



# International Artemia Aquaculture Consortium: Relevance for larviculture

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<https://artemia.info>

# Background

- *Artemia* is a critical feed for larval fish and crustaceans, underpinning the hatchery phase for around **10 million tonnes** of high-value aquaculture end product.
- Annual consumption of *Artemia* cysts is estimated at around 3,500-4,000 tonnes.
- Yet over 90% of *Artemia* cyst production is harvested from salt lakes, which are relatively fragile ecosystems that are strongly influenced by environmental fluctuations. This is something of a risk.
- There is a need to **guarantee a sustainable supply** of *Artemia* for aquaculture, from both natural sources and from extraction under controlled conditions, integrated with salt production and aquaculture systems.

# About

- The **International Artemia Aquaculture Consortium** is a network of scientists and institutions engaged in *Artemia* research, conservation, and capacity building. Participation presently covers 28 states across the globe.
- The consortium seeks to address issues surrounding the conservation and management of *Artemia* resources, and its sustainable supply and utilisation in aquaculture.
- It arose from a meeting of *Artemia* experts in Kuala Lumpur in November 2019. A provisional Steering Committee has been established and it is hosted virtually by the Network of Aquaculture Centres in Asia-Pacific.
- <https://artemia.info>

# Opportunities

- Conservation and documentation of *Artemia* biodiversity.
- Development of science-based protocols/guidelines for sustainable management and harvesting of wild *Artemia* resources.
- Characterisation of species and strains and their suitable applications.
- Selective breeding to develop improved or application-specific strains for aquaculture.
- Integration of *Artemia* into artisanal salt farms in Asia and Africa to improve income of rural communities.
- Use of *Artemia* biomass as a protein source in human diets.
- Development of improved guidelines on biosecure *Artemia* production and utilisation in hatcheries.
- Training and extension on all these things.





### SDG-aligned *Artemia* Aquaculture

Workshop at the Global Conference on Aquaculture Millennium +20.



### Status of *Artemia* Cyst Use

Webinar on cyst use practices in hatcheries around the world.



### Great Salt Lake Management, Utah

Webinar on multi-stakeholder management of the lake & its *Artemia* resources.



### *Artemia* Activities in Africa

Webinar on the history of *Artemia* usage and developments.



### *Artemia* Pond & Tank Production

Webinar on culture practices and experiences around the world.



### Meeting with Saxon Bosworth

Webinar to assist research for a National Geographic article on *Artemia*.

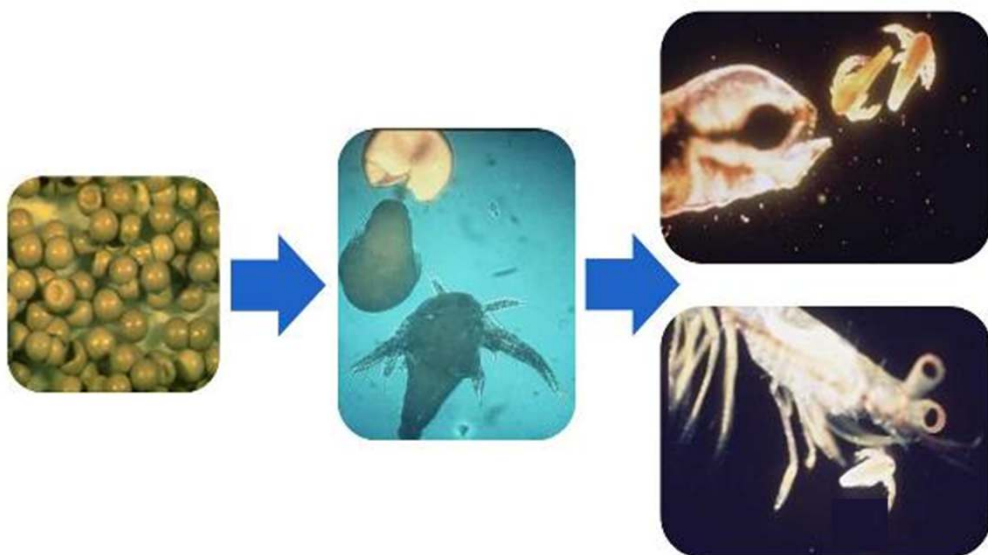


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## Webinar - *Status of Artemia cyst use in fish and crustacean hatcheries*

