

Brine Shrimp and Brine Flies feed migratory birds and support much of the lake's industry. The salinity of the main body of the lake has climbed to ~19%. At this level, the brine flies and brine shrimp cannot maintain their populations.

Brine fly populations declined dramatically in 2022, and brine shrimp are expected to decline in 2023.

American Avocet and Eared Grebe

The American Avocet and the Eared Grebe are just two of the almost 350 bird species that depend on Great Salt Lake habitats, providing food and habitat for more than 10 million migratory birds and wildlife throughout the Wasatch Front. The lake's diverse wetland, island, and open-water environments are a vital link in the Pacific Flyway, and are becoming even more crucial as habitat is lost or degraded throughout the western states.

A note worthy symbiotic relationship between brine flies and brine shrimp relates to water clarity. After brine shrimp have grazed much of the lake's algae during summer, mid-lake waters become very clear. This allows more light to reach down to the lake bottom, which then stimulates the growth of blue-green algae—the food of the brine fly larvae.

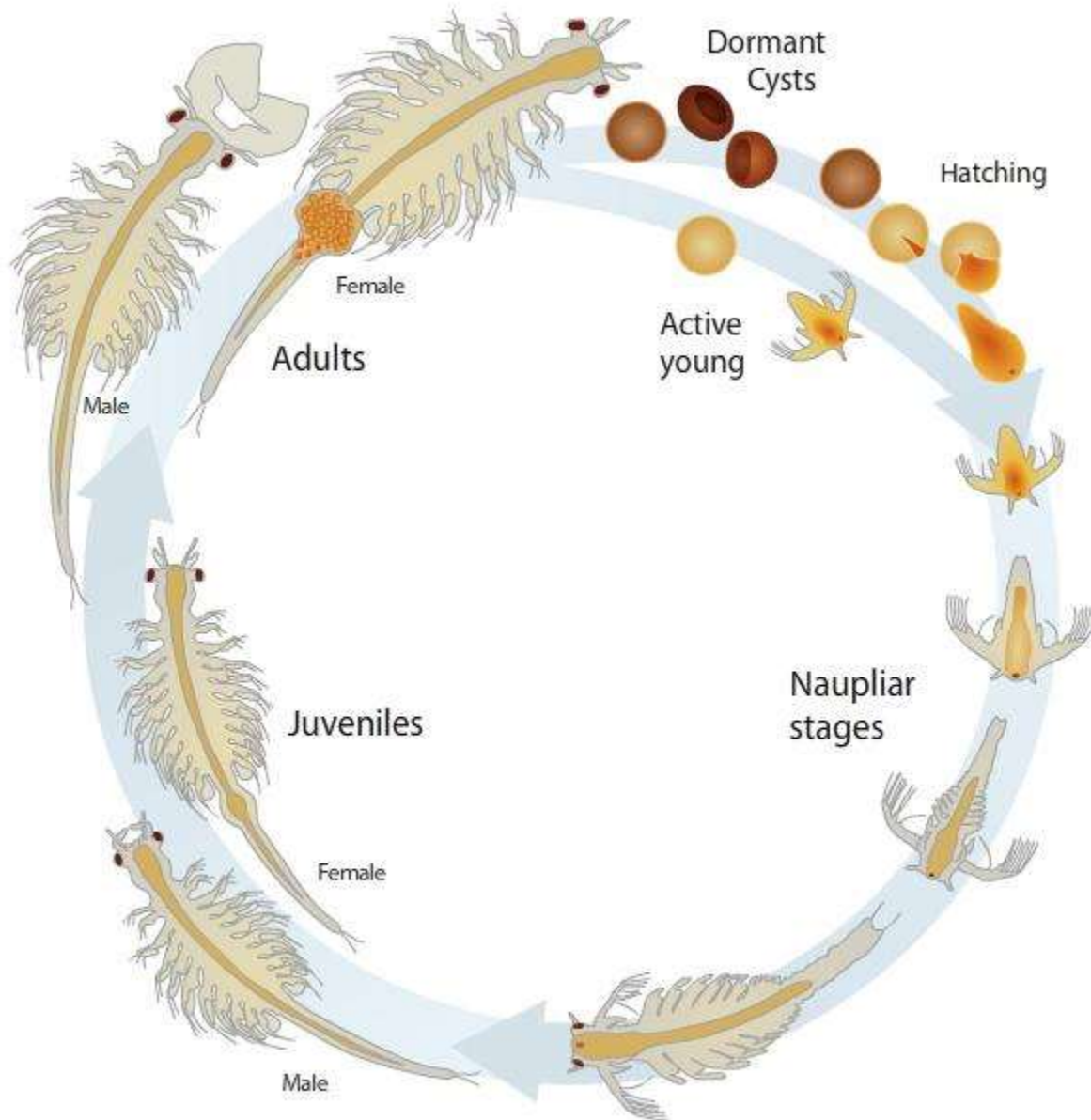


Photo: USGS/U of U Genetic Science Learning Center

<https://learn.genetics.utah.edu/content/gsl/artemia/>

American Avocets

Many migratory bird species, particularly the **American avocet**, come to the **Great Salt Lake wetlands to breed for the summer**. This includes all the marshes from the far southern tip of the lake to the wetlands of the Bear River Migratory Bird Refuge to the north. This represents thousands and thousands of acres of wetland habitat that attracts the American avocet for the breeding season. **It has been estimated that as much as 14% of the continental breeding population of American avocets are found to breed in the wetlands of the Great Salt Lake**, including the Bear River Bird Refuge which lists the avocet as their number 1 priority species.

