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AN ECONOMIC & PRODUCTION ASSESSMENT MODEL FOR ORNAMENTAL FISH PRODUCTION IN JAMAICA

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ABSTRACT

Ornamental fish production is a popular and financially viable business in many countries all over the world. Jamaica being a tropical country possesses the ideal environment and several other advantages that would support such a business. However, while small-scale producers often lack the capital or access to the capital, larger investors and financial institutions are uncertain of its profitability or the possible return on investment that can be expected. Hence this project entitled is designed to facilitate identification of adequate farm size and production output needed for a profitable business, the expected return on the investment as well as the level of risk. The methodology utilized was to develop production and economic assumptions through literature review, field visits, questionnaires, and telephone interviews with ornamental fish producers in Jamaica as well as the Aquaculture unit in the Ministry of Agriculture and Fisheries. These assumptions were then used to design both models. Based on the results from the model, using an investment of 22.5 MJMD to produce five species of fish is a profitable business that will produce a pay back in 9 years and Internal Rate of Return of 21%. The business would however be sensitive to reduction in sales price and increases in production cost.

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1 INTRODUCTION

Ornamental fish can be classified as aquatic organisms that are reared as pets and are generally kept for relaxation, home or business decoration, or as a hobby. They are both from freshwater and marine environments; however, approximately 90% of the species from freshwater are bred in captivity while those from marine waters are mostly captured (FAO 2011).

Approximately 80% of ornamental fish species are tropical and found in developing countries. This presents an ideal opportunity for Jamaica, which is approximately 11/2 hour away from the largest market while most of the other exporters are mainly from Asian countries, which are 2 – 3 days away. Additionally, Jamaica being a tropical island has suitable climatic condition for all year production of most species (Rana 2002).

Although such opportunities are present, ornamental fish production in Jamaica still operates on a small scale with under a hundred fish farmers. Most of these farmers due to the small size of their operations, lack of resources and capital are unable to adequately meet the demands of the export market. That is to supply large volumes of good quality ornamental fish consistently. Therefore, this requires input from large investors who have access to capital and the ability to operate on an international level. As such, it is necessary to have an effective financial and production tool that will attract and guide potential investors in this industry. Hence, the topic for this project is "An Economic and Production Assessment Model for Ornamental Fish Production in Jamaica". This project will focus on the production of five species of fish, namely the Goldfish (*Carassius auratus auratus*), Redswords (*Xiphophorous hellerii*), Molly (*Poecilia sphenops*), Freshwater Angel fish (*Pterophyllum scalare*) and Blue Gourami (*Trichogaster trichopterus*). These species are commonly grown in Jamaica and are among the popular varieties to be exported or to be sold in pet stores all over the world.

2 RATIONALE

An individual backyard size farm is often too small to take on an export market, which often requires large quantities weekly. Also, because the export market buys at cheaper rate, the farmer would need to sell in high volumes to achieve profits. Consequently, the options for growing this industry would be for small farmers to organize themselves into a single large group, which would make them able to support the large overseas market. However, this concept has not worked much in Jamaica among the ornamental fish farmers. This may result from inaccessibility to financing, inability to penetrate international market, mistrust among farmers, and variation in education levels and economic status among the group, and uncertainty of production capacity due to poor record keeping or inconsistency in production among farmer. An alternative is to invite large investors who have access to capital, the ability to employ marketing personnel and technicians with the required skills and experience to make the farms operate at optimum productivity.

Therefore, by developing a production and economic model, the Fisheries Division of the Ministry of Agriculture will have a tool that will provide potential investors with sound knowledge base before entering this business and as such effectively guide the industry forward.

This will definitely benefit the division being the technically competent body and the agency responsible for aquaculture development in Jamaica. Additionally, having the ability to demonstrate the profitability of such a business venture, the department is also assisting the country in job creation; a need, which will not be difficult to fill given that in the last five years, the department has trained roughly 300 persons in basic ornamental fish production.

2.1 Objectives

Potential investors interested in this business venture would want to know exactly what returns on investment can be expected. And so the objective of this study is to

- Develop an Economic and Production model with which the profitability of an investment can be analysed. These models will allow for:
    - The identification of the minimum farm size in terms of number of tanks and area of land, etc. that will make an investment profitable
    - To determine the quantity of production output for one species or a combination of species required to stock such a facility.
    - To determine the quantity of brood stock or group of brood stock required
    - The expected returns on investment
- To determine the expected financial risk of such an investment

3 GLOBAL OVERVIEW OF THE ORNAMENTAL SECTOR

Ornamental fish are considered among the most popular pets worldwide. Statistics indicate that in the United States one in every eight persons kept fish as pets, in Canada 1.2 million people have an aquarium, and in the UK 3.5 million people kept fish amounting to over 140 million fish. France's records indicates 34 million fish being kept by 2.1 million households while in Germany approximately 3.7 million households own fish (Rana 2002).

It is estimated that about US$350 million is spent annually on fish in stores that sells ornamental fish and or aquarium, and even more on pet fish supplies. Pet fish sales constitute 65% of the revenues generated by pet animals with the price per individual fish ranging from less than US$1.00 up to US$20.00 (Noga 2010).

Globally the ornamental fish sector is growing and constitutes a significant component of international trade in fisheries and aquaculture. According to FAO, the value of the international trade in export of ornamental fish is increasing and has been growing at an average of 14% per annum since 1985. The report further stated that annual international exports in ornamental fish is approximately US$200 million, while the total value of the wholesale and retail trade is approximately US$ 1 and 3 billion respectively. A similar FAO report revealed that in 1998 the import value of ornamental fish was valued at US$257 million. However, when other factors such as wages, retail sales, associated materials etc. are considered, the industry is worth approximately US$15 billion (FAO 2011).

With 68% of the ornamental fish supply coming from developing countries, countries in Asia currently supply about 50% of the total world supply of pet fish. In the period 1990 - 2000,

exports from developing countries have increased by 7.5% per annum in comparison to a 0.3% per annum from developed countries. In 2000, US$120 million went to suppliers/fish producers in developing countries such as Sri Lanka, Malaysia, Thailand and Indonesia, among others. Other suppliers include the Czech Republic and Singapore, which commands about 25% of the market share (FAO 2011).

On the other hand, the major importers are countries like United States, which is also the largest importer and producer of pet fish, having 24% of the market. They are followed by Japan with 14%, Germany with 9% and France and the UK with 8% each (FAO 2011).

Ornamental fish production is not only important because of its recreational significance or its worth in international trade but it also provides well developed skills, income earning opportunities/jobs to both men and women in several rural, coastal and urban depressed communities. It also serves as a tool in motivating development in some of these communities. This is especially the case given that most ornamental fish are from freshwater sources and as such are mostly farmed. Marine species are mostly caught from the wild; however, given the unsustainability of such practice even greater opportunities for aquaculture are now available.

4 BACKGROUND ON ORNAMENTAL FISH PRODUCTION IN JAMAICA

Commercial aquaculture started in Jamaica in the 70s with the introduction of Tilapia in a jointly sponsored project by the USAID and the Government of Jamaica. The project, which was administered by Auburn University, was responsible for establishing an aquaculture facility, providing staff with the technical skills needed to guide aquaculture development and introduced a new species of Tilapia (*Tilapia niloticus*), which increased the growth in the sector. This growth led to the diversification and the further introduction of other aquaculture species such as penaid shrimp, carp species and species of ornamental fish (Aiken *et al.* 2002).

The development of the ornamental fish sub-sector started out mainly as a hobby for many persons in the inner city and rural communities in the 70s. However, commercial production and export began in 1990 (Dinham 1996). Additional information from the statistical institute of Jamaica (STATIN) reveals that international trade of ornamental fish between Jamaica and the United States continued up to 2001 (Table 1) (Rana 2002).

