Current Status of *Eriocheir sinensis* Larviculture in China

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World Distribution

Chinese Mitten Crab
Eriocheir sinensis

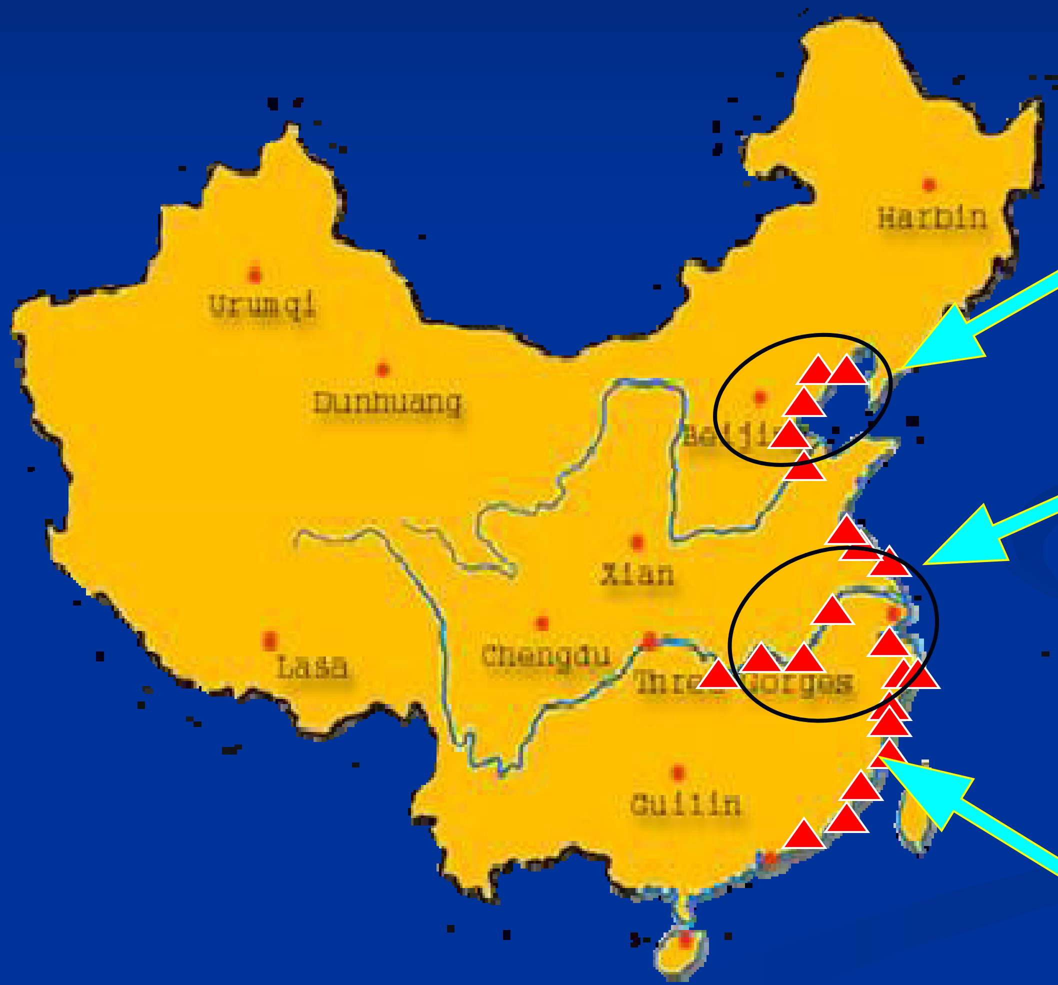
- Carapace 8-10 cm;
  BW 100-200 g

- Only being cultured in China
- Only favored by Chinese people

Crabs identified with laser tag

Competition for the largest size and best quality

Geographical Distribution in China



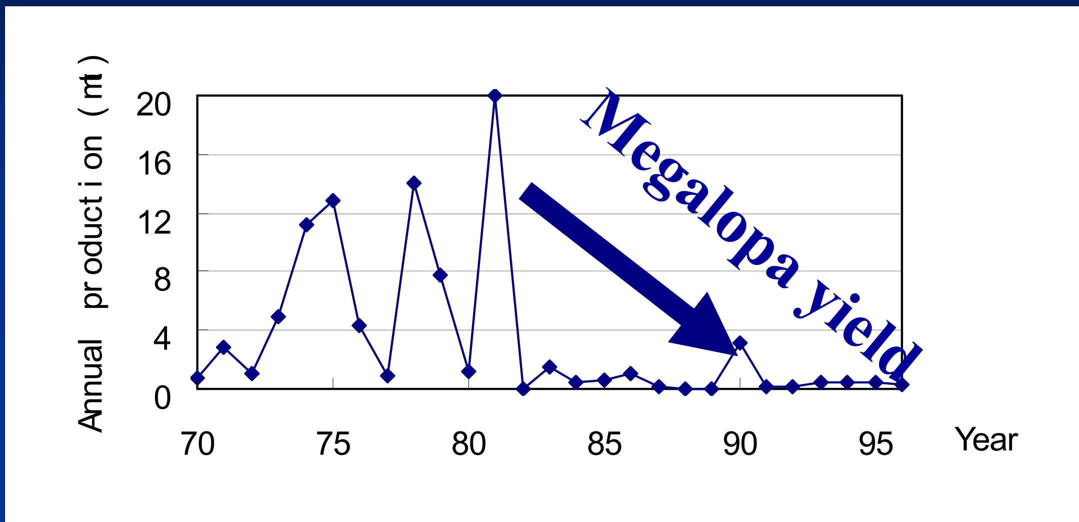
Liaohe River population

Yangtze River population

- *Fastest growth*
- *Biggest body size*
- *Most valuable*

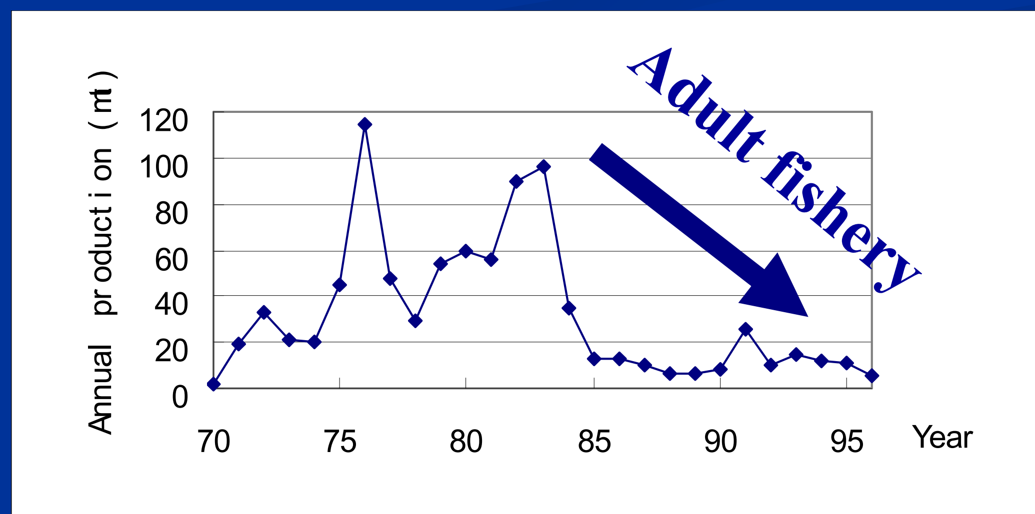
Ou River population

Natural Resources in China

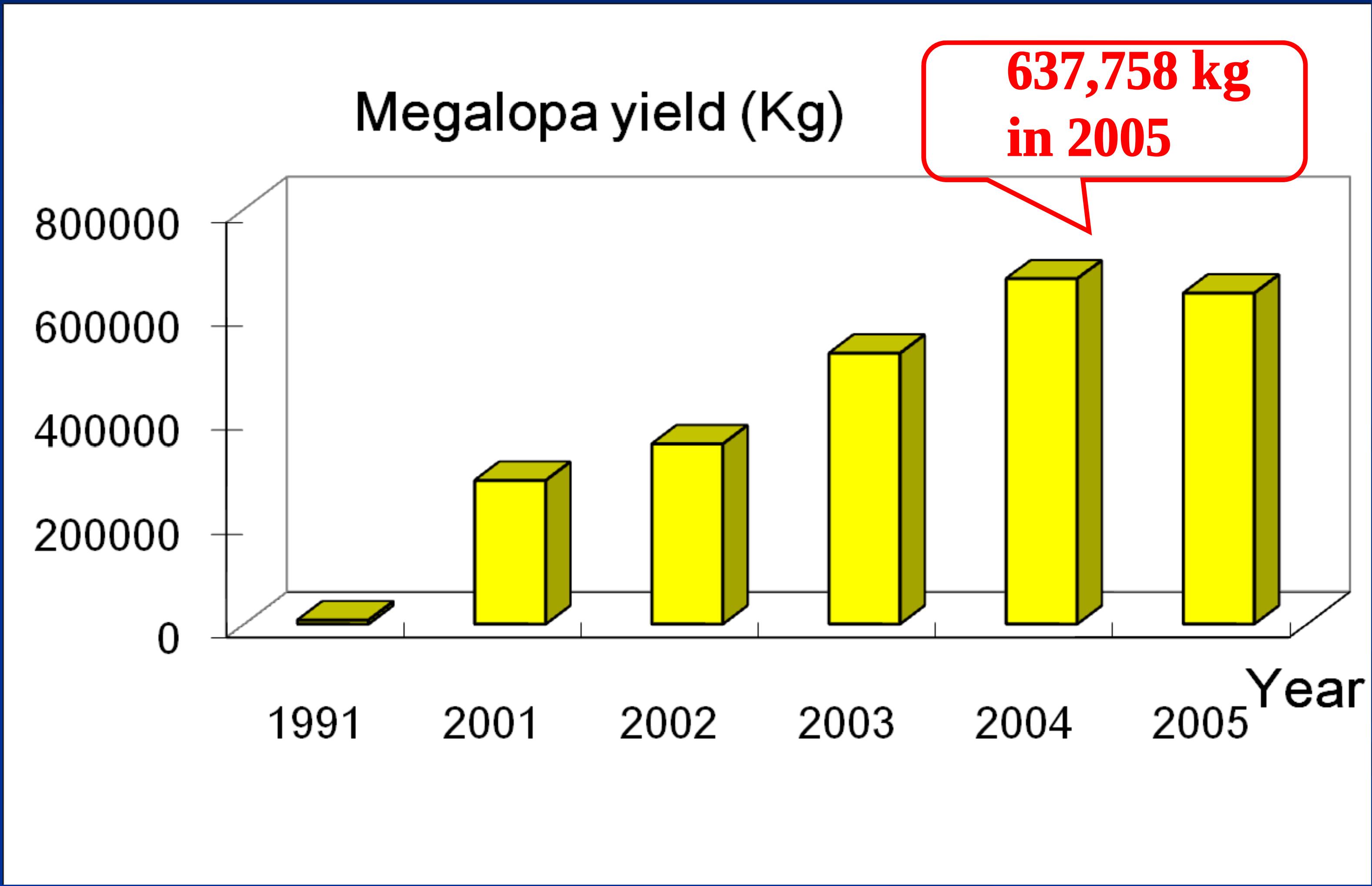


