Branchiae-legged crayfish Artemia, in most cases classified as Artemia salina. During the past decade Artemia salina has become the most popular fodder for both salt-water and fresh-water fish bred in domestic aquariums or industrial ponds. This amazing species won its reputation not only thanks to its nourishment value but also its way of reproduction and its ability to survive in the most extreme conditions.

Officially, Artemia salina has been declared extinct. This name belonged to a crawfish, which used to breed in the now-extinct British lake Livington. This was the first Artemia species classified by biologists, namely by Swedish botanist and founder of animal species classification Carl von Linné in 1758. By tradition this name was later awarded to all European Artemia.

Currently, seven kinds of this species live around the world:

1. *Artemia tunisiana*(Europe and North Africa);
2. *Artemia species* (America, part of Europe, Asia);
3. *Artemia franciscana* (America, part of Europe);
4. *Artemia parthenogenetica* (Europe, Africa, Asia, Australia);
5. *Artemia sinica* (Central Asia, China);
6. *Artemia persimilis* (Argentina);
7. *Artemia urmiana* (Iran).

A majority of artemias – also called Urzeitkrebse, Salinenkrebse, Salzkrebse, Feenkrebse and Brine Shrimp – with habitat in Eastern Europe and Asia belong to one of the following kinds: Artemia tunisiana, Artemia species or Artemia parthenogenetica. The last species includes a number of populations with certain genetic differences, including the capability of reproducing without participation of male species.

In terms of nutritious value, there is no difference between the species, and in many cases it is difficult to classify particular kinds and sub-kinds because Artemia crawfish are able to change their appearance depending on environment.

Artemia cysts produced and sold by company Artemia World are cultivated exclusively in artificially produced natural habitat conditions, but are genetically equal to those living in a natural environment.

Biology

Artemia belongs to the Arthropoda pfylum, Branchiata sub-phylum, Crustacea class, Branchiopoda sub-class, Anostraca order, Arterniidae family and Artemia genus.
Adult dioecian crayfish can reach a length of 10 millimeters, while some monoecioius grow up to 20 millimeters. Their color varies from greenish to bright red depending on food and oxygen concentrations within the water.

There are two ways Artemias can reproduce: sexual and dioecian (meaning reproduction occurs without the participation of male species as embryonic development starts immediately after eggs arrive at the uterus). If conditions are favorable, an entire cycle of development occurs within the uterus as fingerlings are hatched. If living conditions deteriorate, a crayfish lays eggs – cysts, which have a harder shell and an exceptional ability to survive.

Cysts prove to be extraordinarily resilient during diapause. According to tests, they can survive in ionizing radiation, a vacuum, and temperatures ranging between -196°C and +103°C. Cysts are able to survive in contact with aggressive liquids, extreme drying, oxygen-free conditions,

and under the influence of pesticides and metabolism products. For example, in the U.S. in 1976, during a drilling operation in the Great Salt Lake in Utah, Artemia cysts were discovered in soil sample between two layers of salt. Radiocarbon analysis found the age of the cysts to be 10,000 years old.

Dry cysts can be carried from one body of water to another by wind. In favorable conditions cysts produce Artemia fingerlings. During the first 24 hours of its existence a cyst absorbs an amount of water 1.4 times that of its initial weight, after which an embryo is resuscitated and its development continues. Eventually the embryo leaves the cyst through a split. The average length of a newborn nauplia is 0.45 millimeters, weighing 0.01 milligrams. Its color ranges from pale pink to bright red. When nauplias completely dispose of their shell and the membranes covering their body they begin moving quickly. Before its first peeling, 10–12 hours after birth, a nauplia does not eat. Following the aforementioned timeframe, the creature then enters a second fingerling phase and begins to filtrate and devour one-celled algae, bacteria and detritus. In a period of growth lasting eight days, a nauplia has approximately 15 peelings. Artemia can have a lifespan of up to six months.

Artemia live in salt lakes, which consist of chloride, sulfate and carbon. Concentration of salt in the water where the crayfish live can reach 300 grams of salt per 1 liter of water. However, artemias are very adaptable and are able, for some time, to exist even in fresh water. This makes it possible to use them as live fodder for fresh-water aquarium fish.

Artemias can also survive in water with a huge oxygen deficiency. The minimum concentration of oxygen for an adult species is very low – 0.5 milligrams per one liter, and for nauplia it requires even less at 0.3 milligrams per liter. The crayfish can survive up to two hours even in an oxygen-free environment. In some bodies of water Artemia tend to be the only representative of fauna because no other species can survive in such extreme conditions.

Artemia is also resistant to environmental change as a result of pollution. Due to this, Artemia is, in many cases, the only species able to survive in some bodies of water contaminated with hydrogen sulphide. Although the species has no defense mechanisms – anatomic or behavioral in nature – its protection is solely based on the very surroundings it lives in; an environment not suitable for enemies and competitors.

Thanks to its ability to survive and adaptability, Artemia even made it to the outer reaches of the earth’s atmosphere: In 1982 the crayfish was chosen for experiments carried out by a Soviet-French crew in space. The crew conducted research relating to the impact of space-borne radiation on Artemia cysts and plant seeds.

