

LOCAL ENTERPRISE AND VALUE CHAIN ENHANCEMENT PROJECT

**IMPACT ASSESSMENT
OF
CARIBBEAN HARVEST S.A. FISH FARMERS
AS A RESULT OF SUPPORT PROVIDED BY LEVE**

DRAFT FOR COMMENT

December 2018

LIMITED DISTRIBUTION

This report was prepared by LEVE, using the results of the field work conducted by Socio-Dig S.A. from September to October 2018

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ACRONYM LIST

APMPL	Asosyasyon Peche ak Machann Pwason Lilet
CH	Caribbean Harvest S.A.
CHF	Caribbean Harvest Foundation
HACCP	Hazard analysis and critical control points
LEVE	Local Enterprise and Value Chain Enhancement Project
MSME	Micro, small and medium enterprises
NGO	Non-governmental organization
SD	Socio-Dig
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

Given that some time had passed since the initial grant to Caribbean Harvest S.A. was made to increase production capacity, LEVE and Caribbean Harvest S.A. agreed to undertake an impact assessment that would go beyond simply capturing results, but more to measuring resiliency (as defined by the United States Agency for International Development) of the fish farmers. The initial grant was to increase both energy supply and the number of cages, which would lead to an overall increase in fish production by fish farmers. An increase in fish farming and subsequent revenues would be the basis for improved resiliency, showing conclusively that the LEVE grant was “worth more than the simple sum of the parts”. And if not, what lessons could be learned from this activity and applied to future activities of a similar nature.

A scope of work was developed, agreed upon by Caribbean Harvest S.A. and then a local firm – Socio-Dig S.A. – was awarded the contract to conduct the assessment. Socio-Dig has experience in both measuring impact and resiliency, and in fish culture and fisheries. Prior to starting the field work in September 2018, the concerned parties – Socio-Dig, Caribbean Harvest S.A. and LEVE – conducted meetings to ensure a complete understanding of the objectives and tasks.

Over 300 families residing in the 4 to 5 villages that were part of the fish farming program of Caribbean Harvest S.A. were interviewed, concentrating the work on Betel, the only village in which Caribbean Harvest S.A. is currently working. The research team from Socio-Dig worked with Caribbean Harvest S.A. technicians, but also visited other fish farming activities to vet findings. The team also conducted significant research via the internet and one-on-one communications. Non-governmental organizations working in the same geographic area around Lake Azuei were also interviewed to better understand the depth of their social programs, so as to be able to ascertain the impact of the Caribbean Harvest S.A. social programs, being implemented in cooperation with the Caribbean Harvest Foundation. This was critical to ascertaining the level of improved resiliency as a result of the LEVE intervention. To the extent possible, the findings presented herein are limited to the scope of work.

The findings were not what the team had expected. After doing extensive interviews among the majority of the families in the villages where Caribbean Harvest S.A. has been working, the research team was not able to identify sufficient fish farmer beneficiaries to construct a significant sample size to permit comparison of either impact or resiliency. To understand why, the research team extended their investigation into areas such as production practices, and non-governmental organization support activities.

The observations being presented to Caribbean Harvest and LEVE show that a very low number of fish farmers actually exist; that few fish farmers received more than one cage of fingerlings and feed; that the revenue per cage harvested was much smaller than the numbers that had been projected (based on actual numbers realized according to Caribbean Harvest); and that as a result, few, if any, fish farmers were continuing to farm fish. The conclusion is that the model is not working, and may never have been working.

Second, the observations showed that any impact upon resiliency was due to the work of other non-governmental organizations in the region, and that the linked activities of Caribbean Harvest S.A. and Caribbean Harvest Foundation were more limited than the activities of other organizations in this area. Given the fact that most people in this region are transitory, beneficiaries travel from one area to another where services and opportunities benefit them more.

This report is now being submitted to Caribbean Harvest S.A. for their input prior to being published for a broader audience.

BACKGROUND

The USAID-funded Local Enterprise and Value Chain Enhancement (LEVE) project strives to increase economic growth and employment opportunities in Haiti. LEVE expands opportunities for micro, small and medium enterprises (MSMEs) to generate employment for Haitian men, women, and youth in three key sectors – construction, apparel and textile, and agribusiness. LEVE works lead firms in value chains that hold the most potential for growth.

LEVE has four components:

1. Enable MSMEs to engage with other value chain actors to mutually create value.
2. Increase MSMEs access to a productive labor pool with relevant skills and competencies.
3. Improve the sustainability of Haitian organizations serving target sectors and corridors.
4. Identify and improve synergies among existing programs and activities.

Within the agribusiness sector, LEVE has supported activities in the tilapia value chain, more specifically, expansion of production capacity and food safety (HACCP) certification. One of the first activities supported by LEVE was to co-finance the expansion of Caribbean Harvest S.A. (CH). CH is an integrated tilapia fish farm, producing fingerlings, which are then grown out in cages in Lakes Azuei and Péligre. CH had sufficient production capacity in its hatchery, but lacked access to affordable energy to be able to increase production, which limited the number of fingerlings that could be grown out, which in turn limited the production of marketable fish.

LEVE and CH co-financed an expansion to address these issues, doubling the solar energy capacity of the hatchery, and adding cages, so that more fingerlings could be produced, and then grown out. This included both smaller cages which were given to fish farmers, and larger cages, which are managed by CH themselves. Most of these fish farmers come from a very destitute region of Haiti on the shores of Lake Azuei.

CH's social business model has CH producing the inputs and providing the technical assistance, and then selling the inputs to the Caribbean Harvest Foundation (CHF) who distributes cages, fingerlings and feed to selected fish farmers living on the shores of the two lakes. CHF purchases the inputs from CH by using donations raised in the US and elsewhere. CH also funnels 20% of its profits from the sales of fish to CHF. The fish farmers grow out the fingerlings, and then sell them back to CH, who process and market the fish, which takes 3-4 months. The fish farmer is then left with cash with which to start a new cycle. The CHF also uses its donations to continue to add fish farmers, and support the development of housing, schools and medical services to these communities.

To date, LEVE has recorded that 50 fish farmers located in Lake Azuei were part of this activity between LEVE and CH.

LEVE's second grant provided support to expand the retail outlets of CH through the establishment of sales centers in the Western province. This was to address a constraint of only selling to Madame Sara at the hatchery gate. A third intervention is helping CH obtain HACCP certification to facilitate the eventual export of tilapia to other countries, most notably the Dominican Republic.

CH and LEVE agreed to evaluate the impact of the initial activity – expansion of hatchery and production – upon the livelihoods of the fish farmers, with the purpose being to evaluate the immediate and longer-term impact of LEVE's intervention with CH on the livelihoods of the 50 fish farmers who received cages, and their families. LEVE and CH are ultimately interested to know what impact, if any, this intervention

has had upon the resiliency of the fish farmer, and their ability to sustainably continue this economic activity to the benefit of their family, their community and ultimately the Haitian economy.

INTRODUCTION

In 2014, LEVE co-financed, through a \$250,000 grant, the expansion of the productive capacity of Caribbean Harvest S.A.:

1. Increasing the capacity of solar equipment at the hatchery from 73 to 133 kw.
2. Purchasing an additional 300 small cages to increase the number of small fish farmers producing for CH.

This investment was intended to contribute to a doubling of fish production; the increased energy capacity would increase fingerling production from 2.5 million to 5 million per year; and the additional cages would double the number of small fish farmers.

In 2017 LEVE supported the expansion of sales points through a \$50,000 incentive grant to add additional points of sale.

As the grants have been disbursed, LEVE and CH were interested in learning about the actual impact on the fish farmers, and more importantly upon the resiliency of the families who received cages and had begun to produce fish on a continuous basis.

Caribbean Harvest S.A. (CH) is a private company created in 2005 under Haitian laws (Identification Number: 000-400-895-7). The company is a sole ownership with no board members. The company owns and operates fish hatcheries at Croix des Bouquets and Lake Péligre, as well as a processing plant in Croix-des-Bouquets, and has several sales outlets throughout the Port-au-Prince region. Fish are produced both directly by the company in larger volume floating cages and through a network of fish farmers using smaller volume floating cages.

