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Asian Institute of Technology

# Can welfare concepts contribute to better sustainability of freshwater prawn value chain?

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# GFP Aquaculture in Thailand

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- The central river valley of the Chao Phraya
- Local laws prevent marine shrimp farming in inland locations
- Chachoengsao and Nakhonsithammarat shifting focus to prawn culture
- Location of hatcheries:
  - Suphan Buri
  - Chachoengsao
  - Ratcha Buri
  - Nakorn Pathom







# GFP Welfare

- **Farming:**

- Clean water source and water quality management (DO)
- Stocking intensity, feeds & feeding
- Transportation: Stressful PL transport induce mortality post-stocking
- Disease management

- **Marketing:**

- Harvesting practices (partial harvests and batch harvests)
- Handling; induce less suffering
- Transportation: Less stress during farm to market
- Slaughter methods



# Live prawn market in Thailand

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- Excellent domestic market
- Live prawns fetch a high value







## Culture intensity and stocking density

- GFP is not amenable to crowding ?
- White shrimp stocking density =  $500/\text{m}^2$
- Maximum reported *M. rosenbergii* stocking density =  $37.5/\text{m}^2$
- All-male and all-female stocks promising
- Good farm management is required

# Water Quality

- RAS and Biofloc systems
- Large-scale investments in RAS for *M.rosenbergii* failed
- Biofloc systems still not widespread

## SHRIMP NEWS INTERNATIONAL

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### China

#### Sino Agro, Freshwater Prawns, Production Delays, Technical Problems and Criticism

[Sino Agro Food's](#) plan to build the world's largest [freshwater prawn \(\*Macrobrachium rosenbergii\*\)](#) farm in China is far behind schedule due to a funding shortfall and [technical issues related to farming prawns in intensive systems.](#)

More than two years after Sino Agro announced it was three months from starting cultivation at its first phase, but the farm has still not harvested any freshwater prawns.





# GFP Welfare: Handling stress

- Constant handling induces stress
- Staggered handling has been linked to reduced haemolymph glucose levels
- GFP effectively responds to heat stress through heat shock proteins 40 and 90





# Monosex prawn farming

- All male and All female prawn farming systems
- Manual segregation is easy, but stressful
- Advanced biotechnological tools currently available