After the breeding season is over, the avocet molts into its winter plumage, a more drab grey and black version of their creamy-brown summer attire.

Once molted, they begin to amass on the open-water shores of the Great Salt Lake to get ready for the long flight southward to a warmer winter climate.

The avocets congregate on the Great Salt Lake in large flocks to feed up for the long journey south, eating as many small water-born crustaceans and insects as they can before something triggers the beginning of their flight southward. **As many as 250,000 avocets have been said to stage on the Great Salt Lake** for a term as they rest and feed for another leg of their long journey southward.

Avocets typically arrive in April and leave in September.

Brine Shrimp

Brine shrimp of the Great Salt Lake are of the species *Artemia franciscana*.

These tiny crustaceans, along with the brine fly's aquatic larvae, are the foundation of the Great Salt Lake Ecosystem. Millions of birds visit Great Salt Lake each year to feed on brine shrimp during migration or while nesting.

Not much can live in Great Salt Lake, with its salt concentrations as high as 25%, but by adapting to these conditions, brine shrimp avoid many predators and have little competition for the abundant algae and bacteria that grow there.

Beginning in late winter or early spring, as the water temperature increases and there is an influx of fresh water to the lake, **brine shrimp hatch from cysts**, which are hard-shelled dormant eggs. The brine shrimp **larva**, also called a nauplius, survives on a yolk sack for the first 12 hours, but then feeds on algae as it grows into an adult.

Some species of Artemia have only females, but the Great Salt Lake populations has both males and females. The male can be distinguished by his 'grasper' antennae, which almost look like a giant handlebar moustache, and the female can often be seen with two small, orange or pink egg sacs at the base of her tail.

When conditions in the lake are good, such as with high oxygen and relatively low salt concentrations, **female brine shrimp will give birth to live nauplii**. But, if salt concentrations increase due to drought in summer, or when water temperature drops in late fall, females switch to making more cysts to ensure the survival of future generations. As winter passes, and spring starts to make an appearance, the life cycle of the brine shrimp starts all over again.

Brine fly

An estimated 5,000 billion brine flies hatch each year on Great Salt Lake. At their summer peak, there can be 110 billion flies at any moment along 335 miles of lake shore line. The hatch begins in April and May and continues through October and November, usually peaking about two or three times.

Brine fly are consumed by migrating birds that rely on the Great Salt Lake ecosystem for energy and growth. A typical brine fly has as much as eight times the caloric value of a brine shrimp.

Two main species of brine fly inhabit areas of Great Salt Lake, *Ephydra cineria* (the most abundant) and *Ephydra hians* (the larger), neither of which bite or like to land on people.

In spring, females each lay about 75 eggs on the lake's surface. These eggs hatch and grow into half-inch tube like **larvae, which feed on algae** (and other organic matter). Just like caterpillars, brine fly larvae form a "chrysalis," or casing, before they turn into adult flies! They eventually attach their pupal case to shallow substrate bottoms of the lake called **microbialites** (brine flies seem to prefer microbialite substrates, likely due to the microbialites' solid surface texture and availability as a food source). Before **adult flies** emerge, the pupal case produces an air bubble to help float toward the surface.

During summer the lake shores are covered with masses of empty pupal cases that have washed up from the lake surface. These casings have been known to reach numbers of 370 million per mile of shoreline.

The brine fly lives just 3-4 days; they do not bite or feed in the adult state; they are there for one reason—to reproduce. During their brief lives as larvae, they eat great quantities of algae, bacteria, and organic waste from both brine shrimp and their own life processes—about 120,000 tons each year! The water cleansing provided by brine flies has been said to be more efficient than a \$75, million sewage treatment plant. **Without the flies, it is believed algae would essentially take over the lake and the Great Salt Lake as we know it would cease to exist.**

