Project Report on breeding, seed production and culture of Nile Tilapia (Oreochromis niloticus) at Mwanza, Tanzania

To be implemented
By

M/S VICTORIA TREASURES LTD

At
LucheleleShadi Village, located at
Victoria Basin
Mwanza, TANZANIA

MARCH, 2022

Our Presence: UGANDA, TANZANIA

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NILE TILAPIA

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1) Introduction

The fisheries sector is among the important subsectors of Tanzanian economy. This sector provides substantial employment, income, livelihood, foreign earnings and revenue to the country. Tanzania is blessed with abundant natural resources from aquatic resource base. The total inland area covers nearly 61,500 km^2 or about 6.5% of the total land area of which Lake Victoria has 13, 489 km^2. These water bodies have substantial fisheries resources. There is tremendous scope for developing aquaculture in Tanzania where political and sociological situations are very favorable to this highly profitable venture. In addition to providing the protein-rich food to the local populations, aquaculture also can generate employment and valuable foreign exchange to the country in a big way.

Presently, aquaculture in Tanzania is a small scale low-stocking density enterprise. The main fish cultured is Nile Tilapia (*Oreochromis niloticus).* The total production of Nile Tilapia during 2013 was 2,131.40 tons from 20,235 fish ponds.

The main objective of the project is breeding, seed production and culture of the Nile Tilapia in Mwanza, Tanzania.

The specific objective of this project is to set up a hatchery for seed production of Nile tilapia and the culture of tilapia in cages set up in Victoria Basin and culture of tilapia in earthen ponds. The hatchery will ensure a steady supply of seeds (juvenile) of tilapia for cage culture operations without interruptions, throughout the year.

The fishes produced under this project, apart from meeting the protein requirements of the local population, will also bring precious foreign exchange to the country, due to the export of the fishes. The project will be operated by the involvement of the local people and will provide considerable employment opportunities to the local population.

2) Executive Summary

The Tilapia is one of the ideal species for culture because it grows fast, breeds easily and requires relatively less technical input. The Nile Tilapia (*Oreochromis niloticus)* is the most preferred species for farming because of its fast growth; it is hardy and well adapted for farming in warm tropical countries.

There is tremendous demand for Nile Tilapia in Tanzania. Production from capture fisheries is unable to meet the huge demand. As per the existing regulations, the Tilapia caught from the wild cannot be processed and exported. Only the Tilapia cultured can be processed and exported. There is huge scope for the culture of Tilapia in Tanzania. Hence, the proposed project will be taken up by M/s. Victoria Treasures Ltd, Mwanza, Tanzania.

Under the project, *cage* culture of Nile Tilapia will be done in Victoria Basin using **120 floating cages**. The size of the floating cages will be 180m^3(**6 x 6 x 6m**) in the case of cages installed in Victoria Basin. The quantity of marketable size Tilapia produced will be 540 Metric Tons/cycle, from **120 floating net cages** installed in Victoria Basin and 396 Metric Tons from culture in the ponds in 6 months of culture period. Total quantity of fish produced will be 936 Metric Tons in 6 months of culture period. Hatchery phase lasts for 3 months. 2 crops will be taken in a year. The total quantity of marketable size Tilapia produced will be 1872 MT in a year from cage culture and pond culture.

The feed required for the Hatchery, Nursery and Cage Culture will be imported. This Integrated Aquaculture project is environmentally friendly, sustainable, technically feasible and economically viable. An Environment Impact Assessment (EIA) study will be conducted prior to the final submission of the project.

3) The Project Site

The site is situated in the banks of the Victoria Basin at Lucheleleshadi Village, which is 15km away from the Mwanza city. The total land area is 68 acres. **The site has a clay-loamy soil and there will not be any seepage of water from the ponds.** Analysis of water and soil samples collected from the project site indicated that the site is suitable for Tilapia culture. The site is easily accessible by road and there is 3Phase electricity connection in the site. The site is free from pollution. The depth of Victoria Basin and water circulation in the area of site is suitable for cage culture of Nile Tilapia. There are no social problems in the site, but poaching could be major problem for which adequate security measures will be setup. A good laboratory also will be constructed for daily monitoring of water, health of the cultured fish.

4) Details of various components of the project

The latest technologies will be employed for brood stock development, breeding, seed production, , cage culture in Victoria Basin. An Effluent Treatment Plant to be set up in the site will ensure the quality of discharged water. The safe substances will be used to treat the effluents. Utmost care will be given for environment and the quality of the fish produced.

The Technologies to be followed are eco-friendly and sustainable. No antibiotics or chemicals will be used in the hatchery and farming. Only probiotics will be used in the farm. The effluents will be treated biologically and the discharged water after the effluent- treatment will be of good quality.

