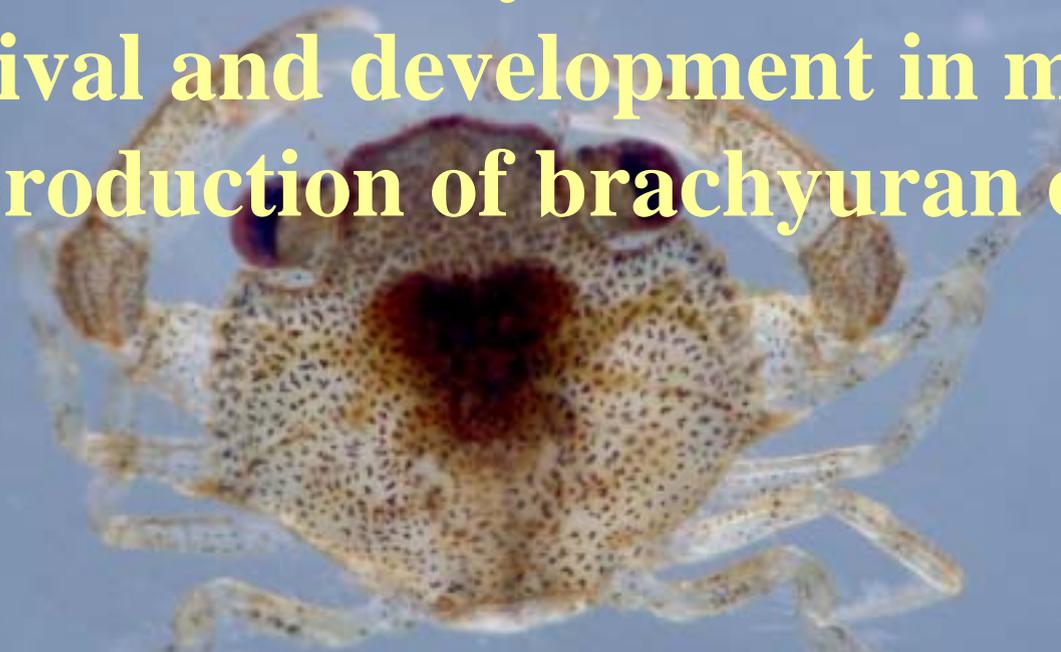


Nutritional significance of n-3 highly unsaturated fatty acids for larval survival and development in mass seed production of brachyuran crabs



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Target species



Swimming crab

Portunus trituberculatus



Mud crab

Scylla serrata



Mud crab

Scylla paramamosain



Snow crab

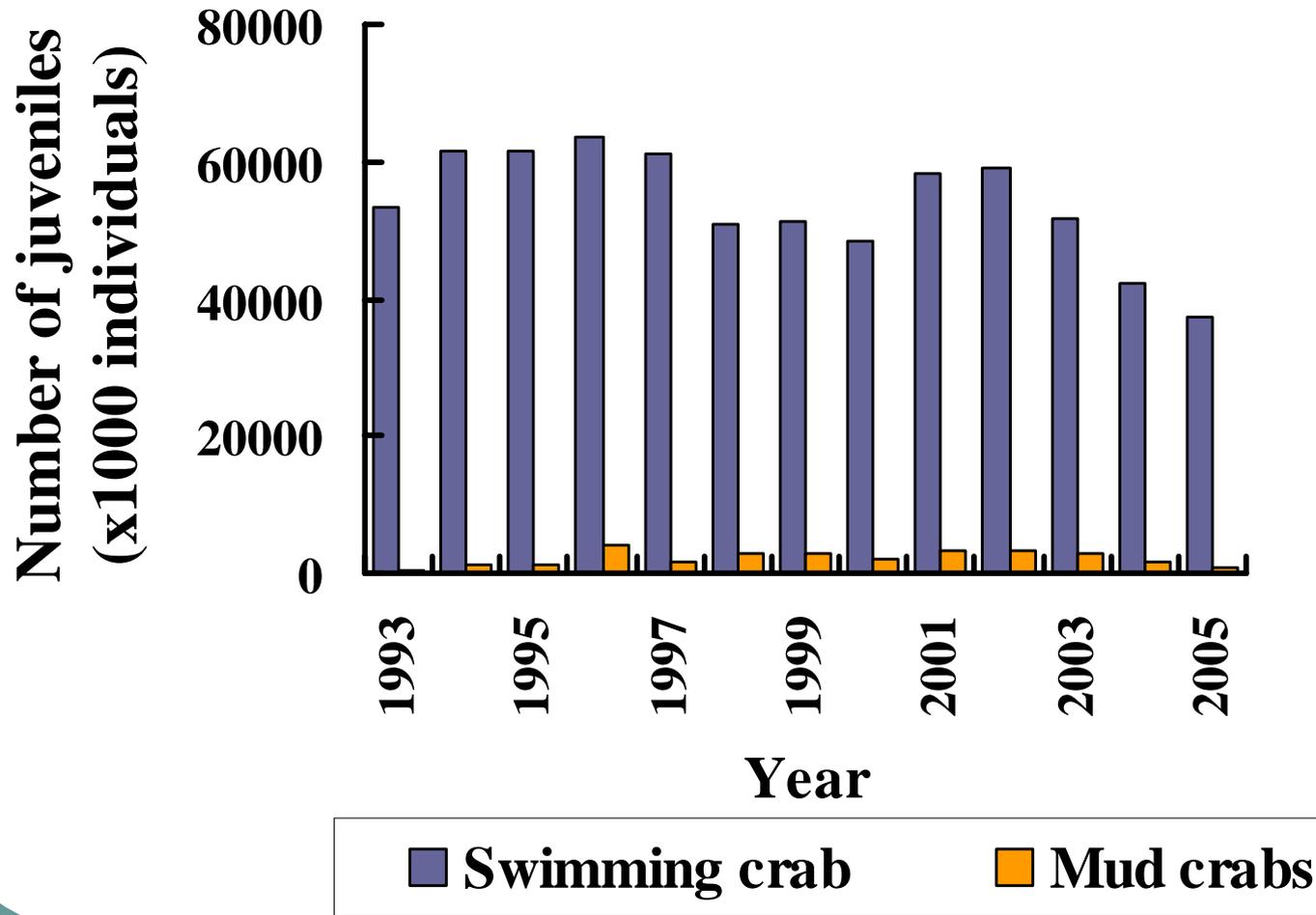
Chionoecetes opilio



Horsehair crab

Erimacrus isenbeckii

Annual production of juvenile swimming crab and mud crabs in Japan 1



Annual production of juvenile swimming crab and mud crabs in Japan 2

- **Hatchery technologies have been developed for these warm water species.**
- **Larval mass mortality has frequently occurred during the seed production process, and reliable techniques are needed to produce a large number of juveniles.**
- **Large-scale seed production techniques have not been developed for snow crab and horsehair crab.**

