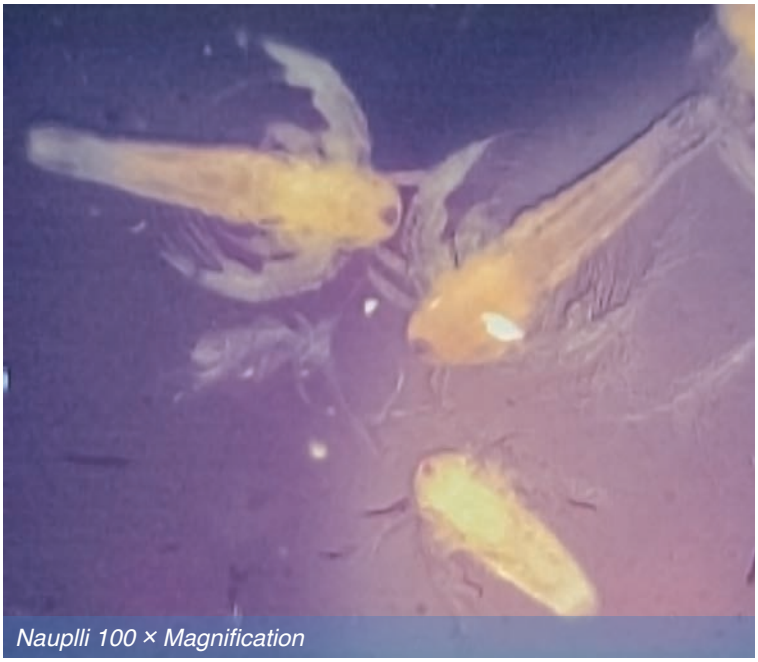
GROWING BRINE SHRIMP...

If you are looking to raise brine shrimp as a food source for your fish it is easier and less expensive to buy live or frozen adult brine shrimp from your local fish store as you cannot raise enough shrimp in a small aquarium to make the effort worthwhile, but if you want to do it as an experiment or learning experience, you can start with a tank of 10 gallons or larger and limit the amount of shrimp nauplii you use as a starter.

LARVAL DEVELOPMENT

Before reaching adulthood, brine shrimp go through 15 larval stages which are called Instar 1 to Instar 15. The newly hatched baby brine shrimp is called an “Instar 1 nauplius”. It does not need to be fed yet as the nauplius lives on it’s yolk reserves which it got from the egg (cyst). After about 6 to 8 hours (depending on the temperature), the yolk-sac is depleted, the mouth and anus of the nauplius have opened and the animal can start feeding itself. At this time however, mortalities can occur as bacteria start “invading” the nauplius through the mouth and the anus. Some of the nauplii do not survive this “invasion”. In order to limit the damage done to the culture, it is important to harvest the nauplii from the hatching container and rinse them well. During the hatching process, glycerol is being released into the hatching medium as the cysts start bursting. This glycerol forms a perfect feeding ground for bacteria, which were already present in the hatching medium as large amounts of bacteria are always present on the cyst shell.



Nauplli 100 × Magnification

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FEEDING

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 pleiopoda; 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. Because they feed continuously, the food should be continuously added to the water column in the grow-out tank. The trick is to prepare the food into a solution (with light aeration) and drip the solution into the grow-out tank. As brine shrimp have a very small mouth, they can not feed on food particles bigger than 50 micrometer (i.e. 0.000050 m or 1/500 inch). This is the reason why the food needs to be “micronized”. You can prepare food to this size by obtaining a piece of 30 micrometer filter netting from a scientific goods supplier and sifting the food through the net. Another way is to use a kitchen blender when making the food. Blend thorough and

at least for 5 minutes. Sieve it afterwards through the aforementioned fine mesh sieve or squeeze it through a handkerchief.

