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A guide to the co-culture of giant tiger prawn with a seaweed and a microsnail

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1. Giant tiger prawn co-culture with *Chaetomorpha* sp. and *Stenothyra* sp.

- A simple, economical, and innovative shrimp culture system using a green seaweed, *Chaetomorpha*, and micro-snail, *Stenothyra* (Pic 1)
- *Chaetomorpha* and *Stenothyra* as supplementary feed at an early stage of intensive culture (Fig 1)
- Higher profitability owing to higher shrimp productivity and higher feed efficiency (Fig 1)

Pic 1. View of the pilot farm

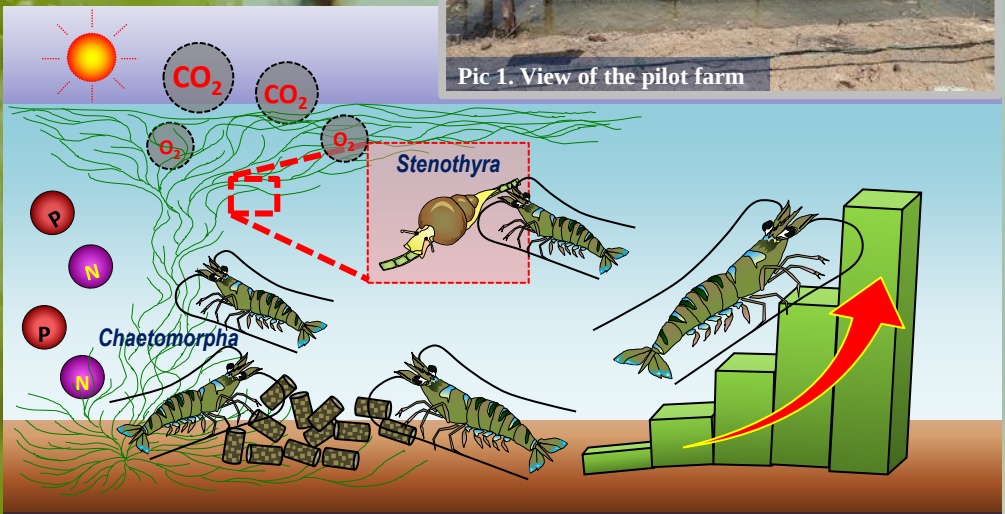

Fig 1. Conceptual diagram illustrating giant tiger prawn co-culture with *Chaetomorpha* and *Stenothyra*

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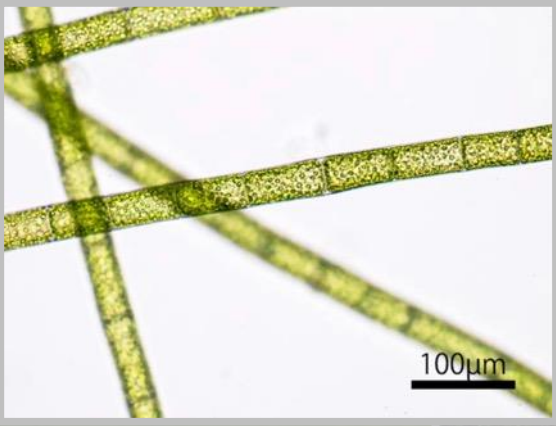
2. *Chaetomorpha* sp. used for co-culture

- A green filamentous seaweed, belonging to the family Cladophoraceae
- Composed of a series of small cylindrical cell (Pic 2), slightly soft and woven together in a mass
- Abundant in stagnant waters at mangrove areas (Pic 3)
- Euryhaline, eurythermal and fast growing
- A good skimmer of nutrients in water
- A good natural feed for shrimp



Pic 2. Microscopic view of *Chaetomorpha* thalli

Pic 3. Natural habitat of *Chaetomorpha* sp.

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3. *Stenothyra* sp. used for co-culture

- A microsnail, belonging to the family Stenothyridae
- Adult length of approximately 2–3 mm (Pic 4)
- Abundant in stagnant waters in mangrove areas; commonly found on *Chaetomorpha* thalli
- Euryhaline, eurythermal and fast growing
- A good natural feed for shrimp

Pic 4. Close-up of *Stenothyra* sp.

4. Pond design for benthos propagation

- Applicable to culture ponds around 1,000–4,000 m^2 in area
- Dig benthos nursery ditch (approximate length depending on pond size: 1 m wide and 50 cm deep) in pond to propagate *Chaetomorpha* and *Stenothyra* during dry preparation (Fig 2 & Pic 5)
- Install a series of plastic nets (5–6 m long, 1 m apart) along the edges of the pond to contain benthic organisms (Pic 6).
- Install gate nets (2 m long) in front of each entrance (1 m apart)

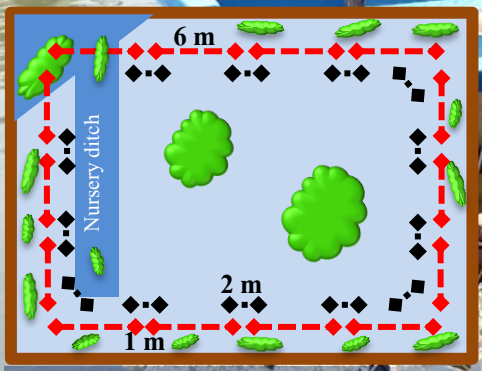

Fig 2. Diagram of a co-culture pond

Pic 5. Benthos nursery ditch

Pic 6. Benthos propagation area

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5. Pond preparation

- Plow the pond bottom during dry preparation (Pic 7).
- Dry up the pond bottom under the sun until cracks appear on the surface of the soil (~1 month).
- Apply lime (calcium carbonate ($CaCO_3$) to the completely dried soil at a ratio of 30 g/m^2 for pH control (Pic 8).
- Introduce seawater (5–30 ppt) into shrimp pond through a cloth filter (~50 µm) until water depth reaches 50 cm.

