NACA webinar "Status of the use of *Artemia* cysts in fish/crustacean hatcheries around the world"

September 2, 2021 via Zoom

Background

The goal of the webinar was to document differences in practices used by fish and crustacean hatcheries in the use of *Artemia* cysts for the preparation of live feeds. Over time, the practices used by hatcheries in Asia, Europe and Latin America have diverged from the good aquaculture practices for *Artemia* production recommended by FAO in the 1996 *Live Food Manual*.

The technical programme (Table 1) included presentations from twelve speakers from around the world, with an introduction from the Director General of NACA, Huang Jie. The webinar was attended by 359 people from 53 countries representing all sectors of the aquaculture industry, government and academia.

The webinar was facilitated by the International *Artemia* Aquaculture Consortium (under formation) as a follow up to the recommendations of the recent article *Past, present and future scenarios for SDG-aligned brine shrimp Artemia aquaculture* in FAO Aquaculture News. It was hosted by the Network of Aquaculture Centres in Asia-Pacific.

Report

The 0.5 mm brine shrimp *Artemia* nauplii that can be easily hatched out from so-called "dried cysts" (i.e. inactive embryos in late gastrula stage) are used as a suitable substitute for natural live plankton in the feeding of a wide variety of marine and freshwater crustaceans and fishes. Commercial use of *Artemia* started in the 1960s, initially in Japan with Japanese seabream and kuruma shrimp and soon thereafter in other parts of the world with many more species. With the expansion of hatchery production of more aquaculture species, the demand for *Artemia* cysts has continued to increase and annual consumption is now estimated at 3,500–4,000 tonnes for the production of over 900 billion crustacean postlarvae and fish fry by a hatchery industry valued at more than USD 2 billion and responsible for the final production of over 10 million tonnes of high-value aquaculture species (e.g. shrimp, prawn, crab, bass, bream, grouper, flounder, milkfish, catfish).

Although back in the 1980s and 1990s several scientific papers, manuals and handbooks were published describing the biology of *Artemia* and its optimal use in aquaculture hatcheries, some of the aspects of good practice, described in these documents, might not be relevant anymore for the present larviculture situation. On the other hand, other aspects that are still very much valid are nowadays sometimes not given sufficient attention or are even entirely ignored. The purpose of this NACA webinar was thus to review the status of the use of *Artemia* cysts in small as well as large scale hatcheries producing different species of fish and crustaceans in Asia, Europe, and Latin America.

The webinar started with a brief introduction on the *Artemia* cyst hatching process and the crucial parameters to ensure optimal hatching and preparation of *Artemia* for use in the start feeding of larval fish and crustaceans.

Powerpoint presentations as well as videoclips documented the wide diversity of practices with Penaeid shrimp, *Macrobrachium* prawn and mud crabs (*Scylla*) in Bangladesh, Brazil, China, Ecuador, India, Thailand

and Vietnam. Speakers from Greece and Spain mainly covered the use of *Artemia* in European seabass and seabream hatcheries.

Summarising, daily cyst consumptions range from a few kg up to 100 kg per day in some of the biggest shrimp hatcheries (for example in Vietnam and China). Cyst hatching tanks vary in size and shape, from a few 100L to several m^3 in volume, operated at cyst densities from 1 to several kg per m^3. The *Artemia* hatching conditions are only in rare cases strictly controlled (especially with regard to temperature, pH and light) and might result in the harvesting of instar II or older stages that have already lost a significant amount of their nutritional value and furthermore might be loaded with high *Vibrio* concentrations (that bloom in the cyst hatching tank when the cysts release glycerol at the moment of breaking and appearance of the umbrella stage, preceding the release of the instar I nauplius). Surprisingly/nonetheless most participants in the polls admitted knowing that there is a difference between instar I and instar II stage, although many didn't realise that *Artemia* nauplii – as soon as they molt into instar II stage - can be carrier of *Vibrio* and might pose biosecurity problems in the hatchery. Overall, the presentations clearly showed that there is indeed much room for improvement in optimising the use of *Artemia* cysts in aquaculture hatcheries, and this should result not only in economising its use but especially offering a highly nutritional and *Vibrio*-free food to the larval fish and crustaceans.

