



CSC Evaluation and Monitoring Programme

## Insect Technology for Sustainable Fish Farming and Waste Management in Kenya

*Proscovia Amondi Alando*



**Like most countries in Africa, Kenya has a fast-growing population estimated by the United Nations to be approximately 56 million in 2022, and predicted to surpass 100 million people by the end of 2058.**

Due to rapid population growth, the country's wild fisheries are struggling to meet the high demand for fish. Wild fisheries being one of the main source of protein for Kenyans, the country is rapidly pacing towards food insecurity exposing its population to potential nutrition deficit.

Furthermore, fishmeal which has been traditionally used as a protein source to formulate fish feed is expensive. This has led to overfishing and added to the country's struggle with food security. Arguably, soybean could be an alternative for replacing fishmeal, however it is not locally produced and it is associated with massive deforestation. This calls for an urgent need to identify alternative and sustainable fish feeds to boost food security and reduce the environmental impact of fish farming.

Using insects as an alternative protein source for animal feed is proving to be a promising solution for fish farmers. However, some farmers still lack the knowledge and finance to adopt insect technology in their fish farming practices. At the forefront of implementing insect technology to boost aquaculture in Kenya is Proscovia Amondi Alando, a Commonwealth Alumnus who completed a Master's degree in Sustainable Aquaculture. Through her co-founded start-

up, Ressect, the black soldier fly (BSF) has been identified as an insect that is very rich in protein and fat, and therefore an ideal candidate to be farmed sustainably and used as a protein substitute for fish feed formulation. As part of this work, Ressect has been training small-scale farmers in Kenya on how to use the black soldier fly technology. The technology has been adopted by many farmers who have since benefited from reducing fish production costs while maximising their profits from their fish enterprises. Apart from their nutritional qualities, the BSF larvae feed on organic waste thereby reducing waste from the environment which consequently reduces greenhouse gas (GHG) emissions.



Training of visitors at Ressect Facility on Black Soldier Fly Technology in 2021.

**Proscovia Amondi Alando** was awarded a Commonwealth Scholarship in 2018 to study for a Master's degree in Sustainable Aquaculture at University of Stirling. Following her Scholarship, she founded Samaky Hub, a start-up that offers consultancy services to fish farmers, and co-founded Ressect, a start-up specialising in farming black soldier flies as an alternative protein for animal feed. She has been instrumental in influencing government policies on aquaculture in Kenya to be inclusive of women and youth. As part of her advocacy work on promoting sustainable aquaculture and food systems, Proscovia is renowned for writing articles for The Fish Site, a knowledge-sharing platform on developments in aquaculture in Africa. Proscovia was one of the panellists for the UN Food Systems Dialogue in 2021, 'The Green Donut', Post-pandemic food systems for tomorrow's wealth. In 2022, Proscovia presented at the COP 27 Food System Pavillion as part of a panel that focused on emerging innovations in water and blue food systems. As a One Young World Ambassador she has played a pivotal role in empowering other young leaders to promote sustainable development.

## A Passion Awakened: Promoting Sustainable Fishing for Food and Nutrition Security in Kenya

Prior to being awarded a Commonwealth Scholarship to study for a Master's degree in Sustainable Aquaculture, Proscovia had worked very closely with fish farmers in Kenya. As a part of this work, she observed and learnt about the challenges encountered by farmers in the fish production industry, which inspired her to apply for a Commonwealth Scholarship to learn more about sustainable aquaculture. She was convinced that she could use the knowledge and skills acquired from a Scholarship to overcome some of the challenges faced by fish farmers, as she wrote in her Scholarship application letter,

'During my undergraduate industrial attachment, I was working with fish farmers, and I learnt that the major problems they face are poor quality fingerlings and fish feeds. The new skills that I will obtain from the MSc in Sustainable Aquaculture programme will be directed towards formulation of high-quality fish feeds and the production of good quality fingerlings for fish farmers. The course will equip me with the necessary skills to come up with and implement projects that will be able to create employment opportunities in my community. I will implement the projects immediately after I graduate from the course. I also plan on spearheading an aquaculture and a consultancy agency that will offer support to the community and create employment for the youth.'

