CANTHO UNIVERSITY

Biology and culture of Mud crab

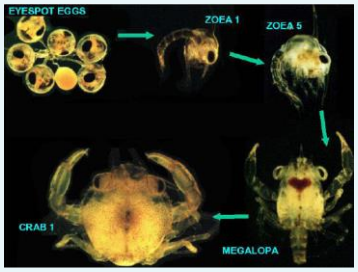
Tran Ngoc Hai (Prof. Dr.)
College of Aquaculture and Fisheries,
Can Tho University
Vietnam
https://www.ctu.edu.vn/
Email: tnhai@ctu.edu.vn

2021

CANTHO UNIVERSITY

Outline

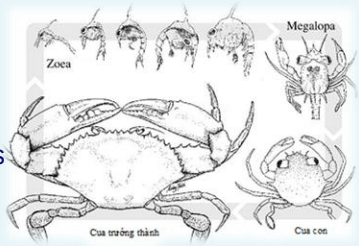
1. Introduction
2. Biology of mud crab
3. Hatchery
4. Broodstock culture
5. Larval rearing
6. Crablet nursery
7. Farming
8. Diseases



CANTHO UNIVERSITY

1. Introduction

- Mud crab is of important aquaculture commodities
- Development of world aquaculture of mud crabs with different methods, scales and significance have been documented (Cowan, 1984; Angell, 1991; FAO, 2017; Hungria et al, 2017; Tavares, 2017).
- World production from mud crab farming was reported far over for from mud crab capture fisheries (FAO, 2017).
- Seed production of mud crab was firstly successful by 1964 (Ong, 1964).
- Several large, regional projects of mud crabs have recently carried out with important achievement on seed production.



CANTHO UNIVERSITY

1. Introduction

- In Vietnam, mud crab is an important species for aquaculture, especially for the improved extensive and integrated mangrove-aquaculture farming systems in the Mekong Delta of Vietnam
- With 330.000ha of the improved extensive shrimp farming systems, 50.000ha of the integrated mangrove – aquaculture farming systems, yield of mud crab of 100-200 kg/ha/year, annual production of mud crab in the region is estimated at about 38,000-76,000 tons (N T T Van, 2013)
- With stocking density of mud crab to these systems at 0.5-1 crab/m^2/year, a total of 1.9-3.8 billions of crablets are needed for stocking annually.

CANTHO UNIVERSITY

1. Introduction

- In seed production of mud crab, many studies on mud crab broodstock culture, larval rearing and crablet nursery have been conducted since the mid 1990s to develop technology for mud crab seed production in the region.
- Many training courses on hatchery operation have been conducted yearly by Can Tho University to national and international companies, provincial departments and private participants.

CANTHO UNIVERSITY

2. Biology of mud crab

Species

Scylla olivacea

Scylla paramamosain

Scylla serrata

Scylla stranqueparica

CANTHO UNIVERSITY

2. Biology of mud crab
Species

Scylla serrata (Clive P. Keenan, 1997)

Diagnostic features: high, bluntly pointed frontal lobe spines; pairs of large spines obvious on carpus and propodus; polygonal patterning clearly present on all appendages.

Photo: Queensland Museum.

CANTHO UNIVERSITY

2. Biology of mud crab
Species

Scylla tranquebarica (Clive P. Keenan, 1997)

Diagnostic features: moderate, blunted frontal lobe spines; pairs of large spines obvious on carpus and propodus; polygonal patterning present on last two pairs of legs, weak or absent on other appendages.

Photo: Queensland Museum.

CANTHO UNIVERSITY

2. Biology of mud crab
Species

Crabs in Myanmar

CANTHO UNIVERSITY

2. Biology of mud crab
Species

- *Scylla paramamosain* (Clive P. Keenan, 1997)

Diagnostic features: moderately high, pointed and triangular frontal lobe spines usual; pair of large spines obvious on propodus, on carpus inner spine absent and outer spine reduced; polygonal patterning present on last two pairs of legs, weak or absent on other appendages.

- Photo: Queensland Museum.

CANTHO UNIVERSITY

2. Biology of mud crab
Species

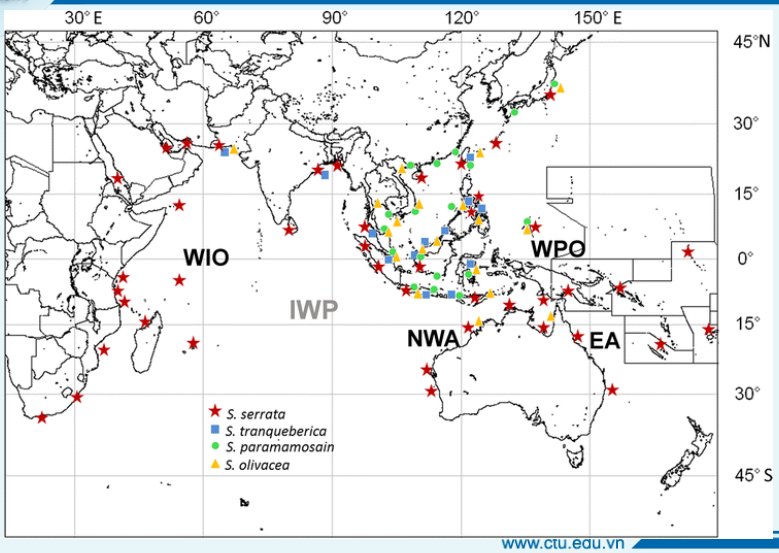
Scylla olivacea (Clive P. Keenan, 1997)

Diagnostic features: low and rounded frontal lobe spines; pair of reduced spines obvious on propodus, on carpus inner spine absent and outer spine reduced; polygonal patterning absent from all appendages.

Photo: Queensland Museum

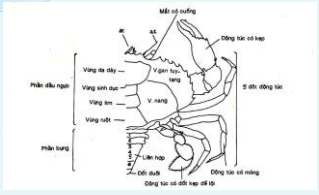
CANTHO UNIVERSITY

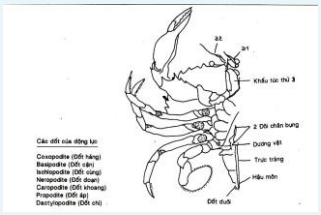
2. Biology of mud crab
Distribution of mud crab species

