

Aquaculture priorities in Zanzibar

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Introduction

The fisheries resources sector contributes significantly to the livelihood improvement of the coastal communities of Zanzibar by providing employment opportunities, food and nutrition. It contributes about 5.7 percent to the GDP and the sector is estimated to employ more than 34500 fishers, 2000 fish mongers, 1500 fish and crustaceans farmers and 25000 seaweed farmers (RGZ. 2016). Aquaculture which is the farming of aquatic organisms such as fish, shellfish, crab, sponges and seaweed in marine or fresh water is a relatively new initiative now taking place in Zanzibar.

Species which have been tried in Zanzibar and have a possible rearing potential includes milkfish, mullets, tilapia, oysters, sponges, sea cucumbers and crabs. Also there are abundant potential farming areas such as mangrove creeks, intertidal areas and deep water inlets. Seaweed farming is one of the most important economic mariculture activity for coastal residents (mostly women) in Zanzibar. Seaweed farming is nowadays an alternative source of income that increases socioeconomic status of coastal communities. The other Mariculture activities are still in their infancy mainly due to the lack of an enabling environment to boost the development of commercial aquaculture.

The Ministry in charge of fisheries aims to promote sustainable and responsible fisheries and aquaculture through research, technical support and extension services including in the postharvest sector, regulations, institutional building for co-management and stakeholder's participation, provision of statistical and intelligence information, control and surveillance services, and national, regional and international cooperation.

The objective of aquaculture as indicated in the Zanzibar Fisheries Policy 2014 is “to increase the production of seaweed, cultured finfish, shell fish and other cultured species to

complement the declining production from capture fisheries”. The goal also is “to promote and diversify output and marketing of aquaculture products while ensuring environmental conservation” (RGZ, 2014)

Aquaculture is managed under the Fisheries Policy of 2001 and the Fisheries Act of 2010. There are also other related acts and regulations such as environmental policies. Zanzibar have several institutions responsible for fisheries research, education and training. These are Tropical Centre of oceanography environment science and Natural resources TROCEN under the State University of Zanzibar SUZA , Institute of Marine Sciences which is part of the University of Dar es Salaam but based in Zanzibar. Also the newly established research Unit within the Department of fisheries development, Zanzibar.

The government sets research priorities through the research institutions and also the Commission for Science and technology (COSTECH) has formulated a research agenda specifically for Zanzibar in which mariculture is highlighted. Government institutions are involved in setting research priorities, conducting research and disseminating research findings and in building capacity such as training of researchers. Non-governmental institutions also fund research and collaborate with farmers on developing and implementing research projects and information delivery systems.

Mariculture species of priority in Zanzibar include finfish culture specifically milkfish (*Chanos chanos*) and mullet (*Mugil* sp). Also, half pearl oyster and bivalve culture, sea cucumber farming, sponge farming and crab fattening which are carried out in some coastal areas of the islands. Moreover, potential fish species that could be produced include *Caranx* (African pompano *Trachinotus blochii*) using cage culture technique. The Mariculture initiatives and priorities in Zanzibar are elaborated below:

i. Seaweed farming

In the aquaculture sector, sea-weed farming is number one in importance and is the 3rd economic contributor to the GDP of Zanzibar after tourism and cloves. However, currently it is faced with problems of market and price fluctuations. It started in late 1989 with the first

export of 261 tons of dry seaweed (Jiddawi and Ngazy, 2000). However, production reached up to 16,000 tons and now fluctuates between 11, 000 tons to 14, 000 tons (RGZ , 2018).

It is one the most important income-generating activities for coastal communities, particularly for women. The common technique used is the off bottom stick and pegs method. However now due to climate change imposing high mortality on the seaweed the the deep water farming technique is being practiced and encouraged and is now common in many parts of Pemba. Also a new technique using nets to culture seaweed in the floating system has been introduced in Mungoni and Ndambani in Unguja (Msuya et al., 2018).

