

## Revised Project Summary

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## 1. Site Location and Description

The project will be implemented at two locations, an on-land Hatchery and Shore Base area, and an open sea Growout area.

### a. Hatchery

The Hatchery operations will be land based, at Le Ressouvenir, East Coast Demerara, at the following GPS coordinates:

- 6<sup>0</sup>49' 14.08" N; 58<sup>0</sup>4' 41.56" W.

The boundaries of the plot of land for the Hatchery Operations are:

- 6<sup>0</sup>49' 12.68" N; 58<sup>0</sup>4' 37.03" W.
- 6<sup>0</sup>49' 16.78" N; 58<sup>0</sup>4' 36.71" W.
- 6<sup>0</sup>49' 17.23" N; 58<sup>0</sup>4' 42.14" W.
- 6<sup>0</sup>49' 14.33" N; 58<sup>0</sup>4' 42.56" W.

The area is bordered by mangroves to the east and west, the Atlantic Ocean to the north, and by residential areas and drainage structures to the south.

### b. Shore Base

The Shore Base operations will be land based, at Le Ressouvenir, East Coast Demerara, at the following GPS coordinates:

- 6<sup>0</sup>49' 15.17" N; 58<sup>0</sup>4' 46.71" W.

The boundaries of the plot of land for the Shore Base Operations are as follows:

- 6<sup>0</sup>49' 14.92" N; 58<sup>0</sup>4' 46.46" W.
- 6<sup>0</sup>49' 18.04" N; 58<sup>0</sup>4' 47.73" W.
- 6<sup>0</sup>49' 18.72" N; 58<sup>0</sup>4' 51.31" W.
- 6<sup>0</sup>49' 16.55" N; 58<sup>0</sup>4' 51.87" W.

The area is located next to the hatchery area, and is bordered by mangroves to the east and west, the Atlantic Ocean to the north, and by residential areas and drainage structures to the south.

# Shore Base and Hatchery Site

**Legend**

- Hatchery
- Shore Base



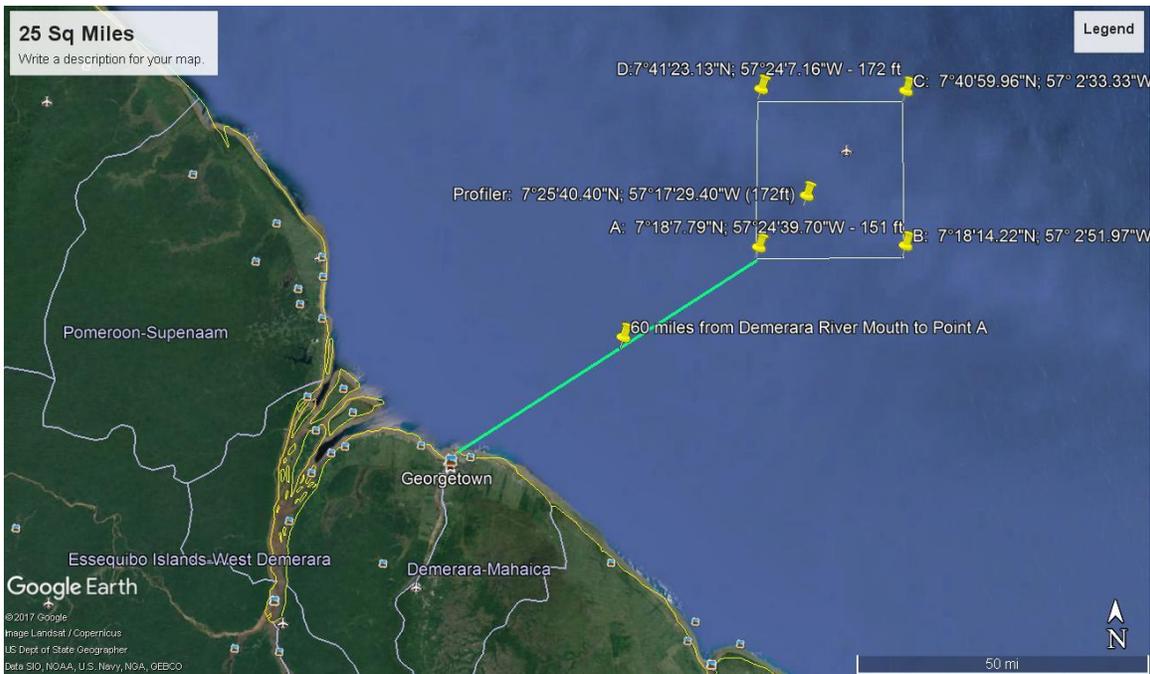
**c. Growout Area**

The Growout operations will be done in the open ocean, at the at the following GPS coordinates:

- 7° 30' 33.61" N; 57° 13' 37.30" W

The proposed location will occupy an area of 39 square kilometers, with the following boundaries:

- 7° 18' 7.79" N; 57° 24' 39.70" W
- 7° 18' 14.22" N; 57° 2' 51.97" W
- 7° 40' 59.96" N; 57° 2' 33.33" W
- 7° 41' 23.13" N; 57° 24' 7.16" W



The proposed location lies between, and parallel to, the following on-shore areas:

- 120 kilometers from an area north of Devonshire Castle, at GPS coordinates:  $7^{\circ} 21' 3.01''$  N;  $58^{\circ} 29' 26.42''$  W
- 160 kilometers from an area north of the boundary between Administrative Regions 1 and 2, at GPS coordinates:  $7^{\circ} 45' 41.67''$  N;  $58^{\circ} 52' 50.08''$  W



## 2. Project Design and Operation

### a. Overview

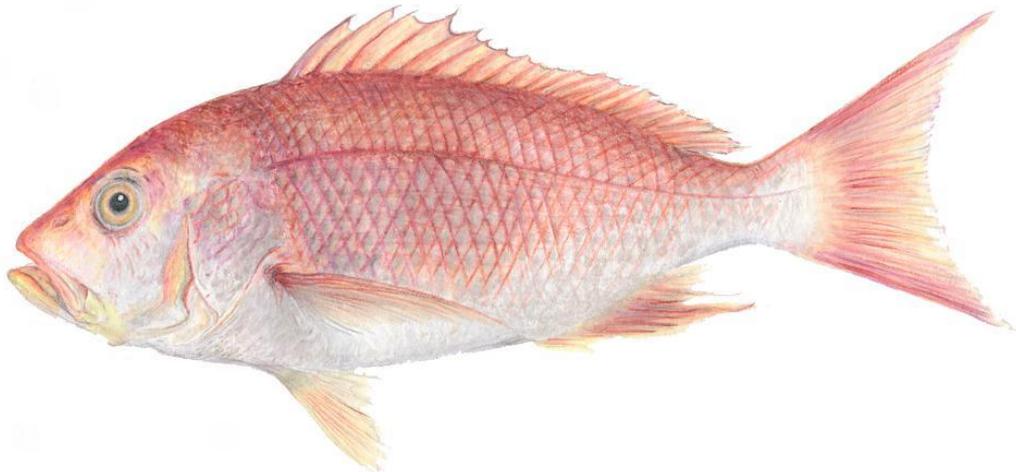
The project is designed to grow marine species currently caught by the capture fisheries in Guyana. Catches can be unreliable, and result in the long-term depletion of marine capture fisheries resources.

By growing these species of fish, the marine resources are spared, and fish production becomes more reliable.

### b. Species to be Grown

The species to be grown are as follows:

- i. Southern Red Snapper (*Lutjanus purpureus*)



ii. Atlantic Grouper (*Epinephelus itajara*)



iii. Cobia (*Rachycentron canadum*)



iv. Grey Snapper (*Cynoscion acoupa*)



v. Gillbacker (*Sciades parkeri*)



### c. Hatchery Operations

Broodstock of the various species will be captured alive from the wild, and transported to the hatchery. The broodstock will be placed in the hatchery, in concrete tanks, to conduct the necessary operations. There will be eight tanks, with a capacity of 28 cubic meters each.

The broodstock will be induced utilizing environmental manipulation, so as to facilitate spawning. This will involve manipulation of photoperiod, water quality and nutrition.

Chlorine bleach will be used to clean the tanks, and the hatchery in general. No additives will be used.

In the hatchery, the broodstock will be spawned, producing eggs, which will then hatch into fry (very small fish). These fry will be grown to fingerlings (slightly larger fish). These fingerlings will then be transported to the Growout area, where they will be stocked, and grown to market sized fish.



Hatchery Tanks

While in the hatchery, the broodstock, fry and fingerlings will be fed a high quality feed, with the following constituents:

- Fish Meal
- Soybean Meal
- Wheat
- Wheat Middlings
- Broken Rice
- Rice Bran
- Copra Meal
- Vitamin and Mineral Mix