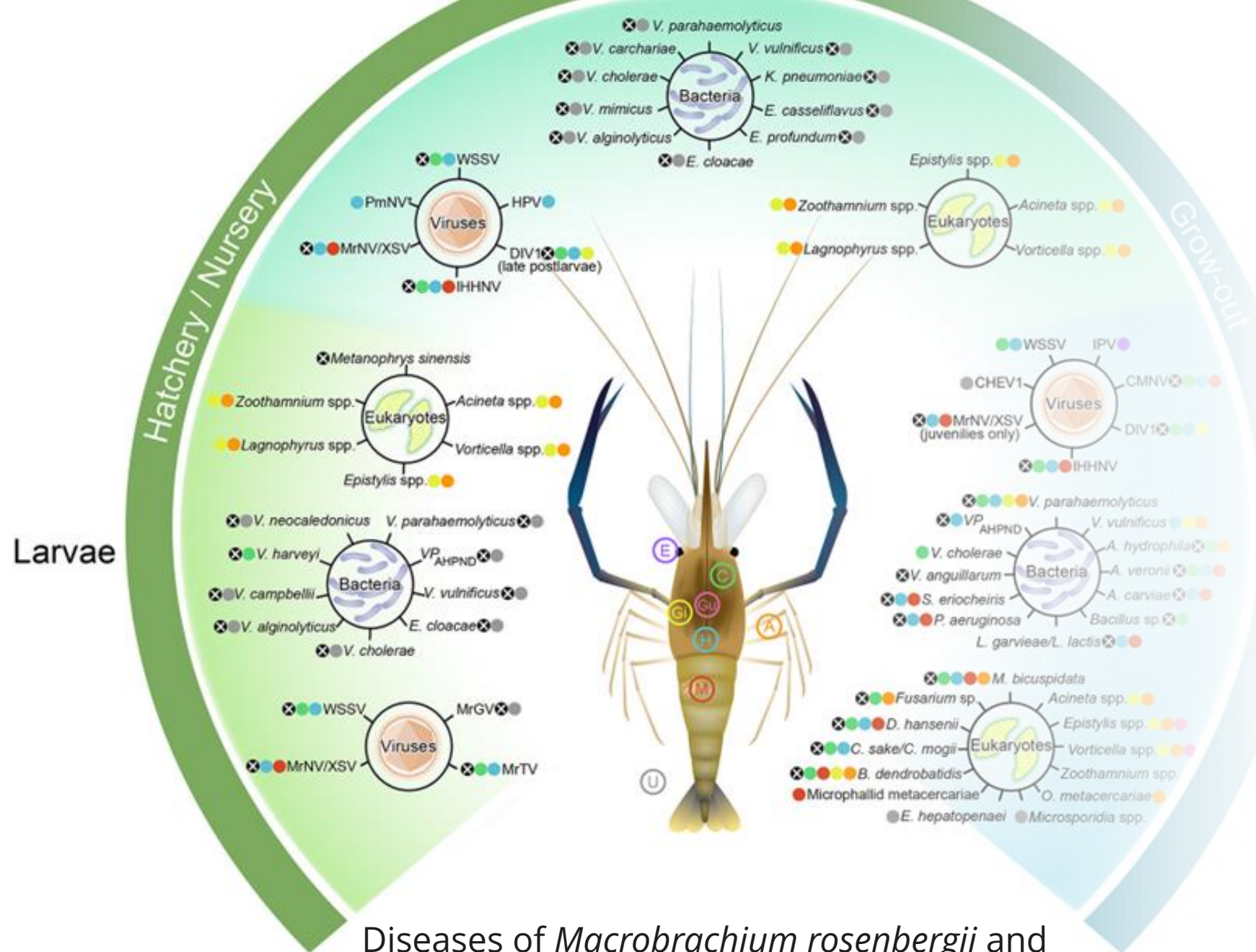
# Biotechnological tools for monosex prawn

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- Development of neomales and neofemales
- Micro-injection of androgenic gland cell implantation from males into juvenile female PLs transforms them into anatomical males
- Many welfare issues may emerge impacting the sustainability of prawn farming
- Gene silencing technologies helpful
- New genome editing tools promising to mitigate many welfare issues?



# Disease management



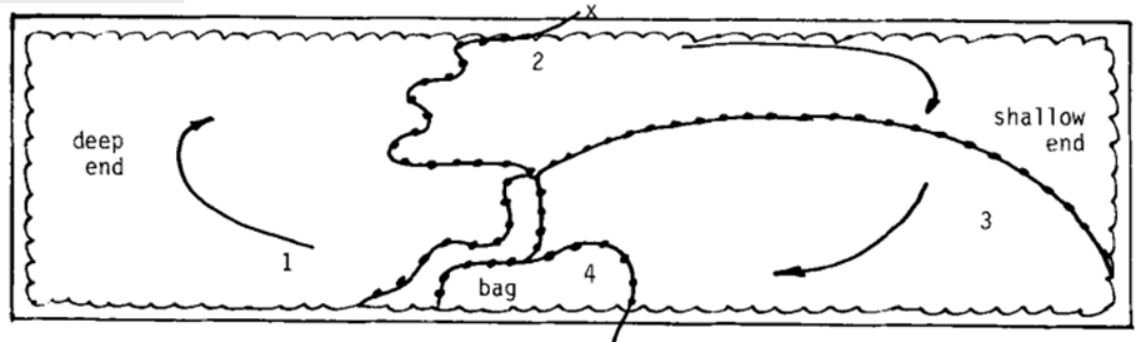
- Several diseases
- Discouraging the use of antibiotics
- Alternative disease management methods
- Selenium-enriched diets
- Probiotics
- Phytobiotics

Diseases of *Macrobrachium rosenbergii* and the life stage(s) affected ([Hooper et al. 2022](#))