POTENTIAL FEEDS INCLUDE

- Micro-Algae: the best food for feeding your brine shrimp. Suitable species include: Tetraselmis, Nannochloropsis, Isochrysis, Chaetoceros and more.
- Live Algae: for the seriously interested, after some googling one can easily find websites selling live algae starter kits. Though a little expensive to start up and very labor consuming, rearing algae is not that difficult.
- Dried Algae: local health food shop sell jars of dried algae tablets which can be grinded up in a mixer. Most of these dried algae however contain a high amount of water soluble proteins which can not be taken up by Artemia so in order to get rid of these soluble proteins (which will be used by the bacteria present in the culture), you can suspend the dried algae in a container, mix well with a kitchen blender, aerate the mixture for about 90 minutes, leave it to settle and decant the solution. Only use the matter settled on the bottom to feed the brine shrimp.
- Algae Paste: obtainable from specialized websites. Detailed instructions for use are provided by the suppliers of the algae paste. Though sometimes expensive, algae (paste) are well worth the extra effort as they form a superior food compared to the feeds mentioned below as algae are rich in Highly Unsaturated Fatty Acids. Another advantage of using live algae is that algae are thought to release substances into the rearing medium which act as natural antibiotics which can suppress unwanted bacterial growth.
- De-Fatted and Micronized Rice-Bran: suspend the rice bran in some salt water and mix well with a kitchen blender. It must be noted that this food contains a high amount of fibers.
- Brewer's Yeast (Saccharomyces albicans): although readily available, easy to use and digestible for Artemia, the nutritional composition of this yeast is far from optimal. Do not use it as a main diet!
- Home-Made Feeds: many people have developed their own home-made recipe for feeding their brine shrimp over the years. Most of them contain a mixture of: egg(yolk), fish meal, cod oil, soy meal, wheat and cottonseed meal (enriched with lysine).

Note on soy meal: in the aquaculture industry soy meal is enriched with methionine and lysine, essential amino acids lacking in soy meal. Another disadvantage of (non-heated) soy meal is that it contains trypsine inhibitors, which can limit performance, and that it contains a high amount of water soluble proteins.

HOW MUCH FOOD

As aforementioned, a continuous drip-feeding should be provided. When not possible, a daily feeding schedule of 4 to 6 times should be followed. When to feed? This is where a Secchi-disc comes in handy. A Secchi-disc is a plastic (e.g. the lid of a plastic jug) or wooden disc on which 2 perpendicular lines are drawn. Two shranked surfaces are painted black, the other 2 are painted white. Perpendicular to the disc surface, a stick is attached to the disc so the disc can be lowered and raised in the tank, parallel to the water surface.

HOW TO USE A SECCHI-DISC

Gently lower the disc in the water, keeping the disc surface parallel to the water surface, until you can not distinguish the difference anymore between the white and black areas. Hold the disc and note on which depth the disc is. Slowly move the disc up until you can distinguish both colors again. Note this depth. Make the average of these 2 measurements; this average is the Secchi-reading. A reading of about 20 cm should be recorded. This level of turbidity should provide enough food for the brine shrimp. Of course, this is only a general rule. After a while you will notice which Secchi-reading is most optimal for the brine shrimp in the conditions you keep them in.

OTHER METHODS

If you own a microscope you can check the gut or digestive tract of the brine shrimp. You should be able to see food particles packed in the digestive tract. You can also use a strong magnifying glass and examine the brine shrimp which are put on a piece of glass under which a light source is installed. When you can't distinguish food particles in the tract, too less food is present in the rearing tank. A completely filled tract is also not desirable as the ingested food might leave the digestive tract without actually being digested. Remember that brine shrimp are feeding continuously, they do not know the feelings "hungry" and "I'm full". So when too much food is present, the food may just pass the tractus without being digested, and the brine shrimp will die from

starvation!

Yet another thing to watch are … fecal pellets. These should be firm and compact. If not the case, more than likely you do not provide enough food.

GROW-OUT TANK

CLEANLINESS

When starting, make sure to start with a disinfected tank as to limit the amount of bacteria present in the tank.

SALINITY

Brine shrimp are euryhaline animals, which means that they are tolerant to a wide range in salinity, e.g. from about 5 ppt. to around 220 ppt. However, in order to reduce the amount of osmotic stress the brine shrimp are subjected to, we should keep them in a salinity of about 25 (1.021) to 40 ppt (1.030). The exact salinity is of minor importance, just keep it around this level. To keep things simple (though scientifically not exact): 35 ppt. means 35 g of salt dissolved in 1 liter of water (or about 4.7 oz. in 1 gallon). Make sure that the salinity of the hatching medium is the same as the salinity in your grow out tank; in this way the nauplii will not have to bridge a salinity shock.

PH

A pH ranging from 8 to 9 is most optimal. This is also the pH of most of the salt lakes and solar evaporation ponds brine shrimp naturally occur in. As pH will slowly drop during cultivation (due to the release of waste products and subsequent nitrification) you will have to perform water changes and/or enhance the buffer capacity of the medium by administering technical grade NaHCO3 (until 2 g per liter). Do not use Na2CO3 as this increases pH to above 9!

