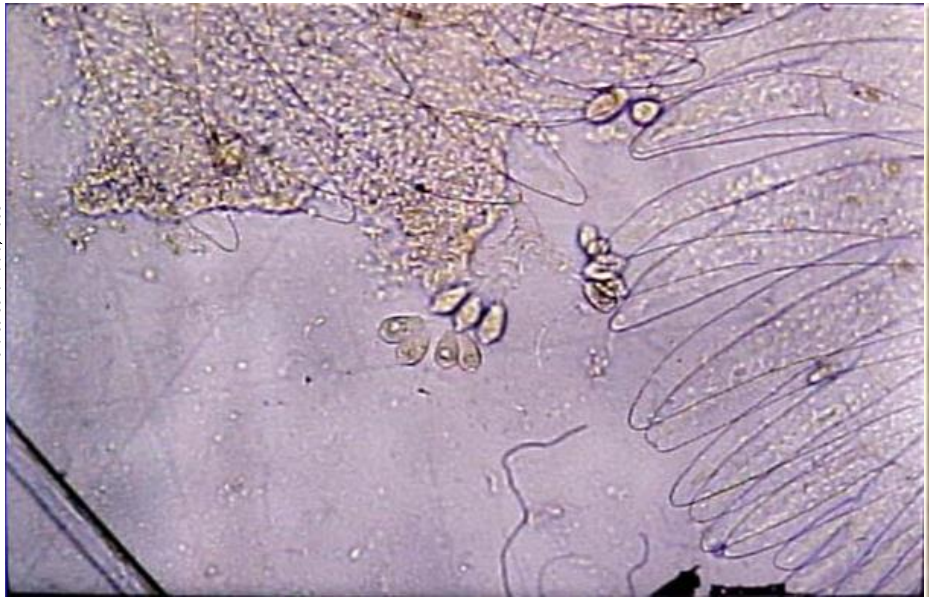


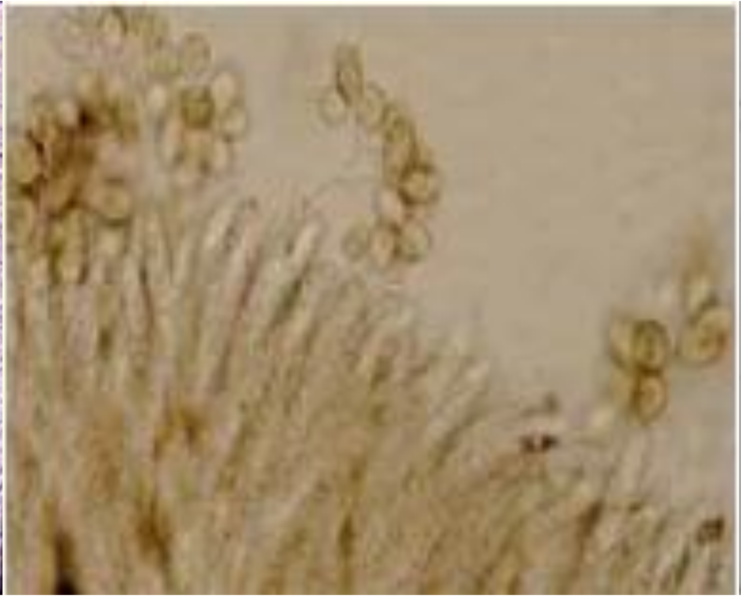
Imagen from parasitosypatogenos.com.ar

The crustacean gill is a multi-functional organ, and it is the site of a number of physiological processes, including respiration, osmoregulation, and ammonia excretion. The gill is also the site by which many toxic metals are taken up by aquatic crustaceans (Raymond, *et al.*, 2012).

Due to the importance of this organ, it's important to take special care on it.

Morales Covarrubia, 2008

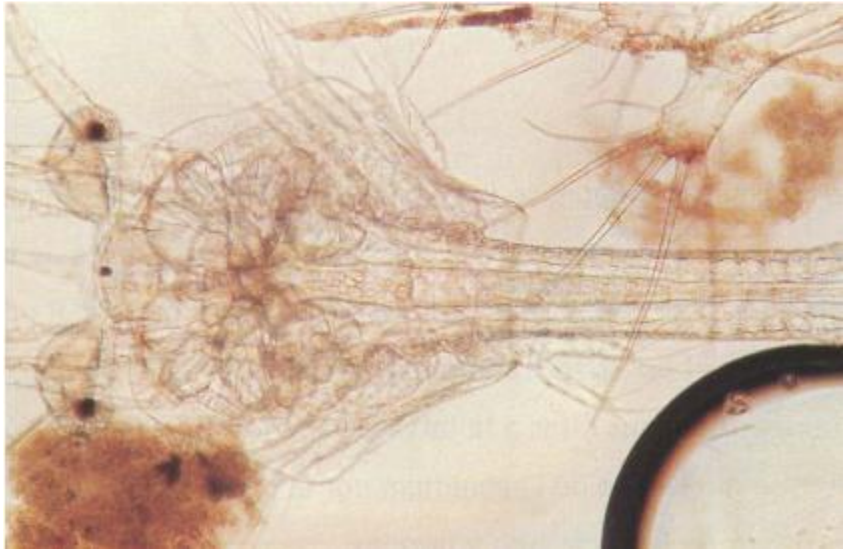




Most common problems in production

Related with Water Quality

Fungus contamination



Zoea II Sindrome

Ammonia High Concentration

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PL Quality Assesment

CRITERIA	GOOD	BAD	TOLERANCE	DESITION
Pathological Analysis (Diagnosis PCR , Histology)	Must be negative to WSSV, EHP, IHHNV, NHP, TSV, YH, BP, AHPND,		No tolerance	Discard
Gill Development	100% in PL12	Less than 85% in PL12	95% as minimal	Discard
HP and Gut	With lipids in HP and gut with feed	Without lipids and feed in gut	75% population	Accept with remarks
Fouling	No fouling in gill and exoesqueletum	10 % or more of fouling	Maximum 3%	Discard
Necrosis Bacteria	No Necrosis	Necrosis > 5%	No tolerance	Discard
Necrosis Canibalism	No cannibalism	> 8% canibalism	Maximum 5%	Discard
Activity	Good natatorium activity	No natatorium activity	Maximum 20%	Discard

PL Quality Assesment

CRITERIA	GOOD	BAD	TOLERANCE	DESITION
Deformities	No deformities	> 10 % Deformities	Maximum 10%	Discard
Mortality in Tank	No visual mortality	Presence of mortality	Maximum 5%	Discard
Size variation	< 20%	> 30%	25% maximum de CV	Discard
Stress Test (0 ppt & 19 ^{o}C x 30`)	100% Salt water > 85% Fresh Water	< 90% Salt water < 85% Fresh water	Minimum 90% Salt Water Minimum 85% Fresh Water	Depend on other observation
Weight	4 mg in PL12	2 mg in PL12	3 mg in PL12	Wait until achieve desired weight

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PL with good activity

Good HP and Gut