Also the current government Aquaculture strategy aims to improve value addition in seaweed farming through increasing the capacity of farmers in price negotiation (awareness-raising, training, market information system), promoting the establishment of semi-industrial processing units in Zanzibar in close collaboration with private investors (possibly through promoting financial incentives) and improving formalization and enhanced regulation of seaweed trade activities. Also ensuring that seaweed farming development is in adequacy with environmental objectives in coastal zones through notably preparing local coastal management plans for seaweed farming including zoning measures (e.g. no seaweed zones) in close collaboration with existing Village Seaweed Fishing Committees (VSFCs) (Draft aquaculture strategy (RGZ, 2016).



The off bottom culture method of sea weed farming

ii. Sea Cucumber Aquaculture

Sea cucumbers (*bêche-de-mer*) locally known as “*majongoo bahari*” are among the most important fishery resources in Zanzibar. The fishery is mostly artisanal with few commercial

exporters mostly led by local Chinese traders. The fishery of sea cucumber provides income to local collectors and also contributes to foreign exchange earnings to the Zanzibar economy. However now due to the decline in this fisheries in the wild it has prompted an increase in sea cucumber aquaculture. The tropical sandfish (*Holothuria scabra*) has, in this context, been reared and produced with mixed success. However, with a growing concern of depleted stocks introduction of hatcheries to farm sandfish as a community livelihood and to replenish wild stocks is being promoted. Some studies on sea cucumber culture have been done in Tanzania (Mgaya and Mmbaga, 2007. There are several sites like Fukuchani, Unguja Ukuu, Bweleo and Nyamanzi where sea cucumber is ongoing. The juveniles so far are collected from the wild but a new hatchery has been developed through FAO under the Department of Fisheries development Zanzibar and is expecting to produce sea cucumber larvae.

The potential for sustainable, profitable, and socially equitable sandfish farming in Zanzibar is there but still needs more research.

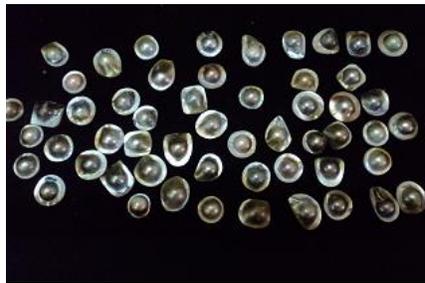


Various types of Sea cucumbers (Left) and the *Holothuria scabra* (Right)

iii. Half pearl farming and spat collection

Marine pearl culture in Zanzibar started in 2006 and is now demonstrating how scientific research can successfully support environmentally and economically sustainable projects Half-pearl culture has empowered the coastal communities livelihoods economically. These community usually depend directly on exploitation of marine resources. However, for communities to be able to run a sustainable and profitable enterprise there is a need to understand the technique well and be able to have a sustainable source of oysters. . The oysters used in half pearl farming are *Pteria penguin* and *Pinctada margaritifera* . These

are usually seeded with plastic buttons for half-pearl production. Each oyster is seeded with 2–3 semi-spherical nuclei and suspended at a depth of 4 m from a raft (Ishengoma et al., 2011). The good thing for these produced half pearls is the presence of a market and acceptance from more than 400,000 tourists who visit Zanzibar each year. Half pearl farming is also an attractive business venture because of the high value of the final product, the relative ease of producing the half-pearls and can fetch good prices. Also the final product is lightweight and nonperishable. A beginners guide to half pearl farming has been developed (Haws and Ellis, 2016) and a Swahili short version in Kiswahili too (Jiddawi and Hamed, 2015).



Half pearls

Currently, there is a growing interest in pearl culture among most Tanzanian coastal communities as an alternative source of income (Saidi and Southgate, 2017). In order to make the activity sustainable there is a need to find out where spats can be obtained instead of relying on adult ones only which can only be obtained through diving. Thus the current priorities are introduction of a hatchery to produce juvenile oysters as well as the use of spat collection techniques and to determine the seasonality where a lot of spats can be obtained (Jiddawi and Haws, 2018).