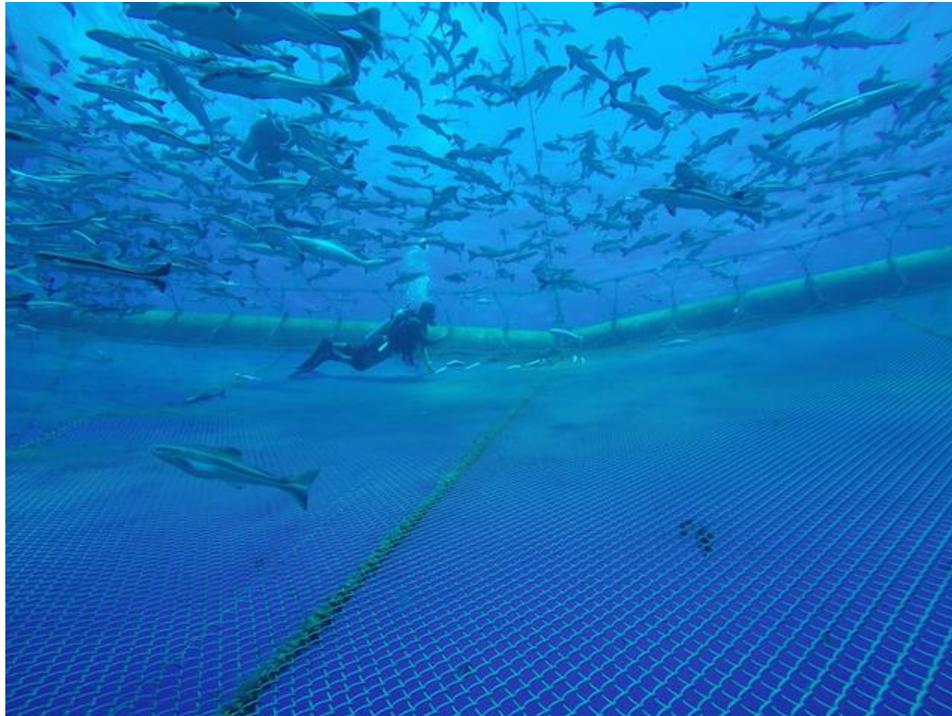
Hatchery operations will utilize 0.2 MT of feed per month.

#### **d. Growout Operations**

The Growout area will encompass an area of 39 square kilometers.

Fingerlings produced in the hatchery will be transported to the Growout area, and stocked into large mesh cages, where they will be grown to market size.

Each mesh cage will be 6,400 cubic meters in size. These cages will be able to be lowered or raised, depending on the current operation.



The project will utilize a mesh size of 35mm to 45mm bar measurement (knot to knot), or 70mm to 90mm stretch measure. This size has been selected to accommodate the size of fingerlings to be stocked from the hatchery operations, prevent the entry of predators, and facilitate adequate water exchange.

In order to secure the cages, the project will use 1.0 to 2.5 MT drag embedment anchors.

The Growout operation will be serviced by feeding, holding and harvesting support infrastructure, as well as logistics support, so as to be able to get inputs onto, and products off of, the facility. The Growout operation will also have accommodation for staff, who will be required to supervise operations and conduct required tasks on a 24-hour basis.

While in the Growout area, the fish will be fed a high quality feed, with the following constituents:

- Fish Meal
- Soybean Meal
- Wheat
- Wheat Middlings
- Broken Rice
- Rice Bran
- Copra Meal
- Vitamin and Mineral Mix

Growout operations will utilize 20 MT of feed per month.

### **3. Project Size and Duration**

#### **a. Production Area**

The hatchery area will comprise eight tanks, with a capacity of 28 cubic meters each.

The Growout area will occupy an area of 39 square kilometers

#### **b. Investment**

The capital investment in the project is US\$17.5 million, over a three-year period. The annual turnover is estimated at US\$4 million to US\$6 million.

#### **c. Labour**

The labour required by phase is as follows:

Phase 1:	20 persons
Phase 2:	25 persons
Phase 3:	35 persons
Phase 4:	45 persons
Phase 5:	60 persons

#### **d. Production**

The project is expected to produce 100,000 pounds of fish per month.

#### **e. Project Lifespan**

The project lifespan is expected to be 20 years.

## **4. Potential Environmental Effects**

### **a. Eutrophication of Surrounding Area**

The main negative environmental effects in aquaculture are associated with discharge of effluent, containing fish waste products, from farms into the environment.

Due to the feed applied to, and the waste generated by, the cultured species, the water in the immediate vicinity of the culture area will be subject to eutrophication.

### **b. Predation of Fingerlings of Wild Fish Species**

It is probable that fingerlings of various species of wild fish will enter the cages, which are used as growing structures for the fish. Once in the cages, it is likely that these fingerlings will be subject to predation, due to two main reasons.

The first is that four of the five species slated for culture are predaceous, and the fifth is omnivorous. As such, all of these species will naturally and instinctively target and consume fish.

The second reason is that fingerlings entering through the mesh will be smaller than the fish in the rearing areas, and as such, will be of a size that facilitates consumption by the cultured species.