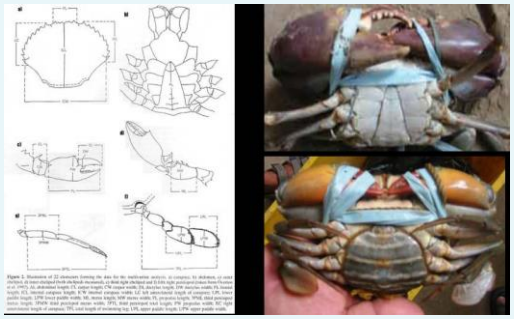


CANTHO UNIVERSITY

2. Biology of mud crab
Morphology

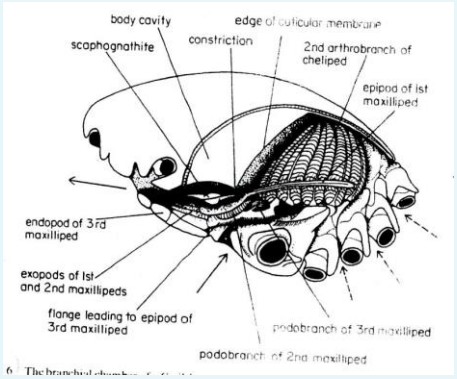


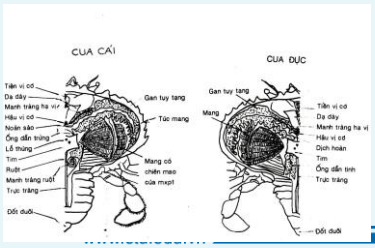




CANTHO UNIVERSITY

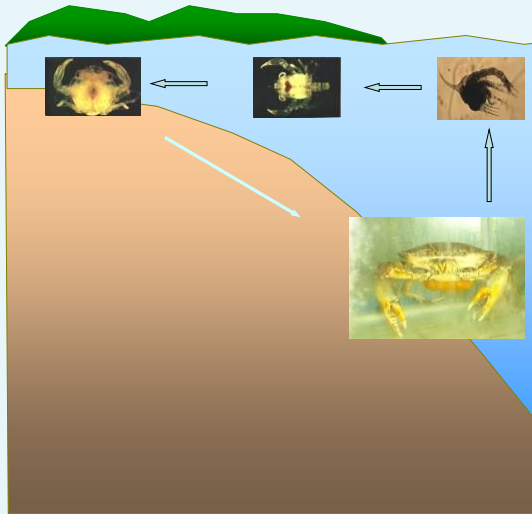
2. Biology of mud crab
Morphology





CANTHO UNIVERSITY

2. Biology of mud crab
Life cycle

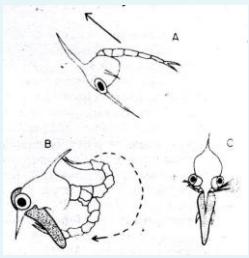


- ❑ Juvenile and adult: Wide distribution frm brackishwater to sea
- ❑ Mature crab: Migrate to estuary or open sea for spawning
- ❑ Berried female: Carrying eggs and incubating for 9-12 days
- ❑ Zoea: Planktonic, 15 days
- ❑ Megalopa: Settled on substrate, 8 days
- ❑ Crablet: Buried in hollow, and migrate gradually to brackish water area

CANTHO UNIVERSITY

2. Biology of mud crab
Feeding habitat

- Omnivorous and carnivorous
- Cannibalism
- Nocturnal feeder
- Change with stages
- Large crabs can survive without feeding for 1 week



Feeding types	% of feed types for different stages		
	Crablet	Sub-adult	Adult
Organic matters (animal)	42,09	46,30	41,09
Shells	9,46	15,04	17,18
Algae, plant	13,05	12,88	16,00
Fish	17,41	12,18	10,24
Mollusk	9,21	7,18	8,58
Crustacean	8,20	5,16	4,56
Organic matter (Plant)	0,57	1,26	2,24

(Shelley và Lovatelli, 2011)

CANTHO UNIVERSITY

2. Biology of mud crab
Spawning

- Mature age: 1 year
- Mature size: 8.3cm (200g)
- Ovary development: through 4 phases
- Important indices:
  - Female mature index (FMI)
  - Gonad somatic index (GSI)

CANTHO UNIVERSITY

2. Biology of mud crab
Spawning

- In the wild, mature crabs migrate to estuary or open sea for copulation and spawning during spring tide of spawning season (August - December)
- In maturation culture: crabs spawn year-round
- Can spawn many times in life-span
- Fecundity: 0.6-3.0 million eggs/spawning

CANTHO UNIVERSITY

2. Biology of mud crab
Spawning

- Eggs after spawning are stick to pleopods
- Egg size: 0.3-0.4mm
- Egg color: Yellow > Orange > dark gray
- Egg incubation: 9-12 days
- Hatching time: 24-60 hrs
- Water salinity for incubation: 20-40%o, optimum 30%o.

CANTHO UNIVERSITY

2. Biology of mud crab
Larval stages

CANTHO UNIVERSITY

2. Biology of mud crab
Larval stages

Stages	Eyes	Outer branch of head 2nd appendages	No. Abdomen segments	Ventral appendages	Telson
Zoea1	Not yet stalked	4 fairs	5	No	2 branches
Zoea2	Stalked	6 fairs	5	No	2 branches
Zoea3		8 fairs	6	No	2 branches
Zoae 4		10 fairs		Bugs appear	2 branches
Zoae 5		12 fairs		Bugs branched	2 branches
Megalopa				Appendages with a lot of fairs	round

CANTHO UNIVERSITY

2. Biology of mud crab
Larval stages

Stages	Characteristics
Zoae (1-5)	- Body length 1.2-4.5mm - Planktonic, photopositive - Feeding (randomly) on Zooplankton - Salinity: 30-35‰ - Duration: 15 days
Megalopa	- Body length 4.0mm - Cling on substrates, low photopositive - Feeding on zoobenthos, actively with claw - Salinity: 24-30‰ - Duration: 7-8 days
Crablets	- Carapace width and length 3mm, hiding in substrate or bottom, feeding on zoobenthos, cannibalism, salinity 18-24‰.

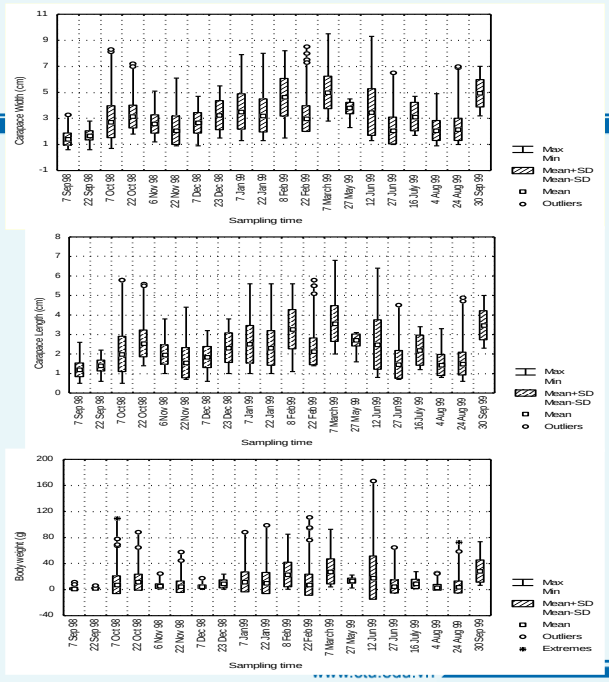
CANTHO UNIVERSITY

2. Biology of mud crab
Growth

- Crab 1 (C_1) of 3mm can reach C_{5-6} (1.5-2cm) after 1 month, and C_{7-8} (2-3cm) after 2 months
- Crab seeds (2-3cm) can reach 250-400g after 4 months of culture
- Can molt 15 times per year
- Maximum BW: 3kg for *Scylla serrata; or* 1kg for other species

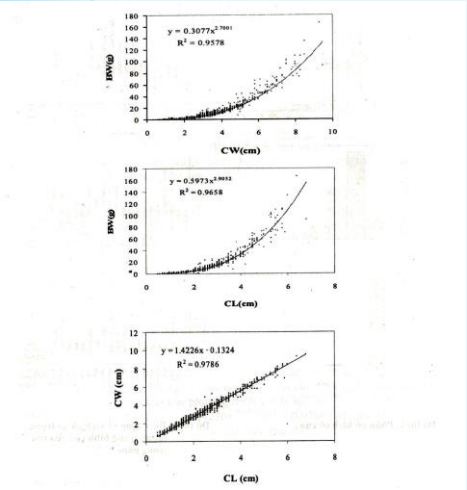
CANTHO UNIVERSITY

2. Biology of mud crab
Growth



CANTHO UNIVERSITY

2. Biology of mud crab
Growth



Correlation between CW and CL with BW of mud crabs

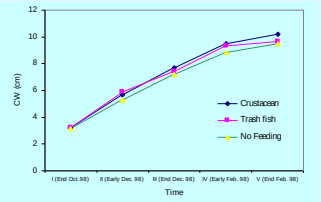


Figure 5: Growth in CW of Crabs Cultured with Different Feeding Types

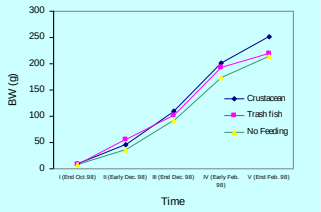
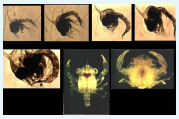


