

# Review of the African distribution of the brine shrimp genus *Artemia*

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## Abstract

Brine shrimp (genus *Artemia*) are small (8 to 12 mm long) cosmopolitan crustaceans (Anostraca) found predominately in hypersaline water bodies such as inland salt lakes and pans, coastal lagoons, and salt works at salinity levels above 40 g·l<sup>-1</sup>. They have been extensively studied due to their high monetary value as food for larval fish in aquaculture and their unique reproductive strategies. Brine shrimp occur as either bisexual species or as parthenogenetic populations. Despite published reviews of their world-wide distribution little is known about their occurrence in Africa. This review adds new information about 70 African *Artemia* sites and lists 26 potential sites and their coordinates. Sixteen sites in Southern Africa and Namibia were visited during a collecting trip, and new information on the reproductive mode of nine of these sites is given. Several South African populations exhibit bisexual reproduction. In Namibia there are two parthenogenetic populations (Walvis Bay and Swartkops) and an additional bisexual population (Hentie's Bay). A mixed population (bisexual and parthenogenetic reproduction at the same site) was found at Coega, South Africa.

**Keywords:** Biogeography, brine shrimp, site description, hypersaline water bodies

## Introduction

Brine shrimp of the genus *Artemia* (Crustacea, Anostraca) are of interest to both biologists studying their evolution and developmental biology (Abatzopoulos et al., 2002) and aquaculturists using them as live food in fish and shrimp larviculture (Dhont and Sorgeloos, 2002). The life cycle of *Artemia* can begin as an embryo within a dormant cyst. Depending on environmental conditions, embryos can enter into diapause and arrested development for many years and are capable of surviving a very wide range of environmental conditions (Clegg and Trotman, 2002). *Artemia* nauplii can be easily hatched from cysts and have various applications in aquaculture, for example: they can be enriched with nutrients, i.e., essential fatty acids and vitamins to improve their nutritional value to cultured fish larvae or juveniles (Dhont and Sorgeloos, 2002); they have been used as carriers of spawning hormones to treat fish diseases or induce spawning in adult fish (Burton et al., 1998); and they have been tested as a promising vehicle for probiotics in marine fish larviculture (King, 2002).

The genus is cosmopolitan and comprises both sexually reproducing species and parthenogenetic populations. Salinity is the most important environmental factor governing *Artemia* distribution with populations being found in salt lakes and pans at salinity levels above approximately 40 g·l<sup>-1</sup> (Vanhaecke et al., 1987) where fish and many predatory invertebrates are absent (Browne and MacDonald, 1982). Information from reviews (Persoone and Sorgeloos, 1980; Browne and MacDonald, 1982; Vanhaecke et al., 1987 and Triantaphyllidis et al., 1998) suggests that reproduction is sexual in the new world/western hemisphere (Americas), while in the old world (Europe, Asia, and Africa) *Artemia* populations can reproduce either sexually or parthenogenetically (Browne and MacDonald, 1982).

*Artemia* cysts can be naturally dispersed over long distances by becoming attached to the feathers of wading birds (Green et al., 2005) or being carried by wind. However, due to their high commercial value, *Artemia* cysts have also been inoculated into salt pans throughout the world, for example in Kenya (Rasowo and Radull, 1986) and Vietnam (Vu Do Quynh and Nguyen, 1987). Unfortunately, inoculation harbours the danger of introducing invasive species that may establish themselves in the new environment and replace local species. For instance, Van Stappen (2002) suggested that *Artemia franciscana* may replace other species, such as *A. salina* which is known to occur on the African continent from Tunisia to Southern Africa.

Despite their wide distribution, very little is known about the distribution of *Artemia* in Southern Africa (Van Stappen, 2002). For example, Persoone and Sorgeloos (1980) listed nine *Artemia* sites for sub-Saharan Africa, a number that was increased to only 15 sites 18 years later in a review by Triantaphyllidis et al. (1998). In comparison, the number of records for China increased from 2 to 73 sites and in Central America from 18 to 57 (Van Stappen, 2002). Thus, for more than 20 years little progress has been made in our understanding of African *Artemia* distribution. There is, however, an increasing interest in *Artemia* research in Africa (Triantaphyllidis et al., 1998). This review contributes to the biogeography of *Artemia* by presenting information about the presence of *Artemia* in Africa. We report new sites visited and/or sampled as part of a sampling trip through South Africa and Namibia. Hence, the lists previously provided by Triantaphyllidis et al. (1998) and Van Stappen (2002) were updated.

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