The Percentage of Brine Shrimp (*Artemia franciscana*) from the Great Salt Lake infected with Cysticercoids (e.g. *Confluaria podicipina*, *Hymenolepis californicus*).

**Introduction:**
The brine shrimp *Artemia franciscana* is the common North American species and the species present in the Great Salt Lake. (USGS, 2007) The Great Salt Lake Ecosystem is an area of hemispheric importance utilized by many migratory shorebirds for resting, nesting, and feeding (Andres et al. 2006). The brine shrimp is an intermediary host to helminth parasites that infect shorebirds such as gulls (*Larus spp.*), grebe (*Podiceps spp.*), avocet (*Charadrius alexandrinus*), black-necked stilt (*Hymantopus mexicanus*), Wilson’s phalarope (*Phalaropus tricolor*), and pelican (*Pelecanus erythrorhynchos*).

Avian cestodes manipulate the intermediate host in order to make it more appealing to the final host (Sanchez et al., 2007). Infected brine shrimp begin to produce carotenoid pigments that give the brine shrimp an appealing red color. The reproductive system is affected so as to render the animal sterile, and the infected shrimp are known to occupy a place higher in the water column than non-infected shrimp therefore causing infected brine shrimp to be more available to the avian host. The fascinating manipulation of *Artemia* by avian cestodes can be observed in *Artemia franciscana* from the Great Salt Lake.

Many questions may be posed concerning these parasites, their intermediate, and final hosts. For instance, what percentage of birds using the Great Salt Lake are infected by tapeworms? In what ways do tapeworms affect infected birds? What species of birds are infected? Are the cestodes species specific? Do birds feed preferentially on red brine shrimp? What percentage of brine shrimp do cestodes infect? What part of the water column do infected brine shrimp occupy in the Great Salt Lake? Answers to such questions can help furnish an understanding of the delicate relationships present in the Great Salt Lake Ecosystem.

**Question:** What Percentage of *Artemia franciscana* collected for this lab is infected with avian parasites?

**Objectives:**
At the conclusion of this lab students will be able to:
- Identify adult and juvenile brine shrimp.
- Distinguish between male and female brine shrimp
- Prepare slides of *Artemia* for microscopic observation.
- Identify *Artemia* infected with cysticercoids.
- Estimate the percentage of infected brine shrimp in the study area.
- Determine the location in the water column of infected brine shrimp within the study area.
Procedure:

1. Separate by sex and age:
   - Place approximately 10-20 *Artemia franciscana* in a Petri dish.
   - View the *Artemia* sample under a stereomicroscope. Separate the males and females. The males have modified antennae, graspers, for gripping the female (Fig 1.). Females are recognizable by their “brood sac” (ovisac), which may contain eggs. The ovisac terminates in a single opening. Males bear a pair of retractile penes (USGS, 2009). Small individuals with indistinguishable reproductive parts are juvenile. Separate juveniles from adults. Place the separate genders in labeled petri dishes.

![Female and male brine shrimp showing anatomical differences.](image: Golden Gate Aquaculture)

2. Mount on microscope slides:
   - Place a small drop of glycerin on a microscope slide at the area 1/3 from the left of the slide and 2/3 from the left. This allows you to view 2 *Artemia* per slide.
   - Place a single *Artemia* ventral side up aligned horizontally, on each glycerin drop and cover with a cover slip (Fig 2.)
   - Carefully, using forceps and dissecting needles, press the cover slip down on the specimen until air bubbles escape and the cover slip sticks to the slide.
   - Place under a compound microscope.
• Beginning with the lowest power, focus on the specimen. Change lenses to increase power. When you are viewing the specimen on the next to the highest magnification (The highest requires oil immersion) parasites if present should be visible.
• Beginning at the head of the animal, scan for parasites. Parasites are most often found in the thorax. You are looking for a round capsule with hooks that eventually comprise the scolex of the tapeworm (Gergana et al. 2009).
• In the margin of the slide write the sex of the specimen, date, location where collected, and number of parasites. Also note color in the following way: R=red, SR=some red, and NR=no red. A= adult, J=juvenile.

Fig. 2.
Illustration of microscope slide and labeling.

9/8/09
Gilbert
Shore
J-Male
Par.3 NR

A-Female
Par. 0 SR

Fig. 3.
Microscopic view of *Confluaria podicipina* seen in *Artemia francisana*. (Center of circle) Note the Carotenoid pigments dispersed throughout the organism (photo: Monica Linford)

Fig. 4.
*Confluaria podicipina* parasite of Grebes. Hooks of the scolex (red arrow) and calcareous deposits (blue arrows) are visible (Photo: Monica Linford)
3. **Record Data in table:**
Record the location, number of individuals, and the number of parasites found, in the table under the correct Artemia type, in the following table.

<table>
<thead>
<tr>
<th>Collection Location (Gilbert 100M)</th>
<th>Adult-R #ind/#par</th>
<th>Adult-SR #ind/#par</th>
<th>Adult-NR #ind/#par</th>
<th>Juv.-R #ind/#par</th>
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4. **Calculate percentage of infection:**

What percent of *Artemia franciscana* that you observed are infected with cysticercoids?

Overall:

By Location:

Combined class calculation:
Glossary

cestode
n. A parasitic platyhelminth or flatworm of the class Cestoda, which comprises the tapeworms.

cysticercoid (sɪs'tɪ-sɜ'kɔɪd)
n. The larval stage of certain tapeworms, resembling a cysticercus but having the scolex completely filling the enclosing cyst.

Scolex
n. anterior part (‘head’) of the cestodes specialized for attachment at the gut wall of the host.

References