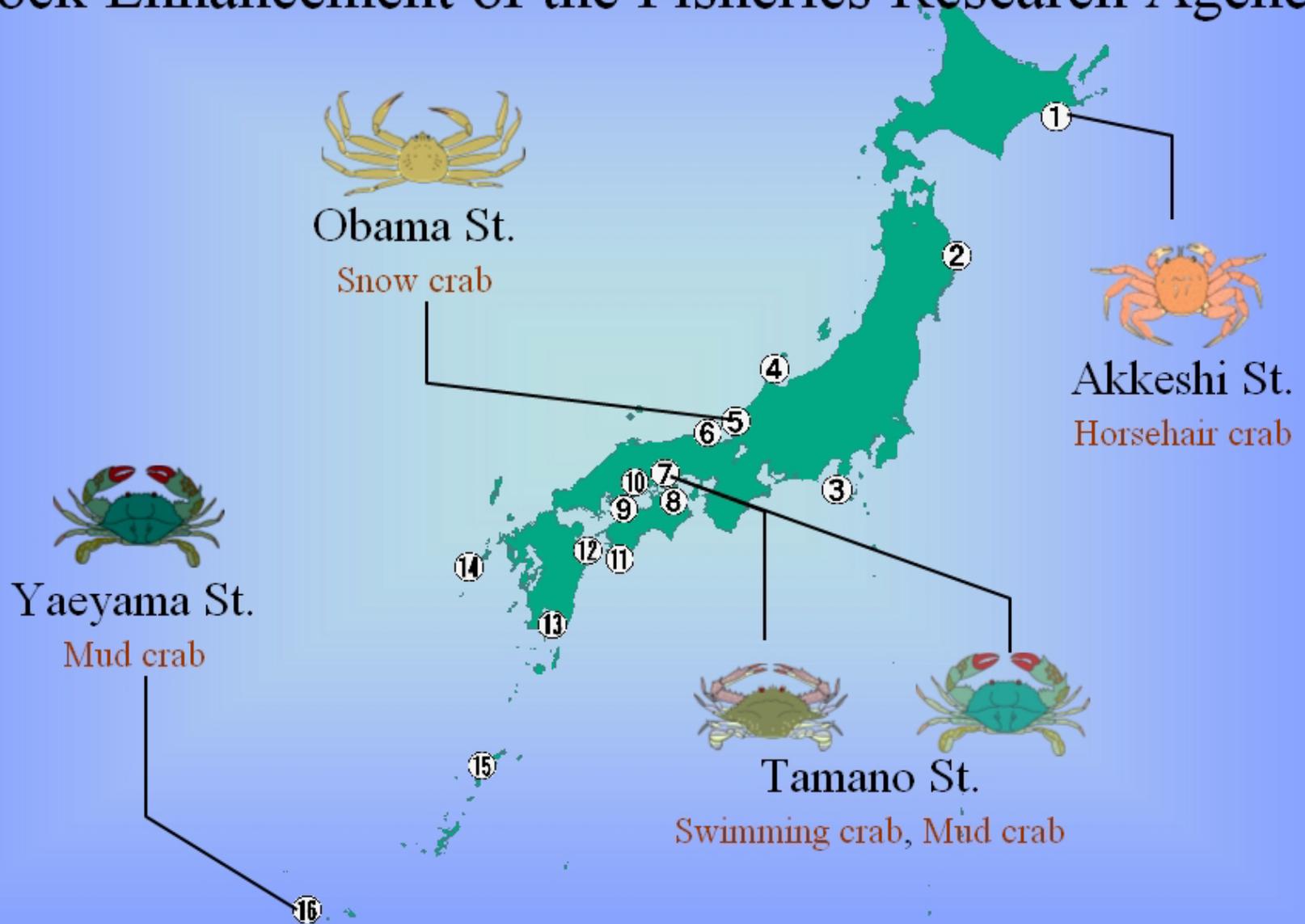
Background of our research

- **n-3HUFA (EPA, DHA) are essential fatty acids for marine fishes.**
- **n-3HUFA affect larval survival, as well as growth and stress tolerance of marine fish larvae and juveniles.**
- **Little research had been done on the effect of n-3HUFA on larval brachyuran crabs**
- **Since the early 1990s, we have studied this issue in order to develop and improve mass seed production technologies for brachyuran crabs, and we have revealed the significance of dietary n-3HUFA for our target species.**

Presentation topics

- **Results of larval rearing experiments which we examined the n-3HUFA requirement of swimming crab and mud crab larvae.**
- **Unbelievable advanced morphogenesis of the mud crab larvae affected by dietary n-3HUFA.**
 - **Important insights that helped us to evaluate the results of rearing experiments of these crabs**
- **Experiments on the combined effects of environmental factors (salinity) and dietary n-3HUFA on survival and development of larvae of the mud crab.**
- **Importance of dietary n-3HUFA in improving the survival rates of the snow crab larvae.**

Location of the National Centers for Stock Enhancement of the Fisheries Research Agency



