"Strengthening Fisheries Management in ACP Countries"

Final technical report

STRATEGIC ASSESSMENT OF AQUACULTURE POTENTIAL IN HAITI, 2012

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ABREVIATIONS AND ACRONYMS

ACDI	Agence Canadienne de Développement International
AECID	Agence Espagnole de Coopération Internationale pour le Développement
ASC	Aquaculture Service Conseil ASC Inc
AFD	Agence Française pour le Développement
BAC	Bureau Agricole Communal
BAD	Banque africaine de développement
BID	Banque Interaméricaine de Développement
BRHC	Bureau des Ressources Halieutiques et Côtières
CAMPAM	Caribbean Marine Protected Area Managers Network
CARICOM	Caribbean Community
CARIFIS	Caribbean Fisheries Information System
CFI	Centre de Facilitation des Investissements
CFO	Chief Fisheries Officer
CFRAMP	Caricom Fisheries Resource Assessment and Management Programme
CNIGS	Centre National De L'information Géo-Spatiale (National GIS)
DDA	Direction Départementale Agricole
CNSA	Coordination nationale de la sécurité alimentaire
DPAQ	Direction de la Pêche et de l'Aquaculture (Directorate of Fisheries and Aquaculture)
DSNCRP	Document de stratégie nationale pour la croissance et pour la réduction de la pauvreté
EDH	Électricité de Haïti
EIE	Étude d'impact environnementale
EMAF	Ecole Moyenne d'Agroforesterie
EMAVA	Ecole Moyenne d'Agriculture de la Vallée de l'Artibonite
EMDH	Ecole Moyenne de Développement de Hinche
EU	European Union
FAC	Fisheries Advisory Committee
FAMV	Faculté d'agronomie et de médecine vétérinaire
FAO	Food & Agriculture Organization of the United Nations
FMP	Fisheries Management Plan
FD	Fisheries Department
GEF	Global Environmental Facility
GIS	Geographical Information Systems
GOH	Government of Haiti
INARA	Institut National de la Réforme Agraire
JICA	Japan International Co-operation Agency
LHA	Lake Harvest Aquaculture
LMH	Les Moulins de Haïti
MDE	Ministère de l'Environnement
MARNDR	Ministry of Agriculture, Natural Resources and Rural

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	Development
MPA	Marine Protected Area
MINUSTAH	United Nations Mission in Haiti
ODVA	Office de Développement de la vallée de l'Artibonite
OECS	Organization of Eastern Caribbean States
OSM	Open Street Map
PAZ	Priority Aquacole Zone
PGP	Plan de gestion des pêches
PNLCH	Programme des Lacs Collinaires d'Haïti
RESEPAG	Renforcement de l'Efficacité des Services Publics Agricoles
SRTM	Shuttle Radar Telemetry Mission (for measuring height)
TNC	The Nature Conservancy
UNDP	United Nations Development Program
USAID	United States of America International Development
WDPA	World Database on Protected Areas
ZAP	Zone Aquacole Prioritaire

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SUMMARY

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ANALYTICAL SUMMARY

This report sets out the findings of a support assignment implemented at the request of the Ministry of Agriculture, Natural Resources and Sustainable Development (MARNDR)'s Fisheries and Aquaculture Department (DPAQ), within the framework of the ACP FISH II Programme funded by the European Commission and the European Development Fund. The purpose of the assignment was to carry out a "strategic assessment of aquaculture potential in Haiti", as part of an approach to promote the sustainable development of aquaculture in Haiti.

A team of three international experts, comprising a Senior Aquaculture Expert and Team Leader, a GIS/Mapping Expert, and a Fisheries and Aquaculture Expert with relevant knowledge of the social and economic environment, conducted three missions in Haiti for this project.

From the beginning of its mandate, the team sought to gather the largest possible number of documents on fisheries and aquaculture, as well as on related topics, such as the country's environment and business sector. The team's exchange-based approach was extended well beyond the key MARNDR representatives, as the experts had numerous encounters with people from business, finance, trade, and environmental sectors, as well as NGO representatives and project managers.

During the first field mission (6 to 19 May 2012), the team was able to visit several of the main aquaculture farms and to identify both their strengths and a number of issues hindering the production process. The Team Leader, whose experience in Haitian aquaculture spans well over 20 years and who has carried out regular field missions in the country, was able to provide the relevant additional information on aquaculture farms that could not be visited, so that the team could produce a comprehensive report with proposals encompassing all sites.

A survey was conducted among the staff of the MARNDR's Fisheries and Aquaculture Department, to collect feedback on the institution's work and structure, to identify its strengths and weaknesses, and to measure the staff's job satisfaction.

To prepare the field survey, the aquaculture socio-economist spent 10 days in Haiti from 14 to 22 July 2012. His objective for this second mission was: (i) to design and draw up the questionnaire to be used to (a) analyse the impact of social, institutional, economic and technical factors on aquaculture in Haiti and (b) identify constraints, opportunities, strengths and weaknesses of the sector; (ii) organise a two-day training session in Port-au-Prince for the 20 surveyors (17 to 18 July), followed by a 2-day field pilot survey in a selected site in the Port-au-Prince area (19 to 20 July); (iii) review and revise the questionnaire in the light of the survey results, (iv) organise the field mission (logistics, budget etc.) and (v) develop a database to be used by the surveyors to enter the data collected.

The 20 surveyors conducted the survey over an eight-day period in July and August 2012 in Haiti's 10 geographic departments (2 surveyors per department, 8 days of work), and entered the survey data into the database. The geographical coordinates of the sites were also recorded using GPS units provided by the Department of Fisheries and 4 GPS units acquired for the needs of the project.

The aquaculture socio-economist returned to Haiti in mid-August to supervise the entry of survey data into the database and undertake a series of preliminary analyses for the purposes of the assessment, which took place from 15 August to 2 September in collaboration with the other two experts.

The findings of the survey were combined and overlaid with mapping/GIS data and works based on existing secondary data to produce an extensive assessment comprising a series of analyses and maps that clearly identify the most suitable zones for each type of aquaculture, as well as bio-physical, institutional and structural constraints that may hinder development.

The mapping expert's specific tasks included collating all data relevant to aquaculture from the available databases. The information retrieved was combined and overlaid with the conclusions of the large-scale survey and with information provided and disseminated by international contacts. The experts used this optimised approach and comprehensive pool of information to draw up maps that illustrated a number of indicators used for the assessment of Haiti's aquaculture potential.

The team was able to complete all tasks set out in the initial ToR without meeting any major obstacles. It was not possible to conduct the field survey over the entire territory of Haiti, but this part of the project was not intended to be exhaustive and this limitation was acknowledged from the outset. Moreover, a detailed study of the survey forms shows that part of the information that was supposed to be collected could not be obtained for various reasons (unwillingness of respondents to disclose certain information, difficulties in accessing the right site/person, etc.). However, the experts concluded that the information gathered during the field survey was of sufficient quality and quantity to enable an accurate analysis of the situation.

A validation workshop attended by major players in the aquaculture sector was held in Port-au-Prince on 31 August. Four work groups put forward suggestions and proposals on the basis of the project results, presented by the team of experts. The Team Leader's mission in Haiti was extended until September to enable him to finalise the gathering of information among key aquaculture stakeholders and complete the validation of the proposals put forward at the workshop.

BACKGROUND

In 2009, the Government in Haiti, through the Ministry of Agriculture's, Department of Fisheries and Aquaculture, established the necessary conditions for investment by the private sector in order to increase over the next ten years the production of marine fisheries from 16,000 tonnes to 35,000 tonnes; pond aquaculture from 400 to 5,000 tonnes, and inland water from 600 to 10,000 tonnes. It also intends to create 70,000 jobs during this development phase and to provide its nationals with a much needed guaranteed supply of affordable fish protein. For aquaculture and mainland fishing, in the short term and medium term, the MARNDR's targets include:

Short Term:

1. Analysis of the sector and review of commercial policy
2. Assessment of resources and of aquaculture potential
3. Studies rolled out on fish processing, conservation and marketing
4. Production of fish feed

Medium-Long Term:

5. Stocking of ponds
6. Creation of aquafarms (cage and pond production)
7. Increase in the output of existing hatcheries and creation of new ones
8. Rehabilitation of existing aquafarms with higher potential
9. Provision of training and technical assistance to fishing communities
10. Monitoring and assessment of actions.

As per the TOR, the **overall objective** of the project was to contribute to the sustainable and equitable management of fisheries in ACP regions, thus leading to poverty alleviation and improving food security in ACP States.

The purpose of the assignment (from the Terms of Reference) was to provide technical assistance (TA) to support the Department of Fisheries and Aquaculture of Haiti to complete a strategic assessment of aquaculture potential in the country, and thereby contribute to the long term development of the aquaculture sector.

The results to be achieved by the consultant (from the Terms of Reference) were:

- A completed field-survey reporting current aquaculture activities
- Preparation of an institutional analysis of potential for aquaculture production
- Preparation of an analytical report on the strategic assessment of the aquaculture potential in Haiti with recommendations for aquaculture planning and development (including spatial analysis with potential zoning for aquaculture development) validated through a workshop.

COMMENTS ON TERMS OF REFERENCES

The consulting team found the Terms of Reference to be clear, comprehensive and unambiguous. The main issues to be addressed and potential difficulties were highlighted.

In addition to the initial ToR, the mission characterised the strengths and weaknesses of each of the largest water bodies, in particular Étang Saumâtre, Étang de Miragoâne and Lac de Péligre in order to define the most suitable and profitable model of aquaculture production which remains sustainable and appropriate to the local context. The Team convinced that sustainability of aquaculture production is dependent upon the revenues that producers get out of them, and recognising the potential critical contribution that aquaculture can make to food security, promoted a commercial approach which is in line with both the needs of producers and consumers.

As stated in the TOR, the significant innovation in the Agricultural Investment Plan (AIP) is the recognition of the new role that the Government should play as a facilitator while the development of the aquaculture sector should be led by the private sector. The thinking within DPAQ however, at this stage does not seem to be in alignment with this approach.

The report "Strategic Assessment of the Aquaculture Potential in Haiti", including detailed spatial and technical analysis, written by the team was the result of close collaboration with a lot of partners in the sector. The proposals and recommendations for planning and development reflect the results of these consultations and our experience regarding a realistic approach to the successful take-off of this agro-industry.

APPROACH TO THE ASSIGNMENT

As part of the project, three missions were carried out in Haiti by Landell-Mills experts. During these missions, the team worked alongside key DPAQ personnel and a number of different aquaculture stakeholders to ensure that the activities reflected the beneficiaries' expectations, fully addressed their needs, and were adapted to the specific conditions in Haiti.

The first mission in Haiti carried out by the team of experts comprised project start-up meetings, document gathering, consultations and synthesis of the relevant aspects of fisheries and aquaculture. The technical team visited main Haitian aquaculture sites, namely in the Artibonite and Centre and West Departments. The team of experts also identified modelling parameters and thresholds for mapping suitable aquaculture sites.

The team's main objective from the outset of the project and throughout its duration was to successfully carry out institutional analysis. This assessment was based on the review of existing documents combined with discussions and informal consultations with stakeholders in the aquaculture sector. It also included an analysis of the legal and policy framework governing aquaculture with the objective of identifying potential shortcomings in the relevant policies. Upon recognising a lack of information on the institutional and organisational structure of DPAQ, the Team Leader decided to conduct a survey among DPAQ staff.

The objective of the second mission was to devise and implement a data collection and analysis system that could be used to monitor and assess the current and future aquaculture activities in Haiti. This involved:

- Selecting one method of data collection adapted to the conditions in Haiti
- Defining selection criteria for the assessment of aquaculture potential of existing and future sites
- Organising a two-day training session for the 20 field surveyors
- Developing, piloting and revising a survey tool (questionnaire) to be used to gather information on aquaculture operations across Haiti, with a pilot implemented in the Port-au-Prince area.

In July and August, the team supervised the field survey carried out by 20 field trained surveyors in Haiti's ten geographic departments (two surveyors per department/eight days).

During the third mission, additional information relevant to aquaculture in Haiti, in the form of literature, policy and legislation documentation, was gathered and analysed. The team followed this up with consultations and collaboration with Haitian aquaculture stakeholders. They also drew up a series of overlay maps to identify areas particularly suitable for certain types of aquaculture. These maps were drawn up in accordance with the type of information available, soil types, terrain, elevation, slope, water supply, flood risks, erosion areas, infrastructure provision, land tenure, etc. At the end of this mission, the draft Technical Report was presented at a validation workshop and the feedback received during the workshop was used to revise the document.

ORGANISATION AND METHODOLOGY

Implementation of Terms of Reference

	KEY ACTIVITIES FROM TERMS OF REFERENCE	IMPLEMENTATION
	Inception Phase	
1	Briefing with ACP Fish II Programme and the Department of Fisheries and Aquaculture in Haiti.	The Team Leader and Key Expert 2 visited the offices of the DPAQ Director on Monday 7 May to discuss implementation of the assignment with ACP Fish II. Meeting with Steven Rault, EU Programme Manager.
2	In consultation with the Department of Fisheries and Aquaculture, establish a project Technical Team consisting of the Director, the Chief Extension Officer for Aquaculture and the Statistician. The Technical Team is directly responsible for the coordination of this project.	The technical team envisaged in the original ToR could not be established, as the DPAQ Director did not have time to work on the project and the Chief Extension Officer for Aquaculture role could not be fulfilled. The Statistician was, however, available to work with the team.
3	Conduct and report an institutional assessment of the aquaculture sub-sector in Haiti.	The team conducted an institutional assessment of aquaculture in Haiti from 7 to 18 May. Meetings with aquaculture stakeholders were held and field missions carried out in order to visit major aquaculture sites and begin data collection.
4	Revision of the report by the Technical Team and distribution to stakeholders.	The report will be distributed upon completion.
5	Prepare and submit an Inception Report.	The Inception Report was submitted on Friday 18 May.
6	Develop, pilot and revise a Survey Tool (questionnaire) to be used to gather information on aquaculture operations across Haiti.	During the first mission and the following weeks, the team developed and revised the Field Survey questionnaire. They briefed the surveyors and oversaw pilots and data collection.
7	Develop a database for the storage and analysis of survey results.	A database was developed for the storage and analysis of survey results.
8	In collaboration with the Technical Team, coordinate and train a team of 20 field surveyors at a two-day training session.	Key Expert 2 held this training from 16 to 20 July, which took place at the DPAQ in Port-au-Prince.

9	Facilitate and supervise the Haitian aquaculture activities survey. The Consultant will be responsible for all logistical arrangements (e.g. travel, accommodation, and meals) associated with the field survey and to this end will work closely with the Technical Team.	The field survey was supervised in consultation and collaboration with DPAQ from the end of July to 15 August.
10	Use of mapping applications available in the Ministry or other government departments/agencies, collate and overlay available variables to identify areas of particular potential for aquaculture.	In order to identify areas where earth pond aquaculture could be developed, GIS layers were gathered from various secondary sources and four major favourable factors were modelled, namely: ❑ Continuous availability of water ❑ Access to soil with high clay content ❑ Flat land ❑ Areas of existing suitable land cover Four major unfavourable factors were then also modelled, namely: ❑ Proximity to existing built-up areas ❑ Land areas ❑ Proximity to rivers susceptible to flooding ❑ Areas prone to accelerated erosion.
11	Facilitate and supervise entry of the survey results to the database and conduct simple analysis and reporting.	The field survey was carried out in 141 sites visited by the investigators during the eight days of field work. Analysis of survey results helped the team to gain a thorough understanding of the current aquaculture potential in Haiti.
12	Prepare a survey report combining results of the field survey and outputs from the zonation work.	Given that some of the official documents on the institutional structure of DPAQ were missing, the Team Leader collected further information using network requests, consulting available literature and meeting with key individuals. In-between missions and during the third mission from 15 August to 5 September, the team worked very hard to collect accurate data.
13	Using results from the activities above, prepare a Report entitled “Strategic Assessment of the Potential for Aquaculture in Haiti”.	The expert used survey results and all other data collected to prepare the report and to develop an innovative strategy for Haitian aquaculture.
14	Review and validate survey results and report to the Technical Team.	This activity has not been possible due to the fact that a Technical Team is not in place.

15	Prepare an "Information Document" on the Strategic Assessment of the Potential for Aquaculture in Haiti for use and distribution at the Validation Workshop.	All necessary arrangements for the workshop were made by the Key Experts in conjunction with DPAQ and a Power Presentation Information document was prepared for use and distribution at the Validation Workshop.
16	In collaboration with the Technical Team, organise a national Validation Workshop to discuss provisional results with key stakeholders (1 day, 50 participants approx.).	The Validation Workshop was held in Port-au-Prince on Wednesday 31 August 2012. The meeting was opened by the Director Géneral Adjoint à la Pêche (MARNDR), Mr Pierre-Guy Lafontant, agricultural engineer. Attendance (34 people) was lower than expected due to delays within DPAQ.
17	Revise Strategic Assessment report on the basis of Workshop inputs and submit to MARNDR.	The report will be revised following feedback from MARNDR.
18	Prepare and submit Final Technical Report (FTR).	The Final Technical Report will be submitted upon approval of the draft.

Phase 1 – Inception - 6 to 19 May 2012

The aim of this inception phase was to allow the team to meet with the various relevant Government officials and partners involved in the project, with the specific objective of (a) raising these partners' awareness of the project and (b) initiating good relationships and getting their endorsement and full collaboration. Particular efforts were made to ensure that the partners understood the aims of the project (to avoid misunderstanding and false expectations) and to initiate the process of identifying the strengths and potential weaknesses of the sector.

Mobilisation of the team in Haiti:

The Team Leader Jean Pierre Réville, and Key expert 2 Christophe Béné, arrived in Port-au-Prince on Sunday 6 May. Key expert 3 Alan Mills arrived on Monday 7 May.

On Monday 7 September the team held a briefing with ACP Fish II at the DPAQ Office with the Programme Manager, Sandra Grant, and the Director of Fisheries Department, Robert Badio.

This first meeting was an opportunity for the partners to share their views on how the assignment should be carried out. The DPAQ Director had stated that he did not have enough time to be involved in the project, and that he would not be able to spare staff to make up a team as initially planned in the ToR. However, Magdala Sanon, a statistician from the Directorate, joined the project team for two days, as well as Murielle Felix who was assigned to assist with logistical and administrative tasks.

The Landell-Mills team suggested a number of changes to the ToR in order to improve the efficiency of the work, such as assigning to the project 20 field surveyors, all from the DPAQ, over eight days, instead of 40 people over four days. In this way, the 20 employees of the Directorate would receive relevant training and acquire experience in conducting aquaculture field studies. Both the ACP FISH II Manager and the Director approved this suggestion. The partners also agreed on the schedule of assignments to be carried out, and the date of the final validation workshop, which would be 31 August in Port-au-Prince.

The Team Leader provided the Director with a list of documents that would be needed to carry out the project, and in particular for the institutional analysis of the sector.

In the afternoon, the partners met with Steven Rault, Programme Officer for the European Union Delegation in Haiti, and informed him about the aims and schedule of the project.

The following day (8 May), the team attended another meeting on DPAQ premises, which provided an opportunity to agree upon the logistics of the field mission required in order to visit the main aquaculture farms. The team members contacted key aquaculture stakeholders in order to start gathering information, including technical aquaculture data, background social and economic information, maps, and GIS data required for the mapping assignment.

Both aquaculture experts conducted a field mission from 9 to 11 May during which they visited aquaculture farms in the Artibonite Valley and in the Hinche and Mirebalais

regions. Over the three days, Murielle Félix supported the team effectively by organising meetings with local MARNDR officers and aquaculture farm owners, and the GIS expert met with mapping specialists from various bodies and ministries with a view to collecting as much data as possible. Agreeing upon field mission logistics proved time-consuming, with the question of surveyors' allowances and other financial aspects requiring a good deal of negotiation.

On 11 May, the team, accompanied by Miss Félix, visited the aquaculture farm in Christianville, before travelling as far as the Miragoâne pond with a view to visiting the Food for the Poor floating cages. Their journey was however cut short by a violent storm.

From 13 to 18 May, the team contacted and had meetings with a wide range of aquaculture stakeholders. However, it proved very difficult to meet with key officers from the Ministries concerned, due to the pending appointment of a new Government. Despite repeated requests to the DPAQ Director, it proved impossible to meet the partners that the team had hoped to consult, such as FAO representatives, officers from other aquaculture-related private or public institutions, private producers etc. Similarly, certain documents could not be obtained, such as those relating to the institutional situation of the Directorate of Fisheries and Aquaculture, and reports from previous aquaculture missions. Nevertheless, the team was still able to organise a number of key meetings thanks to the Team Leader's existing contacts in the aquaculture sphere. The inception report was completed within the deadline (see Annex 2).

Work carried out in-between assignments

In-between the different missions, the team continued its work outside of Haiti by seeking information from websites and through discussions with international contacts. This proved essential, in particular for the institutional analysis of the sector, given the lack of information provided by national partners.

Mission 2

The second mission, whose objective was to lay the groundwork for the field survey, took place from 14 to 22 July 2012. The tasks performed included: (i) designing and drawing up the questionnaire to be used to analyse the impact of social, institutional, economic and technical factors on aquaculture in Haiti; (ii) organising a two-day training session in Port-au-Prince for the 20 surveyors (17 to 18 July), followed by a 2-day field pilot survey in a selected site in the Port-au-Prince area, West department (19 to 20 July); (iii) reviewing and revising the questionnaire in the light of the survey results, (iv) organising the field mission (logistics, budget etc.) and (v) developing a database to be used by the surveyors to enter the data collected.

The 20 surveyors conducted the survey over an eight-day period in July and August 2012 in Haiti's 10 geographic departments (2 surveyors per department, 8 days of work), and entered the survey data into the database. The geographical coordinates of the sites were also recorded using GPS units provided by the Department of Fisheries and 4 GPS units acquired for the needs of the project.

It was agreed that the first data entered into the system would be promptly transmitted to the team, so that the experts could monitor the implementation of the project and pinpoint any problems. However, the data was not made available to the team until the beginning of the third mission, when the surveyors presented their findings.

Mission 3

The Team Leader, J.P. Réville, arrived in Haiti on Wednesday 15 August and returned to Canada on 5 September. Expert 2, C. Béné, arrived in Port-au-Prince on 16 August and stayed until 2 September. A. Mills arrived on 22 August and left on 1 September.

The Team Leader visited the Directorate of Fisheries and Aquaculture on 16 August, and was very briefly received by the Director, who confirmed that the surveyors would be present the following day to submit the results of the survey. Mr Réville again requested to obtain the information required to carry out the institutional analysis, but to no avail.

Nevertheless, he held a long meeting with the Deputy Director for Commercial Fishing, agricultural engineer P.G. Lafontant and two of his co-workers. The details of this meeting had been arranged when the Team Leader was in Canada. During this 2-hour meeting, the Team Leader was able to gather useful information on the Haitian aquaculture sector and target groups who would be interested in the first findings of the project. Through this exchange, the Team Leader found that the initial strategic guidelines identified by the team were realistic and well-suited to the specific environment in Haiti.

On 16 August, he was also received by the Secretary of State for Animal Husbandry, Mr Chancy, a meeting which he had organised from Canada. The meeting provided an opportunity to briefly explain the vision and strategy identified by the team, in the presence of DPAQ Director, for the development of Haitian aquaculture.

On Friday 17 August, a workshop was held for field surveyors to submit the results of the survey. A first review of the data was immediately carried out, through which it was

possible to correct any anomalies, in particular as regards the surface area of ponds. Some of the data was amended by the surveyors themselves. Two surveyors did not attend the workshop, but the data that they had collected was submitted to the team in the following days. Despite repeated requests, some photographs of the visited sites were not received in time for the workshop (the last ones were submitted on 30 August, a day before the workshop).

Due to the persistant lack of information on the institutional situation of the DPAQ, the Team Leader decided to send an additional questionnaire to the surveyors, in order to obtain complementary information that would provide a basis for the institutional analysis of the sector. This was sent to the surveyors on 18 August. The Team Leader repeatedly tried to elicit a response, and was eventually successful in collecting useful data, which enabled the team to draw up a report on the DPAQ and its employees.

From 18 to 30 August, the team focused on analysing the survey findings, which involved linking these findings to the mapping of national aquaculture potential, and completed the institutional analysis.

The findings of the survey were combined and overlaid with mapping/GIS data and works based on existing secondary data to produce an extensive assessment comprising a series of analyses and maps that clearly identify the most suitable zones for each type of aquaculture, as well as bio-physical, institutional and structural constraints that may hinder development.

In addition, the Team Leader organised further meetings with key stakeholders, potential private investors and officers from decision-making bodies such as the Centre for the Facilitation of Investment (CFI). He also continued the search for missing information, such as the latest results on the hill reservoirs preservation programme.

The team members held discussions and shared opinions on the strategy to put forward for the sustainable development of Haitian aquaculture. Their conclusions underpin the strategic report.

Moreover, numerous organisational details needed to be agreed in preparation for the workshop, in particular as regards the financial aspects. As early as 21 August, the team submitted a list to the DPAQ Director specifying the guests whose presence was desired at the workshop. This list notably included officers from key Ministries, such as the Trade & Industry Ministry and the Environment Ministry, and from other equally important bodies such as the CFI and the Haitian Board of Trade. It was hoped that sending this list would secure their presence at the August workshop.

On Wednesday 22 August, a preparatory meeting was held on DPAQ premises. The main aspects discussed were as follows:

- The urgent need to contact as many of the persons invited as possible. The Team Leader insisted that the Director promptly identify those representatives of Ministries and institutions whose presence is essential to the quality and success of exchanges on the general development strategy for Haitian aquaculture.
- The content of the invitation and agenda of the workshop.
- The requirement to translate part of the information into creole.

- Other organisational aspects (breaks, buffet, expenses allowance, photocopies etc.)

The validation workshop was held in Port-au-Prince on 31 August from 9 am to 5 pm. Thirty-four persons attended. Only eight out of the expected 25 fish farmers attended. Some of the delegates from Ministries and institutions also failed to attend.

The Deputy Director for Commercial Fishing, P.G. Lafontant, opened the workshop, followed by the DPAQ Director. After a break, the team presented a summary of its work, which included a PowerPoint presentation (Annex 8). Then a question and answer session was held until 1 pm. After the lunch break, during which time many views had been exchanged, four working groups answered questions relating to their vision of aquaculture in Haiti with an emphasis on requirements in terms of technical assistance and capacity building for fish farmers, and the issues stemming from the differences in size between fish farms, which range from subsistence to industrial scale farms.

A representative from each group was appointed to present the conclusions of that group's work. Following this, the Team Leader and the DPAQ Director presented a summary of the issues raised and proposals made.

From 1 to 5 September, some of the comments and proposals made during the workshop were incorporated into the report. Various logistical details were also resolved. A first draft of the FTR was submitted on 6 September.

Conclusions and recommendations

The field survey made it possible to identify a large number of aquaculture units, document their characteristics and variables, and determine the problems faced by fish farmers. The report presents a clear vision encompassing almost all the aquaculture activities on the Haitian territory. It demonstrates the need to provide more robust technical support to the fish farmers scattered across the country. The majority of them are not professional fish farmers, implying that they do not derive their main income from it. More often than not, aquaculture is carried out to supplement income from other activities or agricultural productions. As a consequence, there is a distinct lack of professionalism in the sector.

The MARNDR has ambitious objectives, and aims to increase aquaculture production from its current output to 25,000 tons/year. To do so, it has requested substantial institutional funding (over US $32m) as well as US $50m of private investment.

However, laying the groundwork for this material development is likely to prove difficult. Firstly, the mapping work performed by the team concluded that the most suitable areas for fish-farming in earth ponds are located on farming lands. This contradicts the Ministry's assertion that lands favourable for aquaculture are not agricultural lands. Serious economic and property-related issues are likely to arise from this situation.

Secondly, the project showed that the poor water quality in earth ponds, particularly in the plains, will have a negative impact on the profitability of aquaculture production.

Thirdly, although the country's three largest lakes have an undeniable potential for floating cage aquaculture, some of their chemical or structural properties could jeopardise the profitability of such a venture.

Therefore, potential output from earth ponds or floating cages is limited by a number of physical, economic and human factors.

The strategy put forward by consultants sets out the following solutions:

- Strengthen the capacities of the DPAQ in terms of trained human resources (i.e. demonstrating an appropriate knowledge of aquafarming techniques), and in terms of logistical resources, so that the institution may efficiently support fish farmers and provide them with the required technical assistance
- Concentrate a majority of financial and technical means on a small number of areas, so as to reach a critical size for self-sustainable development
- Create Priority Aquaculture Zones (PAZ) with a favourable legal, economic and technical environment to foster the perennial development of aquaculture in Haiti.

ANNEX 1

ACP Fish II – Strengthening fisheries management in ACP states
9 ACP RPR 128 Accounting No. RPR/006/07 – EDF IX

Strategic assessment of aquaculture potential in Haiti.

Reference: CAR/3.1/B12

TERMS OF REFERENCE

BACKGROUND INFORMATION

Beneficiary country

The direct beneficiary country for the implementation of this contract is Haiti.

Contracting Authority

ACP FISH II Coordination Unit
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Relevant country background

Haiti belongs to the category of low-income countries. Clear income poverty has been accentuated in recent years due to the deterioration of socio–economic and political conditions. The population of Haiti was estimated at around 10 million by the World Bank in 2009 with 47% estimated as illiterate and almost 70% living in rural areas. Per capita GDP (PPP) in Haiti is only of $1164 and the country is 145th in the global HDI. According to a report of Program Development of United Nations (2002) on the profile of poverty, approximately 55% of Haiti's population, more than 4.6 million, live below the extreme poverty line i.e., below 1 USD per day. By most international measures of poverty, Haiti has continued to see a decline in living conditions (DSNCRP[1], 2007) and with social inequalities and political upheaval, the challenges facing the country are substantial. Natural disasters compound some of these problems. The economy of Haiti is dominated by the agricultural sector contributing over 25% of the GDP and employing up to 66% of the population. Despite this situation, Haiti is also the most food insecure country in the hemisphere due to deterioration of the natural resource base and an agricultural sector increasingly unable to produce enough food. The country is reliant on food imports (currently importing around 20,000 tonnes of fish per year) and also foreign aid and support.

Haiti has a per capita food supply from fish and fishery product of 2.5 kg/person/year, fish consumption is weak compared to Guyana 57 kg/person/year and Jamaica 17 kg/year. At the present time although fish and fisheries are not considered of strategic importance in Haiti, their role in providing livelihoods and food security for coastal communities should not be

[1] Growth and Poverty Reduction Strategy Paper (Document de Stratégie Nationale pour la Croissance et pour la Réduction de la Pauvreté)

underestimated. In recognition of the future role, the authorities in Haiti raised the priority status of fisheries in the agricultural policies of 2010 and 2011.

Thee structural problems in the economy were further compounded when Haiti experienced a catastrophic magnitude 7.0 M_w earthquake on January 24, 2010. An estimated three million people were affected; 230,000 died, 300,000 injured, and one million made homeless. The earthquake caused major damage to infrastructure (roads, buildings, and notable landmark buildings) and various sectors, including agriculture and fisheries facilities.

The recovery of Haiti after the earthquake in 2010 has been difficult and slow with "emergency conditions" prevailing over much of the affected area in late 2010. Whilst initial commitments of finance were high and immediate, inaction by the government and donor authorities is cited as the prime reason for the slow rate of improvement. The continued difficulty of maintaining law and order and the outbreak of cholera has done nothing to hasten the recovery. Many people still live in so-called "emergency camps" almost two years after the quake itself. Despite the slow reconstruction, the country held elections in later 2010 and, despite operational difficulties, elected a new President who took office in May 2011.

Current state of affairs in the relevant sector

Haiti is experiencing enormous challenges in the management of its fisheries resources, particularly aquaculture. Food security is of major concern in Haiti, due to rapid human population growth and the loss of agricultural lands and forests resulting from poor land-use practices and deforestation. The destruction of crops from flooding and wind damage due to recent hurricanes further exacerbates food shortages. With the additional burdens of food shortages as a result of the January 2010 earthquake, the urgency to develop a more advanced and cost effective approach to feeding all of Haiti should now be at the forefront of infrastructure planning. In common with other sectors, the aquaculture and fisheries sector was reviewed in May 2010 and policies and approaches updated designed to place higher priority ion food production and gainful employment.

Aquaculture is an important way of producing fish and other aquatic organisms to satisfy nutritional needs and growing demands for fish consumption, employment creation, foreign exchange earnings and diversification of the economy base of the country. Capture fisheries will not be able to produce enough fish to meet growing demand because they are near or beyond their sustainable limits. Any significant expansion in fish supply will therefore have to come from aquaculture production. In addition to producing fish, shellfish and aquatic plants (e.g. sea moss) for direct human consumption, aquaculture can provide other products for a wide variety of purposes such as the aquarium industry, health products and food additives.

Haiti presents ideal climatic conditions for the development of aquaculture and has good potential for aquaculture development in various zones in the country. Through the ten geographic departments in the country, more than 23,000 hectares of lands not suitable for agriculture are very favourable for the development of commercial fish farms. There is an Aquaculture Unit at the Department of Fisheries and Aquaculture and an Aquaculture station at Port Sondé. Presently, the contribution of aquaculture is very low (approximately 400 metric tons per year). The challenge today is to make use of these opportunities for the sustainable development of aquaculture in Haiti.

Despite various attempts at development, the contribution of aquaculture to national food production remains very low at around 400 metric tons per year. Since 1950s attempts have been made to develop the aquaculture sector led by the national administrations and supported by FAO and USAID amongst others. These efforts continued through the 1980s and 1990s so that by 2010 a range of small and medium scale projects had been established with some able to demonstrate considerable success. The achievements in aquaculture in these years had been achieved through efforts of private individuals, SMEs, NGOs, church groups and international and bilateral aid

organisations. Since the earthquake in January 2010, attention to aquaculture (and especially small scale backyard approaches) increased dramatically. The ad-hoc nature of the development was partly a result of the lack of strategic guidance for the sector's development. For government to support this sub-sector and to be able to provide financial incentives or prioritised infrastructure development, the administration needs to have a clear understanding of the current situation and a vision of how the aquaculture sector should move forward and what the role of the different stakeholders should be. Recent developments however, demonstrate the renewed commitment of the government to pursue aquaculture development.

