

APTSAD Project Profile

Title	Optimizing <i>Artemia</i> Production Technology for Sustainable Aquaculture Development (APTSAD), Food Security and Economic Growth for the East African Coastal Communities
Countries covered	Kenya and Tanzania
Partner institutions	<ul style="list-style-type: none"> ● Maseno University, Kenya ● Kenya Marine and Fisheries Research Institute (KMFRI), Kenya ● Tanzania Fisheries Research Institute (TAFIRI), Tanzania ● University of Gothenburg, Sweden
Collaborators	<ul style="list-style-type: none"> ● Kadzuhoni Self Help Group, Kenya (community development group) ● Kensalt Ltd, Kenya (Private salt producing company) ● MWEVUPI salt farmers (Community development group) and Omary salt works (Private salt producing company), Tanga, Tanzania.
Lead institution	Maseno University, P.O.Box Private Bag, Maseno, Kenya
Principal Investigator (PI)	Erick Ochieng Ogello (Ph.D.), Department of Fisheries and Natural Resources, Maseno University, Kenya, P.O. Box Private Bag, Maseno, Kenya, Email: eogello@maseno.co.ke Tel: +254708842832, Alternative Email: erick.ogello@gmail.com
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Project period	2 years

Artemia are small crustaceans found in saline habitats such as salt lakes, coastal lagoons and evaporation saltworks. It is the excellent nutrition profile of *Artemia* that makes them suitable for aquaculture, especially as food for larval fish. The fish feed disparity is more critical at fish larval stages. *Artemia* has been used globally (as food for ‘baby fish’) to improve fish larviculture production in hatcheries and ensure high production of quality larval fish seeds. *Artemia* can as well be used as a protein source to formulate aqua-feed for grow-out fish. Currently, *Artemia* cysts are only used by few hatcheries in East Africa and are expensive since they are imported from Asia, America or Europe. Fortunately, *Artemia* culture has been established on the Kenyan and Tanzanian coast for more than three decades, thanks to the Kenya-Belgium Project (KBP), implemented by Kenya Marine and Fisheries Research Institute (KMFRI) and University of Ghent (UGent), Belgium that introduced *Artemia franciscana* to coastal Kenya. However, there is limited scientific information on 1); identity and adaptability of *Artemia* to the local conditions along the Kenyan and Tanzanian coastline, 2); reproductive traits of the East African *Artemia*; and 3); application of local *Artemia* strains in aquaculture initiatives.

The general objective of this project is to improve the livelihood of coastal communities in Kenya and Tanzania through establishment of innovative *Artemia* Value Chain (AVC) linkages that involves production of *Artemia* biomass / cysts, and applications in the emerging larviculture initiatives. Specifically, the project will 1) characterize the local *Artemia* biotopes in coastal Kenyan and Tanzanian using molecular techniques

to determine the genetic adaptation of the *Artemia* biotopes along the East African coastline. 2), apply innovative biofloc technology for mass production of *Artemia* biomass, 3) promote utilization of *Artemia* biomass in emerging local aquaculture initiatives i.e. larviculture, and aqua-feed production.

Description of research methods

Objective 1: *To characterize local Artemia biotopes using molecular techniques:* This project will characterize local *Artemia* strain(s) and cysts in terms of genetic divergence, nutritive capacity, reproductive performance, and determine their suitability for aquaculture. Molecular identification techniques will be done at the University of Gothenburg, Sweden. *Artemia* samples will be obtained from Kenya and Tanzania during a baseline survey and transported to Sweden for lab analysis. Growth and reproduction laboratory tests with local *Artemia* strain(s) will be performed in Kenya and Tanzania. Parameters will include hatching, growth, and reproduction in abiotic and biotic (phytoplankton) conditions. As prevailing in coastal saltworks, assessment of *Artemia* suitability for pond production will be done using standard methodologies. Similar studies will also be done using original *Artemia* cysts from San Francisco Bay (SFB) sourced from KMFRI-*Artemia* cyst bank, for comparison.