Rearing experiments

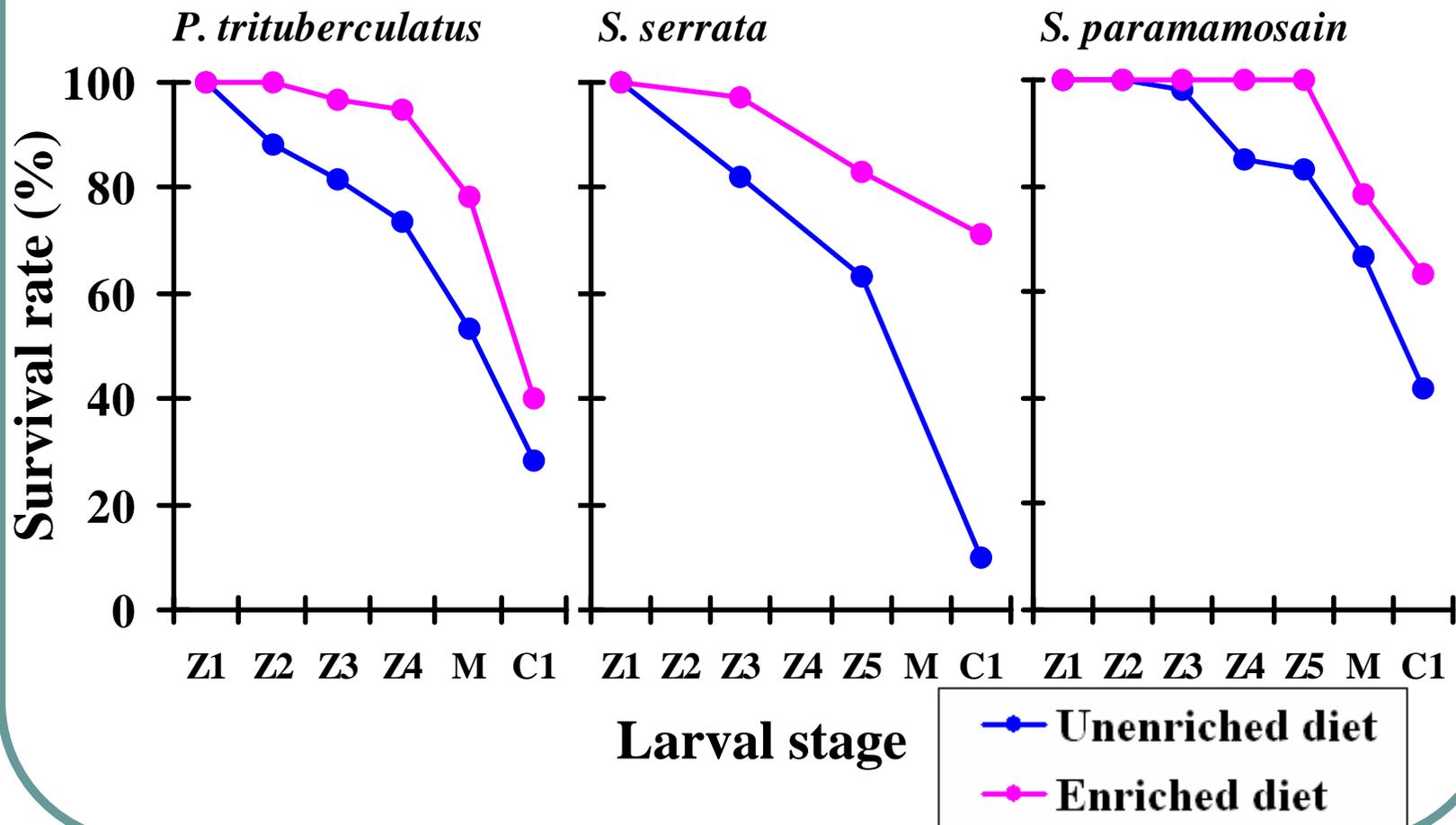
Small vessels
1-2 L beakers



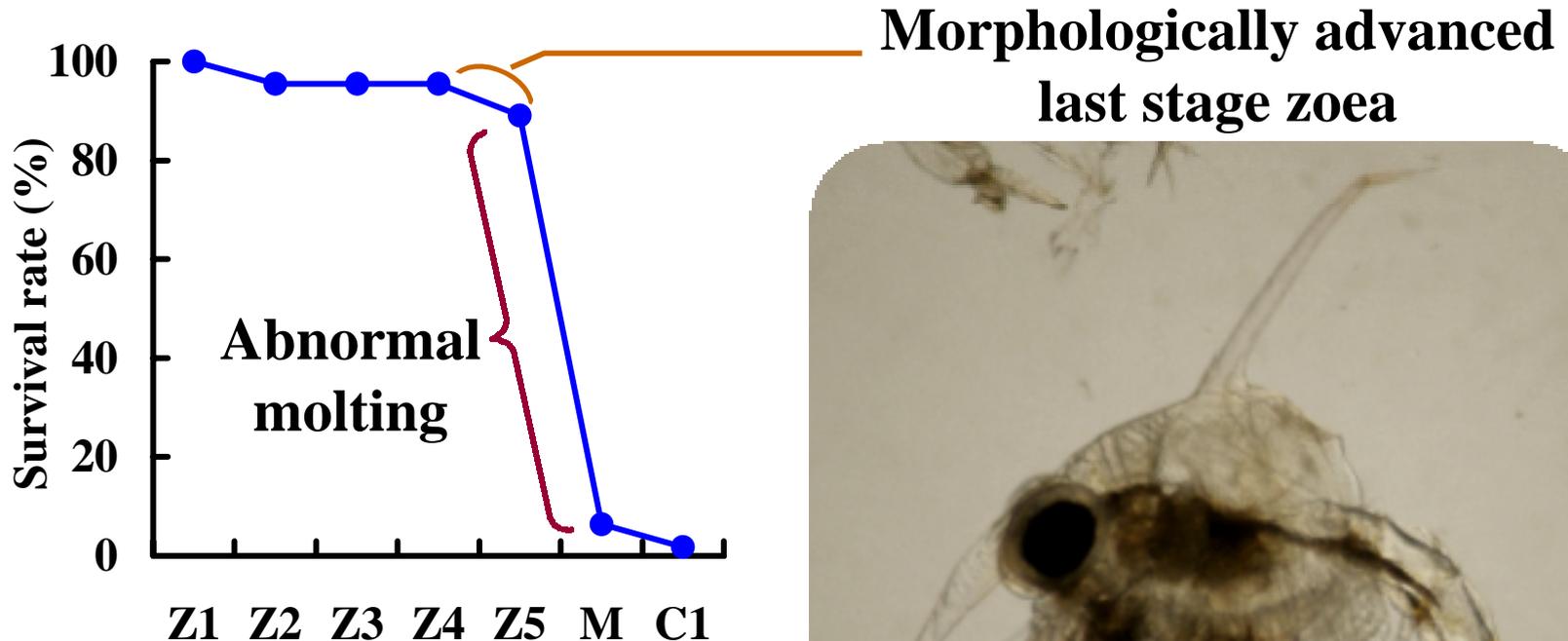
Large tanks
20-200 kL



Effect of dietary n-3HUFA on portunid crab larvae in small rearing vessels

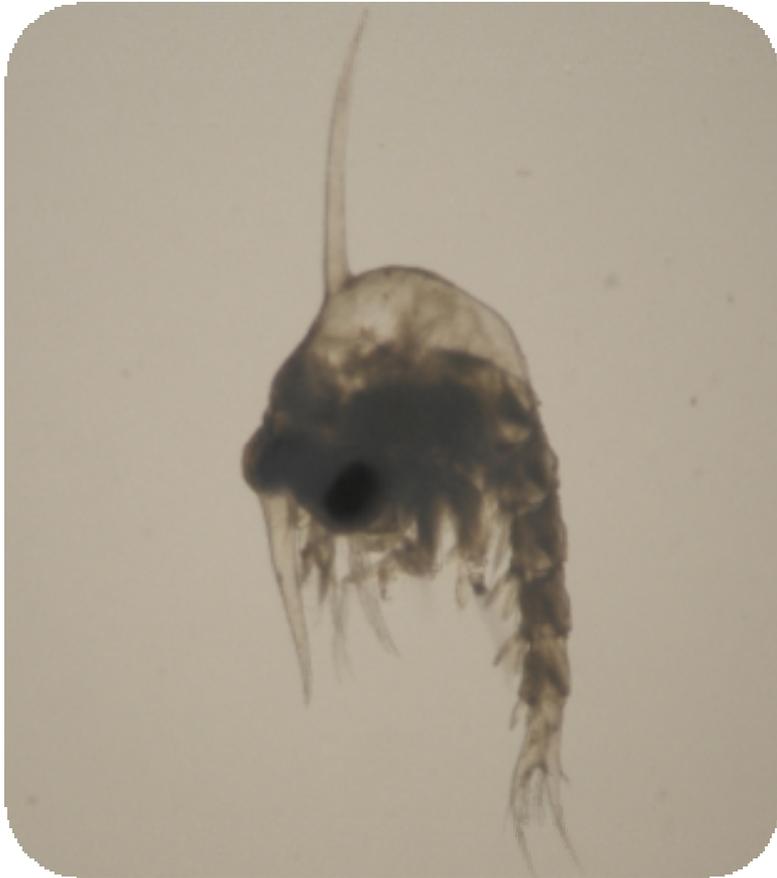


