Trout Eggs

Benjamin McFadyen

Introduction and Product Overview

The product in which I am trying to endorse from Canada is trout eggs, a cheap product that will increase productivity of hatcheries and fish farms across Nepal.

Canada has a variety of wild species of trout, and hatcheries that can produce commercial amounts of trout eggs. These eggs can be shipped to Nepal and spawned in hatcheries. The spawn can then either be grown to market weight in aquaculture ponds/raceways, or sold as young fish (called spawn or fry) to the Nepalese farmers to grow on their own. The trout eggs that I recommend from Canada are of high quality and they are sterile so you don't have to worry about infected fish from the start. Included in this report is overview of fish farming and input costs for aquaculture, that may be used to encourage skeptical farmers that aquaculture may be a good choice for them. The overview will also be intended to encourage safe, environmentally friendly, sustainable and most importantly profitability fish production.

Beyond just the product (trout eggs) and the supplies outlined, profitable fish farming needs guidance for people new to the industry. In fact, the fish farming industry is such a new and rapidly growing industry that it lacks a standard operating procedure. If done properly fish farming is very suitable with little or no pollution, while still producing a profit. For these reasons, healthy and environmentally safe aquaculture practices are highly recommended to ensure profit and standardize quality of the product being grown, trout (Steering Committee, 2012).

For more details on this product Eyed please get in touch Ted or Maureen at the number 250-677-4308 and ask about their live BC Rainbow Trout eggs. The website is also available without prices: http://tedstrout.com/bc-live-trout-egg-sales/

Product Description

The trout eggs can be spawn in hatcheries in major cities around Nepal. The young fish can be distributed to farmers form the hatcheries. The farmers then can increase their food security and hopefully produce a profit off the first harvest. Fish farming, even on a small scale, can also increase efficiency of a farm by using more waste and recycling it. This can be achieved

by using waste products from your vegetable garden to help feed your fish (Basnyat, A.P. Nepal and S.R. 2016). To farm fish and get a healthy product that is marketable and profitable is sometimes difficult. The trout eggs from Canada are of high quality, sterile and produced in controlled environments to ensure you receive trout eggs that will spawn and grow normally. This is not always the case and sometimes it is difficult to achieve sterility by harvesting wild trout eggs, depending on the equipment you have at your disposal. By investing in Canadian trout eggs you are ensuring that the fish being produced are going to grow normally, have minimal/no infection and have good genetics (better growth).

If done in a reasonable way trout farmers whom take on the task of fish farming, I believe will have better food security and increased income if they sell their product.

The product, trout eggs, are very cheap; they cost around 0.04 - 0.06 dollars an egg, compared to the $3-4 dollars (Canadian) they receive on the market when sold at 1.0 kg weight (Basnyat, Nepal and S.R. 2016).

How/Where Trout are Grown

The product will start in a fish hatchery, where the eggs will be incubated and hatched, which can take up to 2 months. The fish are then transferred to a “rearing chamber’’ to be grown out. These fish after hatching are referred to a spawn (or a fry) and once a fry reaches about 4-5 grams in weight they will be removed from the rearing tank. The fry fish are then transferred to raceways or a pond with adequate water flow as trout need a steady supply of oxygen which is carried by the fresh water (NHCFH, 2016). At this point the fish is referred to as a fingerling which is ready to be grown to market size or sold to fish farmers to grow. The fish will be fed multiple times daily, with increased feeding rates when they are young. I will outline briefly two methods of aquaculture which are the most productive and sustainable.

A fish pond, is a dug-out pond on a farm, that uses a pump with a filter to bring clean water in. The fish are given animal based feed along with vegetables left over from the garden if available. This is most suitable for small scale farms and is a very efficient and cheap (low start up cost) for the average Nepalese farmer with little income. The fish can be added to the pond and fed for sometime, usually between 8 months to 2 years, or until market weight is achieved or the farmer is hungry for some trout.