Overfishing

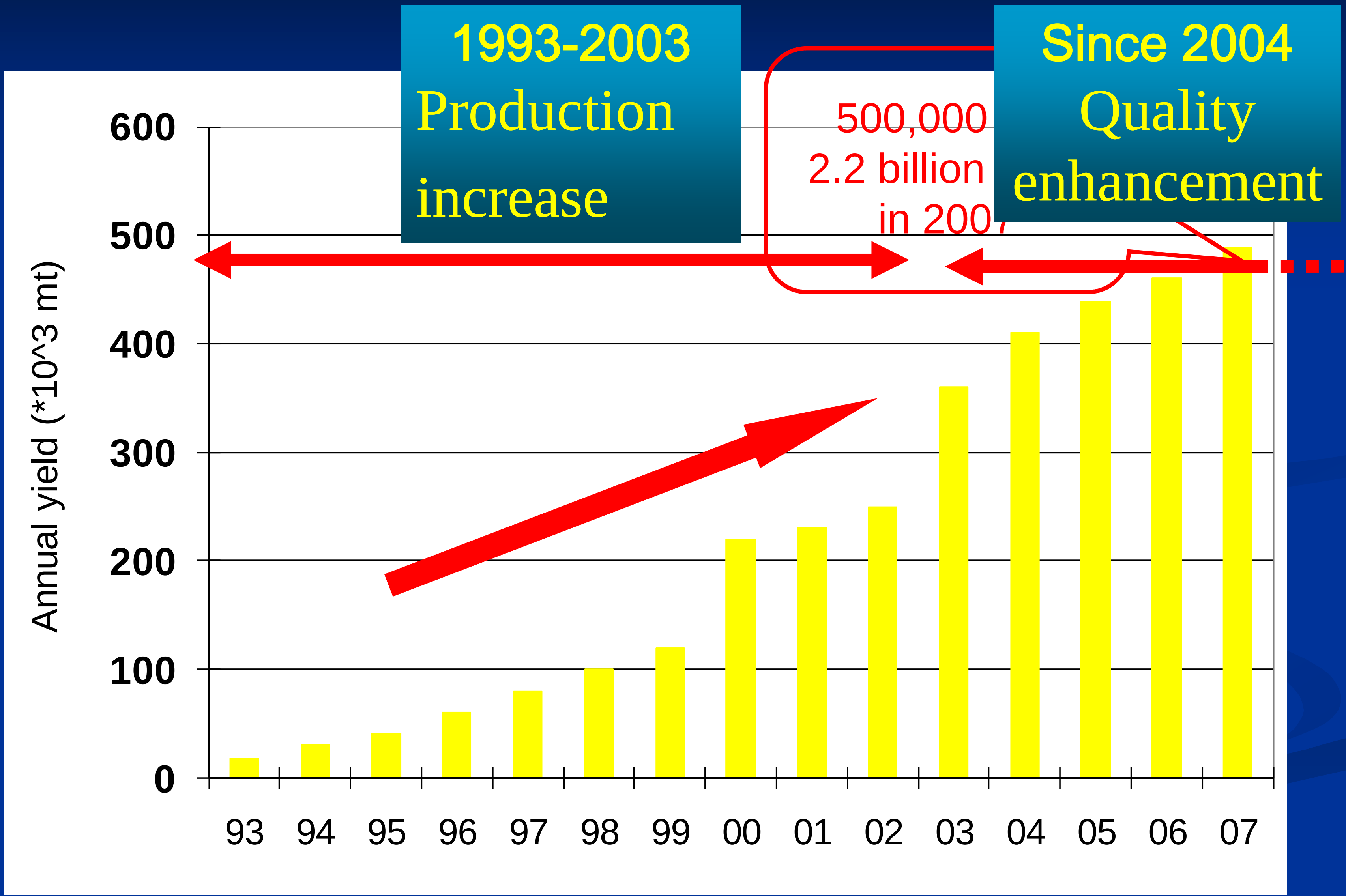
Dam construction



Megalopa Production



Aquaculture Production



Aquaculture Operation

Broodstock management (3-4 months)

Broodstock selection (wild or farmed)

↓

Mating(13-15°C)

↓

Berried female maintenance over winter

↓ ambient temp.

Fertilized eggs incubation

↓ 15-20°C

Larval rearing (20-30 days)

Z1

↓ 21-24°C

Z5

↓

Megalopa

↓ temperature↓ salinity ↓

Growout (1 or 2 years)

Juvenile crab

↓

Yellow crab

↓

Green crab

↓

Market

Larval Rearing Techniques

Indoor Intensive Larviculture

Outdoor Semi-Extensive Larviculture

Outdoor “Ecological” Larviculture

E. sinensis Larviculture Models