Figure 6: Growth in BW of Crabs Cultured with Different Feeding Types

CANTHO UNIVERSITY

2. Biology of mud crab
Environment

Species	Stages	Optimal temperature and salinity	Ref.
S. serrata	Zoea	25–35 ‰, 26–32 ^{0}C	Baylon, 2010
	Zoea – Megalop	20–30 ‰, 28–30 ^{0}C	Nurdiani và Zeng, 2007
	Megalop	15–45 ‰, 20, 26 và 32 ^{0}C	Baylon, 2010
	Crablet	5–45 ‰, 20, 26 và 32 ^{0}C	Baylon, 2010
	Crab C2	10–20 ‰, 30 ^{0}C	Ruscoe et al, 2004
S. paramamosain	Zoea	26–30 ^{0}C	Zeng & Li, 1992
	Crab C1	32 ^{0}C, 10–40 ‰	Gong et al, 2015b
	Crab C1-C5	18–24 ‰	Trần Ngọc Hải, 1997; 1998
	Crablet	15-25 ‰	Vũ Ngọc Út, 2006



CANTHO UNIVERSITY

2. Biology of mud crab
Environment

- Euryhaline (2-38‰), pH 7.5-9.2
- Slow water current and migrate against stream
- Can survive in air condition for 1 week
- Can live in hole up to 1m deep, with U-shape
- Mangrove is the feeding and growing ground

CANTHO UNIVERSITY

3. Hatchery

- Site selection
- Hatchery structure
- Tank systems
- Aeration systems
- Light systems
- Water systems
- Others

CANTHO UNIVERSITY

3. Hatchery

- ***Criteria for site selection***
  - *Weather:* tropical?
  - *Water sources*
    - Freshwater: tap water, river water, ground water?
    - Saline water: sea water, brine water, saline ground water?
  - *Broodstock sources:* Wild or farmed broodstock?
  - *Electricity:* electric network available or generator?
  - *Transportation:* accessible?
  - *Grow-out area:* near or far from grow-out area?
  - *Rearing systems applied*?

CANTHO UNIVERSITY

3. Hatchery

- ***Hatchery house***
  - Scale: 200 m^2 – 0.5 ha
  - Simple or modern
  - Roof: transparent sheet altered with opaque sheets
  - Wall: could be adjusted with curtain
- Ensuring lighting condition (6000-50,000 lux), warm temperature

CANTHO UNIVERSITY

3. Hatchery

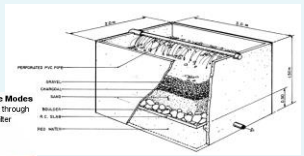
- Water storage tanks

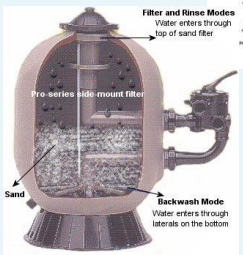
www.ctu.edu.vn

CANTHO UNIVERSITY

3. Hatchery

- Mechanical Filters





Cardtrige

Sand filter

Charcoal filter

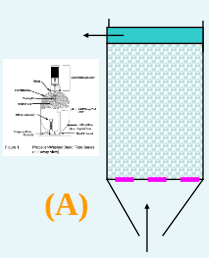
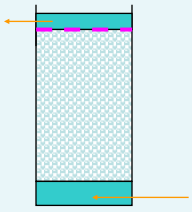
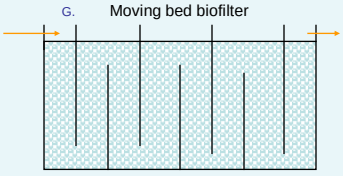
Bag filter

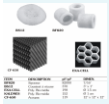
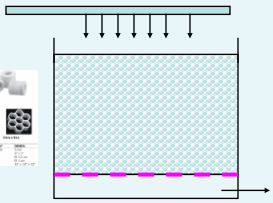
CANTHO UNIVERSITY

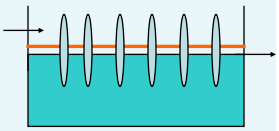
3. Hatchery

Bio-filters

A. Bead filter
B. Bead filter 2
C. Submerged biofilter
D. Trickling filter
E. Drum biofilter
F. Disc biofilter
G. Moving bed biofilter



(A) (B) (C) (D) (E) (F)

CANTHO UNIVERSITY

3. Hatchery


- Simple moving bed biofilter and trickling biofilter

CANTHO UNIVERSITY

3. Hatchery

Water treatment systems

Ozon creator

UV system

CANTHO UNIVERSITY

3. Hatchery

www.ctu.edu.vn

CANTHO UNIVERSITY

3. Hatchery

- **Broodstock tank system**

Mud crab broodstocks can be cultured in crab hatcheries or specific hatcheries for broodstocks culture and supply only

CANTHO UNIVERSITY

3. Hatchery

- **Broodstock tank system**

- Culture tanks: 50-100 L (1 crab/tank), open or recirculating system
- Sand bottom for maturation culture, hard bottom for berried crab culture
- Water salinity 28-33‰
- Dark condition with shading

CANTHO UNIVERSITY

3. Hatchery





CANTHO UNIVERSITY

3. Hatchery

- **Larval rearing tank systems**




CANTHO UNIVERSITY

3. Hatchery

- **Larval rearing tank systems**
  - Tanks:
    - Zoea stages: composite 0.5-1m^3 tanks, conical bottom
    - Megalopa stages: Cement of composite tanks, earthen tanks lined with plastic, flat bottom, 1-10m^2