Spat collectors

iv. Fin fish farming

Finfish mariculture started in the 1980s with a study on cage culture for rabbitfish *Siganus canaliculatus* (Bwathondi, 1982) This cage was installed opposite the Zanzibar harbour in stone town. Later experiments more were conducted in ponds at Makoba (Dubi et al., 2006).

Finfish farming is only picking up recently. As now there are not less than 15 finfish farmer units in Unguja and twice this number in Pemba.

The long standing problems of fish farming in Tanzania has been the supply of seed from the wild, fry and fingerling production, availability of skilled manpower, research, and training support, feed manufacture and storage and reliable market for the products. Therefore, several studies have been done in attempts to improve fin fish culture in Zanzibar. For examples surveys of the nursery grounds and fry/fingerlings collection, areas investigation on the occurrence and seasonality of adult milkfish and mullet as well as feed production (Hamed et al., 2016 a, 2016 b; Dubi et al., 2006, Mwangamilo, and Jiddawi, 2003).



Cage used in fish farming at Bweleo and pond at Makoba

v. Crab fattening

The mud crabs *Scylla serrata*, locally known as “*Kaa koko*” are Portunid crabs which are typically found associated with mangroves, Due to its large size in growth, they are considered as the most commercially important species for fishery and aquaculture. In Zanzibar these crabs are very popular in tourist hotels and can fetch as much as \$5 per crab of about ½ kg. They are also exported to the Middle east (Jiddawi et al., 2013).

In Zanzibar crab farming is done by fattening mangrove crablets collected from the wild. The species farmed is the mangrove crab *Scylla serrata*, using cages/pens and fenced enclosures

Moksnes, et al., (2015). The present crab farming techniques depends on captured sub-adult (~100g) wild crabs collected from the wild. The practice poses serious crab population imbalance. If the present crab farming continues to expand there is a possibility to overexploit the wild crab populations on the coastal regions. The fattening cycle ranges from one to three months, depending on the size of the juvenile crab at stocking time and the type of feed provided. This is a very important initiative as crabs are very popular food item in tourist hotels.



Crab pen (Left) and samples of the mangrove crab *Scylla serrata*.

A project on Novel techniques on stock enhancements of mud crabs (*Scylla serrata*) around Tanzania coast was done aiming at trying to find alternative culturing techniques for this species by looking at juveniles in the wild using low-tech methods and rearing these as well as putting the crabs on sites which will not destroy mangroves as well as finding alternative feed that does not compete with human beings. This project was supported by the Commission for Science and Technology, Tanzania (Jiddawi et al., 2013).

vi. Shell fish

Shell fish especially *Anadara* sp. are favoured in restaurants and local communities as being rich in protein. The bivalve *Anadara* is the one which was tried in the culture experiments, However, the same species is used for conservation efforts in a community-based initiative known as no-take zones on the southwest coast of Zanzibar (Fumba peninsula). In this initiative, juvenile bivalves are held in pens and grown to market size. A combination of

methods in shallow and deep waters including fencing, nylon baskets, and floating rafts are used. Seed is mostly collected from the wild but sometimes it is purchased from fishermen



Pens made from sticks used in bivalve farming

vii Sponge farming

Sea sponge aquaculture is the process of farming [sea sponges](#) under controlled conditions. The benefits of sea sponge aquaculture are due to its ease of establishment, minimum infrastructure requirements, profitable, environmentally friendly and the potential to be used as a source of income for the communities and that is why it is encouraged (Vaterlaus, and Bumbak, 2011). Usually the sponges are produced on a commercial scale to be used as bath sponges or to extract [biologically active compounds](#) which are found in certain sponge species. Techniques such as the rope and mesh bag method are used in culturing

The first experiments of sponge farming were conducted in the village of Jambiani, Unguja, by an NGO called *Marine Cultures* involving local communities. This is an experimental sponge farming initiative to improve local employment and support economic development.