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### **Aims**

Document differences in practices used by fish & crustacean hatcheries in Asia, Europe and Latin America

### **Speakers**

- Asia: Bangladesh, China, India, Thailand and Vietnam
- Europe: Greece and Spain
- Latin America: Brazil and Ecuador

### **Participants**

359 from 53 countries

Report prepared by Simon Wilkinson, Nguyen Van Hoa, Meezanur Rahman and Gilbert Van Stappen  
see NACA website for video of all presentations: [www.enaca.org](http://www.enaca.org)



**Commercial cyst sources from Great Salt Lake (USA), different salt lakes in Siberia (Russia), Kazakhstan and China, Aral sea (Uzbekistan) and small quantities from salt ponds in Brazil and Vietnam**





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## Webinar - *Status of Artemia cyst use in fish and crustacean hatcheries*

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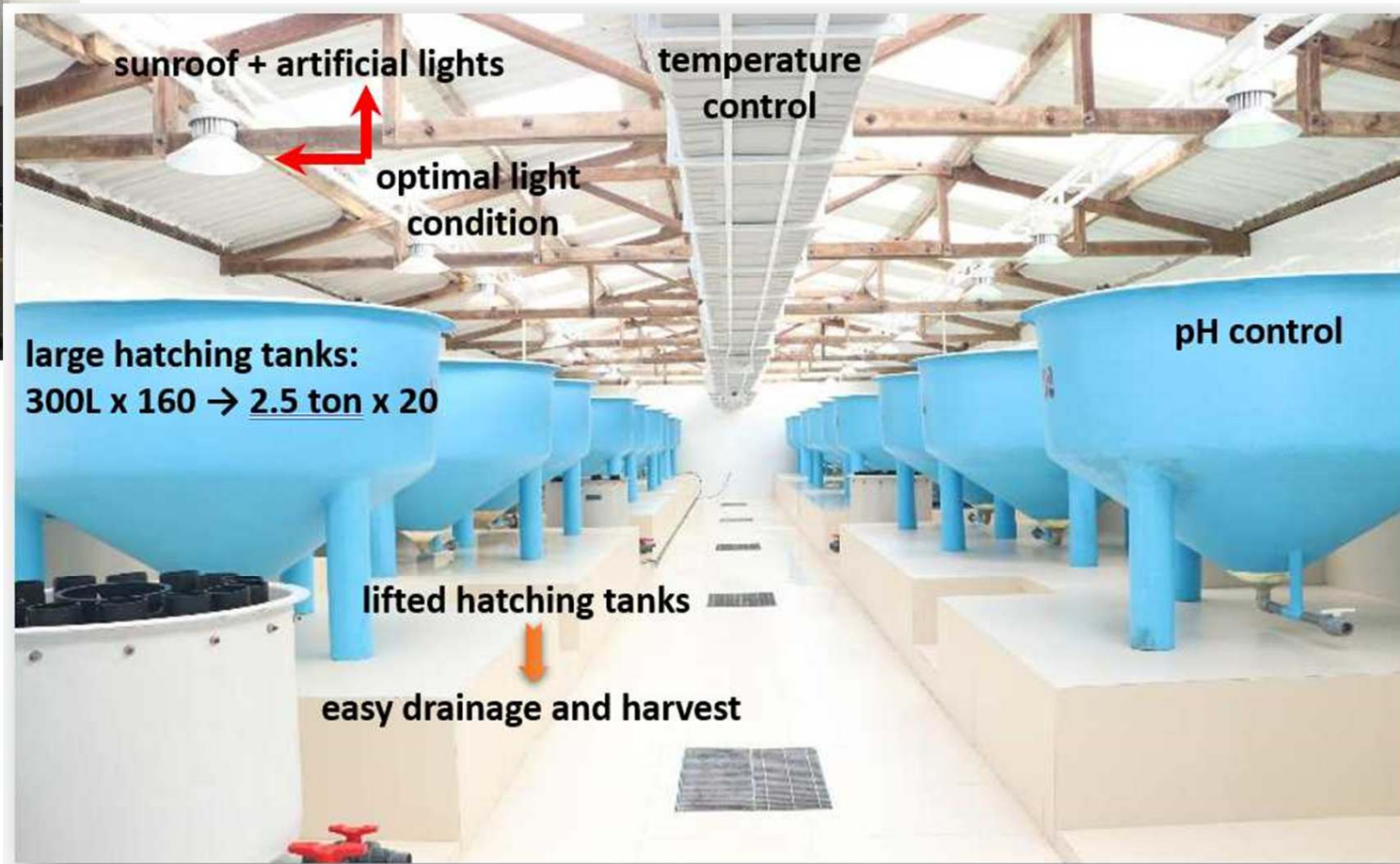
- cyst disinfection
- cyst decapsulation
- cyst hatching conditions
- nauplius harvesting / separation
- nauplius washing
- nauplius cold storage
- nauplius enrichment