The records also indicated that greater volumes were exported in the mid 90s in comparison to the later years although the price per unit for each fish increased or almost doubled in some cases (Table 1). The drop in export resulted from the major exporter, an immigrant, falling out of the market due to unknown reasons. This caused a significant fall of the industry as export volumes dropped from almost 700,000 fish or US$99,000 per annum in 1996 to a mere 230,000 fish or US$51,000 in 2001. Other factors that affected the trade were limited financial support from financial institutions, damages from hurricanes, and a more lucrative local market in which farmers were able to get approximately 30% more per unit price per fish. Also, on the local market there is less bureaucracy and the quantities demanded is much less than that required on an export market. Given that most of the existing farmers have a backyard size operation, which is incapable of producing large quantities, a local market would be more ideal.

Table 1. Exports and Unit Value of Ornamental Fish in Jamaica (Rana 2002).

Year	Export (J$)	Export (USD)	Numbers	Unit price (J$)	Unit price (US$)
1996	3,964,574	99,114	693,422	5.91	0.15
1997	2,726,098	68,152	576,994	4.92	0.12
1998	2,564,441	64,111	572,000	4.48	0.11
1999	722,000	18,050	149,000	4.85	0.12
2000	2,041,067	51,027	204,652	9.97	0.25
2001	2,077,743	51,194	229,857	8.91	0.22

The majority of the producers who currently export have been consolidating their efforts and their production outputs to meet large quantities demanded by the export market. Although data relating to quantities and species being exported are absent, information from the Aquaculture Extension unit in the Ministry of Agriculture and Fisheries suggests that trades are on-going in this subsector although in a smaller quantities. This is also supported by import and export permits requested from the Aquaculture Branch and the Veterinary Services Division of the Ministry of Agriculture and Fisheries.

The species being traded internationally and also on the local market are a mixture of egg layers and live bearers and can be grouped as follows:

- *Poecillids* (Guppies, mollies, swordtails, platies)
- *Characins* (Tetras)
- Tropical *Cyprinids* (barbs, danio)
- Cool Water *Cyprinids* (koi, carp, goldfish)
- *Anabantids* (fighters, gourami, paradise)
- *Cyprinodonts* (killifishes)
- Catfish (corydoras, pleco)
- *Cichlids* (angel, discus, oscar)
- Sharks (red tail, rainbow, iridescent)

Based on observations, Jamaican producers mainly utilized recirculation culture system built with circular tanks with volumes of 1- 3m^3 connected by PVC fittings and gravel bed filters. This is mainly used for grow-out, while aquaria and other forms of tanks from recycled materials are used for breeding. Some farmers also utilize earthen ponds for grow out. Of the approximately 70 fish farmers in Jamaica, less than 10 operate large to medium sized farms, utilizing earthen ponds for grow-out, recirculation system or open tanks and even operate their own pet stores. The majority utilize backyard recirculation systems (about 30m^2 – 50 m^2) and are often from urban depressed or rural communities. Medium and large-scale farms are generally located in rural parishes and in farming communities. Medium size farms range in sizes between 1 – 4 hectares while large-scale farms are generally above 4 hectares.

5 A REVIEW OF THE JAMAICAN ENVIRONMENT

For a major investment of this nature to be successful, the investor would need to be able to penetrate an overseas market. Jamaican producers possess several strengths that make them capable of taking on an export market. Some of which being, the producers are enthusiastic and competent and are able to produce good quality fish in less than ideal environments and with very

basic technological input. Additionally, Jamaica has ideal conditions for all year production of most species, great potential for selling on the export market especially given its close proximity, 1 ½ hour flight, to the largest market, United States. There is also an existing domestic market. There is also an expression of interest by private sector as well as available governmental support (Torreano 2007)

Other strengths identified include Jamaica's tropical climate, which facilitates the production of roughly 80% of ornamental species throughout the year while countries like the USA will have seasonal fluctuations due to its October to February cold climate. There is cargo/airfreight available from Jamaica directly into North America and Europe. Start-up capital, operational costs and required space is much less than other aquaculture enterprises, and there is a growing trend towards the use of aquaria and/or water fountains with tropical fish in hotels, waiting rooms, and restaurants (Dinham 1996). In addition to proximity to the international airports and concessionary rate financing, Jamaica is also free from major pests and diseases being experienced by other farmers in the major exporting countries in Asia (Rana 2002).

Although some level of loan scheme is available from institutions such as the Development Bank of Jamaica (DBJ), National People's Cooperative Bank (PC) and other commercial banks it might not be accessible by most of the ornamental fish farmers given that they operate on very small scale and may lack the collateral. Most of these farmers operate from small backyard systems, and may not be classified as business operators and as such not eligible for a business loan. And so access to financing may not be a strength for those farmers. On the other hand, it would be a strength for larger investors with access to collateral and adequate space for development.

As it relates to weaknesses, Rana identified obstacles such as unnecessary bureaucracy, inadequate site selection, farm design, and trained personnel to support the expansion of the industry. Additionally, he believed that there was poor recognition and regulatory definition of the sector (Rana 2002). Whereas, these were weakness for the sector, the farmers have little control over them and as such are more of a threat to the individual farmers. Torreano (2007) identified other weaknesses among the individual farmers:

- *"Operating at low levels of productivity and not following industry best practices".*
- *"Raising the same species of fish poor with very little specialization amongst farmers"*
- *"Not working together to overcome obstacles and for procurement of inputs and export of fish".*

<u>"Operating at low levels of productivity and not following industry best practices"</u>

Most of the ornamental fish farmers in Jamaica use very limited technology except that of recirculation system. Although many farms have a fairly good filtration system, limited water quality checks are done. Most farmers commonly practice to under stock and use the fish's behaviour, smell and look of the water to determine its quality. As such, full productivity of these farms has never been achieved. Additionally, farmers tend to produce quantities which they are certain will sell. And so marketing is also a challenge (Torreano 2007)

"Raising the same species of fish with very little specialization amongst farmers"

It is common practice for many farmers in Jamaica to grow up to five species of fish and even more varieties of each species. This is not the best practice; however, for some farmers it ensures that they will always have a market. For others, it is an indication that they have not been fully transitioned from a hobbyist to a business operator.

"Not working together to overcome obstacles and for procurement of inputs and exportof fish"

Pet stores in quantities and at hobbyist prices only sell most of these inputs. And so the farmers will need to organize themselves as a group so they can pool their resources together to import raw materials and overcome other obstacles, even those related to the export market. These inputs include feed, broodstock, medications and basic equipment like water quality test kits, air pumps, etc. (Torreano 2007).

Almost all industries have their share of threats especially those that are developing and the ornamental fish sub-sector in Jamaica is no different. According to Rana (2002), there is an "increased incidence of fish disease/parasites due to limited knowledge, poor management, number of ponds, and increase in potential out-grower linkages." However, in the very same report, as a strength, he mentioned that Jamaica is free of most major pests and diseases being encountered by their Asian counterparts (Rana 2002). Consequently, it will be necessary for adequate competent personnel be trained in the area of fish disease management and parasitology. As the industry develops and productivity increases so will the potential for disease outbreaks. The need also exists for adequate quarantine facility either at ports of entry or other appropriate location, especially for fish that are being imported.

As it relates to export of ornamental fish a major threat is the consolidation of the pet industry, in that three companies control 80% of the U.S retail market for ornamental fish: Walmart, Petsmart and Petco. As a result, the power of large distributors has increased as well as the types of fish being sought after, which are mostly small popular varieties in large quantities and consistent qualities (Torreano 2007)

This though may also prove to be an opportunity for Jamaica in that most of the fish being produced currently in Jamaica are fast growing popular varieties. Studies suggest that there is an increase in demand for ornamental fish internationally, especially from Florida and Canada given that there is a deterioration in weather patterns during the winter months, which impacts on their productivity. There is great interest from importers in importing fish from Jamaica especially since there continues to be a decline in demand from Asian countries like Singapore due to poor quality, which results from long flights (Rana 2002).