CANTHO UNIVERSITY

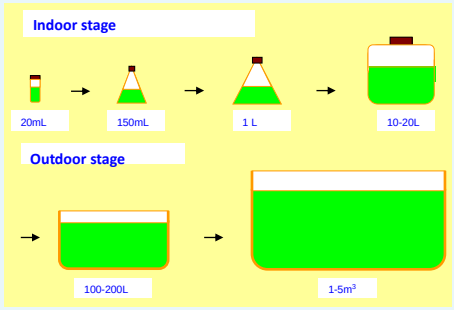
3. Hatchery

- Shrimp hatchery for mud crab in the Mekong Delta

CANTHO UNIVERSITY

3. Hatchery

- Algal culture system



Batch culture of Algae

CANTHO UNIVERSITY

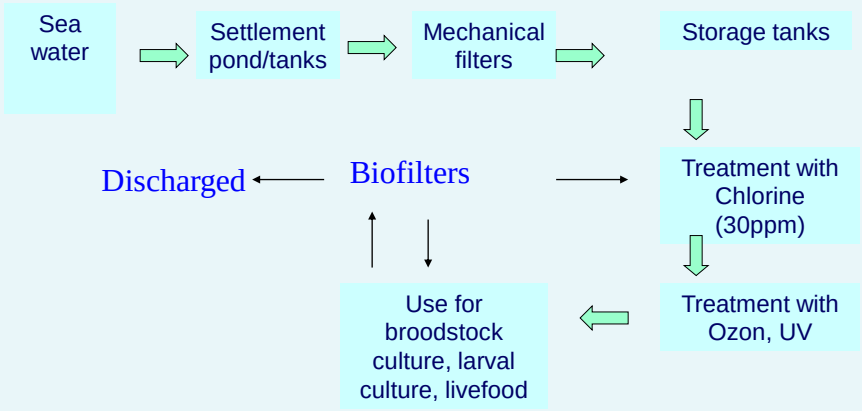
3. Hatchery

- Artemia incubating system

CANTHO UNIVERSITY

3. Hatchery

- Water treatment



CANTHO UNIVERSITY

3. Hatchery

Biosecurity

CANTHO UNIVERSITY

4
Broodstock culture

www.ctu.edu.vn

CANTHO UNIVERSITY

4. Broodstock culture

- **Source of broodstock?**
  - Wild broodstock (From sea)
  - Farmed broodstock

www.ctu.edu.vn

CANTHO UNIVERSITY

4. Broodstock culture

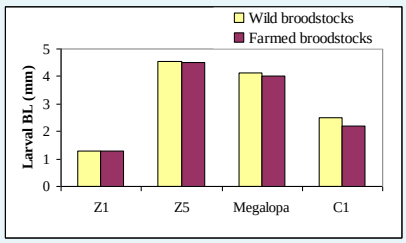
- Spawning performance of wild crab and farmed crab broodstocks (Quyết, 2008)

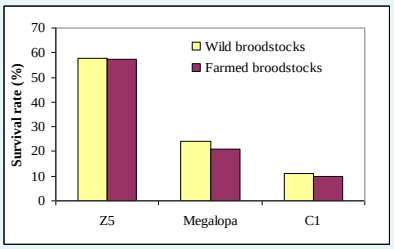
	Farmed broodstocks	Wild broodstocks
Spawning rate (%)	77.5	85.7
Absolute fecundity (Million eggs)	2,468±760	2,666±660
Relative fecundity (Egg/g of female)	6241±1629	6770±1359
Fetilizing rate (%)	78.42±2.48	88.1±3.53
Hatching rate (%)	64.2±2.08	74.9±2.84

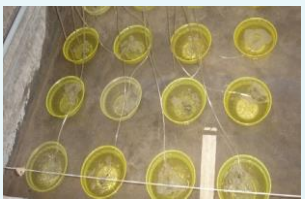
CANTHO UNIVERSITY

4. Broodstock culture

- BL and survivals of larvae sourced from wild crab and farmed crab broodstocks (Quyết, 2008)







www.ctu.edu.vn

CANTHO UNIVERSITY

4. Broodstock culture

- **Broodstock size?**

CANTHO UNIVERSITY

4. Broodstock culture

- **Broodstock size?**

Spawning performance of broodstocks at different sizes (Nguyen and Hai, 2010)

Spawning characteristics	Female Body weight		
	< 300g	300 – 500g	> 500g
Maturation culture (days)	42 ± 34.77	16.22 ± 11.97	24.17 ± 16.69
Fertilizer rate (%)	61.56 ± 39.77	82.63 ± 18.17	94 ± 2.83
Fecundity (1000eggs/crab)	2,182± 0.52^{a}	3,373.9 ± 0.85^{b}	3,474.4 ± 0.75^{b}
Fecundity (Eggs/g of spawner)	7,711 ± 2.189	8,324 ± 1.830	5,803 ± 1.240
Hatching rate (%)	77.77 ± 33.56	62.84 ± 23.96	96.82 ± 1.77

www.ctu.edu.vn

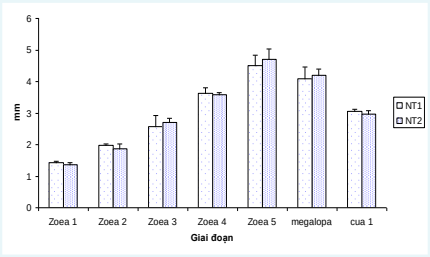
CANTHO UNIVERSITY

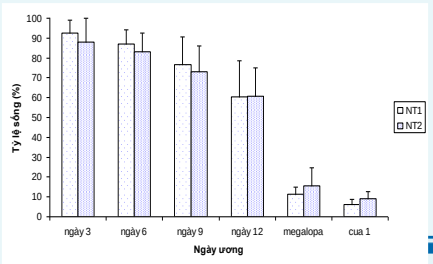
4. Broodstock culture

- **Broodstock size?**

Body length and survival rates of larvae from broodstocks of <300g (NT1) and 300-500g (NT2)

(Nguyen and Hai, 2010)





CANTHO UNIVERSITY

4. Broodstock culture

- Preparation and stocking of broodstocks for maturation culture and spawning

  - Full mature female
  - Cleaning crab body
  - Treated with Formalin 100ppm for 1hr
  - Ablating eyestalk (cutting or tying eyestalk
  - Stocking the crabs individually in small tanks (50-100L/tank) (with RAS if possible) as mentioned.

CANTHO UNIVERSITY

4. Broodstock culture

- Feeding and water management
  - Fresh feed: Bloodcockle, oyster, squid
  - Feeding rate: 5-20% daily
  - Cleaning uneaten feed daily
  - Exchange water 100% daily, or recirculating 5 rounds (500%) daily

CANTHO UNIVERSITY

4. Broodstock culture

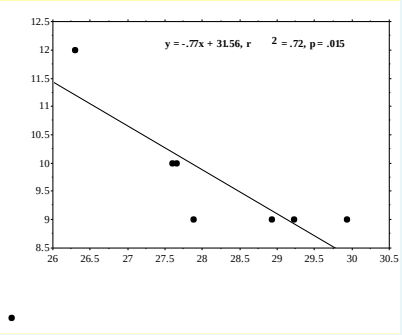
Crab spawning and culture of berried crab

- Spawning year round, about 5-30 days after ablation
- Transferring berried crabs to clean tank (without sand)
- Feeding crab normally
- Water quality: optimum at 30‰; 29-30^{o}C; continuously aerated; exchanged daily 100% (change crabs to new tank)
- Egg color: yellow > orange > dark grey
- Incubating duration: 9-12 days
- Hatching time: 24-60 hours

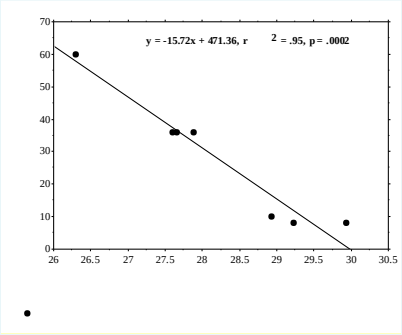
CANTHO UNIVERSITY

4. Broodstock culture

- Crab spawning and culture of berried crabs



Effects of water temperature to incubating duration (days)

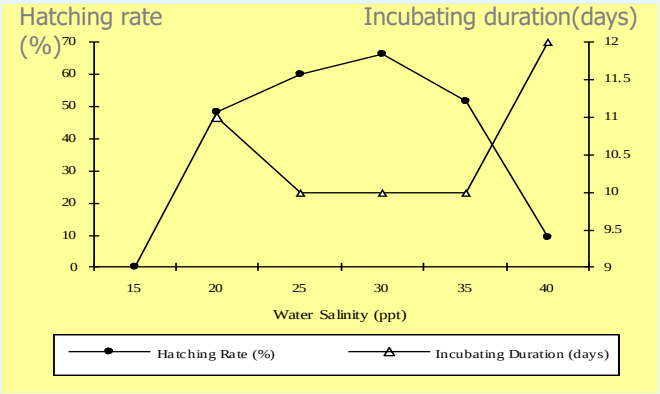


Effects of water temperature to hatching duration (hrs)