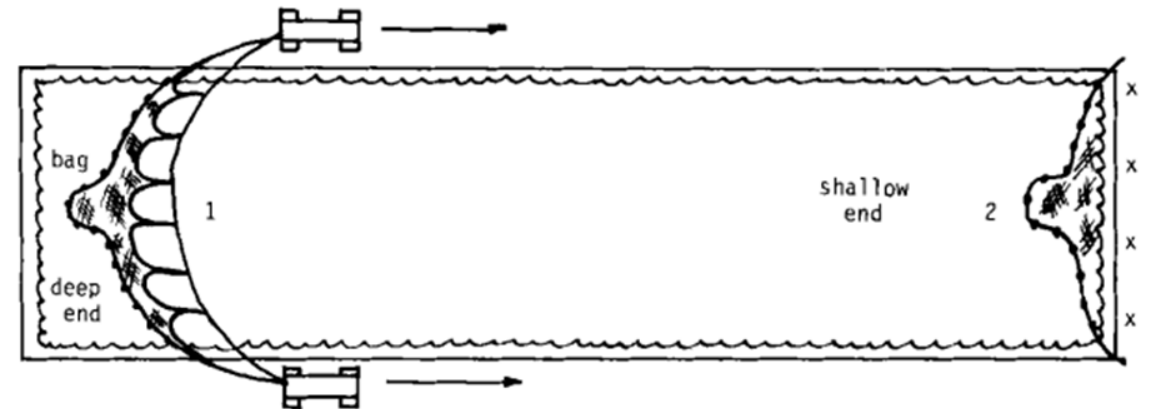


# Harvesting

- Hand seining suitable for small-scale farmers, but stressful
- Modified seine harvesting might be more efficient



Hand seining (Source: Peterson 1982)



Modified seining (Source: Peterson 1982)



# Live transportation

- Challenges during transportation
  - Poor survival (PLs)
  - Cannibalism (Adults)
- Sedation during transport
- Live transportation without water

Aquaculture Research, 2005, 36, 300–310

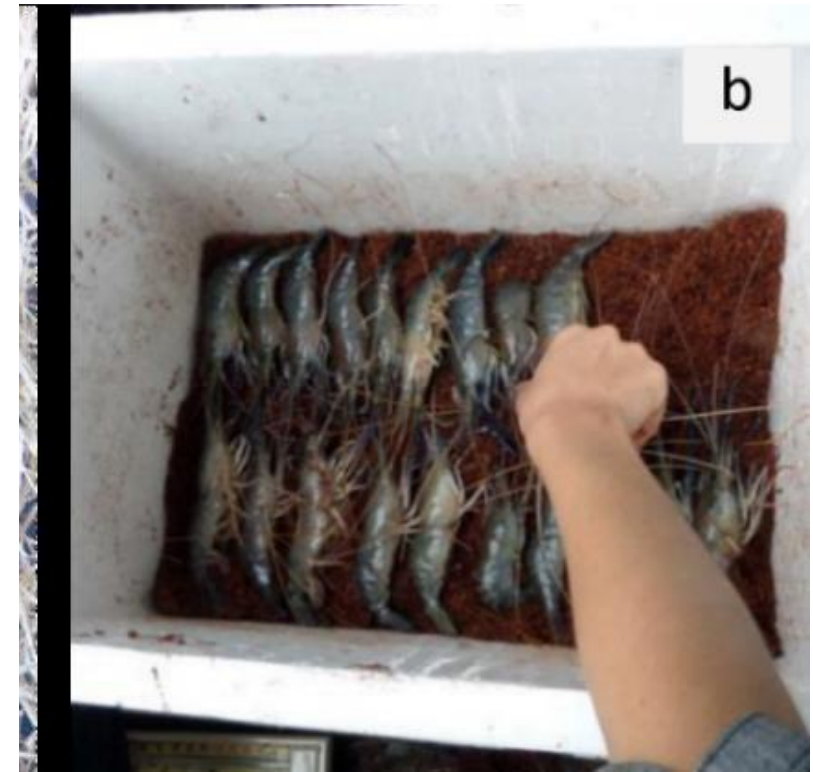
doi: 10.1111/j.1365-2109.2005.01245.x

## Live transportation of *Macrobrachium rosenbergii* (De Man) in chilled sawdust

K R Salin

Natures Way Hydrofauna, Cherthala, Alleppey, Kerala, India

<https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1365-2109.2005.01245.x>