Larval mass mortality in large tanks 1

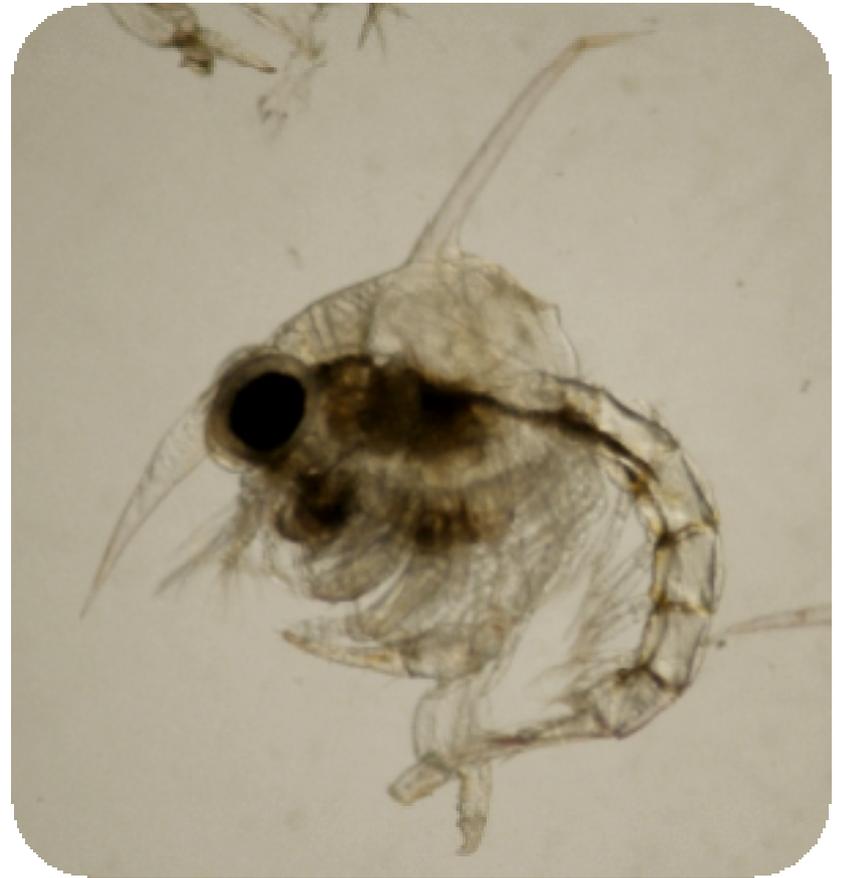


Larval mass mortality in large tanks 2

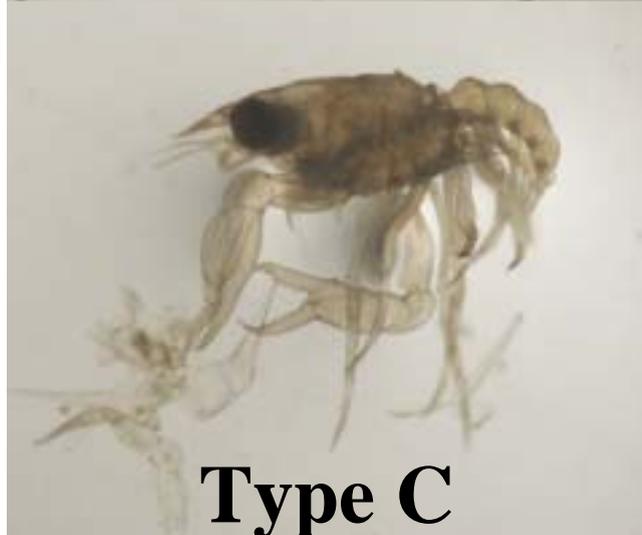
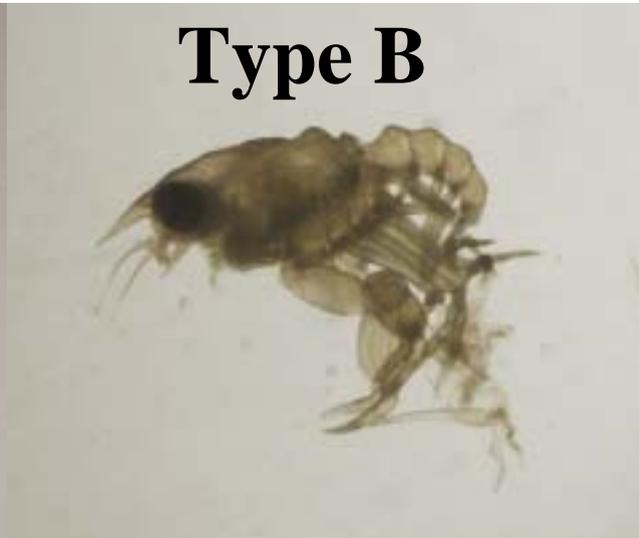
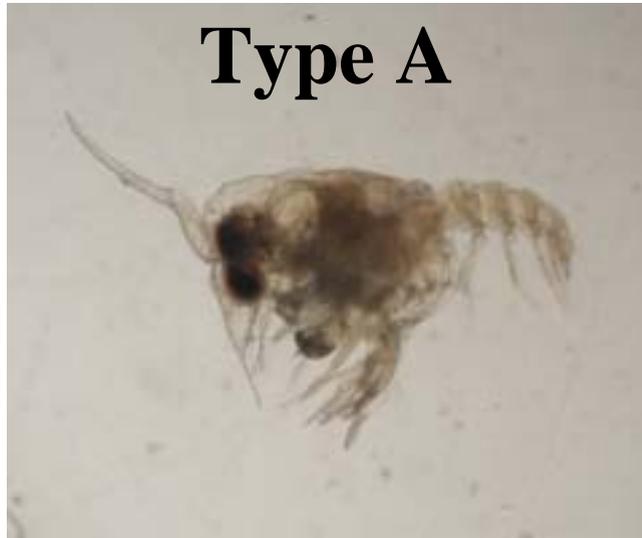
**Normal
last stage zoea**