The Growth and Poverty Reduction Strategy Paper (DSNCRP) (November 2007) identifies the promotion of fisheries and aquaculture as one of the "pillars" for growth, development and elimination of poverty. Development of aquaculture was specifically mentioned as an area of focus between 2007 – 2010, and efforts would be to increase production thereby providing greater access to high-protein foods. The devastating earthquake in January 2010 may have derailed these plans but in May 2010 the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR) prepared a national Agricultural Investment Plan re-inforcing the government's position holding agriculture and fisheries as one of the pillars of development and poverty reduction. The AIP was in effect a recovery plan designed to bring the country's growth back on track and continues to place fisheries and aquaculture as one of the key pillars of growth. The document was produced through an assembly involving civil society, administration and the private sector and has the widest possible support nation-wide. The plan re-inforces some of the programs identified in the 2009 "Development program of Deep Sea Fishing; National Program for the Development of Aquaculture and Mainland fishing". National priorities set out in the AIP address sea fishing and aquaculture and mainland fishing separately. For aquaculture and mainland fishing, in the short term and medium term, targets of the administration include:

11. The creation of fields of study allowing the revision of commercial politics
12. The evaluation of resources and potential
13. The creation of studies on processing, conservation, and commercialization
14. The production of aliments for fish

Medium-Long Term:

15. The stocking of fish in ponds
16. The establishment of aquaculture farms: controlled production and pond production
17. The increase in the current farms production and the creation of new centers of production
18. The rehabilitation of farms with an already established potentiality
19. The formation and provision for technical assistance to fishermen
20. The monitoring and evaluation of actions

One significant difference between this renewed commitment and the earlier attempts is the acceptance of the role of government as the facilitator whereas ultimately, the producers will be the private sector. National goals will only be obtained when stakeholders work together and to achieve this collaboration the policy framework has to be correctly developed and informed by high quality, recent and focused information for decision making. Similarly, efforts to encourage growth in the aquaculture sector, need to be supported by a range of policies including those

external to the sector itself such as financial incentives, tax support and subsidies and support mechanisms for small and medium sized enterprises.

Whilst additional information is being gathered, analysed and used in decision-making, the Department of Fisheries and Aquaculture, mainly the Aquaculture Unit is involved in a variety of support tasks: Producing fingerling (tilapia, common and Chinese carps and Colosoma species) for small fish farmers; Assisting farmers to build small fish ponds and to stock these farms; Creating fish farms to provide alternative food source; Maintaining a demonstration farm at the University; and Developing a development plan for aquaculture to guide the Industry.

Related programmes and other donor activities

There are a number of donors and agencies providing support to the fishing sector in Haiti and the variety of support organisations increased markedly after the earthquake in January 2010. Among the major long term development partners are United States Agency for International Development (USAID), United Nations Food and Agriculture Organisation (FAO) and the Inter-American Development Bank (IADB). The USAID provides boats, engines, other equipment and material, support in building and placing Fish Aggregating Devices (FADs); the FAO supports backyard fish ponds aquaculture development through training and the provision of technical assistance; and the IADB continues to provide support to the government and people of Haiti mainly through financial measures. There are many NGOs active in the fish farming sub-sector as a route to providing food security for displaced populations.

The CARICOM / CRFM / JICA Project on Formulation of Master Plan on Sustainable Use of Fisheries Resources for Coastal Community Development in the Caribbean has one component dealing with aquaculture development. In March 2011 they held their first Workshop on Aquaculture Development Planning, and Haiti was one of the participants in this training. It is expected that the outputs from this ACP Fish II assignment will be used in the development planning associated with the JICA project. The JICA supported project, through the Workshops in 2011 will "assist in the preparation of draft action plans for sustainable aquaculture development in Belize, Guyana, Haiti, Jamaica, Suriname and Trinidad and Tobago".

OBJECTIVE, PURPOSE AND EXPECTED RESULTS

Overall and specific objectives

The overall objective of the ACP Fish II Programme is to contribute to the sustainable and equitable management of fisheries in ACP regions, thus leading to poverty alleviation and improving food security in ACP States.

Purpose

The purpose of this contract is to deliver Technical Assistance to support the Department of Fisheries and Aquaculture of Haïti to complete a strategic assessment of aquaculture potential in the country, and thereby contribute to the long-term development of the aquaculture sector.

Results to be achieved by the Consultant

The consultant will achieve the following results as part of this contract:

1. Completed field-survey reporting current aquaculture activities;
2. Institutional analysis of potential for aquaculture production prepared;

3. Preparation of an analytical report (Strategic Assessment of the Aquaculture Potential in Haiti) with recommendations for aquaculture planning and development (including spatial analysis with potential zoning for aquaculture development) validated through a Workshop.

ASSUMPTIONS AND RISKS

Assumptions underlying project intervention

The need for this intervention was clearly identified in the Regional Needs Assessment workshop with fisheries administrations and representatives of regional fisheries bodies carried out in Belize City, October 2009. The need for this activity was further confirmed via additional discussion with the Director of Fisheries and Aquaculture in Haiti. Similarly, a range of national action and development plans (including the DSNCRP) clearly identify this area as one of national priority for development and therefore the expectation is for continued, full support from the fisheries administration and related government departments. In practical terms this will mean that counterpart institutions will take all the necessary measures to ensure their fulfilment of obligations and responsibilities as set forth under this project. Failure to meet that requirement is likely to result in the project not achieving the necessary results.

Risk factors underlying project intervention

Risks for the implementation of this contract are minimised, since the intervention was identified and endorsed in cooperation with the Haitian Director of Fisheries and Aquaculture. The assumption is they are well aware of the intervention and prepared to allocate official hours to its implementation. The participatory planning approach adopted in the development of this intervention will continue through implementation to ensure that risks of overlap and lack of co-ordination with other initiatives of the government will be minimised. Likewise, the chosen methodology is consistent with Haiti needs.

Despite the commitments given by beneficiaries, Haiti still remains in a fragile political and social state and the risk of deterioration of the situation still exists. The conditions will be carefully observed by all stakeholders so that the earliest possible warning is given of any conditions which may arise to put in jeopardy the achievement of project objectives.

SCOPE OF THE WORK

General

Description of the assignment

It is widely recognised that Haiti has potential to increase production from aquaculture. Attempts in the past have failed to enable the sector to reach a "take-off point" whereby the industry is able to reach a critical point of self-sustaining development. Support is provided and then completed without sufficient real momentum or capacity being built. One reason for these "failures" and the predominance of ad-hoc development is the lack of a guiding plan within which stakeholders can play their part and complete their role in achieving shared objectives. As a first step to developing this plan there is a need for clear, updated and detailed investigation into the real potential for aquaculture in Haiti. This assignment aims to use field survey techniques to conduct the initial survey with ground truthing and then using spatial analysis of physical and human factors, to enable simple zoning of the land area to identify those areas most suitable for particular types of aquaculture. Field survey work will be combined with an institutional analysis to examine the opportunities in this crucial sub-sector. The resulting Strategic Assessment of Aquaculture Potential in Haiti will serve as one key reference document to support the Administration to undertake subsequent planning tasks.

The **institutional analysis** of the aquaculture sector (including freshwater, brackish water, and marine aquaculture) will pay careful attention to the governance framework for the sector from the widest possible standpoint (international, regional and national) and considering both fisheries and non-fisheries sectors having an impact on the aquaculture sector. This assessment will include review of existing documents; informal consultations with stakeholders in the aquaculture sector; visits to key field sites and will include an analysis of the legal and policy framework governing aquaculture specifically identifying opportunities and threats in the sector and also gaps in the policy environment whilst highlighting specific achievements in the sector.

The **field-survey component** will actively learn and document lessons and establish a system and methodologies (data collection, management and analysis) of monitoring of aquaculture activities which will be carried out at regular intervals in the future with direct funding from the Fisheries Department. Each aquaculture unit will be inventoried, recording variables such as: size of unit, species farmed, source of fingerlings, food consumed, hectares under production, past and future production etc. The field survey will be undertaken in the 10 departments of Haiti and will use 40 field surveyors. This team of field surveyors will be graduate agronomists and the individuals have already been selected by the Fisheries Department for this purpose.). Following an initial assessment visit by the KE to each of the 10 departmental offices (Agricultural Department Directorates) accompanied by the relevant government officer from the HQ, the 40 surveyors will be trained centrally and then despatched to conduct the inventory, completing an average of 10 questionnaires, over 4 – 5 days in their particular region (4 surveyors per department). The enumerators will be brought back to the central training venue where they will be debriefed and arrangements made for the entry of the survey data to a simple database/analytical tool developed by the Consultant for this purpose. Information provided through this assignment will assist the authorities to better estimate the current contribution of the sector to the food security, socio-economic conditions and wider development objectives in addition to providing a baseline from which to plan, implement and measure developments with stakeholders in this sub-sector.

Another important part of the data and information collection component is the use of secondary data (existing maps and database) to **prepare a series of overlay maps** to identify areas particularly suitable for certain types of aquaculture. Maps will be prepared, depending on the type of information available, for example, soil types, terrain, elevation, slope, water table, water supply, infrastructure provision, land tenure, markets, access to markets, labour force, existing facilities etc. The Key Expert team will work closely with representatives of government departments to access relevant databases and facilities so that the spatial database may be prepared to overlay and combine variables to identify suitable areas for aquaculture. A series of zonation maps, identifying specific zones most suitable for specific aquaculture activities, will be the key output of this stage.

The three inputs above will be combined to a comprehensive Strategic Assessment of Aquaculture Potential in Haiti report providing clear recommendations on the way forward. The strategic assessment will include analysis of the strengths, weaknesses, opportunities and threats in the sector, identifying the main constraints to development whilst examining a range of options for the future. The analytical component will enable well-founded recommendations regarding options to strengthen the capability for aquaculture research and development; for investment and financing mechanisms to support growth of the sector; on the most appropriate aquaculture system and species to be cultured; and on data collection methodologies and the data-base for continued information management.

Following discussion and assessment of this document in the Fisheries Department, the information will be presented to a Validation Workshop with key stakeholders (1 day and indicative number of participants, 50). Following this Validation Workshop the KE team will submit the revised Strategic Assessment to the Fisheries Department.

In the conduct of this assignment the Key Expert team will work very closely with the Department of Aquaculture in Port-au-Prince and in the departmental offices. The assignment will be completed by three experts: Senior Aquaculture Specialist (and Team Leader), an Aquaculture Specialist and a GIS/mapping specialist. The KE team will be guided by a Technical Team from the Department of Fisheries and Aquaculture.

Geographic coverage

The country to be covered by this contract is Haiti. The specific area to be studied is the aquaculture fishery in the entire country.

Target groups

Target group of the present consultancy will include the Department of Fisheries and Aquaculture/ Aquaculture Unit, other relevant Government Departments, and NGOs. The intervention will directly target the aquaculture industry, local communities and the fishing sector as they will benefit from recommendations of how to improve aquaculture in Haiti.

Specific activities

The Consultant may propose phases for the implementation of this contract. The consultant will complete the following tasks:

1. Briefing with ACP Fish II Programme and the Department of Fisheries and Aquaculture in Haiti;
2. In consultation with the Department of Fisheries and Aquaculture, establish a project Technical Team consisting of the Director, the Chief Extension Officer for Aquaculture and the Statistician. The Technical Team is directly responsible for the coordination of this project.
3. Conduct and report an institutional assessment of the aquaculture sub-sector in Haiti;
4. The report will be reviewed with the Technical Team and distributed to stakeholders;
5. Prepare and submit an Inception Report;
6. Develop, pilot and revise a Survey Tool (Questionnaire) to be used in collecting information from aquaculture operations across Haiti;
7. Develop a database for the storage and analysis of survey results;
8. With the Technical Team, organize and train (2 days) a team of 40 field surveyors;
9. Facilitate and supervise the survey of aquaculture activities in Haiti. The Consultant will be responsible for all logistical arrangements (e.g. travel, accommodations, meals) associated with the field-survey and to this end will work closely with the Technical Team;
10. Using mapping applications available in the Ministry or other government department/agency, collate and overlay available variables to identify areas of particular potential for aquaculture;
11. Facilitate and supervise entry of the survey results to the database and conduct simple analysis and reporting;
12. Prepare a survey report combining results of the field survey and also the outputs from the zonation work;
13. Using results of the activities above, prepare a Report entitled: Strategic Assessment of the Potential for Aquaculture in Haiti;
14. Review and validate survey results and report with the Technical Team;
15. Prepare an “Information Note” on the Strategic Assessment of the Potential for Aquaculture in Haiti for use and distribution at the Validation Workshop;
16. With the Technical Team, organize 1 (one) national Validation Workshop to discuss provisional results with key stakeholders (1 day, indicative number of participants is 50);
17. Revise Strategic Assessment report on the basis of Workshop inputs and submit to MARNDR;
18. Prepare and submit Final Technical Report (FTR).

Communication and project visibility

a) ACP FISH II projects should follow the EU requirements and guidelines for communication and visibility available on the Programme website at http://acpfish2-eu.org/index.php?page=templates&hl=en. The CU will provide ACP FISH II templates for various communication products.

b) When validation workshops are needed, given their importance for disseminating the results of the Project and ACP FISH II Programme the following activities will be requested:

    1) The Consultant will provide all necessary information in press-release style ("information note") on the project objectives and results, the activities to undertake, the main axes or strategic goals proposed and the future role of the beneficiaries.

    2) The Fisheries Administrations/Regional Fisheries Bodies will receive the information note at least 3 days before the workshop, through their Government communication/press bodies or officials, in order to mobilise local media and to assure full coverage of the event. Financial support to media coverage is included in the "Incidental Expenditure". Receipt(s) of the incurred cost for media coverage will be required to verify the costs incurred.

Technical reporting

The Consultant is required to prepare the following reports in English

i. An Inception Report (IR) no later than 10 days after the first Expert arriving in the place of posting for the first time. This report of a maximum of 10 pages in length will be submitted to the Fisheries Administrations/Regional Fisheries Bodies, RFU and CU. Comments, if any, on the IR must be provided by the fisheries administrations or regional fisheries bodies, RFU and CU within 5 days from receipt.

ii. A draft FTR will be submitted before the Team Leader leaves the country on conclusion of the assignment. Comments on the draft FTR, if any, must be provided by the RFU, CU and the Fisheries Administrations/Regional Fisheries Bodies within 14 days. The Final Technical Report (FTR), taking into account such changes and comments will be submitted no later than 10 days from receiving comments on the draft FTR. If no comments on the report are given within the time limit of 14 days, the draft FTR shall be deemed to have been approved.

The Draft Final Technical Report and the approved Final Technical Report will be translated by the Consultant into French. In addition to this, on approval of the FTR by CU/RFU the executive summary of this document will be translated by the consultant into French.

The formats of technical reports are available on the ACP FISH II web site at http://acpfish2-eu.org/index.php?page=templates&hl=en

Project management

Responsible body

The Coordination Unit of the ACP Fish II Programme, on behalf of the ACP Secretariat is responsible for managing the implementation of this contract.

Management structure

The ACP Fish II Programme is implemented through the CU in Brussels and six Regional Facilitation Units (RFUs) across the ACP States. The RFU in Belize City covering ACP Member States in Caribbean Region will closely supervise the implementation of this intervention and equally monitor its execution pursuant to these Terms of Reference. For the purposes of this assignment, the ACP Fish II Programme Coordinator will act as the Project Manager.

All contractual communications including requests for contract modifications or changes to the Terms of Reference during the execution period of the contract must be addressed with a formal request to the CU and copied to the RFU. Beneficiaries' support for these changes is required.

Facilities to be provided by the Contracting Authority and/or other parties

Not applicable.

LOGISTICS AND TIMING

Location

The place of posting will be Port-au-Prince. The principal working location for the consultant will be the Department of Fisheries and Aquaculture. Field visits in the country will be carried out according to the approved timeline and work plan presented by the Consultant.

Commencement date and period of implementation

The intended commencement date is 22 March 2012 and the period of implementation of the contract will be seven months from this date. Please refer to Articles 4 and 5 of the Special Conditions for the actual commencement date and period of implementation.

REQUIREMENTS

Personnel

Key experts

All experts who have a crucial role in implementing the contract are referred to as Key Experts. The profiles of the Key Experts for this contract are as follows:

Key expert 1: Senior Aquaculture Specialist and Team Leader

Qualifications and skills

- Post-graduate degree, or equivalent, in fisheries management, aquaculture, aquatic resources management, economics or field directly related to the assignment
- High level of proficiency in spoken and written French and English; and knowledge of locally spoken French Creole will be an advantage;
- Proven team leadership skills.

General professional experience

- Minimum of 8 years of relevant experience in fisheries management and policy development with particular expertise in aquaculture;
- Proven report-writing and project management skills.

Specific professional experience

- Experience in preparation of aquaculture policy related documents (minimum 3 assignments) with practical aquaculture assessment experience considered an advantage;
- Experience in the region and specific experience in Haiti will be considered an advantage;
- Experience in carrying out consultancy assignments for the EU or other equivalent international development organisations (minimum of 2 assignments);

The indicative number of missions outside the normal place of posting requiring overnights for this expert is 3. There will be in-country field visits outside the normal place of posting not requiring overnights for this expert.

Key expert 2: Aquaculture expert

Qualifications and skills

- A degree, or equivalent, in fisheries management, aquaculture, social sciences, or field directly related to the assignment;
- High level of proficiency in spoken and written French and English; and knowledge of locally spoken French Creole will be an advantage.

General professional experience

- Minimum of 3 years experience in fisheries and aquaculture management and development with particular expertise in community level consultations or related survey work and;
- Proven skills in field survey planning, implementation and reporting;

Specific professional experience

- Experience in planning, implementing and reporting socio-economic surveys/ aquaculture/ fishing /community or related surveys (minimum 2 assignments);
- Experience in the region and specific experience in Haiti will be considered an advantage;

The indicative number of missions outside the normal place of posting requiring overnights for this expert is 3. There will be in-country field visits outside the normal place of posting not requiring overnights for this expert.

Key expert 3: GIS/mapping specialist

Qualifications and skills

- A degree, or equivalent, in Geographical Information Systems (GIS), geography or any field directly related to the required tasks;
- Proficiency in spoken and written French and English;

General professional experience

- Minimum of 2 years experience in GIS applications and spatial zoning with particular expertise related to fisheries and aquaculture an advantage;

Specific professional experience

- Experience in using GIS applications for assessing land and/or water use and potential (minimum 2 assignment) for management planning;
- Experience conducting GIS-based assessments of aquaculture potential would be considered an advantage;
- Experience in the region and specific experience in Haiti will be considered an advantage.

The indicative number of missions outside the normal place of posting requiring overnights for this expert is 1. There will be in-country field visits outside the normal place of posting not requiring overnights for this expert.

Indicative number of working days by expert and task.

Indicative task	KE 1	KE 2	KE 3
Briefing with ACP Fish II Programme and the Fisheries Department	1	1	0
Document review and planning	4	4	0
Field visits, consultations and assessments	12	12	2
Survey (questionnaire and database) design	2	2	2
Training design (2 days) and delivery (2 days)	4	4	0
Field supervision of survey team	2	8	0
Data entry supervision	0	7	2
Analysis and reporting	15	13	10
Internal report review and amendment	2	2	2
Validation Workshop	3	3	1
Total	**45**	**56**	**19**

Additional information

a) Key Experts are expected to spend at least 70% of the total indicative number of working days in the country;
b) Note that civil servants and other staff of the public administration of the beneficiary country cannot be recruited as experts, unless prior written approval has been obtained from the European Commission;
c) The Consultant must complete a timesheet using the ACP Fish II template provided by the CU at the start of the implementation period. The Consultant is entitled to work a maximum of 6 days per week. Mobilisation and demobilisation days will not be considered as working days. Only in case of travel for mobilisation longer than 24 hours, will the additional days spent for mobilisation will be considered as working days; and

Other experts

No other experts will be recruited under this contract.

Support staff and backstopping

Backstopping costs are considered to be included in the fee rates of the experts.

Office accommodation

Office accommodation of a reasonable standard and of approximately 10 square metres for each expert working on the contract is to be provided by the Department of Fisheries and Aquaculture in Haiti.

Facilities to be provided by the Consultant

The Consultant shall ensure that experts are adequately supported and equipped for all the tasks required (for example IT and communication tools). In particular it shall ensure that there is sufficient administrative, secretarial and interpreting provision to enable experts to concentrate on their primary responsibilities. It must also transfer funds as necessary to support its activities under the assignment and to ensure that its employees are paid regularly and in a timely fashion.

The Consultant will be expected to work very closely with the beneficiary country to ensure that all the necessary supplies, documentation, IT & communication equipment and support is available at the correct time and place necessary for the safe and successful conduct of the tasks specific in this Terms of Reference. Communication and IT equipment for the direct use of the KE team will be included in the fee rates of the experts, except where technical requirements specific to the task in hand demand otherwise such as mapping and printing software for GIS activities, SPSS or other analytical software packages for the analysis of survey results.

If the Consultant is a consortium, the arrangements should allow for the maximum flexibility in project implementation. Arrangements offering each consortium member a fixed percentage of the work to be undertaken under the contract should be avoided.

Equipment

No equipment is to be purchased on behalf of the Contracting Authority or beneficiary country as part of this service contract or transferred to the Contracting Authority or beneficiary country at the end of the contract. Any equipment related to this contract which is to be acquired by the beneficiary country must be purchased by means of a separate supply tender procedure.

Incidental expenditure

The Provision for incidental expenditure covers the ancillary and exceptional eligible expenditure incurred under this contract. It cannot be used for costs which should be covered by the Consultant as part of its fee rates, as specified above. Its use is governed by the provisions in the General Conditions and the notes in Annex V of the contract. It covers:

a) KEY EXPERTS

- Travel costs and daily subsistence allowances (perdiems) for **missions** for Key Experts, **outside the normal place of posting**, to be undertaken as part of this contract. If applicable, indicate if the provision includes costs for environmental measures, for example CO2 offsetting.
- Travel costs for **field visits** for the Key Experts (car or boat rental, fuel and domestic flights). Any subsistence allowances to be paid for missions undertaken as part of this contract must not exceed the per diem rates published on the European Union (EU) website at: http://ec.europa.eu/europeaid/work/procedures/implementation/per_diems/index_en.ht

b) WORKSHOP/TRAINING/CONSULTATIONS ORGANISATION

- The cost of organisation of **stakeholders' consultative workshops, training and validation workshops** including cost for venue, communication and media activities, transport (domestic travel or car or boat rental to/from), accommodation and meals for all participants requiring an overnight stay. For all participants not requiring an overnight stay, the cost for daily transport allowance and lunch will be paid on the basis of actual costs. All costs for accommodation and meals must not exceed the EU per diem rate for the country.
- The cost of venue (if needed) and lunch for **consultations of less than one day with locally-based participants**.

c) FUNDING OF NATIONAL/REGIONAL ADMINISTRATION OFFICERS ACCOMPANYING KEY EXPERTS ON MISSIONS.

Representatives of fisheries administrations or regional fisheries bodies may **exceptionally** accompany the Key Experts on regional or national missions **following the approval from**

the CU and providing a formal document from the local administration stating that, in light of budget constraints, the administration cannot cover the cost of the mission for this officer, but it acknowledges the need of this attendance for an effective project implementation. In reference, see further section 6.5 of the Terms of Reference.

The cost of flights, accommodation and meals for the representatives of fisheries administrations or regional fisheries bodies accompanying the Key Experts on regional or national missions under the following conditions:

i) Request of a prior approval to the CU, attaching to this request the declaration issued by local fisheries administrations or regional fisheries bodies stating that the cost of this extra activity for their officers cannot be covered given the internal budget restrictions. The administration should acknowledge, despite this, the need of the attendance of its officer for an effective project implementation.

ii) The total cost for accommodation and meals based on actual cost (invoices to be provided) cannot exceed the EU per diem rate for the country.

iii) If private or administration's means of transport are used by the representatives of fisheries administrations or regional fisheries bodies accompanying the Key Experts on regional or national missions, fuel cost will be reimbursed upon receipt of the officer's reimbursement request based on distance travelled and local price for fuel per unit.

d) TRANSLATION

- The cost of translation of the Draft Final Technical Report and the approved Final Technical Report as well as its executive summary into French

e) OTHER

- The costs of training, preparation, planning, conducting, analysis and reporting of the aquaculture survey;
- The cost of producing communication items, printing charts, maps, GIS outputs for the Workshop or survey activities for example, and other technical documents outside normal editing formats to be used in consultations and workshops;
- The cost of producing up to three extra copies of the Final Technical Report, to be presented to Regional Administration upon his formal request.

The Provision for incidental expenditure for this contract is **EUR 72.939.** This amount must be included without modification in the Budget breakdown.

Expenditure verification

The Provision for expenditure verification relates to the fees of the auditor who has been charged with the expenditure verification of this contract in order to proceed with the payment of further pre-financing instalments if any and/or interim payments if any.

The Provision for expenditure verification for this contract is **EUR 1,800.** This amount must be included without modification in the Budget breakdown. This provision cannot be decreased but can be increased during the execution of the contract.

REPORTS

Reporting requirements

Please refer to Article 26 of the General Conditions. There must be a final report, a final invoice and the financial report accompanied by an expenditure verification report at the end of the period of implementation of the tasks. The final report must be submitted at least one month before the end of the period of implementation of the tasks. Note that this final report is additional to any required in Section 4.2 of these Terms of Reference.

The final report shall consist of a narrative section and a financial section. The financial section must contain details of the time inputs of the experts, of the incidental expenditure and of the provision for expenditure verification.

To summarise, in addition to the documents, reports and output which could be specified under the duties and responsibilities of each key expert above the Consultant shall provide the following reports:

Name of report	Content	Time of submission
Inception Report	Analysis of existing situation and plan of work for the project	No later than 10 days after the first Expert arriving in the place of posting for the first time
Draft Final Technical Report	Description of achievements, problems encountered, recommendations and technical proposals including the draft Strategic Assessment document suggested by the consultant	Before the Team Leader leaves the country at the end of the assignment
Final Technical Report	Description of achievements, problems encountered, recommendations and technical proposals suggested by the consultant, taking into account changes and comments from the RFU, CU and the fisheries administrations or regional fisheries bodies.	Within 10 days after receiving comments on the Draft Final Technical report (DFTR)
Final Report	Short description of achievements including problems encountered and recommendations and suggestions; together with the Final Technical Report including the validated Strategic Assessment Report and a final invoice and the financial report accompanied by the expenditure verification report.	Within 1 month of receiving the Final Technical Report (FTR).

Submission and approval of reports

Two copies of the approved Final Technical Report must be submitted to the Project Manager identified in the contract (CU) and two copies to the RFU. The final technical report must be written in English. The Project Manager is responsible for approving this report.

MONITORING AND EVALUATION

Definition of indicators

The results to be achieved by the consultant are included in section 2.3. Progress to achieving these results will be measured through the following indicators:

1. Quality of consultants fielded and speed of mobilisation;
2. Identification of issues and problems as recorded in the Inception Report;
3. Nature and quality of survey instruments completed;
4. Successful mobilization of data collectors to rural areas and their return with quality data;
5. Response from stakeholders during the Validation Workshop;
6. Quality of Institutional Assessment, Survey Report and overall Strategic Assessment Report;
7. Number and nature of comments received on the Draft Final Technical Report.

The Consultant may suggest additional monitoring tools for the contract duration.

Special requirements

Not applicable.

ANNEX 2

Inception Report

STRATEGIC ASSESSMENT OF AQUACULTURE POTENTIAL IN HAITI

Project ref. N° CAR/3.1/B12

Region: Caribbean
Country: Haiti

May 2012

Assignment by:

1. Short Background

Food security is of major concern in Haïti, due to rapid human population growth and the loss of agricultural lands and forests resulting from poor land-use practices and deforestation. With the additional burdens of food shortages as a result of the January 2010 earthquake, the urgency to develop a more advanced and cost effective approach to feeding all of Haïti should now be at the forefront of planning.

Aquaculture is an important way of producing fish and other aquatic organisms to satisfy nutritional needs and growing demands for fish consumption, employment creation, foreign exchange earnings and diversification of the economy base of the country. Capture fisheries will not be able to produce enough fish to meet growing demand because they are near or beyond their sustainable limits. Any significant expansion in fish supply will therefore have to come from aquaculture production.

Haiti presents potentially good climatic conditions for the development of aquaculture and has good potential for aquaculture development in various zones in the country. Through the ten geographic departments in the country, more than an estimated 23,000 hectares of land which is not suitable for agriculture, is favourable for the development of commercial fish farms. Presently, the contribution of aquaculture is very low. The challenge is to make use of these opportunities for the sustainable development of aquaculture in Haïti.

In this context, the purpose of this project is to deliver Technical Assistance to support the Directorate of Fisheries and Aquaculture of Haïti to complete a strategic assessment of aquaculture potential in the country (including an inventory of existing activities), and contribute to the long-term development of the aquaculture sector. The project is a 7-month project (May-Nov 2012) implemented with the technical input of 3 experts: Jean Pierre Réville (Senior Aquaculture Specialist and Team Leader), Alan Mills (GIS/mapping specialist) and Chris Béné (Aquaculture Socio-economist), contracted by Landell Mills Ltd.

2. Comments on Terms of Reference

The technical experts found the Terms of Reference clear and unambiguous. The following observations can be added:

Convinced that the sustainability of aquaculture production is dependent upon the revenues that producers will derive from their activities, and recognising the potential critical contribution that aquaculture can make to food security, the experts will promote an overall approach which is in line with both the needs of producers and consumers.

As stated in the ToR, the significant innovation in the Agricultural Investment Plan (AIP) is the recognition of the new role that the Government should play as a facilitator while the development of the aquaculture sector should be led by the private sector. In this context, the experts believe that substantial work is still to be done with the Administration for this new model to be understood, supported and implemented. In this model, the specific

responsibilities of the Aquaculture Department within the MARDNR should be clearly redefined.

The ToR correctly identifies two components that are critically important for a comprehensive evaluation of the sectoral potential in aquaculture: (i) the inventory and identification of bio-physical and technical conditions for the development of aquaculture; (ii) the general institutional and policy context, including sectoral and cross-sectoral governance. What however is missing in this ToR is the third critical element: the economic and market component. Without a full and comprehensive assessment of this economic and market component (ranging from the economic and financial viability at farm gate level, to market and consumer preference analysis), it will be difficult to provide a correct evaluation of the actual/real potential of aquaculture development in Haïti. Even with good bio-physical/technical conditions and a transparent and enabling policy environment, the success of the sector will critically depend on the characteristics and level of consumers' demand for aquaculture products. This third element is not however clearly identified in the ToR and no resources have been allocated in the project to explore and capture its complexity. Aware of this gap, the experts will endeavour to provide some initial element of response, but recognise that this question which would deserve a specific analysis will however remain unanswered.

3. Approach to the assignment

The assessment will draw on (i) an inventory of the existing aquaculture investments and (ii) an evaluation of the potential for future development. Attention will be paid specifically to potential key-issues and challenges, including lack of human and technical capacities, poor access to critical input (fingerlings, fish meal) and governance and institutional constraints.

The approach adopted to implement this assessment will follow the strategy proposed in the technical report submitted during the tender. The approach will include an in-depth review of existing documents, combined with key-informant interviews. A field survey will be undertaken in the 10 departments of Haiti with the objective to document and assess existing aquaculture sites. The field survey results will be completed by an institutional analysis to identify the opportunities and challenges of the sector. Finally spatial analysis will be used to enable simple zoning of the land area to identify those areas most suitable for particular types of aquaculture.

The field survey will address the urgent need identified during the March 2011 Workshop on Aquaculture Development Planning for a clear, updated and detailed investigation into the real potential for aquaculture in Haiti. For this the experts will design and implement a system of data collection (survey) and analysis that can be used to monitor and assess the status of the aquaculture sector in Haiti. In addition to providing a baseline from which to plan, implement and measure developments with stakeholders in the sector, information provided through the survey will assist the authorities to better estimate the potential future contribution of the sector to food security, socio-economy and wider development objectives.

The results of the survey will then be 'fed into' the mapping/GIS exercise to complement existing secondary data sources and lead to the identification of zones potentially suitable for aquaculture (land suitable for pond construction and open water available for use of floating cages, as well as reservoirs and catchment lakes suitable for enhanced fisheries). The secondary data will include biophysical data (e.g. location or water bodies, hypsography, land

cover, etc.) but also human and infrastructure data (land use, electrical power, demography). Where appropriate the GIS will use a modelling approach to overlay these parameters with thresholds agreed by the consultancy team, to pick out zones that satisfy all criteria. Where data are not of sufficient quality or modelling techniques not sufficiently developed (e.g. with identification of upstream pollution sources within a catchment), visual interpretation of data will be used. The results will be demonstrated in maps, but also rely on GIS extrapolations to calculate areas or distance measurements where relevant.

The results of the survey/GIS mapping exercise will be completed by an institutional analysis. The objective of this analysis will be to review and assess thoroughly and comprehensively the overall context and in particular the governance framework of the sector from a wide perspective while considering both aquaculture and the other non-aquaculture sectors which are recognised to have potential impacts on the activity. This assessment will be based on a review of existing documents, combined with discussions and informal consultations with stakeholders in the aquaculture sector and visits to key field sites. It will also include an analysis of the legal and policy framework governing aquaculture with the objective of identifying potential gaps in the policy environment.

The information generated through the survey, the GIS zonation mapping and the institutional analysis will then be combined into a comprehensive Strategic Assessment of Aquaculture Potential document which will be presented at a national validation workshop. Feedback from the participants will be documented and used for the preparation of the final version of the report.

4. Set up and members of the Technical Team

The technical team is composed of three experts who have served as technical consultants on many international, multi and/or bi-laterally funded missions including for the EU, and have considerable complementary experience in the assessment of aquaculture potential. They are also experts in their respective fields and are able to draw from experience on similar projects around the world.

