



The behaviour of brine shrimps



Manchester
Metropolitan
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An ASAB & MMU teaching resource (DVD) for Key Stage 2 (Years 5 and 6)

Introduction

Most teachers will know that primary school children have a great interest and enthusiasm for animals. Some pupils will have pets at home and many parents will have taken their children to wildlife centres for a closer interaction with more exotic animals. The majority of primary school teachers will also ensure that visits to farms and zoos are built into their curriculum experience at some time over the first seven years at school and may also be able to arrange for specialist animal services, such as falconry displays, to visit their school. Some schools may have the benefit of extensive grounds so that other experiences can be arranged for the pupils, such as setting up nature trails and/or wildlife areas and carrying out hunts for mini-animals (see Appendix).

In view of the perceived difficulties regarding health and safety and animal welfare considerations, fewer animals are now kept in schools so most pupils will not have the opportunity to observe and carry out investigations with live animals. This is perhaps to be regretted but it is also understandable.

One animal that we know does well in a primary school environment is the brine shrimp, *Artemia franciscana*. It is relatively easy to rear and maintain populations of these delightful creatures for several weeks in a large plastic bottle, or even longer if they are kept in a small aquarium tank. Once

established, a population of brine shrimps in a tank represents an ecosystem in balance and can be viable for many months. An alternative would be to buy in some adult brine shrimps, as many pet shops sell them as live food for fish! A typical price for 50 - 80 ish shrimps in a small plastic bag is in the range 60 - 80p.



Since many teachers might not feel confident about keeping a population of brine shrimps in their classroom, ASAB (The Association for the Study of Animal Behaviour) and MMU (Manchester Metropolitan University) have produced this DVD resource so that investigations of live shrimps can be carried out in a primary classroom without the hassle of rearing and maintaining the animals! [Though you would be foregoing the great pleasure of seeing the brine shrimps develop from eggs and grow into a thriving population!]

The DVD has four sections:

1. An introduction to brine shrimps for Year 5 and 6 children, using film footage shot in the laboratories at MMU. This consists of a short description of the animals and some footage of them swimming around in a narrow glass tank.

2. A short section of film showing the apparatus and set-up used for the two investigations.

This would also allow teachers to carry out a pilot study if they wished, to ensure the children know exactly what is expected of them when they carry out either, or both, of the two investigations.

3 & 4. Two five minutes sections of film which are to be used for the two investigations, which are:

a) to determine whether brine shrimps shoal together when in a dish;

b) to determine whether brine shrimps prefer to swim in the `centre` or at the `edge` of a dish.



Background notes for teachers

Brine shrimps are invertebrates found in salt lakes in tropical and sub-tropical areas of the world, for example, parts of the USA and Israel. They are sometimes marketed as `sea monkeys` or `fairy shrimps` in pet shops or trade outlets so children may already be aware of them.

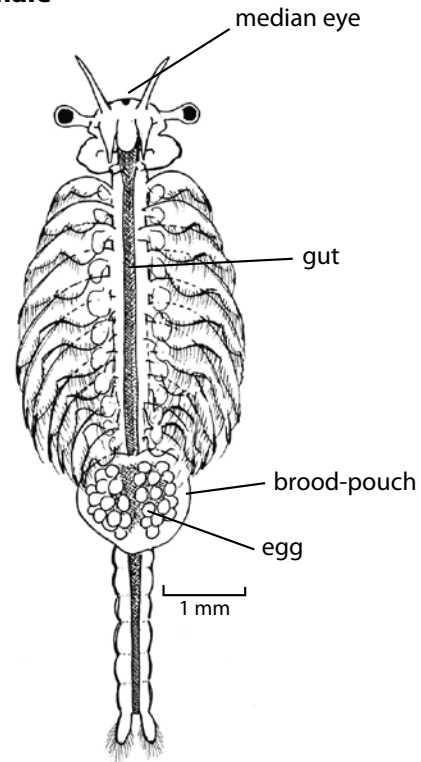
In their natural habitat of salty water only a few species of algae and bacteria are found, as the salinity can reach very high levels. Brine shrimps are among the very few animals that are adapted to these conditions. Brine shrimps feed on algae and the shrimps in turn are eaten by birds, such as flamingos and avocets. Some lakes have fish and they will also eat brine shrimps but since many lakes dry up during the hottest months fish are often absent.