Driven by high hopes and clear future goals, Proscovia completed her degree and returned to Kenya only to face disappointment as she was unable to secure employment – a result of challenging economic environment in Kenya which was exacerbated by Covid-19 pandemic. However, the Commonwealth Alumnus could not be deterred and was prompted to seriously consider establishing her own fish farming enterprise, yet was exposed to another challenge that forced her to dig deeper for solutions.

'I found out that the feed that is used to feed the fish was accounting for up to 70% of the total production costs. I did have some savings, but they were not enough to establish the business. I tried applying for jobs, but there were no jobs. I didn't have collateral to apply for a bank loan, because in my community, women do not own land. So, I was stuck. And I noticed that the high costs of establishing that business were due to high costs of production. And most of the research I did showed that the black soldier fly insects can be used to replace fish meal as a protein source for fish food formulation. In addition, it can lower the cost of production and it's environmentally sustainable.'

Motivated to learn more about the black soldier fly technology, she reached out to two of her colleagues who were farming black soldier fly insects at Egerton University in Kenya. Proscovia partnered with them and became the co-founder of Ressect, a start-up that specialises in farming black soldier fly (BSF) as an alternative protein source in animal feed formulation. As part of this work, Ressect runs training sessions for farmers and offers consultancy services on BSF production, facility set up, and provides a portable starter-kit that farmers can use for backyard farming as they manage domestic waste. Shortly after, she also founded Samaky Hub, an aquaculture consultancy start-up targeting small scale fish farmers in East Africa.



Field visit by farmers at Ressect facility in Nakuru, Kenya in 2021.

'Through the Scholarship, I was able to sharpen my skills on sustainable fish farming and learnt how aquaculture does not only create a means of livelihood but also provide healthy and affordable nutrition. The networks I gained during my studies mentored me to be a better strategist and on how to apply the knowledge gained from research in achieving my goals. I now specialise in sustainable aquaculture which I use to create the change I would like to see.'

In addition to running her own enterprise, Proscovia writes for The Fish Site, an online knowledge-sharing platform, sharing news, analysis and resources for the aquaculture industries. In one of her articles, entitled '**How can Kenya fulfil its untapped aquaculture potential?**' Proscovia highlights how Sub-Saharan Africa's limited aquaculture supply creates an excellent opportunity for Kenya's fish farming sector, giving it the potential to bank on favourable climate conditions and untapped land and water resources. Advocating for women empowerment in aquaculture, she also wrote an article entitled '**Women in aquaculture: Angela Odero**'. In this article she reveals how Angela Odero, the CEO and co-founder of Rio Fish Limited is working towards ending the sex-for-fish trade in Kenya (whereby women traders are sexually exploited by predatory fishermen through a sex-for-fish trade) through creating market linkages for women traders to access an adequate, convenient, and affordable fish supply can help them reclaim their dignity.

Moreover, Proscovia has been working in collaboration with different organisations including The Lexicon, SUSTAIN Switzerland GmbH, and The African Food Fellowship to support sustainable food systems and the inclusion of women and youth in food production.

**'The Scholarship played a significant role in opening up opportunities especially because of the high reputation of the institution [The University of Stirling] and the support I received from my lecturers during my studies.'**

As part of her advocacy work, Proscovia has presented on the use of alternative protein in aquafeed formulation and sustainable aquaculture in international conferences. Her most recent international engagement was at the 27th Conference of the Parties of the United Nations Climate Change Conference (COP27) where she presented on the theme: Emerging innovation in water and local systems.



Proscovia featuring as one of the COP27 Panelists in 2022.

In her presentation she highlighted how Ressect and Samaky Hub are promoting the farming of insects to small-scale fish farmers in Kenya as a sustainable alternative protein for fish feed formulation. She highly recommended the use of BSF insects, for their added benefits to the environment as the larvae of BSF insects feed on organic waste that would have otherwise gone to landfill.



Black soldier fly larvae at Ressect Facility in 2021.