A fish raceway is a narrow channel in which water flows through at a greater rate due to its narrow diameter. This allows for more efficient trout farming as trout need adequate oxygen provided by fresh water to grow quickly. There can be a single raceway or multiple set up in parallel to use more space if available. Parallel raceways are considered a productive way to produce trout commercially because they are easy to maintain and clean/sanitize (Basnyat, Nepal and S.R. 2016).

The trout is grown using a feed chart, one example can be found online at http://www.fao.org/docrep/005/y3994e/y3994e0o.htm (Basnyat, Nepal and S.R. 2016).

The basic premise of a feed chart is to give the fish optimal feed for the temperature they are living in and their size/weight. In general, higher temperature water require more feed to be given, but can increase growth rate to some extent. Also, the percentage of feed vs the fish bodyweight is high when the fish is young and gets to a lower feed percentage for older fish (Basnyat, Nepal and S.R. 2016).

Labour

Labour inputs are generally low for trout production, start up money and labour being the main barrier. The highest amount of labour is required when the aquaculture system is being the set up. The cost can also increase if contamination occurs, since maintenance/sanitation of the farming area is needed. Also, labour for maintenance, cleaning and transport are a factor but pose no real issues to profitability (Basnyat, Nepal and S.R. 2016).

Fish feeding can be done 2-10 times a day depending on what stage of growth they are at, and this also requires labour. Young fish need to be fed more frequently (up to 10 times daily) where older fish can handle 2-3 times a day. There are many simple feeding mechanisms that can be set up to reduce the amount of labour and require only a small amount of input. Two examples of labour reduction tools are a machine operated feeder (based on time and amount fed) or a demand based feeder in which the fish can decide when to eat, through a mechanical button, when they get fed. For a commercial fish farm investment in this type of machinery is a good idea and reduce labour cost in the long run. Although there are solutions to reduce the labour required, a small-scale pond is not difficult to feed the fish and labour is minimal if being done by the farmer himself (Hinshaw, 1990).

Inputs required

Many inputs are required for safe and productive trout farming. At the hatchery level this includes pH papers, sanitation equipment, incubation chambers, holding tanks, aerators, water filters, water pumps, limestone (to adjust pH of acidic water), oxygen tank and the list goes on. These supplies are well known and can be explored at government or local fish hatcheries where information is available. There are also many reports out on how to set up and manage a good aquaculture or fish hatchery system (Cittolin, Alvarez-Lajonchère and Giancarlo, 2013). Assuming the fish hatcheries buying trout, eggs have all the equipment needed to spawn and grow trout, the main inputs would be labour, sanitation equipment, pH adjusters and electricity for running the hatchery equipment. The estimation of this cost is highly variable depending on the efficiency and size of the hatchery.

The main input drain would be fish feed which can cost from $700 up to $1200.00 (CDN) or 52, 000 to 82, 000 Nepalese Rupees per ton of fish feed. Just the feed can account for over 1/3 of the total cost in producing fish and is the main limiting factor in growing trout commercially as they need proper feed to grow well and healthy. One ton of fish feed is a large amount of feed, which could be bought be large hatcheries or government operations and then be sold to fish farmers at a small profit to reduce the overall cost of the feed for the farmer. This feed can be bought from China and varies in prices slightly depending on quality and the stage of growth the feed is intended for. Small amounts of feed could be distributed from the hatcheries as a package with young fish. This package could include all the inputs necessary for a fish farmer and different packages could be made for different levels of farming. For example, a package for farmers wishing to start a small-scale farm could have pH papers, limestone, a fish net, sanitation supplies, a shovel, a water pump, aeration tube and fish feed. This would be suitable for most small-scale operations, and a guide should be included that describes variables that could occur in your farm. For example, a guide of how many fish you should grow in a small pond and how to get adequate water flow while minimizing waste and pollution run off. Another example would be a package for a farmer that has already grown trout in the past, which may include fish feed, new pump filters, sanitation refills and limestone for pH adjustment.