### **c. Water Quality Changes**

Due to the activities associated with the proposed culture of a significant biomass of fish, there will be changes in the baseline water parameters around the culture site.

This will be due primarily to the feed applied for, and the waste generated by, the cultured species.

In the immediate vicinity of the culture area, it is expected that there will be an increase of certain compounds, such as ammonia, nitrites and nitrates, resulting from protein metabolism by the cultured species. There may also be a slight decrease in the dissolved oxygen concentration, and an increase in the carbon dioxide concentration, in the water in the immediate vicinity of the culture area.

**d. Noise Pollution**

Noise will be generated, by the operation of diesel generators. These generators are expected to be operational between eight to twelve hours per day, depending on the power requirements.

**e. Spills and Leakages**

There is the possibility of spills and leakages of fuel, which can cause dangerous pollution of the surrounding environment.

This is a possibility, given the requirement for power generation using diesel.

**f. Sewerage**

Both the On Land and In Sea operations will generate sewerage, which represents a potential source of pollution.

## **5. Proposed Mitigation Plans**

### **a. Hatchery Effluent**

Effluent from the hatchery will be drained into a settlement area. Following settlement, the liquid portion will be drained into the ocean.

The remaining solid and semisolid portions will be periodically removed, and used in land reclamation activities.

### **b. Growout Waste Products**

No treatment of wastewater will be required for the Growout section of the operation. Given the extremely large volume of the surrounding ocean, and the relatively small extent of the culture area, the eutrophication impacts are expected to be minimal.

In addition, due to the natural tidal movement and currents, the nutrient rich water will be diluted and dispersed away from the culture area.

It should also be noted that the resulting eutrophication will enrich the surrounding nutrient poor water, albeit to a small extent. This enrichment will increase primary productivity, and eventually, may contribute to increased wild fisheries populations.

### **c. Water Quality Changes**

One of the advantages of cage aquaculture in the open ocean is the fact that the vast area of the surrounding water has a significant effect on the much smaller culture area. Consequently, any changes in the surrounding water quality are expected to be temporary, and minimal.

In addition, the Growout operation will be sited to take advantage of natural currents. These currents will bring a regular flow of fresh water into the culture area, and remove water which would have been contaminated by culture activities. This will result in dilution and dispersal of contaminated water, while simultaneously ensuring a healthy culture environment for the fish.

**d. Predation of Wild Fish Fingerlings**

While there is a possibility of entry of wild fingerlings into the cages, and resultant predation, small fish instinctively avoid larger fish, due to the possibility of predation.

Consequently, the smaller wild fish will instinctively avoid the large mass of fish in the culture area.

In addition, the mesh on the culture area will also form a barrier to fish outside. Entry into the culture area will not be easy, or natural, and as such, this will also serve as a deterrent to entry and predation of fingerlings.

**e. Noise Pollution**

Noise pollution will be minimized using appropriate muffling equipment for the diesel generators.

No other significant sources of noise are expected.

**f. Spills and Leakages**

The possibility of spills and leakages will be minimized by using suitable, recommended storage containers.

In addition, containment areas will be set up, to contain materials in the unlikely event of spills or leakages.

**g. Sewerage**

There will be recommended treatment for sewerage for both the On Land and In Sea operations.

## **6. Non-Technical Project Summary**

The project involves the growing of marine fish species, which are currently caught by the marine capture fisheries of Guyana. These species are the Southern Red Snapper, Atlantic Grouper, Grey Snapper, Cobia and Gillbacker.

The intention is to replace the fish caught by fishing boats, with fish grown by aquaculture. This will lead to a more reliable supply of fish, and will also reduce the pressure on the wild caught fish.

The project is expected to employ 20 persons at the beginning, and 60 persons when it is fully developed. The total investment is estimated to be US\$17.5 million, and will produce 100,000 pounds of fish per month. The project is expected to last for 20 years.

Breeding fish for the above-stated species will be reproduced, to produce small fish, or fingerlings, in a hatchery facility located on land. The hatchery will contain concrete tanks. These fingerlings will be grown in the hatchery until they are big enough to go to the next stage, the Growout stage.

When they are large enough, the fingerlings will be transferred to the Growout area, located in the open ocean, 39 square kilometers in size, and 120 kilometers from shore. Here, they will be placed in large, floating mesh cages, and grown to market size.

During all stages, the fish will be fed a suitable feed, to ensure that they get the required nutrients.

The fish will also be carefully managed, so as to ensure their rapid growth.

Some of the potential environmental problems relate to the effect and disposal of wastewater and waste products from the hatchery and Growout areas. However, for the hatchery area, the water will be settled out before disposal. For the Growout area, due to the vast ocean space and the remote location, no water treatment will be necessary.