**'I studied sustainable aquaculture, and that is exactly what I'm trying to do - farming fish sustainably. And also, trying to tell other people this is the way you can practise sustainable fish farming. So, the course itself [MSc in Sustainable Aquaculture] is a great contributor for where I am now, because during my studies I learnt about different ways of practising sustainable fish farming. It was a wholesome package, because what we studied was not only sustainability for the environment, but also for the people who practised this farming. So, there are a lot of linkages from the Scholarship studies to the work that I'm doing now.'**

## Transforming Fish Farming Through Black Soldier Fly Technology

Insect farming as an alternative protein source in animal feed formulation (including fish) has been widely used across the globe. Industry practices in insect farming has shown that it is a cost-effective way for sourcing protein from alternatives. Moreover, black soldier fly (*Hermetia illucens*) larvae consumes vast amounts of organic material over its life cycle which helps in upcycling of organic waste and reduction of greenhouse gas (GHG) emissions. The excretions (frass) from the insect have also proven as a highly effective fertilizer to boost crop growth. In short, black soldier fly provides an opportunity for fish farmers to move over to a relatively reliable and profitable protein farming which will contribute to improving food security, while reducing overfishing. Proscovia quantified multiple benefits of the BSF as follows:

**'The use of BSF lowers the cost of production by up to 30% and has no effect on the taste of fish. Compared to open dumping of organic waste the BSF treatment can reduce GHG emissions by 80-90%.'**

Proscovia's work has greatly transformed fish farming practices in Kenya. For example, one of the poor farming practices in fish farming includes feeding fish with food leftovers that would sink to the bottom of the pond and rot, resulting in deterioration of water quality which leads to the death of some fish.



Proscovia visits a Trout Farm in Kenya in 2021.

Through training conducted by Proscovia and colleagues on good practices in fish farming and how to measure water quality parameters to prevent loss of fish, these farmers have benefited from increased income from fish production.

Proscovia and her team have also approached farmers who practice integrated farming (farming poultry, fish and other livestock) and introduced them to the black soldier fly technology, which has resulted in cost savings for the farmers who have incorporated insect farming in their farms.

Since its inception in 2019, Ressect has trained **200** small scale farmers on the BSF technology and offered consultancy, training, and facility set up to farmers. It currently processes two tonnes of organic waste and aims to process **1,000** tonnes of organic waste, provide **22** tonnes of black soldier fly larvae (BSFL) and **90** tonnes of organic fertilizer by the end of 2023.

'We've told them [the farmers] with all this waste that you're producing, especially from poultry, the black soldier insects can feed on poultry droppings. So, by integrating insect farming in their farms as an additional product, it has resulted in improved income for the farmers. Because if we train them to farm insects, they can sell those insects, or use them on their farm. They do not have to incur extra costs to buy feed, thereby lowering the cost of production. So, increased income and lowering the cost of production by up to 30% depending on the type of food fed to the insects, is one of the greatest impacts that we are seeing.'

The boosting of the fish production industry has seen fish consumption increase in Kenya. Proscovia believes that this is **the most significant positive change that her work has brought to her local community.**

'The most significant change to my community has been providing healthy nutrition through fish farming and through insect farming which contributes to food security in Kenya. I would say the impact of Ressect has a potential to go beyond local. And I would say this specifically because being a start-up, and when we upcycle organic waste, we have the potential to significantly lower the greenhouse gas emissions. At the moment we might be doing that at a very small scale. But once we scale up, then we could be able to lower greenhouse gas emissions by upcycling organic waste that would have otherwise gone to landfill and caused greenhouse gas emissions.'

## Turning Challenges to Opportunities for Women in Sustainable Aquaculture

Lack of land and property rights is a major barrier for most women in Kenya looking to practice farming. According to a United Nations Development Programme (UNDP) report of 2020, only 10% of land titles in Kenya are issued to women and this translates to 1.62% of agricultural land owned by women. This extremely low percentage of land ownership by women in Kenya has been attributed to the weak implementation of policies to promote gender balance in land ownership, coupled with persistent discriminatory social norms and practices that have formed barriers that stand between women and their land and property rights.

Determined to promote the engagement and inclusion of women in fish farming, Proscovia has been advocating for women empowerment by encouraging women to form women's groups and farm fish in lakes. She has also led a campaign which called upon the government to offer financial support to these groups to establish their aquaculture enterprises.



Proscovia sun drying Dagaa fish (*Rastrineobola argentea*) in Kisumu, Kenya in 2023.