On the other hand, Jamaican ornamental fish farmers can look closer to home for opportunities. This includes other Caribbean countries and markets within Jamaica itself. Farmers could create niche markets by investing in products such as water gardens, which have become a popular thing among the middle and upper class as well as hotels and restaurants. Also, rather than all farmers producing the same fish, if they were to diversify a bit and start producing newer high quality species and/or varieties they would be creating a market for themselves (Torreano 2007)

6 THE SPECIES USED IN PRODUCTION MODEL

The species of focus are Red swordtail (*X. hellerii*), Molly (*P. sphenops),* Goldfish (*C. auratus auratus*), Freshwater Angelfish *(P. scalare) and* Blue Gourami *(T. trichopterus).*

6.1 Red Swordtails (*X. hellerii*) and Mollies (*P. sphenops)*

Both Red Swordtails (Figure 2) and Mollies (Figure 3) are considered livebearers because they are fertilized internally and give birth to live, free swimming organisms. Additionally, they both belong to the family *Poeciliidae;* a family to which Guppies and Platys also belong. Both species exhibit sexual dimorphism by the male carrying a gonopodium (modified anal fin) and females often display a gravid (dark) spot near the base of the anal fin. The stretching of the peritoneal wall causes this. Additionally, the male swords also carry a longer caudal fin, resembling that of a sword, hence, the name swordtail.

Figure 1. A male Red Swordtail.

These species should normally be bred at the age of 10 – 12 weeks. However, for most livebearers, young females can be fertilized as early as 8 weeks once mature males are present among them. When fertilization is done at a very early stage of the fish's life, the females do not bear young for many weeks and may be expected to drop their first brood not earlier than 10-12 weeks. This is why it is necessary to keep sexes separated when involved in commercial production. Another reason is that during the spawning ritual the male injects a milt sac, known as a miltatozeugmata (sper-mato-zeug-mata), into the female's genital pore. The milt is stored in the female's reproductive tract and is used to fertilize successive crops of eggs for the next five or six months (approximately 5 – 6 broods). While this does not prevent another or the same male from mating with the female and depositing another milt sac, the extent to which the original insemination is superseded by later ones has never been fully worked out. To achieve the most from brood stock, it might be necessary to use a male to female ratio of 1:3 or 4.

Live bearers breed naturally in aquaria without any special attention as long as they are well cared for and fed. However, after spawning, the parents should be removed so as to avoid cannibalism. Acid water, poor temperature and lack of adequate light and can arrest reproduction. The main influence of heat is to shorten the period of gestation. At an average temperature range of (21°C - 28°C), the gestation period is approximately 28 - 42 days. One week is used for the development of

the next crop of eggs (ovulation) prior to them actually being fertilized. The number of fry ranges from 30-100 for Mollies and 20-100 for Swordtails (Muha 2005). In many cases, livebearers produce young at about 22 days interval.

Figure 2. A male Dalmatian Molly.

6.2 Freshwater Angelfish (*P. scalare*)

The Freshwater water Angelfish (Figure 4) is peaceful although it belongs to the Cichlidae family. It is an egg laying species and breeds in pairs with a male to female ratio of 1:1. Spawning generally starts between 4-5 months of age at an average length of 3.8cm – 5cm. It is very difficult to differentiate between species. However, males sometimes display a pointed dorsal and anal fin with the dorsal having a red spot at the tip while the female's fins lack points and are much rounder. Additionally, if a group of angelfish is placed in a large tank, they will separate in pairs, which can then be removed and placed in tank to spawn by themselves. General tank requirement includes soft, slightly acidic – neutral water and a piece of slate or PVC pipe at a 45 degrees angle. At an average temperature of 27 - 29°C, angelfish will produce up to 300 eggs per spawn. (Muha 2005).

Figure 3. Freshwater Angelfish.

This species is shy and require privacy during spawning. They may also display some aggression at this time. Eggs generally hatch in 48-60 hours (2 – 2.5 days) after spawning and become free-swimming larvae by the 7th day after hatching. Angelfish spawns at 10 – 15 days intervals.

6.3 Blue Gourami (*T. trichopterus*)

This species (Figure 5) belongs to the group known as anabantid. They have an accessory respiratory apparatus called the labyrinth organ that permits then to breathe atmospheric oxygen (separate from their gills). As such they are capable of breathing air under low dissolved oxygen.

Figure 4. Blue Gourami.

The Blue Gourami is hardy fish and tends to be more aggressive than most Gourami. Both sexes are similar in appearance except that the male has a very pointed dorsal fin while the female's dorsal is rounded. During spawning the male builds the bubble nest in which the eggs are laid. The fish reaches an average length of 13cm but will begin breeding at a length of 9 cm and temperature of (23°C - 28°C). The breeding tank must be large and long about 5L (Jennings, 2006). The male to female ratio is 1:1. Being a prolific breeder, the average brood numbers almost a thousand eggs and will hatch in about 30 hours after spawn. Blue Gourami has an approximate breeding interval of a month.

6.4 Goldfish (*C. auratus*)

Goldfish (Figure 6) are one of the most popular aquarium fish. They come in many colours and varieties from round shaped Orandas to long bodied Comets. They breed by scattering their eggs on the side of tank or any substrate present. They exhibit sexual dimorphism in that the male often carries small tubercles on the opercula. These tubercles turn white when sexually matured. Additionally, the females when sexually matured tend to be rounder in the abdomen and bulges to one side when observed vertically.

Figure 5. Goldfish.

The goldfish prefers a water temperature ranging from 16^{o} - 24°C and stocking density of 5 gallons per inch of fish or 50 fish per cubic meter. Using brood stock of approximately 18 months old and a male to female ratio of 2:1, the trio can easily produce 3000 or more offspring. Goldfish will take up to 4 months of conditioning, before spawning again.

7 METHODOLOGY

To get a basic understanding of what level of production is currently taking place in Jamaica, field visits and telephone interviews were conducted with seven of the main producers and extension officers from the agency responsible for aquaculture development in Jamaica, the Aquaculture Branch of the Ministry of Agriculture & Fisheries. A questionnaire was later administered to a sample of these producers. The information received along with other research material was used to assist in the development of a production model.

7.1 Development of the Production Model

In developing the production model (Appendix I) certain standards were set (Table 2**)**, which is based on literature research and interviews conducted with ornamental fish producers in Jamaica. The other assumptions made include the quantity of broodstock for each species required to produce over 600 thousand pieces of fish per annum for export. The number of brood stock per species used was 40 pairs of Angelfish, 30 pairs of Gourami, 90 pieces of Goldfish, 200 Swordtails and 200 Mollies. The quantities of each species were further broken down according to the male female ratio (Table 2). The output from the production model was then added to an economic model. A mortality of 30 - 40% was used to compensate for additional selection criteria that the market may prefer. These include hi-fins, colour pattern or band, veil or fancy tails, etc.

Table 2. Assumptions used to develop the production model.

Fish Species	**Broodstock Ratio (F:M)**	**Breeding interval**	**Fecundity per Female**	**%Mortality**	**No. of fish per m^3**	**Crop Cycle**	**Crops per Month**
Freshwater Angel	1:1	10 days	300	40	2000	2 months	2
Goldfish	1:2	4 months	3000	40	50	6 months	1
Gourami	1:1	2 - 6 weeks	500	40	150	4 months	2
Molly	3:1	1 month	50	30	1500	3 months	1
Swordtails	3:1	1 month	70	30	1500	3 months	1

7.2 Development of the Economic Model

The economic model was developed to assess the profitability and financial risk if any that a potential investor may incur in this type of business. The planning horizon for this investment is 10 years. The model comprises the following components: investment, operation, cash flow, balance sheet and profitability.