Brine shrimps develop from eggs, which can be bought in most pet shops. [For details about how to establish a brine shrimp culture in tanks or plastic bottles in schools see the website of the British Ecological Society, which has the details available for teachers to download: the address is www.britishecologicalsociety.org] The eggs hatch 24 – 48 hours after being sprinkled onto saltwater, if it is around 23 °C. When they emerge from the egg, the small shrimps (known as nauplius larvae) are only around 1 mm in length, and orange-brown in colour. They feed on algal particles which are floating in the saltwater and over the next 2 – 3 weeks go through a series of moults until they become sexually mature male and female adults, and are about 1 cm long. When adult (see Figure 1), the sexes can easily be identified by Year 5 and Year 6 children. The stages in the development of brine shrimps are seen in Figure 2.

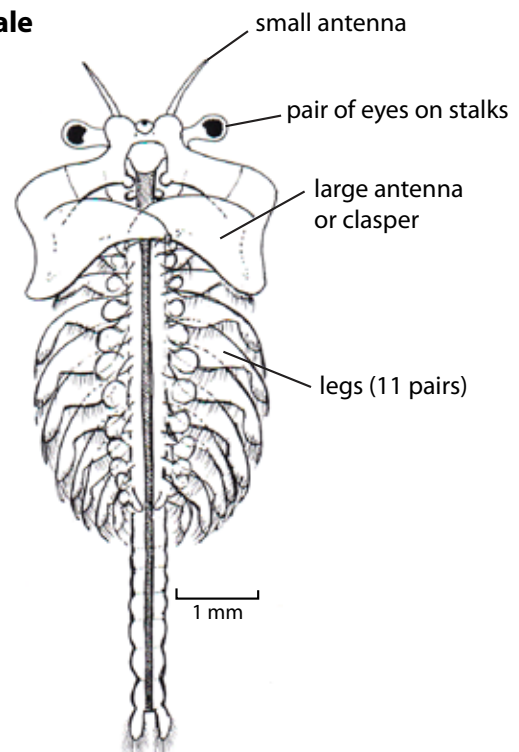
For both the activities suggested here, the same equipment and techniques are used. The adult brine shrimps (12 were used in each investigation, but the sexes were not recorded) were pipetted up out of their tank and placed into a clear plastic dish holding saltwater, to a depth of about 1 cm. [If teachers wish to carry out the actual investigations in their classrooms then a clear plastic or glass dish is best but any suitable transparent container would suffice, such as a Ferrero Rocher box or dessert container. Just put the shrimps into saltwater (made up from tapwater with 35 grams per litre of table salt added) in your dish, or other transparent

Figure 1 Adult female and male brine shrimps.