For the famer inputs are variable and depend on mostly on the farmer’s disposable income and the scale of fish farming they wish to achieve. Inputs can be little as cleaning/sanitation tools, a shovel (to make a pond/flow system), a net and fish feed. Although

small scale trout farming can be accomplished cheaply with few inputs commercial trout farming can be quite different. For commercial production, I would %100 recommend a good amount of investment in control factors. The main factors that need to be controlled are contamination and any changes to pH, dissolved oxygen or temperature, which can cause large losses of stocked fish.

Temperature of the water is generally not a big issue as evaporation generally keeps water below 23 degrees Celsius if the water is circulating properly. This temperature is high for trout as they prefer temperature around 10-20 degrees but the trout will not die at this temperature. At high temperatures dissolved oxygen in the water becomes a problem, as high temperature cause less oxygen to be available. Dissolved oxygen is easily managed with oxygen tanks which are cheap and available from china (Swar, 2016).

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With a good amount of flow, of fresh water, pH rarely becomes an issue. If pH becomes a problem, it can be solved with pH papers (very inexpensive) to tell how acidic the water is and limestone (also cheap) to lower the pH of the water. Trout needs a lot of oxygen so fresh water inputs are required. If natural sourced water is used this is not an issue. A great method using free flowing water is using a flow through system with long trenches that can run in parallel. This type of system is more than possible and can reduce input costs from saving water (Cittolin, Alvarez-Lajonchère and Giancarlo, 2013).

Overall inputs should be decided by the individual farmer and the scale of farming that they wish to achieve.

Table of input costs:

Note: Prices are based on maximum cost and can be reduced with larger orders. Prices retrieved from Alibaba.com, most products come from China, which is close by and reduces transport costs.

	US $	NR (Nepalese Rupee)

Inputs

Canadian trout eggs (per 150 000 eggs)	7000	769230
Fish feed (per ton)	1000	109890
Labour	Variable	
Limestone (per ton)	80	8791.2
pH papers (per box)	1	109.89
Oxygen (per cubic m)	5	549.45
Sanitation - Chlorine (per 4.5 kg)	25	2747.25
Biofilter (per cubic m)	300	32967
Water pump (per unit)	40	4395.6
Aerator tubing	0.2	21.978

Equipment

Brush (per large brush)	2	219.78
Fish net (per square m)	2	219.78
Feeding machine	600	65934
Farming shovel (per shovel)	4	439.56

Benefits to Canada

The main people whom will benefit in Canada from this proposed trade is Ted’s trout farm and the transportation and shipping industry (the airport). Canada may also be able to help Nepal and establish a healthy trading relationship that can lead to future trade which may bring future benefits.

Part II

Export potential to Nepal

Nepal has no natural wild varieties of trout although they have already been introduced into the environment (Swar, 2016). The genetics and sanitary fish eggs Canada can supply can aid in supplying good genetics for trout farming.

Transportation Logistics

The trout eggs will start at Ted's Trout farm in Kamloops, BC where they will be picked up on ice and delivered to the airport via UPS. From the airport, they can be brought to Kathmandu Nepal and delivered to the local fish hatchery with a local shipping service. The total cost of shipping was calculated using an online shipping calculator and came out to $750 dollars Canadian based on a 25kg package (which could contain 150 000 trout eggs or more).

Fish eggs must be kept fresh so transporting them is key factor in making this a successful product to sell, anything other than air is unacceptable as there are too many variables that would make getting this product to Nepal impossible (Shluter, 2016).

The transportation of trout eggs can be difficult as they need to be cold to last any period of travel, which require ice or dry ice. The hatcheries in Nepal are in major cities (both government and private) for these reasons; they need access to transport, water, inputs form the market etc. This makes getting the trout eggs to the fish hatcheries easily accomplishable. Another issue is bringing the fingerlings to private fish farms has proven to be a bit more of a challenge. There is an excellent online article that describes transporting live fish and can be found at: http://www.ag.auburn.edu/fish/documents/International_Pubs/Water%20Harvesting/English/Transport%20fish.pdf

Below is a brief overview of transporting fish.