The mission of CH is to improve nutrition for millions of Haitians and generate income for thousands while growing into one of the leading fish production enterprises in the Caribbean. To achieve these goals, CH vows to use environmentally friendly technology to produce the highest quality fish, and to provide stable work environment with equal opportunity for all the employees and personal growth of each local producer.

The vision of CH is to develop a new industry in Haiti based on freshwater and brackish water culture of tilapia using both modern aquaculture technics and natural production. The development of this new industry uses a model that integrates the most vulnerable within the population potentially creating over 4,000 jobs in extremely poor areas.

To attract funding from international NGOs, a social business model was adopted. A foundation was created – Caribbean Harvest Foundation (CHF) – to incorporate social programming, with a six member board of directors. With regards to the fish farming activity, CHF provides a starter-kit of a small cage, fingerlings and feed. Once this initial production is harvested, the fish farmers are able to start the cycle over, thereby establishing a renewable cycle of fish farming that will lead to improved livelihoods. CHF purchases this kit from CH, while CH provides the technical assistance and supervision. At harvest, 10% of the fish are supposed to be used as food for the fish farmer, the remaining 90% is to be sold, and then the profits split 40/60 between the fish farmer and CH, with CH then giving 20% of the profits back to the CHF.

The model was lauded by Bill Clinton as, “*the biggest return on an investment under \$1 million for people to chart their own course in life that I have yet seen. It’s stunning. It’s amazing.*”¹

RESEARCH STRATEGY

The focus of the assessment was to measure the impact upon production by small fish farmers that came about from 1) the expected increased production of fingerlings as a result of the increased capacity to aerate fish tanks at the hatchery due to increased solar energy generating capacity, and 2) the addition of 300 small cages. The expectation was that the production of fingerlings would double, with a corresponding doubling of fish produced. This would then increase the use and efficiency of the processing plant.

Second, the assessment was to determine to what extent fish farming contributed to the absorptive, adaptive and transformative resiliency of those individuals and their families who practice fish farming in association with CH. Using households as units of analysis, the research team would compare resiliency of CH fish farmer families against counterparts not engaged in fish farming and determine what caused or did not cause differential resiliency of people in the studied communities.

Definition and Concept of Resiliency

The concepts and measurements drew on USAID commissioned research that defines resiliency as the ability of a household to resist shocks brought about by economic crises (e.g. recession and inflation), environmental crises (e.g. storm, floods, and earthquakes), political crises (e.g. embargo, strikes and riots) or intra-household crisis (e.g. loss of income or property by theft, death of livestock from epidemic or accident, and illness or death of a family member). Even more specifically, USAID² breaks resiliency into three conceptual categories,

- Absorptive resiliency: determine if CH fish farming households are better prepared than in the past to deal with internal and external household shocks and are they better prepared than households that are not participating in CH supported fish farming.
- Adaptive resiliency: determine if CH fish farming households make more aggressive and enlightened investments in alternative livelihood strategies than those households not directly involved in CH fish farming.
- Transformative resiliency: determine if CH fish farming activities contribute in any way to local governance and community social protection strategies.

Methodology

The research took place from September 8th to October 30th of 2018. The research team was composed of a Team Leader (PhD in anthropology, fluent Kreyol, 30 years of research experience in Haiti); a four-person interview team (two women, two men) of Haitian nationals with at least three years of survey experience with Socio-Dig; a logistic coordinator and telephone surveyor who is a Haitian national fluent in Kreyol, French, and English.

The research was designed to draw on village censuses, surveys, focus groups, and nutritional surveys of children. The evaluation was intended to be diachronic (how resiliency has changed over time), and

¹ See Clinton Foundation, <https://stories.clintonfoundation.org/fish-farms-fighting-poverty-in-haitis-rural-communities-8dae22aece20>

² See references, USAID 2017a and USAID 2017b

synchronic (how resiliency for households and communities involved in the program currently compare to those families and communities not directly involved in aquaculture). A specific test of resiliency was intended to be a comparison of nutritional status of children involved in the fish farming program as well as those in the CH activity zone around Lake Azuei. The null hypothesis was that CH activities had no impact on the nutritional status of children.

In summary, the research conducted included:

- Review of all reports provided by CH (annual reports for 2013, 2014, 2014-15, and 2016-17) as well as documentation of all Lake Azuei harvests for the months August 2015 to June 2017.
- 10 focus groups with members of both treatment communities (five) and control communities (five) involving a total of 89 people representing 73 households.
- Interviews of 313 households in the five communities³.
- 32 follow-up surveys with people who have/or have had cages – the research team telephoned 32 of the 43 respondents who reported ever having had a cage, and asked questions about number of harvests, and income from each harvest.
- 100 or more key informant interviews, including members of fishing associations on Lake Azuei and Lake Péligre.
- Measurement of the weight, height and brachial circumference for 89 children in four communities; 28 in Betel and 61 in the four other Lake Azuei communities.
- Extensive field observation and photo analysis.
- Examination of six different fish farming operations and models.
- Multiple visits to CH hatcheries at Croix-des-Bouquets and Lake Péligre.
- Visits to CH cages on both Lake Azuei and Lake Péligre.
- 10 respondent follow-up telephone verifications regarding water availability in the community of Betel.
- Extensive review of the literature and internet searches.
- Comparison of findings against information provided by CH to LEVE on a quarterly basis.

The survey was conducted around the Lake Azuei communities where CH has worked since 2007. These include Betel, Kanez-Belizè (a single merged community of the two villages of Kanez and Belizè), Lilet, and Fon Bayard. They are depicted in Figure E1 below.

³ Socio-Dig counted 490 residential units in all 4 communities. In 114 cases, two residential units shared a house, meaning that a single physical domicile was divided into two 'residences', something manifest in each family/residential unit occupying a room or space sectioned off by sheets/curtains where they performed social, biological, productive and consumptive activities that define them as a residential unit/family (sleeping, eating, dressing, preparing food...). In 24 cases three residential units shared a house. None of the shared homes were in Betel. Note that in four cases in Betel, the houses had in fact never been lived in. In 22 cases houses had, according to neighbors, been abandoned. In another 20 cases there were only children living in the house. In 442 cases the surveyors were able to get basic information on the household inhabitants, such as renter status, place of origin of household head, and where the owner had been living before coming to live in the present house. Note also that for high number of houses in Kanez-Belize. In 317 cases the surveyors were able to locate a household head or proxy to read the introduction of the survey. Four were defined as declining interview (but in fact omitted because there were only children living the house), leaving a total of 313 households where surveyors were able to locate and interview a household head or proxy (note that two who agreed to be interviewed but refused to give their name).



Figure E1: Map of the CH activity area, where the four studied communities are located. Important features of the area are, a) the paved and well maintained road leading to the major Haitian-Dominican border crossing as well as physically close proximity to the border, b) all target communities lie in the Commune of Ganthier, historically a cattle grazing region, c) Kanez-Belizè and Lilet evolved from temporary fishing communities on the edge of the lake, d) all the communities except Betel received significant boosts in recent decades as offloading points for contraband charcoal from the DR, e) intense NGO activity that has come about from having easy access to Port-au-Prince via the border road, abundant relatively empty and inexpensive land, and scenic impoverished villages. This latter point, the influence of the NGOs, should not be gainsaid. Arguably none of these communities would exist as permanent settlements if not for the aid agencies.

OBSERVATIONS AND RESULTS

While every attempt possible was used to try and identify a significant sample size of fish farmer beneficiaries who had been farming fish on a regular basis, the end result was that this was not possible. As a consequence, the research team focused on why this was not possible, generating the observations and results organized below by key headings:

- Fish Farmers
- Income Generation
- Physical Inspection of Cages
- Production Factors
- Distribution System
- Resiliency

Fish Farmers

CH was expected to have 350 or more fish farmers managing and tending their cages, with at least one half of these on Lake Azuei. From these 150 or more fish farmers, the research team intended to draw a treatment sample of 30 respondents for the resiliency survey and child nutritional measurement survey. The assumption that there was at least 150 participatory fish farming families was based on the following:

- Claims dating back to 2009 in both the literature and on websites that the project is self-sustaining⁴.
- Reported high expectations of production growth – reaching 11 million pounds of fish by 2012⁵.
- Reports of several donors purchasing cages dating back to 2007⁶.
- Reports that the model was working “...average harvest was 880 pounds per cage per, with 2.5 cycles per year yielding an average annual income for participating families of \$2,468.” CH 2014 report; “...USAID/LEVE grant “allowed us to double our energy output, which allowed us to add 150 more farmers...Now we have more than 400.” 2015, CH Director.
- No reports – by CH or anybody else – indicating that the model was not working.