Mr Jean Pierre Réville (J-PR) has over 40 years experience working in the fields of aquaculture and fisheries in the Caribbean region and in developing /transitional countries around the world. He has extensive experience as a Team Leader on technical assistance and research projects focusing on improving techniques and systems for fisheries and the culture of fish and other aquatic organisms in fresh, brackish and marine waters. Promoting sound environmentally friendly practices in lakes, rivers and coastal areas, he works in accordance with modern assessment and management standards and adheres to best practices for aquaculture and fisheries.

Dr Christophe Béné (CB) is an internationally renowned fisheries and aquaculture socio-economist with specific expertise in poverty, food security and development. From 2003 to 2010 Dr Béné has worked as Regional Director and then Senior Policy Advisor for the WorldFish Center – the institute of the Consultative Group on International Agricultural Research (CGIAR) specialised on fisheries and aquaculture. As part of this work, Dr Béné has led fisheries and aquaculture-related research and assessment projects with field work in more than 20 countries in Asia, Africa, and the Caribbean.

Mr Alan Mills (AM) has 20 years of experience working in the application of GIS and remote sensing for natural resources management, including fisheries and aquaculture information management. Mr Mills has worked extensively across the Caribbean region including 2 years as the GIS officer for the Conservation and Fisheries Department in the British Virgin Islands (BVI) and the National GIS coordinator in the BVI in which inter alia he implemented a fish catch monitoring tool, coastal resource monitoring and mapping. He also worked on the EU ACP Fish II project "Elaboration of a Management Plan for The *Kafue* Fishery" in Zambia.

5. Proposed work plan (including travel plan of experts)

No major changes have been identified in the implementation of the rest of the project's programme and the work-plan should therefore remain very similar to the version that was submitted in the initial bidding process. The aquaculture socio-economist (CB) will return to Haiti in June for 10 days to prepare the field survey. During this second mission his tasks will include (i) the design and drafting of a questionnaire aimed at (a) analysing the current social, institutional, economic and technical factors affecting the development of the aquaculture sector in Haiti; and (b) identifying the constraints and opportunities, strength and weaknesses of the major segments of the sector; (ii) the implantation of a 2-day training session for the 20 enumerators (convened in Port au Prince), followed by a 2-day field testing (in two sites close to Port au Prince, e.g. Departement de l'Ouest); (iii) if/where necessary the revision of the questionnaire; (iv) the preparation of the details (logistic, budget) of the field survey; and (v) the development of the database spreadsheet to be used by the enumerators to enter/store the data.

The 20 enumerators will then implement the survey over a period of 8 days in July in the 10 departments of Haiti (2 enumerators per department, 8 days per enumerator), and use the database designed by the expert to enter the data electronically, directly in the computers of the Department of Fisheries. The geo-references of each site visited will also be recorded by the enumerators using the GPS units of the Department of Fisheries.

CB will then return to Haiti mid August to double-check the data entry and then conduct a series of preliminary analysis in preparation to the assessment exercise that will then take place once the two other experts have arrived (J-PR and AM). Combining the results of the survey data with the preliminary mapping/GIS exercise that will have been initiated with the existing secondary data, the experts will be able to complete the assessment and produce a series of overlay maps to identify areas particularly suitable for certain types of aquaculture. Maps will be prepared integrating the type of primary and secondary information collected.

J-PR will initiate the institutional analysis from the beginning of August from Canada. He will then return to Haiti from August 15th to September 5th 2012. The following main activities will be conducted; making contact with, and collection of information from, institutional partners, collecting information about organisation charts, characterisation of the workforce, assessing the academic and technical capacities and the actual skills of key actors in the sector. Parallel to this, the financial situation and office/equipment facilities of each organisation will be analysed. Conjointly, CB will finalise the analysis of data collected during the field survey and work in close collaboration with AM to generate the GIS component of the analysis.

The team will then organise a national validation workshop in Port au Prince (31st Aug 2012) where the preliminary version of the Strategic Assessment of Aquaculture Potential will be

presented to a group of 50 key actors. The final version of the document will be submitted with the comments and potential amendments suggested by these key-actors.

6. Results of initial document review, consultations and TNA etc

The first two days of the inception mission were used by the experts (J-PR, CB, and AM) to meet with the Director of Department of Fisheries and Aquaculture (Dr Jean Robert Badio) and the ACP Fish II Caribbean Manager (Mrs Sandra Grant). In consultation with these stakeholders, the experts established the final schedule of activities, including the validation workshop date (31st August 2012). A few necessary changes in the working plan were identified, discussed and agreed. The main one concerns the reduction of the number of field surveyors from 40 to 20 (each of them working 8 days instead of the 4 days initially planned). This change was proposed to increase the capacities building component of the programme (the 20 enumerators are all from the DoFA), improve the reliability and homogeneity of the data to be collected and reduce the logistical costs. A courtesy visit was convened with the EU (Steven Rault, Chargé de Programmes - Section Développement Rural, Environment, et Sécurité Alimentaire).

Following these intial meetings, J-PR and CB undertook a 4-day field visit in four departments (Artibonite, Centre, Ouest, and Grand-Anse) with the objective to get a visual first-hand evaluation of the existing aquaculture investments and to discuss with relevant key-actors. The visited sites including the governmental Pont Sondé fingerlings production station, the floating cages project at Lac Peligre, several catchment lakes (lacs collineaires) in Hinche area, several rural ponds in Plateau Central, Artibonite, Port-au Prince and the Miragoâne area (see details of sites and persons in Appendix 1).

Prior to the inception mission, AM had completed an online search for GIS data and retrieved free GIS data from various sources. These consisted of the United Nations Stabilisation Mission in Haiti (MINUSTAH), the Nature Conservancy (TNC), the Common Operational Datasets (COD) from the United Nations Office for Coordination of Humanitarian Affairs (OCHA), elevation data from the Shuttle Radar Telemetry Mission (SRTM) and some other data from global online data sources. During the inception mission, AM met with the Centre National de l'Information Géo-Spatiale (CNIGS) who are the central repository in all Haiti for data and managed to fill in the gaps for most secondary data of use. Thanks to these successful meetings, the project now has a detailed countrywide geospatial database on topographic data (coastline, road, river, artificial and natural lakes and catchment lakes or lac collinaire, elevation, slope, aspect, railway), administrative data (Country, Département, Arrondissement, Commune and Section), placenames and major settlement, population totals and density by section for 2003, population by département for 2012, geology, land use, national parks and reserved lands, areas of accentuated erosion.

Additional discussions amongst the key-expert allowed them to identify key-information priorities and modelling parameters for the GIS exercise. Discussion has also been held on the format of the survey data to ensure it is GIS-ready and can be used to map spatial distribution of patterns.

During the second week of the mission, the experts (J-PR and CB) collected and analysed documents they had collated personally and those made available by the DoFA. The team also organised and conducted a series of meetings and consultations with different stakeholders and sectoral partners, especially in the private and financial sectors (see list in Appendix 2).

The team was also expecting to benefit from a series of meetings with civil servants and representatives from the various ministries directly and/or indirectly related with aquaculture (Finance, Planning, Environment, Agriculture, Health, Industry and trade). Due to the designation of the new Prime Minister's cabinet taking place on that specific week however, none of the persons contacted were able/willing to meet the team or to answer their questions.

7. Key issues to be addressed/solved

Overall the inception mission has been successful and the members of the expert team are confident that they will be able to complete the ToR of the project. The only unsolved issue that will need attention has been the inability of the experts to meet any representatives of the various ministries during the inception mission (see point above). Meetings will be organised in August to meet some of these key stakeholders.

8. Financial statement

Based on discussion with the members of the Technical team and estimations made during the inception mission, no major discrepancies are expected between the budget as presented in the initial bidding proposal and the actual figures, with the exception of the travel costs which appear higher than expected.

9. Recommendations

No recommendations at this stage.

Appendix 1: Sites visited and persons met during the 4-day field visit (9-12 May 2012) by J-PR and CB

LOCATION	SITES		CONTACTS
Wednesday 9 may 2012			
Pont Sondé	Pont Sondé Hatchery		Mr. Dieuveni
Verrettes	Private farm (Dr Maurice)		
	School Farm (École des Frères)		
Mirebalais	Gregory Chévry farm	Private	Mr. Chévry
Thursday 10 May 2012			
Hinche	Mr. Jean Jules' s fish farm	Private	Mr. Jean Jules
Hinche (Pindiassou)	Petit-Frère de l'incarnation	Local NGO	Fr. Armand Franklin
Hinche	Mouvement Paysan Papaye (MPP)		Mr. William jean
Friday 11 May 2012			
Mirebalais	Lac Peligre (Floating Cages)	HEIFER International	Mr. Robert Séjour
Bouccan Carré	Zanmi Lasanté Hatchery	Local NGO	
Santo	Opération Blessing (Zanmi béni)	American (faith-based) organization	Mr. Erick Lotz
Saturday 12 Mai 2012			
Leogane	Christian Ville's fish farm	American (faith-based) organization	Mr. Jerri Frenier
Miragoane	Miragoane Lake, Floating cages		Ti Saint

Appendix 2: List of persons contacted and interviewed during the first mission

Name	Position	Meeting and/or contact
Grant S	ACP Fish II Regional Manager for the Caribbean	Monday 07th May 2012
Badio JR	Director of the Fisheries and Aquaculture Department, MARNDR	Monday 07th May 2012
Lafontant PG	DDG MARNDR	Monday 07th May 2012
Rault S	UE, Program Manager	Monday 07th May 2012
Alvarez del Toro D	Cuban Technician Pont Sondé	Wednesday 09th May 2012
Maurice Dr	Pond owner (étang de Verrette)	Wednesday 09th May 2012
Chang Forrin JC	Cuban Technician Pont Sondé	Wednesday 09th May 2012
Chevry G	Investor in aquaculture	Wednesday 09th May 2012
Franklin A Frère	Communauté des petits Frères de l'Incarnation	Thursday 10th May 2012
Lotz Eric	Programme Manager Opération Blessing	Thursday 10th May 2012
Jean W	MPP Project Manager	Thursday 10th May 2012
Jean J	Private fish farmer	Thursday 10th May 2012
Frenier J	Site manager Christianville	Friday 11th May 2012
Séjour JR	Cage projet Manager, lake Peligre	Friday 11th May 2012
Ti-Saint	Beneficiary - Food for Poor project (Étang Miragoâne)	Saturday 12th May 2012
Rousseau L	Sipal, CEO	Monday 14th May 2012
Lebrun JM	Unibank, Chairman & CEO assistant	Tuesday 15th May 2012
Léger René	CEO Caribagences	Tuesday 15th May 2012
Poun Michel	Fish processing plant owner	Wednesday 16th May 2012 (phone conversation)
Ms. Dupiton	Ministry of Economy and Finance	Wednesday 16th May 2012 (phone conversation)
Chancy M	Director of Animal Husbandry Dpt, MARNDR	Wednesday 16th May 2012 (phone conversation)
Grégory J	LDGA, Agro-Food importer	Thursday 17th May 2012
St Louis J	Agro-industry - Import	Thursday 17th May 2012
S. Jean Baptiste	Advisor – Société de Distribution Générale SA	Thursday 17th May 2012

APPENDIX 3

Sites visited and persons met during the 4-day field visit (9-12 May 2012) by J-PR and CB

LOCATION	SITES		CONTACTS
Wednesday 9 may 2012			
Pont Sondé	Pont Sondé Hatchery		Mr. Dieuveni
Verrettes	Private farm (Dr Maurice)		
	School Farm (École des Frères)		
Mirebalais	Gregory Chévry farm	Private	Mr. Chévry
Thursday 10 May 2012			
Hinche	Mr Jean Jules's fish farm	Private	Mr. Jean Jules
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Hinche	Mouvement Paysan Papaye (MPP)		Mr. William jean
Friday 11 May 2012			
Mirebalais	Lac Peligre (Floating Cages)	HEIFER International	Mr. Robert Séjour
Bouccan Carré	Zanmi Lasanté Hatchery	Local NGO	
Santo	Opération Blessing (Zanmi béni)	American (faith-based) organization	Mr. Erick Lotz
Saturday 12 Mai 2012			
Leogane	Christian Ville's fish farm	American (faith-based) organization	Mr. Jerri Frenier
Miragoane	Miragoane Lake, Floating cages		Ti Saint

List of persons contacted and interviewed during the first mission.

Name	Position	Meeting and/or contact
Grant S	ACP Fish II Regional Manager for the Caribbean	Monday 07th May 2012
Badio JR	Director of the Fisheries and Aquaculture Dpt, MARNDR	Monday 07th May 2012
Lafontant PG	DDG MARNDR	Monday 07th May 2012
Rault S	UE, Programme Manager	Monday 07th May 2012
Alvarez del Toro D	Cuban Technician Pont Sondé	Wednesday 09th May 2012
Maurice Dr	Pond owner (étang de Verrette)	Wednesday 09th May 2012
Chang Forrin JC	Cuban Technician Pont Sondé	Wednesday 09th May 2012
Chevry G	Investor in aquaculture	Wednesday 09th May 2012
Franklin A Frère	Communauté des petits Frères de l'Incarnation	Thursday 10th May 2012
Lotz Eric	Programme Manager Opération Blessing	Thursday 10th May 2012
Jean W	MPP Project Manager	Thursday 10th May 2012

Jean J	Private fish farmer	Thursday 10th May 2012
Frenier J	Site manager Christianville	Friday 11th May 2012
Séjour JR	Cage projet Manager lake Peligre	Friday 11th May 2012
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Ms. Dupiton	Ministry of Economy and Finance	Wednesday 16th May 2012 (phone conversation)
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Grégory J	LDGA, Agro-Food importer	Thursday 17th May 2012
St Louis J	Agro-industry - Import	Thursday 17th May 2012
S. Jean Baptiste	Advisor – Société de Distribution Générale SA	Thursday 17th May 2012

LIST OF GUESTS ATTENDING THE WORKSHOP ON AUGUST 31, 2012

Name	First name	Institution	Phone number
Douyon	Alix	KZO	34-70-56-54
Pierre-Toussaint	Ernest	Aquaculture	47-56-62-02
Félix	Angelo	Aquaculture	32-35-91-88
Dreureck	Rosembert	OB	37-84-08-23
Léger	René	Miraqua. S.A	34-48-73-30
Éliacin	William	Rhum Barbancourt	32-01-83-68
Prudent	Daniel	Renapti	38-52-02-02
Maurice	Obed	Renapti	38-73-67-05
Petit-Homme	Widny	Renapti	38-21-76-58
Jacob	Renard	ACEDLP	38-44-62-62
Séjour	Jean-Robert	ACEDLP	38-94-44-44
Élysée	Raoul	CREER	47-50-47-01
Élysée	Gérarda	DANTI	37-31-78-30
Vilna	Josaphat	Oxfam	36-87-28-73
Rault	Steven	European Union	46-32-00-37
Jean	Pierre-Valdo	MARNDR	36-47-78-74
Auguste	Antoine	RENAPTI	37-25-47-79
Sanon	Eddy	Aquafarmer	34-10-96-42
Rosendo	C	Aquafarmer	48-96-03-97
Dupiton	Marie-Maude	Direct/opération CFI	34-43-40-33
Clerisme	Jean-Rénald	PNLCH	37-71-17-80
Chery	Frisnel	PNLCH	37-34-37-44
Crawford	Nelson	Opération Blessing	37-01-75-22
Dorsaint	Wilvick	MARNDR	38-16-38-84
Charité	John Pélé Walter	Kiskeya Farm	36-11-36-19
Sanon	Magdala	MARNDR	37-01-84-88
Sonneus	Fereste	Zanmi lasanté	38-40-36-06
Joseph	Jechonias	Aquafarmer	88-64-90-97
Joseph	Marie Carmèle	MARNDR	37-01-74-52
Wooley	Patrick	Taïno	46-90-42-38
Wooley	Gilbert	Taïno	47-56-96-08
Germain	Ismara	PNLCH	37-01-32-65
Desgrottes	Philippe Andy	Investor	37-00-75-06
Badio	Jean Robert	DAPQ Director	36-57-05-07
Félix	Murielle	MARNDR	38-25-17-94
Réville	Jean Pierre	Landell-Mills	44-68-62-28
Mills	Alan	Landell-Mills	
Bene	Christophe	Landell-Mills	

APPENDIX 4: List of reports and documents consulted

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Water Quality Parameters for Tilapia. Unknown

APPENDIX 5: Photos

Some of the ponds visited (Christianville)

The expert team visiting private ponds (Petit-Frère de l'incarnation)

The expert team visiting Port Sondé

The expert team visiting private ponds (Verrettes)

Cages on Lake Peligre

Zanmi Lasanté Hatchery

Earth pond Anse in Veau (visited in 2002)

Miragoâne Pond (visited in 2008)

ANNEX 6

STRATEGIC ASSESSMENT OF AQUACULTURE POTENTIAL IN HAITI, 2012

Project Ref Number: N° CAR/3.1/B12

Region: Caribbean
Country: Haiti

September 2012

Assignment by:

ACKNOWLEDGEMENTS

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ABREVIATIONS AND ACRONYMS

ACDI	Agence Canadienne de Développement International
AECID	Agence Espagnole de Coopération Internationale pour le Développement
ASC	Aquaculture Service Conseil ASC Inc
AFD	Agence Française pour le Développement
BAC	Bureau Agricole Communal
BAD	Banque africaine de développement
BID	Banque Interaméricaine de Développement
BRHC	Bureau des Ressources Halieutiques et Côtières
CAMPAM	Caribbean Marine Protected Area Managers Network
CARICOM	Caribbean Community
CARIFIS	Caribbean Fisheries Information System
CFI	Centre de Facilitation des Investissements
CFO	Chief Fisheries Officer
CFRAMP	Caricom Fisheries Resource Assessment and Management Programme
CNIGS	Centre National De L'information Géo-Spatiale (National GIS)
DDA	Direction Départementale Agricole
CNSA	Coordination nationale de la sécurité alimentaire
DPAQ	Direction de la Pêche et de l'Aquaculture (Directorate of Fisheries and Aquaculture)
DSNCRP	Document de stratégie nationale pour la croissance et pour la réduction de la pauvreté
EDH	Électricité de Haïti
EIE	Étude d'impact environnementale
EMAF	Ecole Moyenne d'Agroforesterie
EMAVA	Ecole Moyenne d'Agriculture de la Vallée de l'Artibonite
EMDH	Ecole Moyenne de Développement de Hinche
EU	European Union
FAC	Fisheries Advisory Committee
FAMV	Faculté d'agronomie et de médecine vétérinaire
FAO	Food & Agriculture Organization of the United Nations
FMP	Fisheries Management Plan
FD	Fisheries Department
GEF	Global Environmental Facility
GIS	Geographical Information Systems
GOH	Government of Haiti
INARA	Institut National de la Réforme Agraire
JICA	Japan International Co-operation Agency
LHA	Lake Harvest Aquaculture
LMH	Les Moulins de Haïti
MDE	Ministère de l'Environnement
MARNDR	Ministry of Agriculture, Natural Resources and Rural Development
MPA	Marine Protected Area
MINUSTAH	United Nations Mission in Haiti
ODVA	Office de Développement de la vallée de l'Artibonite
OECS	Organization of Eastern Caribbean States

OSM	Open Street Map
PAZ	Priority Aquacole Zone
PGP	Plan de gestion des pêches
PNLCH	Programme des Lacs Collinaires d'Haïti
RESEPAG	Renforcement de l'Efficacité des Services Publics Agricoles
SRTM	Shuttle Radar Telemetry Mission (for measuring height)
TNC	The Nature Conservancy
UNDP	United Nations Development Program
USAID	United States of America International Development
WDPA	World Database on Protected Areas

SUMMARY

1. BACKGROUND INFORMATION AND CONTEXT

Food security is of major concern in Haiti, due to rapid human population growth and the loss of agricultural lands and forests resulting from poor land-use practices and deforestation. With the additional burdens of food shortages as a result of the January 2010 earthquake, the urgency to develop a more advanced and cost effective approach to feeding all of Haiti should now be at the forefront of planning.

Aquaculture is an important way of producing fish and other aquatic organisms to satisfy nutritional needs and growing demands for fish consumption, employment creation, foreign exchange earnings and diversification of the economy base of the country. Capture fisheries will not be able to produce enough fish to meet growing demand because they are near or beyond their sustainable limits. Any significant expansion in fish supply will therefore have to come from aquaculture production.

Haiti presents ideal climatic conditions for the development of aquaculture and has good potential for aquaculture development in various zones in the country. Through the ten geographic departments in the country (Map 1), more than 23,000 hectares of land not suitable for agriculture are in theory very favourable for the development of commercial fish farms according to MARNDR 2010. Presently, the contribution of aquaculture is very low. The challenge is therefore to make use of these opportunities for the sustainable development of aquaculture in Haiti.

In this context, the purpose of this project, supported by the ACP FISH II (Project ref. N° CAR/3.1/B12) is to deliver Technical Assistance to support the Directorate of Fisheries and Aquaculture of Haiti to complete a strategic assessment of aquaculture potential in the country (including an inventory of existing activities), and contribute to the long-term development of the aquaculture sector.

Map 1 Geographical zones in Haiti

2. Methodology

Over a seven-month period (May-November 2012), a team of three international experts, including a Senior Aquaculture Specialist (Team Leader), a GIS/Mapping specialist and an Aquaculture Socio-economist, spent several weeks in Haiti to implement the project's ToR.

2.1 Documentary research and analysis

From the start of its mandate, the team sought to gather the largest possible number of documents on fisheries and aquaculture, as well as on related sectors such as the environmental and commercial conditions in the country. The most relevant information was selected and used both to document the situation of the sector and to cross-check the various sources and the data collected during the field survey (see the list of documents mentioned in Annex 4).

2.2 Encounters with key stakeholders

The team's exchange-based approach was extended well beyond the key MARNDR representatives, as the experts had numerous encounters with people from business, finance, trade, and environmental sectors, as well as NGO representatives and project managers. These consultations were essential in identifying the strengths and weaknesses of the fisheries and aquaculture sub-sector and in incorporating the recommendations and strategic guidelines put forward by these players.

Through intensive and fruitful exchange with aquaculture specialists, as well as representatives of industrial aquaculture and fish trade companies in Haiti and various regions of the world, our consultants were able to gather opinions and information on the potential for aquaculture in Haiti. (See list of persons consulted in Annex 3)

2.3 Initial field information-gathering mission

During the first field mission (6 to 9 May 2012), the team visited a number of Haiti's main aquaculture sites in order to identify their strengths and a number of issues hindering the production process. The team produced a comprehensive report with proposals encompassing all aquaculture activities.

2.4 Survey among DPAQ staff

A survey was conducted among staff of the MARNDR's Fisheries and Aquaculture Department to collect feedback on the institution's work and structure, to identify its strengths and weaknesses, and to measure the staff's job satisfaction.

2.5 Field survey

No major changes were introduced during the implementation of the field survey. Accordingly, the work schedule remained closely in line with the initial Terms of Reference (see Annexes 1 and 2). The aquaculture socio-economist spent 10 days in Haiti from 14 to 22 July 2012 to lay the groundwork for the field survey. During this second assignment his task was: (i) to design and draw up the questionnaire to be used to (a) analyse the impact of social, institutional, economic and technical factors on aquaculture in Haiti and (b) identify the constraints, opportunities, strengths and weaknesses of the sector; (ii) organise a two-day training session in Port-au-Prince for the 20 surveyors (17 to 18 July), followed by a 2-day field pilot survey in a selected site in the Port-au-Prince area (19 to 20 July); (iii) review and revise the questionnaire in the light of the survey results, (iv) organise the field mission (logistics, budget etc.) and (v) develop a database to be used by the surveyors to enter the data collected.

The questionnaire (Annex 8) comprises 35 sections covering the following areas:

- Experience and skills of the site manager
- Bio-physical properties of the sampled body of water (pond, basin, reservoir, hillside lakes etc.) in terms of water quality, type of soil, type of structure, size, etc.
- Investment in fish feed, energy and equipment by farmers participating in the survey
- Quality of management and extent of monitoring
- Production-volume in terms of frequency, price, costs, profit
- Access to inputs (fish food, fingerlings, energy etc.)
- Access to technical assistance and information
- Access to funding and credit
- Access to markets, competition etc.

The 20 surveyors conducted the survey over an eight-day period in July and August 2012 in Haiti's 10 geographic departments (2 surveyors per department, 8 days of work), and entered the survey data into the database. The geographical coordinates of the sites were also recorded using GPS units provided by the Department of Fisheries and 4 GPS units acquired for the needs of the project.

Over this period, the aquaculture expert actively continued his search for information and held consultations with specialists in order to cross-check as much of this information as possible.

The aquaculture socio-economist returned to Haiti in mid-August to supervise the entry of survey data into the database and undertake a series of preliminary analyses for the purposes of the assessment, which took place from 15 August to 2 September in collaboration with the other two experts. The Team Leader's mission in Haiti was extended until September to enable him to finalise the gathering of information among key aquaculture stakeholders and complete the validation of the proposals put forward at the workshop.

The findings of the survey were combined and overlaid with mapping/GIS data and works based on existing secondary data to produce an extensive assessment comprising a series of analyses and maps that clearly identify the most suitable zones for each type of aquaculture, as well as bio-physical, institutional and structural constraints that may hinder development. The findings of these analyses are presented in the following pages of this report.

2.6 Specific GIS data collection

The mapping expert's specific tasks included collating all data relevant to aquaculture from the available databases. The information retrieved was combined and overlaid with the conclusions of the large-scale survey and with information provided and disseminated by international contacts. The experts used this optimised approach and comprehensive pool of information to draw up maps that illustrated a number of indicators used for the assessment of Haiti's aquaculture potential.

GIS was used to map the results of the field survey in order to determine spatial patterns across Haitian Departments for the distribution of aquaculture, proximity to technical resources, and potential productivity. Additionally, using secondary data sources collected from the National GIS (CNIGS), the Nature Conservancy, MINUSTAH and others, GIS modelling of the potential for sitting earth ponds was conducted. This involved finding overlapping areas associated with favourable factors (such as water availability, soils with high clay content, flat land and existing favourable land cover - i.e. irrigated agriculture), excluding areas of non-favourable factors (i.e. proximity to industrial or urban areas, proximity to rivers prone to flooding, areas where erosion is a problem). The resultant areas were identified within each department and real statistics calculated. Data in ArcView GIS, Shapefile and Google Earth KMZ formats were created from key results.

2.7 Limitations

The team was able to complete all tasks set out in the initial ToR without meeting any major obstacles. It was not possible to conduct the field survey over the entire territory of Haiti, but this part of the project was not intended to be exhaustive and this limitation was acknowledged from the outset. Moreover, a detailed study of the survey forms shows that part of the information that was supposed to be collected could not be obtained for various reasons (unwillingness of respondents to disclose certain information, difficulties in accessing the right site/person, etc.). However, the experts concluded that the information gathered during the field survey was of sufficient quality and quantity to enable an accurate analysis of the situation.

GIS modelling and data were limited by the quality of the secondary data provided by other parties, and also restricted to physical parameters (e.g. land cover, geology, topography and water). Other key factors for the selection of aquaculture sites, whether social, economic, infrastructural (i.e. access to electricity) or institutional, were not integrated due to lack of available GIS data with national coverage, or the difficulty in realistically capturing the spatial nature of such factors. While most of the field survey used GPS and accurately located aquaculture sites, some points could only be located approximately using village names and descriptions

2.8 Data analysis and drawing up of the report

Detailed analysis of the current state of affairs in Haitian aquaculture, and the study of the country's aquaculture potential were carried out in light of all technical, economic and social information gathered by the team, combined with guidance on the strategies of key ministries managing fisheries and aquaculture. The various proposals made by the team as part of this approach, underpin the expectations of the project.

3 INSTITUTIONL ANALYSIS

3.1 Aims

"Institutional analysis is intended as a means to appraise the capacities of MARNDR, of the Directorate of Fisheries and Aquaculture and of other institutions and bodies involved in the fisheries and aquaculture sector, and determine the extent to which they fulfil their respective remits. The approach aims at identifying requirements for support going beyond a mere lack of resources, which highlight broader issues such as the effectiveness, consistency and efficiency of public policies and related processes" (Adapted from CTB Ioca, 2007).

3.2 The Ministry of Agriculture, Natural Resources and Rural Development (MARNDR)

3.2.1. MARNDR's mission

The Ministry of Agriculture, Natural Resources and Rural Development (MARNDR) is the public body in charge of establishing sector guidelines, piloting public investments, coordinating the action of the different players (including NGOs) and implementing the required basic services, primarily in terms of public health protection and information, in the agricultural sector. Within the Ministry, the Directorate of Fisheries and Aquaculture (DPAQ) supervises all matters and activities linked to this sub-sector (www.agriculture.gouv.ht).

3.2.2. MARNDR's organisation chart

The Ministry is organised as one Directorate-General which supervises 18 Technical Directorates and/or Central Units (one of them being the Directorate of Fisheries and Aquaculture); 10 Departmental Authorities (Direction Départementale de l'Agriculture, DDA); two independent bodies (ODVA, BCA) having their own Board of Directors and legal personality; two bodies created by presidential decree (INARA) and one body created by a Council of Ministers (CNSA). The Departmental Authorities (DDA) supervise Municipal Bureaus of Agriculture (Bureaux d'Agriculture Communaux, BAC), whose purpose is to provide local farmers with community services. There are 140 municipalities in Haiti, but only a dozen BAC are operational (www.agriculture.gouv.ht).

The Departmental Authorities and Municipal Bureaus of Agriculture are local delegations of the MARNDR. All technical directorates operating within the MARNDR are supposed to be represented within each DDA. However, due to a lack of financial and human resources, the Directorate of Fisheries and Aquaculture is often under-represented.

In 2009, MARNDR employed approximately 1,500 staff, two thirds of them working in local delegations (DDAs and other bodies).

3.2.4. Difficulties and needs of the MARNDR

The Ministry has a clear vision of its needs and of the obstacles hindering the efficiency of its operations. According to the institution (MARNDR. *National Investment Plan for agriculture - Agricultural services and institutional support - Appendix 12: Institutional support to public agricultural services*. March 2010), these issues are as follows:

- Lack of qualified human resources (most staff have no qualifications, middle management lacks executives, and most senior executives are old)
- Since the 90's, the MARNDR's institutional mission was redefined as a guidance and regulation mission, while investment was supposed to be the exclusive domain of NGOs, producers' organisations and private bodies. This new division of responsibilities does not seem to work well in practice
- Serious flaws in planning and guidance systems: The MARNDR inadequately fulfils its coordination and monitoring assignments (the institution lacks executives qualified in IT, data analysis, sector analysis, policy design and assessment)
- Inadequate financial resources: the Ministry lacks means of transportation and office equipment; the operating budget is insufficient, which is particularly true of regional bodies (DDA/BAC). These bodies are thus unable to organise field operations, support missions etc. independently from NGOs
- Until the early 90's, agricultural research was very well developed thanks to a network of Research and Development Centres supervised by the MARNDR. These centres are no longer able to fulfil their objectives, due to a lack of work programmes, operating budget and human and technical resources
- Difficulties in assessing and analysing the situation and in defining a strategic vision and development guidelines of the sub-sector.

3.2.5. Identified needs

The National Investment Plan for Agriculture indicates that reenergising the research and technical advice departments is a prerequisite to continue providing adequate services in rural areas. In addition to the investments and activities described above, specific support is required in the medium and long term to reinforce the MARNDR's field structures. This includes:

- Additional support to regional Research/Development Centres with a view to reinforcing existing or planned missions: four centres are currently supported within the framework of on-going projects (DEFI/BID and RESEPAG/BM), and a fifth by a

Brazilian cooperation agency. To obtain a total of 10 operating centres (one per geographical department), five other centres would have to be restored or reinforced. Centres should be given the means to become regional hubs for applied research, the dissemination of technical knowledge and training (targeting MARNDR middle management as well as farmers and other players in the rural economy, such as craftsmen, managers of professional organisations, etc.). Cooperation between the centres, the DDA/BAC, the local governing bodies and other stakeholders should be developed on a systematic basis, and the body supervising the centres at Ministry level should be reinforced.

- Plans implemented with a view to developing vocational training in agriculture should include the establishment of three main channels: basic training (through regional centres); dedicated training for junior management (by restoring and re-opening Schools of Agriculture (the Artibonite Valley School (EMAVA), the Hinche District School (EMDH), the School of Agroforestry (EMAF), the Damien School of Agriculture and the School of Animal Husbandry); and managerial training for senior executives (graduate or postgraduate level).

- DDAs need specific support to upgrade their facilities and improve communication with MARNDR headquarters. At the same time, the BAC network should be reinforced and restructured, as its current scope reflects neither the needs nor the distribution of farmers across the country.

The required investment is estimated at US $40m, including US $15m to support five regional research/development centres, US $5m to support DDAs and US $20m to re-open schools of agriculture and train executives, which amounts to US $40m under the general category of "institutional support to agricultural public services" (MARNDR. *National Investment Plan for agriculture - Agricultural services and institutional support - Appendix 12: Institutional support to public agricultural services*. March 2010).

3.2.6. Improving the efficiency of MARNDR services

The Ministry has implemented a number of strategies to improve its services in the areas of:

- Planning

Just before the 2010 earthquake, the MARNDR was about to finalise and validate a document on Agriculture Development Policies for 2010 to 2025. This policy was in line with the National Strategic Document for Growth and Poverty Alleviation, and one of its strategic pillars was the reinforcement of agricultural services.

- Operating policy

MARNDR policy consists of assigning contractual partners (SMEs, NGOs, consultants and other teams) to carry out field operations. Similarly, the Ministry often relies on its regional services (DDAs and BACs) to implement planning, monitoring and supervising missions (Details can be found on www.agriculture.gouv.ht).

3.3 The Directorate of Fisheries and Aquaculture

3.3.1. Background: contribution of fisheries and aquaculture to national economy

Fisheries (most notably marine fisheries) play a significant part in the national economy. In 2004, the value of capture fisheries was estimated at US $30m, representing 2.5% of GDP. (Mateo, J. and M. Haughton. GCFI: 54. 2003). However, major discrepancies exist between different studies on the assessment of fisheries' output and the resulting job creation. The exact number of fishermen in Haiti is hard to reliably determine. Laserre et al (1985), cited by FAO 1999, reported an estimated 11,000 fishermen. The UNDP/FAO (1989) and Puga et al (1998), raise this number to 12,000. Breuil (2000) and Cuba Technical Assistance reported an estimated total of 30,000 during a mission in Haiti. In 2010, the MARNDR gave an even higher estimate, estimating that as many as 50,000 households derive their livelihood from fishing and related activities (Damais et al. 2008).