	Indoor Intensive Larviculture	Outdoor Semi-intensive Larviculture	Outdoor "Ecological" Larviculture
Ponds	concrete	earthen	earthen
Size (m^2)	12-30	400-700	10,000-15,000
Stocking density of Z1(ind/m^3)	200,000-500,000	20,000-30,000	< 10,000
Diets for Z1-Z5	Microalgae, egg yolk, *Artemia* nauplii, frozen rotifer and copepod	Microalgae, soybean milk, *Artemia* nauplii	Microalgae, rotifer
Diet for Z5-M	*Artemia* nauplii, frozen adult *Artemia* and copepod	*Artemia* nauplii, frozen adult *Artemia* and copepod	Live rotifer, frozen adult *Artemia* and copepod
Antibiotics	Yes (occasionally)	No	No

E. sinensis Larviculture Models

	Indoor Intensive Larviculture	Outdoor Semi-intensive Larviculture	Outdoor "Ecological" Larvicutlure
Probiotics	Only in Z1-Z2	Yes	Yes (occasional)
Megalopa yield (g/m^3)	150-500	15-30	1-7.5
Survival to megalop (%)	10-15	5-10	2-4
Cost (RMB/kg megalop)	600-1200	500-1000	300-500
Duration of larviculture	22-24 days	28-30 days	28-30 days
Water temperature (°C)	18-24	10-23	10-23

Outdoor Extensive Larviculture

Scientific Research on Mitten Crab Hatchery Techniques

(Shanghai Ocean University, China / Gent University, Belgium)

Our publications

- Sui L.Y., Fumin Zhang, Xiaomei Wang, Peter Bossier, Patrick Sorgeloos and Bernd Hanfling. (2009). Genetic diversity and population structure of the Chinese mitten crab *Eriocheir sinensis* in its native range. Marine Biology. DOI: 10.1007/s00227-009-1193-2.

