PROJECT PROFORMA
FOR AQUACULTURE WITHOUT FRONTIERS

SECTION 1: Project Outline
Project Title: **Aquaculture without Frontiers/NOVUS: Support for Haiti aquaculture training and demonstration center**

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Funding Requested from AwF

Year 1	Year 2	Year 3	Year 4	Total
$7,761	$3,560	$3,560	0	$14,881

2. PROJECT SUMMARY

2.1 Need

Malnutrition has been a chronic problem in Haiti for many decades. There is an urgent need to train Haitians in sustainable aquaculture methods whereby they can produce nutritious food using the resources they have available to them. During the past 8 years the Marine Biological Laboratory (MBL)'s Sustainable Aquaculture Initiative (SAI) has been involved in efforts to enhance tilapia production in 50+ concrete ponds constructed in the Cormeir area of Haiti. Originally these ponds were to produce fish using imported feed but proved too costly to be sustainable. We propose to supplement our recent success of introducing and promoting periphyton- based feed in extensive cultured fish ponds. What is badly needed now is semi-intensive methods to meet dire dietary needs that extensive methods cannot meet. Our experience in Haiti has shown that there is a need to first gain trust in any new technology that is introduced and then provide a means for Haitians to perpetuate the technology.

2.2 Objective

1. Establish an aquaculture-learning center and demonstration farm in Haiti. Design has been completed and construction is targeted to be completed in early 2011.
2. Train and hire two "Haitian Aquaculture Specialists" who will be responsible for assisting others interested in producing fish.
3. Produce a technical manual (in Creole) and provide training resources to facilitate duplication by other schools, community organizations, small businesses, or families
4. * Develop a fish diet with Haitian-equivalent ingredients and manufacturing methods identical to what will be used in Haiti.
5. * Conduct grow-out trials with tilapia in Woods Hole.
6. Import proven feed making equipment to learning center in Haiti, and train Haitians to make fish feed.
7. Conduct grow-out trials in Haiti

* *We are seeking funding from other sources to conduct these objectives, not from AwF.*

The broad goal of this project is to help the people of Haiti improve the amount of high quality protein (fish) that can be produced per unit of available space. Techniques will be introduced to improve existing methods, demonstrate alternative methods, and disseminate these methods for replication. A critical component of this objective is to develop fish rearing methods that are easy to operate and are able produce fish on a regular basis at an affordable price to those who need it most. An important facet of this objective is to craft these methods so that they will comfortably work within the culture, be transferable between one Haitian to another, and immune to the need for continued support of non-Haitian help. Success of this objective will be measured by the ability of the methods to be self-perpetuating and sustainable.

2.3 Methods

Objective 1
A 54 cubic meter system for producing fish, using locally available resources, will be installed at the Henri Christophe School in Jacmel, Haiti with the keen support of teachers and administers at the school. MBL staff will design the system and provide onsite training during the startup of the system (early 2011) and work with the teachers at the school to produce a training manual (in Creole). The MBL is working closely with the group ("Haitian American Engineers and Scientists" LLC (HAES) to orchestrate the construction of this fish rearing system. While the MBL works to design the fish rearing system, members of HAES will provide logistical support, recruit local laborers, work with key decision makers at the school, and aid with translation for help and construction engineering assistance. The local knowledge provided by HAES is vital in helping us meld our technology into the culture and meet our objectives. HAES will also participate in the hiring, performance monitoring and payroll disbursements of the "Aquaculture Specialists".

The fish production system is designed to initially be operated as a static rearing unit (aeration only) stocked at a rate of 35 fish/cubic meter. Until a fish feed is developed that can be made using locally available ingredients, fish will be fed periphyton, papaya leaves, and a commercial feed purchased from the Dominican Republic. The fish rearing system is designed with sub-compartments within the rearing unit to facilitate the maintenance of broodstock and continuous fingerling production. Initial fingerlings and broodstock will be purchased from "Caribbean Harvest" located near Lake Azuie

Objective 2
MBL staff will spend at least one week every month at the facility working closely to teach techniques needed to operate the system and assess suitable candidates interested in becoming "Aquaculture Specialists". During this time considerable attention will be spent to ensure the techniques and training methods are crafted to fit the culture.