Discrepancies in the assessment of captures are illustrated by the following quotes, by two different sources:

"The sector comprises more than 50,000 fishermen and fish-farmers, which together produce around 16,000 tons of fish per year (only 320 kg of fish per fisherman per year), 400 tons of which coming from aquaculture, for a total population of 10 million" (Damais et al. 2008).

Annual captures of 6,000 tons/year generate an annual income of about EUR 16m. The estimated number of fishermen ranges from 25,000 to 30,000 and 100,000 jobs are derived from fish production activities (FAO/TCP/HAI/6712. 1999).

Similarly, discrepancies come to light when assessing the contribution of aquaculture to national fish production. According to W. Célestin (2000), national aquaculture production ranges from 220 to 360 tons/year, including output from the recently launched floating cage system. The MARNDR reports an estimated 400 tons/year (Investment plan, 2010) while some FAO sources report only 89 tons/year.

In all cases, even the largest estimate of production, at 400 tons a year (Badio 31 August 2012. ACP Fish II Workshop) is negligible, in particular when compared to total annual fish consumption, which is estimated at 23,000 tons (FAO/TCP.1999).

At the same time, the country imports approximately 12,600 tons of fish a year, valued at US $18m (Mateo, J. and M. Haughton. GCFI: 54. 2003) while exports are estimated at only 350 tons/year. More specific data shows that 23 tons of conches (lambi) were exported during the 2003-2004 fishing season and about 111 tons of spiny lobster per year between 1997 and 2007 (MARNDR. 2008).

3.3.2. Institutional analysis of DPAQ

Sector Management

Management of the fisheries and aquaculture sector is entirely assigned to the MARNDR. Within this Ministry, the department in charge of fisheries and aquaculture was formerly known as "Bureau des Ressources Halieutiques et Côtières (BRHC, Bureau of Halieutic and

Coastal Resources)", then "Service des Pêches et de la Pisciculture (Fisheries and Fish-farming Department)". The sector was initially placed under the jurisdiction of the Directorate of Natural Resources, but has now been granted its own Directorate, entitled Directorate of Fisheries and Aquaculture (Direction de la pêche et de l'aquaculture, DPAQ). This legal framework reform, implemented in 1987, has not affected the operating rules, organisation chart or powers of the DPAQ.

In 2002, the Directorate's employed staff stood at 22, including 11 technicians with an undergraduate or graduate degree and six with a Master's Degree (Hamilton and Associates 2009). In 2009 however, staff numbers had appeared to decrease. "DPAQ staff includes a small number of civil servants with a graduate degree and a group of field officers and "technicians", who have completed secondary education and often lack means of transportation. Some have benefited from specialised training of varying quality and duration. This lack of qualified human resources and logistics reflects the shortcomings of the Directorate in implementing its operations. As a consequence, all procedures carried out in the country in the field of aquaculture are done so on an ad hoc basis and without coordination, usually with the support of international funding or private investment. No monitoring of these activities is carried out at DPAQ level, and no historical data is available on programmes previously implemented by the Authorities" (AECID/MARNDR. 2009).

DPAQ mission

The DPAQ's mission is to gather and analyse statistical data and to assess and manage halieutic resources. The Directorate exercises its authority on capture fishing in marine, brackish and fresh waters, as well as on aquaculture. It does not have a separate budget from the MARNDR.

As previously indicated, the current national legal framework allows for the implementation of aquaculture projects on the territory without any prior notice to the DPAQ, as no authorisation has to be granted (except for the introduction of new species). This could be seen as an advantage for aquaculture initiatives, given that administrative procedures are reputedly lengthy and cumbersome. Nevertheless, when the required level of operating efficiency and operating method is achieved within the DPAQ, it will at least have to be informed of all projects being implemented.

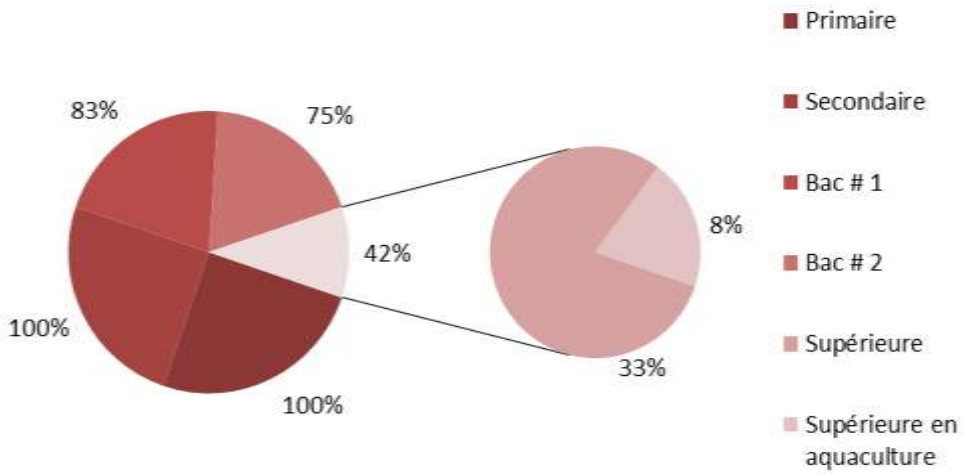
Results of the survey among DPAQ staff

Once the surveyors carrying out the field survey had completed their assignment, they were asked to complete a survey questionnaire of 91 questions (see Annex 8). 58% of the respondents were DPAQ staff, and the analysis was based on their answers. On the basis of the DPAQ's 2002 headcount (which could not be verified), 32% of its staff answered the questionnaire. As shown below, simple analysis of this data shows a number of trends with regard to the officers' profile and their opinion of the Directorate's operations at their level.

Academic background

75% of staff have pursued secondary education up to Baccalaureat level (A levels) and 42% have received higher education, including 8% with an aquaculture-related degree.

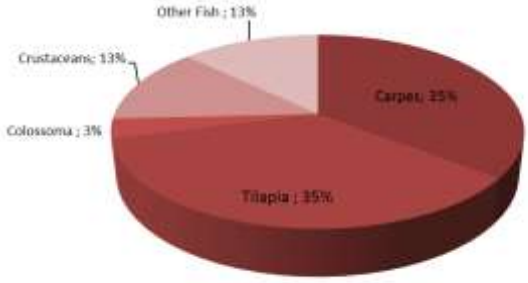
Academic background



Technical aquaculture training

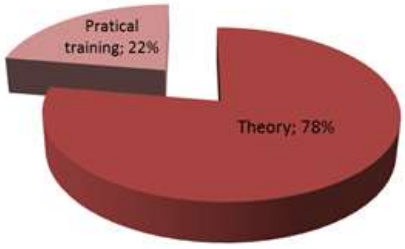
All of the staff have received specialised aquaculture training at some stage during their employment. The type and duration of training varies from a few days of intensive training, to work placements lasting several months, mainly carried out in Cuba. The species most commonly studied are tilapia and carp.

Species studied



Generally speaking, theoretical training greatly outweighs practical training, with the latter being completely sidestepped in some cases.

% of theoretical and practical training



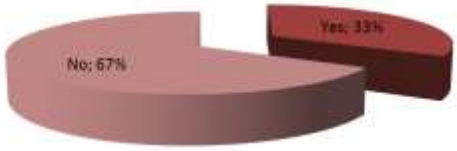
Job staisfaction within DPAQ

None of the officers are satisfied with their wages and 100% think they are paid low wages.

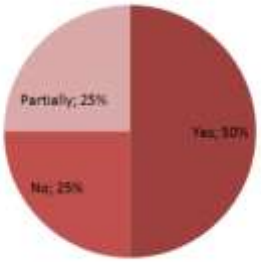
Are you staisfied with your wages?
NO : 100%

Answering further questions relating to salary was optional and only three respondents provided information: a technician (monthly wages of Gourde 7,400), a Head of Department (monthly wages of Gourde 8,000) and an inspector (monthly wages of Gourde 20,000). The minority of staff (33%) say they have access to social benefits and only 50% are satisfied with these benefits.

Social benefits

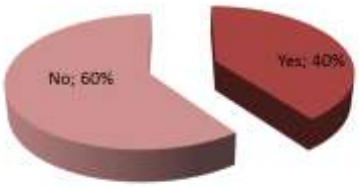


Satisfaction with social benefits

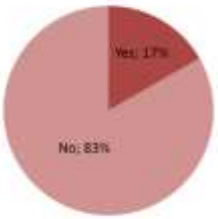


On the existence of a career development system, 50% said yes and 50% no.

Are you satisfied with the career development system ?

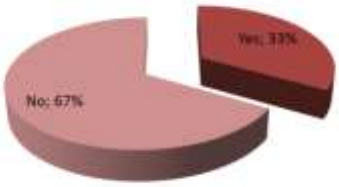


If yes, do you think it is clear-cut?

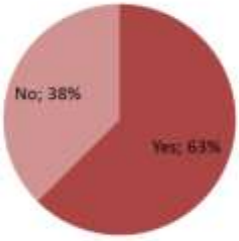


Staff lack accurate information about the career development sytem within their Department.

Does the DPAQ have a capacity building strategy ?



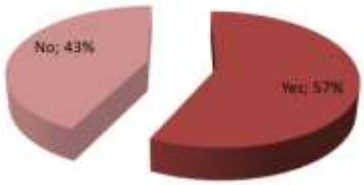
Do you think it is helpful to plan your career development?



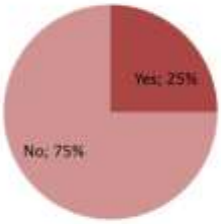
<u>100% of the respondents are dissatisfied with the capacity building strategy.</u>

When asked “Is there a performance assessment system in place?” 50% said no and 50% yes.

Is it operational?

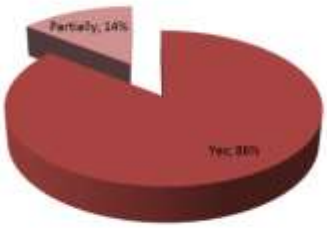


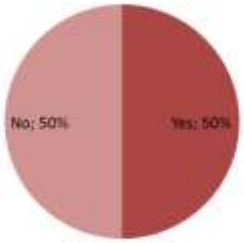
Are you satisfied with it?



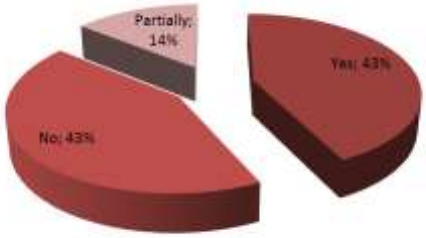
A performance assessment sytem seems to exist, but 75% of staff are not satisfied with it.

When asked: "Is there satisfactory internal communication within your department?" 86% said yes and 14% said to some extent. The satisfaction rate is 50/50.



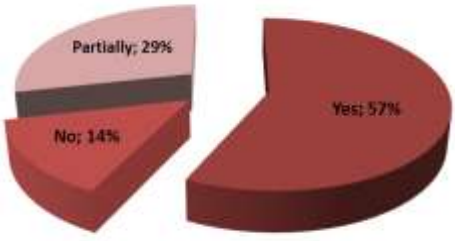


When asked: "Do you feel involved and do you think you get sufficient information about the organizational changes within your Department?" staff answered as follows:



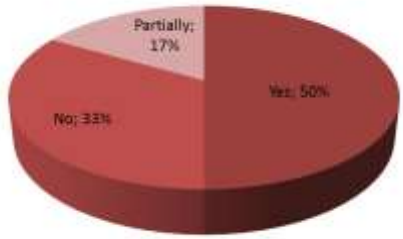
There is a fairly modest level of information and involvement within the DPAQ, but information appears to be sufficiently distributed and available.

Do you think your department's work culture is useful in providing products and services to the beneficiaries?



57% of staff feel that DPAQ action is useful in providing products and services to the beneficiaries.

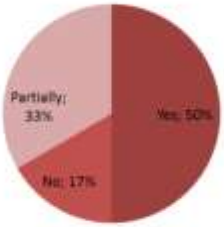
Do you think that the current state of things within your department encourages integrity aand honesty?

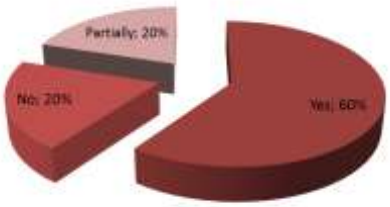


50% of respondants think that their Department fails, or does not fully succeed, in encouraging integrity/honesty.

When asked: "Is there a work planning system in use?" 63% answered that there is, at least to some extent:

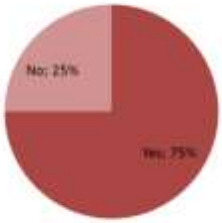
Is it satisfying?



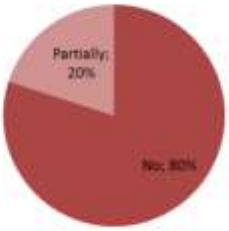


Infrastructures and equipment

Do you have an office ?

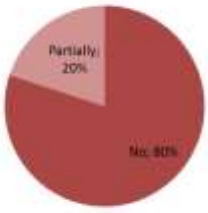


Is the state of the premises satisfying ?

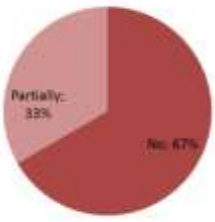


25% of staff do not have an office and 80% of those who have one said that it is in poor condition - the remaining 20% are only partially satisfied with it.

Are you provided with appropriate IT equipment?



Is it in good condition ?



Is it maintained free of charge?

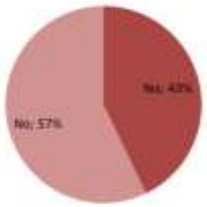
NO : 100%

Do you have to pay for its maintenance costs?

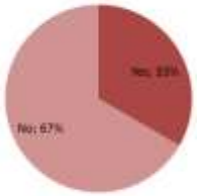
NO : 100%

This implies that, should the MARNDR or international donors provide staff with IT equipment within the framework of a support programme - which appears to be an exceptional event - this equipment would be out of service at the first breakdown.

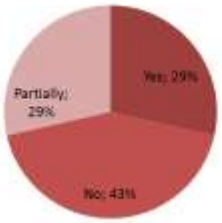
Do you have a vehicle for business travel?



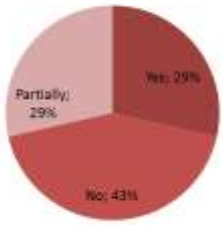
Provided by DPAQ?



Does the DPAQ cover its operating costs?



Is the budget for it adequate?



57% of staff do not have a vehicle for business travel (a majority of professional vehicles are motorcycles). Only 29% of available vehicles can be regularly used thanks to adequate operating budgets.

Needs identified

The findings of the survey, combined with those of other mission reports and studies, allow for the analysis of strengths and weaknesses that seem to be recurring in the operations of the Directorate of Fisheries and Aquaculture. The state of affairs reported in the framework of ACP Fish II is confirmed by the FAO (FAO/TCP/HAI/6712) and (ICT Net & AIMC. 2010)

Table 1. SWOP DPAQ

External factors DPAQ (aquaculture sector)	
Help	Hindrance
Existence of a national and international market	Staff attrition to projects led by NGOs
Technical and financial support of donors and NGOs	Very low aquaculture production levels
	Aquaculture activities are often unsustainable
Participation of international experts	Some donors act in their own interest rather than
Long history of aquaculture projects in the country	that of sustainable development
	The deciding bodies underestimate aquaculture potential
	Non-realistic proposals put forward by some

	experts Under the legal framework, aquaculture projects are often not reported to the DPAQ
Internal factors DPAQ (aquaculture sector)	
Help	Hindrance
Staff can benefit from stable positions Staff demonstrate multidisciplinary knowledge Opportunities to train abroad Sufficient distribution and availability of information	Often inadequate budget, in particular for vehicles and IT equipment No separate budget for the Directorate Career development for staff not clear-cut Wages deemed too low Cumbersome procedures slowing down the implementation of projects Persisting inability to make good use of the Pont-Sondé station

Having no separate budget, lacking clear institutional direction and lacking technical support, the Directorate struggles to successfully implement the operations falling within its remit. The field survey demonstrated that fish farmers are in dire need of technical support, particularly in those geographical departments where qualified human resources are hard to come by.

The needs of the Directorate are similar to those of the Ministry as a whole. The very low level of aquaculture production, as opposed to larger agricultural productions and livestock farming, compounds the difficulties.

Due to these drawbacks, the role of the DPAQ is generally limited to providing advice to the private sector, processing administrative files and making the occasional vague and usually unsuccessful attempt at enforcing the current fishing laws and regulations (Hamilton and Associates, 2009).

Although substantial amounts are invested in the fishing and aquaculture sectors by various donors, the DPAQ is in a situation of constant financial deficit. Accordingly, donors are more likely to work with NGOs, consultancy firms and research/teaching institutions rather than with governmental agencies.

Suggested improvements at institutional and organisational levels

The following is recommended:

- Strengthen and develop long-term collaboration with specialised stakeholders and bodies in the sector
- Implement an on-going technical training programme with a focus on mastery of current aquaculture production techniques, namely through work placements in private or public aquaculture sites
- Improve overall working conditions (salaries and benefits) with a view to motivating staff members and implement a clear career plan and internal promotion system based on merit-rating, at all levels
- Once aquaculture projects start demonstrating notable success, enlist the involvement of DPAQ staff in these projects so that they can become ambassadors for Haitian aquaculture
- Make sure that the Directorate has a separate and yearly renewed budget that adequately covers its needs in terms of infrastructures (offices), vehicles (motorcycles) and which, most importantly, covers operating costs such as fuel and oil for vehicles, acquisition costs and maintenance of IT equipment and GPS units.

Seeking access to financial resources granted by donors is a possibility, but it is important to bear in mind the following statement, made by a project officer: "Having qualified staff and adequate infrastructure and logistics is not enough. The Directorate also needs a separate budget of its own, renewed year after year, so that it can establish and pursue a long-term work plan rather than living hand to mouth and restricting its activities due to lack of funding" (PNUD DP/HAI/78/004).

3.4.1. Other istitutions involved in Fisheries and Aquaculture

A number of other Ministries and institutions are involved, to varying degrees, in fisheries and aquaculture.

The Ministry of Environmental Issues (Ministère de l'Environnement, MDE)

"The Ministry of Environmental Issues was founded in November 1994 by the Haitian Government, with a view to promoting sustainable development and the preservation of the environment. The tasks are to:

- Define, enforce and guide Government environmental management policy
- Ensure sustainable management of biodiversity and protected areas
- Guarantee a better and safer living environment for the population
- Protect, restore and promote the natural heritage of the country
- Support local authorities in their efforts to protect the environment
- Monitor and regulate any public and private activity relating to the environment
- Raise environmental awareness and promote a national culture of environment preservation
- Make sure natural resources are sustainably used" (www.mde-h.gouv.ht).

This last task underpins the MDE's involvement in aquaculture projects.

The College of Agronomy and Veterinary studies (FAMV)

This institution has demonstrated strong involvement in aquaculture and inland fishery projects and remains a key partner in the Hill Reservoirs Project (PNLCH). The College used to belong to the MARNDR but is now supervised by the State University. It still however receives ad hoc funding from the Ministry.

Kiskeya University

Although this university does not provide tuition or training in the specific area of aquaculture, it is able to contribute to specific spheres such as remote sensing and geographic information systems (GIS).

The following ministries are also occasionally involved in the aquaculture sector, for example in the areas of exports, tax incentives and other general policy:

- The Trade and Industry Ministry
- The Planning and Cooperation Ministry
- Others.

The Investment facilitation Centre (Centre de Facilitation des Investissements, CFI).

"The Investment Facilitation Centre is an independent governmental body created in 2006. It is supervised by the Trade and Industry Ministry, and stems from a partnership between public and private sectors. The CFI is intended to be a hub for all investors, making it possible for them to go through the whole investment process in one single administration. It reduces the time needed to register a company and the transaction costs.

The CFI's mission is to foster the development of investment in Haiti by:

- Implementing strategies and policies to promote investments
- Offering customised guidance for Haitian and foreign investors, and helping them through the stages of the investment process" (www.cfihaiti.net).

The CFI could play a major part in the preliminary stages of aquaculture development in Haiti.

3.4.2. Laws and regulations governing the fisheries and aquaculture sector

The Decree of 27 October 1978, published in Le Moniteur / 81 le 20 novembre 1978 is still in force to govern the fisheries and aquaculture sector.

This decree governs the practice of fishing activities and stipulates that foreigners – whether individuals, companies or cooperatives – must obtain a fishing license. The Decree comprises 147 articles organised into the following 10 chapters: General considerations (1), Exercise of the public right to fish (2), Fishing equipment (3), Fisheries (4), Expiry, termination and cancellation of fishing licenses (5), Fishing and preservation cooperatives (6), upriver fishery (7), Water pollution and preservation of certain species (8), Penalties (9) and Special provisions (10).

The DPAQ is directly responsible for implementing some of the provisions of the Decree, and in particular must:

- Make sure halieutic resources are sustainably managed, in particular by deciding on and enforcing the end date of lobster and lambi fishing seasons, and enforcing a maximum legal mesh size for fishing nets.

It must also:

- Preserve wetlands and aquatic habitats
- Provide institutional support to the sector
- Collect and analyse data on fisheries
- Monitor, strengthen and regulate activities
- Control technologies used in the transformation process and make sure quality standards are enforced
- Cooperate with fishermen communities to sustainably manage natural resources.

3.4.3. Updating legislation

In 1986, the FAO TCP/HAI/4509 Tavares De Pinho project demonstrated the flaws and inconsistencies of the fishing laws and regulations in Haiti. Since then, these laws and regulations have not been updated or revised.

A further review of texts relating to environmental regulations, which included those governing fisheries and aquaculture, was carried out in 2001 (PNUD/UNOPS/HAI/92/001). Even if the laws and regulations were better adapted to the needs of the sector and to new sustainability standards (FAO Codex for responsible aquaculture), the authorities would probably experience serious difficulty in enforcing them, as is already the case.

The Haitian government has not yet endorsed a new national fishing policy. A draft Fisheries Management Plan was drawn up in 1999 with the help of the FAO, but has not been implemented due to a lack of funding and of other resources. The main objectives of the Plan are to:

1. Restore damaged habitats
2. Meet basic literacy targets in fishermen communities
3. Introduce and implement appropriate fishing gear and equipment
4. Provide advanced training in monitoring and management of fisheries
5. Assess stocks.

Recent projects involving Haitian representatives, such as 'The Caribbean Common Fisheries Policy' should accelerate the enforcement of a new and better adapted fishing legislation.

Upgrading the laws and regulations is essential to the development of Haitian aquaculture. Table 2 shows how the following countries and regions, which have modernised their aquaculture legal framework, have seen substantial development in the sector. No such developments have occurred in Haiti, which has failed to implement these changes.

Table 2. Modernisation of legal framework and production, 1980-2010

Country	Restructuring of institutions	Production 1980 t/year	Institutions in charge	Date of aquaculture law	Production 2010 t/year
Costa Rica	1994	27	Institut costaricain des pêches et de l'aquaculture (Incopesca)	2003	26 000
Chile	1978	2 088	Service national de la pêche (Sernapesca)	2003	713 241
Brazil	1989	3 737	Secrétariat Spécial de l'Aquaculture et de la Pêche (SEAP)	2003	480 129
Guatemala	2000	-	Unité d'aménagement des pêches et de l'aquaculture (UNIPESCA)	2005	22 792
Panama	1995	180	Direction nationale de l'aquaculture (DNA)	1997-99	6 248
Nicaragua	1993	-	Administration nationale de la pêche et de l'Aquaculture (AdPesca)	2004	16 972
Cuba	N/D	2 300	Direction des pêches et de l'aquaculture	N/D	36 000

Guyana	N/D	-	Administration nationale de la pêche et de l'Aquaculture (AdPesca)	1977	488
Haiti	N/D	50	Direction de la Pêche et aquaculture (DPAQ)	1978	360

3.4.4. MARNDR's strategy for the development of aquaculture

The Ministry has shown interest in developing aquaculture for many years. The many internationally-funded fish-farming awareness projects that have been carried out have mainly been implemented in cooperation with key government officials in charge of the sector. Fish-farming has seen substantial development in the sub-region, which has reinforced interest, and accordingly, aquaculture is identified in strategic policies as a high-potential sector.

Since 2008, the MARDNR has assigned experts to assess the development potential of various agricultural sectors, including aquaculture. "Like other economic activities, the sector of marine and inland fishing and aquaculture was negatively impacted by poverty, which hindered the exploitation of coastal marine resources and prevented the development of aquaculture. Once these activities start to develop, they will contribute to poverty alleviation and food security" (National Programme for the Development of Aquaculture in Haiti. 2010-2014. MARNDR July 2010).

Growth forecasts were:

- An increase in production from 200 to 2,000 tons by the end of 2010
- An increase in production from 2,000 to 4,000 tons between 2011 and 2013.

This analysis also included a section on the funding requirements and objectives of the sector Quote from the MARNDR. Plan, 2010:

"The Investment Plan for the development of agriculture drawn up by the MARNDR sets out the strategy needed to ensure the development of the fisheries and aquaculture sector. This strategy supports the approach put forward by the 2009 Working Group on Competitiveness, appointed by the President, as regards public-private partnerships and exports. The programme will be based on the requirements of the code of conduct for sustainable fishing and will support the Government, in particular the Directorate of Fisheries and Aquaculture of the MARNDR, in its efforts to manage natural resources and rural development. It will endeavour to reinforce the fisheries and aquaculture sector, and thus contribute towards achieving the Millennium Goals and alleviating poverty, improving food security and reducing the impact of natural disasters. The program will target small producers on the national market as well as larger enterprises on the national and exports markets. Particular attention will be paid to minorities and women."

The guidelines set out in the investment plan are aimed at creating a sustainable source of income, and are in line with the Programmes for the Development of Marine Fishing, Aquaculture and Inland Fishing, which were devised in 2009 by a working group comprising private sector stakeholders, MARNDR representatives and professors from the College of Agronomy and Veterinary studies.

As far as aquaculture and inland fishing are concerned, the following goals need to be achieved:

- Analysis of the sector and review of commercial policy
- Assessment of resources and of aquaculture potential
- Stocking of ponds
- Creation of aquafarms (cage and pond production)
- Increase in the output of existing hatcheries and creation of new ones
- Rehabilitation of aquafarms and assessment of their potential
- Production of fish feed
- Studies rolled out on fish processing, conservation and marketing
- Provision of technical assistance to fishing communities.

Through the use of loans granted by financial institutions or other means, the programme will seek to create favourable conditions for private investment, in order to increase production by 30,000 tons/year over a 10-years period (5,000 tons in fisheries and 25,000 tons in aquaculture). Of this additional output, some 11,000 tons/year could be exported. The programme is expected to generate around 70,000 jobs and increase GDP by US $100m per year. The total projected private investment is US $ 50m.

Table 3. Summary of costs of the "Fisheries and Aquaculture" component

Activities	Budget (USD)
Short term	**5,700,000**
Implementation of organisation and legal structure	300,000
Studies on processing, conservation and marketing	100,000
Assessment of resources and aquaculture potential	1,000,000
Creation of pilot fish farms	300,000
Raising awareness / training / technical assistance	1,500,000
Creating hatcheries	500,000
Acquiring fishing gear and equipment	2,000,000
Medium / long term	**26.800,000**
Strengthening the institutional background	3,000,000
DAPQ institutional reinforcement	500,000
Rehabilitation of fish farms	2,000,000
Further development of fishing facilities and infrastructure	10,000,000
Stocking ponds and reservoirs	3,000,000
Training / technical assistance	8,000,000
Monitoring and appraisal	300,000
Total	**32,500,000**

Source: "Draft budget for MARNDR's projected operations in the fisheries and aquaculture sector" (MARNDR 2010).

Growth targets for aquaculture production increase exponentially in MARNDR reference documents. As forecast in the Investment Plan, production should reach 2,000 tons by the end of 2010, reach 4,000 tons in 2013 and eventually stabilise at 25,000 tons/year.

Despite these ambitious objectives, there has been little real growth: according to the most optimistic estimate, current aquaculture production is somewhere between 400 and 600 tons/year and there is no reliable data available for a more accurate estimate (Badio. Personal communication. 2012). Therefore, these thousands of tons of fish that exist on paper are still merely theoretical.

4 AQUACULTURE, A BOOMING AGRO-INDUSTRY

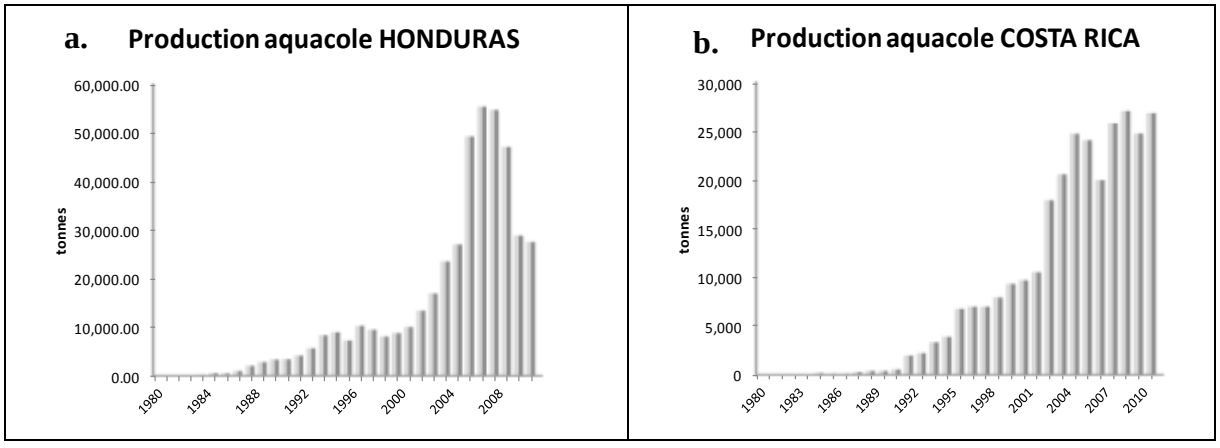
Of all worldwide sectors producing animal source foods, aquaculture is expected to continue as one of the fastest-growing. Over the next 10 years, the total production of capture fishing and aquaculture is expected to surpass that of beef, pork or poultry. Over the past 30 years (1980-2010), the global production of farmed fish for human consumption has multiplied by a factor of 12 worldwide, with an annual growth rate of 8.8%. Global aquaculture production increased from 47.3 million tons in 2006 to 60 million tons in 2010 with an estimated value of US $119 billion. Employment in the fisheries and aquaculture sector has increased faster than in agriculture. In many regions, these jobs have allowed young people to remain in their communities and it has also helped to reinforce economic independence in isolated locations. Direct jobs in aquaculture in the Caribbean increased from 69,000 in 1999 to more than 248,000 in 2010 (Fisheries and aquaculture report, FAO 2012).

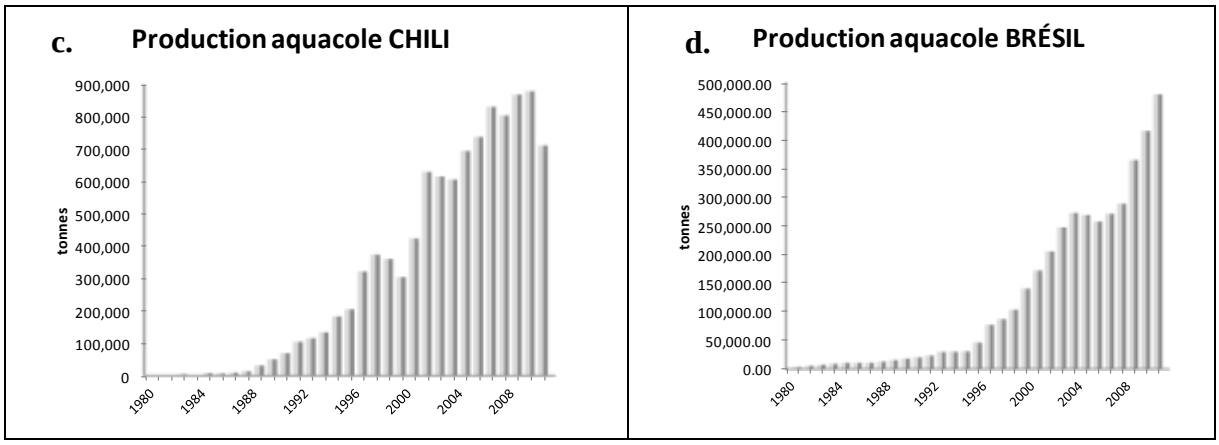
4.1 Aquaculture in the sub-region

4.1.1. History of aquaculture in the sub-region

In South America, aquaculture production soared from 869 tons in 1970 to about 1,900,000 tons in 2010. In the Caribbean, production increased from 350 tons in 1970 to 42,000 tons in 2009 (FAO 2012). The following graphs (Figures 1a-d) illustrate this growth in different countries of the sub-region.

Fig.1 Growth in aquaculture production in Honduras, Costa Rica, Chile, and Brazil





4.1.2. History of aquaculture production in Haiti

At the same time, aquaculture in Haiti stagnated, with production ranging from 200 to 400 tons a year, depending on the source. For instance, in 2009, the FAO estimated production at a mere 82 tons a year, whereas Winston Celestin (2002) claimed that production varies from 220 to 360 tons a year, including cage production.

Several aquaculture projects have been developed in different areas of the country, and have mobilised considerable funding from international donors, charities and occasionally, limited private investment.

The following table shows that marked and on-going efforts have been made for decades to develop freshwater aquafarming.