At the time of the evaluation – September 8 to October 30, 2018 – only five cages in Lake Azuei, belonging for four resident beneficiaries of Betel, were found (Figure F1)⁷.

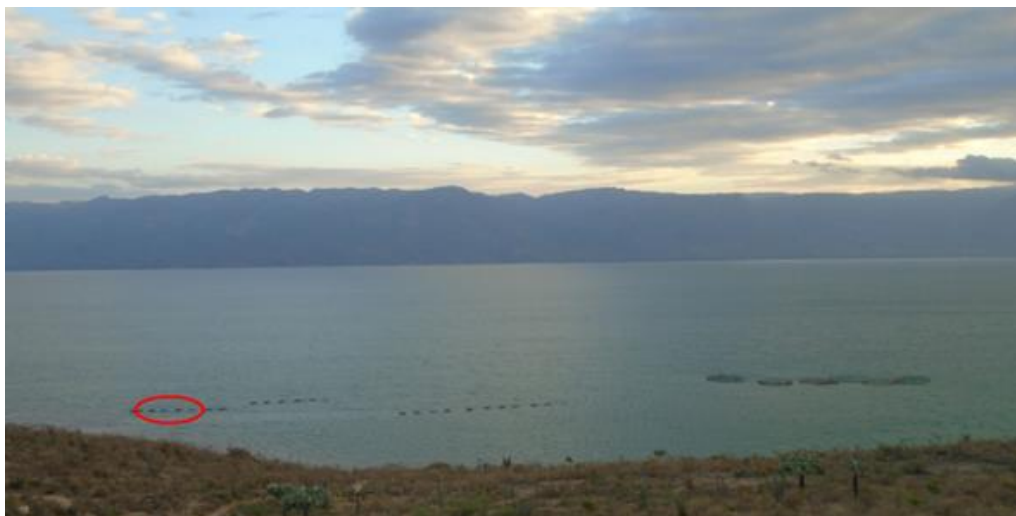


Figure 0-1. Cages belonging to CH beneficiaries circled in red

⁴ Examples of where claims are made that the model was already proven successful: Social Enterprise Fund (2011), http://www.socialenterprisefund.org/haiti_fish_proj_13.html; Caribbean Harvest Website, <https://www.caribbeanharvestfoundation.org/about-dr-abe.php>; Clinton Foundation, Fish Farms: Fighting Poverty in Haiti's Rural Communities, <https://stories.clintonfoundation.org/fish-farms-fighting-poverty-in-haitis-rural-communities-8dae22aece20>; Fish4Life/Michael Peterson Foundation, <https://www.fish4life.org/the-impact/>.

⁵ Examples of High expectations for growth: Engineering Aquaculture in Rural Haiti: A Case Study, International Journal for Service Learning in Engineering, Humanitarian Engineering and Social Entrepreneurship Vol. 12, No. 2, pp. 15-33, Fall 2017 ISSN 1555-9033; Caribbean Harvest Website, <https://www.caribbeanharvestfoundation.org/about-dr-abe.php>; Caribbean Harvest 2013 Annual Report; Social Enterprise Fund (2011), http://www.socialenterprisefund.org/haiti_fish_proj_13.html; Quote by Valentin Abe, 2010, Clinton Foundation. Fish Farms Fight Poverty in Haiti's Rural Communities. Video. Youtube.com. Published on Dec 13, 2010; Clinton Global Initiative, Poverty Alleviation In Haiti: An Aquaculture Business Model, <https://www.clintonfoundation.org/clinton-global-initiative/commitments/poverty-alleviation-haiti-aquaculture-business-model>.

⁶ Known Donations gathered from online claims, postings and articles: Brinks Foundation, Clinton Foundation/Global Initiative, Clinton-Bush Foundation, Fish4Life, Island Creek Oysters, Kellogg Foundation, LEVE, Operation Blessing, Social Enterprise Fund, The World We Want Foundation, TNA.

⁷ At the time of the assessment CH also provided cages and fingerlings to beneficiaries in Lilet, but that program is financed by Oxfam and the fish, and profits are entirely under the auspices of the APMPL (*Assosyasyon Peche ak Machann Pwason Lilet*).

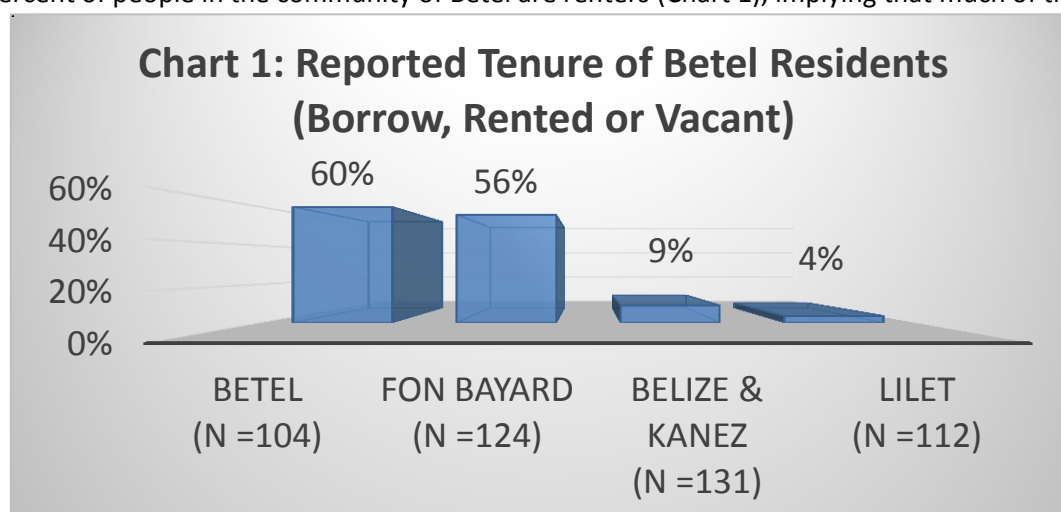
17 other small cages and six large cages (equivalent of 137 small cages) were also in the water, but these belonged to CH, not individual fish farmers. Furthermore, only four of the 72 Betel respondent households reported currently having a cage, and only 13 of the Betel respondents reported ever having a cage. Taking into account all of the 313 survey respondents in all four communities – all of which were at some time in the past part of the fish cage program – only 43 respondents were found who reported ever having a cage (Table 1), and many of these respondents had not had a cage since 2012 when tropical storm Isaac wiped out the CH cages on Lake Azuei.

Table 1: Summary of Census and Cage Data by Village					
Variable	Kanez-Belizè	Betel	Fon Bayard	Lilet	TOTAL
Head of household found/available to be interviewed	71	72	82	88	313
Ever had cage in past 12 years	18	13	6	6	43
Currently have a cage in the water	0	4	0	1	5
Total number of fish harvests in community	45	25	18	7	95
Average number of harvests per beneficiary household	2.5	2	3	1	2
Mean number of fish harvests per beneficiary household	2	1	1.5	1	1
Average number of harvests/household in the community	0.6	0.3	0.2	0.1	0.3

Additional confirmation came through the list of beneficiaries kept by the CH Technician who was a resident of Betel. The Technician shared his ledger information with the research team, which tracked beneficiaries and harvests for the 23 month period from August 2015 to June 2017. From that list the team was able to identify 60 different beneficiaries; however, comparing those names with the 72 respondents from the village survey only produced 11 matches. Five of the remaining 49 beneficiaries were found on the lists of households for Kanez-Belizè. The rest of the beneficiaries had presumably moved out of the area or hid their identify because of possibly being a dual resident of both Betel and Kanez-Belizè.

In effect, at least a major, if not the major, reason for low correlation between the number of beneficiaries on the CH lists and the village survey has to do with mobility of the beneficiaries and the fact that many past beneficiaries no longer live in Betel. The mobility of the beneficiaries is logical in view of other demographic data collected during the research. And, to state the obvious, if the fish farming activity is not lucrative, then this would contribute to people not staying.