Objective 3
We will work closely with the teachers and students who will be operating the system to ensure the materials produced to train others and disseminate information are accessible and formatted to facilitate future "Haitians teaching Haitians". Haitian American members of HAES will play an integral role in helping to develop these materials and have agreed to help disburse this information via their website and contacts in Haiti.

Objective 4 *
Concurrent to helping to oversee the construction and initial training of the fish rearing system in Jacmel, feed trails will be conducted at the MBL to develop a viable floating fish feed that can be made using ingredients available in Haiti. These ingredients include; brewery waste, and a variety of under utilized plants (moringa, leucena, calliandra, cassava). Laboratory analysis of these combined ingredients has shown that they contain most of the essential amino acids and proteins needed to make a good fish feed. Statistically valid growth studies need to be conducted in replicate tanks and the

machinery needed to produce a floating pellet needs to be determined before this "Haitian made" feed will be used in the fish system at the school. We will have access to extrusion feed manufacturing equipment at the University of Rhode Island's Feed and Nutrition Lab at Food Science and Nutrition (FSN) Research Center. Other ingredients and feed manufacturing methods may be incorporated based on our review of progress in this discipline in Asia.

Objective 5 *
Replicate fish rearing units will be used to conduct feed trails at the MBL's experimental greenhouse. A commercially made tilapia diet will serve as a control.

Objective 6
Extrusion feed manufacturing equipment (http://www.biodiesel-machine.com/flat-die-pellet-mill.htmlthat will be used to manufacture the feed will be imported to Haiti and selected Haitians trained to operate and maintain it. Standard operating procedures and recipes written in Creole will be provided to those responsible for making the feed, as well as QA/QC protocols. Provisions to facilitate our ability to monitor the performance of the feed manufacturing and quality of feed being produced will be established. This will include the establishment of robust Internet communication between the school and the MBL. (The MBL has already donated 7 lap top computers and software to the school)

Objective 7
Teachers and students will be trained in the collection of data on fish growth, water quality assessment and general fish health to allow accurate quantification of the performance of the feed in the system. In order to evaluate the effectiveness in the rural ponds, feed manufactured at the school and a control commercial diet will be fed to replicate rural ponds that we have historical data from. A local Haitian, currently responsible for monitoring these ponds will be trained on how to collect growth and production data.

2.4 Outputs

Output 1
We expect that the aquaculture learning center and demonstration farm will produce 900-1,000 kg of fish per school year (250 days) and supplement 7,500 student meals with at least 100g of fish/meal (the equivalent of over 6 kg of fish/year for each of the approximately 150 students). Demonstration of an economically successful tilapia production in school will spur an interest from graduates or others in the community to start private operations. The training manual and availability of a hands-on demonstration fish production system will be a vital tool for technology transfer

Output 2
Language barriers, cultural differences and trust, make it very difficult for "Blans" (outsiders) to effectively introduce anything new in Haiti. Trained Haitian "Aquaculture

Specialists" will be the most effective tool to expand the aquaculture industry, especially if there is a carefully planned, easy to monitor, financial incentive.

Output 3
Well crafted teaching materials, both printed and web-based will allow us to share the technology and help more people raise fish. These materials will allow us to more effectively help the many organizations (Haitian and NGOs) that are currently waiting for guidance.

Output 4
Developing a Haitian made fish feed (or feeding strategy based on the experience of others) is the only way to create a sustainable aquaculture industry in Haiti. If done properly, harvests for those currently using periphyton-grazing methods will increase dramatically. Novel feeding strategies and/or a Haitian made fish feed will allow aquaculture in Haiti to be vertically integrated, and fish can be produced for a price typical Haitians can afford. Haiti has limited space (horizontal) to build fish rearing units and supplemental feeding is desperately needed to increase the yield per unit area. Developing a Haitian made fish feed and material processing equipment (pelletizers, grinders etc.) also provides opportunity for entrepreneurs to make other much-needed feeds (poultry etc.).
The current price of imported feed is $0.40- 0.60/lb, assuming a feed conversion of 1.5, produces a product that most Haitians (70% of whom are malnourished), cannot afford because the median wage is $1 per day.

Output 5
Real data will be available to evaluate production data and feed performance and allow others to assess the economic viability of initiating future fish production systems.