CANTHO UNIVERSITY

4. Broodstock culture

- Crab spawning and culture of berried crabs



Effects of salinity on incubating duration (days) and hatching rate (%)

www.ctu.edu.vn

4. Broodstock culture

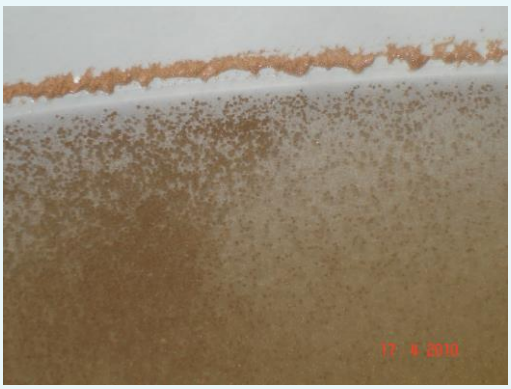
Summary

Characteristics	Mangement
Culture tanks	100 litter – 10m^3, composite or cement, recirculating or open, sand bottom
Culture density	1 ind/tank of 100 litter
Eyestalk ablation	Cutting or tying 1 eye stalk
Light	Dark
Water quality	28-33‰, 28-30^{o}C
Water exchange	Recirculating (500% daily) or open system (100% daily)
Feeding	Fresh feed (mollusc, polycheate, marine fish, shrimp, at 5-10% BW)
Culture duration	5-30 days after eyestalk ablation
Berried crab culture	Individual culture, bottom without sand

CANTHO UNIVERSITY

5

Larval rearing



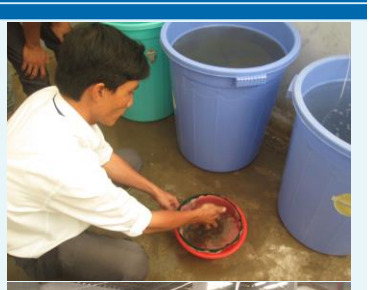
www.ctu.edu.vn

CANTHO UNIVERSITY

5. Larval rearing

Collecting and stocking larvae

- Collecting strong larvae as soon as possible after hatching
- Collecting larvae several times if hatching take long time
- Treating larvae with Formalin 100ppm in 30 second
- Feeding larvae as soon as possible
- Good larvae: strongly photopositive, active



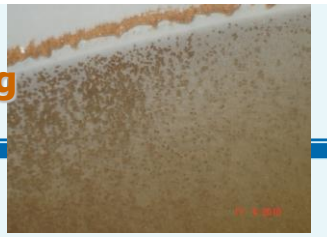
CANTHO UNIVERSITY

5. Larval rearing

Stages of larvae

CANTHO UNIVERSITY

5. Larval rearing



Stocking density:

1-phase method: 100-150 inds/L

2-phases method:

- Zoea 1-Zoae 5: 200-300 inds/L
- Zoea 5- Crablets: 25-50 inds/L

3-phases method:

- Zoea 1-Zoea 4: 200-300 inds/L
- Zoea 4-Megalopa: 100-150 inds/L
- Megalopa – Crablets: 25-50 inds/L

CANTHO UNIVERSITY

5. Larval rearing

- Body length and survival rates of Zoea 5 reared at different stocking densities (TM Nhứt, T N Hải, 2010)

Stocking density (ind/ml)	Mean
Body length of Zoea 5 (mm)	
100	4,41±0,20[a]
150	4,34±0,17[a]
200	4,38±0,19[a]
250	4,31±0,24[a]
300	4,33±0,26[a]
Survival Rate of Zoea 5 (%)	
100	83,67±3,08[a]
150	81,83±9,06[a]
200	82,50±6,72[a]
250	80,50±6,60[a]
300	81,83±6,27[a]

CANTHO UNIVERSITY

5. Larval rearing

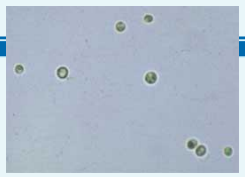
- Body length and survival rates of Megalopa and Crab reared at different stocking densities (TM Nhứt, T N Hải, 2010)

Stocking density (No. Zoea5 /ml)	Mean
Body length of Megalopa (mm)	
25	3,96±0,09^{a}
50	3,95±0,12^{a}
75	3,92±0,12^{a}
100	3,91±0,14^{a}
Body length of Crab 1 (mm)	
25	2,95±0,13^{b}
50	2,95±0,12^{b}
75	2,90±0,13^{ab}
100	2,85±0,14^{a}
Survival rate of Crab 1 (%)	
25	24,57±1,50^{b}
50	11,32±1,84^{a}
75	9,63±1,72^{a}
100	10,30±1,52^{a}

CANTHO UNIVERSITY

5. Larval rearing

Feed and feeding larvae - *Chlorella*

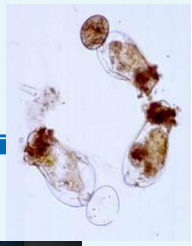


- Chlorella algae can be added to all stages of larvae, at 0.5-1 million cells/ml
- Chlorella: uni-cell, round, 2-5um.
- Chlorella can be from pure culture or green water from tilapia culture

- Advantages and Disadvantages?

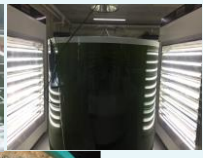
CANTHO UNIVERSITY

5. Larval rearing



- **Feed and feeding larvae - *Rotifer***

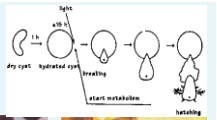
  - Important for Zoea 1-Zoea 2
  - Feeding rate: 20-30 inds/ml
  - Enrich of Rotifer
    - 6 hours before collecting to feed to larvae
    - Can be enriched with algae, artificial feed, DHA, Vitamin C,…. (1 g feed/ 1 million Rotifer)



Advantages and Disadvantages?

CANTHO UNIVERSITY

5. Larval rearing



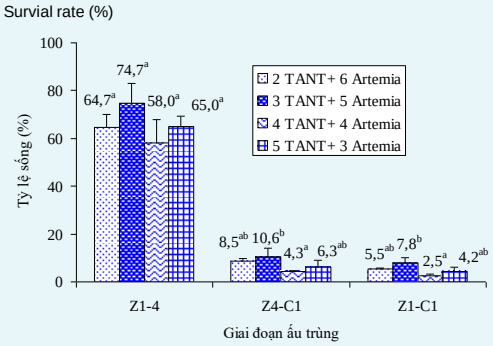
- **Feed and feeding larvae - *Artemia***

  - Zoae 1- Zoea 2: feeding with umbrella Artemia, at 0.5-1 inds/ml, 3 hrs/time
  - Zoea 3-Zoea 4: feeding with newly hatch Artemia, at 1-2 inds/ml, 6 hrs/time
  - **Zoea 5-Megalopa-Crabs: feeding with enriched Artemia, at 2-3 inds/ml, 6 hrs/time**
  - Enrichment of Artemia
    - From Instar 2 (8-12hours after hatching)
    - Enrich with algae, aritificial feed, HUFA, DHA for 12 hours

Advantages and Disadvantages?