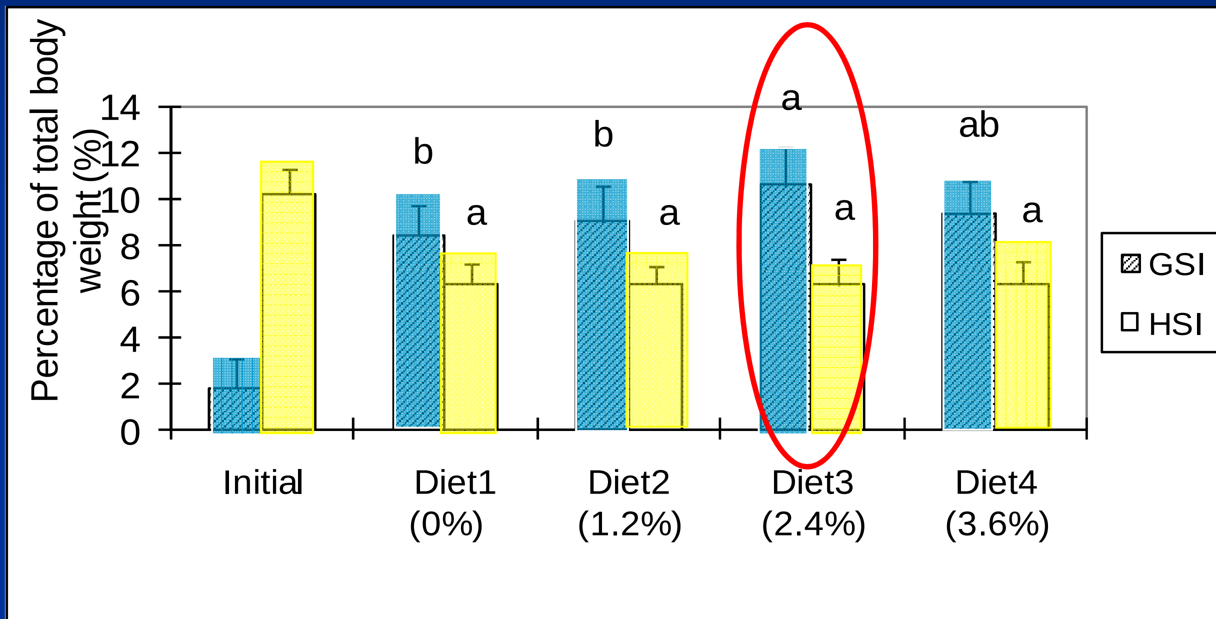
- Sui L.Y., Wille M., Wu Xugan, Cheng Y.X. and Sorgeloos P. (2009). Ingestion of *Artemia* nauplii by Chinese mitten crab *Eriocheir sinensis* zoea larvae. Aquaculture Research, 40 , 950-954.

- Sui L.Y., Wille M., Wu Xugan, Cheng Y.X. and Sorgeloos P. (2008). Effect of feeding scheme and prey density on survival and development of Chinese mitten crab *Eriocheir sinensis* zoea larvae. Aquaculture Research 39, 568-576.

- Sui L.Y., et al., Effect of **dietary soybean lecithin** on reproductive performance of Chinese mitten crab *Eriocheir sinensis* (H. Milne-Edwards) broodstock. Aquaculture International, Aquaculture International, 2008, 17: 45-56.

- Sui L.Y., Wille M., Cheng Y.X. and Sorgeloos P. (2007). The effect of dietary n-3 HUFA levels and DHA/EPA ratios on growth, survival and osmotic stress tolerance of Chinese mitten crab *Eriocheir sinensis* larvae. Aquaculture 273, 139-150.
- Wu et al., Reproductive performance and offspring quality of Chinese mitten crab, *Eriocheir sinensis*, females fed an **optimized formulated diet and the razor clam**, *Sinonovacula constricta.* Aquaculture research, 2009, 40: doi:10.1111/j.1365-2109.2008.02121.x
- Wu et al., Effect of **dietary supplementation of phospholipid and highly unsaturated fatty acids** on reproductive performance and offspring quality of the Chinese mitten crab (*Eriocheir sinensis*) broodstock. Aquaculture, 2007, 273: 602-613.
- Wu et al., Effect of enriching broodstock on reproductive performance and zoea I quality of *Eriocheir sinensis* , Journal of Fisheries of China, 2007, 31: 842-850.

Effect of Dietary PL on GSI/HSI During Ovary Maturation (after 3 months feeding)