2.5 Benefits

This project expects to provide roughly 100-150 grams of fish to each student each week (double the existing Haitian per capita consumption of fish). An aquaculture-learning center provides several benefits:

1. The nutritional needs of students will be bolstered by fish consumed in their school meal, and at a life stage that is critical to proper brain development and learning.
2. Students will learn how to raise fish and make fish feed (technology that can be transferred to their villages).
3. Teachers can use the system as a teaching tool for various topics.

This project will directly benefit other people in Haiti who want to raise fish by providing them with a location to observe functional fish rearing technology and obtain training materials. Anyone who wishes to produce high quality protein will now have the tools to do so, regardless of soil conditions, available infrastructure or assistance from others. The development of a locally producible fish feed will significantly increase the current yields of the farmers now using the periphyton aquaculture technology (PAT) technique and

others who wish to raise fish. Having access to supplemental fish feed will benefit farmers now using the PAT technique in that they will be able to increase the yield per unit area and hopefully avoid the current biannual “harvest and sell” management practice. The increased production made possible by supplemental feeding should result in fish being consumed on a more regular basis.

Appendix:
Justification for the construction of concrete tanks instead of earthen ponds

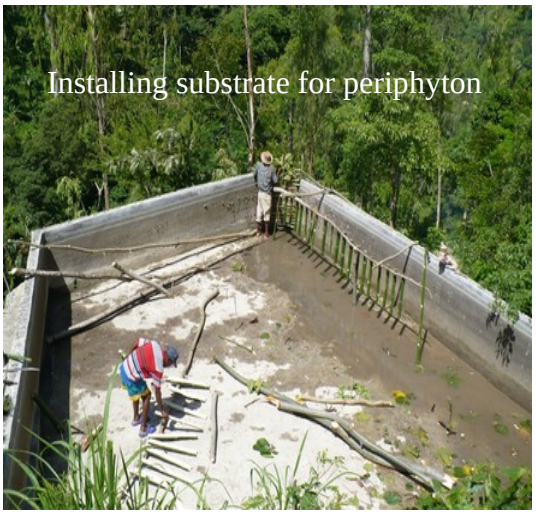
Synopsis of MBL's efforts in Haiti and future goals

For the past 8-10 years we have been working in the Cormier area of Haiti helping fishpond owners produce more fish from the 45+ ponds that were constructed prior to our arrival. The original intent of these ponds was to produce tilapia using commercial feed that would be brought in from the US. For a variety of reason the initial project failed (primarily the inability to import feed).

Our strategy, which is working, was to introduce periphyton based culture methods. Densities are lower than a feed based system but the technique works and is being duplicated in other areas of Haiti. People are harvesting fish every six months, average fish size 250 grams. Production rate is approx. 2,700 kg/ha. The steep terrain in the areas where the ponds were built and poor soil conditions required the use of concrete to build the ponds. Concrete was also the material of choice because it was available, cheap, and the Haitians were well versed in working with it. Building the ponds using concrete was also labor intensive, an important factor that helped build community ownership and subsequent security of the ponds.

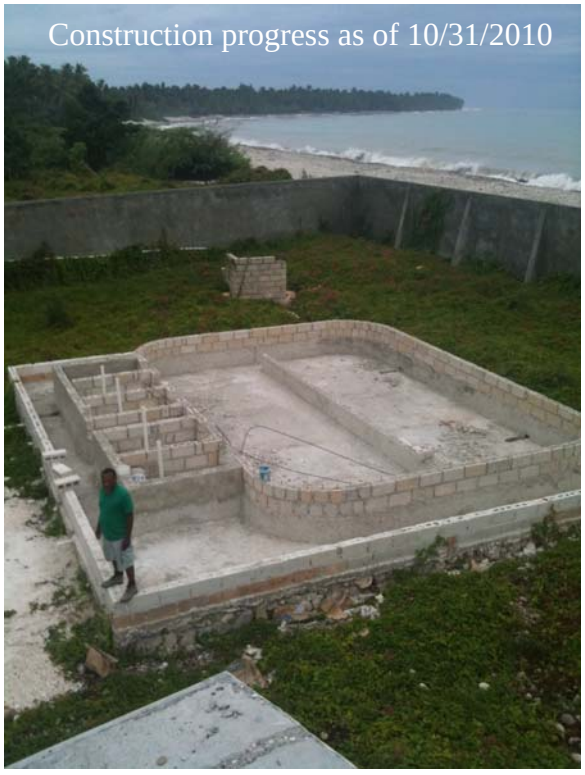

Typical mountain ponds

The biggest issue with the concrete ponds we inherited is that production levels using PAT are not high enough to warrant "community ownership" like the ponds were designed to be used. The Haitians have figured a way to "lease" rights to a pond by single families but there is still tension and much arguing when fish are harvested – everyone wants a piece of a very small pie.