sunroof + artificial lights

temperature  
control

optimal light  
condition

large hatching tanks:  
300L x 160 → 2.5 ton x 20

pH control

lifted hatching tanks

easy drainage and harvest

## Artemia cyst disinfection



Chlorine solution used for Disinfection



Disinfection in Process



Rinsing methods used to clear the chlorine residues



## Artemia cyst decapsulation



hydration



**Decapsulation**

chorion removal by  
chemical oxidation  
(hypochlorite at high pH)



dehydration  
(dried decapsulated cysts)







Artemia hatching room in three different hatcheries



Nauplii harvest



Separation of unhatched cyst



Nauplii washing and disinfection treatment



## Treatment for cleaning nauplii from cyst debris



Brine salt solution



After  $\text{H}_2\text{O}_2$   
addition

Prior to  $\text{H}_2\text{O}_2$   
addition



Peroxide solution



## Treatment for killing nauplii and Vibrio



dip in cooking water



freezing



**SEP- Art (by INVE):**

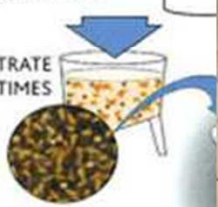


**Innovation in nauplii separation**  
*use of magnetic trapping of cysts*

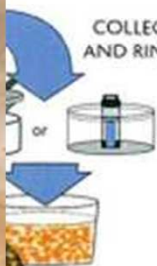
**2013**

AFTER 1 TO 5 MINUTES  
HARVEST &  
CONCENTRATE

CONCENTRATE  
UP TO 10 TIMES



COLLECT  
AND RINSE



**SEP-Art  
HandyMag**  
- NEW TOOL -

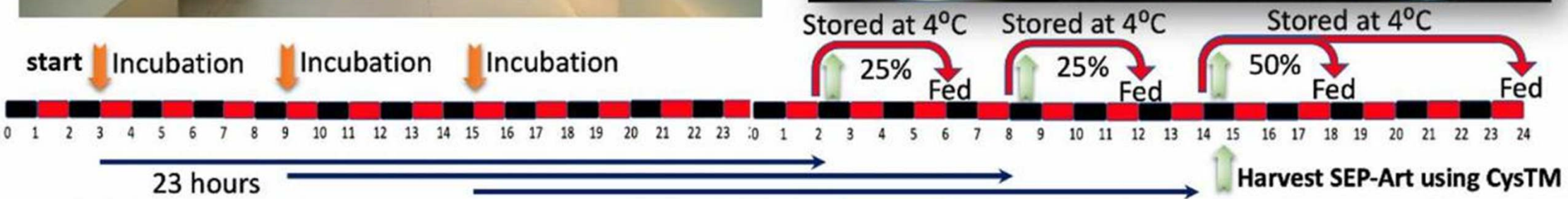
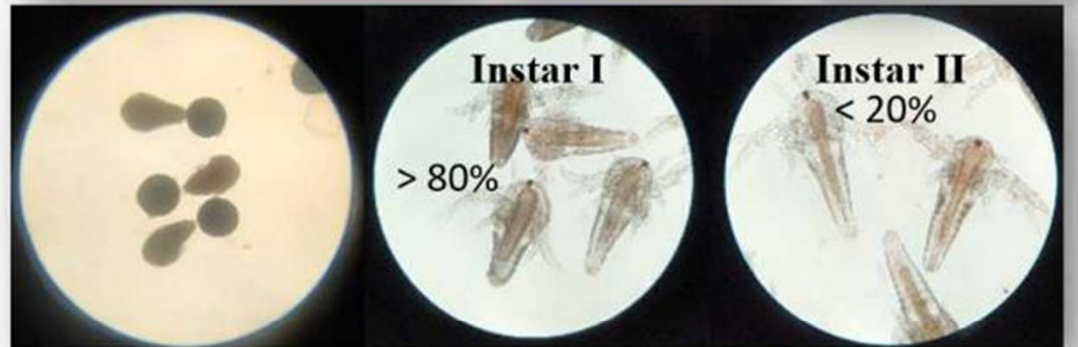