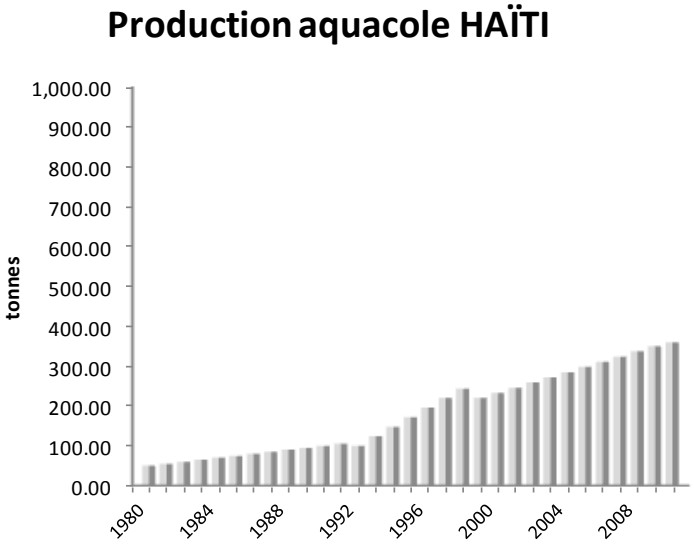
Table 4. History of aquaculture projects in Haiti since 1950

History of aquafarming projects in Haiti (non exhaustive list)			
Period	**Donor/initiator**	**Location**	**Type of project**
1950-1954	FAO	Damien	Technical assistance
1950-1955	FAO	Zone rurale PAP	Educational/Production
1971, 1973 and 1978	USAID	Damien	Rehabilitation project management
1971 now	Religious communities/NGOs	Various regions	Educational/Production
1971		Limonade	Educational/Production
1978	NGO Protos(Belgium)	Fort-Liberté	Educational/Production
80's	NGOs, religious communities	Vialet	Educational/Production
1981	NGOs, religious communities	Christianville	Educational/Production
1982	NGOs, religious communities	île de la Gonave	Educational/Production
1983	NGOs, religious communities	Chambellan	Educational/Production
80's	NGOs, religious communities	Gébeau	Educational/Production
1984	FAO	Pont Sondé	National scope hatchery
1988	FAO, NGOs, religious communities	Christianville	Tech. assistance/fish culture station
1988 and later	FAO, NGOs, religious communities	Petite place Cazeau	Tech. assistance/fish culture station
1988 and later	FAO, NGOs, religious communities	Petite rivière à Nippes	Tech. assistance/fish culture station
1988 and later	FAO, NGOs, religious communities	Saut-d'Eau	Tech. assistance/fish culture station
1988 and later	FAO, NGOs, religious communities	Duparc	Tech. assistance/fish culture station

1988	FAO	Various regions	Introduction of species
1988-2000	FAO	12 regions	Educational/Production
1988-2000	FAO	12 regions	980 farmers, ponds 80 m2
1988-2000	FAO	12 regions	Training of 6 executives
1988-2000	FAO	12 regions	12 study visits of 2551 students-days
1988-2000	FAO	12 regions	Training (3) heavy equipment operators
1992	FAO/Private/USAID	Small rivers in Nippes	Support for the creation of 2 commercial farms
1992	FAO/Private/USAID	Plaine du cul de sac	Support for the creation of 1 commercial farms
1987	Canadian cooperation/private funds	Grande Saline	Feasibility study
1987	Canadian cooperation/private funds	Estère	Feasibility study
1997	Rotary Club/Caribbean Harvest Fisheries	Trois Rigoles	Educational/commercial farm
90's , now	Cuban technical assistance	Pont Sondé	Technicians for the hatchery / educational (rural environment)
1987-1990	N/D		Artificial water damming
1996-1999 now	PNUD/UE		Hill reservoirs
1999-2001	PNUD/UE	North-East	Hill reservoirs
2002-2004	FAO	South and Artibonite	Small-scale aquaculture
2005-2007	Canadian Cooperation	Central Department	Integrated fish farming project
2005-2006	FAO and OPEC	South and Artibonite Department	
now	American NGO	Fond parisien	Cement ponds
now	Opération Blessing	Croix des Bouquets	Covered pools intensive aquafarming
now	Taino Aquaculture, S.A	Lac Azuei	Floating cages
2006	Caribbean Harvest Fisheries	Croix des Bouquets	Hatcchery and floating cages
2010	Partners in Health/Clinton Global Initiative	Boucan Carré	Hatchery
2011-2012	Clinton Global Initiative/Operation Blessing	Lac de Peligre	Floating cages
Now	Haitian-american entrepreneur and a doctor from Boston	Sheridan proche Leogane	Earth ponds
2009	Food for the Poor	Petit étang Miragoâne	Floating cages
2006-2011	French cooperation	Lac Azuei	PRODESELA
2009-now	Spanish cooperation	South-East dpt	Develop aquaculture and inland fishing

Despite an impressive number of projects and substantial funding, (not estimated in the table), aquaculture production remains modest and there has been no substantial growth (Fig. 2).

Fig.2 Growth in Haitian aquaculture production 1980-2010



Reasons for failures

This brief historical analysis raises questions on how aquaculture has failed to develop: Why are there so few success stories? What are the maladaptive strategies that could go some way towards explaining these failures?

The following statement relates to aquaculture in Uruguay, but is also relevant to the situation in Haiti: "the subdued development of aquaculture in the country is the result of inconsistent research and development policies, a lack of qualified human resources, inadequate public infrastructure and a virtually non-existent cost-benefits analysis of intensive production" (FAO Uruguay 2012).

Fish farming: a profession that requires specific training

Fish farming may not be a highly technical job, but it still requires extensive training with an emphasis on practical training. In order to know how to produce fish, it is essential to actually produce fish rather than learning the theory about it. Aquaculture is clearly more demanding than most other types of breeding. A chicken farmer, for instance, sees his chickens every day and can therefore very easily check if they are eating normally, growing well, appear healthy and can see how many there are. It is a different story for fish, which live underwater. It is therefore very difficult to determine:

- What is happening underwater
- How many fish there are
- Whether they had enough food, or too much
- How much money will be earned from the sale.

Moreover, like all other productions, fish farming requires basic management training. Fish farmers need to be able to estimate needs for working capital, manage fish-feed stocks and market their products.

A sector in need of professionalisation

Most projects carried out to promote aquaculture established the activity as a parallel and supplementary activity to other agricultural productions. The main problem with this was that farmers who became amateur fish-farmers, having received little training and not having enough time to dedicate to it, found it difficult to keep up their efforts once the project had ended. Most of the time, the fish production resulting from such projects was modest, as was the income derived from it. Farmers soon became discouraged, all the more so when technical assistance stopped due to depleted funds.

Field operations scattered across the territory

The mapping of ponds visited (see Section 5 below) clearly shows that ponds and aquaculture projects were developed all over the territory. At first sight, this could be considered an advantage. Yet, the mushrooming of projects, carried out in various areas by a large number of different stakeholders (specialised bodies like FAO, NGOs and charities, etc.) had a negative "scattering" effect. If all of the funds invested in aquaculture had been concentrated on one area, the industry might have reached a critical mass. Aquaculture activities could have then started to become more sustainable.

Lack of pursuit of profitability

Despite a few encouraging signs, aquaculture in Haiti is still totally dependent upon ad hoc financial contributions from various development aid programmes, and there appears to be little motivation for profitability, which is, nonetheless, the only guarantee that these activities will survive.

As a consequence, although it has benefited from a large number of support projects, aquaculture production still falls short of expectations. The analysis of previously implemented development projects seems to demonstrate that, in most cases, their strategic guidelines did not reflect a desire for profitability, which prevented production from developing and reaching sustainability. This seems to apply in particular to several current floating cage projects. As part of these projects, the beneficiaries receive free cages, fingerlings and fish food, and share the income derived from output, or even keep all the income for themselves. Can this really be considered "sustainable aquaculture"?

Questionable technical choices

Several project developers seem to be disconnected from the country's realities, and to ignore technical and human limitations. For example, the selection of Bouccan Carré as the site for the Zanmi Lasanté hatchery is questionable, due to the poor water quality in the area (if the information given by the technicians is correct). Given that high water quality is a crucial for aquafarming, this issue has forced the project managers to purchase costly equipment, which does not seem a wise decision given the high level of technology required. Moreover, the technical knowledge required surpasses that of the staff met during the visit to the site. The result of this inconsistency is 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.

Fig. 3 Zanmi Lasanté hatchery and river

By contrast, the strategic choices of Opération Blessing reflect a desire for tangible results:

The water is pumped from the groundwater table and aerated, the stocking density is high and highly qualified technical staff is on hand at all times. The level of profitability resulting from these technical and economic choices is yet to be determined, but production is successful and carried out in a professional manner.

The team visited four recently created ponds in the Hinche region (PNLCH), under W. Célestin's technical supervision. The technical decisions behind the siting are questionable: the ponds are situated downstream of the lake embankment, but their water supply comes from pumping. In addition, there is no vegetation to protect the embankments from erosion. When we visited the site, gully erosion caused by rain had already caused damages. This infrastructure is likely to be seriously damaged by rain in the near future. About US $50,000 has been invested to build these ponds over approximately 3,000 square metres, but it has not even occurred to the project managers to safeguard them against erosion.

Fig. 4: Ponds lacking anti-erosion measures, PNLCH, Savanne Baptiste area, FAO, Renald and Maxi

Low productivity of the Pont-Sonde hatchery

When asked about the causes of the slow development of aquaculture, Haitian fish farmers often cite the difficulty of supplying their farm with selected fingerlings. Several floating cage projects, and many fish farmers, currently face with this issue. In particular, the managers of the Hill Reservoirs Project struggle to find enough fingerlings to stock their ponds. The team visited the Pont Sondé hatchery, which they visited for the first time in 2002. The hatchery is in operation thanks to Cuban cooperation, which resumed technical support after four years of absence, during which time the facility was abandoned and deprived of breeding stock. Despite the efforts of the highly skilled Cuban technicians, production is still well below the hatchery's potential. Since 2002, the hatchery has not been able to solve its serious water quality problem; funds are insufficient to buy a larger pump that would enable more water to be supplied from the groundwater table, to buy fuel for the electric generator, etc. In other words, production falls far short of potential. The hatchery is capable of producing 25 to 30 million larval fish and on-growing 10 million of them to 3 grams. These fingerlings sold to fishermen and on-grown to only 125 grams would represent a production of over 1,000 tons/year.

The Cuban technicians could not confirm current production data, but it was claimed during the validation workshop the DPAQ that in 2012 production stood at 18 million fingerlings ranging from 3 to 5 grams. Management continually fails to boost production of fingerlings in this facility. This is all the more regrettable because this station has high quality breeding stock comprising several different species, including Asian carp and *Colossoma macropomum*.

5 Assessment of aquaculture potential in Haiti

5.1. Suitable areas identified

5.1.1. Mapping exercise - methodology

For proposing potentially suitable areas where earth pond aquaculture could be encouraged, GIS is a useful tool to model biophysical parameters both favourable and/or unfavourable for construction. Based on the available GIS layers gathered from various secondary sources (see Annex 9), four major favourable factors were modelled, namely:

- **Availability of permanent water**. This included the identification of flat flood plain land served by permanent rivers and areas around mapped lac collinaire (saddle ponds), larger lakes, and mapped permanent springs
- **Access to soils with high clay content.** The impermeable clay reduces the need for other materials to be bought and used to construct ponds
- **Flat Land** (slope less than 2 degrees); obviously fish farms need less infrastructure if constructed in an already flat area
- **Areas of existing suitable land cover** (irrigated lands – especially for rice and cereal cropping, and land not in other use at present). Rice and cereal are usual food stocks for aquaculture.

Four major unfavourable factors were then also modelled, namely:

- **Proximity to areas already heavily developed** (continuous urban zones, transportation areas and industrial sites), where land is more expensive, subject to other competing land uses and with potential for pollution
- **Land areas** either already or proposed to be **protected** (e.g. National Parks), where any new development will be excluded
- Near to **rivers that can flood** (in this case all primary and secondary rivers were included in the study, with different arbitrary units), to avoid causing damage to infrastructure, sedimentation or pollution
- **Areas prone to the effects of accelerated erosion** (both from hill slope and coastal erosion) which could cause damage to infrastructure or sedimentation.

For each factor identified, various pre-processing occurred; primarily selecting those features from the total dataset identified as a factor (e.g. selecting areas or continuous urban development, airports and ports and industrial sites from a dataset of land cover). In some cases not just the area of the feature itself might be favourable or unfavourable, but also the surrounding area, and GIS could be used to identify this buffer zone. Once the selections and buffers were made, the favourable factors were intersected together to identify the areas where all four parameters existed together and the unfavourable factors were unioned together to identify those areas where at least one parameter existed. The principles behind these rules were that while it is preferable to have all four favourable factors at a site, the presence of only one unfavourable factor would render the location unsuitable.

The results from the intersection of favourable and union of unfavourable parameters were then put together, and the areas that were unsuitable subtracted from the areas which were deemed generally favourable. The final layer was compared to the proximity to spring and other standing water and combined with a map of departments to allow statistics on the areas in each respective department to be calculated.

Before the results are explained, it should be appreciated that this kind of countrywide modelling has been subjected to a number of assumptions and generalisations that could cause errors or misinterpretations. First of all, almost all data used were collected for other purposes and might not be perfectly suitable for the modelling of potential suitable aquaculture sites. Much of the data may be out of date or incomplete, and open to various interpretations. Little data collected had associated metadata so much of it had to be interpreted as visualised in the GIS without the assistance of documentation or outside assumptions.

Some key datasets that would describe the parameters better (e.g. soils and clay content) were not available, so surrogate date (in this case geology) had to be used and very broad brush assumptions made on what constituted a sensible interpretation. In some cases data were found that by description could be used but were of too coarse a scale, positionally inaccurate, or without sufficient explanation of their detail to make them useful within this analysis.

All factors used have been given equal weighting in the analysis; any attempt at ranking might skew results unduly in favour or one factor or another, and in many cases the relative importance of factors may alter from site to site. Several factors are autocorrelated (e.g. alluvial plains and flat land) so ranking of any factors might have increased bias towards some factors.

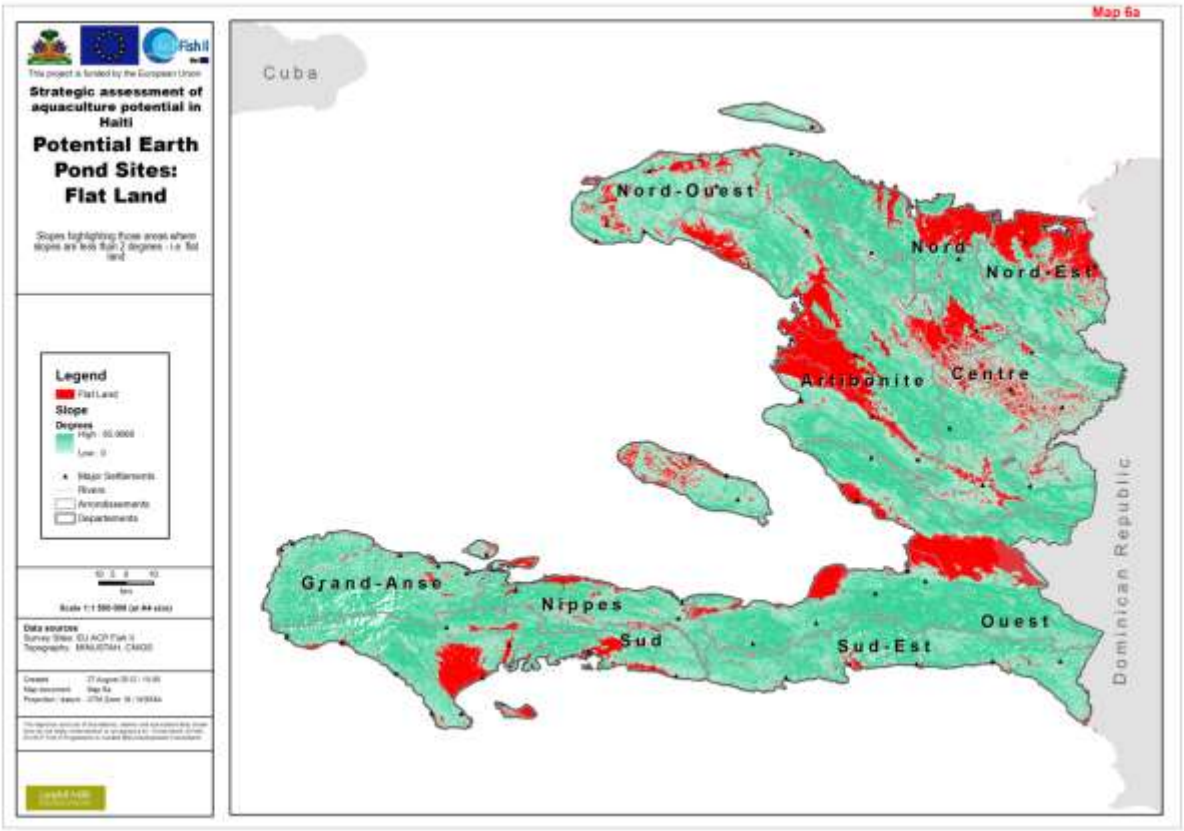
Finally, in interpreting the modelling results, one should understand that the combination of so many multiple layers of varying quality, accuracy and scale means the final layer only

gives an indication of suitable areas, not a definitive boundary, zone or detail. First, the GIS data model used (vector) creates artificial hard boundaries between suitable or unsuitable areas for both one factor and a combination of factors, whereas in reality, the degree of suitability is more likely to decrease incrementally from one zone to another. Second, because all datasets cover the whole of Haiti, where data were originally mapped down to 1:250 000, (1: 300 000 for geology), the information should not be directly transferred to determining an aquaculture facility, given micro-pedological and other site issues which will not be identified from countrywide data. Third, areas denoted are only indicative of suitability given available modelling factors; the analysis excluded those factors which are not so clearly geographical in their variation, including social and economic variables, institutional arrangements and supply chain mechanisms, or not available as GIS (e.g. land ownership and cadastre).

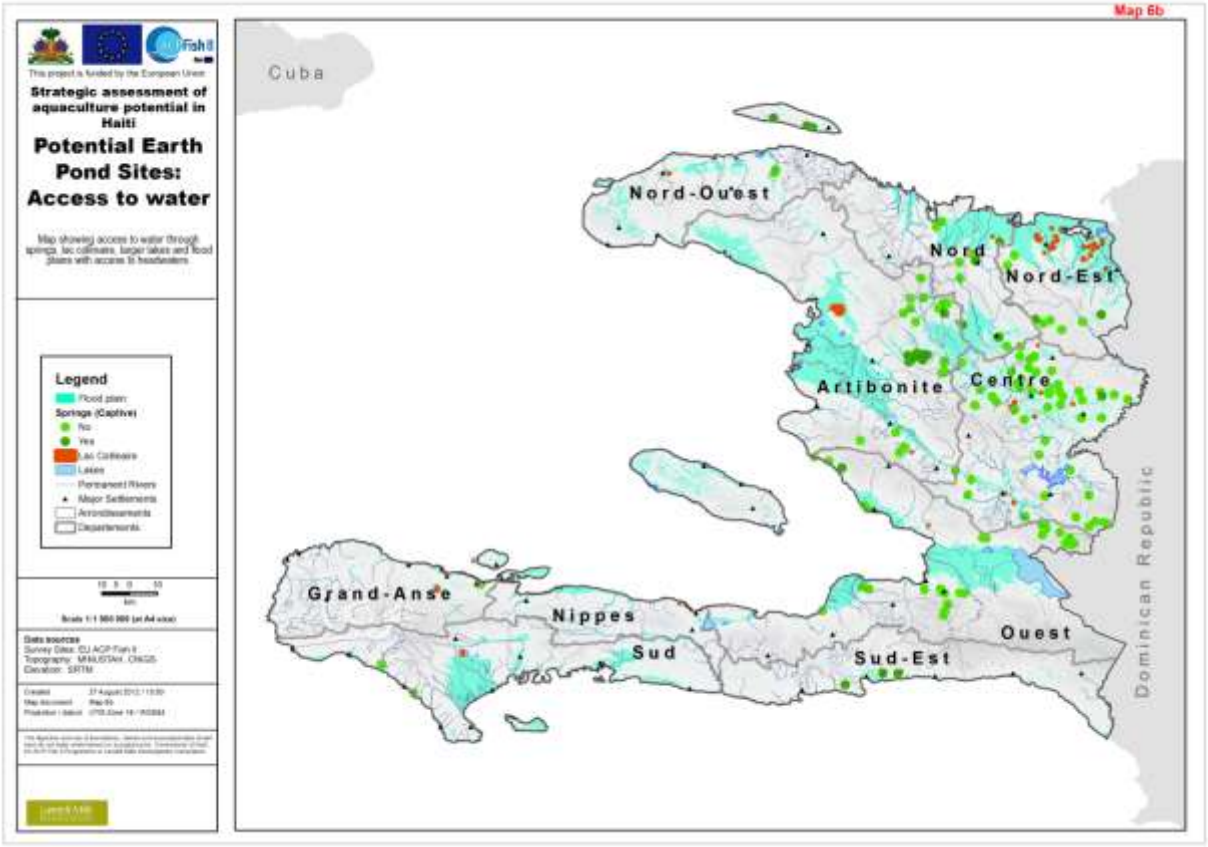
5.1.2. Mapping exercise - results

Looking at the original data selections that fit the favourable factors, there are eight major flat land areas or plains (Map 2), i.e. areas with less than 2^{o} slope that would be appropriate locations for fish pond aquaculture, chief amongst these being the Artibonite Valley, around Port au Prince, Les Cayes and in Nord-Est Department. Additionally there are smaller coastal plains and narrow river valleys with some flat land, and some higher plateaus and fragmented areas of flatter land in Centre, Nord Ouest and Nippes Departments. Many of these can be seen as surrogates for access to permanent water from rivers (Map 3).

Map 2 Flat land

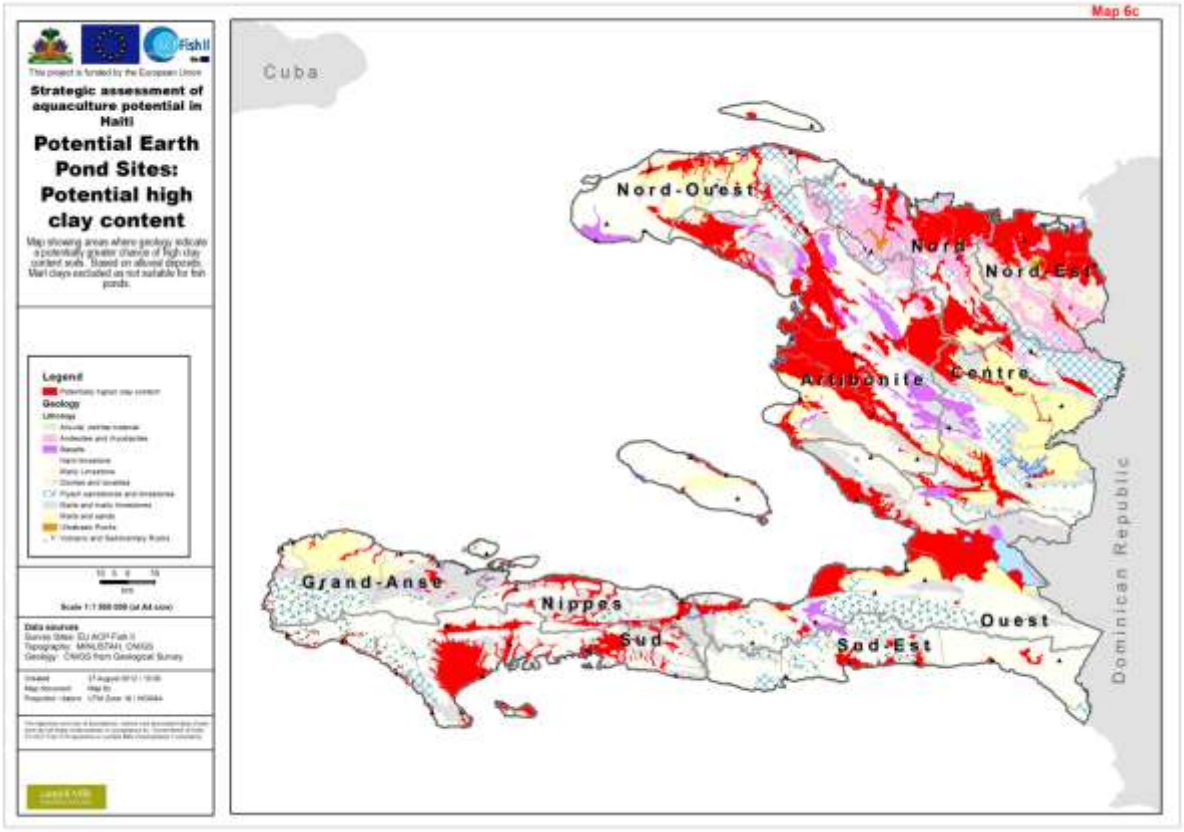


Map 3. Access to water

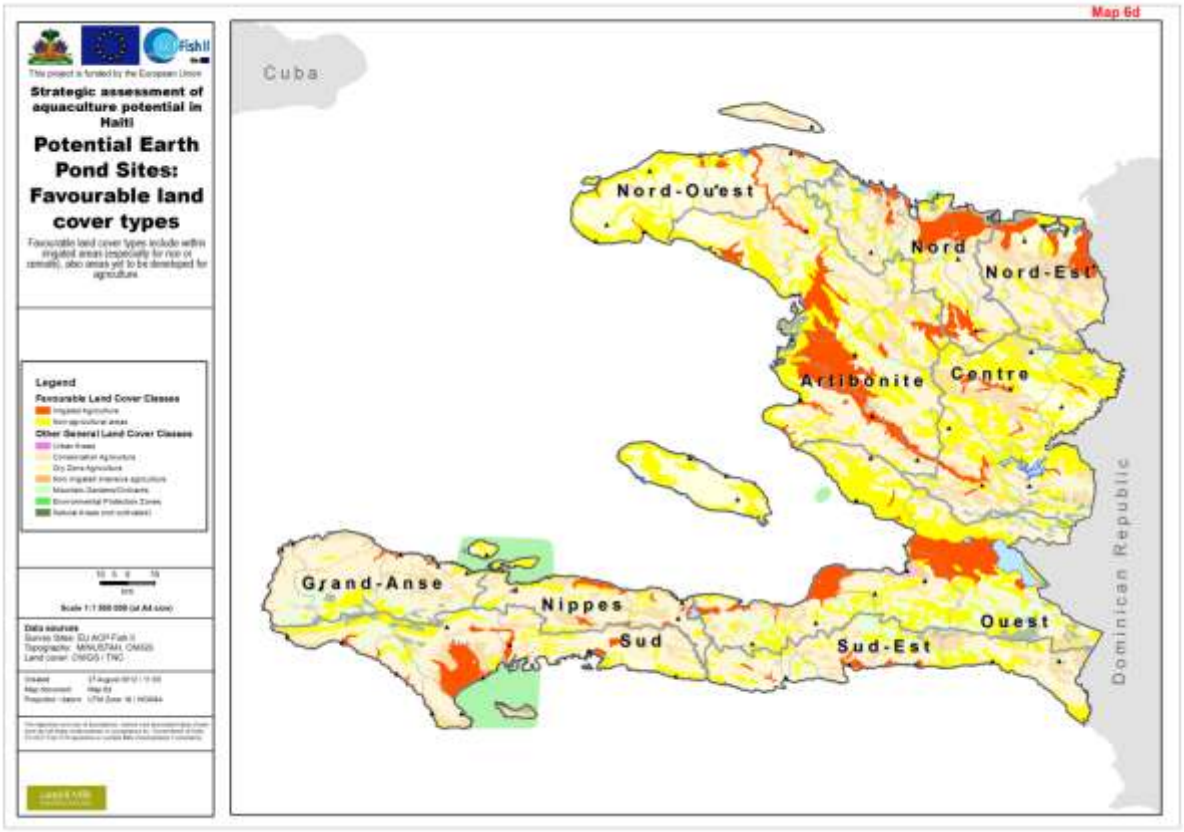


Additionally the concentration of springs in eastern Artibonite and Centre, and lac collinaire in the hilly and more mountainous regions of northern Haiti and major lakes such as Peligre, Lac Azuie and Etang de Miragoane could provide ample water. Regrettably no suitable GIS layer of soil exists, and certainly none demonstrating clay content, so despite its limitations, geology was used as a surrogate layer (Map 4). While clays are present in abundant marls, their calcareous nature prohibit their suitability for pond construction, and only alluvial deposits, while mixed and unsorted, would suggest suitable clay contents at this scale of modelling. These generally tie well with the flood plains already delimited as suitably flat. Similarly, when describing the suitable land cover types, the most preferred (i.e. irrigated lands) are also flood plains in alluvial deposits (Map 5). Rice and cereal cropping zones are most suitable given their use as stock feed, but the available GIS layer could not be further subdivided into irrigated agriculture for rice and cereals against other crops (e.g. fruit, cocoa, coffee). An additional layer used was “areas not currently under agricultural development”. Again this could not be disaggregated into vacant lands against those not suitable for agriculture (e.g. saline ground, sand dunes) but other factors acknowledged that these are unsuitable so were discounted at a later stage.

Map 4. Soils with high clay content

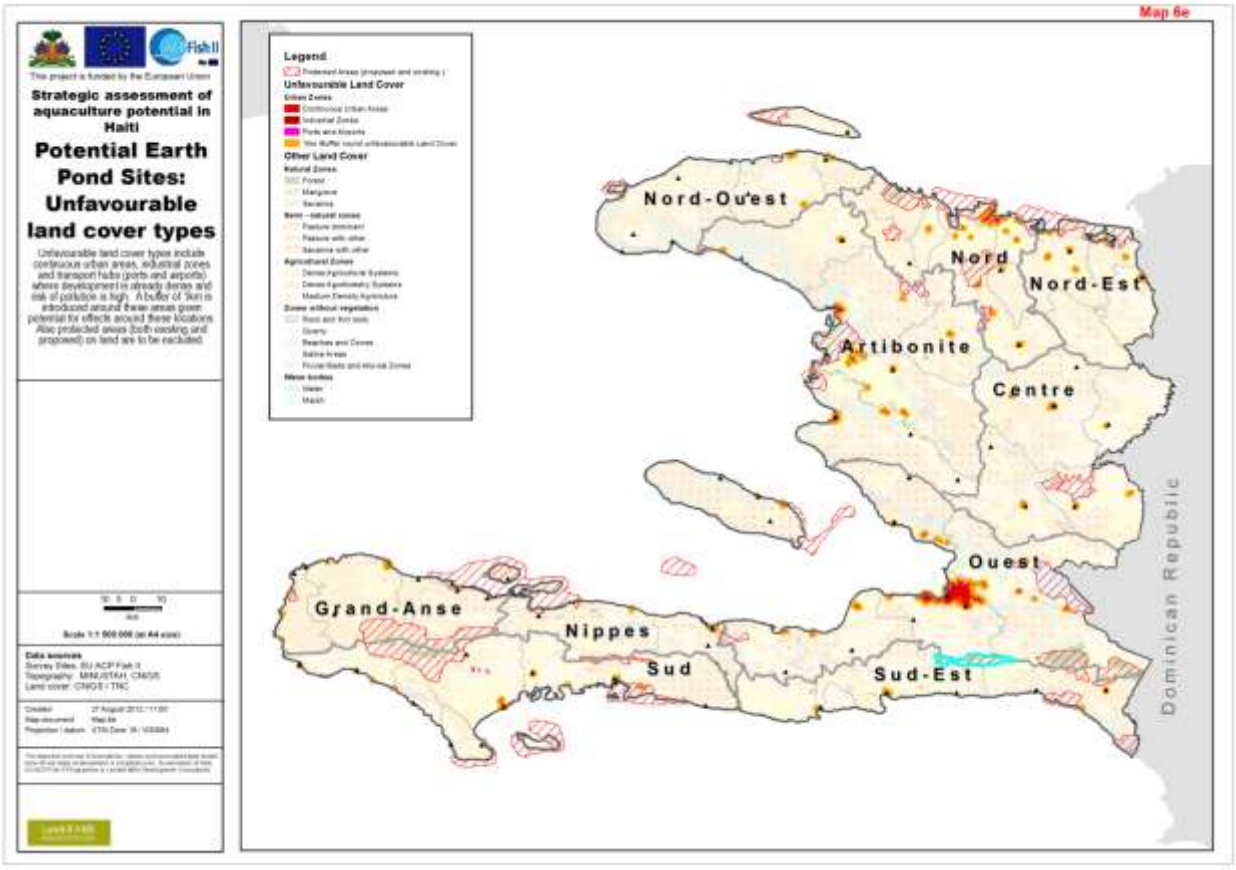


Map 5. Flood plains in alluviale deposits

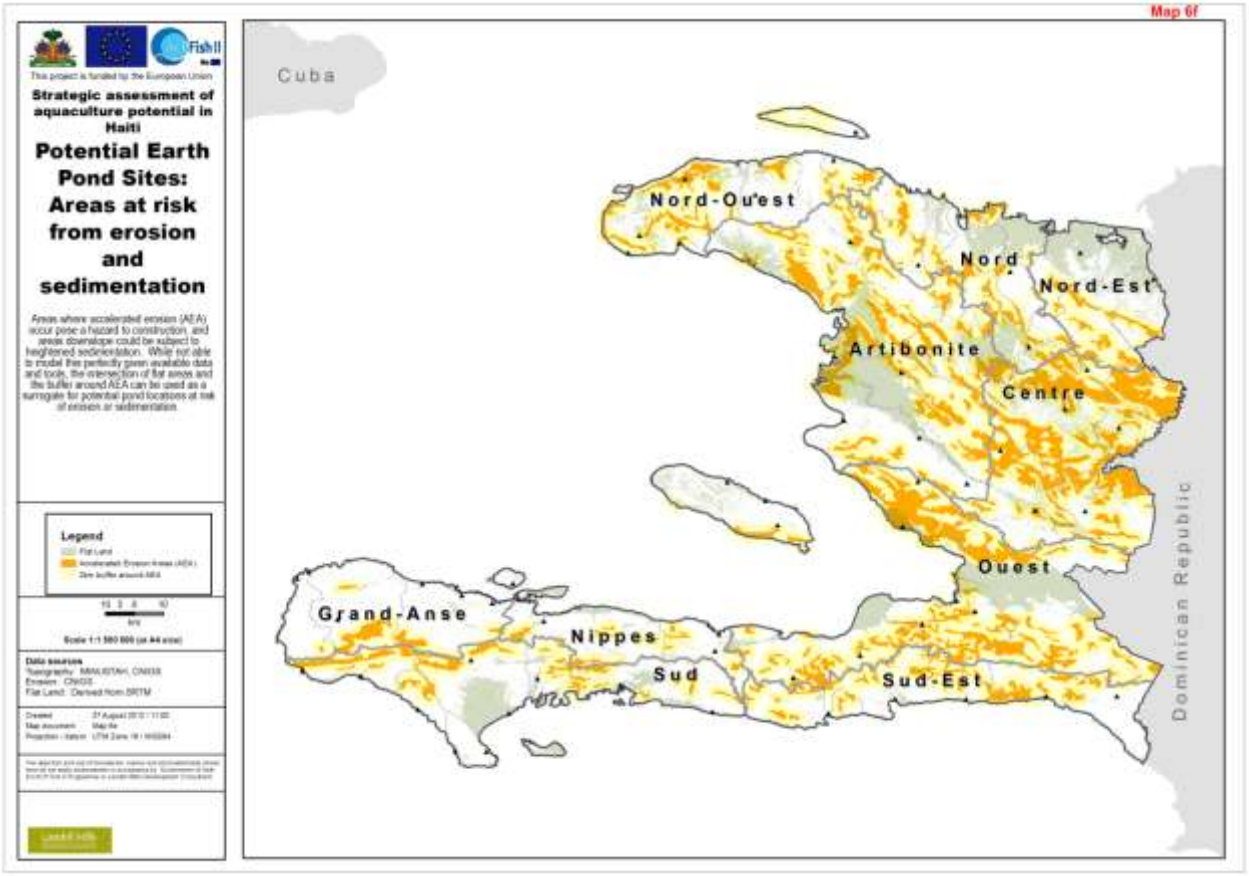


In terms of unfavourable factors, both existing and currently proposed protected areas were excluded from the analysis (Map 6). This has the effect of excluding some potentially favourable areas such as part of the Artibonite coast and Lac Azuei. Additionally small areas around areas of continuous urban and industrial developments were excluded, as were areas around transport facilities such as ports and airports. While urban markets can be seen as more profitable for producers, the high price of land and the potential for pollutants to affect earth ponds diminish their suitability. Finally, large areas of Haiti are losing soil through deforestation, seismic activity and poor agricultural practices. Zones of accelerated erosion from these areas and those along coastal margins have been demarcated. While the GIS analysis could not be sophisticated to model down-slope/downstream risk of landslip or sedimentation, the associated vulnerable areas of flat land near these zones could be identified and excluded from the analysis (Map 7). The major areas this affects are the coastal Artibonite flood plain, the Central Department plateau and some smaller valleys in Ouest, Centre and Nord Ouest departments. Some flood risk mapping has occurred at department level but the only nationwide dataset found was not deemed at a sufficient scale or accuracy to be synthesised with the other parameters; instead, the use of the river network maps were used. While water availability is key, siting ponds too close to rivers puts them at risk to flash floods, which could damage infrastructure, pollute waters or kill stock. Arbitrary buffers of 50m around smaller rivers and 200m around primary rivers give an indication of the risk zone only and can be seen to be widespread throughout the country (Map 8).