Investment component:
This component comprises of the capital goods, which in this case is land, buildings, equipment and other materials. The book value and depreciation of the capital goods are also calculated during the period of the planning horizon. The investment component (Appendix II) also shows how the financing of the project will be done over the 10 years. This includes what comes from equity versus bank loan, repayment of loan, loan interest and management fees.

Operations component:
This component shows how the revenue and costs associated with the operations will develop over the ten years. The total quantity of individual fish per annum is imported into the model along with sales price per fish. This is used to calculate the total revenue per annum. The variable cost is subtracted to give the Net Profit Contribution. Fixed costs are subtracted to give the operating surplus or EBITDA (earnings before interest, taxes, depreciation, and amortization). In like manner the depreciation, financial cost, taxes and dividends are deducted in order to arrive at the net profit or loss. See Appendix II & V for further details.

Cash Flow component:
This component of the model shows the inflow and the outflow of cash into the business during the planning horizon. The inflow includes cash from sales, lenders and investors while the outflow includes paid dividends, taxes, repayment of loans and other financial cost. To calculate the cash flow, the EBITDA is imported from operations and then the changes of the debtors and creditors is deducted from it to achieve the cash flow before the tax. Taxes paid are subtracted to get the cash flow after tax. From this the financial cost and loan repayment per annum is deducted to arrive at the free or net cash flow, from which dividends are paid.

Balance sheet component:
The balance sheet (Appendix IX) is a way of showing the financial status of the business each year. It is built on the principle that total assets are equal to capital plus liabilities. In the first section of the balance sheet all the assets are totalled for each year. In the other section, the liabilities are also totalled and then added to the total capital. If this is the same value as that on the total assets line, the error check line will show a zero across the planning horizon indicating that the balance sheet is in balance.

Profitability component:
The profitability component of the model is to determine if the investment is worthwhile based on assigned financial indicators such the Net Present Value (NPV) and the Internal Rate of Return (IRR). The IRR represents the highest interest rate that the business can support. It is a discounting factor that brings the NPV to zero while the NPV is gives an indication as to the level of return the investor will receive on the investment in the future. The NPV was calculated by using the following formula:
where CF_t = Cash flow in year t and i = Discounting factor

Then NPV = $\sum_{t=0}^{n} \frac{CF_n}{(1+i)^t}$

8 PRODUCTION MODEL

The production model (Appendix I) that has been developed focuses on 5 commonly cultured species (Goldfish, Swordtails, Freshwater Angelfish, Gourami and Molly) and standards listed in Table 2. This model allows for the modification of various inputs to determine expected output, such as changes in the quantity of brood stock to determine the number of off-spring to be produced, feed required, number of tanks or water volume and so on.

Basic formulas were used to determine the quantity of feed required, the quantities of fish to be produced, quantities of tanks to be used, etc.

Quantity to be harvested (Ht) per species per month was:

$Ht = n*Q*F*(1 – M)$

where Q is the number of female brood stock of a species.
F is fecundity.
M is percentage mortality.
n is number of crops per month.

To arrive at total feed (Tf) per crop per species for a particular feed type the following was used:

$Tf = R*Tp*d$

where R is the quantity of feed per month per fish;
Tp is total fish produced (Q*F)
d is feeding duration in months

Quantities of tanks required was calculated using:

$$\frac{(Tp\rho)}{V}$$

where ρ is for stocking density (fish per m^3) and
V is for volume (m^3) of each tank

9 ECONOMIC ASSUMPTIONS

The main assumptions used in the economic analysis include the investment cost, the operating cost and the market assumptions (sales quantity and sales price). The sales prices utilized are a pessimistic reduction of those prices given by the fish producers in Jamaica. The investment cost (Appendix IV) is derived from retail prices in Jamaica with a 15% mark-up and comprises of basic equipment and materials and major cost items (land & buildings), which also includes a motor vehicle and a generator. The total cost associated with the major cost items is approximately

US$142,000 assuming a conversion rate of 1 USD: 86 JMD. The cost for the other items, equipment and materials is approximately $US80,000. Other assumption made was that of the operation cost, which is divided into fixed and variable cost. The main cost items that make up the variable cost (Table 3) are the feed, medication, filter repairs, packaging and delivery and travelling overseas by the marketing manager at approximately three times per year. This works out to be approximately US$85,000 per annum while the fixed cost (Table 4), which consist of salary for three regular staff, the general, and marketing manager, utilities and replenishing of brood stock is approximately US$58,000 per year.

Table 3. Variable cost per annum (JMD).

Items	**Unit Cost per Month**	**Total Cost per Year**
Feed per crop (grams)		
Brine Shrimp	187,548	2,250,573
Aquamax 00	9,361	112,326
Aquamax 100 +	38,167	458,004
Flakes	136,801	1,641,608
Koi Sticks	14,868	178,414
Other (egg yolk, home-made diet, etc)	8,031	96,366
Packaging & Delivery	80,000	960,000
Medication	2,000	24,000
Travelling Overseas	86,000	258,000
Filter Repairs	7,500	90,000
		6,069,291
Contingency 20%		1,213,858
		$ 7,283,149 JMD

Table 4. Fixed cost per annum (JMD).

Quantities	**Items**	**Unit cost per month**	**Total cost per Year**
	Broodstocks		
160	Freshwater Angelfish	500	80,000
270	Goldfish	2,500	675,000
180	Gourami	400	72,000
400	Mollies	200	80,000
400	Red Swordtails	200	80,000
3	Labourers (general staff) -$26000 each	78,000	936,000
1	General Manager	90,000	1,080,000
1	Marketing Manager	80,000	960,000
	Electricity	15,000	180,000
	Water	3,000	36,000
	Sub Total		4,179,000
	Contingency 20%		835,800
	Grand total		$5,014,800

It is also assumed that all the fish produced (Table 5) will be sold to wholesalers in the US. These fish will be sold at minimum price of 0.23 cents US to an approximate 0.44 cents US per fish. The total fish to be supplied is a minimum of 50,000 fish monthly. This will generate a gross revenue of approximately 197,000 USD per annum (Appendix V). More information on assumption can be found in the Appendix VI.

Table 5. Assumptions for sale price and quantities to be sold monthly.

Species	**Sales price per fish (USD)**	**Quantity of fish per month**
Freshwater Angelfish	0.44	14,400
Goldfish	0.35	13,500
Gourami	0.29	7,500
Mollies	0.20	7,350
Red Swordtails	0.23	7,350
		50,100

10 RESULTS AND INTERPRETATIONS

10.1 The Total and Free Cash Flow

The total investment for the ornamental business is approximately 19.2 MJMD (Appendix III). This is in addition to a working capital of 400, 000 JMD. The cash flow (fig.8) in the first year is negative given that it is the year of investment and no sales are occurring that year; however by the second year it becomes positive and continues on that trend throughout the 10 years investment period. At the end of the 10 years, the cash flow is approximately 5.2 MJMD (Appendix VII). This demonstrates that the business is in good financial condition and is able to support its financial obligations.

10.2 Profitability

The two main instruments used to determine or measure profitability (Appendix VIII) are the IRR (figure 8) and the Net Present Value (figure 9). This investment after 10 years has a NPV of 229 JMD on total capital and 2,608JMD on equity. In like manner, the IRR on the investment is 21% on equity and 15% on total capital. The payback on equity is approximately 7 years while the payback on capital is roughly 9 ½ years (fig. 10). This means that this investment is profitable especially since the repayment is completed before the 10 year planning horizon.