60 percent of people in the community of Betel are renters (Chart 1), implying that much of the original



population relocated from Kanez-Belizè to Betel moved back to Kanez-Belizè or somewhere else. It is notable that Fon Bayard, like Betel, is a village composed of highly mobile people where 56 percent reported being renters, borrowers, or the house was vacant.

Lilet and Kanez-Belizè are more difficult to explain as both are composed primarily of owners and both have participated in projects in the past. Kanez-Belizè participated in the CH project at least from 2009 to 2012 when tropical storm Isaac destroyed the cages, after which CH only gave cages to those Kanez-Belizè residents who agreed to relocate to Betel. Excluding the 10 cages currently in Lilet that are paid for by Oxfam and managed by AP MPL (Asosyasyon Peche ak Machann Pwason Lilet), Lilet participated in the CH program as recently as 2016, but many of those cages were, according to the CH Director, looted and destroyed, something that has occurred repeatedly in all the villages except Betel. In Kanez-Belizè there are remnants of cages clearly visible on the roofs of the houses, where they are used to hold thatch in place and as fence posts in goat corrals (Figures F3 thru F8).



Figures F3 to F8: Remnants of CH Cages in Kanez-Belizè (specifically Madam Belizè), Used to Hold Down Thatch Roofs and as a Goat Corral

Part of the explanation for the low number of beneficiaries has to do with the cage destruction mentioned above. The CH project has experienced repeated destruction of cages due to weather, negligence and vandalism. The CH Technicians and Director also complained of chronic theft in all cage sites except Betel, where they maintain a 24-hour presence and own the land on which the village was constructed.

As mentioned above, in 2012 tropical storm Isaac wiped out the cages in Kanez-Belizè. According to participants interviewed, CH Technicians blamed the Kanez-Belizè beneficiaries for the failure to save the cages from the storm. Kanez-Belizè was subsequently excluded from participation in the project and, from that time on, CH only included those beneficiaries who agreed to move to the new village of Betel.

CH experienced similar theft of fish and cage destruction in Lilet and Fon Bayard, prompting the decision to suspend the project in those communities as well. In March 2016, 26 cages were completely emptied of fish and destroyed in a single evening⁸. CH reports that it was in fact beneficiaries who stole the fish.

What these low numbers of actual fish farmers mean is that the original expectation that the research team would obtain a sample of 30 household heads and children of beneficiary families was impossible. Despite the reports citing as many as 400 fish farmers as recently as 2017⁹, at the time of the assessment the research team was only able to find four fish-farmers who had five cages between them. Moreover, during surveys of the villages that participated since 2006, the assessment team could only identify 43 households that ever received cages. When asked specifically how many beneficiaries CH had identified who were reliable partners, the CH Technician told the research team that there were three, two of whom are employees of CH.

Income Generation

In follow-up interviews with 28 of the 43 households who reported ever having a cage, the conclusions derived are presented in Table 2. Average reported income from a harvest was \$44 (2,840 HTG¹⁰). The maximum income that went to a beneficiary for a single harvest was \$94 (6,000 HTG) and the minimum was \$0. The average number of harvests ever made for all 43 households was two and the median was one; 33 households reported ever harvesting a cage only once, eight reported two harvests, and two reported three or more harvests.

Table 2: Income per Cage Harvested ¹¹	
Average income per harvest	\$44
Average number of harvests	2
Median number of harvests	1
Number of respondents reporting 1 lifetime harvest	33
Number of respondents reporting 2 lifetime harvests	8
Number of respondents reporting 3 lifetime harvests	2
Minimum income for a beneficiary from a single harvest	\$0
Maximum income for a beneficiary from a single harvest	\$94

CH beneficiary and harvest-yield lists corroborate reports seen above from village residents and past beneficiaries regarding low income (Table 3). For the 60 beneficiaries on the CH lists, the average harvest per cage was 130 lbs., yielding average revenue of \$286, of which the beneficiary received 40 percent of the profits, which is fixed at 15 percent¹² of the proceeds, which equals \$43, a similar figure to that found by the research team.

Table 3: Summary of CH Cage Beneficiary List	
Number of individual harvests	177
Number of individual harvests eliminating 10 for schools and 15 for CH	152
Total beneficiaries ¹³	60
Average number of harvests per beneficiary	2.5
Median number of harvests per beneficiary	1.5

⁸ The incident of the destruction of cages in Lilet on March 23, 2016 was reported to LEVE via email.

⁹ Caribbean Harvest Reports

¹⁰ 64 HTG per USD 1

¹¹ From the follow-up survey of 28 of the 43 beneficiaries who reported ever getting a cage

¹² Based on an interview with the current CHF Chairperson of the Board of Directors

¹³ Note that 5 are CH employees, at least one of whom lives in Ganthier, is a school director and pastor and married to a Regional Delegee.

Table 3: Summary of CH Cage Beneficiary List	
Number of harvests of 0 lbs.	43
Number of beneficiaries with total of 0 lbs. for all harvests	9
Number of harvests > 0 lbs.	134
Number of beneficiaries with only 1 harvest	30
Number of beneficiaries with 2 harvests	11
Number of beneficiaries with 3 to 7 harvests	17
Number of beneficiaries with 10-11 harvests	2
Total lbs. harvested by all beneficiaries before CH share	22,237
Remaining for beneficiaries after CH share	3,336
Average lbs. of fish for each harvest before CH share	130
Remaining for beneficiaries after CH share	19.5
Average value of a beneficiary's share of a harvest at \$2.20/lb.	\$43
Average lbs. of fish harvested if we eliminate 0 lb. harvests	159
Average value of beneficiary share of a harvest at \$2.20	\$52
Total income for all fish at \$2.20	\$48,921
Total income for beneficiaries	\$7,338

Similarly, the average number of harvests for all beneficiaries in the 23 months indicated by the records was 2.5 and a median of 1.5 harvests. More specifically, thirty of the 60 beneficiaries (50 percent) participated in only one harvest, 11 beneficiaries participated in two harvests, 17 beneficiaries participated in 3 to 7 harvests, and two beneficiaries had 10 to 11 harvests over the course of the 23 months. Put another way, 18 percent got a 2nd harvest; 28 percent had between 3 and 7 harvests and 3 percent got 10 to 11 harvests. The greatest total combined income for any beneficiary over the course of the entire 23 months was \$461. That was for the individual who participated in 11 harvests.

Most respondents reported an average income per harvest per cage that was nowhere close to the expected figure of between \$500 and \$1,500 for 4 months of work; nor does the cycle repeat itself two times per year. According to CH beneficiary lists, the average income beneficiaries earn for four to six months of care and feeding fish is \$43. Both the CH lists and survey reports show that most people only ever get one cage, and half of beneficiaries only ever get a single harvest. Fully 28 percent of harvests recorded on the CH lists ended in 0 lbs. of fish, presumably returning nothing for 4 to 6 months of labor. In addition, of 28 fish farmers interviewed, only one reported every having received fish from the harvest, contrary to the understanding that 10 percent of the fish were to go to beneficiary families.

Previously, it was discovered that the number of beneficiaries was too few to evaluate; and here it is noted that the rewards of participating are much less than expected. As a comparison, cutting charcoal can generate \$8 to \$10 per day, versus raising fish at \$8 to \$10 per month. Hence, the economic reasoning that would be the foundation to higher resiliency by CH fish farmers is not evident.

Physical Inspection of Cages

To try and determine why realized income levels were so low compared to expectations, the research team visited fish cages of both CH and another fish farm in Lake Azuei, and Lake Péligre. On October 6th, 2018, the research Team Lead visited the cages on Lake Azuei. In the lake there were 22 – 4 m² cages and four – 16 m² meter cages, with two – 16 m² meter cages on the beach that had been harvested three days before the visit. By implication, this means that during the evaluation period there had been six – 16 m² cages in production.

The CH Technician who accompanied the Team Lead claimed there were approximately 600 fish per small cage, explaining that typically more than 50 percent of fish in the cages die. Physical examination

did not leave the impression that there were many fish in the cages, supported in part by the lack of surface action when feed was cast into the cages (Figures F16 to F19).