Eared Grebe

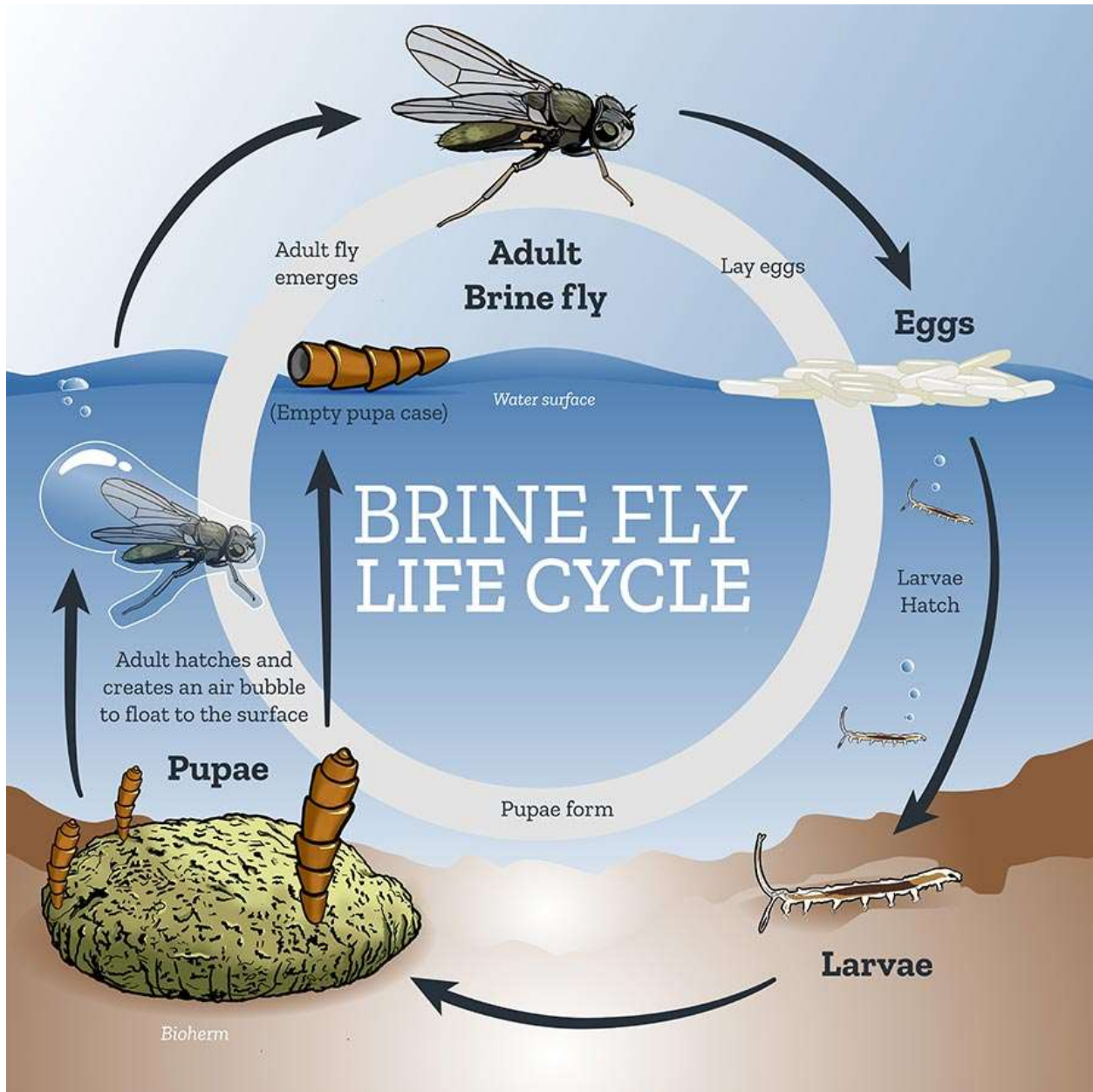
Eared Grebes are one species of bird that keeps coming back to the Great Salt Lake on its annual migration—**5 million Eared Grebes call the Great Salt Lake home for several months a year;** the weather and the water are the foundation for that accommodation.

They are night-fliers, whose survival depends on the lake's unique ecosystem. Because they fly at night, they can only be spotted on weather radar as they head south for the winter.

Kyle Stone, a wildlife biologist for the Division of Wildlife Resources, says, "Great Salt Lake is such an important resource for them because just the uniqueness of the Great Salt Lake and productivity of the brine shrimp as a species... **During the time that they are here, from August to December, the Eared Grebes go through a feather molt and lose all their flight feathers.** During this time, their flight muscles also atrophy and they actually lose body mass, and weight and muscle mass, but they increase their stomach organs to where they can actually pull out more nutritional value in brine shrimp."

A single Grebe eats about 30,000 brine shrimp a day. When you consider the number of Eared Grebes in GSL—it calculates out to 165 billion shrimp consumed a day. Fortunately for the migrating birds, there can be up to 4 trillion brine shrimp swimming in the lake's salty waters on a given day.

The southern part of the Great Salt Lake has roughly four times more salt than ocean water. The high salinity level of the lakes not only protects the brine shrimp, but their food sources as well: a nearly invisible algae called Phytoplankton.



Graphic: Utah Division of Wildlife Resources

<https://wildlife.utah.gov/images/gslp/brine-fly-life-cycle-2.jpg>