10.3 Sensitivity Analysis

The type of sensitivity analysis used in this model is an impact analysis on changes in the sales price, investment and production cost (table 6). From the analysis, the IRR is more sensitive to sales price and production in that if either of the two falls by 20% then the IRR would be zero (0), which would make the business very risky. If production falls by 10% then the IRR becomes 11% quite similar to that of the current interest rate on loans. A change in the investment cost by less than 30% will also bring the IRR within range of the current interest rate.

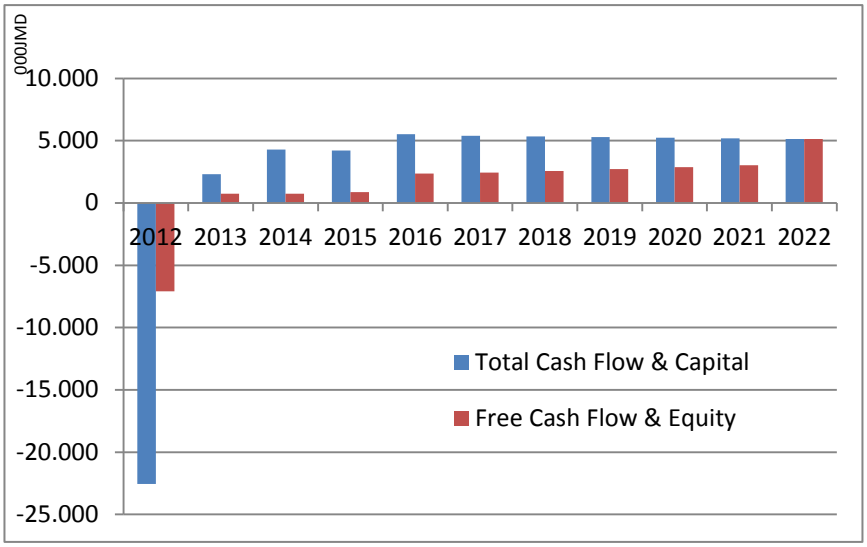

Figure 6. Diagram showing the cash flow over the 10 years for all five species.

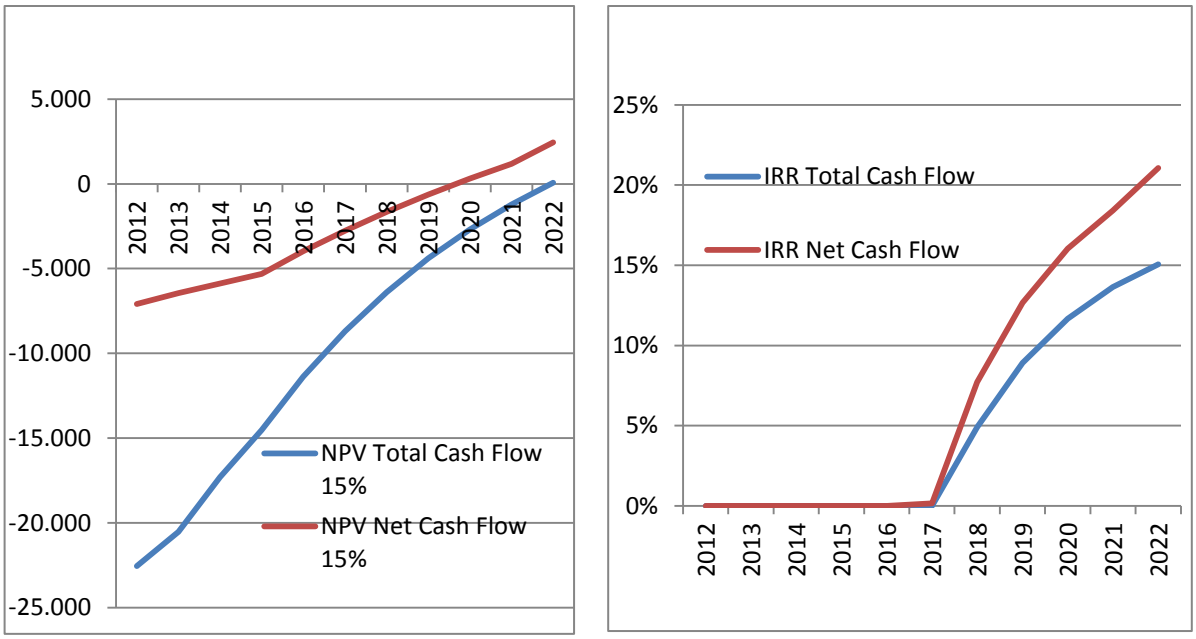

Figure 7. Diagram showing the accumulated net present value of all five species (left) and diagram showing the internal rate of return on all five species (right).

Table 6. Table showing impact analysis on IRR of equity.

		Investment		**Production**		**Sales Price**
		21%		**21%**		**21%**
-50%	50%	**62%**	50%	**0%**	50%	**0%**
-40%	60%	**49%**	60%	**0%**	60%	**0%**
-30%	70%	**40%**	70%	**0%**	70%	**0%**
-20%	80%	**33%**	80%	**1%**	80%	**0%**
-10%	90%	**27%**	90%	**11%**	90%	**4%**
0%	100%	**21%**	100%	**21%**	100%	**21%**
10%	110%	**17%**	110%	**31%**	110%	**38%**
20%	120%	**13%**	120%	**41%**	120%	**55%**
30%	130%	**10%**	130%	**50%**	130%	**72%**
40%	140%	**7%**	140%	**60%**	140%	**90%**
50%	150%	**4%**	150%	**69%**	150%	**108%**

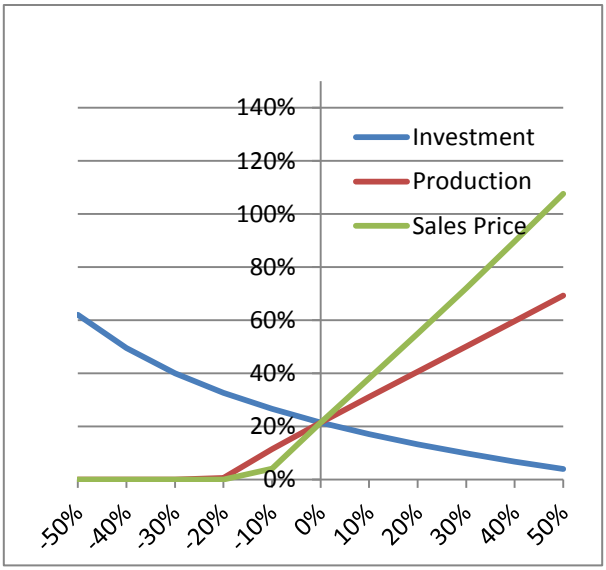

Figure 9. Graph showing impact analysis of IRR on equity.

11 DISCUSSION

In analysing the results of the models, producing ornamental fish appears to be extremely profitable and a worthwhile investment for persons to venture in. Given its margin of profitability, it begs the question, why aren't more persons involved? Or is this a too good to be true scenario? The results basically strengthens the point of view of many ornamental fish farmers in Jamaica in that ornamental fish production is a profitable industry that should be treated seriously as an area of priority. For years, many of the small-scale producers have been requesting that government implement a clearinghouse, with staff responsible for marketing ornamental fish overseas. These small-scale producers would then be able to sell their supplies to this clearinghouse. However, this

was never implemented. As such small-scale producers have not been able to market their supplies overseas. This is mostly due to inadequate space, which is necessary for mass production along with marketing and financial challenges.

Access to financing is a major problem for a lot of producers given that they may not possess acceptable collateral to secure a major loan. There are others who can access the loan but are unwilling due to the high interest rate especially when starting a business that is dependent on purchases made from disposable income.

