Mtafiti Monthly

A PUBLICATION OF KENYA MARINE AND FISHERIES RESEARCH INSTITUTE (KMFRI)
@KmfriResearch

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By: THEKHA OSMAN & JANE KIGUTA

KMFRI hosts Head of Public Service while on his tour of Coast region

Kenya Marine and Fisheries Research Institute (KMFRI) on Friday 7th July 2023 played host to a high-profile government official. The Head of Public Service and Chief of Staff Hon Felix Koskei made his maiden tour of KMFRI since his appointment to the position by His Excellency President William Samoei Ruto in October last year. He was accompanied by Principal Secretary Blue Economy and Fisheries Madam Betsy Njagi.

The two were in the coast region to inspect government development projects.

Upon arrival at the Institute, they were received by KMFRI's Board Chair Hon John Safari Mumba alongside CEO Prof James Njiru.

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KMFRI's top management headed by BoM Chair Hon John Safari Mumba and CEO Prof James Njiru receive the Head of Public Service Hon Felix Koskei.

KMFRI top management and staff pose for a photo with the Head of Public Service Hon Koskei's delegation, who included Fisheries PS Madam Betsy Njagi

Addressing KMFRI staff, the Chief of Staff lauded the management's effort in improving the Institute's infrastructure, saying that KMFRI has come a long way, and had made great strides since his visit at the Institute in 2013.

Hon Koskei addresses KMFRI staff

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Head of Public Service Hon Felix Koskei signs the visitors book

The Chief of Staff also interacted with researchers and various Heads of Departments at KMFRI where CEO Prof Njiru delivered a profound presentation on various research milestones achieved.

The Head of Public Service acknowledged research activities being undertaken at KMFRI and promised to root for higher budgetary allocations to enable it procure futuristic research equipment. He added that the Institute needs a brand new research vessel to enable researchers generate relevant data that will harness blue economy potential and research, and the government will soon embark on fresh plans to acquire a new vessel for KMFRI.

Staff follow proceedings

In his remarks, Hon Koskei also warned staff, against corruption. He warned employees claiming they 'act on orders from above' that they will not be spared and will face the full wrath of the law.

The Chief of Staff made the sentiments ahead of the African Anti-corruption Day 7th anniversary celebrations observed in Kenya on July, 11, 2023.

The Head of Public Service urged those engaged in the vice to desist from illegal dealings.

He further mentioned that KMFRI is little known and there is need to come up with a strategy on how to increase its visibility to the public to create understanding of the Institute's mandate.

The office of the Chief of Staff and Head of Public Service is responsible for managing operations, coordinating policies and supervising staff.

During his tour of the Coast region Hon Koskei also visited Liwattoni Fishing Complex, Kenya Ports Authority headquarters, Kenya Navy headquarters, Galana Kulalu, among other project sites.

Hon Koskei plants a tree during his maiden tour of KMFRI as the Head of Public Service

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Edited by Phionalorna Nzikwa

#MarineFisheries @KmfriResearch

Salinity tolerance of Kenyan Artemia population versus San Francisco Bay and Great Salt Lake Artemia populations in laboratory conditions

Background

Artemia are Anostracan Branchiopods that are adapted and thrive in extreme salinity ecosystems. *Artemia* cysts (encyst embryo) are produced during harsh conditions to enhance survival and have been an important live feed in marine fish and crustacean hatcheries around the world. While much of the cysts traded come from natural *Artemia* resources, manmade resources have been established through inoculation of saltworks in countries that lack natural resources to provide a local affordable supply of cysts.

In Kenya, *Artemia* was inoculated in saltworks using a parental inoculum from San Francisco Bay, USA in the mid-1980s and since then *Artemia* have colonized and established stable populations in most saltworks.

Despite the established *Artemia* populations in Kenya, little information is available on their physiological characteristics which are key in shaping the development of management strategies and culture methods for commercial production of the Kenyan *Artemia* population.

KMFRI's Aquaculture team compared the salinity tolerance of a Kenyan *Artemia* population with its parental population from San Francisco Bay (SFB), and another commonly used *Artemia* from Great Salt Lake, Uta, USA (GSL).

Adult Artemia during Courtship

Sources of Artemia Cysts

Cysts of the Kenyan population were collected from Kadzuhoni artisanal saltwork in February 2021. The cysts for the San Francisco Bay *Artemia* were obtained from the cysts bank at the Laboratory of Aquaculture and *Artemia* Reference Centre, Gent University. For the Great Salt Lake *Artemia*, cysts were purchased from the USA.