**Morphologically advanced
last stage zoea**

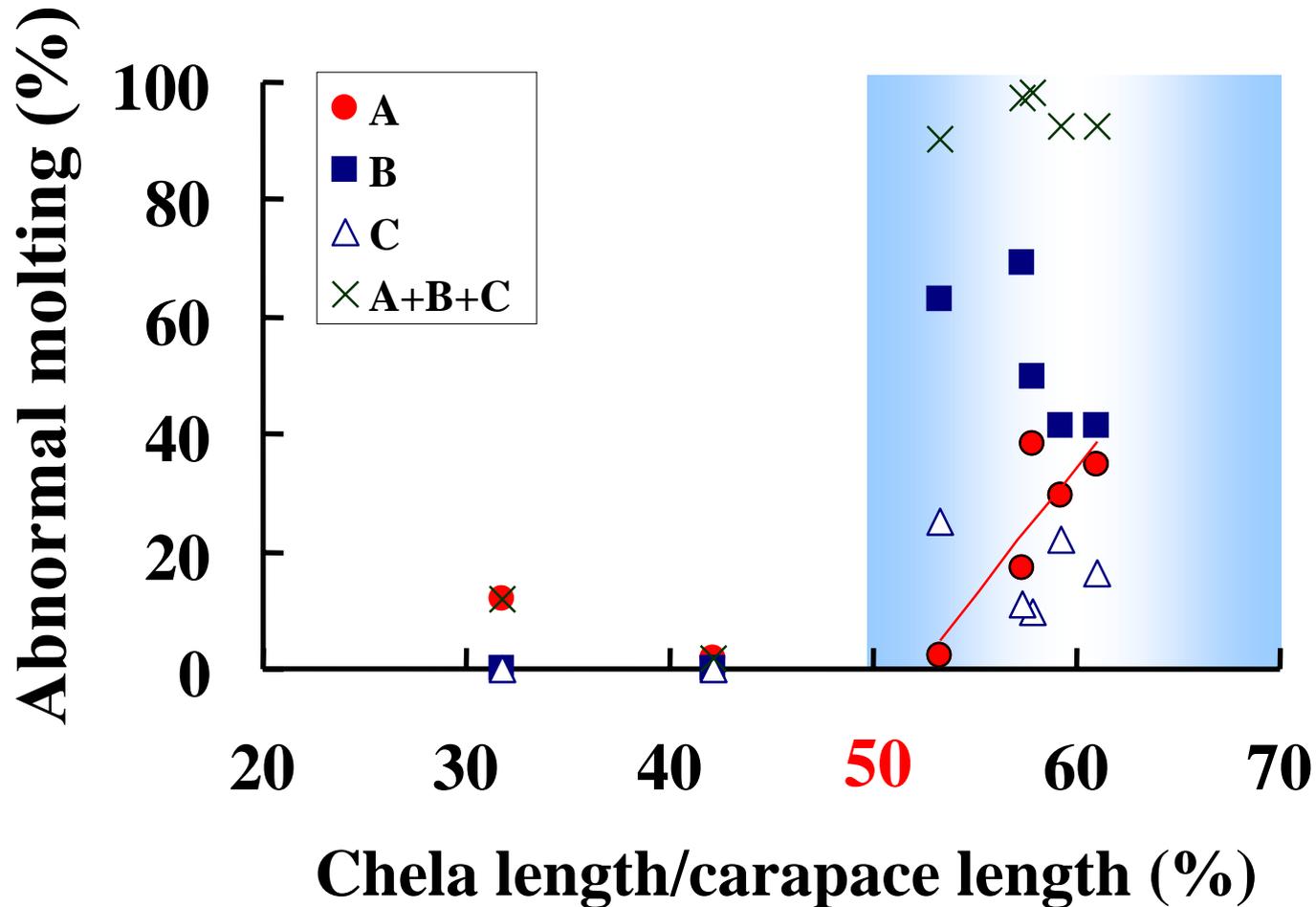


Abnormal molting by morphologically advanced zoeas

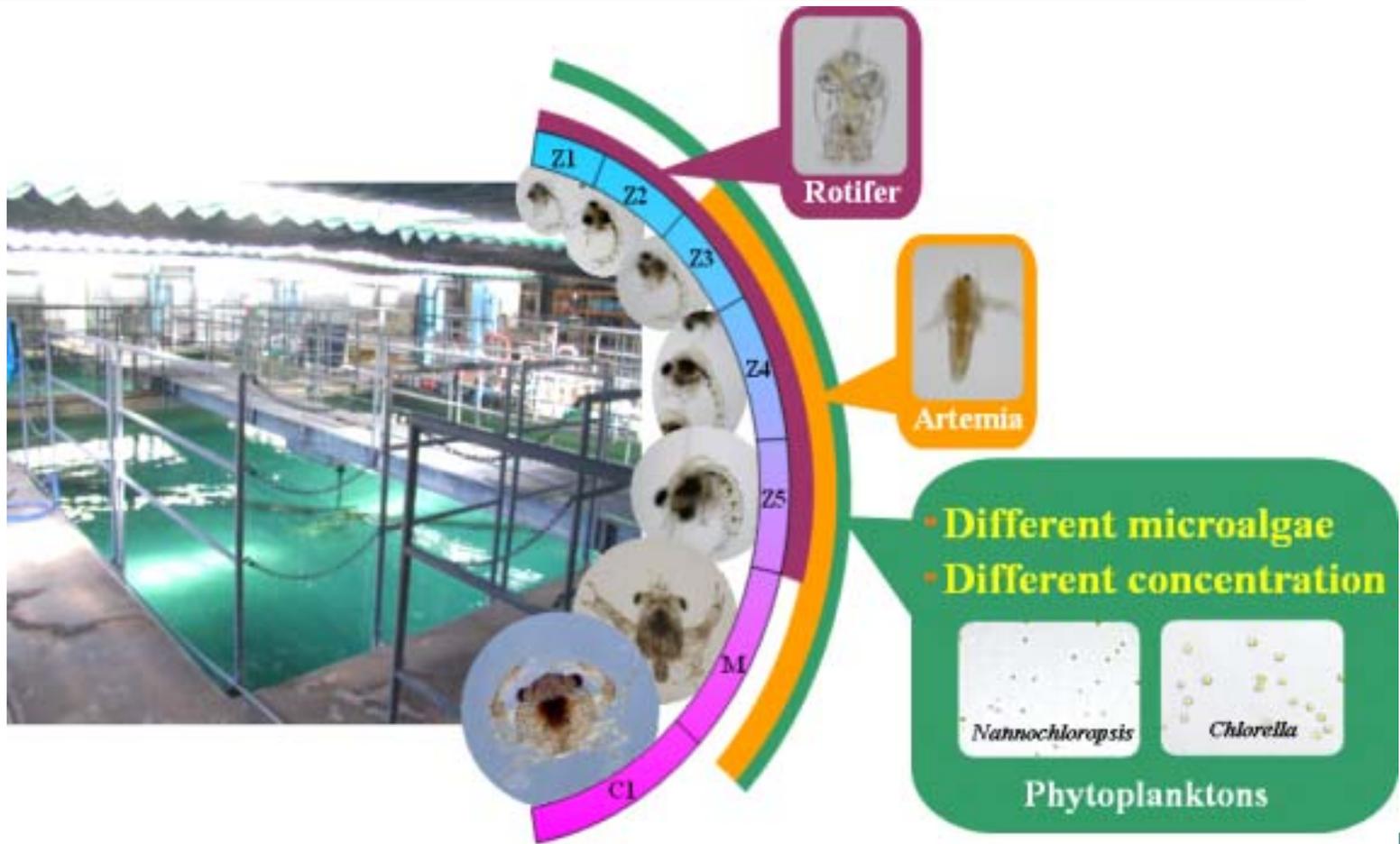