Additionally, there are other risks associated with this type of business, such as poor husbandry technique. Often due to poor brood stock conditioning or management, the requisite fecundity rate may not be achieved and so lower production. Also, improper caring for the fry (off-springs) often results in high mortality, which again lowers production. Additionally, if the brood stock is not allowed to spawn in a timely manner, the eggs can be over-ripen and re-absorb by the fish, which means that there will be no form of production from those fish for that spawning period. Hence, lowering the monthly production target. And so an investor must ensure that the person responsible for breeding is technically competent and has experience. Poor management of the brood stock may also include its overuse, in that the fish is not allowed to rest from spawning and so have less fecundity with each spawn. The fish breeder would then need to know when to change the brood stock. For the purposes of this model an assumption was made for the replenishing the brood stock every six months to ensure continuity in production.

There can also be hatchery management issues that include controlling environmental stress factors such as water quality management, which by itself can lead to massive mortality. Poor water quality also often leads to disease outbreak. It is generally quite easy for the presence of a disease to spread throughout or wipe out a facility, especially if there are no disease prevention/control measures implemented. Therefore good hatchery and disease management practice is critical for to the survival of an aquaculture business of this nature. The presence of diseases can shut down a facility for up to a year or more especially since there is no fish pathologist on the island and the two veterinary officers at the Ministry of Agriculture also have other responsibilities.

Any form of reduction in the number of fish produced based on this investment will negatively impact its profitability and may also increase the challenges of getting into or remaining in an overseas market because it impacts on reliability and consistency – tenets that this market is built on. This can be a stressful situation especially when an investor has a major loan to repay.

Therefore, in analysing the profitability of this investment, different scenarios were considered. This includes the quantities or variation in species to be produced as well as quantities of individual fish to be produced, as it relates to the quantity of species to produce. That is what if four or less species were to be produced versus five; or what if rather than producing five species, focus was given to the greater quantities of the cheaper varieties?

The five species in the model appeared to be a good combination in terms of the profitability of the investment. Angelfish, goldfish and gourami normally cost the most depending the varieties, colour pattern and size and can be considered the top 3 species within the group of five while the

swordtail and the molies are normally classified as cheap low cost species. A full removal of the top 2 or top 3 species showed that the business would see a negative NPV up to -38,000 JMD on equity and a negative balance on the cash flow at the end of the 10 year planning horizon and hence not a viable decision. If the top three species are to be removed, the production of the two cheaper varieties would need to be increase at least by 6 times in order to have an IRR of about 13% on equity. On the other hand, the removal of the two cheaper species or a combination of gourami and any one of the cheaper species would see the business having an IRR of 4% and 0% respectively. This is not a viable option.

The sensitivity analysis showed that the business is very sensitive to decrease in sales price and production. Consequently, other options that could keep or increase the profitability of the business if prices reduce must be considered. One such option is to increase the volume of fish being sold. An increase in the quantity of fish being sold by about 10% would see the IRR on equity move from 21% to about 35%. The assumption in this study is that the fish will be sold to the United States; however, there are markets in countries such as Canada and the United Kingdom, which can support an increase in production volume. Although increase in volumes of fish being produce would also cause the operation cost to increase, the business would still be profitable given that the main cost would come from feed, packaging and transportation. Additionally, very conservative prices and were used to set up the model and current infrastructure can support more than two times the proposed production of 50,000 fish per month.

12 CONCLUSIONS AND RECOMMENDATIONS

Ornamental fish production can be a very profitable business but like every business investment, there is some level of risk. To increase the chances of success, the investor must use the right combination of species in adequate quantities. This model showed that producing angelfish, gourami, goldfish, swordtail and molly in quantities amounting to approximately 50,000 fish and above and selling them on the US market is a very profitable. It also showed that if the quantity or variation in species is to be reduced, the quantity or output from the other species has to be increased to maintain profitability. In other words, 50,000 fish per month is the minimum quantify of fish that can be produced to make a profit. Given that at this quantity the business is susceptible to 10% fall in production or sales, it would be best to ensure that production is maintained at least 100,000 per month. This would ensure that the business could survive more than fall in production or sales.

In a case where the investor is not the individual responsible for breeding and growing of the fish, he must ensure that the individual is well trained or have the relevant experience. He should collaborate with the Fisheries Division, Ministry of Agriculture & Fisheries to have all his employees trained in ornamental fish production. It would also be wise for the general manager to have some share in the business given that the success or failure of this business rest ultimately on the individual producing the fish. An option may also be to have different individuals responsible for the production of different species.

On a government level, the Fisheries Division can now use this tool to assist new or potential entrants in developing their business and business plan. Additionally, this tool should be used to increase awareness and demonstrate to financial institutions and others within the ornamental fish sub-sector the profitability of this type of investment. Also, where possible, collaborations should be formed between the Aquaculture Branch and financial institutions to develop profitable production models that can benefit from financial aids (grants and loans). Given that in the near future, all fish farms and farmers must be duly registered, Government could also implement a policy that would have all fish farmers trained before being registered. Being trained would impact on the ability of the farmer or workers to be productive on the farm.

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Thank you all!

APPENDIX

Appendix I: Production Model

		Angelfish	Goldfish	Gourami	Molly	Swordtails
Assumptions						
Stocking density of grow-out tank(fish per cubic meter)		2000	50	150	1500	1500
Initial Number of female Broodstock		40	30	30	150	150
Initial Number of male Broodstock		40	60	30	50	50
Fecundity per Brood pair		300	3000	500	70	70
Mortality per crop		40%	40%	40%	30%	30%
Crops per month		2	0	1	1	1
Months to Market size		2	6	4	3	3
Crops per year		24	3	10	12	12
Fish Produce per Month						
Quantity (output)		12,000	90,000	15,000	10,500	10,500
Mortality		4,800	36,000	6,000	3,150	3,150
Expected Total number of individuals		**7,200**	**54,000**	**9,000**	**7,350**	**7,350**
Total production per month		14,400	13,500	7,500	7,350	7,350
Total Production per year		**172,800**	**162,000**	**90,000**	**88,200**	**88,200**
Production Needs						
Feed (grams per fish per month)		**Total Feed per Crop in grams**				
Brine Shrimp	0.1	4,800	2,250	1,250	1,050	1,050
Aquamax 00	0.2	4,800	9,000	2,500		
Aquamax 100 up	1.5		101,250		15,750	15,750
Flakes	0.4	9,600	9,000	15,000	12,600	12,600
Koi Sticks	0.5		22,500			
Other (egg yolk or home-made diet)	1		22,500	12,500		

Appendix II: Breakdown of Investment Cost

Capital Expenditure:		Unit cost (JMD)	Total (JMD)	
0.8 hectares	Purchase of Land (2 acres)	3,000,000	3,000,000	
1	Office building with furnishing	2,500,000	2,500,000	
1	Packaging house	1,500,000	1,500,000	
220	Material for Fish House construction (square meters)	3,100	682,000	
1	Generator	1,500,000	1,500,000	
1	Twin cab 4x4 pick-up truck	3,000,000	3,000,000	**$12,182,000**
Broodstock				
160	Freshwater Angelfish	500	80,000	
270	Goldfish	2,500	675,000	
180	Gourami	400	72,000	
400	Mollies	200	80,000	
400	Red Swordtails	200	80,000	
	Tanks for Broodstock			
20	*Aquaria (6L)*	5,000	100,000	
20	Aquaria (1 - 3L)	3,000	60,000	
16	Plastic Vats	9,000	144,000	
1	Filters	20,000	20,000	
1	Accessories/substrate for tanks	20,000	20,000	
6	Earthen Ponds (15m*30m)	250,000	1,500,000	
40	56" Plastic Vats	9,000	360,000	
1	1/8 hp air pump	35,000	35,000	
1	DAB recir pump	40,000	40,000	
3	UV sterilizer	60,000	180,000	
2	Water quality test kit (incl. DO meter)	40,000	80,000	
220	PVC pipes & fittings (per square meters	2,500	550,000	
220	Filter media	400	88,000	
8	Vats for filtration	9,000	72,000	
220	Electrical Inputs & labour	600	132,000	
	Labour	200,000	200,000	
Sub-total			**16,750,000**	
	Contingency (15%)	0	2,512,500	
Grand Total			**19,262,500**	**$7,080,500**