✓Significant lipid mobilization from hepatopancreas to ovary

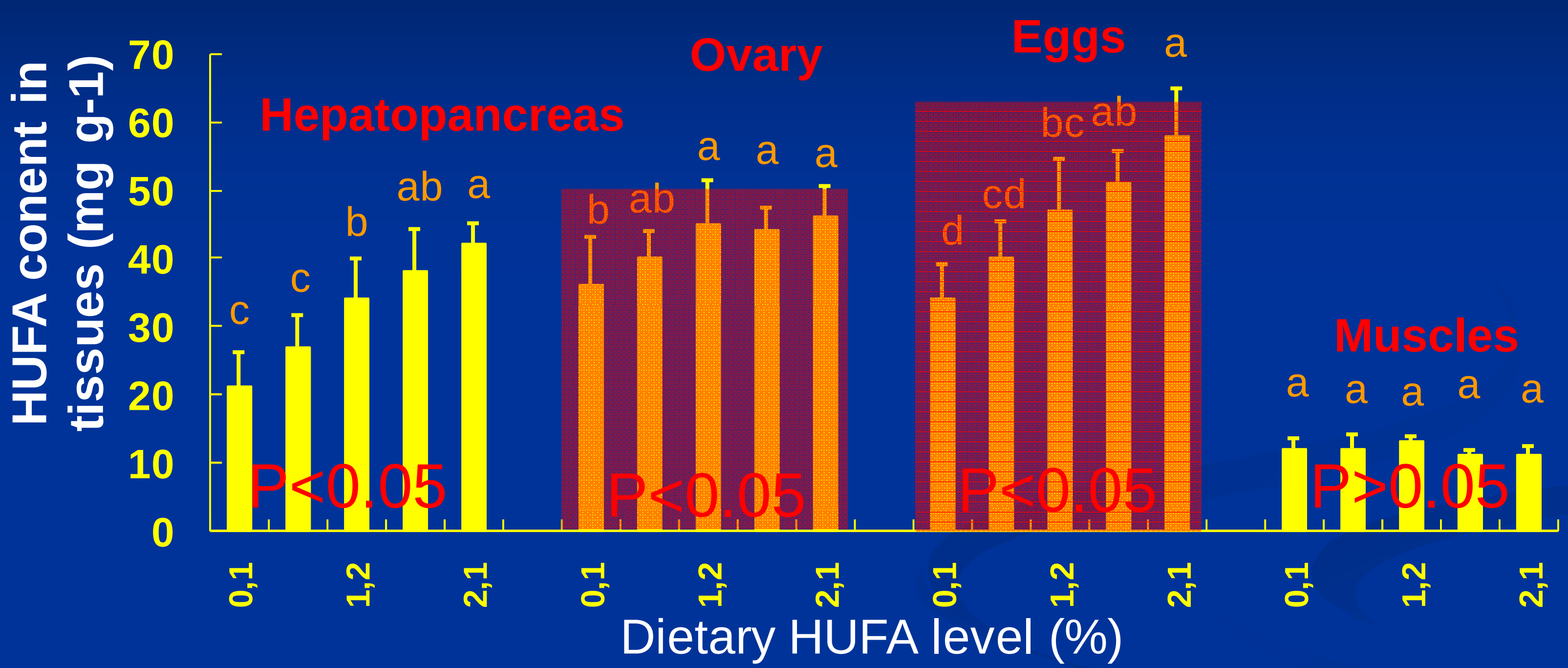
✓ Higher dietary PL significantly improve ovary maturation

Effect of PL on Reproductive Performance

	Diet 1 (0%PL)	Diet 2 (1.2%PL)	Diet 3 (2.4%PL)	Diet 4 (3.6%PL)
Spawning rate (%)	81	81	92	95
No. of eggs / female ($*10^4$)	30.8 **b**	33.9 **b**	39.4 **ab**	41.1 **a**
Fecundity (No. of eggs / g female)	2957 **c**	3312 **bc**	3825 **ab**	4106 **a**
Egg diameter (µm)	351	343	345	342
Hatching rate (%)	54	55	51	50

✓ Egg production and fecundity increase significantly with increasing dietary PL

Effect of dietary HUFA on the HUFA Content in Tissues



✓Significant correlation between dietary HUFA content and HUFA content in hepatopancreas, ovary and eggs

✓Relatively higher HUFA content in ovary and eggs, indicates certain HUFA requirement during ovary maturation