Modified from
Hamasaki *et al.*
2002

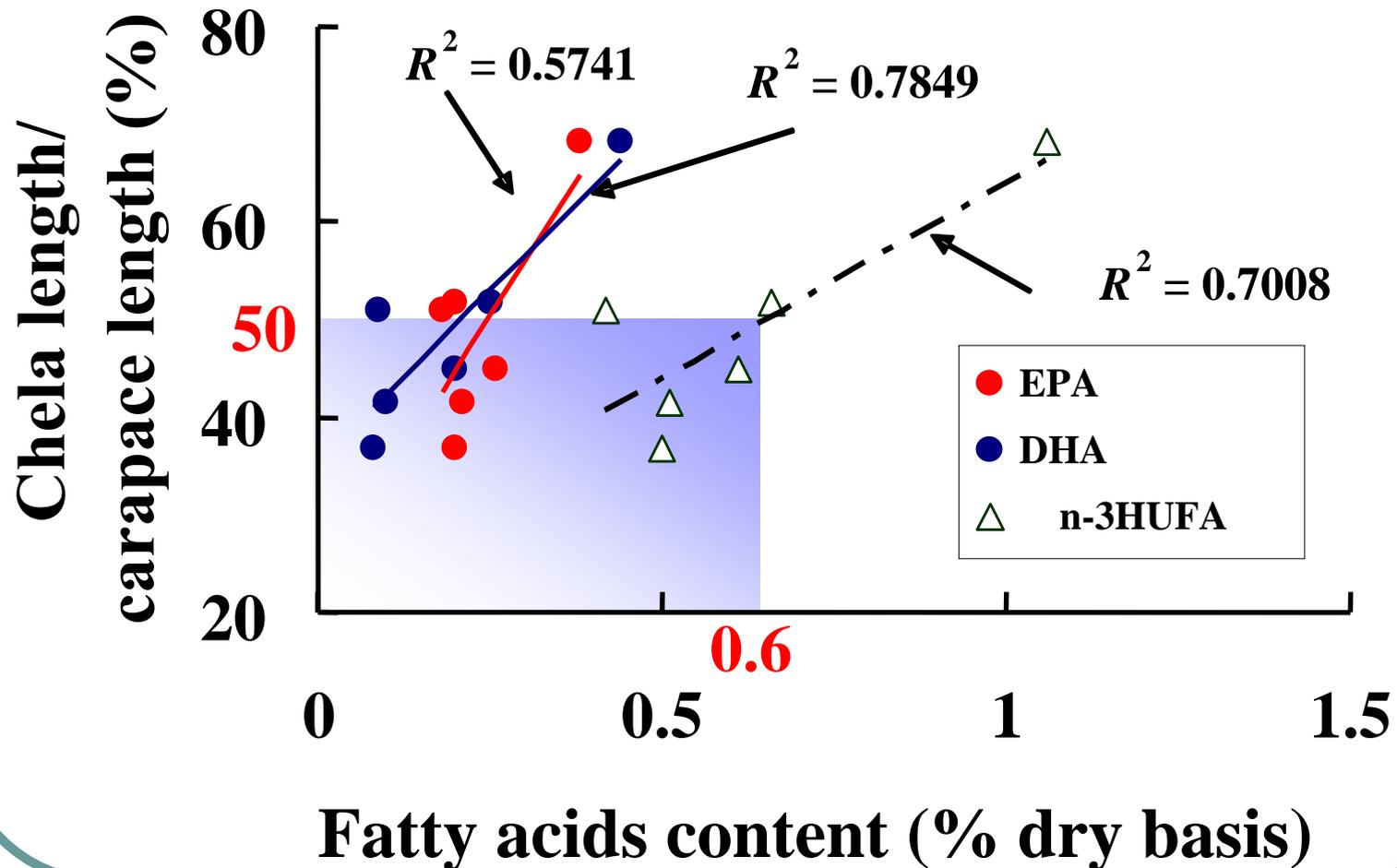
Relationship between morphogenesis of fifth stage zoeas and abnormal molting