Appendix III: Operation Cost

Feed per crop (grams)	**Cost/45 4 grams**	**Cost per Annum/Species/feed type (JMD)**					JMD$	
Brine Shrimp	6,400	1,623,965	95,154	176,211	177,621	177,621	2,250,573	
Aquamax 00	305	77,392	18,139	16,795			112,326	
Aquamax 100 up	305		204,061		126,971	126,971	458,004	
Flakes	1,050	532,863	62,445	346,916	349,692	349,692	1,641,608	
Koi Sticks	1,200		178,414				178,414	
Other (egg yolk or home-made diet)	350		-	96,366			96,366	
			Total Cost per Month					
Packaging & Delivery			80,000				960,000	
Travelling overseas			86,000				258,000	
Medication			2,000				24,000	
Filter Repairs			7,500				90,000	
Contingency 20%							1,213,858	
Total Variable Cost								**7,283,148**

Brood Stocks							
Angelfish	500 each	80,000				80,000	
Goldfish	2,500 each	675,000				675,000	
Gourami	400 each	72,000				72,000	
Molly	200 each	80,000				80,000	
Swordtails	200 each	80,000				80,000	
Labour (3 staff)	6,500 per person per week	78,000				936,000	
General Manager	90,000	90,000				1,080,000	
Marketing Manager	80,000	80,000				960,000	
Electricity	15,000	15,000				180,000	
Water	3,000	3,000				36,000	
Sub Total		1,253,000				4,179,000	
Contingency 20%		250,600				835,800	
Total Fix Cost		**1,503,600**				**5,014,800**	**5,014,800**
Total Operation Cost							**12,297,948**

Appendix IV: Investment and Financing

						Investment						
000JMD												
		2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**
Investment and Financing			1	2	3	4	5	6	7	8	9	10	
Investment:													
Land and Buildings		12,182	11,695	11,207	10,720	10,233	9,746	9,258	8,771	8,284	7,796	7,309	
Equipment and Material		7,081	6,372	5,664	4,956	4,248	3,540	2,832	2,124	1,416	708	0	
Other		2,889	2,600	2,312	2,023	1,734	1,445	1,156	867	578	289	0	
Booked Value		**22,152**	**20,668**	**19,183**	**17,699**	**16,215**	**14,731**	**13,246**	**11,762**	**10,278**	**8,793**	**7,309**	
Depreciation:													
Depreciation Buildings	4%		487	487	487	487	487	487	487	487	487	487	**4,873**
Depreciation Equipm.	10%		708	708	708	708	708	708	708	708	708	708	**7,081**
Depreciation Other	10%		289	289	289	289	289	289	289	289	289	289	**2,889**
Total Depreciation			**1,484**	**1,484**	**1,484**	**1,484**	**1,484**	**1,484**	**1,484**	**1,484**	**1,484**	**1,484**	**14,843**
Financing:		**22,552**											
Equity	30%	6,766											
Loans	70%	15,786											
Repayment	8		0	1,973	1,973	1,973	1,973	1,973	1,973	1,973	1,973		**15,786**
Principal		15,786	15,786	13,813	11,840	9,866	7,893	5,920	3,947	1,973	0	0	
Interest	10%		1,579	1,579	1,381	1,184	987	789	592	395	197	0	**8,682**
Loan Managem. Fees	2%	316											

Appendix V: Operation Statement

		Operations											
000JMD		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Operations Statement													
Sales			601	601	601	601	601	601	601	601	601	601	**6,012**
Price			35	35	35	35	35	35	35	35	35	35	
Revenue			**16,940**	**16,940**	**16,940**	**18,634**	**18,634**	**18,634**	**18,634**	**18,634**	**18,634**	**18,634**	**181,256**
Variable Cost	12.1		7,283	7,283	7,283	7,283	7,283	7,283	7,283	7,283	7,283	7,283	**72,831**
Net Profit Contribution			**9,657**	**9,657**	**9,657**	**11,351**	**11,351**	**11,351**	**11,351**	**11,351**	**11,351**	**11,351**	**108,424**
Fixed Cost	5014.8		5,015	5,015	5,015	5,015	5,015	5,015	5,015	5,015	5,015	5,015	**50,148**
Diverse Taxes													**0**
EBITDA (Operating Surplus)			**4,642**	**4,642**	**4,642**	**6,336**	**6,336**	**6,336**	**6,336**	**6,336**	**6,336**	**6,336**	**58,276**
Inventory Movement			0										**0**
Depreciation			1,484	1,484	1,484	1,484	1,484	1,484	1,484	1,484	1,484	1,484	**14,843**
Operating Gain/Loss (EBIT)			**3,158**	**3,158**	**3,158**	**4,852**	**4,852**	**4,852**	**4,852**	**4,852**	**4,852**	**4,852**	**43,434**
Financial Costs (Interest &LMFee)		316	1,579	1,579	1,381	1,184	987	789	592	395	197	0	**8,998**
Profit before Tax (EBT)		**-316**	**1,579**	**1,579**	**1,776**	**3,668**	**3,865**	**4,062**	**4,260**	**4,457**	**4,654**	**4,852**	**34,436**
Loss Transfer	0	-316	0	0	0	0	0	0	0	0	0	0	
Taxable Profit		0	1,263	1,579	1,776	3,668	3,865	4,062	4,260	4,457	4,654	4,852	
Income Tax	25%	0	316	395	444	917	966	1,016	1,065	1,114	1,164	1,213	**8,609**
Profit after Tax		**-316**	**1,263**	**1,184**	**1,332**	**2,751**	**2,899**	**3,047**	**3,195**	**3,343**	**3,491**	**3,639**	**25,827**
Dividend	20%	0	253	237	266	550	580	609	639	669	698	728	**5,228**
Net Profit/Loss		**-316**	**1,011**	**947**	**1,066**	**2,201**	**2,319**	**2,437**	**2,556**	**2,674**	**2,793**	**2,911**	**20,598**

Appendix VI: Revenue per Annum per Species

Species	Sales price	Quantity fish per month	Year 1 (JMD)	Year 2 (JMD)	Year 3 (JMD)	Year 4 (JMD)	Year 5 (JMD)	Year 6 (JMD)	Year 7 (JMD)	Year 8 (JMD)	Year 9 (JMD)	Year 10 (JMD)
Freshwater Angelfish	**38**	**14,400**	6,566,400	6,566,400	6,566,400	7,223,040	7,223,040	7,223,040	7,223,040	7,223,040	7,223,040	7,223,040
Goldfish	**30**	**13,500**	4,860,000	4,860,000	4,860,000	5,346,000	5,346,000	5,346,000	5,346,000	5,346,000	5,346,000	5,346,000
Gourami	**25**	**7,500**	2,250,000	2,250,000	2,250,000	2,475,000	2,475,000	2,475,000	2,475,000	2,475,000	2,475,000	2,475,000
Mollies	**20**	**7,350**	1,764,000	1,764,000	1,764,000	1,940,400	1,940,400	1,940,400	1,940,400	1,940,400	1,940,400	1,940,400
Red Swordtails	**17**	**7,350**	1,499,400	1,499,400	1,499,400	1,649,340	1,649,340	1,649,340	1,649,340	1,649,340	1,649,340	1,649,340
Total			**$16,939,800**	**$16,939,800**	**$16,939,800**	**$18,633,780**	**$18,633,780**	**$18,633,780**	**$18,633,780**	**$18,633,780**	**$18,633,780**	**$18,633,780**