Installing substrate for periphyton

Given the publicity and revenue being generated from the fish-rearing project we have been working on, we have been inundated with requests to help other areas of Haiti. People are eating better, fish are being harvested regularly, and the enthusiasm to duplicate the process is overwhelming. Hospitals, schools, private business, and many families have asked us to help them rear fish. The resources (human, financial, and material) each of these potential fish farmers has available is as varied as the topography where they want to do it. Careful evaluation of the human and material resources available in Haiti and thousands of hours of dialog with our Haitian friends prompted us to formulate a strategy to best perpetuate aquaculture in Haiti. This strategy involves the construction of an "Aquaculture Learning Center" (ALC). The ALC has been designed and built with careful attention to the needs and suggestions of the local people. There is no single system that will work best in Haiti, but there is a need to provide a platform where people can learn the basics of aquaculture and apply methods that work best in their area. The ALC will be a full-scale semi-intensive fish production system that will showcase simple, sustainable, equipment and methods. Participants who visit the learning center can incorporate as much or as little of the technology as they can afford.

***Artist rendition of Aquaculture Learning Center being built at the Henri Christophe School near* Jacmel**



The system is being built at a local school near Jacmel. In addition to supplementing meals for kids at the school, it will serve as a teaching tool for various topics suggested by the teachers; math, water chemistry, animal husbandry, economics etc. An important motif of the ALC is to provide people with a variety of tools that can be used to bolster fish production; vermiculture techniques, composting, poultry waste supplementation, aquaponics etc. Regardless of the rearing unit people decide to build; concrete ponds, cages, earthen ponds, or small cisterns, they will learn valuable production enhancing skills that can be applied wherever they wish, as resources and skill levels dictate.

Our long-term goal is to have many of these Aquaculture Learning Centers throughout Haiti and form a network of Haitians who can serve as Aquaculture Extension Agents who will be trained at these Centers to carry the message and help others. Haitians teaching Haitians is the goal.

A very critical component to enhance aquaculture in Haiti is developing a locally produced fish feed or nutritious input to the rearing units that will increase the yield/unit area. In most areas of Haiti, horizontal space is limited and family owned property is small. Unless the nutritional and monetary yield/unit area is greater than what can be achieved with beans, corn, and etc. aquaculture will not work (my opinion). Supplemental feed or creative polyculture is the only way I can see this happening.

There are a variety of good ingredients that can be used to make fish feed (brewery waste, cabrit (goat) blood, moringa, cassava, rice hulls (limited areas), and maybe some ground nuts (limited areas)). Further research needs to be conducted in this area and/or duplicating what has been successful in other areas of the world – I have yet to find a method that can be transferred to Haiti yet, but the search is on and hopefully AwF folks could lend a hand in this area.

Until a locally produced fish feed can be made, the ALC will be feeding a commercial 32% CP (made in the US) diet purchased from a vendor in central Haiti. We are targeting a production capacity of about 1-2 metric tons/school year (250 days). This is assuming a feed conversion of 2.0 and a maximum holding density of 33 grams/liter. The system is approx. 50,000 liters and should be capable of receiving about 13kg of food/day. The completed cost of the system will probably be somewhere close to $12,000 USD. All fish produced in this system will be consumed by the students but if they were sold at the typical price of $3/lb USD, the ROI for the system would be about three years. If the soil conditions were better and an earthen pond could be built the ROI would be <1 year.

The topography and resources available in Haiti are incredibly varied and there is no single system that would work best. We are making every attempt to provide a means to help people raise fish regardless of what they may have available to them. We need funding to complete the system in Jacmel, investigate methods to build a fish feed in Haiti, and follow through with developing teaching materials (in Creole).