5) Hatchery Management

The hatchery will be an integral part of the farming system and is very essential to ensure and enhance a sustainable production. Find diagram in Annexure 1.

The Hatchery for Nile Tilapia consists of:-

Conditioning Tanks.

These consists of six numbers of 6m diameter concrete circular tanks painted with epoxy (***Epoxy coatings*** *are formulated based upon the performance requirements for the end product. When properly catalyzed and applied,* ***epoxies*** *produce a hard, chemical and solvent resistant finish. They are typically used on concrete and steel to give resistance to water, alkali and acids*). The height of the tanks will be 0.8m. The water filtered through pressure sand filters and 5 micron fabric filters are pumped into these tanks. The tanks are provided with aeration from a 7.5 HP air blower. The fishes for brood stock development will be collected from Victoria Basin, two times a year. The selection of brood stock will be carefully done. The fishes above 100gm size with body shape, color and body thickness will be selected. The females are smaller than males of the same age. The genital papilla of the female is oval and has two pores. The male genital papilla has a pointed tip where the urogenital pore is located. The male displays a marked brilliant coloration that attracts female tilapias during courtship. In the conditioning tanks, 4 pieces of sexually matured tilapia (3 females and one male) for square meter of tank space are stocked. Water in the conditioning tanks is maintained at a minimum level of 0.5m.

The adult fishes are fed with pellet feed @2% of body weight, twice daily. The excess feeds are removed by siphoning. Fishes are conditioned to the hatchery conditions for a period of three days before transferring them to the breeding tanks for breeding.

Breeding Tanks & Breeding Technology

The breeding tanks consist of 6m diameter circular tanks (10) with 0.8m height. These are also concrete tanks painted with epoxy paint. The tanks are provided with aeration from a 7.5 HP air blower. The water filtered through pressure sand filters and 5 micron fabric filters is used in these tanks. The fishes, after conditioning, are stocked in these ponds. 3000 females and 1200 males are required to produce 20,000 fingerlings per day. **Excess fingerlings produced will be distributed on a subsidized price to the local farmers.**

The brood stock fishes are fed on artificial diets @2% of the total biomass. The total quantity of the feed is divided into two rations per day. Excess feeds are removed every day, by siphoning.

Two to three weeks after stocking spawning sets, the presence of swim-up fry /hatchlings that normally swim along the sides of the concrete tanks will be seen. Once, swim-up fry are found, the water is gradually drained from the tank. While the water is being drained, breeders will swim towards the catch basin and stay there until the water has been completely drained. In the catch basin, some of the breeders will release swim-up fry which were incubated inside their mouth. The swim-up fry will be scooped out gradually using fine- meshed scoop nets. Meanwhile, the breeders are individually inspected and examined for eggs / fries which are manually removed. The fertilized eggs are further incubated in artificial incubators while the swim-up fry are pooled and reared in nursery tanks.

Mixed Sex Tanks for Reconditioning

These Tanks are 6m diameter concrete tanks with 0.8m height (10Nos). These tanks are used for development of brood stock for Hatchery operations. The Juvenile fishes will be fed with pellet feed, twice daily, @10% – 5% of the body weight. The excess feeds are removed by siphoning. These tanks are provided with aeration from a 7.5 HP air blower. The water filtered through Pressure Sand Filter, UV and 5 micron fabric filters are used in this tank. The water exchange in these tanks is 50% per day. Fishes are allowed to remain in these tanks for four months before using them for the next breeding cycle.

Fry Rearing Tanks &The Rearing Technology

The Fry rearing facility consists of 20 concrete tanks (painted with epoxy) of 2m diameter and 0.8m height. The tanks are provided with aeration from a 7.5 HP air blower. The water used is filtered through pressure sand filters, UV filters and 2 microns fabric filters. A female Tilapia breeder that weighs 100g can produce from 250-400 eggs/ fries in a single spawn. Fertilized eggs are incubated inside the mouth of the female parent. Hatching occurs 3 days after fertilization while the hatchling's yolksac is completely absorbed 7 days thence. The fertilized eggs or fry from mouth breeding female are removed manually and transferred to hatchery tanks. The 1 – 3 day old fry are fed with feed containing the synthetic hormone, Methyl Testosterone dissolved in ethyl alcohol for a period of 21-30 days to get all male fingerlings. The feeding will be done three to five times a day. The stocking density in the tank will be 1000 Nos/per sqm. The all-male tilapia, after one month rearing, will be approximately 16 mm in length and 6mm in breadth. There will be size variation in the fries. Only the uniform size of fries will be used for rearing. The water exchange in these tanks is 40% per day.