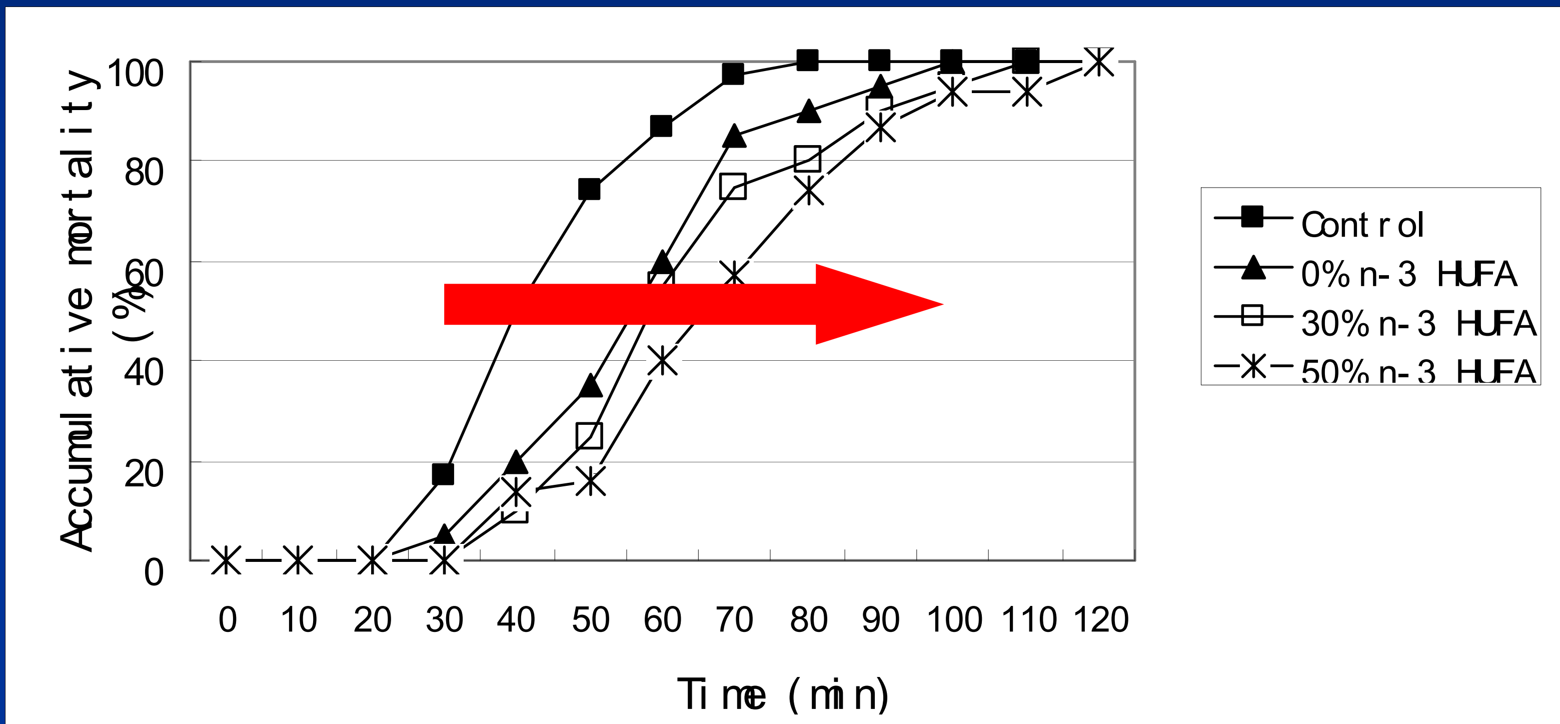
Effect of Dietary n-3 HUFA on Larval Growth and Survival

Treatments	Larval stage index (LSI)	dry BW (µg)	Survival (%)	Cumulative stress index (CSI)
ICES 0/-	5.83 [bc]	957 [b]	20.0 [a]	69 [b]
ICES 30/0.6	5.92 [ab]	1203 [a]	22.0 [a]	62 [ab]
ICES 50/0.6	5.99 [a]	1203 [a]	18.2 [a]	57 [a]
Control	5.74 [c]	973 [b]	24.7 [a]	85 [c]

- ✓ n-3 HUFA significantly improved LSI, BW and CSI, but did not affect survival
- ✓ Total HUFA level of 17 to 18 mg g^{-1} dw in rotifers and *Artemia* is optimum for larvae growth and survival

Cumulative Mortality of Megalopa

(transferred from 20 to 60 g L^{-1})



✓ Osmotic tolerance of megalopa significantly improved with increasing dietary n-3 HUFA levels