Objective 2: *To apply innovative biofloc technology for mass culture of Artemia cysts and biomass*

Live culture production protocols for other live food resources (i.e. rotifers, copepods and cladocerans) using BFT already exist (Ogello 2017; Ogello *et al.* 2018, 2019). This project will apply these protocols for mass production of *Artemia* biomass in the existing demonstrational units. The technology will be called *Artemia* Biofloc Production Technology (ABPT). New protocols / manuals will be developed and shared with local communities. The *Artemia* biofloc experiments will be carried out at KMFRI's Malindi *Artemia* research field station in Kenya and in the Tanzanian salt works in Tanga. Green Water (GW) technology supplemented with chicken manure, molasses and other environmental wastes will be used at elevated carbon nitrogen ratios (C/N). As developed elsewhere in the world, the project will foresee a dissemination platform of project findings and *Artemia* production protocols for local rural communities. The project will promote adoption of *Artemia* production techniques (biofloc) by commercial salt producers, artisanal salt farmers and local communities. The activities will include purchasing of equipment and consumables needed for ABFT *Artemia* pond production e.g. molasses, nets, chicken manure extracts etc, enriching water supply, supplementary feeding, raking in culture ponds, water exchange and renewal, biomass harvesting. The physico-chemical conditions will be monitored and phytoplankton analysis will be done using a light microscope on a weekly basis. Data will be collected for *Artemia* population growth parameters.

Objective 3: *To promote utilization of Artemia cysts and biomass in emerging local aquaculture activities for better growth performance, feed utilization and survival of fish and improving local livelihoods*

a) Fish larviculture initiatives: Protocols for co-feeding larval fish using *Artemia* nauplii, other live diets (rotifers, copepods and cladocerans) and commercial inert diets will be produced. This study will be carried out at Maseno, KMFRI and TAFIRI. Culture trials of marine fishes i.e. *Chanos chanos* and crabs or shrimps will be done at KMFRI and Khadzuhoni SHG. Studies of using *Artemia* in comparison with other live and dry feeds will be carried out consecutively. Growth rate and survival studies will be carried out to determine the effectiveness of *Artemia* as compared to the other live and dry starter fish feeds. *Artemia* biomass or cysts will also be supplied to specific hatcheries owned by local communities in Kenya and Tanzania in order to improve larviculture in those hatcheries. University students (undergraduate, masters) undertaking aquaculture studies will be encouraged to run larviculture tests at Maseno University, TAFIRI and KMFRI laboratories using different fish species.

b) Aqua-feed production for grow-out fish: *Artemia* biomass produced in objective 2 above will be harvested using existing techniques and processed as protein source ingredient for fish feed production. We will use the proximate analysis in objective 1 to determine best formulation for *Artemia* aqua-feed. The formulation will be shared among community interest groups so that they can apply this knowledge to develop a cottage feed industry. The project team will also approach commercial fish feed producers for capacity building wherein we will train staff on the potential of *Artemia* as a protein ingredient in aqua-feed production. The commercial companies will be given information about using *Artemia* production as a source of fish meal for aqua-feed production, with a similar approach involving other livestock feed producers in the long run once trials have been shown to be successful. Growth performance, feed utilization and survival of the fish will be analysed/calculated based on formulated *Artemia*-diets. Local cottage industries will be encouraged to produce more *Artemia*-based fish feeds for sale in local markets.

c) Socio-economic studies on AVC: The study will assess the economic practicability of the venture to uncover strengths and weaknesses. Specific farmers will be identified and briefed on how to apply these tools to assess the economic feasibility of *Artemia* production for applications in aquaculture.

This project will produce a catalogue of the biogeography of existing *Artemia* biotopes in East Africa region, and scientific information, which will put the East African *Artemia* biotopes in the global map for promotion of trade and aquaculture initiatives in the local cities within WIO region. This will improve the livelihoods of the local communities through AVC.