The water must be cooled to increase oxygen levels using ice or other cooling methods. Usually oxygen tanks are needed as low oxygen can be harmful and damaging to the young fish. The issue with oxygen is not a big problem if the fish farms are close to the major hatcheries but can be much more difficult when transporting long distances (Shluter, 2016).

Harvest to Market Logistics

The fish will be produced at small scale fish farms around centralized regions (large cities) to make product marketing easier. The fish are then caught wherever it is being grown and then transported as quickly to the market as possible as the market demands them.

The trout after being caught with a net can be sold fresh, sundried on site or transported to major city (e.g., Kathmandu, Pokara and others) to be smoked or preserved. This only works for fish farms close to the market place. For long distant transport the logistics is not practical but would require a cooling system and an oxygen tank to transport live fish. It would also work if the fish are cleaned and gutted first and then either smoked, sundried or salted for transport in cooled container. The practicality of getting preserved fish on ice and transporting them to a market close to a major city is not viable currently (Rajbanshi, 2016).

A possible solution to this issue could be developing a natural transport network or stream, that travels downstream of production. This natural downhill stream could be an effective way of bringing trout farmed up in the hill and mountain regions closer to the market where it is sold. This idea has never been implement as the risk of loosing trout into the wild is high. A large a contained race way with adequate, clean water would be needed to make this practical, but would be very costly to make. The raceway could lead to a drop off/collection tank near the market place in a major city. After being transported downhill the fully-grown trout could not escape and would be transported naturally, from water gravity and their swimming to the market.

Cost Analysis

The cost of trout eggs is very inexpensive, around 0.05 Canadian dollars or 4 Nepalese rupees. The market sized trout is sold at 300 Nepalese rupees, which is reasonable. When looking at feed, and using a 1 FCR rating it is easy to see trout farming as profitable, as one metric ton of feed costs around $1000.00 Canadian. If you get 1 ton of trout for 1 tons of feed and the trout can sell for close to $3000.00 dollars Canadian, this is quite profitable. Although many inputs are required they do not always impact profitability, sometimes they can increase profitability. The major cost drain comes from labour and equipment needed to start farming trout. Another major cost is the aquaculture supplies/equipment but this will not effect

profitability for the most part. Generally, the amount of money you put into an aquaculture system will help you achieve better yield, quicker growth, less labour and less technical issues (e.g. contamination) which in turn will increase profitability. For these reasons aquaculture, can be profitable for the small-scale farmer just as much for the large scale commercial producer (whom invests a lot) and the return percentage is around 15-19% (Basnyat, Nepal and S.R. 2016).

Benefits to the Nepalese People and Health Information

There has been some controversy over fish, the main question being "is fish healthy and do the pros outweigh the cons?". Fish is known to be healthy despite some recant claims suggesting that fish can contains high levels or PCBs dioxins and mercury (Wyness and McKenzie, 2013). For example, one study from the EU has shown recently levels of dioxins and PCBs have been found in fish and fish feed above the permitted levels allowed by 3% and 10% (European Food Safety Authority, 2012). These levels are slightly above the permitted levels and can affect people of different age/development stage differently. In contrary to these claims, other studies indicate that eating fish has more benefits than downsides. For example, heart attacks are a rising concern for death across the world, and in Nepal Ischemic heart disease is the #1 cause of death, just over 25% of all deaths (IHME, 2015). Eating one to two servings of fish a week has been shown to decrease the risk of coronary death by 36% and reduces total mortality (deaths per 1000 people) by 17%. The data that I have retrieved suggests that if everyone in Nepal ate 1-2 servings of fish a week the rate of death from Ischemic heart disease could drop from 25% to 16% after the 36% reduction. This works out to saving 2.6 million lives a year, which is hundreds of millions of dollars that can be saved. Besides the potential health benefits for people fish is a good source of protein with many healthy oils and nutrients, which would allow a fish farmer to have better food security by having a healthy source of protein, nutrients and oils.