CANTHO UNIVERSITY

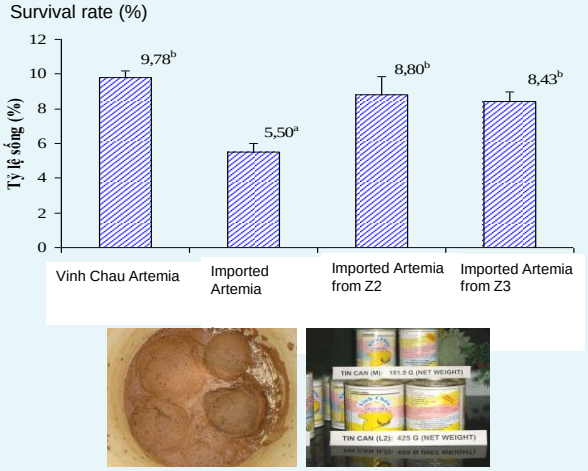
5. Larval rearing



Survival rates to C1 under different feeding times of Artificial feed (TANT) and Artemia daily

CANTHO UNIVERSITY

5. Larval rearing



CANTHO UNIVERSITY

5. Larval rearing

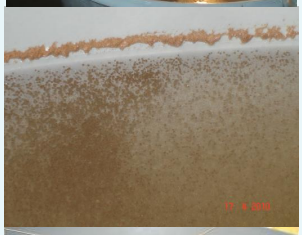
Feed and feeding larvae – *Artificial feed*

- Artificial feed (*Frippak, Lansy)*
- Particle size: 150-500um
- Fed from $Zoae_3$- Crab lets
- 1-3g/m^3 daily, 6 hr / time

CANTHO UNIVERSITY

5. Larval rearing

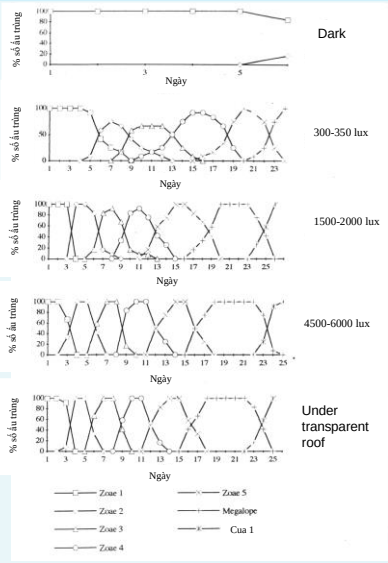
- **Water quality management**
  - Light: > 5000 lux, 12 light/12 dark
  - Temperature: 25-30°C
  - Salinity: 30-32‰ (Zoea)
    24-30‰ (Megalopa)
  - pH: 7,5-8,5
  - Amon: <1mg/L
  - Nitrite: <0,1 mg/L
  - Substrate:
    - Placed from Megalopa stage,
    - With nylon net, nylon bunch



CANTHO UNIVERSITY

5. Larval rearing

Effect of light intensity on development of larvae



CANTHO UNIVERSITY

5. Larval rearing

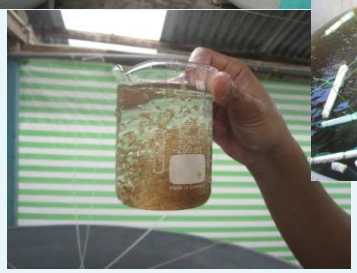
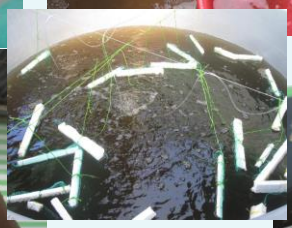
Water quality parameters in larval rearing

Water parameters in larval rearing	Ranges	Ref
Temperature (ºC)	26-30	Lâm Tâm Nguyên, 2010
	28-30,2	Lê Quốc Việt và Trần Ngọc Hải, 2015
	26,7-30,5	Trần Minh Nhứt và ctv, 2010
	28,5-30,4	Trần Ngọc Hải và Lê Quốc Việt, 2015
pH	8,24-8,37	Lê Quốc Việt và Trần Ngọc Hải, 2015
	8,0-8,5	Trần Ngọc Hải và Lê Quốc Việt, 2015
	8,0-8,5	Lý Văn Khánh và ctv, 2015
DO (mg/L)	5,26-5,47	Trần Minh Nhứt và ctv, 2010
Amon (mg/L)	0,2-1,4	Lâm Tâm Nguyên, 2010
	0,27-5,0	Lê Quốc Việt và Trần Ngọc Hải, 2015
	0,5-5,0	Trần Ngọc Hải và Lê Quốc Việt, 2015
	0,21-0,72	Trần Minh Nhứt và ctv, 2010
Nitrite (mg/L)	0,13-4,15	Lâm Tâm Nguyên, 2010
	0,2-4,7	Lê Quốc Việt và Trần Ngọc Hải, 2015
	0,1 – 0,45	Trần Ngọc Hải và Lê Quốc Việt, 2015
	0,02-0,37	Trần Minh Nhứt và ctv, 2010
Alkality (mg/L)	80-160	Lý Văn Khánh và ctv, 2015

CANTHO UNIVERSITY

5. Larval rearing




CANTHO UNIVERSITY

5. Larval rearing

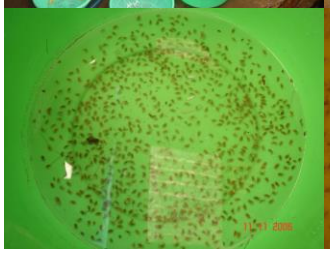
Probiotics

- 1-3mg/L, 2-3 days intervals
- If use probiotics, not use of antibiotic.


5. Larval rearing

Harvest

- At Crab-1, after 25- 30 days of culture
- Survival rate: 5-15%



5. Larval rearing

Transportation

Wet condition, 500-1000 crablets/tray of 20X 30 cm

	5. Larval rearing - summary
Rearing tanks	100 Liter –10m^3, composite or cement, open of recirculating
Rearing density	1 phase: 100-150 larvae/L, 2 phases:: 200-300 Zoea1/L, 25-50 Zoea5/L 3 phases: 200-300 Zoea1/L, 100-150 Zoea4/L, 25-50 Me/L
Feed	
Zoea1-Zoea2	Rotifer 20inds/ml + Algae 0.5 million cell/ml Umbrella Artemia (0.5-1 inds/ml; 3 hrs/time) (alone or with rotifer)
Zoea 3-Zoea4	Newly hatched Artemia 1-2 Nauplii/ml (6 hr/time, 5 timers/day), Artificial feed 1-2 g/m^3 (6hrs/time, 3 time/day) With or without algae
Zoea 5-Megalopa	Enriched Artemia, (2-3 inds/ml, 6hrs/time, 5times/day); Artificial feed: 2-3 g/m^3, (6 hrs/time, 3 times/day)
Water quality	25-30^{o}C, 25-33‰, pH: 7,5-8.5, NH_4< 1ppm; NO_2< 0.1ppm; Alkality: >100ppm
Light	> 6000-8000 lux, 12-24 hr/ day
Substrate	Nylon net, placed from Megalopa stage
Water exchage	Open or recirculating 200% daily
Culture duration	23-30 days
Survival rate	5-15% to C1 from Zoea1

CANTHO UNIVERSITY

5. Larval rearing

Province	Unit	2014	2015	2016
Bac Lieu				
- No. hatchery	Number	40	40	40
- Production of crablet	Million	-	-	500
Ca Mau				
- No. hatchery	Number	372	394	438
- Production of crablet	Million	618.4	802.6	935.8
Kien Giang				
- No. hatchery	Number	136	136	136
- Production of crablet	Million	167.2	172.4	157.5