‘Apart from my personal experience, the challenges that women face, especially when you look at the nutrition aspect or nutrition security, drive me to be an ambassador for the women and youth. In aquaculture, you find that fish consumption in Kenya is very low. It’s at 4 kg per capita per year, compared to the global average of 20 kg per capita per year. And the people who suffer most from under nutrition or malnutrition are child-bearing women and children.’

As part of their work on empowering women to engage in fish farming, Proscovia and her team educate women on health benefits of fish consumption, and this has presented an opportunity for women to make informed decisions about their health and that of their children. For the women who have taken up fish farming, they now have a constant source of income to support their families and improve their livelihoods. Others have taken up Dagaa harvesting from lakes for consumption and to generate income.

Lake Victoria Sardines, popularly known as Dagaa fish in Kenya are an important nutrition source. They are high in quality protein, fatty acids, and a variety of vitamins and minerals such as calcium, potassium, phosphorus, iron, copper, and iodine. Kisumu is one of the major markets in Kenya where the dried fish is packed in sacks and distributed by traders all over eastern and southern Africa.

As a determined young leader with a passion for developing aquaculture and food systems, Proscovia undertook the African Food Systems Fellowship programme to further build on the knowledge and skills on sustainable aquaculture acquired during her Commonwealth Scholarship. This Fellowship is targeted at empowering emerging leaders to jointly transform Africa’s food systems and ensure equitable availability and access to healthy and sustainable food.

‘I am grateful for the Scholarship because apart from gaining a Master’s degree, I have been able to learn other ways to achieve my personal development goals and I continued to improve myself after the Scholarship through taking short courses to develop my skills further or getting into fellowships and other personal development spaces. I also gained a global perspective of various issues and learnt about different cultures by interacting with people from different countries during my Master’s degree studies.’

Following the Fellowship, she has been engaged in more advocacy work focusing on empowering women and the youth to participate in sustainable aquaculture.

‘I write on The Fish Site about the status of aquaculture in sub-Saharan Africa, the challenges, and the opportunities. And I feature women in aquaculture who are doing a remarkable job. So, I’m trying to highlight what challenges these women face. How do they overcome these challenges? What are some of their needs? What are some of their concerns? And how can we have gender balance in the system?’

Furthermore, Proscovia is a member of One Young World (OYW), a group of young leaders whose goal is to empower and develop young leaders for sustainable development. As an Ambassador for OYW and a firm advocate for women and youth empowerment which she believes is a catalyst to societal growth, she actively seeks to include women and youth in sustainable aquaculture.

‘The big goal when I started these projects [Ressect and Samaky Hub], especially after facing challenges as a woman and a youth (such as lack of capital to set up the business, lack of land for farming, and no collateral to secure a bank loan), I decided that one of my main focuses would be to work with the women and youth, to empower them to participate in the fish industry.’

## Influencing Policy Reforms in Kenya to Include Women and the Youth in Aquaculture

Proscovia's passion and determination to work with youth developed well before she was awarded a Commonwealth Scholarship. During her undergraduate studies, she co-founded Egerton Aqua-fisheries Youth Group. The youth group consisted of 20 undergraduate students who worked with fisheries officers and extension officers to offer extension services to fish farmers and to train the farmers on sustainable fish farming. The youth group worked very closely with the county government which funded its activities, including training on fish farming, exhibitions, and forums conducted with local farmers.

Following the Scholarship, Proscovia's pre-existing relationship with her county government worked positively for her advocacy work on influencing policy frameworks to incorporate strategies on the inclusion of women and youth in sustainable aquaculture. As a member of the African Food Fellowship, Proscovia partnered with representatives from the government, non-governmental organisations, and the private sector to challenge existing policies that guide aquaculture in Kenya, and to collectively develop policy frameworks that support the inclusion of women and youth and empower them to both contribute to and benefit from the aquaculture industry.