**SEP-Art  
CysTM 2.0**  
- NEW TOOL -



**SEP-Art  
AutoMag**  
- NEW TOOL -





Light intensity: >3,000 lux  
 Light sources:  
 natural light (sunroof) + LED light ( 50W)  
**Benefit:** hatching rate is increased up to 19%

pH:  
 Maintained: above pH 7,6 at all times  
 By: adding buffer solution:  
**Benefit:** hatching rate is increased up to 12%

Temperature controlled room  
 Optimum:  $\pm 29^{\circ}\text{C}$   
 Maintain temperature > 27 and <30  
**Benefit:** stabilizing hatching coefficient



# Cold storage of *Artemia* nauplii

- salinity 30-35 g/L
- temperature 4-10 °C
- nauplii density up to 15 million / L
- aeration soft point + aeration collar
- oxygen concentration > 4 ppm
- duration max. 24 hr



milk storage tanks



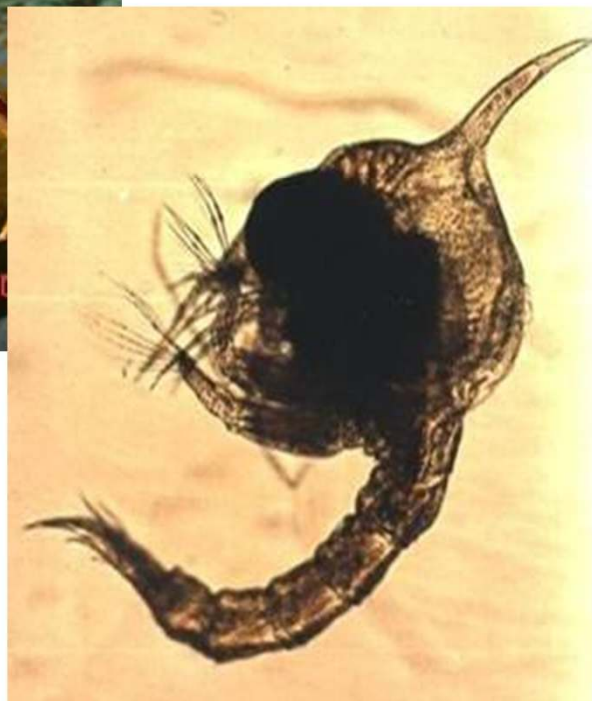