CANTHO UNIVERSITY

5. Larval rearing

Training on seed production of mud crab at Can Tho University










CANTHO UNIVERSITY

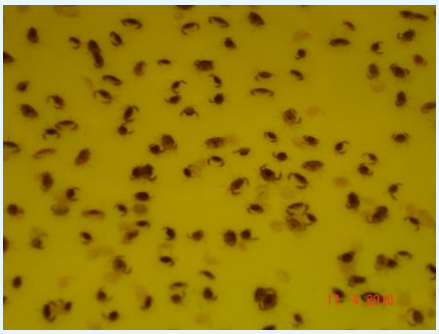
6

Crablet nursery



CANTHO UNIVERSITY

6. Crablet nursery



CANTHO UNIVERSITY

6. Crablet nursery

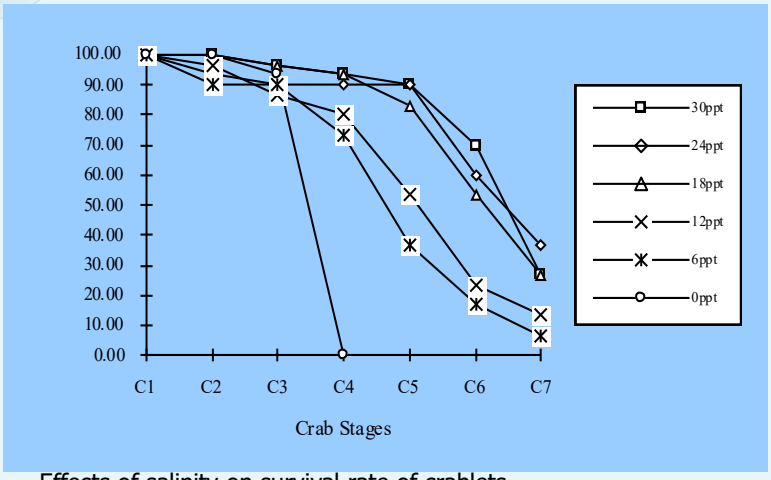
www.ctu.edu.vn

6. Crablet nursery

Characteristics	Management
Nursing facilities	Tanks, line earthen tanks or hapas, 15-20m^2; 20-40 tanks/hatchery
Stocking density	200-500 C_1/m^2; (or from Megalopa at 3 days old)
Salinity	15-25ppt
Water exchange	50-100% daily
Water level	20-50cm
Substrate	Nylon net, pipes, shell, fishing net
Feed	Shrimp, fish, mollusk, artemia biomass, pellet feed, (10% BL) , Acetes
Survival rate	70-80% after 1 week (3mm) 50-70% after 3 weeks (1cm)

6. Crablet nursery

CANTHO UNIVERSITY



Effects of salinity on survival rate of crablets

CANTHO UNIVERSITY

6. Crablet nursery

Growth and survival rate of crablets nursed with different feed types (Đức & Hải, 2010)

Treatments	Week 1	Week 2	Week 3	Week 4
Carapace width (cm)				
Pellet feed	3,54 ± 0,12^{ab}	4,10 ± 0,10^{a}	4,82 ± 0,16^{a}	5,71 ± 0,54^{a}
Shrimp	3,76 ± 0,05^{c}	4,59 ± 0,10^{b}	5,43 ± 0,32^{bc}	6,32 ± 0,24^{ab}
Fish	3,51 ± 0,15^{a}	4,43 ± 0,28^{b}	5,19 ± 0,28^{ab}	6,12 ± 0,07^{a}
Red worm	3,71 ± 0,07^{bc}	4,51 ± 0,17^{b}	5,64 ± 0,13^{c}	6,98 ± 0,59^{bc}
Mixed feed	3,83 ± 0,09^{c}	4,62 ± 0,14^{b}	6,22 ± 0,23^{d}	7,47 ± 0,45^{c}
Survival rate (%)				
Pellet feed	95,24 ± 0,82	82,38 ± 5,02	62,38 ± 2,97	42,86 ± 7,14
Shrimp	88,10 ± 6,44	80,00 ± 7,56	62,86 ± 6,55	44,29 ± 5,15
Fish	90,48 ± 6,75	82,38 ± 9,51	64,29 ± 13,63	41,90 ± 7,33
Red worm	93,81 ± 3,60	83,33 ± 10,14	73,33 ± 13,58	43,33 ± 5,77
Mixed feed	86,67 ± 5,77	82,38 ± 6,44	69,52 ± 7,19	61,90 ± 14,09

CANTHO UNIVERSITY

6. Crablet nursery

Growth and survival rate of crablets nursed with different substrates (Đức & Hải, 2010)

Treatments	Week 1	Week 2	Week 3	Week 4
Carapace width (mm)				
Nylon bunch	4,39 ± 0,21	5,10 ± 0,13^{b}	5,89 ± 0,28	8,14 ± 0,25
Plastic pipes	4,22 ± 0,13	5,14 ± 0,12^{bc}	6,19 ± 0,38	7,36 ± 0,17
Net	3,81 ± 0,12	4,86 ± 0,17^{a}	6,35 ± 0,61	7,75 ± 0,89
Seaweed	4,15 ± 0,22	5,37 ± 0,07^{c}	6,57 ± 0,21	8,14 ± 0,76
Survival rates (%)				
Nylon bunch	77,92 ± 4,02	69,58 ± 1,91^{ab}	61,25 ± 7,60	52,50 ± 6,61^{c}
Plastic pipes	80,00 ± 3,75	63,75 ± 3,31^{a}	45,00 ± 9,01	34,17 ± 5,20^{b}
Net	86,67 ± 5,77	70,83 ± 5,91^{ab}	39,17 ± 8,78	17,08 ± 4,02^{a}
Seaweed	82,92 ± 4,02	76,67 ± 8,32^{b}	39,17 ± 18,76	26,25 ±11,92^{ab}

CANTHO UNIVERSITY

6. Crablet nursery

Totally 460 stations in the MD
Number of station surveyed: 35

Nursing station	Unit	Mean ± STD	Min-Max
Total area of nursing station	m^2/household	192 ± 152	24 - 720
Total number of nuring tanks	Tanks/ household	19.7 ± 12.8	2 - 60
Number of cycle / year	Cyle/year	22.9 ± 3.6	10 - 26
Production per cycle	Crablets/household/cycle	41,600 ± 26,698	4,000 – 120,000
Production per year	Crablets/household/yr	986,000 ± 662,526	54,000 – 2,880,000

CANTHO UNIVERSITY

7. Mud crab farming

www.ctu.edu.vn

CANTHO UNIVERSITY

7. Mud crab farming

Integrated farming systems

- Systems: Integrated mangrove-shrimp; improve extensive shrimp farming systems, rice- shrimp farming systems
- Extensive management
- Stocking: shrimp (1-4 ind/m^2), crabs (0.05-0.1 ind/m^2)
- Water exchange: based on tidal
- No feeding, no chemical applied
- Harvesting shrimp: 2 times/month
- Harvesting crabs: after 2 months, with traps
- Production: 100-150kg/ha/year





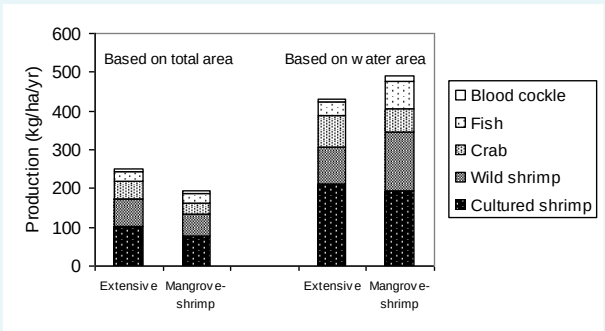


www.ctu.edu.vn

CANTHO UNIVERSITY

7. Mud crab farming

Integrated Mangrove – shrimp farming systems





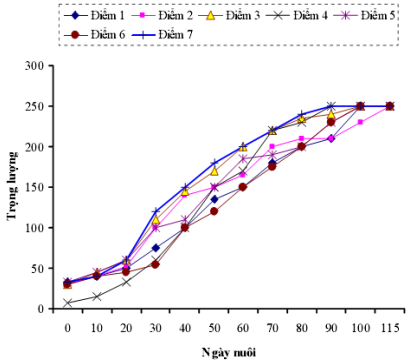

www.ctu

CANTHO UNIVERSITY

7. Mud crab farming

Monoculture in ponds

- Pond area: 2000-3000m^2
- Stocking density: 0,7 inds/m^2
- Feed: Trash fish, 5-7%/day
- Production: 1-1,3 tons/crop