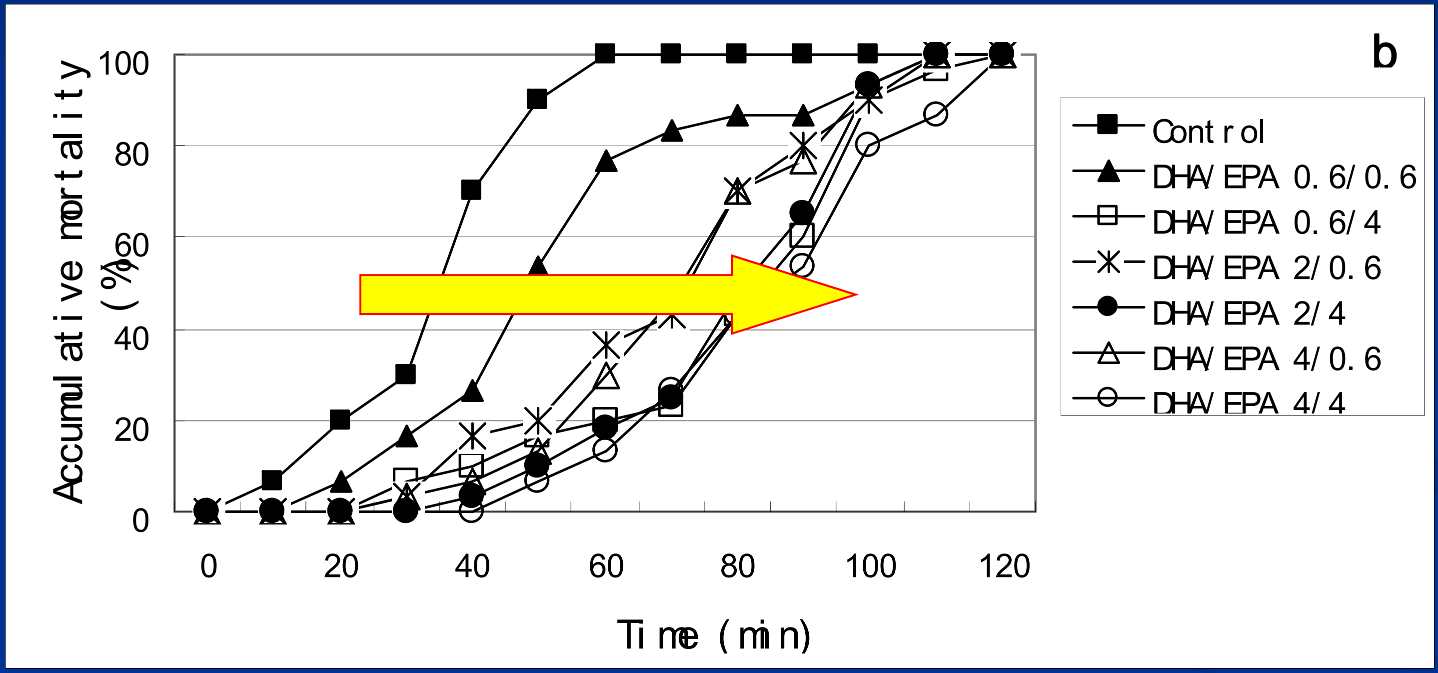
Effect of Dietary DHA/EPA ratio on Larval Growth and Survival

Treatment (Rotifers / *Artemia*)	LSI	Dry BW (ug)	Survival (%)
0.6 / 0.6	5.93 [a]	487 [bc]	52.3 [b]
0.6 / 4	5.99 [a]	563 [ab]	61.9 [a]
2 / 0.6	5.93 [a]	533 [ab]	67.5 [a]
2 / 4	5.94 [a]	553 [ab]	65.0 [a]
4 / 0.6	5.94 [a]	577 [ab]	65.2 [a]
4 / 4	5.93 [a]	613 [a]	66.5 [a]
Control	5.80 [b]	423 [c]	50.0 [b]

- ✓Larvae continuously receiving diets with lower DHA/EPA ratio had significantly lower LSI, survival and BW
- ✓DHA/EPA ratio of 1.2 and 0.3 in rotifers and *Artemia* are optimal for larvae growth and survival

Cumulative Mortality of Z5

(transferred from 20 to 50 g L^{-1})

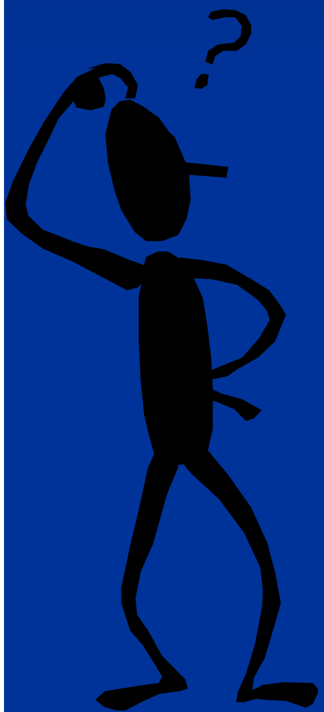


✓ Osmotic tolerance of Z5 significantly improved with increasing dietary DHA/EPA ratio

Feeding Strategy of Zoeal Larvae

- Rotifers are ideal food for early larval stages (Z1/Z2), *Artemia* should be introduced from Z3/Z4 onwards
- Optimal rotifer feeding density for Z1 and Z2: 15 and 20 rotifers/mL with initial Z1 stocking density of 200 ind./mL
- Optimal *Artemia* density for Z3, Z4 and Z5: 3, 5 and 8/mL with initial Z3 stocking density of 150 ind./mL

Future Perspectives



- Nutritional enhancement of broodstock through formulated dry diets
- Formulated dry diets for zoeal larvae
- Indoor intensive hatchery technique improvement

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