pneumatic pump





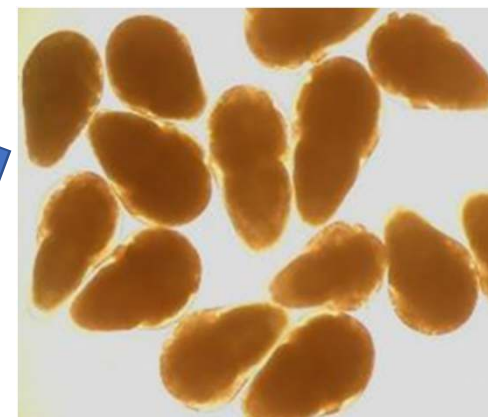


Mudcrab *Scylla paramamosain*



Zoea I and II feeding

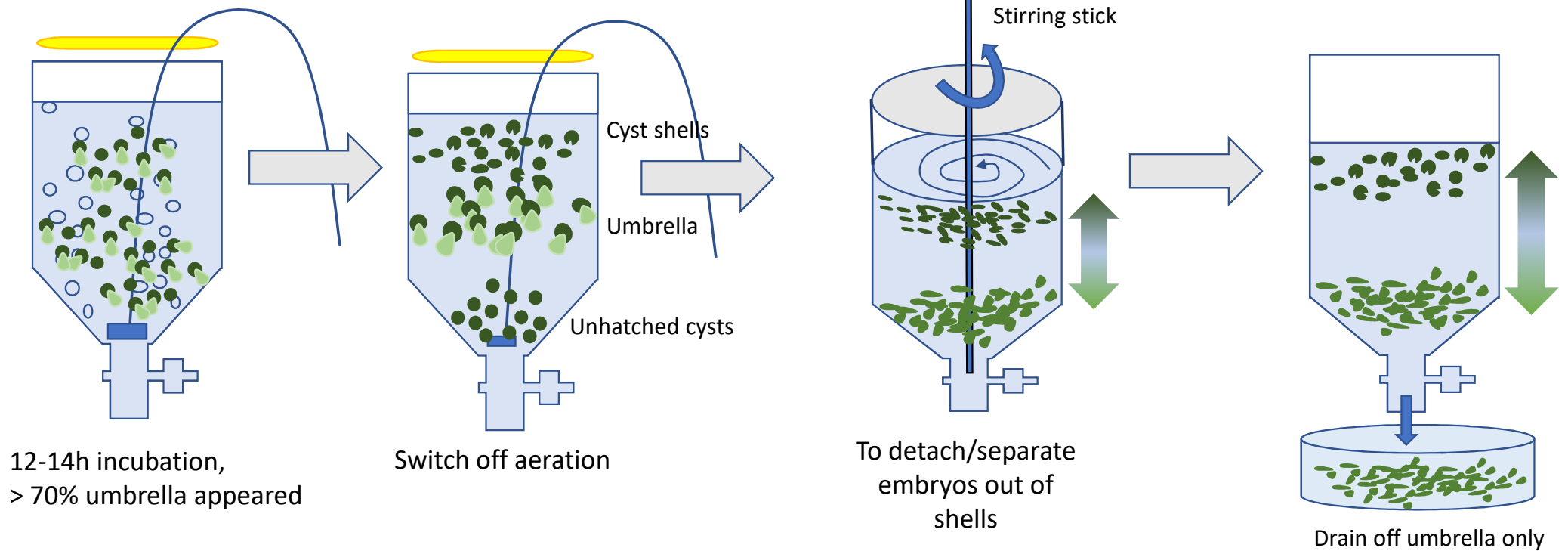
rotifer *Brachionus*



umbrella *Artemia*



## How to collect umbrella stage?



# Live Nauplii Production Centers



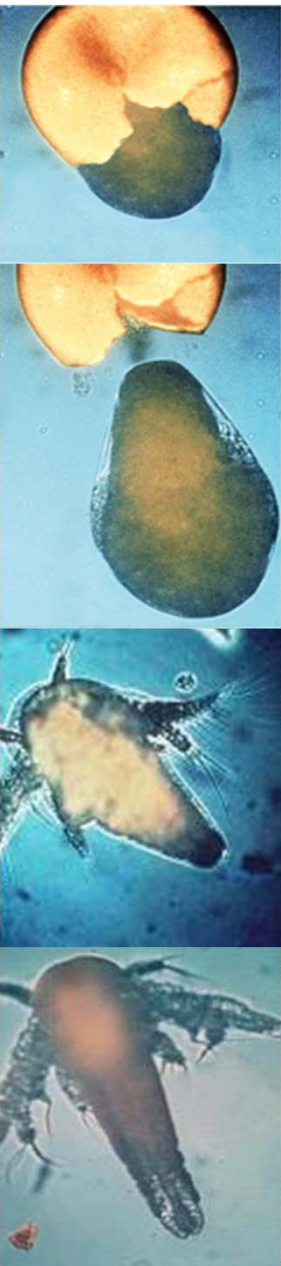


# Use of Artemia Biomass in Hatcheries & Nurseries





## Concluding Remarks / Recommendations



- Improve and standardize GAPs for Artemia hatching – separation – cleaning - cold storage  
→ *Vibrio free instar I*
- Update FAO Artemia Manual – organize training courses
- More use of umbrella Artemia as earlier live food (shrimp)
- Selected strains/species for specific applications
- Better documentation of value of nutrient-enriched Artemia