Hình 4 Tăng trưởng của cua ở các điểm nuôi

CANTHO UNIVERSITY

7. Mud crab farming

Monoculture in ponds

Ponds	FCR	SR (%)	Production (kg)	Yield (kg/ha)
1	3,3	68,5	240	1.200
2	3,38	46,4	325	810
3	2,9	76,2	534	1.330
4	4,32	71,4	250	1.250
5	3,9	66,9	293	1.170
6	3,9	69,2	303	1.210
7	6	53	220	730

CANTHO UNIVERSITY

7. Mud crab farming

- **Fattening**
  - Pond: 200-300m^2
  - Cages: 3x2x1m or
    0.3 x 0.3 x0.3m;
  - Tanks: recirculating tank system
  - Buckets placed in ponds

CANTHO UNIVERSITY

7. Mud crab farming

- **Fattening**
  - Seeds: >200g, female, hardshell
  - Stocking density: 0.5-1 inds/m^2 pond; 20kg/ large cage, 1 crab /small appartment; 20-30 crabs/m^2 tank
  - Feed: trashfish 5% BW/day
  - Salinity: 28-30%o.
  - Harvest: partially after 2 weeks, and totally after 1 month

CANTHO UNIVERSITY

7. Mud crab farming

Quality improvement of female crabs after fattening

Parameters	Feed			
	Tilapia	Cockle	Shrimps	Sesamid crab
Immature female crab before fattening				
BW (g)	322,5±39,6	245,8±45,0	260,0±31,22	296,7±60,54
FMI	1,14±0,03	1,12±0,02	1,12±0,02	1,12±0,02
GSI	1,30±0,32	1,30±0,32	1,30±0,32	1,30±0,32
Full mature crab after fattening				
BW (g)	335,8±50,02	274,2±48,50	276,7±27,65	329,2±3,85
SGR (%/ngày)	0,32±0,15	0,54±0,18	0,51±0,15	0,45±0,14
SR (%)	75,00±25,00	100,00	91,67±14,43	91,67±14,43
GSI (%)	7,0±0,49	9,41±1,41	6,94±1,49	7,82±1,87

CANTHO UNIVERSITY

7. Mud crab farming

Biochemical composition of female crabs after fattening

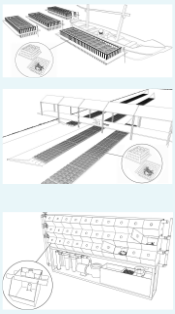
Parameters	Before fattening	After afttening			
		Tilapia	Cockle	Shrimps	Sesamid crab
Ovary					
Lipid (%)	8,08 ± 0,82	10,86 ± 0,52	11,32 ± 0,70	10,10 ± 0,13	10,89 ± 0,20
Protein (%)	81,99 ± 3,3	78,92 ± 7,72	80,82 ± 1,05	82,98 ± 1,93	80,29 ± 0,93
Ash (%)	1,64 ± 0,08	1,49 ± 0,08	1,78 ± 0,28	1,62 ± 0,25	1,66 ± 0,00
Meat					
Lipid (%)	5,93 ± 0,30	6,24 ± 0,63	7,25 ± 0,10	7,39 ± 0,16	7,40 ± 0,28
Protein (%)	80,78 ± 1,50	87,29 ± 3,52	89,40 ± 1,15	87,33 ± 0,42	85,63 ± 1,39
Ash (%)	1,87 ± 0,15	1,79 ± 0,23	1,96 ± 0,09	2,23 ± 0,22	2,29 ± 0,11

www.ctu.edu.vn

CANTHO UNIVERSITY

7. Mud crab farming

- **Soft-shell production**
  - Pond: 100m^2 (5 x20m)
  - Small cages: 0.3 x0.3 x 0.2m
  - Tanks: Recirculating systems

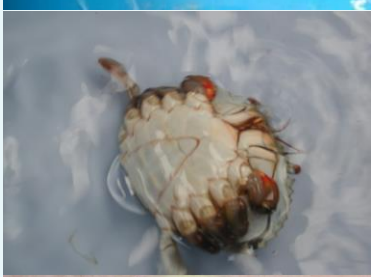


Tavares *và ctv*, 2017

CANTHO UNIVERSITY

7. Mud crab farming

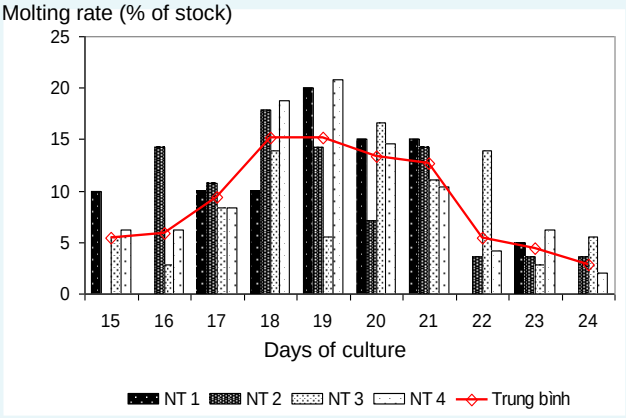
- **Soft-shell crab production**
  - Seed: 50-100g, hard-shell
  - Stocking density: 20 inds/m^2 ponds, 1 inds/small cage, 20-50 ind/m^2 tank
  - Feed: trashfeed (5% BW)
  - Harvest: daily after 15 days



CANTHO UNIVERSITY

7. Mud crab farming

Molting rate (% of stock)



CANTHO UNIVERSITY

7. Mud crab farming

Biochemical composition of crab meat (hard shell and soft shell)

Treatments	Ash (%)	Protein (%)	Lipid (%)
Crab before molting	7,04 ± 0,37	82,72 ± 1,10	1,94 ± 0,24
Soft shell crabs			
Treatmen 1 (Feed of 25 % Protein)	15,47 ± 0,45	59,12 ± 0,34	3,52 ± 0,58
Treatmen 1 (Feed of 35 % Protein)	16,05 ± 0,04	57,02 ± 1,75	8,21 ± 0,27
Treatmen 1 (Feed of 45 % Protein)	16,71 ± 0,05	60,19 ± 0,35	7,57 ± 0,63
Trash fish	10,41± 0,19	65,95 ± 1,67	9,45 ± 0,02

www.ctu.edu.vn

CANTHO UNIVERSITY

7. Mud crab farming






www.ctu.edu.vn

8. Crab diseases


Brown and black spot


Falling egg


Moribund


Molting entrapment


Crab die


Black gill


Banarcle on gills


Fouling organism on eggs

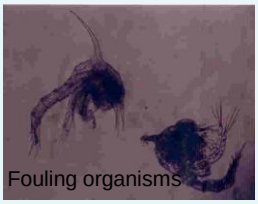
www.ctu.edu.vn

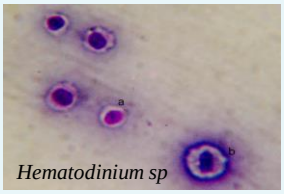
CANTHO UNIVERSITY

8. Crab diseases


Octolasmic sp on gill


Octolasmic sp


Fouling organisms


Hematodinium sp


Fouling organisms


Fouling organisms

Fouling organisms: *Leucothrix sp, Largenidium sp, Zoothanium sp., Epistylis sp., Vorticella sp., Acineta sp., Nitzchia spp, Nematoda*

CANTHO UNIVERSITY

Thank you!