Since heart problems are a rising concern, fish may be a cheap, sustainable and natural solution to prevent heart attack and stroke. The benefits from consuming trout are much more substantial than the harm caused by the small (only 10% above threshold limit) number of harmful PCBs and dioxins found in fish. Fish overall would have a little to no negative impact on the people whom consumed it compared to the lives it would save (Mozaffarian and Rim, 2008).

The exact mechanism of cardiovascular protection is not fully known yet, but data suggests that eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) may be the unsaturated long chain fatty acids that are protective to the heart. Data has also suggested that DHA is important for infant neurological development in infants (Mozaffarian and Rim 2008). Although fish (along with dairy) has been shown to have the highest level of dioxins and PCBs they are sustainable and complete sources of protein which benefits outweigh the potential harm they could cause (European Food Safety Authority, 2012).

Fish is also popular around the world for the same reasons discussed above along with other benefits, which makes it marketable and profitable to farmers. A benefit recently discovered from eating trout is the reduction in the development of Alzheimer's. In America, it is estimated that 236 billion dollars is spent through Medicare (US), direct payments and other methods for treatment and care on patients with Alzheimer's, not to mention the emotional stress it causes on family members of the people involved (Alzheimer's Association, 2015). There is no cure for Alzheimer's once it develops and Alzheimer's is devastating to our health care industry in north America and the EU. Published work has shown that consumption of fish has neuroprotective effects on the brain which can reduce the chance of developing Alzheimer's by 60% (Martha Clare Morris, et al. 2003). By marketing your product to developed country using scientific evidence to support the benefits, it is easy to make this product more marketable on a global stage and not just consumed locally. Although, trout is already profitable to sell which would help solve the issue of low income that the Nepalese people face, with or without increased marketability.

Trade/Subsidy Barriers

From research of law import laws in Nepal I could find no trade barriers that would prevent trout eggs from being imported effectively. Live fish is included but eggs are not listed, and may not be considered as a fish since they have yet to hatch (Department of Customs, 2012).

Future Studies for Trout Aquaculture

Currently growing trout is profitable but some critics point out that the use of animal or fish based protein for feed is not sustainable or good for the environment. What occurs when farming trout or any coniferous fish, is you are using food to make food, and this not as

productive as other aquaculture methods. Depending on the size and stage of growth differing amount of animal bioproducts are in the feed ranging from 40% to 50% (Hinshaw, 1990).

Trout that have been fed all plant diet, for example potatoes based feed, have not been successful in producing results. The results of a study found that potato based feed reduced the trout's feed intake as well as the FCR (food conservation ratio). This data suggests that either farmed trout needs animal protein or more research and development needs to be done in producing a well balanced all plant protein feed that will make the trout healthy and grow fast (K. Tusche et al., 2011).

The reason trout is a good fish for aquaculture is that it has high marketability and consumer demand. Trout is also very high in healthy oils, compared to vegetarian fish grown in aquaculture which can be very unhealthy to eat, such as tilapia. Currently the market demand makes farming trout profitable though better methods should be developed to increase sustainability. More development is underway and hopefully these problems will be solved soon.

For the above reasons, more studies/ research on how to grow trout from vegetable/plant based feed needs to be done, as using fish inputs can be quite costly on the FCR scale and harmful to the environment.

Another problem is phosphorus pollution, because trout need phosphorus to grow bones properly. The extra phosphorus run off can be damaging to the environment and this is a major problem with trout farming. Canada with an international group is working on this problem of phosphorus pollution coming from fish farms by altering the feed. The feed being developed will become more efficient and generate less phosphorus runoff when passed through digestion (Vandenberg, 2011).

Conclusion

Fish farming seems like a difficult task to undertake, but as the above report entails it is possible and profitable. This product could not only bring wealth to some of the Nepalese people but could improve the health and live expectancy of the nation. This may be a bit far reaching but I believe with the right people and/or government supporting this idea, that goal is more than achievable.

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