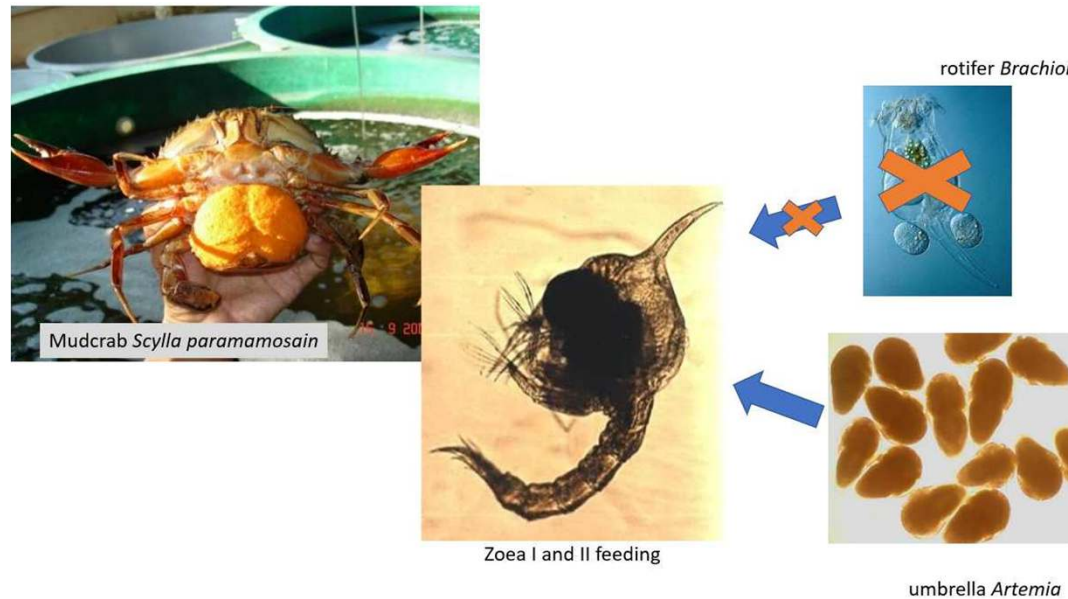
# Recommendations

- Develop improved guidelines for bio-secure production and use of *Artemia* in hatcheries, including an update of the FAO *Artemia* manual, and convene regional *Artemia* training courses for local hatcheries, to disseminate good practices and standardized protocols.
- Characterize species and strains of *Artemia* to identify their most suitable application for specific species of fish and crustaceans (e.g. nutritional composition, hatching synchrony or enrichment characteristics).
- Initiate strain selection and selective breeding to develop improved *Artemia* strains for aquaculture applications.



# Recommendations

- Investigate the use of umbrella *Artemia* as applied in Vietnamese crab hatcheries for wider application in aquaculture, as a new source of live food in earlier larval stages, be it for shrimp or in fish.



# Recommendations

- Reconsider a wider use of *Artemia* enrichment techniques in hatcheries, as it is now restricted to marine fish and crab production. This would allow nutritional enhancement of nauplii and delivery of pre- or pro-biotics to larvae.
- Investigate the impact of climate change on *Artemia* production in inland lakes and coastal saltworks.



# Recommendations

- Develop science-based protocols to assure sustainable harvesting of wild *Artemia* sources, especially in central Asia.
- Conserve *Artemia* biodiversity through means such as a cyst banks, species identification, “wild” vs “farmed” species, genotyping and strain characterization.
- Investigate integration of extractive *Artemia* farming with intensive fish/crustacean aquaculture.
- Consider integration of *Artemia* production in artisanal salt farming in Asia and Africa, desert/arid and salt-affected areas.

# Recommendations

- Investigate the use of *Artemia* biomass as high value protein ingredient in human diets.

## Brine shrimp *Artemia* as human food

*Artemia* omelet - partial replacement in shrimp/fish/crab cakes



## ARTEMIA BIOMASS FOR HUMAN CONSUMPTION







International Artemia Aquaculture  
Consortium  
<https://artemia.info>



Thank you!