Nursery Tanks & Nursery Rearing

The one month old fingerlings are reared in concrete nursery tanks. There are 12 concrete tanks of 20MT capacity (rectangular-10m x2mx1m). The concrete tanks are filled with water filtered through

The fingerlings are fed with pellet feed (Nursery feed), containing 35% protein, three to five times a day. The Nursery rearing period will be for a period of 30 days. The total hatchery phase will be 90 days. The size of fingerlings after two months of nursery rearing will be 10 gm, which can be stocked in earthen ponds and cages.

Feed details are mentioned in feed chart under Feeding section.

Reservoir Tanks

There are three rectangular reservoir tanks (15mx9mx2m). These tanks will be used as settlement tanks before using them in the Hatchery and Nursery.

The settled water is pumped into second reservoir tanks. Later, the water is pumped through Pressure Sand Filters, UV and Fabric Filters to different tanks of the Hatchery.

6) Water Quality Management

The maintenance of good water quality is a necessary prerequisite for the success of the aquaculture operations.

The water quality in the ponds will be maintained as follows:-

- Dissolved Oxygen(DO) - > 5 mg /l
- pH- 6.5 to 8
- Turbidity < 100mg /l
- NH_3-N (Ammonia Nitrogen)< 0.1 mg /l
- No_2-N (Nitrite Nitrogen)< 0.1 mg/l
- Total Inorganic Phosphorus < 0.015mg/l

Whenever needed, Calcium carbonate (lime) will be used in the ponds to maintain the pH of water between 6.5to 8.00. Antibiotics will not be used during the culture but probiotics will be used.

10. Cage Culture of Tilapia in Victoria Basin

In Victoria Basin, **120 cages** will be installed in **6 modules**. In each module, there will be 20 cages. The distance between the cages will be 5m. A catwalk (one meter width) will be provided to each module. The positioning of cages is depicted in Annexure – 3

The details of cages installed in Victoria Basin and the production details are given below:-

Frames for cages (made from non-corrosive metallic pipes)

- Outer frame – 1.5 inch diameter – 4mm thickness
- Inner frame - 1.5 inch diameter – 4mm thickness
- Inner and outer pipes with roller brush painting with epoxy paint
- Height from water – 95 cm
- Height from lower frame – 70cm
- Diagonal frame – 90 cm
- Distance between frames – 35 cm
- Inner connections – 3 on broader side and 5 on longer side

200 liters (90cm diameters) drums made up of Polypropylene for buoyancy.

Each cage requires 16 drums – 3 on broader side and 5 on longer side.

Nets (HDPE)

- Inner cage - -6 x 6 x 3m – 5mm mesh size - 1 mm thickness
- Inner cage -6 x 6 x 3m – 20mm mesh size – 1.5mm thickness
- Inner cage -6 x 6 x 3m – 30mm mesh size – 1.5mm thickness
- Outer Net (Predator Net) – 6 x 6 x 4m – 50mm mesh size -2.5mm thickness
- Bird (protection) net – 11m x 7m – 80mm – 1.5 mm thickness

11. Feeding

Feeds for cage culture of Tilapia are imported. The quality of fish feed to be imported will be fully organic and no antibiotics & hormones will be present in the feed. The floating feeds are used for feeding the fishes stocked in the cages. The feeds are introduced to the feed enclosures (Feed arresters/ feeding rings) installed inside the cages for better utilization of feed. The protein content of the feed varies from 35% in the earlier stages and 27% in the later stages. Feed chart for Tilapia is given below.

FEED CHART FOR TILAPIA				
Growth in weeks	**Fish ABW (g)**	**Daily feed rate (Kg/1000 fish)**	**Protein %**	**Pellet Size (mm)**
0	0.5	0.1	35	Powder
2	2.5	0.3	35	Powder
4	8	0.6	35	2
6	16	0.8	35	2
8	30	1.2	35	2
10	70	2.1	28	2
12	120	2.8	28	3
14	180	3.2	27	3
16	240	3.6	27	3
18	**300**	**3.8**	**27**	**4**
20	370	4.2	27	4
22	440	4.8	27	4
24	520	5.2	27	4
The fish have to be fed 2-3 times for better utilization. **Growth patterns & feeding regime need to be observed fortnightly.**				

12. Production

Under the project, cage culture of Nile Tilapia will be done in Victoria Basin in **120 cages** and pond culture in 36 ponds provided with paddle wheel aerators. The size of the floating cage will be 180m^3(6 x 6 x 3m). The quantity of marketable size Tilapia produced will be 540 Metric Tons from floating net cages installed in Victoria Basin and 396 Metric Tons in the ponds. Total quantity of fish produced will be 936 Metric Tons in 6 months of culture period. (Hatchery phase lasts for 3 months) 2 crops will be taken in a year. Total fish production in a year will be 1872 Metric Tons from **120 cages** installed in Victoria Basin and from culture from 36 earthen ponds.