TEMPERATURE

Brine shrimp can tolerate a wide variety of temperatures, however, a temperature ranging from 20°C to 30°C (68° F to 86° F) is most optimal. Also keep in mind that the optimal temperature for reaching the highest reproduction rates is strain specific! For example, in order to achieve highest reproduction levels for *Artemia sp.* (SF-strain) a rearing temperature of around 24° C (75° F) is optimal. At the lower range (i.e. 20°C and lower) *A. sp.* (SF-strain) grows slower, is less active, requires less food, achieves higher food conversion rates and lives longer. But the reproductive period is shorter and total offspring is much smaller. At the higher end they will be more active, require more food or energy, have less broods and live shorter (Browne, Davis and Sallee, 1988).

AERATION

A moderate aeration should be installed to keep the amount of dissolved oxygen at level (around 4 to 5 mg O2 per liter) as well as to keep the administered food suspended throughout the water column. Very well suited for this purpose are air-water-lifts, though aeration lines can be used as well, provided the produced bubbles aren't too small. Very red colored Artemia are a sign of low oxygen levels, whilst pale, blue to green Artemia (depending on the food they are consuming) indicate medium to high oxygen levels. When oxygen becomes limited, Artemia react by producing haemoglobin molecules, which enables them to "absorb" the dissolved oxygen still present in the medium. Another thing to watch is that you should be careful as to **NOT** produce too small air bubbles as these small bubbles may get stuck between the thoracopoda ("legs") of the brine shrimp. Hereby seriously hindering food uptake and carrying the shrimp to the water surface where they will be helpless!

Note: whilst not proven, it is suspected that pale Artemia are less attractive to fish.

LIGHT

Do not provide too much light as this might work contra-productive. A few installed standard light bulbs are okay. In nature, adult brine shrimp will move to the deeper parts of the ponds during noon (period with highest light intensity). In contrast to the nauplii which are positive phototactic (attracted to light), adult brine shrimp are negative phototactic (move away from light sources).

WATER QUALITY

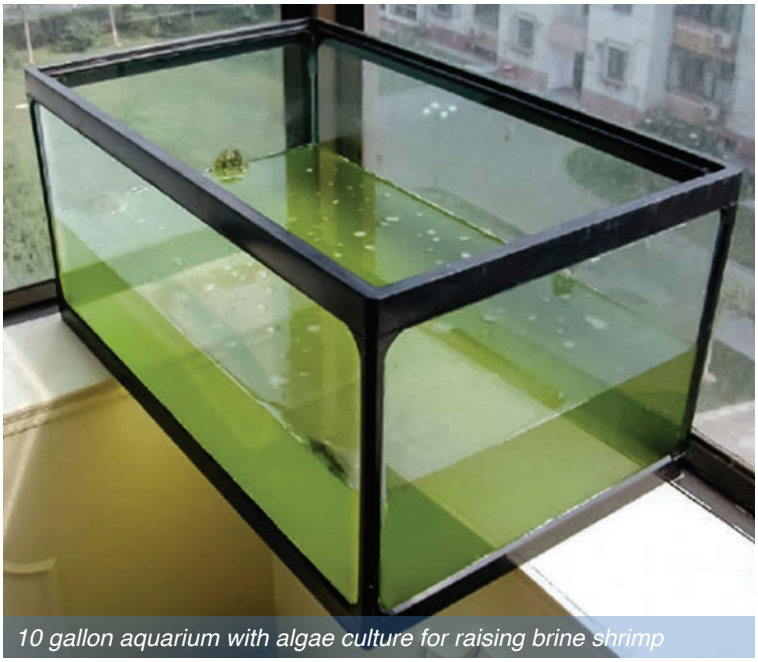
Baby brine Shrimp are much more sensitive to poor water quality as compared to adult brine shrimp. Therefore high levels of ammonia and nitrites should be avoided. Controlling water quality can be accomplished through a combination of biological filtration, frequent water changes and siphoning out of dirt settling on the bottom. When doing a water exchange, siphon the

water out of the tank into a fine mesh net which is submersed in a bucket. Simply catch the brine shrimp in the net as you are siphoning out the water, lift the net with the rising water level and the shrimp will keep on swimming in the net. Return the brine shrimp immediately to the grow-out tank afterwards. The outlet from the growing tank to a biofilter should be screened with a fine mesh of around 200 micrometer. As it will clog up, it will need to be cleaned regularly. As the brine shrimp increase in size, the mesh size should also be increased.

HOW MANY BRINE SHRIMP TO START WITH?

Try to start with a maximum density of about 5,000 nauplii per liter culture medium.

LITERATURE CITED:



10 gallon aquarium with algae culture for raising brine shrimp

Thriving culture of brine shrimp

Browne, Davis and Sallee, 1988. Effects of Temperature and Relative Fitness of Sexual and Asexual Brine Shrimp Artemia, J. Exp. Mar. Biol. Ecol., 1988, Vol. 124, pp. 1-20.

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