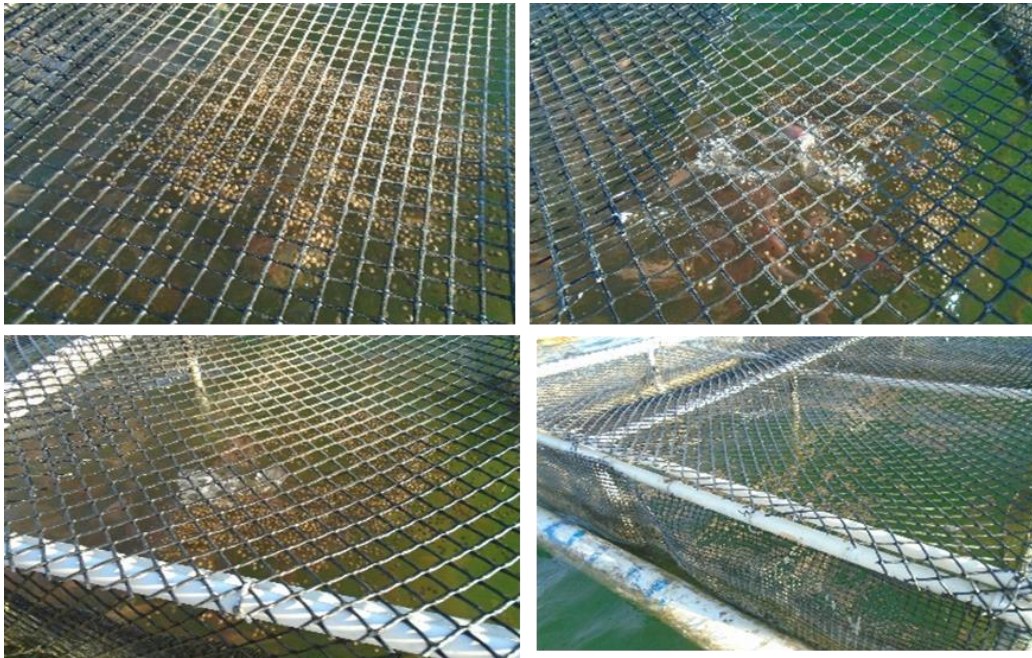


Figure F16 to F19. Feed floating on the water in cages

To compare, the Team Leader visited a neighboring fish farm, Taino Aqua Ferme, to compare the quantity of fish in the CH cages with those in the cages of Taino. The differences were dramatic (Figures F20 to F25). In the left column are pictures from Taino Aqua Ferme 16 m² cages; note that the Taino fish are grey. Right side pictures are from CH 16 m² cages; note that the CH fish are red and are more visible in the water. In both cases the pictures were taken at feeding time:

- Row 1, fish are feeding – note higher level of surfaces activity on left (Taino);
- Row 2, left (Taino) fish are not feeding but the fish on the right (CH) are¹⁴ – note higher density of fish on the left (Taino);
- Row 3, comparative close-up of schooling fish – note higher density on left (Taino).

¹⁴ The CH picture of fish feeding was used simply because the CH cage appeared empty when the fish were not feeding.



Figure F20 to F25. Fish feeding, Taino on left, Caribbean Harvest on right

To complete this activity, the Team Leader visited Lake Peligre on October 21, 2018, and noted that of 24 cages visited in Ba Cange, 17 were empty, and the other seven had what appeared to be no more than a dozen medium sized fish (Figures F10 to F15).



Figures F10 thru F12, top row, are three of the 17 of 24 cages on Lake Peligre that were Empty. Note that some do not even have screen covering. Others are covered with trash. Figures 13 to 15, bottom row, are pictures of three of the 7 cages that had fish. The CH fish are red and hence relatively visible even in the murky waters of Lake Peligre. Note in the middle picture the red coloring under the water, which are fish. In no cages did there appear to be more than a few dozen fish.

Corroboration for what appeared to be a low number of fish came from the CH Technician, who accompanied the Team Leader on his visit to the cages. The large cages on Lake Azuei are equal to 20 small cages and have a potential harvest capacity of 40,000 to 60,000 lbs. of fish. Two of the large cages had been harvested within days of the October 21 visit (Figure F26). The CH Technician reported harvesting a total of 2,000 to 3,000 pounds of fish, or about 100,000 pounds less than should have been expected using what CH has claimed can be harvested from a single 16 m² cage. LEVE staff visiting the CH processing plant at that time reported that they were processing about 2,000 pounds of fish, corroborating the low harvest.

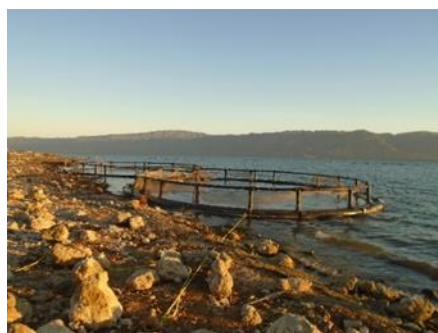


Figure F26. Cage recently harvested

When conducting online research, the research team noted that two other consulting groups made similar observations when visiting CH cages. In 2012, a team of aquaculture specialists working for Landell Mills, within the context of the Haitian Ministry of Agriculture (MARNDR)'s ACP FISH II Programme, funded by the European Commission and the European Development Fund, the team was

charged to conduct a “strategic assessment of aquaculture potential in Haiti”. Writing specifically about the CH Lake Peligre hatchery and cages, the consultants concluded that:

“... the site is unable to produce the fingerlings required to stock the floating cages in Lake Péligre, leaving almost all cages on the lake shore completely empty.”¹⁵

The following year a group of Clemson University aquaculture experts made similar observations that were reported in a refereed academic journal:

“In 2013, authors of this paper spoke with several citizens around Lake Peligre and witnessed very few cages in the water the major issue with aquaculture in the Central Plateau has involved fingerlings lack of a readily available source of fingerlings precluded the fisherman from achieving a steady source of income for their families.”¹⁶

Production Factors

Fingerlings

At the time of the assessment, CH only had 22 – 4 m² cages in the water, and another 82 – 4 m² cages on the shore (land) of Lake Azuei. There were six – 16 m diameter cages in the water, two of which were harvested in October. There was another large cage that had been empty on the shore since the beginning of the assessment in September. There were also the materials at the CH hatchery to make an unknown number of large cages. The explanation provided by the CH Technician for the reason for so few cages in the water was because of a lack of fingerlings.

As long ago as 2009, the CH Director claimed that CH produced 1 million fingerlings per year at its Lake Azuei facility¹⁷. On page 2 of the CH 2013 annual report, CH claimed to have doubled fingerling production from an average of 115,000 to 220,000 per month. Similarly, in a 2017 interview with RTI’s Patrick Adams, the CH Director reaffirmed that CH had reached an annual production rate of 2.5 million fingerlings as far back 2011 and concluded that with the new USAID/LEVE contribution, “monthly fingerling production is expected to surpass 500,000 per month” (RTI 2017).

If these claims are true, and if it is also true, as reported to the Miami Herald, that CH fish average 15 ounces at the time of harvest¹⁸, then we can readily infer combined fingerling and cage mortality rates in excess of 75 percent and perhaps as high as 97 percent. To have produced 5 million fingerlings and only have harvested of 93,346 lbs. in 2016-2017—as per the annual report—CH would have experienced a 97 percent combined fingerling and cage mortality rate (Table 4). Even if CH really did harvest approximately 500,000 lbs. in 2014-2015, and if it really did produce 500,000 fingerlings per month—as anticipated in 2013 report—then it would have had a 90 percent combined fingerling and cage mortality rate.

Table 4: Final Fish Production in lbs. at Various Fingerling Mortality Rates ¹⁹						
At fingerling Capacity	Fingerling Mortality Rate					
	0%	50%	75%	90%	95%	97%
1.5 million	1,406,250 lbs.	703,125 lbs.	351,563 lbs.	140,625 lbs.	70,313 lbs.	28,125 lbs.
2.5 million	2,343,750 lbs.	1,171,875 lbs.	585,938 lbs.	234,375 lbs.	117,188 lbs.	46,875 lbs.
5.0 million	4,687,500 lbs.	2,343,750 lbs.	1,171,875 lbs.	468,750 lbs.	234,375 lbs.	93,750 lbs.

¹⁵ See Landell Mills Report, 2012: 77

¹⁶ See Plumlee et. al. 2017

¹⁷ Operation Blessing International video, 2009.