Appendix VII: Cash Flow

Cash Flow

000JMD	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Cash Flow												
EBITDA (Operating Surplus)	**0**	**4,642**	**4,642**	**4,642**	**6,336**	**6,336**	**6,336**	**6,336**	**6,336**	**6,336**	**6,336**	**58,276**
Debtor Changes		3,388	0	0	339	0	0	0	0	0	0	**3,727**
Creditor Changes		1,092	0	0	0	0	0	0	0	0	0	**1,092**
Cash Flow before Tax	**0**	**2,346**	**4,642**	**4,642**	**5,997**	**6,336**	**6,336**	**6,336**	**6,336**	**6,336**	**6,336**	**55,642**
Paid Taxes		0	316	395	444	917	966	1,016	1,065	1,114	1,164	**7,396**
Cash Flow after Tax	**0**	**2,346**	**4,326**	**4,247**	**5,553**	**5,419**	**5,370**	**5,320**	**5,271**	**5,222**	**5,172**	**48,246**
Financial Costs	316	1,579	1,579	1,381	1,184	987	789	592	395	197	0	**8,998**
Repayment	0	0	1,973	1,973	1,973	1,973	1,973	1,973	1,973	1,973	0	**15,786**
Free (Net) Cash Flow	**-316**	**768**	**774**	**893**	**2,396**	**2,459**	**2,607**	**2,755**	**2,903**	**3,051**	**5,172**	**23,462**
Paid Dividend		0	253	237	266	550	580	609	639	669	698	**4,501**
Financing - Expenditure (Wcap)	400											**400**
Cash Movement	**84**	**768**	**521**	**656**	**2,129**	**1,909**	**2,027**	**2,146**	**2,264**	**2,382**	**4,474**	**19,361**

Appendix VIII: Profitability Analysis

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Profitability Measurements													
NPV and IRR of Total Cash Flow		000JMD											
Cash Flow after Taxes		0	2,346	4,326	4,247	5,553	5,419	5,370	5,320	5,271	5,222	5,172	**48,246**
Equity		-6,766											**-6,766**
Loans		-15,786											**-15,786**
Total Cash Flow & Capital		**-22,552**	**2,346**	**4,326**	**4,247**	**5,553**	**5,419**	**5,370**	**5,320**	**5,271**	**5,222**	**5,172**	**25,694**
NPV Total Cash Flow	15%	**-22,552**	**20,512**	**17,240**	**14,448**	**11,273**	**8,579**	**6,257**	**4,257**	**2,534**	**1,050**	**229**	
IRR Total Cash Flow		**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**5%**	**9%**	**12%**	**14%**	**15%**	
External Rate of Return of Total CF							**4%**	**9%**	**12%**	**13%**	**14%**	**15%**	
NPV and IRR of Net Cash Flow													
Free (Net) Cash Flow		-316	768	774	893	2,396	2,459	2,607	2,755	2,903	3,051	5,172	**23,462**
Equity		-6,766											**-6,766**
Free Cash Flow & Equity		**-7,081**	**768**	**774**	**893**	**2,396**	**2,459**	**2,607**	**2,755**	**2,903**	**3,051**	**5,172**	**16,696**
NPV Net Cash Flow	15%	**-7,081**	**-6,414**	**-5,828**	**-5,241**	**-3,872**	**2,649**	**1,522**	**-486**	**463**	**1,330**	**2,608**	
IRR Net Cash Flow		0%	0%	0%	0%	0%	1%	8%	13%	17%	19%	21%	
External Rate of Return of Free CF							5%	10%	14%	16%	17%	19%	
Financial Ratios													
ROI (Profit+Interest/Debt+Capital)			14%	13%	13%	21%	20%	20%	19%	19%	18%	18%	
ROE (Profit/Shareh. Capital)			20%	16%	16%	29%	25%	22%	19%	18%	16%	15%	
TR (Revenue/Debt+Capital)			76%	68%	71%	81%	77%	76%	74%	72%	70%	68%	
CR (Capital/Debt+Capital)			30%	35%	41%	48%	57%	66%	74%	82%	89%	90%	
Net Current Ratio			1.2	1.3	1.4	1.7	2.1	2.5	2.9	3.3	6.3	7.6	
Liquid Current Ratio			1.2	1.3	1.4	1.7	2.1	2.5	2.9	3.3	6.3	7.6	
Internal Value of Shares (Total Capital/Equity)			1.1	1.2	1.4	1.7	2.1	2.4	2.8	3.2	3.6	4.0	
Debt Service Coverage			1.5	1.2	1.3	1.8	1.8	1.9	2.1	2.2	2.4		
Acceptable Minimum			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Loan Life Cover Ratio:													
NPV of Future Cash Flow during Loan Life			23020	23775	22366	20837	17577	13982	9904	5271			
Principal of Loans			15786	13813	11840	9866	7893	5920	3947	1973			
Loan Life Cover Ratio			1.5	1.7	1.9	2.1	2.2	2.4	2.5	2.7			

Appendix IX: Balance Sheet

Balance Sheet

000JMD		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Balance Sheet												
Assets												
Cash Account	0	84	852	1,374	2,029	4,158	6,067	8,095	10,240	12,504	14,887	19,361
Debtors (Accounts Receivable)	20%	0	3,388	3,388	3,388	3,727	3,727	3,727	3,727	3,727	3,727	3,727
Inventory (Stock)	0	0	0	0	0	0	0	0	0	0	0	0
Current Assets		**84**	**4,240**	**4,761**	**5,417**	**7,885**	**9,794**	**11,821**	**13,967**	**16,231**	**18,613**	**23,088**
Fixed Assets		22,152	20,668	19,183	17,699	16,215	14,731	13,246	11,762	10,278	8,793	7,309
Total Assets		**22,236**	**24,908**	**23,945**	**23,116**	**24,100**	**24,525**	**25,068**	**25,729**	**26,509**	**27,407**	**30,397**
Debts												
Dividend Payable		0	253	237	266	550	580	609	639	669	698	728
Taxes Payable		0	316	395	444	917	966	1,016	1,065	1,114	1,164	1,213
Creditors (Accounts Payable)	15%	0	1,092	1,092	1,092	1,092	1,092	1,092	1,092	1,092	1,092	1,092
Next Year Repayment		0	1,973	1,973	1,973	1,973	1,973	1,973	1,973	1,973	0	
Current Liabilities		**0**	**3,634**	**3,697**	**3,776**	**4,533**	**4,612**	**4,691**	**4,770**	**4,849**	**2,954**	**3,033**
Long Term Loans		15,786	13,813	11,840	9,866	7,893	5,920	3,947	1,973	0	0	
Total Debt		**15,786**	**17,447**	**15,537**	**13,643**	**12,426**	**10,532**	**8,637**	**6,743**	**4,849**	**2,954**	**3,033**
Equity	0	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766
Profit & Loss Balance	0	-316	695	1,642	2,708	4,908	7,227	9,665	12,221	14,895	17,687	20,598
Total Capital		**6,450**	**7,460**	**8,408**	**9,473**	**11,674**	**13,993**	**16,430**	**18,986**	**21,660**	**24,453**	**27,364**
Debts and Capital		**22,236**	**24,908**	**23,945**	**23,116**	**24,100**	**24,525**	**25,068**	**25,729**	**26,509**	**27,407**	**30,397**
Error Check		0	0	0	0	0	0	0	0	0	0	0