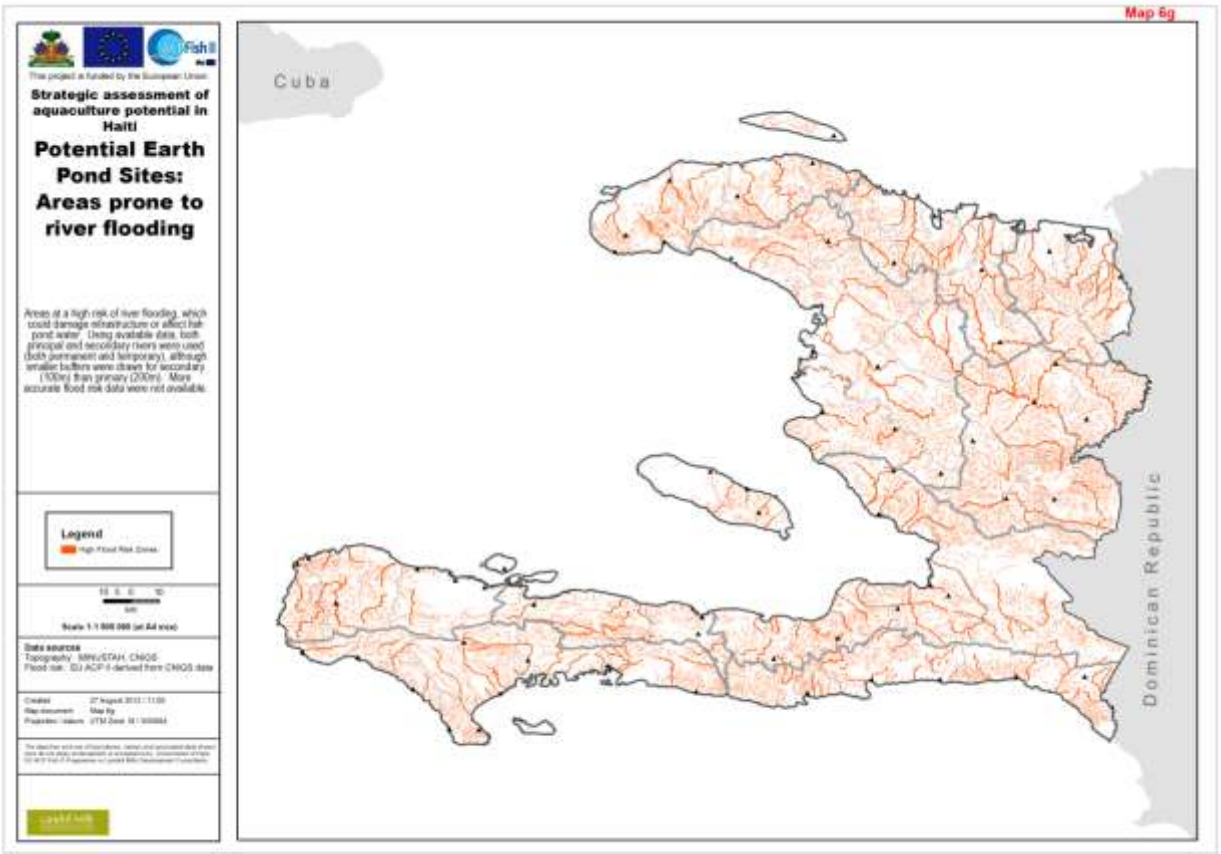
Map 6. Unfavorable cover



Map 7. Areas at risk of erosion and sedimentation

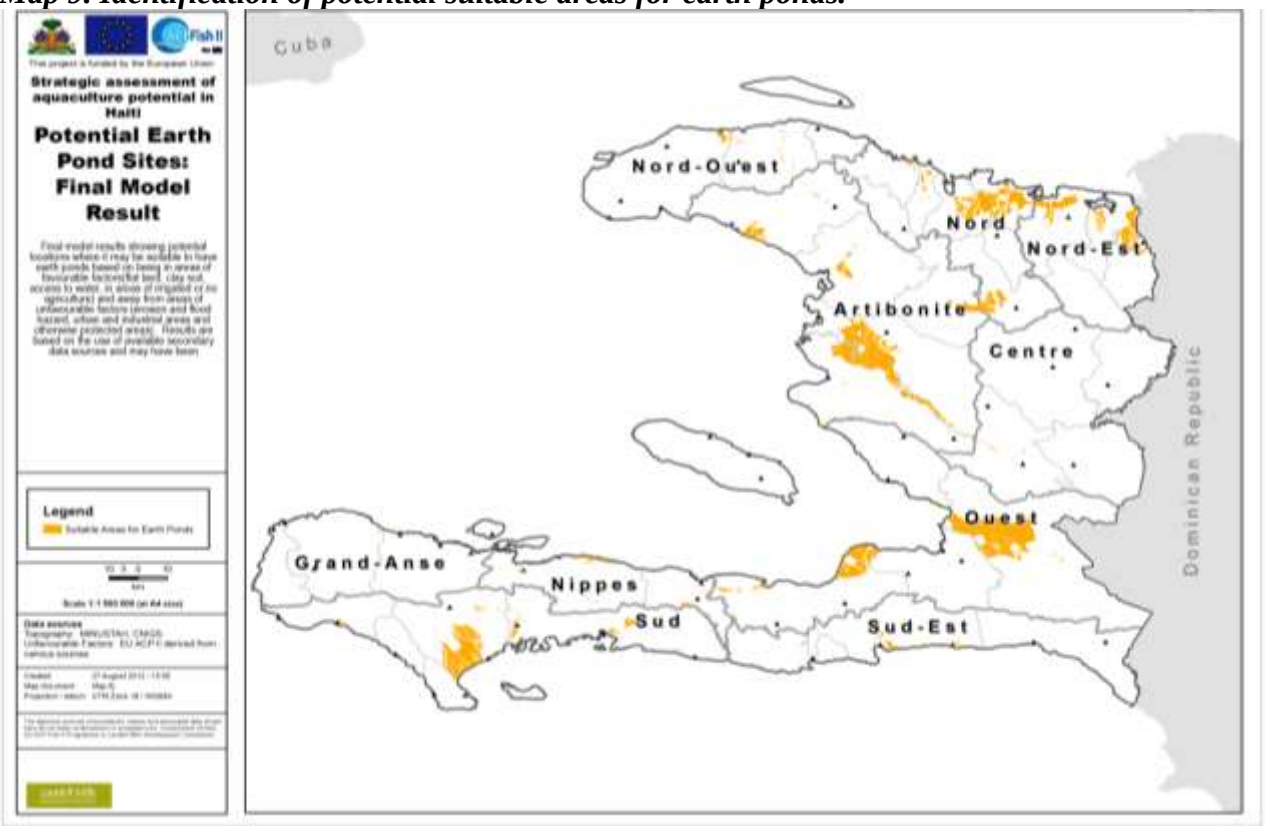


Map 8. Areas prone to river flooding



The combination of favourable factors, ensuring all four are present at locations, focuses on suitable areas on alluvial plains and plateaux in Ouest, Artibonite Valley, round Les Cayes and the Nord/Nord Est Departments. Smaller coastal plain areas of Nippes, Ouest, Artibonite and other departments also exist, and a couple of small river valleys (such as from Lake Peligre) are deemed suitable. However, showing the map of all unfavourable factors where only one factor needs to be present to exclude suitability, a much larger spread of zones are apparent. Major blocks around urban zones, protected areas and those plains at the foot of eroding hillslopes or near coasts are obvious, as is the detailed network of unsuitable ribbons close to rivers. Hardly any part of the country escapes (obvious exceptions being in the central plain of Ouest department and the western portion of Ile de la Gonave). When the unfavourable areas are subtracted from the suitable areas, the focused areas of suitability are slightly decreased by coastal erosion, some urban agglomerations and protected areas, but the effect of potential flooding from rivers generally only dissects these zones. The resulting areas retain those major zones of suitability in the Artibonite valley, the central plain of Ouest Department, around Leogane, and the coastal plains of Nord and Nord-Est. The narrow river valleys, particularly in Centre Department are vulnerable to erosion and flooding and less suitable. The final stage of the analysis was to determine zones around non-riverine permanent water sources, and then identify those suitable areas close to those, and determine in which department the areas area. From this, summary calculations of it can be seen that the greatest potential is in Ouest and Artibonite Departments (Map 9).

Map 9. Identification of potential suitable areas for earth ponds.



For each of these suitable locations, the approximate area (ha) can be estimated (Table 5), leading to a total area of **112,000 has**.

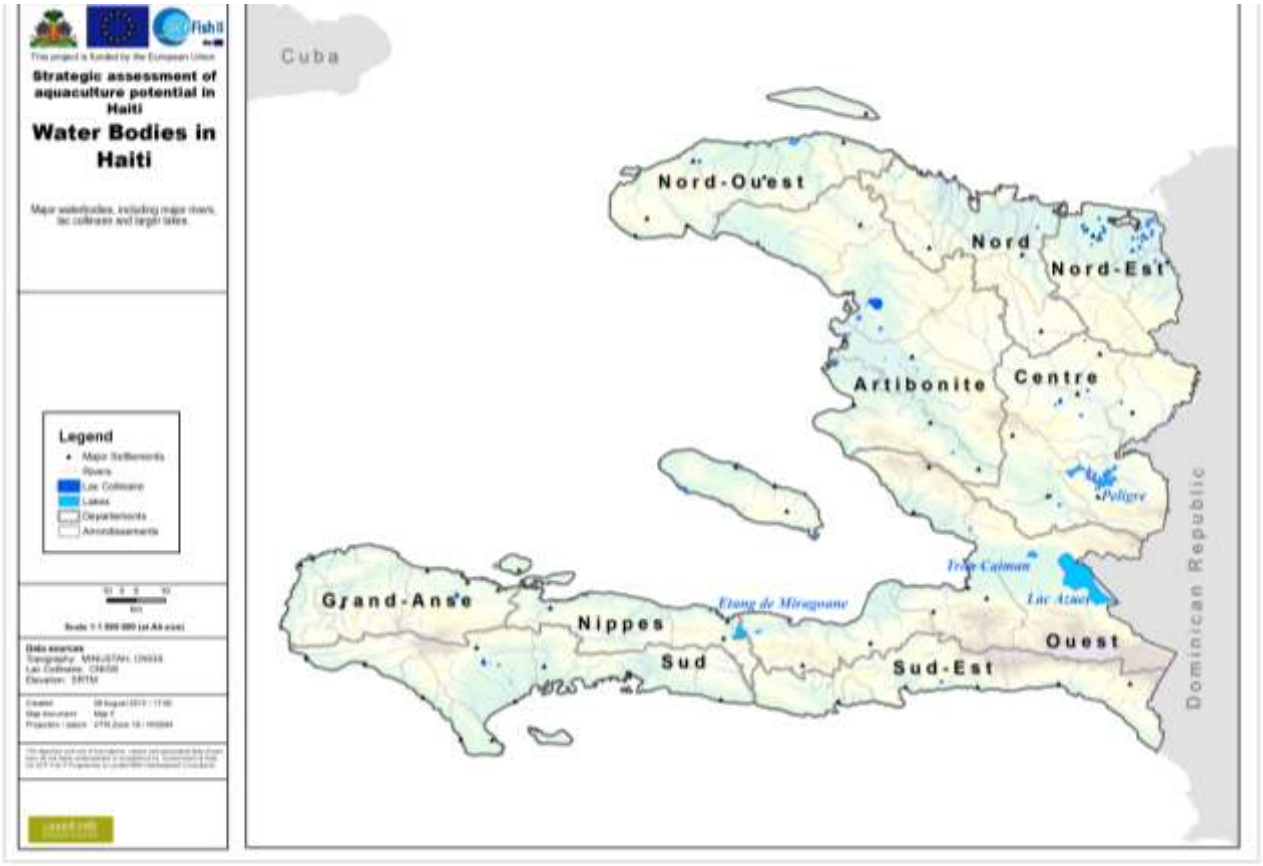
Table 5. Estimated area suitable for earth ponds

Department	Approximate Area (ha)
Ouest	32,660
Artibonite	30,090
Nord	16,970
Sud	16,290
Nord-Est	11,320
Nippes	1,690
Nord-Ouest	1,340
Sud-Est	1,250
Centre	340
Grand-Anse	110
Total	112,060

5.2. Aquaculture potential in Haiti

The total area covered by inland water in Haiti is estimated at **22.700 hectares**. (ICT Net & AIMC. 2010) (Map 10).

Map 10. Main water bodies in Haiti



5.2.1. Small inland ponds and rivers

Small inland ponds

Small inland ponds cover an estimated area of 2.770 ha, and do not represent a particularly favourable environment for aquaculture, due to the shallowness of water and unfavourable physical/chemical parameters (water is polluted by sulphur dioxide and typically contains high concentrations of decaying organic matter). They are also very likely to be polluted by waste from human activities frequently carried out nearby.

Hill reservoirs

The number and surface area of hill reservoirs change as a function of new developments of the Hill Reservoirs Programme (PNLCH). A new report, expected in the near future, will update current data. Current information on the hill reservoirs of the programme states that the existing 84 reservoirs cover an area of over 100 ha (notes on PNLCH report, August 2012). The primary aim of these reservoirs is to improve the local population's access to water, enabling them to use it for different purposes, but their halieutic resources could also be exploited. The techniques used to do so are similar to fishing and aquaculture and are described as an optimisation of halieutic resources. The Landell-Mills team is involved in a similar project producing yields of 0.5 tons per hectare per year. On the basis of this result, the forecasted fish output could reach 50 tons/year and benefit local communities in terms of improved food security and additional income.

Rivers

There are 31 permanent or almost permanent rivers in Haiti, covering approximately 6.820 ha. "Most rivers are small and dry up during the dry season" "Rivers and the water bodies they serve are associated with unsuitable conditions for aquaculture: seasonal drying, major floods and hazardous turbidity" (J Miller, 1987). Being subject both to drying in the hot season, and to episodic severe flooding, they have no aquaculture potential. Our study corroborates this.

5.2.2. Main inland ponds

Large inland ponds make up about 69% of the country's inland water bodies, i.e. **15.000 ha**. These are:

- Lake Azuei, 11.300 ha
- Lake Peligre, 2.750 ha
- Mirogoâne Pond, 1.130 ha.

In theory, these three lakes have great potential for the development of floating cages. This potential, however, has limitations. The factors enabling or hindering aquaculture potential are discussed in this part of the report, in the light of key requirements for aquaculture. The objective is to determine the order in which the three lakes should be used for the implementation of a Priority Aquaculture Zone.

Lake Azuei

This is the country's largest lake. The water supply is obtained primarily from springs flowing through limestone. The lake has undeniable potential for floating cage aquaculture, and

several aquaculture projects based on this technique have indeed been implemented. However, high mortality rates in some of the cages have had a negative impact on some of these programmes. This phenomenon is still unexplained. It could be due to changes in the salinity level (which varies between the west part and the east, the latter being freshwater), or to episodic high turbidity. The causes are not yet confirmed (upwelling has caused disruptive changes in the physical and chemical conditions of the water) and no proven solution has emerged (ASC. 2012).

This uncertainty may weigh heavily on the decision of whether or not to invest material amounts in an intensive floating cage project. The financial stakes are substantial and unpredictable mortality could jeopardise the economic viability of such a venture.

Long and complex investigations will be required to explain the phenomenon and find appropriate solutions for managing risks: for instance, anticipating hazards and moving cages to other parts of the lake not affected by the disturbances at the time.

Moreover, if the appropriate solution to periodic disturbances consists of moving the cages, additional costs must be factored in: customised cages will be required, moving them will cost money, and fish may have a slower growth pattern as a result of being moved, which could reduce profitability.

Lake Azuei can only be designated as a Priority Aquaculture Zone after studies have succeeded in determining the pattern of physical and chemical changes explaining the high reported mortality, and in putting forward technically and economically viable solutions, so that private and institutional investors can make informed decisions.

Lake Péligre

Lake Péligre is a reservoir created in the early 50's over 3,000 ha to produce hydroelectric power. It has substantial potential for floating cage aquaculture and a project is currently being rolled out in the area.

However, this potential is mitigated by a number of technical challenges:

- Variations in the level of water by up to 20m are reported between the dry and wet season, with natural fluctuations being amplified by electricity production needs
- Some of these fluctuations caused by activity in the power station may occur suddenly and unpredictably, which will be difficult to deal with
- The concentration of suspended matter occasionally rises, which could affect the yield of the floating cages (Satellite images, 2003).

Fig. 5 Lake Péligre, in a period of turbidity

A further problem is that authorities in charge of energy production have agreed that the presence of sediments requires a major clean-out of the lake, and that the power station needs large-scale modernisation and rehabilitation works. The Government, with possible support from donors, may well initiate these works in the near future, which would involve draining the lake over a long period of time, from anywhere between several months to two years. Production would inevitably be interrupted over this period of time. The financial consequences of such an undertaking are likely to deter investors from funding aquaculture projects that could cost several million US $ on Lake Péligre.

The people living around Lake Péligre are already involved in aquaculture and endeavour to develop this activity, which could potentially yield 300 tons/year. If Lake Péligre is chosen as a Priority Aquaculture Zone, the existing activities will be further increased. This raises questions on the fate of the locals were the lake to be drained: would they lose their income derived from aquaculture until the works were completed, or would they be compensated during this period? The latter would increase the costs of the works.

Alternatively, Lake Péligre could be designated as a PAZ after the works are completed.

Miragoâne Pond

This pond has proven aquaculture potential (ASC. 2004-2009). There are no known major obstacles to the development of floating cage aquaculture in the area, and conditions are favourable to designate it a PAZ. However, the environmental impact of such a production would have to be closely studied, as the Pond has a relatively small surface area.

Miragoâne Ponds are suitable in their current condition for the creation of a PAZ.

Table 6. Classification of Haiti's three main lakes according to their aquaculture potential.
Scoring grid: favourable = 10; average = 5; unfavourable = 0

Factor	Lake Péligre	Lake Azuei	Miragoâne Pond
Temperature	10	10	10
Dissolved oxygen	10	10	10
pH	10	10	10
Conductivity	10	5	10
Turbidity	5	5	10
Height of waves	10	5	10
Changes in physico-chemical parameters	5	5	10
Water availability *	0	10	10
Resilience to pollution	10	10	5
Proximity to a harbour	0	10	10
Sheltered bays	10	5	0
Score %	73%	77%	86%
Rank	**3**	**2**	**1**

Note: * = Draining may be carried out for long-term works.
Sources: Vlaminck (1990), FAO (FAO/TCP/6712/1999), (Jarnason. 1984), ASC (2005).

Map 11. Sheltered bays in Lake Péligre

The Artibonite River

This 300 km-long river is Haiti's longest river. It originates in the central mountains of the Dominican Republic, at an altitude of 1,000 m (19° 16' 13'' N 71° 29' 24'' W), west of the town of Burende (La Vega district), and flows for a distance of 320 km into the Gonâve Gulf where the town of Port Saline is located (Haiti web portal).

It has numerous tributaries and its flow rate is subject to significant variations between low-flow periods (24 m^3/second) and high-flow periods (196 m^3/second). As far as aquaculture is concerned, the quality of the water is obviously affected by flooding, which can be severe and which will cause increasing damage unless ambitious reforestation programmes are implemented in the basin. For these reasons, the river itself has no aquaculture potential and is not suitable for floating cage production.

Nevertheless, the Artibonite River is a potential source of water supply that could be exploited to serve major aquaculture sites in the valley. "The Artibonite valley boasts a number of sites with clear potential for pond aquaculture, both for industrial production and for small-scale activities combined with other agricultural productions" (ICT Net & AIMC 2010). This aquaculture potential is also clearly shown by the maps produced within the framework of this project. However, a deeper analysis may well contradict this first assessment of the Artibonite river's potential for aquaculture; in particular in the downstream sections.

5.2.3. Water quality problems

Erosion of the watershed and torrential rain have a major negative impact on water quality in the Artibonite, as in most Haitian rivers. Pure water is necessary for aquaculture fish to thrive and reach maximum growth. During rainy periods, the quality of water is greatly and lastingly diminished. High levels of turbidity recorded over lengthy periods could slow down or even prevent the growth of the stock. The suspended matter carried by the water is also an issue, as it could cause irritation to gills, particularly in smaller fish, leading to a higher mortality rate. Managing fish feed would also be more difficult as a result.

Map 12. Guanacasté Valley, Costa Rica

Map 13. Artibonite Valley, Haiti

Guanacasté Valley has a dense vegetation cover, which provides pure water to the ponds downstream. However, the Artibonite valley is subject to heavy watershed erosion, which could significantly diminish the quality of water for aquaculture purposes.

5.2.4. Flood risks

There are two types of risks linked to flooding:

- Damage caused by gully erosion due to the fast-moving surge and massive influx of water going down slopes

Even the sturdiest buildings can be washed away by severe flooding episodes. Building heavy infrastructure able to withstand such flooding would entail significant additional costs.

- Damage caused by flooding over large areas

During these flooding episodes, pond embankments become weakened, fish can escape from pools, access to the site becomes difficult and damage can be caused to equipment and inputs. All of these issues obviously hinder activities, and intensive commercial aquaculture farms striving for profitability can do little to prevent them. This is why aquaculture businessmen

need to be very careful when selecting a site: investors need certainties, in particular as regards the supply of water to the ponds.

Typically, investors and international donors wishing to invest in aquaculture in Haiti lack reliable information on the river systems and cycles. "Hydrological data is scarce. Since April 1998, only three out of the 35 gauging stations and 25% of gauges have been in operation" (Haiti Corp. of American engineers. August 1999). This means that information on flow rates, seasonal variations and physico-chemical parameters is hard to come by. This lack of information causes great difficulties as regards selecting sites and the appropriate techniques when building water intake structures on rivers. Due to these constraints, it may be difficult to secure investment.

Moreover, the land deemed suitable for aquaculture is currently used for agriculture; namely rice and corn crops. Replacing these activities with aquaculture would be an extremely delicate process, and would require irrefutable evidence that this new production would generate higher revenues.

5.3. Findings of the field survey

The starting point for analysing findings is the acknowledgement that the potential for aquaculture in a given country does not only depend on the biophysical parameters of the environment, such as water quality, type of soil and nature of the land. There are other factors involved, which are often ignored or overlooked by technicians, such as institutional capacities in the sector, access to microfinance, availability of technical support by qualified staff and access to information. It is for this reason that the questionnaire's 35 questions aimed to cover all such factors, whether bio-physical or socio-institutional, liable to influence the development of aquaculture in Haiti. These include:

- Capacities and experience of the staff in charge of the site in question
- Size and nature of the site: pond(s), pool(s), reservoir, etc.
- Biophysical parameters of the site: water quality, type of land and soil, etc.
- Initial investment
- Quality of management and monitoring
- Access to inputs (fish food, fingerlings, energy)
- Access to technical support and information
- Access to funding/credit
- Access to markets and competition.

5.3.1. Theoretical model

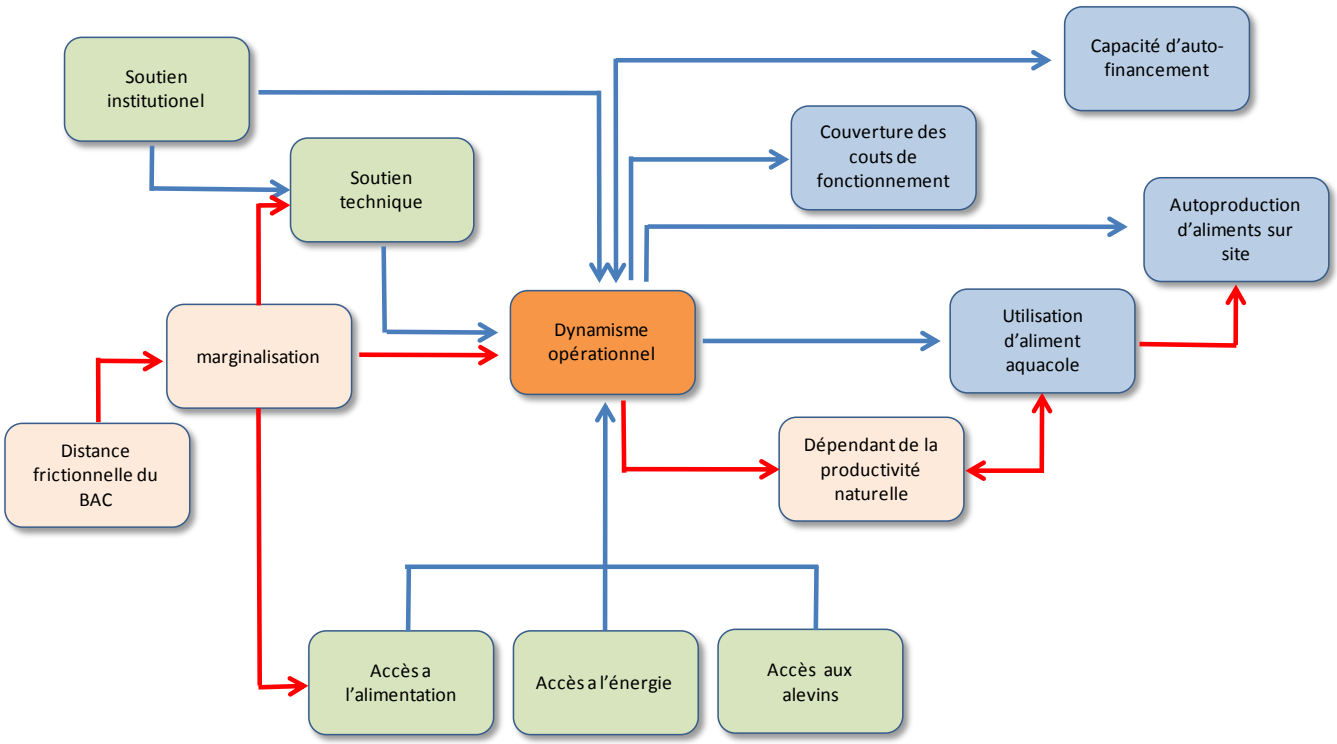
For a given bio-physical environment, the theoretical links between all socio-institutional factors influencing the aquaculture sector can be represented in a diagram (see figure 6). This model is meant to be used as a guide for the assessment and discussion of field survey findings by drawing empirical relationships between these factors. Important lessons can learnt from this when it comes to assessing the country's aquaculture potential.

Due to the absence of detailed economic data, such as the financial results of existing aquafarms (this type of data seems to be non-existent at the national scale), we will use business dynamics (i.e. the level of activity and daily monitoring performed by the owner or manager of the site) as an indicator of the success of the sector.

We know from experience that business dynamics are positively impacted by a series of factors: (i) institutional support, i.e. support that fish farmers (in particular in the case of small farms) can expect to receive on a regular basis from the Department of Aquaculture through the action of BACs staff trained in aquaculture; (ii) support and technical assistance for farmers, through practical training, field visits and the provision of informative documentation. Another essential factor is the access to basic inputs: (iii) feed for fingerlings and fish, (iv) access to energy (EDH or generators); and (v) access to selected fingerlings.
Other factors have a negative impact on business dynamics. This is particularly true of geographic isolation (measured by the distance between the nearest BAC and the farm), which can significantly reduce the chances of success for small farmers, both directly and indirectly: i.e. because it makes access to basic inputs and technical and institutional support more difficult.

Business dynamics interact with other components, in particular (i) the manager's ability to cover initial investment expenses (ii) and operating expenses; (iii) the manager's ability to buy artificial food (made from specific fish or breeding feed ingredients) and (iv) his/her ability to self-produce feed for fish and fingerlings – which is inversely related to the dependence on natural productivity. All of these relationships are illustrated in Fig. 6.

Fig.6 Cause and effect relationships affecting aquaculture potential. Red represents a negative impact, blue a positive impact



5.3.2. Empirical result

The field survey was carried out in a satisfactory manner, with 141 sites visited over 8 days of field work. The primary data collected during the survey is provided in Annex 9. Detailed results and analysis are presented below.

In 2002, in 'Aquaculture in Haiti', W. Celestin had inventoried, for the needs of his studies, 47 hectares of aquaculture ponds and reservoirs, distributed over 6 geographical departments. Although several sites could not be visited, the 141 sites studied covering 92 hectares represent a significant proportion of the country's ponds and reservoirs (the exact proportion is not known).

As a general rule, totally deserted sites were not visited, as surveyors had no information about their location or existence. However, some derelict sites can be identified upon carefully scanning Google satellite images:

Map 12 Abandoned site closed to Digner, Western Haiti

At the 141 sites visited, 11 different types of structure/water bodies were sampled (Table 7). Sample sites were chosen so as to reflect the intensity of aquaculture activities throughout the country. (R. Badio, DPAQ Director, personal comment.) For this reason, the number of sites visited per geographical department varies (Table 8). In the centre, Grand'Anse, Artibonite and north-west departments, the number of sampled sites is 4 to 5 times higher than in the south-east and north-east. Nevertheless, the geographical distribution of samples covers the country in a relatively homogenous manner (Map 8).