¹⁸ See Charles 2013

¹⁹ Assuming an average 15 ounce fish at harvest.

Finally, during a visit to the Boucan Carre hatchery at Lake Péligre in early September, the research Team Leader observed only one of six tanks with any fingerlings.

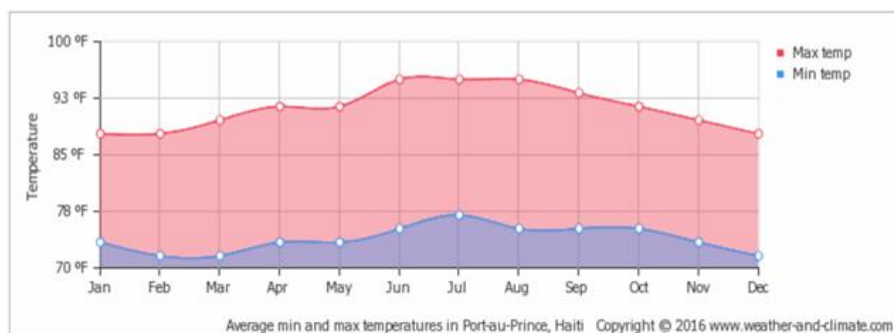
Shade

On October 26, the research Team Leader visited the Croix-des-Bouquets hatchery with the Chairperson of CHF, and the CH Director. According to the CH Director, there were 12 tanks with 20,000 fingerlings in each, all of which would have become mature in the ensuing two months. However, it was noted that fingerling mortality rate had at times been as high as 80 percent, and according to the CH Director, the primary killer of fingerlings at the Croix des Bouquets hatchery was high heat brought on by direct sunlight. Historic data for both August and October (Table 5 and Figure 3) show that there has been little change in average temperatures over the past several years.

Table 5: Temperature 2006 to 2018 ²⁰							
October				August			
Year	Min	Avg	Max	Year	Min	Avg	Max
2006	68	82	98	2006	73	86	98
2007	80	87	93	2007	84	84	91
2008	77	86	93	2008	73	86	100
2009	77	86	96	2009	77	88	98
2010	80	87	93	2010	77	88	100
2011	75	84	95	2011	75	85	96
2012	68	82	98	2012	75	86	96
2013	78	82	89	2013	80	83	93
2014	77	89	95	2014	86	90	95
2015	Missing			2015	78	88	100
2016	73	83	96	2016	75	87	98
2017	73	85	98	2017	77	87	98
2018	71	83	95	2018	73	87	98

²⁰ WU Weather Underground at <https://www.wunderground.com/>

Figure 3: Mean Temperature/Month for Croix des Bouquets Hatchery



To reduce the impact of heat generated by the sun, shade cloth is often used. However, CH has never employed shade cloth over the tanks where fingerlings are produced. When visiting the other hatcheries in the area – Operation Blessing and Taino – both use shade cloth over their fingerling tanks (Figures 37 to 40).



Figure F37: Top left, Valentin in 2009 in front of unprotected fish tanks (i.e. no shade screen in 2009). Figure F38, top right, 8 years later, 2017 pic from LEVE video, 26 of 36 tanks still unprotected from the sun. Figure F39, bottom left, Operation Blessing fish tank covered with shade cloth. Figure 40, bottom right, Taino Aqua Ferme fingerling tanks covered with shades cloth.

Low Aeration and Filtration

Fish need oxygen and the water they swim in must be either changed daily or intensely filtered to reduce build-up of toxic compounds from fish feces, particularly un-ionized ammonia and nitrites. Lack of oxygen and/or the buildup of toxins mean less healthy fish and higher mortality rates. Oxygen is delivered to the fish tanks through pumps and movement of the water. The water can be saturated with oxygen, alleviating the need for aeration, but it is by circulating the water through pumps that toxins can also be removed.

It would be reasonable to expect that fingerling tanks would be constantly filtered to facilitate health of the fingerlings and prevent mortality. The CH Director has spoken in the past of the need for aerating the water, saying in a 2010 Clinton Foundation Video that, “the tanks you see here are going to have aeration 24-hours a day.”²¹ On February 28th, 2012, Associated Press journalist Trenton Daniels, quoted the CH Director explaining that, “extra oxygen” made possible by electricity from solar panels the Clinton Foundation donated “raises the yield of fish from 2,000 a month to 20,000.”²²

The 2014 LEVE grant was in part meant to address these needs. The grant doubled CH solar energy capacity so that CH could supply oxygen to the fingerlings and filter the water. But despite the claims of 24-hour oxygen and water movement, in four visits to the hatcheries, the research team never observed any tanks at either the Lake Azuei or the Lake Péligre hatchery aerating or filtering the water. When asked, both CH Technicians and Director said that the fish tanks are only oxygenated at night. The CH Director added that the water becomes saturated with oxygen and hence it is a waste to run the pumps. Whatever the case, the Socio-Dig team leader visited three other hatcheries and fish farms and at all three there was a constant flow of pumps aerating and filtering the water (Figures F41 to F43).



Figure F41: Typical image of no aeration at Caribbean Harvest's Croix-de-Bouquets Hatchery



Figure F42: Aerated fingerling tanks at Taino Aqua Ferme



Figure F43: Aerated fingerling tanks at Operation Blessing's Santo Hatchery

Salt Water Shock

At least one other reason to expect high fish mortality rates is the shock of bearing and rearing fingerlings in fresh water and then introducing them directly into the brackish water of Lake Azuei. Taino Aqua Ferme reported finding that the shock results in mortality rates of 30 to 40 percent. To overcome the problem, Taino installed tanks at its lakeside facility and gradually adapts the fingerlings to salt water before they are placed in cages. The CH Technician in Betel corroborated that cage mortality rates are in excess of 50 percent but did not think the problem was related to salt water. In short, CH either does not have the problem with salt-water shock, has not considered it, or has not addressed it.

Resiliency

A key objective of this assessment was to evaluate the impact on the resiliency of beneficiaries that came about as a result of the USAID/LEVE support to CH. The primary impact was expected to come

²¹ Minute 2:40 to 2:46

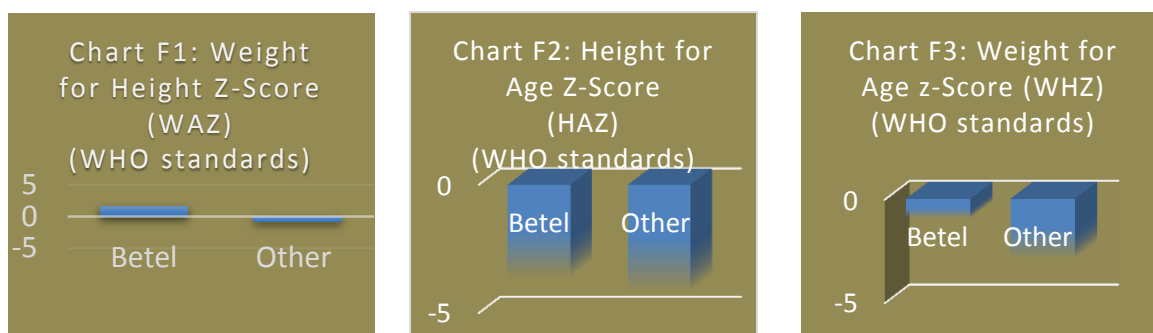
²² Trenton Daniel, Haiti seeks to rebuild, or just build, power grid. The Associated Press

from increases in income of beneficiaries, however, another way that CH may have impacted beneficiary resiliency is through its social programs, managed by the Caribbean Harvest Foundation (CHF).

CHF claims to feed children, provide educational support as well as clean water, housing, and healthcare. These are all means by which the program can be expected to improve the lives of beneficiaries. Moreover, CH claims that a part of the funding for these programs comes from profits generated by the partnership with beneficiaries who tend small fish cages. For this reason, in addition to measuring the nutritional levels of the children in Betel, the research team also looked at the potential impact of the social programs being managed by CHF.