The hypochlorite technique for cyst decapsulation is still used in many countries, except in Europe where the health (release of chlorine) and discharge (toxic effluent) problems made it prohibitive.

Several other practices with the nauplii, especially in the small-scale hatcheries, do not follow the recommendations outlined in *Artemia* manuals and result in mechanical damage during harvesting and washing in non-submerged filters or result in nutritional losses when nauplii, in-between feedings are stored under room-temperature conditions. Several large hatcheries in Latin America as well as Asia are following the state-of-the art techniques and protocols developed in the Mediterranean fish hatcheries using stainless-steel concentrator rinsing devices (welded-wedge screens) and cold storage equipment (used for example in the milk processing industry).

Recently, a more advanced technique for separating the live nauplii from the empty cyst shells and unhatched cysts (based on the SEP-Art technology) is applied by different hatcheries, small and large. This non-invasive technique allows hatcheries to harvest high quality *Artemia* in a consistent and automated way, using tools equipped with magnets to separate the cysts and cyst shells from the nauplii. This technology allows more automation and less handling, resulting in a higher quality *Artemia* at harvest.

Several other chemical and physical techniques are also applied to improve the separation of the nauplii, although most of these techniques still need further scientific documentation and standardisation.

The practice of submerging the *Artemia* nauplii in hot or even boiling water, even if short, should be discommended: this might kill off the *Vibrio* bio-accumulated in the nauplii, but will result in physical damage to the nauplii, leaching of their body fluids in the hatchery tank, eventually promoting *Vibrio* development.

Freezing the nauplii to be able to feed the shrimp in an earlier larval stage is a valid option, provided quick freezing is performed in thin layers, preventing the formation of crystals that otherwise will provoke physical damage with similar consequences as explained above. A good alternative to feed the shrimp in an earlier stage could be the successful practice applied in mud crab hatcheries in Vietnam where umbrella *Artemia* of the small Vinh Chau *Artemia* strain is a successful alternative for rotifers in start-feeding the zoea stages of mud crab larvae.

Marine fish hatcheries in Europe were the first to adopt cold storage of *Artemia* nauplii and now use milk storage tanks. The technique of cold storage needs to receive much more attention as it allows to keep the *Artemia* under the most nutritious condition for a prolonged time, while making the production of *Artemia*

less labor intensive as the hatching of the cysts can be concentrated in a more limited period using the resources in a more efficient way. Furthermore, live *Artemia* storage also allows more frequent feeding of the fish/shrimp larvae, eventually with automatic pumping devices.

Only the European marine fish hatcheries and the mud crab hatcheries in Vietnam apply the *Artemia* nauplii nutrient-enrichment technique to ensure optimal larval development. Although it was reported to have a beneficial effect in *Penaeus monodon* larviculture in Thailand, it was abandoned when the country switched to *P. vannamei* farming.

These problems of unreliable quality of *Artemia* nauplii produced under suboptimal production conditions probably explain the success, especially in shrimp hatcheries, in purchasing live *Artemia* nauplii produced in specialised *Artemia* cyst hatching centres. In China, the biggest consumer of *Artemia* cysts, close to 50% of the hatcheries rely on this practice.

We also see more and more use of *Artemia* biomass (1-cm adult brine shrimp, harvested from salt ponds or lakes) in late hatchery and nursery feeding, especially in shrimp farming in China where it is offered under live, frozen, and dried forms.

In conclusion this webinar confirmed the suspicion that there are important differences in the use of *Artemia* cysts and in the preparation and use of brine shrimp nauplii in fish and crustacean hatcheries: many of the techniques and protocols, widely applied today, do not follow the GAPs in *Artemia* production as recommended by FAO in the 1996 Live Food Manual. On the other hand, new techniques and products have been developed and can result in more controlled and optimized use of *Artemia* cysts in hatchery practices. Therefore, an update of GAPs for *Artemia* cyst use in hatcheries is strongly recommended both under the form of updated manuals and documentation/demonstration materials for hands-on training sessions with hatchery staff. Hopefully hatchery managers will realize that applying more standardized protocols will not only result in using a better and more biosecure food but that they will be able to save on their *Artemia* cyst purchases. All efforts need to be made to optimally use *Artemia* as to guarantee that hatcheries deliver top quality product for stocking in the ponds or the cages.