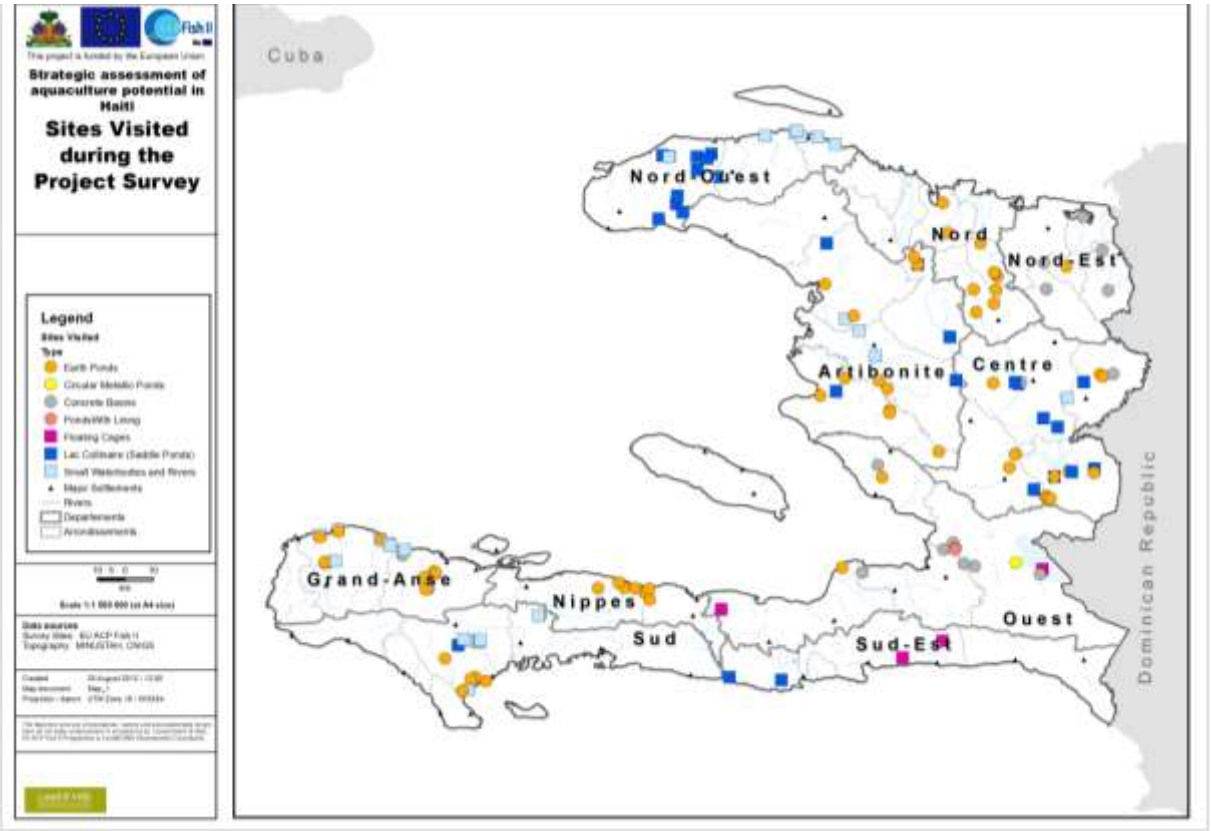
Table 7: Number of visited sites

Structure / type of water body	Number of sites	Structure / type of water body	Number of sites
Earthen ponds	63	Natural ponds	9
Cement ponds	16	Hill reservoirs	29
Floating cages	4	Natural lake	6
Circular basins	2	Lagoon	2
Covered ponds	1	Natural water body	2
		Rivers	7
Total			141

Table 8: Number of sites visited per geographical department

Department	Number	Departments	Number
South	15	Artibonite	19
North	10	South-East	5
West	14	Grand'Anse	20
North-West	19	Centre	26
Nippes	7	North East	6

Map 13. Geographical distribution of the 141 sites visited during the field study.



Natural productivity and potential production in the sites visited. Part of the data collected was used to assess (i) natural productivity and (ii) potential production of the sites.

Natural productivity

Natural productivity depends largely on the quality of water (rich/poor in suspended organic and non-organic matter, pH, etc.) and on the type of soil (loamy, clay, sandy, etc.). No measuring equipment (pH meter, conductometer, etc.) was available, but we were able to create an empirical indicator of natural productivity by combining the nature of soil and water quality as follows:

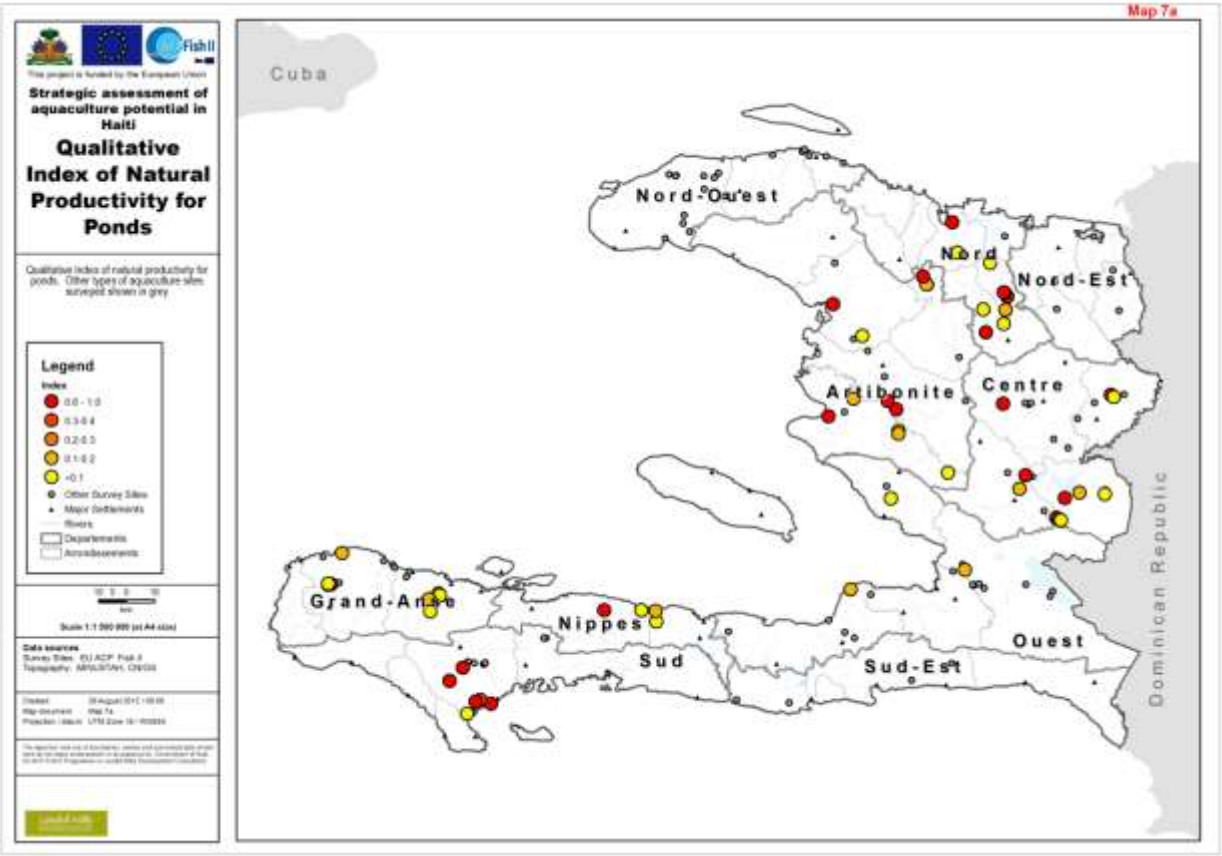
Natural productivity indicator = Water quality × Nature of soil using figures from Table 9.

Table 9: Figures used to assess natural productivity in the sites visited

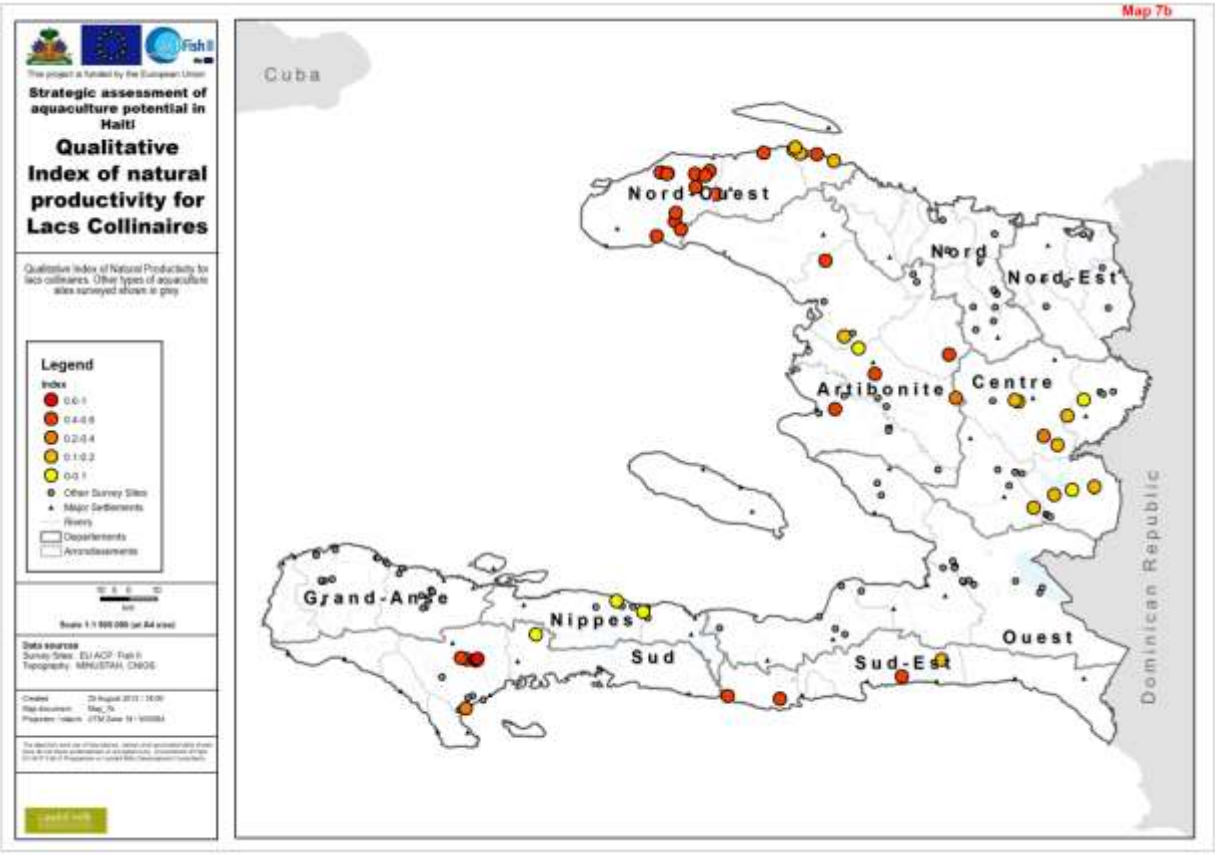
Water quality	Nature of soil
clear = 0.015	Loamy = 5
Light green = 0.043	Clay = 4
Deep green = 0.123	Black soil = 3
Slightly muddy = 0.043	Sandy = 2
Very muddy = 0.015	Rocky = 1

By applying this qualitative indicator to the data collected for each pond or lake visited, we obtained the following two maps showing the natural productivity of both types of sites (Maps 14 and 15).

Map 14. Qualitative indicator of estimated natural productivity in ponds



Map 15 Qualitative indicator of estimated natural productivity in natural lakes at hill reservoirs

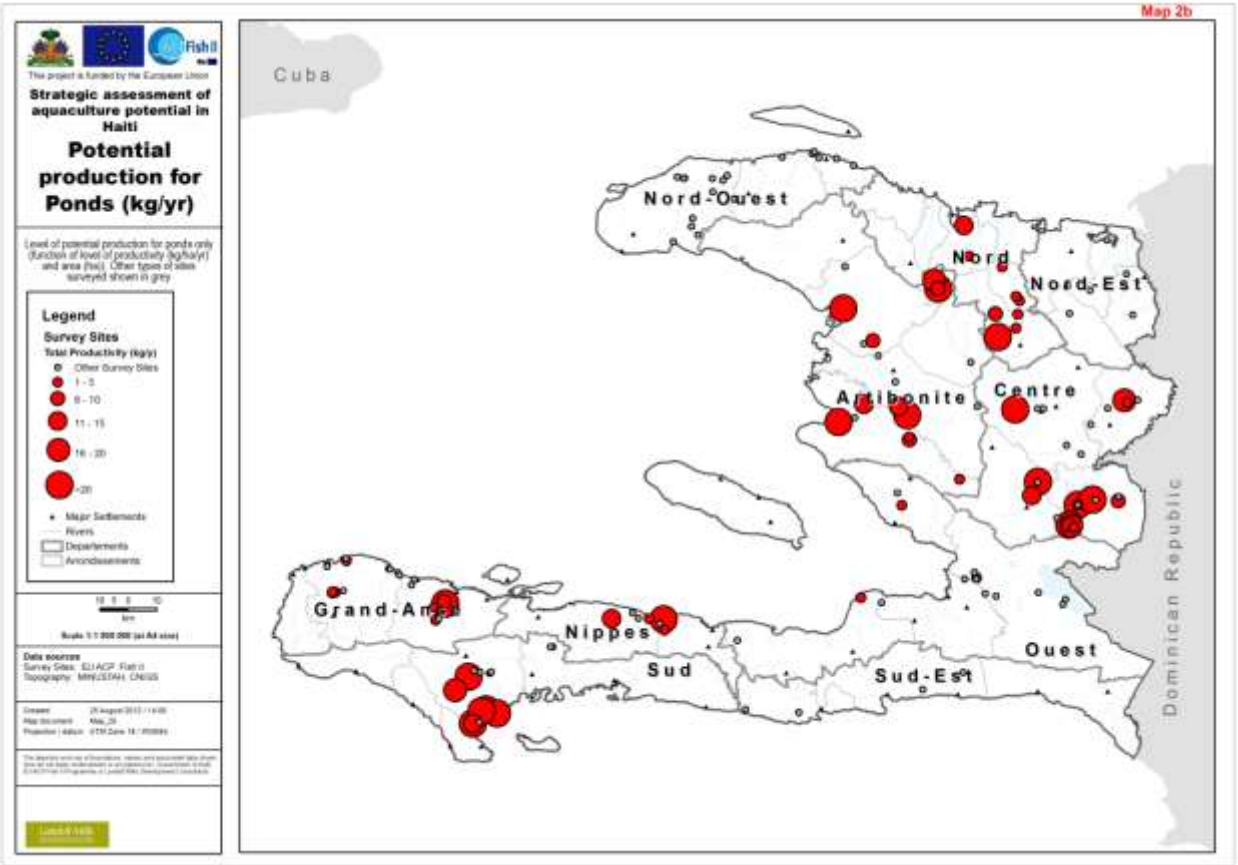


Both maps show the existence of a wide range of natural productivity values within each department. As far as ponds are concerned, no area seems to stand out as having significantly higher values. A similar conclusion can be drawn about hill reservoirs: no area seems to stand out, apart from the north-west zone which has an average but uniform natural productivity as far as lakes are concerned.

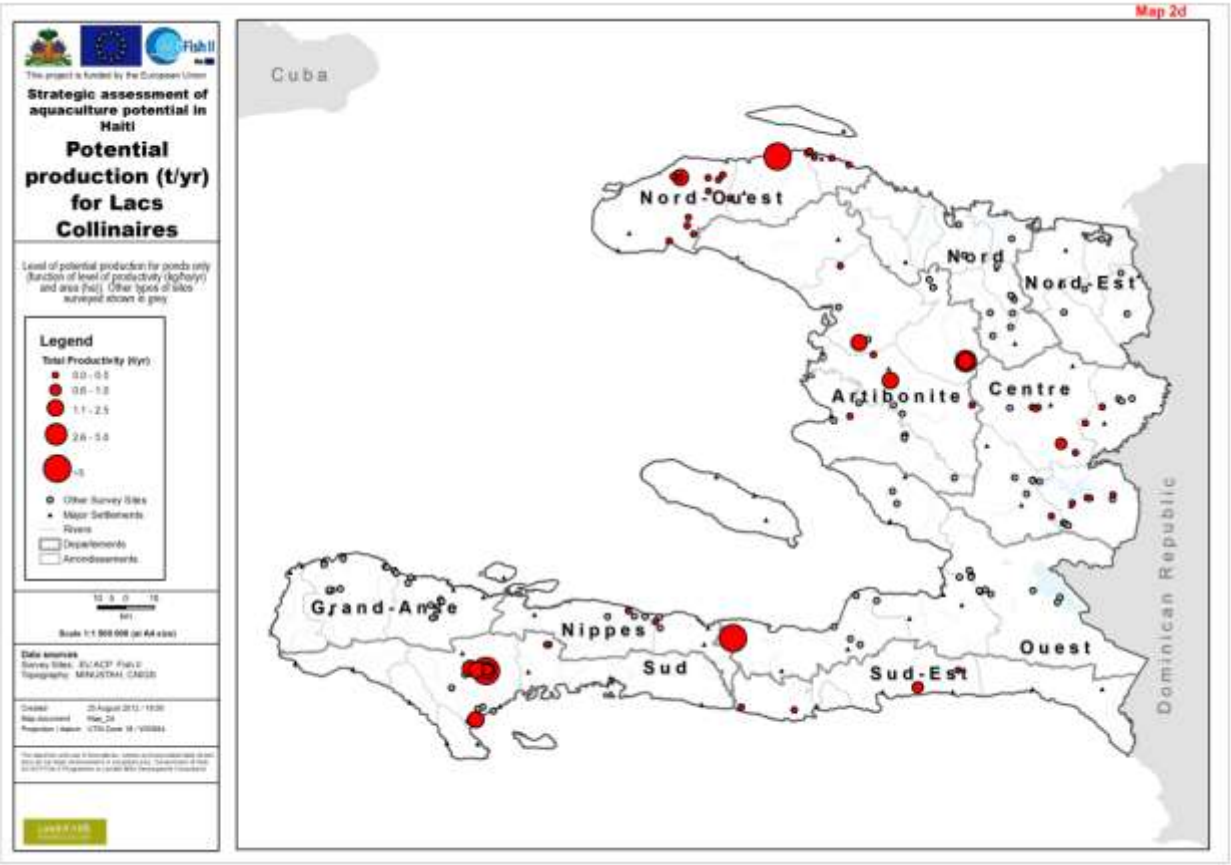
Potential production

The potential natural production of each pond or lake can be measured by multiplying its natural productivity figure (left column of Table 10) by its estimated surface area. Potential natural production is illustrated on maps 16 and 17. These maps should be interpreted with caution, however: the size of the dots reflects both the quality and size of the water bodies, which means that the smaller dots may refer to smaller ponds/lakes that do not necessarily have a low natural productivity. For example, the group of hill reservoirs in the North-West has a high natural productivity figure, due to the satisfactory quality of the water and soil (Map 16), but these reservoirs score relatively low in the potential natural productivity scale because of their small size.

Map 16. Potential natural production of ponds



Map 17 Potential natural production of lakes



Business dynamics

The 141 farms and sites visited have been categorised into five levels reflecting business dynamics: "daily monitoring", "reduced monitoring", "irregular monitoring", "suspended activities" and "no exploitation" (see Table 10 for the criteria describing each level).

Table 10: Levels of business dynamics used to classify the sites and farms visited

Level	Description - criteria
Daily monitoring	Technical staff is on hand (preferably daily), production is monitored and supported, embankments are in a good state, pools are adequately filled, fish feed is available on the site, etc.
Reduced monitoring	Staff with good knowledge of aquaculture techniques regularly visit the site (i.e. once a week or less)
Irregular monitoring	Last activities carried out and maintenance of the pools are inadequate, as is the level of water in the pools, lack of technical staff, etc.
Suspended activities	Sites that were once used for family aquaculture projects (for example : a farmer from the Artibonite Valley who has long since stopped aquaculture activities)
No exploitation	Includes mainly large water bodies and natural ponds with no current aquaculture activity despite their potential.

The data gathered during the field survey show that only 45% of earth ponds and 25% of cement pools are monitored on a daily basis (tables 11a and 11b). Activities have been suspended in 10% of ponds and 25% of pools. Accordingly, only 34% of sites are associated with normal operating conditions (daily monitoring). However, two main factors would suggest that this figure is over-estimated: (1) when selecting sites to visit, surveyors (whether consciously or unconsciously) tend to pick sites where they know they will 'find something' or 'someone to talk to'; (2) the respondents (owners, managers, employees, etc.) are likely to try and present their activity in a good light. Admitting that their activities have been suspended or discontinued would equate to an admission that their business has failed. Thus, there is reasonable ground to believe that the actual level of activity is even lower than what the figures suggest.

Table 11a. Estimated level of activity at the sites visited during the field survey. Figures represent the number of sites concerned

		Business dynamics (level of activity)					
		daily	Reduced	Discontinue	Suspended	No exploitation*	Total
structure	Earth pond	33	18	13	10		74
	Covered pond	1					1
	Cement pond	3	6		3		12
	Cage	2					2
	Hill reservoir	4	5	10	1	11	31
	Natural lake			16		2	18
	No data						4
Total		43	29	39	14	13	141

Table 11.b. Estimated level of activity at the sites visited during the field survey. Figures represent the percentage of sites concerned

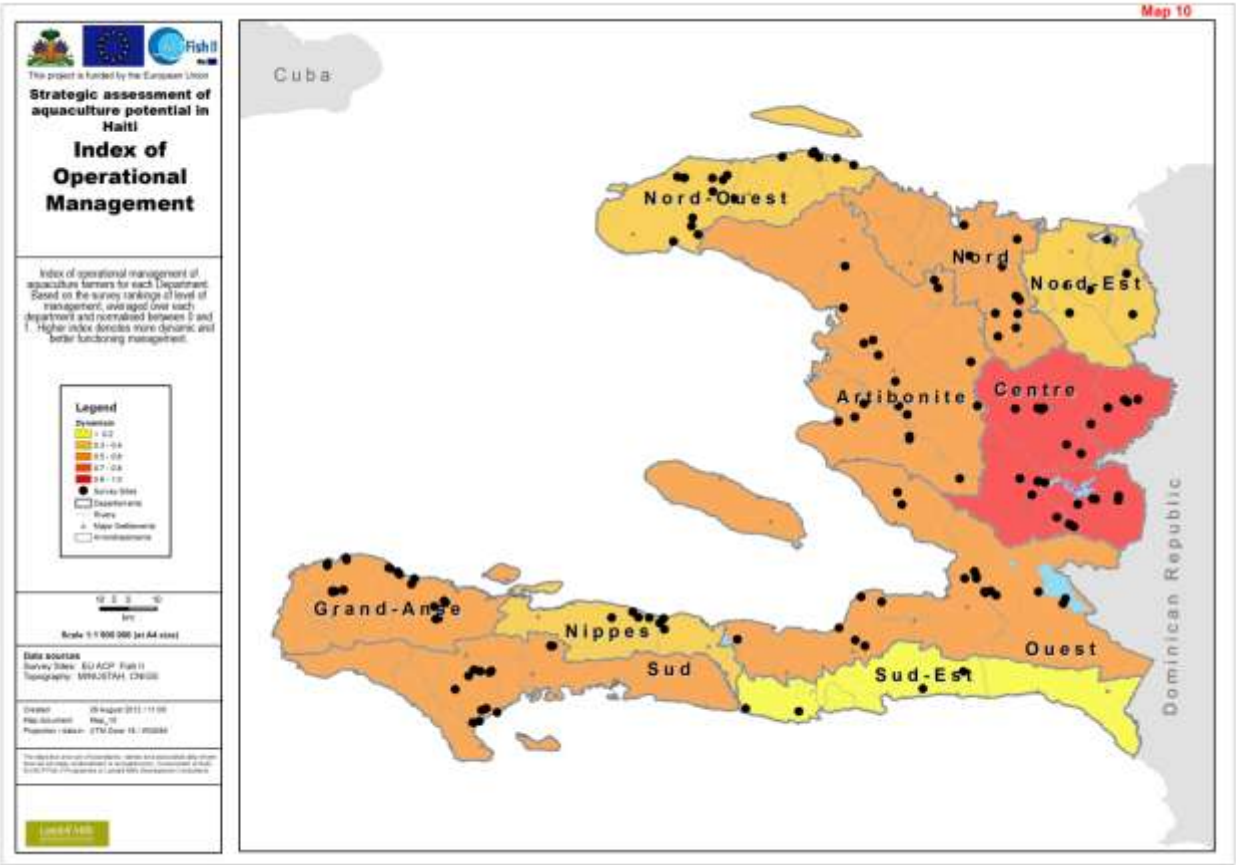
		Business dynamics (level of activity)					
		Daily	Reduced	Discontinue	Suspended	No exploitation*	Total
structure	Earth pond	45%	24%	18%	14%		100%
	Covered pond	100%					100%
	Cement pond	25%	50%		25%		100%
	Cage	100%					100%
	Hill reservoir	13%	16%	32%	3%	35%	100%
	Natural lake			89%		11%	100%

Note: * "No exploitation" means that no form of management is being implemented at the reservoir or pond concerned.

In the interest of accuracy, it must be noted that although the figures in tables 11a/b are presented per type of water body, the sample is too limited to show a clear trend. It is however possible to calculate an average value for each department and analyse the geographic distribution of dynamic sites. This is the aim of Map 18, which shows the average level of activity registered for each department. The Centre department appears as the most dynamic, which is why it is given an indicator of 1. At the other end of the spectrum, the South-East department receives a low score of 0.14.

Interestingly, six out of the 10 departments have scores below 0.5 (the theoretical median value), and the average nationwide is 0.45, also below the median. In light of the previous remark on the likely overestimation of activity, we have to conclude that this average of 0.45 (probably overestimated), is a clear indication of the many technical and structural difficulties faced by those currently trying to invest in aquaculture in Haiti.

Map 18: Business dynamics per department (indicators range from 1: very dynamic, to 0: very low activity).



The next stage in the analysis consists of trying to explain the differences in activity levels by drawing links with biophysical and socio-institutional factors. This is where the analytical model (Fig. 6) comes into play. First, though, a precise description of these factors is required, which is the object of the following paragraphs.

Capacity of BACs to provide institutional support

The survey provides data on the number and academic background of staff employed in the Municipal Bureaus of Aquaculture (BACs). There are 42 BACs in Haiti with an average headcount of 4 employees with aquaculture experience per department (39 for the whole country), which is markedly low (Table 12). The average level of education, conversely, is relatively high: most staff members have completed secondary education or have received higher education.

Table 12. Academic background of BAC staff

	No education	Basic literacy	Primary	Secondary	Baccalauréat	University	Total / dept
South						6	6
North						2	2
West					1	8	9
North-West						2	2
Nippes						1	1
Artibonites	1				6	1	8
South-East						1	1
Grand'Anse						2	2
Centre						2	2
North-East				2	2	2	6
Total nationwide	1			2	9	27	39

The distribution of qualified staff is far from uniform: some departments have eight to nine employees with aquaculture training (West and Artibonite), while others have as few as two (North, North-East, Grand'Anse, Centre) or even one (Nippes and South-East).

Geographic isolation of sites

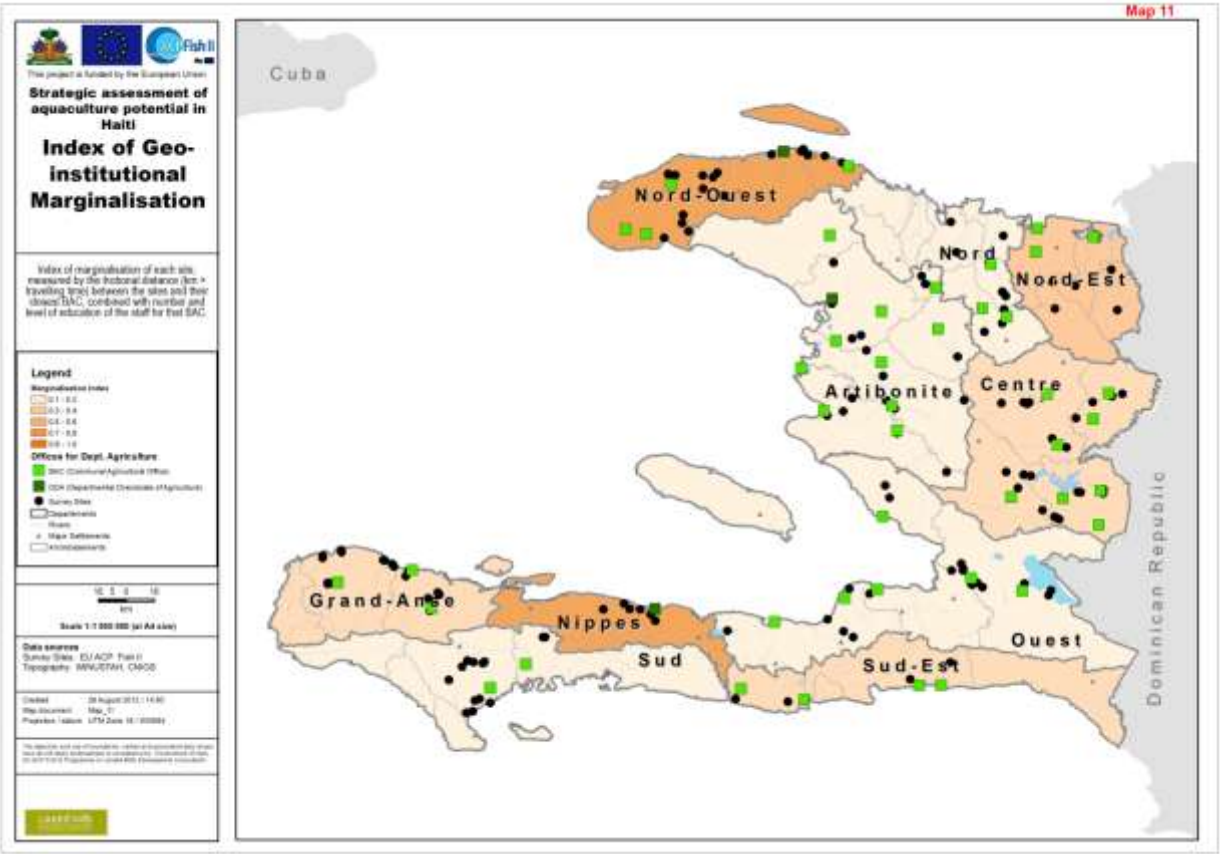
The field survey also investigated the average distance (in km) and travelling time (in minutes) between each site and the closest BAC. Combining both pieces of information (distance x travelling time), we can measure the theoretical distance between a site and the BAC (Table 13), which is an indicator of geographic isolation. This result is then combined with the rating achieved by BACs according to their institutional capacities, to obtain an indicator of geo-institutional marginalisation (Map 19). This indicator is measured on a scale ranging from 0 (lowest degree of marginalisation) to 1 (highest degree of marginalisation).

According to the results obtained, the Nippes and North-West departments seem particularly isolated. Their high score on the marginalisation scale indicates that small aquaculture entrepreneurs from these areas are isolated and deprived of much needed institutional and structural support. On the contrary, the Artibonite, North, South, West and Centre departments have access to more appropriate levels of support.

Table 13. Average theoretical distance (distance × travelling time) between sites and BACs

	Nippes	Nothd-West	North-East	South-East	Grand 'Anse	Centre	South	West	North	Arti-bonite
Thoretical distance	48.58	44.67	28.76	15.68	15.58	10.86	10.90	12.91	7.07	6.60

Map 19. Indicator of geo-institutional marinalization

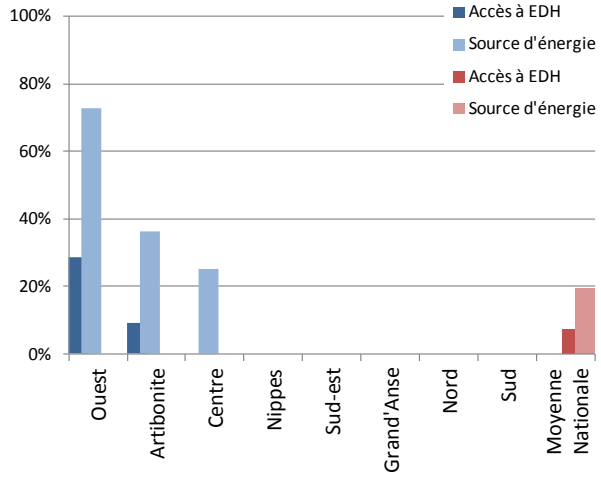


Access to inputs

Three types of inputs are essential to aquaculture: (i) energy; (ii) fingerlings and (iii) fish feed. Several questions had been included in the questionnaire to assess their availability in each department.

Energy

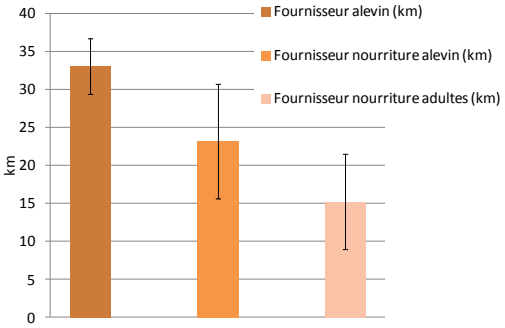
The data collected indicating the number of sites which have access to some kind of energy, whether from the national electricity network (EDH) or a generator, is a testament to the institutional challenges currently facing the aquaculture sector in Haiti. Producers in the West, Centre and North-East departments are the only ones to declare reliable access to energy (Fig. 7). On average, only 7% of the sites are served by EDH. If sites equipped with a generator are factored in, this figure reaches 20%. In other words, 80% of sites are currently operating (or attempting to operate) without energy. Needless to say, this has a serious impact on the activity level and business dynamics, as will be shown in Section 6.



Note : * Access to energy = EDH and/or generator

ig.7 (left): percentage of sites with access o energy (EDH and/or generator)

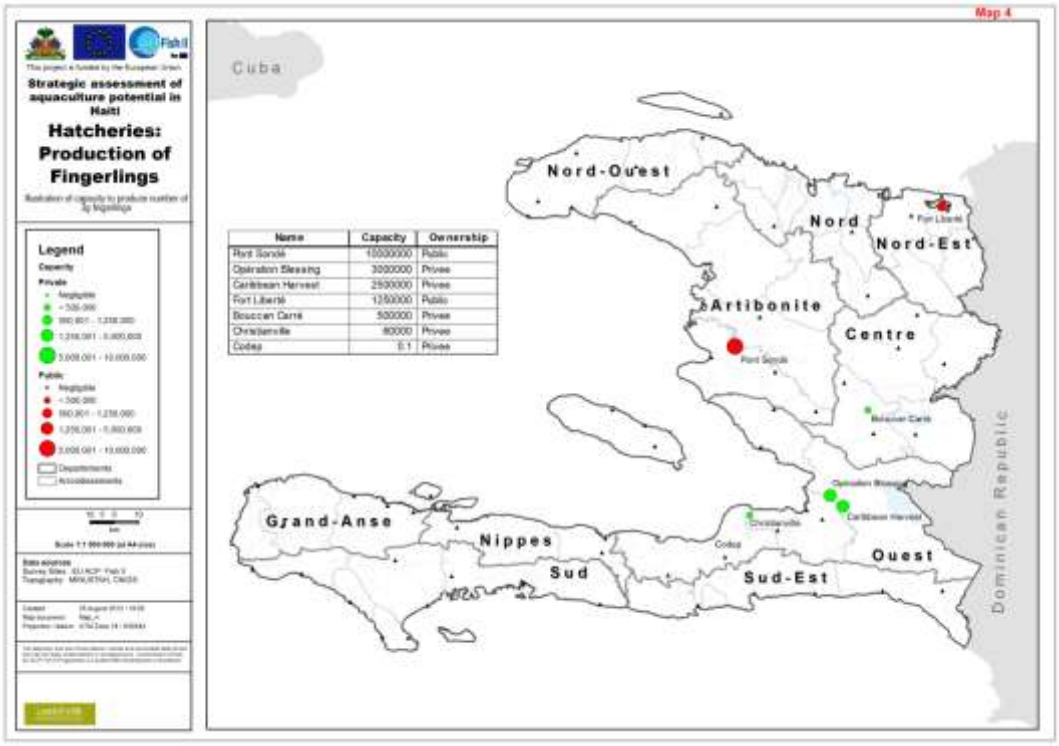
Fig.8. (right): average distance to inputs (fingerlings and food)



Fingerlings and feed

On average, producers in Haiti need to travel 33 km to acquire fingerling supplies, 23 km to acquire feed for fingerlings and 15 km to acquire feed for fish (Fig. 8) The distance that must be travelled for feed supplies (23 and 15 km) is reasonable, but the distance between fish farms and hatcheries is considerable, in particular considering the bad state of roads in the country. This is clearly one of the major obstacles currently hampering the development of the sector. Furthermore, the national average aside, it must be remembered that major differences subsist from one department to the other. According to the data collected, producers from the North-West, Grand'Anse, Nippes and South department are particularly isolated (Map 20)

Map 20. Location of public and private hatcheries



Although the hatcheries (both private and public) are relatively far from one another, they seem to work satisfactorily. All respondents stated that both public hatcheries (port Sondé and Fort Liberté, which are said to be public although their status needs clarifying) are permanently or frequently open (Fig.9a); however the small number of public hatcheries is a clear drawback as it implies that few fish farmers can actually benefit from their services. Private hatcheries also work satisfactorily.