Pic 7. Plowing of the pond bottom

Pic 8. Application of lime

6. Seaweed and snail preparation

- Introduce ~3 g/m^2 of seaweed (small pieces of ~2 mm recommended) (Pic 9) and ~0.6 g/m^2 of microsnail into shrimp culture pond ~1 month before starting shrimp culture.
- Open paddle wheels for aeration to prevent water stratification.
- Propagate benthos for approximately 1 month until seaweed grows to ~60 g/m^2 and snail grows to ~6 g/m^2, which is ideal for starting shrimp cultures (Pic 10).

Pic 9. Release of seaweed particles

Pic 10. Seaweed grown in seaweed propagation area

7. Post-larvae pre-release culture

- Prepare nursery-size-tank(s) for post-larvae (PL) pre-release culture with weak aeration beside the shrimp culture pond.
- Continuously exchange water between pre-release tank(s) and shrimp culture pond using a small water pump.
- Acclimate PL to water temperature and salinity before introduction to pre-culture pond(s).
- Introduce PL that are approximately 10 days old, and stock at a density of ~12,000 PL/ton (Pic 11).
- Feed PL 4 times per day.
- Rear PL for approximately 2 weeks.

Pic 11. Releasing PL into pre-culture tank

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8. Post-larvae selection and release

- Select PL that are of average size and in good health, using a nylon sieve or a basket (Pic 12).
- Increase the amount of dissolved oxygen in shrimp culture pond(s) by using paddle wheel ~1 hour before PL release.
- Release PL to the shrimp culture pond(s) at a density of ~30–40 PL/m^2 (Pic 13).
- Add sea water to the shrimp culture pond(s) until the sea water depth reaches ~120 cm.

Pic 12. PL selection

Pic 13. Releasing PL into shrimp culture pond

9. Feed management

- Shrimp ingests *Chaetomorpha* and *Stenothyra* freely.
- Provide artificial feed 3 times daily: morning, noon, evening.
- Set 30% of the total shrimp feed amount in each meal on a feeding tray.
- Check remaining feed 2 hours after every meal (Pic 14).
- Determine the feed amount for the next day using the following formula and procedures.

$$FAR * 100 / FAPM$$

where FAR is the feed amount (g) remaining on the tray and FAPM is the feed amount (g) provided at the previous meal.

- After determining the percentage of remaining feed, determine the amount of feed to be offered the following day using the dendrogram below.

Pic 14. Remaining feeds on a feeding tray

10. Water quality management

- Once a day, check physical parameters such as water temperature, pH, and transparency.
- Once a week, monitor chemical parameters such as ammonia, nitrite, alkalinity, and minerals.

Water quality ranges suitable for shrimp culture pond

Parameter	Suitable range	Solutions
Water temp.	25–30 ℃	Open paddle wheels to prevent water stratification at noon time.
pH	6.5–9.0	Apply lime ($CaCO_3$) at a ratio of 30 g/m^2.
Transparency	> 40 cm	Exchange water to reduce waste products.
Ammonia	< 0.05 mg/L	Exchange water and/or reduce feed amount.
Nitrite	< 0.1 mg/L	Exchange water and/or reduce feed amount.
Alkalinity	> 80 mg/L	Apply lime ($CaCO_3$) at a ratio of 50 g/m^2.
Minerals	Calcium >100 mg/L Magnesium > 400 mg/L	Apply dolomite $CaMg(CO_3)_2$ at a ratio of 50 g/m^2.

11. Shrimp growth monitoring

- Observe shrimp condition (e.g. size, color, appendages, shell, antenna, diseases symptoms) during feeding.
- Monitor shrimp weight every 2 weeks (Pic 15).

Pic 15. Measuring shrimp weight

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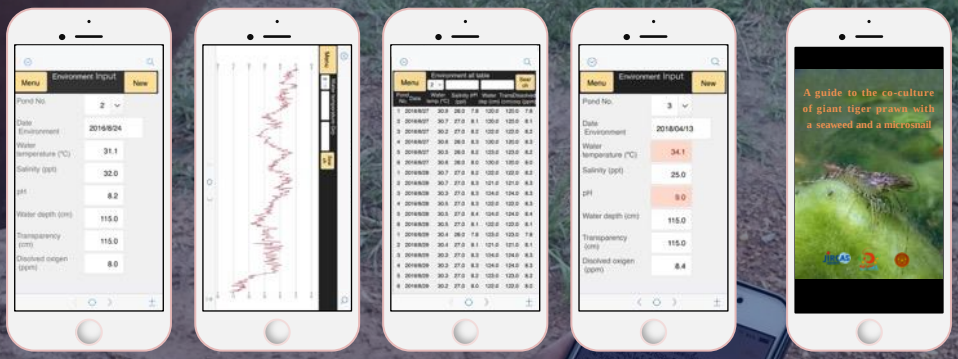
12. Culture support devices

- The Shrimp Co-culture Research Laboratory (SCORL) developed a shrimp co-culture supporting application (Pic 16), which has several functions including data entry, graphing, data searches and alerts.
- An E-manual (Pic 17) and promotion videos (Pic 18 & 19) have also been published.

Data entry Graphing Data search Alert



Pic 16. Co-culture support application

Pic 17. E-manual

Pic 18. Promotional video (Thai)

Pic 19. Promotional video (English)

13. Acknowledgements

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