# Slaughter at the market

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- Current methods involve the direct cooking of live prawns
- Prawns are also killed by asphyxiation
- Killing by prolonged chilling in ice is also common
- 'Chill killing'





# Certification of prawn farms

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- Environmental responsibility
- Social responsibility
- Food safety
- Animal health and welfare
- Certification schemes with GFP Farms
- ASC lists 1 prawn farm in Bangladesh
- BAP lists 7 prawn farms in Bangladesh



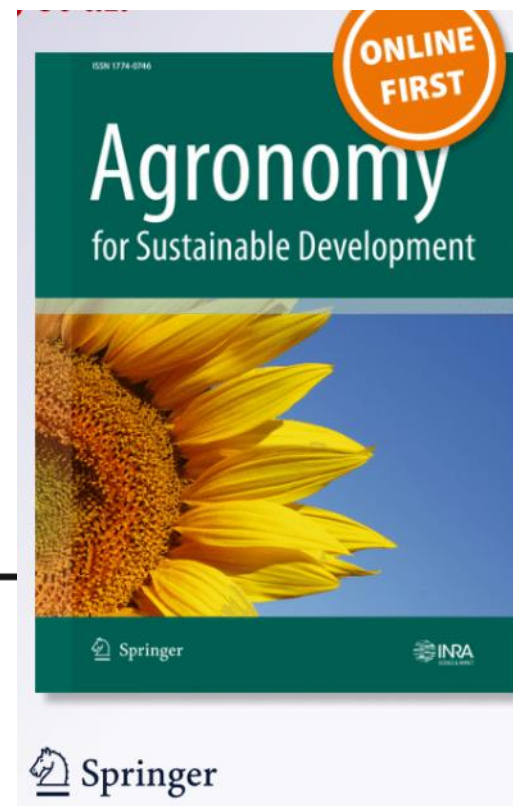


# Organic farming is profitable...

Agron. Sustain. Dev. (2014) 34:569–581

DOI 10.1007/s13593-013-0188-z

RESEARCH ARTICLE



## Organic rice–prawn farming yields 20 % higher revenues

**Chellappan Mohanakumaran Nair • Krishna Rugmini Salin •  
Juliet Joseph • Bahuleyan Aneesh • Vaidhyanathan Geethalakshmi •  
Michael Bernard New**

<https://link.springer.com/article/10.1007/s13593-013-0188-z>



# Summing Up: Good Welfare ?

- **Improved feeding**
  - Formulated feeds based on nutrient requirements
  - Immune response and stress markers
- **Optimal water quality, stocking density and health management**
  - Real-time smart water quality monitoring systems
  - Avoid cross-contamination from polyculture practices
- **Farm waste management**
- **Slaughter** to be done following the set guidelines, and new slaughter methods?
- Certification





# Summing Up: Welfare metrics



- **Feed composition**
  - Protein, lipids, minerals, vitamins, energy
- **Environmental enrichment**
  - Nutrient loads (N, P), eutrophication, sediments
- **Water quality**
  - Oxygen, ammonia, temperature, salinity, pH
- **Stocking density and culture space**
  - Extensive (2.5 to 7.5 pcs.m<sup>2</sup>), Semi-Intensive (10 to 20 pcs.m<sup>-2</sup>), and Intensive (20 to 40 pcs.m<sup>-2</sup>) systems
- **Stunning/slaughter**
  - Physicochemical properties (pH, texture and total volatile basic nitrogen)
  - Microbiota (total aerobic counts and psychrophilic bacterial counts)
  - Sensory characteristics



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Thank you

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## Outlook

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- Some certification schemes have included these indicators in their audit process
- Future research must consider reproductive welfare and vaccination against emerging diseases
- Genetic or biochemical interventions must consider welfare aspects, or should be developed as a tool for welfare
- Methods to assess welfare must not be invasive