The use of umbrella *Artemia* as successfully applied in the Vietnamese crab hatcheries is an interesting new development that should be considered for a wider application in aquaculture, as new source of live food in earlier larval stages be it in shrimp or in fish.

In view of the large variety of species and strains of *Artemia* that are now available in the market it might be time to better study their specific characteristics as to identify their most suitable application for specific species of fish and crustaceans, and this could be related to their nutritional composition, synchrony in hatching, enrichment characteristics, etc.

Finally, it might also be worthwhile to reconsider a wider use in the hatcheries of the *Artemia* enrichment technique, as it is now restricted to applications in marine fish and crab. This method not only allows to enhance the nutritional value of the nauplii but can also be used to do nutritional programming and as a vector to deliver for example pre- or probiotics to the fish/crustacean larvae.

Video recordings of technical presentations

Recordings of the technical presentations are available on Youtube at the link below:

- https://www.youtube.com/playlist?list=PLZxXgR0J17z3oahrQdjZw1S6602KifbUa

Table 1: Technical programme / list of speakers

Speaker	Presentation	Email
Huang Jie *Director General, Network of Aquaculture Centres in Asia-Pacific*	Briefing on webinar objectives	jie.huang@enaca.org
Patrick Sorgeloos *Artemia Reference Center, Ghent University*	Brief introduction on the Artemia cyst hatching process and its use in hatchery feeding	patrick.sorgeloos@ugent.be
Montakan Tamtin *Director, Samut Sakhon Coastal Aquaculture Research and Development Center, Thailand*	The current status of the use of *Artemia* cysts in shrimp and fish hatcheries in Thailand	mtamtin@hotmail.com
Trinh Trung Phi *Technical Director, VIET-UC shrimp hatcheries, Vietnam*	VIET-UC shrimp hatcheries, Vietnam	trinhtrungphi@vietuc.com
Nguyen Van Hoa *Can Tho University, Vietnam*	Use of *Artemia* cysts in crustacean hatcheries in the Mekong Delta, Vietnam	nvhoa@ctu.edu.vn
Nageswara Rao P.V. *All India Hatchery Association*	Status of *Artemia* cyst usage, hatching and application in shrimp hatcheries in India	sarithanagesh@yahoo.com
Muhammad Meezanur Rahman and Khin Mau U *Artemia4Bangladesh*	*Artemia* cyst hatching and application in shrimp and prawn hatcheries in Bangladesh	muhammad.rahman@cgiar.org
Sui Liying[1], Zhang Bo[1] and Gao Song[2] 1. Asian Regional *Artemia* Reference Center, Tianjin University of Science and Technology, China 2. China *Artemia* Association	Use of *Artemia* cysts in hatchery in China	suily@tust.edu.cn
Dimitris Dimopoulos *Tapies Hatchery, PHILOSOFISH SA*	*Artemia* use	d.dimopoulos@philosofish.eu
Gustavo Espellata *Fry Operation Manager, AVRAMAR*	Use of *Artemia* in sea bream, sea bass and meager larvae production	g.espelleta@avramar.eu
Stanislaus Sonnenholzner CENAIM	Ecuador: Hatching practices for *Artemia* cysts	ssonnen@espol.edu.ec
Marcos R. Camara *Federal University of Rio Grande do Norte*	Status of *Artemia* cyst use in shrimp hatcheries in North-east Brazil	marcosrcamara@gmail.com
Christine Medeco *Aquatec/Tecmares*	*Artemia* cyst hatching in the Aquatec and Tecmares hatcheries	c.macedo@inveaquaculture.com
Simon Wilkinson *Communications Manager, Network of Aquaculture Centres in Asia-Pacific*	Host / MC	simon@enaca.org