Nutritional Tests

The research team found better nutritional rates among the Betel children than those in the other communities. Chart F1 illustrates the Z-Scores for Weight for Height (WHZ), a measure of acute malnutrition (wasting). In this case the Betel children are clearly and exclusively better off than the other children. All the Betel children are also above the international average. Chart F2, illustrates Height for Age (HAZ), the standard measure for chronic malnutrition (stunting). In this case there is essentially no difference between the Betel children and those measured in other villages. However, in the final category in Chart F3, Weight for Age (WAZ) is a type of combined acute/chronic indicator of malnutrition, the “other” category of children shows a much wider distribution than Betel, skewing to 2.5 standard deviations below the mean. In contrast, none of the Betel children are less than 1 standard deviation below the mean, meaning that overall, they appear to be significantly better off nutritionally.



However, it is impossible to isolate the impact from the CH and CHF social programs, as many of the children in Betel also live at least part-time in Kanèz-Belizè and they partake in a vigorous variety of humanitarian aid programs—from school feeding to health programs—that only exist in these other communities.

For example, regarding the impact of healthcare upon resiliency, the CHF healthcare program consists of bi-annual visits from a team of faculty and students from the University of Florida (UF) School of Pharmacy. However, there already exists an integrated local system of several internationally supported, fulltime clinics and hospitals – Love A Child, Hotes Foundation, Christ for All, L’eau de vie – including a clinic in Kanèz-Belizè, the community from where the Betel residents were supposed to have been relocated. There are also at least two mobile clinics staffed by local doctors that periodically visit Lilet and Fon Bayard, one staffed and supported by the organization Love-a-Child and the other by the Haitian organization OCMA. Operation Blessing claims to hold a weekly health clinic in its Kanèz-Belizè primary school.

In addition to healthcare activities having a positive impact upon resiliency, the research team also looked at the school feeding programs. The area within walking distance of Betel and the other communities has a multitude of internationally supported pre-schools and primary schools. The supporting organizations include Hotes Foundation, Love-a-Child, Operational Blessing, and Foi et Joie of the Catholic Church, all of which have dedicated school buildings, international teaching standards and that feed the children twice per school day. In contrast, the Betel school classes are held in vacant Betel houses and the evangelical church, and no feeding occurred during the period of evaluation, September to October 2018. By contrast, in Kanez-Belizè alone, the Hotes Foundation implements a very comprehensive community development program – clinic, schools, water, feeding, job creation – which is probably responsible for most of the higher nutritional performance noted in the children tested under this study. The Hotes Foundation feeds all women and children with a hot meal five days a week, with meat, and all children get two meals a day.

What can be concluded from the data is that those children in the Betel sample are not among the most malnourished children studied. Indeed, essentially none of the Betel children are among the most chronically or the most acutely malnourished children. But why and to what degree the elevated nutritional status can be attributed to the combined activities of CH and CHF cannot be established, given the number and size of similar activities in the same region.

CONCLUSION

Based on concordance of the data collected in surveys and the CH Technician records from Betel, supported by observation, extensive interviews and focus groups with stakeholders, the evidence clearly shows that the CH fish farming program is not, and may never have, been anywhere close to the claims that were being made. The reasons for this dramatic shortfall, however, are not clear. Despite being well funded, having a modern infrastructure, supported through the linkage with CHF, and the technical know-how of the CH Director, there is little to no evidence that the promise of higher rural revenues for fish farmers was achieved. On the contrary, the lack of evidence that there are even a handful of fish farmers who have continued to produce fish for CH is evidence that this model is not, and may never have worked.

As a result, the impact of the USAID/LEVE intervention is difficult to measure. Specifically, there were not enough current beneficiaries on Lake Azuei to make up a significant sample; nor were there enough recent beneficiaries; surveys of all the villages where CH has been active on Lake Azuei since 2007, uncovered only 43 beneficiaries who reported ever having had a cage; half of those beneficiaries report having had a cage for only a single harvest, and about half were beneficiaries six years in the past; only 11 were currently found living in Betel. A visit to Lake Péligré revealed similar conflict, low program activity, and frustration among beneficiaries.

APPENDICES

References

- Abe, Valentin Ph.D. 2014. Risk Management in Aquaculture: Case Study of Haiti. Executive Director, Caribbean Harvest Foundation. Port-au-Prince, Haiti.
<http://www.agriskmanagementforum.org/content/risk-management-aquaculture-case-study-haiti>
- Bo-eun, Kim, 2013. "Supporting sustainable fish farming in Haiti", In the Korean Times. 2013-03-31.
http://m.koreatimes.co.kr/phone/news/view.jsp?req_newsidx=133095
- Brass, Jane. 1991. "Social, Economic, and Cultural Considerations for Saltwater Cage Culture of Florida Red Tilapia in Northeastern Haiti."
- Caribbean Harvest Foundation Annual Report – 2015
- Caribbean Harvest Foundation Annual Report - October 2017
- Caribbean Harvest Foundation. Status Report And Outlook For 2013-2014 (August 31, 2013)
- Caribbean Harvest Year End Report 2014
- CECI. Réville, J.P. 1988 Rapport de mission sur l'implantation d'étangs ruraux à Saint Michel de l'Attalaye
- Charles, Jacqueline. 2013. Fish cages bring economic hope to Haitians. Miami Herald. July 04, 2013 06:14 PM.
- Chounoune, F. Jackson. 1998 Fish Culture Projects. Bulletin vol 11 n°1 Some fisheries and aquaculture projects in Haiti. International Center for Aquaculture Auburn University Agricultural
- Chounoune, Jackson. 1998. "Some fisheries and aquaculture projects in Haiti." EC Fisheries Cooperation Bulletin, 11(1). Accessed September 10.
<http://ec.europa.eu/development/body/publications/fish/pe039823.pdf>
- Clinton Foundation, 2012. "Caribbean Harvest." <https://www.clintonfoundation.org/our-work/clinton-foundation-haiti/programs/caribbean-harvest>
- Daniel, Trenton. 2012. "Haiti seeks to rebuild, or just build, power grid". The Associated Press
- DANIEL, TRENTON. 2012. Haiti seeks to rebuild, or just build, power grid. The Associated Press.
- Dyer, Candice. 2010. The Fish Farmer's Story. Auburn Magazine. 8/2/10
- Engle, Jonah. 2009. "Bill Clinton leads largest business delegation to Haiti". Port-au-Prince, October 1, 2009. Article originally published in the Haitian Times, October 2, 2009
- Fish Farming in Haiti: Part III
- Posted by STEVE MIDWAY on JUNE 25, 2012
- Fish4Life 2018. Fish4Life and Caribbean Harvest are implementing this expression in real terms, and into entire communities to drive tremendous economic and social impact.
- Fish4Life 2018. Webpage. <https://www.fish4life.org/the-impact/>
- Food & Agriculture Organization (FAO). 2016. "State of World Fisheries and Aquaculture." United Nations. Accessed September 2016. <http://www.fao.org/3/a-i5555e.pdf>
- Fortuné, Jodany. 2011. Environmental impacts on Lake Azuéi in Haiti due to degradation of its watershed. fjodanyg@yahoo.fr ou jodanyfortune76@gmail.com November 03, 2011 University of

Puerto Rico, RP

Gordon, Aaron, and Jeffery Plumblee, Guy Higdon, Ian Davis, John E. Walker, David Vaughn. 2017. Engineering Aquaculture in Rural Haiti: A Case Study. International Journal for Service Learning in Engineering, Humanitarian Engineering and Social Entrepreneurship Vol. 12, No. 2, pp. 15-33, Fall 2017 ISSN 1555-9033

Haiti Libre Relevant articles on Haiti fishfarming from the Haitian newspaper, the Haiti Libre

<http://www.haitilibre.com/en/news-13270-haiti-agriculture-the-caribbean-harvest-will-double-its-production-of-tilapia.html>

<http://www.haitilibre.com/en/news-13228-haiti-economy-the-association-of-industry-of-haiti-appealed-to-leve-project.html>

<http://www.haitilibre.com/en/news-10816-haiti-economy-launch-of-the-project-leve-in-the-north.html>

<http://www.haitilibre.com/en/news-9557-haiti-agriculture-aquaculture-and-fishing-an-economic-opportunity-for-haiti.html>

<http://www.haitilibre.com/en/news-8709-haiti-agriculture-new-hill-lake.html>

<http://www.haitilibre.com/en/news-8019-haiti-agriculture-the-beekeeping-and-aquaculture-receive-government-assistance.html>

<http://www.haitilibre.com/en/news-8101-haiti-agriculture-the-government-support-to-200-the-development-of-hill-lakes.html>