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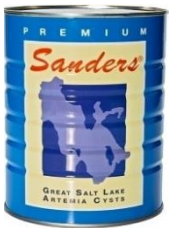
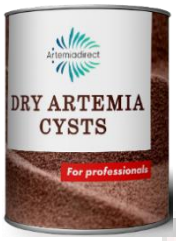


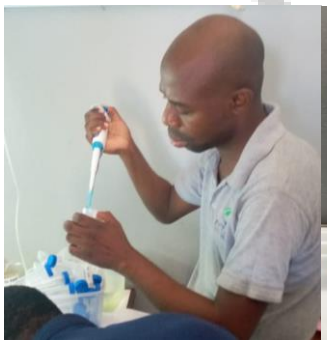


Artemia cysts collection at Kadzuhoni and processed cysts in cans

Hatching and culturing of Artemia

Artemia cysts were first hydrated in fresh water for 2 hours and decapsulated (removing the external shell of cysts) using sodium hypochlorite, sodium hydroxide and sodium thiosulphate according to a standardized *Artemia* cysts decapsulation procedure developed by Lavens and Sorgeloos. Decapsulated cysts were incubated in a well-illuminated room with vigorous aeration for 20 hours.

Hatched instar I nauplii were harvested using a micro sieve and concentrated in glass beakers. From the beakers, 30 nauplii were transferred in batches into centrifuge tubes with 30 ml of saline water at different salinities (35, 70, 105 and 140 g/l). Survival was assessed daily by physical counting of *Artemia* from each centrifuge tube. The nauplii stocked in the centrifuge tubes were cultured for 8 days on live algae cells (*Chaetoceros* spp).




Feeding Artemia with microalgae

Key findings

- Culturing *Artemia* in laboratory conditions at salinities greater than 105 g/l resulted in reduced growth and survival rates.
- Better growth and survival of the three *Artemia* populations lay in the range of 35 to 105 g/l salinity.
- The Kenyan *Artemia* population had lower salinity tolerance above 105 g/l than its parental population, the San Francisco Bay Artemia.

Future work

Studies looking into genetic characterization and other Eco physiological parameters are recommended to confirm whether the Kenyan *Artemia* population is undergoing ecological adaptation with respect to its parental population, the San Francisco Bay Artemia.

Acknowledgement

The team acknowledges WIOMSA for funding the activities of the study through the MASMA-funded APTSAD project (MASMA/OP/2020/02).

KMFRI is also thanked for providing laboratory space and manpower to execute the research activities.

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Edits: Phionalorna Nzikwa

Waste management through Insect-based bioconversion: value from food waste

Background

Kenya Marine and Fisheries Research Institute (KMFRI) through mariculture has been on the forefront on matters of ending land-based litter more so household and market-waste substrate. Waste substrate contains a lot of useful and recyclable nutrients, this form of waste is often considered unworthy and only about 5% is re-used majorly via composting and production of biogas energy in developed countries.

- The SDGs policies encourages waste minimization through extensive waste reuse and recycling activities, where SDG-11 directly relates to solid waste collection and management.

- Currently the global supplies of food waste are estimated to be at 1.3 billion tonnes as a result of growing demands for protein, fertilizers and thus, increasing businesses adopting insect-based bioconversion make economic sense.

- Kenya Climate-Smart Agricultural Project (KCSAP), Karatina University (KU) and Kenya Marine and Fisheries Research Institute (KMFRI) carried out a value addition experiment on food waste to minimise and manage waste through insect-based technology with funding from WIOMSA and KSCAP. Insects (black soldier fly larvae) have the potential to decompose organic waste and convert it into biomass.

Why Bioconversion of Food Waste?

- Insect-based bioconversion of food waste is the controlled breakdown of an initial food waste into insect biomass and frass (waste residuals). The process of insect-based bioconversion of food waste is the natural breakdown of organic matter in ecosystems.
- The naturally occurring insects, colonize and break down food waste, converting the nutrients for their own metabolic and reproductive needs.
- Under controlled conditions, the insects responsible for the decomposition process regulates and the ambient conditions are being optimized to favour the growth and bioconversion by the given species performing the service.

Waste-to-Insect linkage

- To enhance the relationship between insect species and food waste, a combination of biotic integrations and functional traits of the insects for handling wastes should be considered.

- The BSF lays eggs on crevices where they are hatched after a period of 3 days. The instar-1 is fed using the waste substrate collected and sliced into finer form, to increase the surface area to volume ratio for the instar-1 larvae.

- For example, when 100kg of food waste is fed to 20 grams of larvae, the food waste would yield 58 kg of black soldier fly larvae.

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Harvesting of BSF eggs for hatching

	Product	Weight (g)	Price (USD)	Ksh.
1.	Eggs	1000	10	1,000
2.	In star-1	1000	10	1,000
3.	Prepupae	1000	15	1500
4.	Pupa	1000	20	2000
5.	Frass	1000	15	1500

Insect and bioconversion waste as a business model

Insects as Business Processes

- Food waste is viewed as a problem by some, but others view it as an appealing opportunity for business. There has been a growth of businesses using insects to convert food waste a few decades ago.

BSF larvae steps process

- The dark cage was used to hatch and grow black soldier fly larvae. The cages were dark to enable eggs to hatch and grow, and the newly emerged larvae effectively conserved the waste substrate provided. The bins were filled with waste substrate.
- Love cage (greenhouse house) was used for mating and egg production, maintaining the right humidity and temperatures. Female black soldier fly customary lay their eggs in cracks and crevices; thus, corrugated sheets were improvised to provide artificial cracks and crevices.