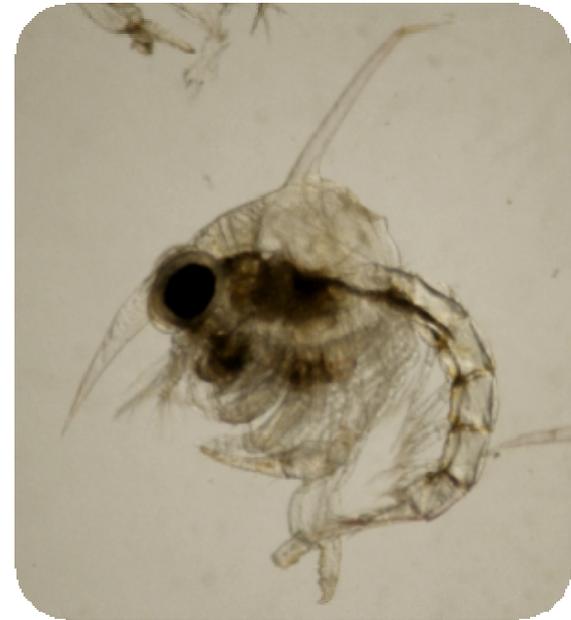
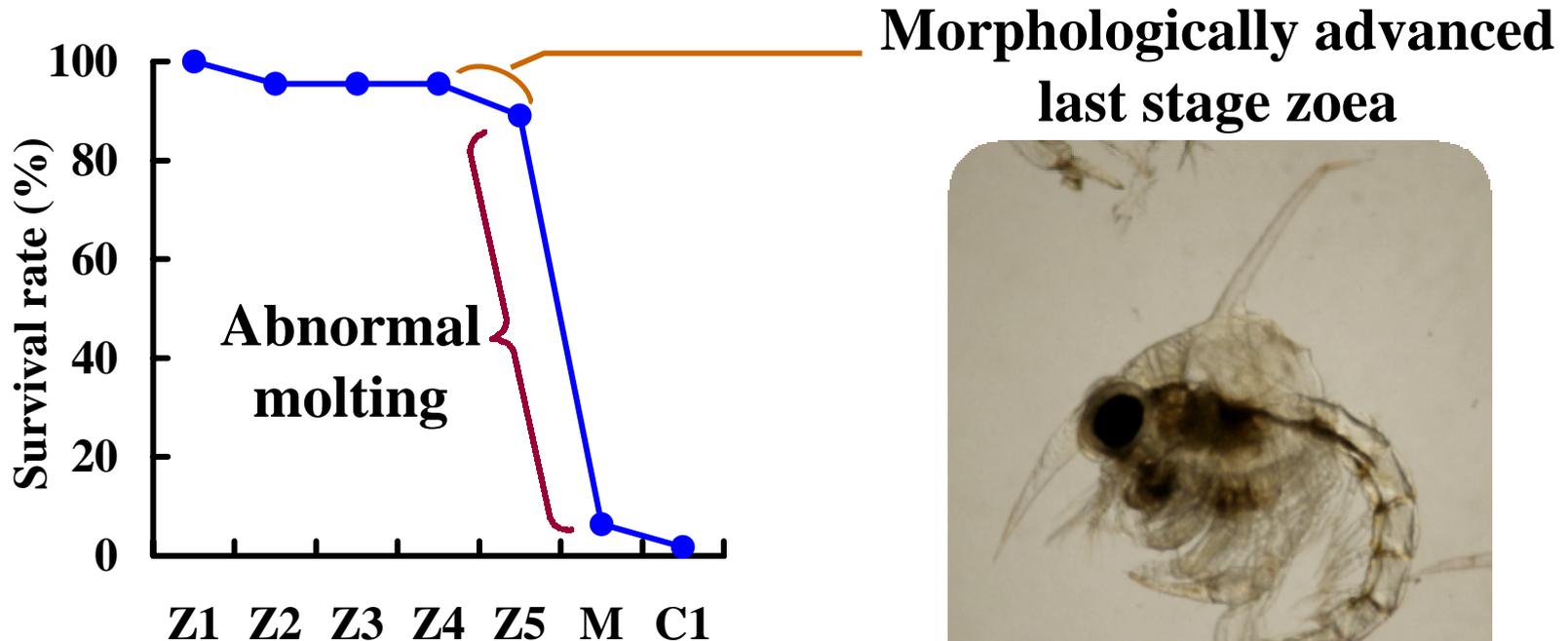
What factors affect larval morphogenesis?



Relationship between n-3HUFA in rotifers and morphogenesis of zoeas



Larval mass mortality of swimming crab and the second type of mud crab in large tanks



- Larval mass mortality by morphologically advanced last stage zoeas has also been observed in seed production of swimming crab and the other mud crab *Scylla paramamosain*.
- The upper limit for n-3HUFA content in rotifers is still unknown.