<http://www.haitilibre.com/en/news-6596-haiti-agriculture-an-aquaponics-farm-in-grace-village.html>

<http://www.haitilibre.com/en/news-6564-haiti-agriculture-aquaculture-a-solution-for-the-future.html>

<http://www.haitilibre.com/en/news-5078-haiti-agriculture-aquaculture-in-macary-receives-assistance-from-spain.html>

Hargreaves, John A. Tilapia Aquaculture In Haiti. Aquaculture without Frontiers Volunteer. Farmer to Farmer Program. 8-16 April 2011

Hargreaves, John A. 2012. Developing Tilapia Aquaculture In Haiti: Opportunities, Constraints, And Action Items Proceedings Of A Workshop Sponsored By Novus International, Aquaculture Without Frontiers, The World Aquaculture Society, And The Marine Biological Laboratory Edited. Aquaculture Assessments LLC

Hargreaves, John A., Craig Browdy, Bill Mebane, Dave Conley, and Valentin Abe. 2012. "Developing Tilapia Aquaculture in Haiti: Opportunities, Constraints, and Action Items." Proceedings of a workshops sponsored by NOVUS International, Aquaculture without Frontiers, the World Aquaculture Society, and the Marine Biological Laboratory. New Orleans: Aquaculture Assessments.

Hargreaves, John. 2011. "Tilapia Aquaculture in Haiti." Aquaculture without Frontiers.

<http://www.mbl.edu/sai/files/2012/05/Hargreaves-April-2011-Trip-Report.pdf>

Hargreaves, John. 2012. "Developing Tilapia Aquaculture in Haiti: Opportunities, Constraints, and Action Items."

Hill, Megan and Kate Davenport, and Margie Brand. 2008. FINAL REPORT Prepared for USAID's IDEJEN Program by EcoVentures International www.eco-ventures.org Prepared by: November 2008

ICO Friends For Haiti Foundation Overview And Event Goals

<https://www.islandcreekfoundation.org/wp-content/uploads/2012/03/Sponsorship-Package.pdf>

JICA 2009. Final Country Report: Haiti – Formulation of a Master Plan on Sustainable Use of Fisheries Resources for Coastal Community Development

Landell Mills. 2012 Final technical report STRATEGIC ASSESSMENT OF AQUACULTURE POTENTIAL IN HAITI, 2012 Project Ref. Number: N° CAR/3.1/B12 Region: Caribbean Country: Haiti October 2012 Project implemented by: Landell Mills "Strengthening Fisheries Management in ACP Countries

Landell Mills. 2012. Strategic Assessment of Aquaculture Potential in Haiti. ACPFish II. <http://acpfish2.eu.org/uploads/projects/id153/Final%20Technical%20report%20CAR-3.1-B12.pdf>

LEVE 2014. Value Chain Assessment Annex 3. Agribusiness Sector Assessment Local Enterprise and Value Chain Enhancement (LEVE) Project <https://haitileveproject.org/wp-content/uploads/2015/06/Annex-3.-LEVE-Agribusiness-Sector-Assessment.pdf>

LEVE. 2016. Report on Local Fish Feed Production Opportunities LOCAL ENTERPRISE AND VALUE CHAIN ENHANCEMENT (LEVE) PROJECT. RTI International

Lovell, R.T. and D.D. Moss. 1971. Fishculture Survey Report for Haiti International Center for Aquaculture and Fisheries and Allied Aquacultures. Auburn University, Alabama.

MARNDR 2010. Programme National pour le Développement de L'Aquaculture en Haïti 2010-2014.

Matsuda, Yoshiaki. 1978. "The Growth of Aquaculture in Developing Countries: Potentials, Patterns and Pitfalls." Fisheries 3 (4).

Matthes, Hubert. 1988. Evaluation de la Situation de la Pêche sur les Lacs en Haiti. Augmentation de la production de poissons en Haïti par l'Aquaculture et la Pêche Continentale. FAO Project HAI/88/003. 48 p.

Miller, J.W. 1987 Proposition d'Étude pour un Projet de Développement de la Pêche Continentale en Haïti sur Lac Peligre, Étang Saumâtre et l'Étang de Miragoane

Miller, James. 2015. Rapid Fisheries Sector Assessment – Three Bays National Park. The Nature Conservancy Report. 49 p.

Nouvelliste. 2011. Valentin Abe, le géniteur de Caribbean Harvest. Publié le 2011-11-22 | Le Nouvelliste

Nouvelliste. 2015. Après les écloséries et la fondation, Caribbean Harvest a son usine d'emballage. Publié le 2015-03-03 | Le Nouvelliste

Nouvelliste. 2015. Haïti - Agriculture : La Caribbean Harvest va doubler sa production de tilapia. 27/02/2015 10:37:51

Nouvelliste: Relevant articles on Haiti fishfarming from the Haitian newspaper, the Nouvelliste

<https://www.lenouvelliste.com/article/142095/after-hatcheries-and-the-foundation-caribbean-harvest-has-its-packaging-plant>

<https://lenouvelliste.com/lenouvelliste/article/143082/Et-si-lon-venait-a-questionner-la-rentabilite-du-projet-national-des-lacs-collinaires-PNCL>

<http://lenouvelliste.com/article/21208/experience-encourageante-de-la-culture-du-tilapia>

NRG. 2012. NRG Completes First Two Projects under \$1 Million Clinton Global Initiative Commitment to Build Solar Energy Sites in Haiti. March 07, 2012 02:04 PM. www.nrgenergy.com/haiti/index.htm

October 2009 Updated in December 2011

OSE (Office of the Special Envoy). 2010. June 2009-December 2010.

Piasecki, Michael and Mahrokh Moknatan, Fred Moshary, Joseph Cleto, Yolanda Leon. 2016. "Bathymetric Survey for Lakes Azuei and Enriquillo, Hispaniola." City University of New York (CUNY) CUNY Academic Works.

PNUD, FAO, 1988 Gouvernement d'Haïti. Rapport de Mission d'Évaluation Conjoint du
Projet de Développement de l'Aquaculture Rurale en Haiti-HAI/84/010. Mission 27/11-
9/12/88. PNUD/FAO/Gouvernement d'Haiti. Membres de la Mission: Pedro Noriega-Curtis,
PNUD-Chef d'Équipe; Richard L'Heureux-FAO; Calixte Clerismé-MARNDR-GOH; Frantz
Bissainthe-CPNAP-GOH

Programme National de Lacs Collinaires. 2012. Report on 100 Lacs Collinaires Construit par le
programme Nationale. 132 p. (Wilson Celestin managed this program which constructed 100 lakes).

Smith, H. Thompson (Tom). 2016. HELP FOR HAITI!. Chairman of the Board of Directors at Caribbean
Harvest Foundation. Published on October 17, 2016.

Snow, Erin. 2012. Cage Fishing Project Improves Output in Haiti. Accessed August 2016.
[http://www.heifer.org/join-the-conversation/blog/2012/November/cage-fishing-project-improves-
output-in-haiti.html](http://www.heifer.org/join-the-conversation/blog/2012/November/cage-fishing-project-improves-output-in-haiti.html).

Soderberg, R.W. 2014. Environmental Assessment for Lake Azuei Tilapia Cage Farm. 12 p.

The World We Want Foundation. Annual Report 2014

The World We Want Foundation. Annual Report 2017

USAID 2017a. Enumerator Guidance: Full Model. A GUIDE FOR IMPLEMENTING A RESILIENCE
MODULE

USAID 2017b. Resilience Measurement Options HOUSEHOLD QUESTIONNAIRE: FULL MODEL.

USAID. 2006. Proceedings of the Fish Feeds Forum. Fisheries Investment for Sustainable Harvest
Project. USAID. Coop. Agreement: 617-A-00-05-00003-00. Auburn Fisheries Dept.

Watkins, Tate. 2012. Valentin Abe is spawning fish farmers in Haiti, lack of formal property rights be
damned. January 29, 2012.

Weis, Carol and Walt Ratterman. 2011. Renewable Energy Healthcare in Haiti. Published In: South
East Shipping News. Issue #142, April / May 2011

Yuwei, Zhang. 2012. Trina brings energy and life to Haiti. New York (China Daily). Updated: 2012-03-
23 11:06

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