Female

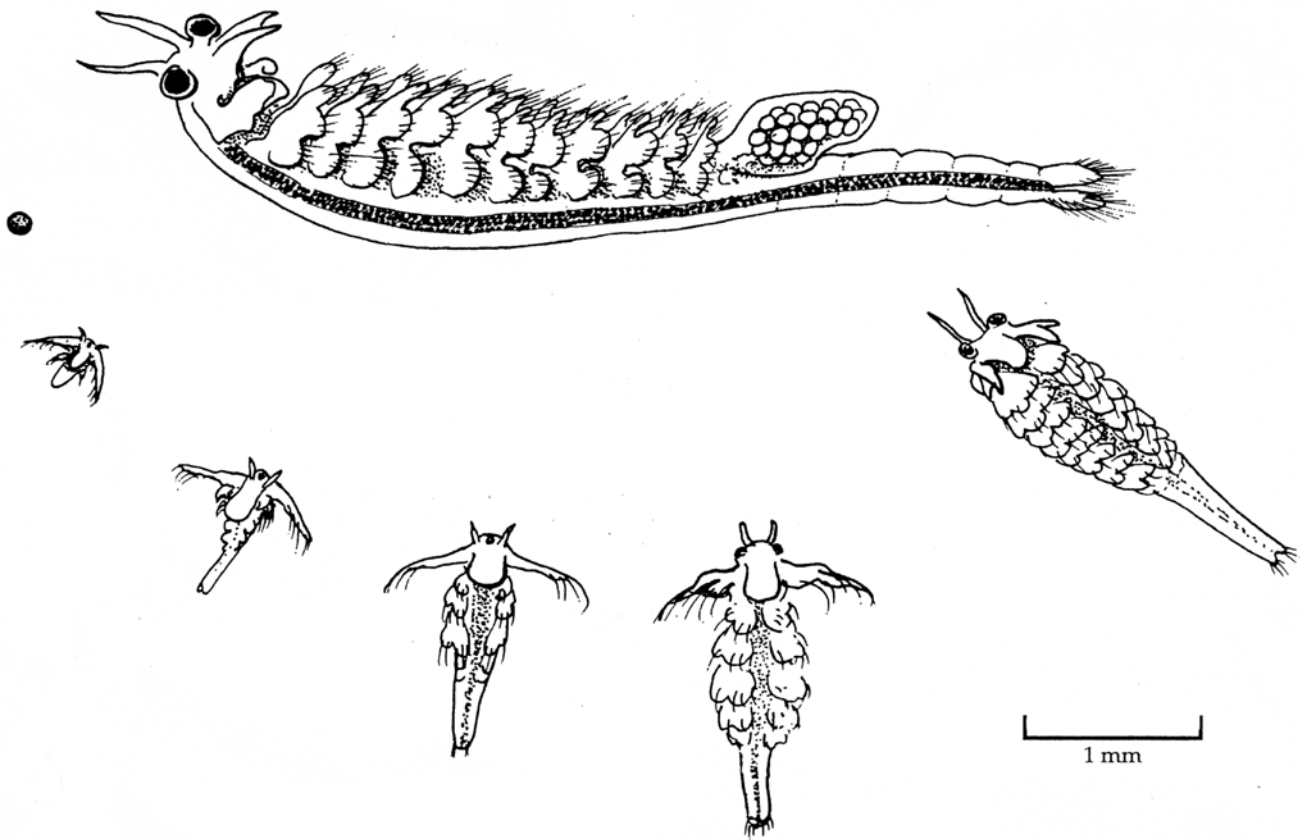


Male



Background notes for teachers

Figure 2 Stages in the growth of brine shrimps.



container, and place on an overhead projector. This should only be done by a teacher since the glass dish, and saltwater, would be placed on a piece of electrical equipment.]

We suggest the following method can be easily used by Year 5 or 6 children to record their data. Divide the class into small groups; we find that 2, or possibly 3, is best. The first few minutes of film (Film sequence 1) can be used as a practice session, so that the technique of recording is well honed by the time they try one of the two investigations. [N.B. There are only 11 brine shrimps in the dish in Film sequence 1 but 12 brine shrimps in the dish for Film sequence 2 and Film sequence 3.] The sequence also allows them to identify male and female shrimps. Tell each group of children that they are to record how many shrimps are in a particular part of the dish (say the left hand side of the dish – you could put a piece of string on the screen or interactive whiteboard to divide the dish into two halves) every 15 seconds for 3 minutes, thus giving twelve pieces of data. The class can use the `bell` in the film footage or the digital clock in the lower

right hand corner of the screen/whiteboard. One very important element is that the children only record how many shrimps are in a particular place when the `bell` sounds, i.e. at 00 minutes 15 s, 00 minutes 30 s, 00 minutes 45 s, etc.. This will take a bit of practice but most will be able to do this. If children do the task as a pair or a trio, any child not quite au fait with this procedure can be paired with a child/children who is/are.

A practice session like this will also allow any questions or potential problems to be addressed before a `real` investigation begins. One frequent question in the first investigation is "Which quadrant of the dish is a shrimp in if it is just crossing a line as the `bell` is heard, or the clock shows, say, 1 min 30s?" This is a crucial part of scientific investigations and illustrates the need for operational definitions. So we might use a rule like "count a shrimp as being in a particular quadrant if that is where its head is" when the signal is heard or seen.

Investigations

1. Do brine shrimps shoal (i.e. swim around in a tight group) when swimming in a clear plastic dish?

If they do, then you would expect that at any moment in time they would be close together, perhaps in one area of the dish. Is this the case, or are they spread out around the dish?

In the 5 minute film sequence (Film sequence 2) each group of children will count how many brine shrimps are in one quadrant/quarter of the dish. [The quadrants were created by putting two lines on a sheet of acetate and placing the sheet under the plastic dish.] For convenience, it is useful to describe the quadrants using the four main compass points so we have a NW, NE, SE, and a SW quadrant. If the children work in pairs, each pair can be given one quadrant to look at and record how many shrimps are in that quadrant every 15 seconds for 5 minutes. On the assumption that a primary class might consist of, say, 30 pupils, then four groups could record the number of brine shrimps present in the NW quadrant, four groups the number in the NE quadrant, four groups the number in the SE and three groups the number in the SW quadrant. This would allow a check to be made for the number of shrimps in each quadrant. [In fact, practice over the years suggests that the three or four groups are not always likely to agree with each other over the number seen for each quadrant. Nevertheless it is good practice to use this method as it illustrates the importance of replication, a key feature of 'How science works'.] Data collected by each group can be recorded in Table 1 and the class results recorded in Table 2 for subsequent graphical work and/or data analysis.