Importance of dietary n-3HUFA for larval swimming crab and mud crabs

- **Dietary n-3HUFA greatly affects the survival and morphogenesis.**
- **The relative chela to carapace length of last stage zoeas can be used as an index of the nutritional conditions of larvae.**
 - **This is an important tool to use when evaluating the effects of salinity and other environmental conditions on larval development and survival.**

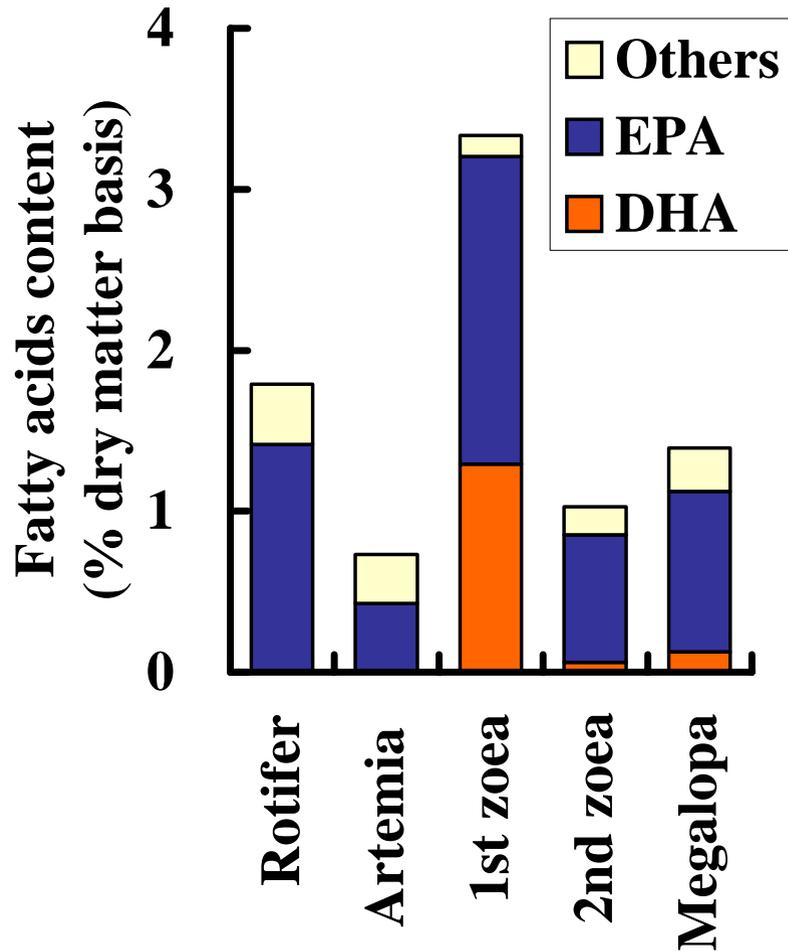
Effect of dietary n-3HUFA on larval horsehair crab and snow crab

- **Results of rearing experiments to reveal the dietary n-3HUFA requirements of horsehair crab and snow crab larvae.**

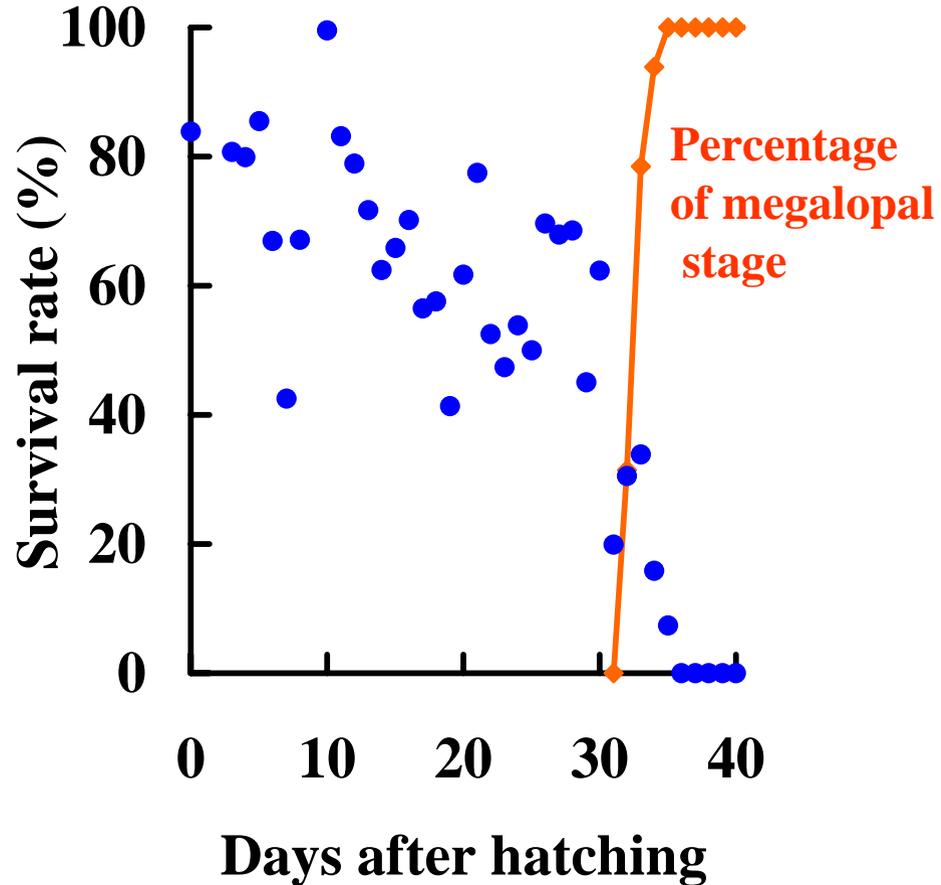


n-3HUFA content in live food and in larvae of snow crab in large tanks.

n-3HUFA contents



Larval survival



Conclusion and future research

- **Dietary n-3HUFA was essential to improve the larval survival and development in the seed production of swimming crab, mud crabs and snow crab.**
- **The requirement of n-3HUFA by larvae of brachyuran crabs varied with species.**



- **Strategies for n-3HUFA enrichment in live food should be developed for each species.**