The cages installed in Victoria Basin will also serve as Fish Aggregating Devices (FADs)

There will be marked aggregation of fishes around the cages. The excess feed coming out of the cages will be utilized by the fishes in the Victoria Basin, thereby improving the productivity of Victoria Basin in the vicinity of project site.

Since Antibiotics will be used during the culture period, the final product (fish) will be purely organic. The technologies followed are green and totally eco-friendly.

13. Summary and conclusions

The project will provide manifold benefits to the country. The total production of marketable fish in a year will be **1872 MT**. The excess seeds of Tilapia produced will be supplied to local farmers on subsidized rates. Therefore, this model project will help to revolutionize fish farming in the country.

The project will help to provide protein–rich quality organic fish to the local populations. The project will bring valuable foreign exchange to the country by export of cultured fish. The project will be operated with active involvement of the local population& will provide direct and indirect employment to the local people.

The cages installed in Victoria Basin will serve as Fish Aggregating Devices and thereby **improving fish production**. The excess feed coming out of the cages will be utilized by the fishes in the Victoria Basin Which will in turn **augment Fish production**. Since antibiotics will not be used during culture period, the fishes produced will be **purely organic and of high quality**.

The Project will have numerous social benefits to the country. Since large number of workers will be commuting to the project site, the transportation facility for the general public will also be improved. Since there is already a three - phase electrical connection available in the site, the local community can take advantage by availing electrical connections, without incurring additional expense. The project will be a model Integrated Aquaculture Project, which will be incorporating a Research and Development (R&D) component. This will serve as an educational facility for the local population.

HATCHERY

Fins and genital papilla of Nile tilapia

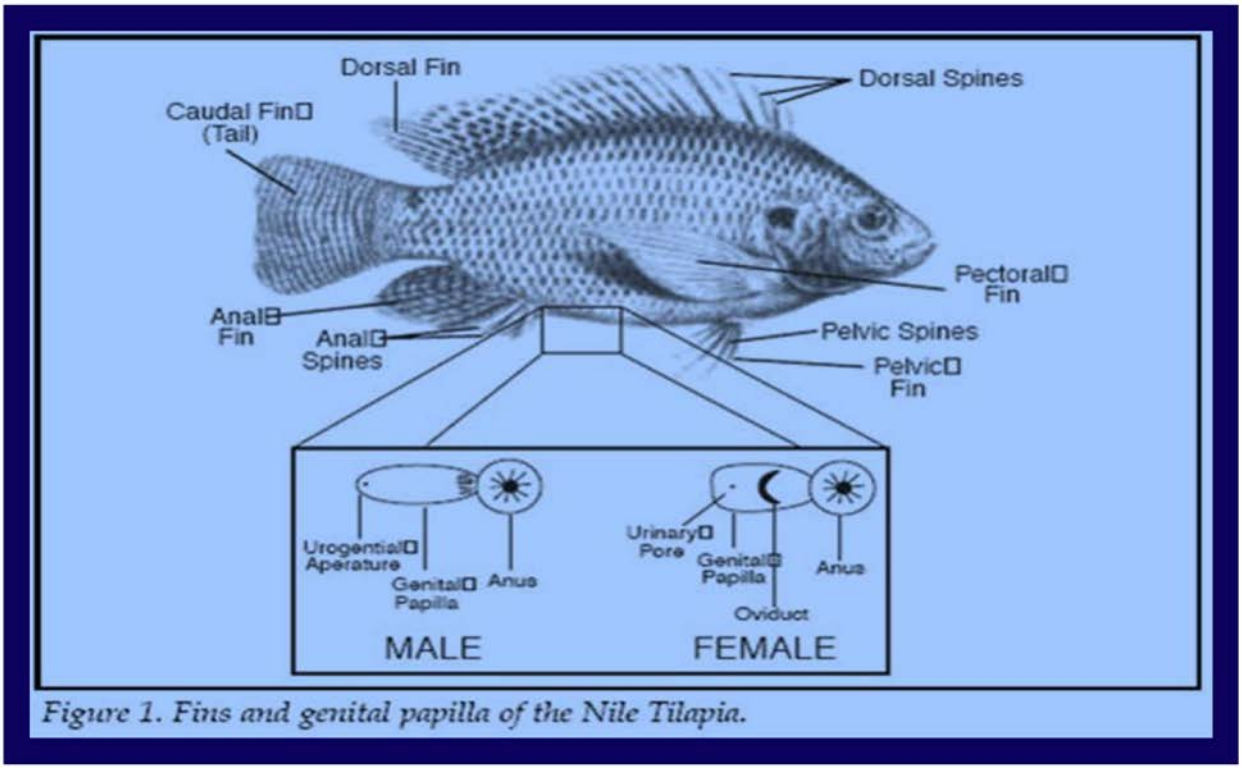

Figure 1. Fins and genital papilla of the Nile Tilapia.