In natural conditions Artemia feeds on microalgae, bacteria, small elemental species and detritus. In the domestic breeding conditions of hatched fingerlings for fish fodder purposes they can be fed baking yeast or microalgae.

Artemia's way of feeding is active filtration. The crayfish has no ability to inventively select and grasps only feeding particles. If the water has a suspension of mild sand and feeding particles Artemia will devour both. It was even observed that hard particles stimulate gulping.

Exposed to excessive amounts of fodder, the crayfish produces excrements with a high concentration of undigested organic matter. The crayfish use this reserve repeatedly when exposed to shortage of fodder. It does this by stirring plankton with its legs and devouring the suspension.

Artemia can be used as aquarium fodder during all three phases of its life cycle.

— Artemia eggs without a shell are excellent fodder containing a high concentration of protein for fingerling and small fish.
— Nauplias – is initial fodder for aquarium fish youth.
— An adult Artemia is excellent fodder for a majority of mature fish species.

Artemia and aquarists

The main benefit of Artemia is that it can be bred at an aquarist's desire year-round and can be used at any phase of its development.

However, despite its strong survival quality, dry cysts should be stored in waterproof packages, otherwise embryos can die. Cysts are very hydroscopic and absorb humidity when exposed to open air, which increases internal metabolic processes. As a result of this effect the cyst will exhaust its energy resources.

Before incubation, cysts should be processed in order to end diapauses. Keeping cysts in a concentrated salt solution in a freezer at -25°C for a period lasting between one to two months produces the best results. However, it is recommended to follow instructions of the cysts' producer because in some cases they can be processed with special activators requiring a unique technology of preparation for incubation. Moreover, Artemia eggs are sometimes sold in decapsulated form because they can thus produce a crayfish of better feeding value as it does not have to expend energy for hatching. Such cysts, however, are more demanding in terms of storage conditions.

Incubation takes place in special facilities – incubators or reactors. These are plastic cylinders with a cone-shaped bottom that are fixed directly in an aquarium or on its outer wall. Other components include: a vessel with salt solution, aerator, lighting and, if required, a heating device. Optimal incubation temperature is 28°C to 30°C. Hatching begins within 24 hours at a sustained temperature of 28°C, and a mass hatching of fodder fingerlings occurs within a period of 30–48 hours. At higher temperatures the process occurs more rapidly and fingerlings hatch simultaneously.

In normal conditions one gram of high-quality eggs produces 200–300 thousand fingerlings. The ideal productivity of such eggs is 95 percent, but in domestic conditions a 40 percent productivity rate is considered good.

The advantages of feeding fingerlings with Artemia stem from its simple production. The possibility of regular breeding via constant introduction of eggs to an incubator, high concentration of protein, fats, carotenoid pigments and vitamin B12 (up to 7.2 mkg/g) facilitates devouring of the fingerlings' soft shell.

Industrial use

It is known in some cases that Artemia served as human food as well. For example, American Indians living near Utah's Salt Lake found these crayfish to be quite delicious. Arabs migrating westward from the Nil riverbed collected Artemia in salt lakes and prepared paste that, according to well-known German geographer August Peterman (1822–78), reminded them of salted herring and ate Artemia instead of meat.

However, Artemia presently is exclusively used as fish fodder and is one of the most popular fodders in industrial fishery. Artemia is a superb, highly nourishing fodder for industrial fish and shrimp bred at fish farms.

For example, young sturgeons deprived of normal reproduction and living conditions due to a large number of hydropower plants and other artificial dams must be, for some time, fed in unique pools before the fish are strong enough to live in a natural environment. They eat only live animals and calorie-rich Artemia. Due to its chemical composition, Artemia turned out to be one of the best fodders for sturgeon fingerlings.

Beginning in the mid-eighties due to a worldwide spread of commercial breeding of fish and shrimp fingerlings, annual consumption of Artemia eggs increased several hundred thousand tonnes. During the past several years the breeding of some kinds of water animals was put into practice thanks to Artemia. For example, a boom in mar culture of evrigalin salt-water fish in the Mediterranean Sea in the 1970s was mainly based on usage of Artemia.

This boom was also related to the breeding of a large-size “commercial” form of Artemia, called Sea Monkeys or Artemia NYOS, by American laboratory New York Ocean Science.

A majority of scientists refuse to recognize it as a biological sub-phylum, although this Artemia is presently supplied to the market, accounting for the main part of U.S. Artemia production.

Interesting facts

— Artemia is a contemporary of dinosaurs and has been living on Earth for approximately 100 million years and, unlike large reptiles has no intention of becoming extinct. Scientists know only one crayfish that is older than Artemia – Triops cancriformis, which emerged more than 220 million years ago.
— The uterus of a single female Artemia can contain as many as 200 eggs.
— Artemia has three eyes. One simple eye develops during the fingerling phase of development and an adult species develops an additional two, more complicated eyes.
— Artemia never sleeps. It must constantly be awake in order to breathe and feed.
— A male Artemia has two reproductive organs.
— Do you know how to tell a male Artemia from its female counterpart? A male Artemia has two big antennas on its head and a female has one small antenna but a big uterus.