**'We [Proscovia and colleagues] came together as one voice to make changes in policy. We developed a framework of policy reforms for the aquaculture industry, saying this is what challenges women and youths face in the industry, and shared it with the government. One of the challenges we identified was limited access to finance. We found that there was bias when women went to access finance, compared to men, especially in the fish industry. There was also limited inclusion of youths in the strategic planning for aquaculture. We recommended the inclusion of the youth in value addition and providing technology to support aquaculture. We're hoping that they [the government] will look at it and have those policy reforms that are inclusive for women and youths.'**

In August 2022, Proscovia and her team set up a black soldier fly facility for a youth group farming fish at Njoro in Kenya to enable the group to reduce their cost of fish production. The initiative was implemented through a partnership with the county government of Nakuru's Fisheries Department and Agricultural Sector Development Support Program (ASDSPIL).

## Looking Ahead: Scaling up Fish Production in Kenya and Beyond

With the high impact of climate change, Ressect and Samaky Hub aim to reduce greenhouse gas emissions using the black soldier fly technology by upcycling organic waste that would have otherwise ended up in landfill and not only caused GHG emissions but also diseases in Kenya where waste management systems are poorly implemented, with open dumping of waste being a common practice. Proscovia predicted the long-term impact of BSF technology to be quite promising in mitigating climate change.

**'With the BSF technology, we project that by 2027, we will have reached a processing capacity of up-cycling 3,650 tonnes of biowaste which is equivalent to avoiding 1,250 tonnes of CO2 emissions per year (this is equivalent to annual GHG emissions of more than 60 people in Switzerland). We aim to develop a carbon credit framework with digital tools to automatically monitor our BSF facility and accurately model GHG emission savings.'**

In line with scaling up of the projects on sustainable aquaculture, Proscovia and colleagues have plans underway to establish a training institute to train more fish farmers on sustainable fish farming. Apart from a training institute, a value adding section will be included in the form of fish products that are healthy. These will be targeted at non-fish-eating communities in Kenya so that they are not left out when it comes to the nutritional benefits of fish consumption. In addition to training farmers, Proscovia and her team are currently seeking funds to conduct a field trip for the farmers to visit other farms for a 'look and learn exercise' to further promote sustainable aquaculture.

There is also a pressing need to scale up the production of trout fish in Kenya which is in high demand. As an agent of change, Proscovia continues to work hard to find innovative ways to create awareness on issues concerning fish farming in the hope that solutions can be found to support farmers to scale up trout fish production. Her recent article, **'The challenges and opportunities of Kenya's trout farms,'** which featured on The Fish Site stimulated a lot of interest in investors. Consequently, she has been contacted by potential investors who are seeking to invest in aquaculture in the African continent and in promoting sustainable fish production and consumption.

'I'll give you an example. I wrote about trout farming in Kenya, and 60% of the people who reached out to me said they never knew that there was trout farming in Kenya. Most of them wanted to find out how they can get in touch with the trout farmers and invest in trout farming in Kenya. I also looked at the challenges. How can we supply sustainable feed? As we speak, there is an innovative feed producer from Israel (GENU Feed) who reached out to inquire about the possibility of a pilot project using black soldier fly as an ingredient for trout feed. We are in the planning phase. They will provide coating material to make the feed, while we provide the larvae.'

Reflecting on the impact of the Commonwealth Scholarship, Proscovia identified **the most significant change to herself as a result of the Scholarship.**

'Firstly, were it not for the Scholarship, I would not have been able to complete a Master's study in not only a high earning foreign country, but also in a very prestigious university, because I could not afford that. Secondly, the skills that I learnt from the studies, I now apply, not only in my work, but also in my day-to-day life. So, technical skills of farming and personal or people skills. In my class, we were students from about 26 nationalities, that was a lot of cultural interactions, we had to try and understand how different cultures work. So, cultural intelligence, and networking with people who had different views from mine. Lastly, I think something which is very important I learnt in the UK, that we miss out in Kenya is time management. So that helps me organise myself. I think it has contributed to me becoming the person I am, because when I set goals, I have timelines with that. I'm always on time, which is good, not only for me, but for my business.'

#### More about Proscovia Alando's work

<https://thefishsite.com/contributors/proscovia-alando>

<http://africanfoodfellowship.org/bio-proscovia.html>

<https://www.agrisrael-sea-desert.org>

<https://www.linkedin.com/in/proscoviaalando/>

<https://ressect.com/>

<https://informaconnect.com/advancing-aquaculture-summit/speakers/proscovia-alando/>

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