Breeding Cycle of tilapia

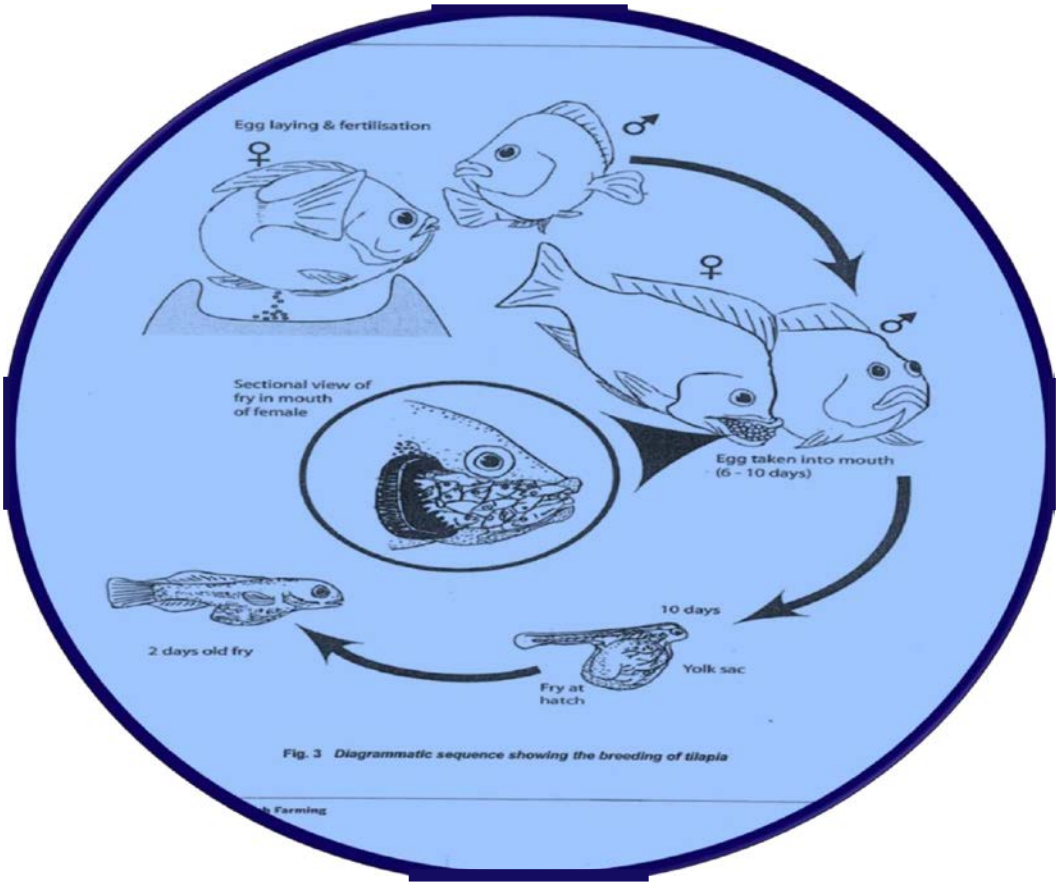

Fig. 3 *Diagrammatic sequence showing the breeding of tilapia*

HATCHERY PONDS

CAGES IN VICTORIA BASIN

CAGES IN VICTORIA BASIN

FLOATING WALK WAY

List of items needed for Hatchery, Nursery & Cage culture of Tilapia

Srn	Particulars	Nos
1	Floating Cages	120
2	Cage Nets Inner	120
3	Cage Nets Outer	120
4	Cage Bird Nets	120
5	Boat for Feed feeding	3
6	Floating security house	2
7	Generator	1
8	Water machine	1
9	Water Pump	1
10	Construction of Hatchery Ponds	1
11	Construction of Hatchery incubation Jar	1
12	Hatchery Equipment's various	1
13	Construction of Feed store	1
14	Construction of Staff area	1
15	Construction of Office and Lab	1
16	Hapa Nets for Hatchery Ponds	1
17	Bird Nets for Hatchery Pond	1