[The usual finding is that shrimps will be found in all four quadrants as they do not shoal. One quadrant will have a greater frequency of counts than the other three and this should encourage discussion as to why this may be. Often small algal particles from the tank get into the pipette holding the shrimps during transfer and this may explain why the brine shrimps may be concentrated in one quadrant of the dish as it would be the only source of food.]

2. Do shrimps prefer to swim in the `centre` or at the `edge` of a dish?

Small mammals, such as mice, will tend to keep to the walls or corners of a rectangular cage if the cage is an unfamiliar environment to them. Being next to a wall or being in a corner offers the best protection from possible predatory attack, or other danger, as the mouse only needs to be vigilant on one side of its body. Objects in the wild that might serve like walls and corners, such as logs, would also offer some protection against wind and rain. Do brine shrimps behave like mice?

The second investigation asks this question of brine shrimps, though the container here is a circular clear plastic dish, not a rectangular cage. The film footage (Film sequence 2) shows 12 brine shrimps swimming in a dish which sits over a sheet of acetate with a circle marked on it. The radius of the inner circle was calculated to be the required radius to ensure that the inner circle was exactly half the area of the dish. The inner circle identifies the `centre` of the dish and the area beyond the inner circle to the perimeter of the plastic dish defines the `edge`.

The children, in pairs as before, count the number of shrimps in the two halves of the dish every 15 seconds for 5 minutes and put their count into Table 3. [Of course, in practice, the pupils do not need to watch both halves of the dish! If they just count the number of shrimps in the `centre` they can easily determine how many there are at the edge as there are 12 in the dish.] The class results for the different groups can be put into Table 4 and then, as before, graphs and calculations can be carried out as desired.

[Often brine shrimps show a preference to swim more frequently in the `edge` but it is not a strong preference so some groups may find the `centre` is the preferred area. The natural habitat of brine shrimps is a salt lake so why might shrimps show a preference for the edge of such a lake? The water at the edge would be shallower and would therefore warm up sooner than the deeper water further out and warm water and sunlight would favour algal growth, algae being the food of brine shrimps. Vegetation is also found around the edges of lakes and the vegetation might offer a refuge from predators of brine shrimps, such as avocets and flamingos. However, avocets are waders so will go into the water around the edges of lakes and feed on shrimps. Flamingos will feed in the same area too, though their very long legs allow them to feed further out. So the picture is a bit more complicated than in the first investigation, since we definitely know that brine shrimps do not move around as a shoal.]

***Happy
shrimping!***

Hopefully, teachers and children will enjoy carrying out one or both investigations and will want to set up their own tanks of shrimps in their own classroom. The pupils might also be keen to devise their own follow-up investigations.

Appendix

1. ASAB has produced a FREE resource for schools titled `Mini-animals`. It is aimed at Year 2 and Year 3 pupils and consists of teacher notes, a poster, several worksheets, card games and a Powerpoint which may be useful as an introduction to a mini-animals hunt. To get the resource, simply e-mail the ASAB Education Officer (Dr Michael Dockery) and he will send it to you – his e-mail address is m.dockery@mmu.ac.uk

2. The British Ecological Society (BES) have produced a book `Brine Shrimp Ecology` which contains all the advice and tips necessary to rear and maintain brine shrimps in a classroom, in either a bottle or a tank. The book is free to download from the BES website which is www.britishecologicalsociety.org

Acknowledgements

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We are especially grateful to teaching colleagues at Our Lady of the Rosary RC Primary School, Davyhulme, St Monica's RC Primary School, Flixton and Withington Girls' School for allowing MD to test the resource with their Year 5 and Year 6 classes.

Table 1**Number of brine shrimps in each quadrant/quarter of the dish**

Time (min and sec)	NE quadrant	SE quadrant	SW quadrant	NW quadrant
0 15				
0 30				
0 45				
1 00				
1 15				
1 30				
1 45				
2 00				
2 15				
2 30				
2 45				
3 00				
3 15				
3 30				
3 45				
4 00				
4 15				
4 30				
4 45				
5 00				



Table 2

Total number of brine shrimps in each quadrant/quarter for each group of children

Group	NE quadrant	SE quadrant	SW quadrant	NW quadrant
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
S				
T				



Table 3**Number of brine shrimps in the centre and edge of the dish**

Time (min and sec)	Centre	Edge
0 15		
0 30		
0 45		
1 00		
1 15		
1 30		
1 45		
2 00		
2 15		
2 30		
2 45		
3 00		
3 15		
3 30		
3 45		
4 00		
4 15		
4 30		
4 45		
5 00		



Table 4

Total number of brine shrimps in the centre and edge of the dish for each group of children

Pupil Group	Centre	Edge
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		
K		
L		
M		
N		
O		
P		
Q		
R		
S		
T		