All sponges used have been harvested from naturally occurring specimen within the Zanzibar archipelago. The common farmed species are *Callyspongiidae sp* and *Agelas mauritiana var. oxeata* (Vaterlaus, and Bumbak, 2011) Currently, sponges are grown using floating raft in shallow intertidal areas not below 2 meter during the low spring tides. Although, this practice is newly introduced in the area, local people have shown interest to practice it in future as it fetches high price in tourist hotels.



Sponges hanged on ropes

viii Existing Policies and strategies

There are several policy and strategy statements encouraging mariculture in Zanzibar. Since Zanzibar is an island state it does not have enough land for mariculture activities so it is giving more priority to culture directly in the ocean like seaweed farming or cage culture now which is done in deeper waters. Also, It is encouraging mangrove restoration and protection while ensuring that the development of aquaculture production of marine resources such as seaweeds, crabs, bivalves and fish will not affect the mangrove ecology.

There is still significant potential for aquaculture development in Zanzibar. In particular, there is a need to improve value addition for seaweed farming at producer level so as to boost existing production and to create an enabling environment to support development initiatives of private entrepreneurs in other mariculture activities. Thus, the policy objective is to promote the development of sustainable aquaculture in Zanzibar and to contribute to social and economic development of coastal population (RGZ, 2016).

Another priority is to promote the preparation and implementation of a Zanzibar Aquaculture Strategic Plan which is now at a draft stage, including identifying potential sites and addressing crucial issues such as the shortages of quality seed, fingerlings and feed for other mariculture activities, the lack of technical and managerial skills among most small-scale fish farmers, the difficulties for accessing adapted credit, the inadequate legal environment and weak extension services, and the need of ensuring adequacy between aquaculture development and coastal environmental preservation and management (RGZ, 2016).

One of the priorities of the policy is to strengthen the capacities of administration in terms of conducting applied research (including in the domains of fish diseases and adaptation to climate change) and delivering adequate extension including thorough setting-up pilot aquaculture centre (hatcheries, labs, ponds, cages, etc.). One big hatchery has already been started in Zanzibar.

There is also a need to improve the legal framework so as to create enabling environment for the development of commercial aquaculture and the protection of environment as well as promoting marketing of aquaculture products while ensuring environmental conservation and there is a need to educate local communities and assist them to enter mixed aquatic farming initiatives and introduce reliable methods for acquiring information on price, size of markets and their potentials (RGZ, 2016).

The Government wants to continue to promote seaweed farming by putting emphasis on improved farming practices such as the deep farming method and ensure that there are regular studies on environmental impacts of aquaculture activities.

ix Challenges

There also some challenges and constraints which needs to be solved in ensuring sustainable aquaculture a few of which are:

A few surveys have been made to identify good fish farming sites. Special expertise for fish farming is crucial to embark on the exercise and do research in order to identify farming sites for different aquatic species to be cultured as well as having a special spatial planning for mariculture.

The collection of fingerlings from the wild is the common practice now for mariculture but in the long term may not be sustainable due to over exploitation and high by catch of untargeted larvae of other fish species. Therefore it is worthwhile to initiate functional hatchery development for different species for sustainability e.g. crabs, sea cucumber, fish fish which take a relatively shorter time to produce seeds of which could be an added value.

Shortage of reliable markets, storage and processing facilities for marine products is another challenge. There is thus a need to establish adequate cold storage to ensure that that fish are frozen under the proper conditions and allow proper distribution and preservation of the harvested products where there is a market demand.

For a successful development of an aquaculture activity that provides long-term economic benefits to coastal communities, demands a multidisciplinary approach that involves social scientists, economists, environmental ecologists, fishery and aquaculture biologists, and coastal managers and this is what is encouraged.

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