KMFRI research scientists Dr David Mirera and Lab. technologist Douglas Okemwa were funded by WIOMSA through MARG-1 and KSCAP to develop a climate-smart qua-feed through waste management along the coast.

“The quality and quantity of BSF larvae produced depends highly on the substrate used as feedstock, and environmental conditions, “Says Okemwa. He also, observed that Black soldier fly larvae’ tolerance of wet wastes and high temperatures (from bacterial and colony metabolism) allow them to capitalize on many waste streams. But husbandry practices also require specific lighting for breeding, the flies are intolerant to temperature drops, and perform poorly in some low-nutrient waste.

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How to value addition on waste conducted

An experiment was carried out at Kilifi County to add value to waste generated from different households by insect-based technology

Insect waste management technology

In this study, waste collected from different sources was sorted manually to have a biodegradable for value addition.

Waste substrate source

- Chicken
- Animal
- Household
- Market
- Hotel

waste substrates

"Black soldier fly larvae have the capability to convert various organic waste substrates into more valuable and less harmful biomass while emitting relatively fewer GHGs and little ammonia, "Dr Mirera.

Key findings

- From our study insect-based technology through BSF larvae rearing could be a solution to managing and upcycling organic waste in an environmentally friendly and economically sustainable way.
- Proximate analysis indicates that BSF larvae can fully substitute animal protein and Omena (*Rastrineobola argentea).*

Are black soldier fly larvae safe?

Yes. In the case of microbial contamination, black soldier fly secretes antimicrobial compounds into the wastes they feed in. These secretions limit and can even prevent hazardous pathogens like *E. coli* and *Salmonella* in the waste. These antimicrobial properties are highly beneficial for the bioconversion of municipal food waste, due to the wastes' heterogeneous states of decomposition, "says Okemwa

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PICTORIALS

Compiled By:THEKHA OSMAN & JANE KIGUTA.

KMFRI BOM Chairman Hon John Mumba with CEO Prof James Njiru handing a gift hamper to Kenya's Head of Public Service Commission Hon Felix Koskei alongside Blue Economy and Fisheries Principal Secretary Madam Betsy Njagi

The Head of Public Service Hon Felix Koskei having a chit-chat with his long-time buddy and classmate KMFRI's Chief Research Scientist Dr James Kairu upon arrival of his delegation at KMFRI.

Kenya Public Service Commission head Hon. Felix Koskei during his tour of KMFRI's instrumental lab.

KMFRI CEO Prof James Njiru introduces Centre Director Dr Eric Okuku to the Chief of Staff Hon Felix Koskei.

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KMFRI BOM Chair Hon. John Mumba giving his remarks during the Head of Public Service Commission maiden tour of KMFRI

KMFRI BOM Chair Hon. John Mumba plants a commemorative tree.

KMFRI CEO Prof James Njiru plants a tree in commemoration of the visit.

KMFRI CEO Prof James Njiru addressing KMFRI management staff in the auditorium ahead of the Chief of Staff visit.

Blue Economy and Fisheries PS Madam Betsy Njagi plants a commemorative tree at KMFRI headquarters.

Head of Public Service and Chief of Staff Hon Koskei with Fisheries PS Madam Betsy Njagi tour KMFRI museum.

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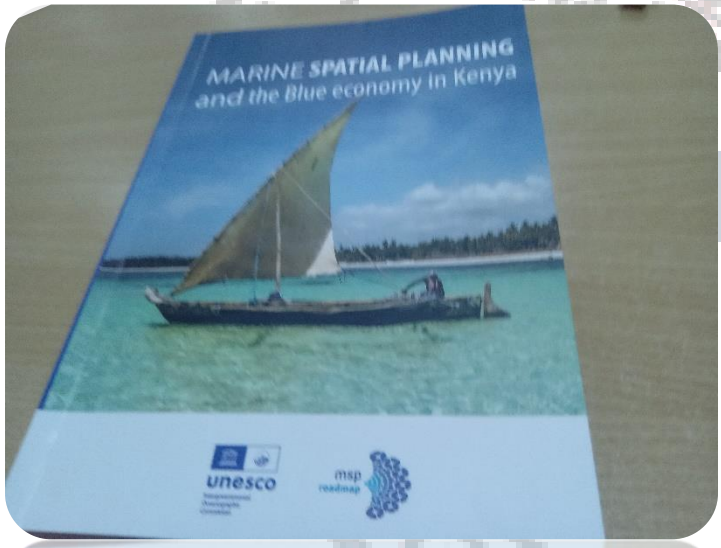
Students from Mama Ngina High School at KMFRI where they toured radioisotope lab to learn more about nuclear science



A copy of the 'Marine Spatial Planning and the Blue Economy in Kenya' book launched during the UN World Oceans Day celebrations held at the Mombasa HQ in June.

KMFRI's AD Oceanography and Hydrography Dr Joseph Kamau, who is also a co-principal investigator for the upcoming UNEP-funded Mikindani water treatment project engages community members during the shooting of a documentary site. Bottom, effluent flowing in a shallow stream in Mikindani.