ABOUT BRINE SHRIMP...

INTRODUCTION

The brine shrimp (*Artemia sp.*) belongs to the phylum Arthropoda, class Branchiopoda and forms a member of the zooplankton community like copepods and Daphnia do. The Artemia life cycle begins by the hatching of dormant cysts, encased embryos which metabolism proceeds so slowly that it can not be measured by currently existing technology. The cysts can remain dormant for many years as long as they are kept dry, cool and protected from UV radiation. When the cysts are placed into salt water, they readily rehydrate and resume the encased embryos continue their development. Brine shrimp are cosmopolitan animals found wherever saline lakes and/or solar evaporation fields are present. From mountain salt lakes in Tibet or in Utah, lakes in the Siberian tundra or the Chinese Gobi dessert to temporary lakes in Iraq and South America, brine shrimp have colonized a wide variety of waters of different chemical composition. From chloride lakes to carbonate, sulfate and potash lakes.

A ball of adult Artemia sp.

HISTORY

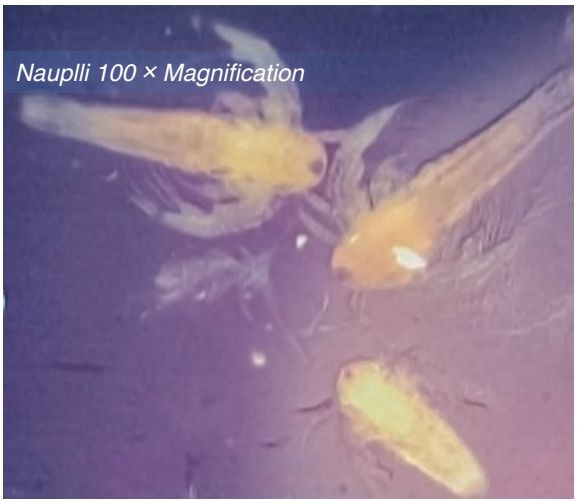
Decades ago brine shrimp were named *Artemia salina Leach*, named after their place of discovery in England. At an international symposium in Texas in 1979 it was agreed that many sibling species exist and the original *A. salina* was extinct. As the name *A. salina* was not valid anymore, the common name *Artemia sp.* is to be used unless the species is genetically identified. We now have:

- A. sp: native to the San Francisco Bay Area and the Great Salt Lake in Utah
- *A. persimilis*: found in Argentina
- *A. urmiana*: found in Iran
- *A. tunesiensis*: found in the Mediterranean area.
- *A. sinensis*: found in western China
- *A. parthenogenetica*: found in Europe, the Middle-East and Central-Asia

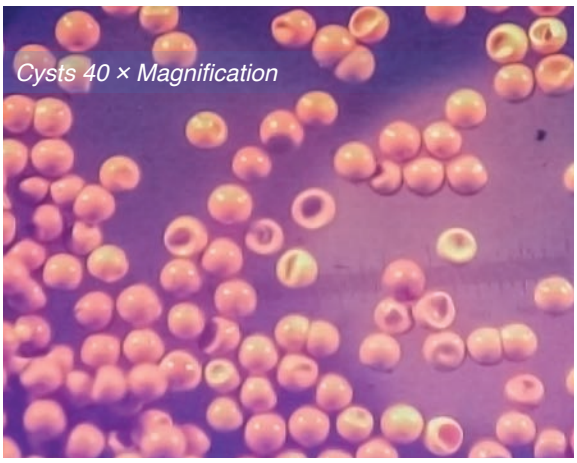
BIOLOGY

Brine shrimp are the masters of osmoregulation and can therefore exist in the high saline waters which exert an enormous osmotic pressure on the creatures living in it. It is this particular capability which protects the otherwise “unarmed” brine shrimp from their predators, which cannot live in waters of such high salinity. The lowest salinity in which brine shrimp are naturally found

Solar salt ponds in the San Francisco Bay area



Nauplli 100 × Magnification



Cysts 40 × Magnification

is about 70 to 80 ppt, i.e. slightly more than double seawater concentration. The presence of brine shrimp is limited to the higher salinity ponds, as in the lower salinity ponds some fish occur periodically. The presence of brine shrimp is limited to the higher salinity ponds, as fish periodically appear in the lower salinity ponds. For example the three-spined stickleback (Gasterosteus aculeatus) and the topsmelt (Atherinops affinis) were found on a survey in some San Francisco Bay ponds. Among others, these 2 fish species were of numerical importance (Carpelan, 1957). As these fish consume all brine shrimp available in the lower salinity ponds, the brine shrimp can only grow in the medium to high salinity ponds, starting at a salinity of around 70 ppt.

Brine Shrimp are continuous, non-selective filter feeders, which means that they actually don't care about what they eat. They just filter particles like micro-algae, bacteria and detritus from the water hereby using the feather-like appendages on the thoracopoda; these appendages continuously filter particles from the water and transport it to a groove located on the ventral side (belly) of the animal. Very fine hairs in this groove transport the food to the mouth where it is ingested.

As long as environmental parameters are favorable brine shrimp reproduce by means of baby brine shrimp (nauplii) which hatch in the uterus (brood sac) and are born free (live-bearing or ovoviviparous reproduction). The nauplii first consume their yolk reserves before they start feeding (after app. 6 to 8 hours). In nature it takes the nauplii about 3 weeks to reach adulthood. Every 3 to 4 days an adult female might produce up to 300 nauplii. Brine shrimp live anywhere from 3 to 6 months in nature, depending on the circumstances.

When environmental parameters become too severe (e.g. too high or too low temperatures or salinity, or lack of food) brine shrimp switch to the production of resting eggs, the cysts you might buy from your local shop. Upon sensing the deteriorating environment, female brine shrimp stop producing nauplii and start producing resting eggs which contain dormant embryos whose development is arrested in the gastrula stage. A special gland in the uterus of the female puts a protective layer of chitin around each egg, which is then released in the water and which will await optimum circumstances before hatching; in this way, the population will survive the period in which survival is impossible for the adult animals.

USE AS LIVE FOOD

In the beginning of the '30, the San Francisco Aquarium Society promoted the use of brine shrimp as live food and consequently, the San Francisco Bay strain was the first strain of brine shrimp to be harvested as a live food for rearing marine and fresh water organisms like fishes and crustaceans. The Steinhart Aquarium at the California Academy of Sciences discovered copious quantities of brine shrimp living in the solar evaporation ponds of Leslie Salt around San Francisco Bay. They proved to be such an ideal aquarium fish food that the San Francisco Aquarium Society quickly endorsed adult and baby brine shrimp as a necessity in bringing aquarium fish to spawning condition and supplying one of the first living feeds to newly hatched fish fry.

LITERATURE CITED

Carpelan, L.H., 1957. Hydrobiology of the Alviso Salt Ponds. Ecology, Vol. 3, pp. 375-389.

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