Food for fingerlings is also produced in both public and private stations, but only half of the public stations operate permanently, and only one is frequently open (Fig. 9b). The majority of private producers operate permanently. Access to food for grown fish, from both public and private producers, seems to be adequate (Fig. 9c).

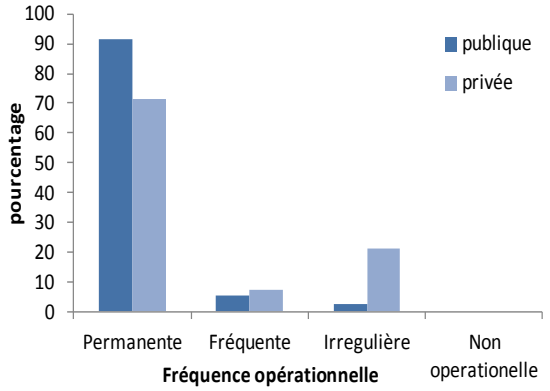


Fig.9a. (top left): Operating frequency of public/private hatcheries

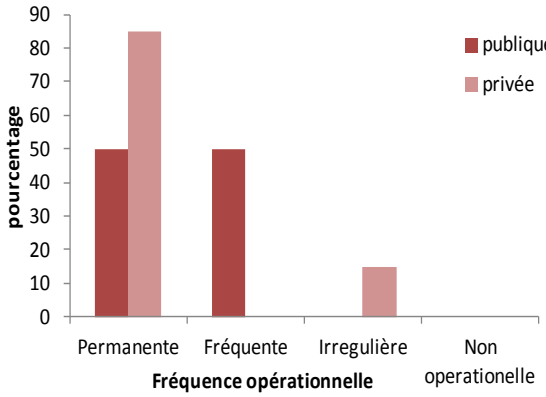


Fig.9b (bottom left): Operating frequency of fingerling feed producers

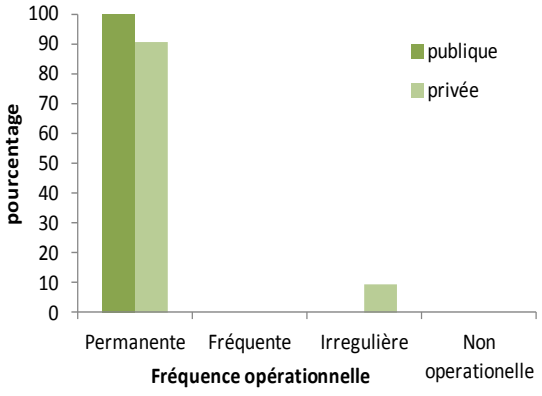


Fig.9c (right): Operating frequency of fish feed producers

Technical support

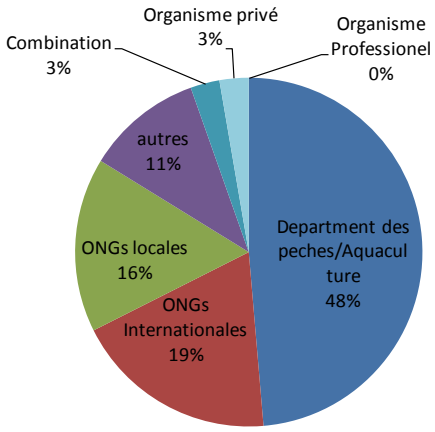
The level of technical support provided to aquaculture sites is markedly low. On average, only 23% of the 141 sites have received some form of support. Here again the national average conceals significant local differences. The North-West and North-East departments appear to be neglected, while other departments (in particular the South and Centre) receive more appropriate support. The correlation analysis (see Fig. 16) demonstrates a link between the lack of technical support and geo-institutional marginalisation.

Table 14. Percentage of sites visited havingg received technical support

	South	North	West	North -West	Nippe s	Arti- bonite	South -East	Grand 'Anse	Centre	North East	National average
Technical support	47 %	10 %	21 %	0	14%	42%	40%	14 %	46%	0	23%

The survey shows that more than 49% of the support provided was in the form of technical visits, 28% consisted of work placements and 23% in the distribution of leaflets and other informative documentation. Support was primarily provided by the Directorate of Fisheries and Aquaculture (48% of cases), followed by international NGOs (19%) and local NGOs (16%) (Fig.10).

Fig.10. Origin of technical support received.



More detailed analysis reveals that technical visits are relatively few and far between: 45% of cases receive a visit every 6 months or less (Fig. 11a). Only 10% of cases benefit from weekly visits. The respondents coincide in saying the support received is satisfactory (Fig.11b), but this result is contradicted by the analysis of other data (see below).

Fig.11a. Frequency of visits

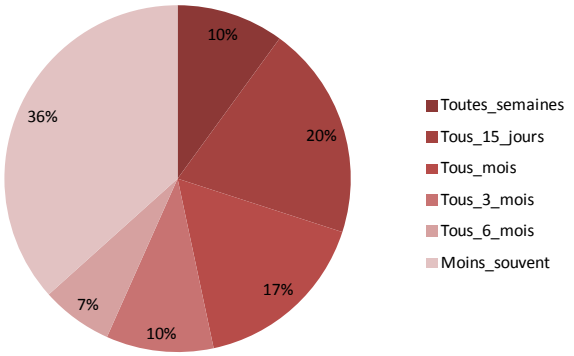
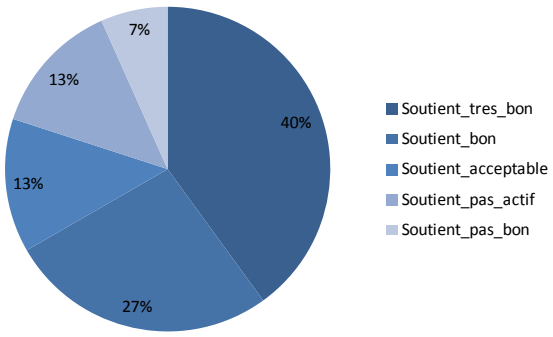
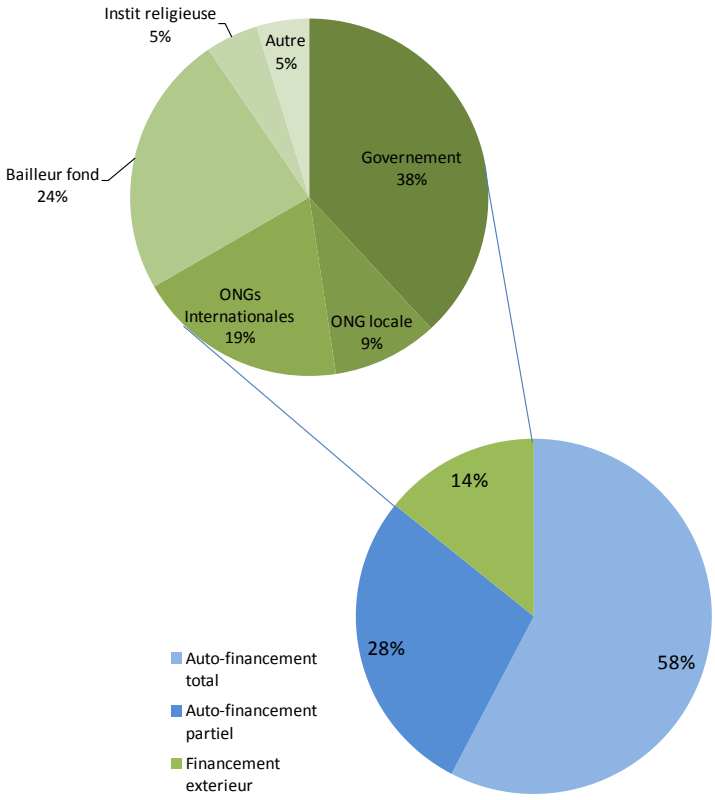


Fig.11b. Quality of technical support



Financial support and self-financing of infrastructures

As regards financial assistance, the gathered data shows that the majority of infrastructure investments were self-financed (Fig 12a). Only 14% of projects were entirely financed by external partners, most of them (38%) by the Government (Fig 12b). Local and international NGOs helped in 28% of cases, and donors (without a middle party) in a quarter of the projects. 5% of externally financed projects were funded by religious organisations. Projects that are both self and externally financed usually have a high self-financing rate, above 50% in half of the cases.



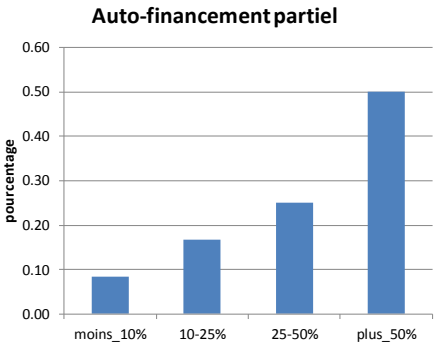


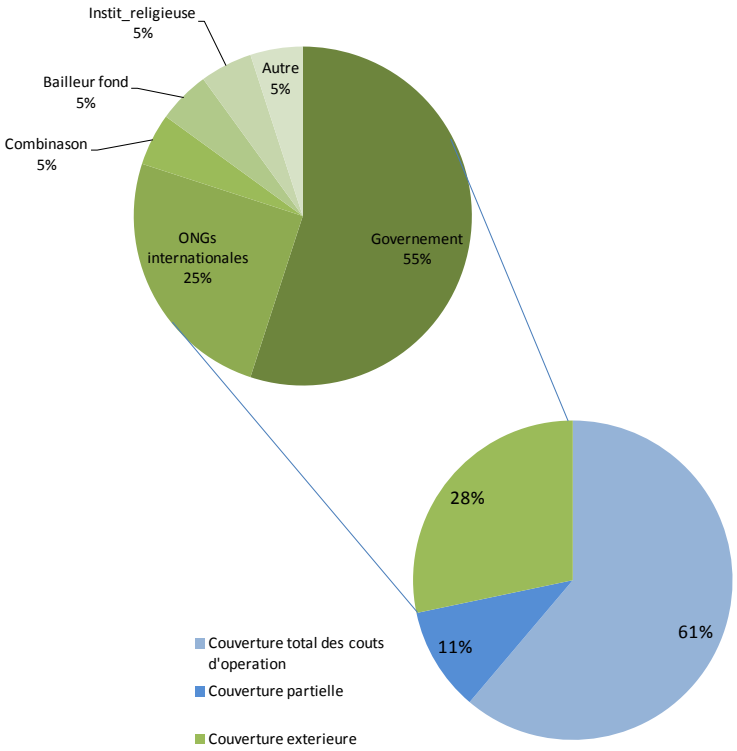
Fig.12a (left) Source of funding of Haitian aquaculture projects

Fig.12b (right) Part of self-funding in mixed funding projects.

Financing operating costs

Operating costs are 61% self-financed, which is close to the rate observed for investing costs. However, when own and external funds are combined, the self-financing rate is only 11% among the visited sites, which implies that a higher proportion (28%) of costs is covered by external donors (Fig 13a). The Government is strongly involved (55% of cases), followed by international NGOs (25%). Direct contributions from donors (5%) are less frequent than they were for investment costs. The data also shows that the partial self-financing rate is still substantial, as more than 80% of owners cover at least 50% of their operating costs (Fig.13b).

These results are in line with what was expected. Given that investment costs are typically higher than operating costs, a larger proportion of the former is directly covered by donors, while the Government is more involved in covering the latter. Similarly, the proportion of owners able to cover 50% of their operating costs is much higher than the proportion able to fund at least 50% of their initial investment costs.



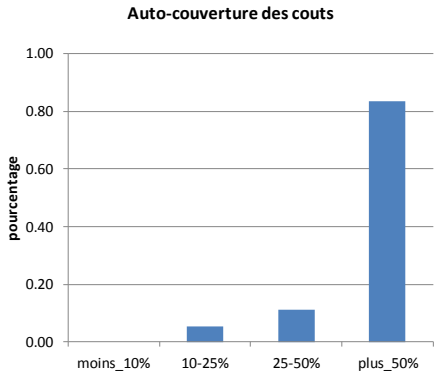


Fig.13a (left). Source of funding o operating costs.

Fig.13b (right). Part of self-funding in the operating costs of mixed funding projects.

Production (ponds)

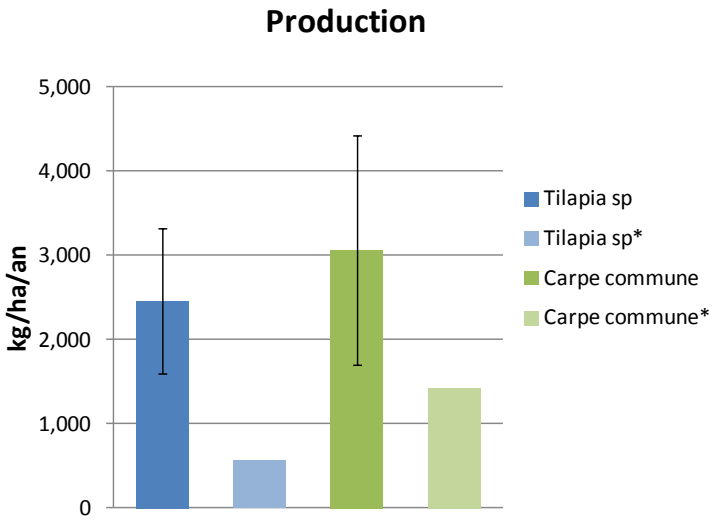
The data gathered during the field survey allow for an estimation of production (kg/ha/year) in aquaculture ponds. Factoring out ponds with no activity at the time of the survey, the following values were obtained: 2,466 kg per ha per year for tilapia and 3,064 kg per ha per year for common carp (Fig.14). If, in order to reflect the overall productivity of ponds in Haiti, abandoned ponds and those with suspended or discontinued activities are factored in, the results are much lower: 559 kg/ha/year for tilapias and 1,430 kg/ha/year for common carp. This reflects the fact that a relatively high proportion of sites are recording low levels of activity, or that they have been abandoned.

These figures can be compared to those put forward by specialised organisations (FAO 1988):

- Semi-intensive production system, inferior value: 0.456 t/ha/year for tilapias
- Semi-intensive production system, superior value: 1.41 t/ha/year for carps

These performance rates are particularly useful for assessing the potential yield of existing infrastructures in the country.

Fig. 14: Average production of aquaculture ponds for the two main species grown in Haiti (tilapia and common carp) (confidence intervals)



Note: Results obtained on the basis of all sampled ponds (both operational and abandoned ponds) are marked *

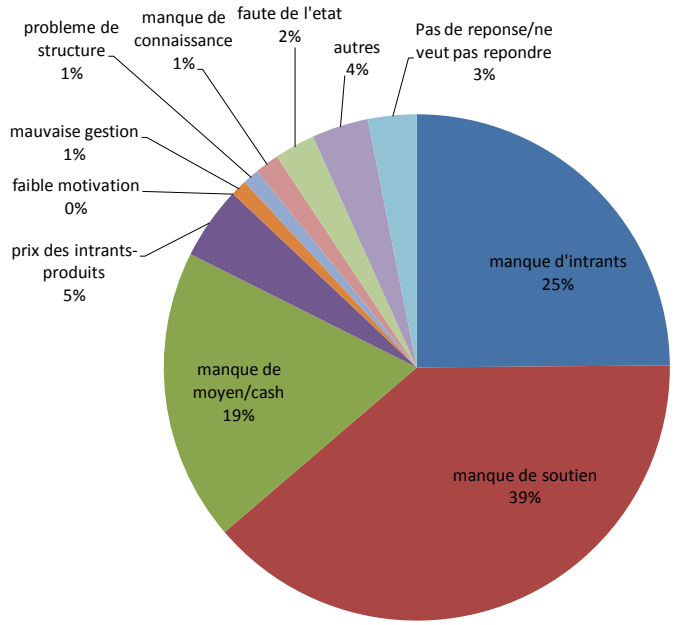
Participatory assessment of the current situation

The last section of the survey was an open question, giving respondents a chance to give their opinion on the main reasons behind the difficulties in implementing and maintaining aquaculture activity in Haiti. The diagram (Fig.15) synthesises the answers into categories so as to put forward the main types of issues cited by respondents.

The most telling result is without a doubt the consensus reached by respondents on three key issues which, in descending order, are a lack of technical support (39% of answers); difficulties in obtaining inputs (25% of answers) and a lack of funding and access to investments (19%). These factors themselves are not very surprising: they are the most widely acknowledged obstacles to the development of aquaculture in developing countries. The interesting aspect, however, is the order in which these factors appear: the top issue according to respondents is the lack of technical support, which is cited twice as often as the lack of funding, and 1.5 times more often than the lack of access to inputs. This casts a new light on the current situation and underlines how vital this issue is for producers – in particular small-scale ones. Indirectly, this finding points to the key importance of information and technical support for small aquaculture investors who are often isolated. This conclusion will be highlighted again by the correlation analysis below.

It should also be noted that these findings clearly contradict the apparently "good" results previously obtained, in particular the fact that 40% of the people interviewed answered that they were satisfied with the technical support received. It is important to remember that in a majority of cases technical visits are scarce, less than two per year. This is undoubtedly inadequate; all the more so given that, in the current situation, the number of qualified and experienced farmers and local delegation staff per department remains low. Without this source of information and experience, the process of disseminating technical knowledge and information cannot be set in motion, which prevents the sector from taking off.

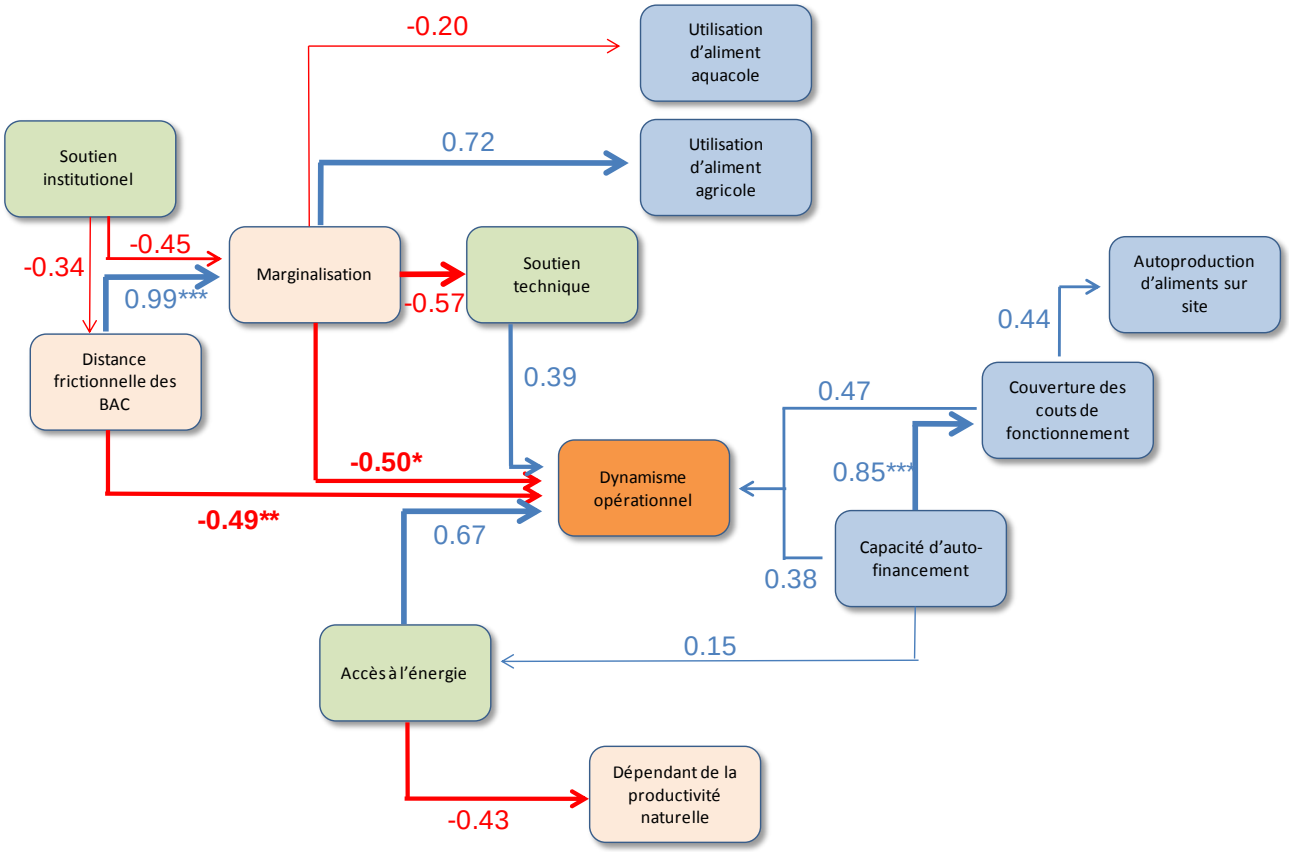
Fig. 15 Issues cited by respondents



Correlation analysis

Once the different factors likely to impact business dynamics of aquaculture sites have been identified, the next step of the analysis is to determine the links between these factors. The small size of the sample does not allow for the use of statistical methods; a limitation which must be taken into account when interpreting and drawing conclusions. It is also important to bear in mind that a correlation does not necessarily imply a cause-effect relationship. Nevertheless, the findings presented below are a useful contribution to our study. Two particular points stand out: (i) a number of strong correlations can be found between some factors; (ii) the sign (positive or negative) of these correlations is in accordance with the theory. The details of the analysis are set out in Fig. 16 and discussed below.

Fig. 16 Correlations (blue = positive; red = negative) between the factors identified in the analysis. The thickness of the arrow is proportional to the strength of the correlation



According to the analysis, the three correlations with the strongest negative impact on business dynamics are: (i) the theoretical distance between BACs and sites (-0.49), (ii) the indicator of geo-institutional marginalisation, which has a direct impact (-0.50) on business dynamics and an indirect impact (iii) on the level of technical support (-0.57). The first two are of statistical importance (Spearman test). From these results it can be clearly interpreted that the most dynamic sites are the least isolated (from a geographical and institutional point of view), in other words, those with easier access to information and technical support. This result corroborates and confirms the findings of the participatory assessment.

Other negative correlations are significant: (i) the correlation between the levels of institutional support and geo-institutional marginalisation (-0,45), which incidentally reflects the definition of geo-institutional marginalisation; (ii) the correlation between the level of institutional support and the theoretical distance from the BACs (-0,34). These correlations teach us that geo-institutional marginalisation can be reduced by increasing institutional support.

As far as positive correlations are concerned, business dynamics are positively affected by two main factors: (i) access to energy (+0,67) and (ii) ability to cover operating costs (+0,47). Once again these results seem logical: they imply that sites where managers can afford to have a source of energy are also those registering strong business dynamics. Similarly, entrepreneurs able to cover their operating costs are also able to maintain a high level of activity.

The negative correlation between access to energy and dependence on water natural productivity (-0.43) is also telling. It suggests that entrepreneurs who have access to a source of energy soon move on to a type of operation that is not dependent on natural fertilisation for sufficient productivity. This finding confirms the importance of having access to energy.

6 Initial comments on the MARNDR's objectives in terms of aquaculture

The MARNDR's Investment Plan in aquaculture, having an ambitious production objective of **25,000 tons a year**, requires some elucidation on a couple of important points:

6.1. Expected private investment

The investment plan underlines that "expected investment from the private sector is estimated at US $50M". Despite some periods of increased interest, private investment in aquaculture in Haiti remains traditionally low.

"Given the interest of more than 40 Haitian and American investors, and taking into account the success of such enterprises in other countries of the region and the malnutrition in Haiti, there will undoubtedly be a large-scale aquaculture agro-industry emerging in the country in the near future" (Miller FAO 1988).

Yet, as emphasised by Breuil 10 years later, "private aquaculture activities are still in their infancy" (FAO/TCP/HAI/6712. 1999):

"Inadequate knowledge of local business communities, local production techniques and other details related to the exploitation of aquaculture farms, as well as the absence of standard contractual commitments guaranteeing the "company/State" relationship (convention) and of other agreements of key importance in the establishment and development of such activities have led to underinvestment in the sector" (Badio 1999).

Since the period from 1988 to 1999, no major private investment has materialised, in spite of the efforts of some businessmen.

The Ministry trusts that the conditions for investments are improving:

"In 2009 the government of Haiti, under the Direction of Fisheries and Aquaculture of the Ministry of Agriculture, brought together private-sector players, officials, professors, and others interested parties to investigate the development of aquaculture in Haiti. This committee proposed the following steps:

- Conducting a study on the revision of trade policies
- Drawing up a list of all existing aquaculture activities in the country
- Exploring mechanisms for promoting modern aquaculture
- Assessing resources and aquaculture potential
- Conducting studies on preservation, processing and marketing
- Increasing fish food production
- Stocking water bodies

- Establishing new farms & cage/pond production sites
- Increasing production in existing hatcheries
- Creating of new production centres
- Rehabilitating farms with established potential
- Providing training and technical assistance to fish farmers
- Monitoring and assessing activities"

(Source: CARICOM/CRFM/JICA first regional workshop on aquaculture development planning, Kingston, March 2011).

For the most part, the steps put forward by the committee seem to have fallen on deaf ears. After the necessary actions have been identified, there will be a long way to go before these actions can be implemented, and there are still barriers to remove before the Government can realistically expect to meet the objective of US $50m. If this considerable amount of projected private investment does not materialise, it is unrealistic to expect a major surge in national aquaculture production. As far as we know, no technical and economic feasibility study, including a market study targeting the national fish market, has been carried out to date, proving that Haiti has potential for profitable commercial aquaculture in earth ponds. A document of this type, whose source would have to be confirmed as trustworthy, is a prerequisite to convince national investors to support this agro-industry.

6.2. Assessment of land requirements

The development of a semi-intensive national aquaculture production, yielding several thousands of tons (MARNDR's objective: 25,000 tons), would require large areas of land to be dedicated to this activity.

6.2.1. Semi-intensivve aquaculture (low level)

If this production of 25,000 tons/year is obtained through semi-intensive aquaculture techniques with fish fed on locally-produced feed (rice bran), on the basis of an average yield of 2 tons/ha/year, and multiplying the surface area of ponds by a factor of 1.5 to take into account the overall surface of the site, a total area of **18,750 ha** will be needed.

6.2.2. Intensive Aquaculture

Intensive aquaculture techniques could be implemented in order to obtain better yields and reduce land ownership issues. Yields could then reach 40 t/ha/year (Ref: production in Costa Rica, FAO 2010). The surface area of ponds multiplied by a factor of 1.5 would then be about **1,000 ha**. Nevertheless, this level of production requires a permanent supply of high quality water to be pumped from the groundwater table, high-protein fish feed and perfect knowledge of aquaculture techniques. Opération Blessing is currently successful in implementing an intensive production, but its profitability is yet to be determined, as this technique is also associated with high operating costs related to energy expenses, the purchase of high-quality fish feed and essential technical management expenses (international experts in charge of the operation).

6.3. Actual land availability and potential loss of agriculture lands

Contrary to the authorities' often repeated assertion that "there is good potential for aquaculture development in various areas of the country, given that more than 23,000 hectares of land that is not suitable for agriculture is favourable for the development of commercial aquaculture fish farms" (Badio in CARICOM/CRFM/JICA, March 2011), this assignment leans towards the theory that lands with high aquaculture potential are also the most suitable areas for agriculture.

The development of aquaculture could therefore be to the detriment of useful agricultural areas. Aquaculture primarily requires water, and for this reason cannot be implemented on barren land. Lands with good access to water are typically farmlands, hence the risk that one activity will impinge on the other.

Although aquaculture could contribute more successfully to food security than rice production does currently, there is no proof that it would be possible, let alone desirable, to convert existing rice production areas into aquaculture land. Around 18,000 ha of coastal marshlands could be used for aquaculture, but these areas of mangrove swamps are environmentally important, and the development of aquaculture could further jeopardise this already fragile habitat. The impact of aquaculture on such ecosystems has proved devastating in Asia, particularly in Thailand. The responsibility and ultimate decisions will therefore fall upon the deciding bodies.

6.4. Insecurity of land ownership

Land ownership problems are a persisting issue in Haiti and quite often stand in the way of initiatives that could have contributed to the country's development and poverty alleviation. Aquaculture projects are frequently faced with concerns related to the insecurity of land ownership and to the issue of land fragmentation: a growing concern as plots of land of a suitable surface area for aquaculture are increasingly difficult to come by.

The small size (1.5 ha in average) of the farms and exploitations is a marked feature in Haiti's land situation. Land insecurity is an issue throughout the country. The causes behind it are primarily the expansion of joint tenancy, unofficial land transactions and the development of short-term tenant farming as substantial pieces of land belong to absent owners and are given to farmers in tenure.There are two types of land management in Haiti:

- Formal management by the State
- Informal management by farmers based on ways and custom

"Lands informally managed under systems such as joint tenancy, unofficial ownership and short-term tenure make up almost 75% of all exploited land. The insecurity of land ownership explains why those wishing to invest are usually reluctant or even scared to do so, and is a breeding ground for violent conflicts" (MARNDR, 2010). This issue and its consequences on aquaculture are a long-standing problem. In 1999, Breuil had already underlined it: "Besides, uncertainties regarding the legal status of land and difficult access to land ownership hinder the development of aquaculture" (Breuil 1999).

This is in particular the case in the Artibonite, a region identified as having strong aquaculture potential.

« In the Artibonite, conflicts stemming from the reclamation of the valley have caused the Executive to intervene directly and create derogative systems, which, until the land reform in 1996-1998, compounded the situation of farmers and landowners whose property was at risk of being seized, sequestrated or placed under control. As a result, state-owned and private property are now undistinguishable. This issue is at the root of many conflicts and also accounts for the authorities' failure to effectively manage the Artibonite area (Haïti demain. Boucle Centre Artibonite CIAT November 2010).

6.5. Assesssment of fingerlings requirements

To achieve yields of 25,000 tons/year, the aquaculture industry will require substantial, stable and reliable supplies in selected fingerlings. Depending on the production model, an estimated production of **70 million fingerlings** will be needed.

The Port Sondé public hatchery, mired in managerial issues, has repeatedly failed to meet expectations over the past years, although this fact is denied by the authorities (validation workshop on August 31st, 2012, Port au Prince). The private sector could take over and easily produce in a short time the required number of fingerlings, as demonstrated by the investments of Opération Blessing: on a few hundred square meters in Santo, the organization has recently set up a hatchery managed by highly qualified staff and pumping water from the groundwater table, able to produce 3 million fingerlings per year. This initiative is a testament to the performance achieved by the private sector as opposed to the feeble attempts made by Government.

Fig.17 Intensive production pool, Opération Blessing

6.6. Assessment of fish feed requirements

MARNDR objectives for animal husbandry inputs (not including auaculture)

Haiti already faces a challenge to provide the large quantities of feed required to support goat, sheep, cattle and poultry farming. The Ministry is planning a massive support programme to tackle the persisting deficit in feed supply. The MARNDR's plan aims at "ensuring that the

availability of inputs for animal husbandry, in particular concentrates, becomes a key component of the stimulus package. By the means of a public/private partnership governed by an agreement, a working capital fund will be set up and used to purchase raw materials (soy meal, corn and premixed feed), and supply it to Haitian mills according to demand".

The MARNDR's announced objective is to gradually increase feed production to 24,000 tons a year after three years, for the sole needs of goat, sheep, cattle and poultry farming.

Specific fish feed needs

Intensive commercial aquaculture will notably increase these needs. On the basis of a food conversion rate of 1.5/1, the production objective of 25,000 tons of fish /year requires supplying an additional **37,500 tons of fish feed per year.** If aquaculture develops on a high-level semi-intensive model, (4.4 tons/ha/year), the food conversion rate will increase to 2/1, and the needs for fish feed will subsequently increase to **50,000 tons/year.**

There is still a long way to go. To facilitate the development of aquaculture, it is suggested that during a first phase (i) high quality fish food must be imported to cover the needs of commercial intensive aquaculture; (ii) locally produced fish feed made from agricultural by-products (rice or wheat bran) can be used for the needs of semi intensive aquaculture.

The annual revenues of the fish feed trade (for all types of productions) could be about **US $ 35 millions** (about US $ 800 / ton).

In a second phase, ideally, a significant increase in fish feed production would foster investments in heavier production infrastructures by specialized investors. As an example, BioMar and AquaChile have jointly invested over US $ 15M to build a fish feed production facility in Costa Rica (FIS. July 2012). Nevertheless, the cost of energy in Haiti and the size of investments required to produce this specific kind of feed could prevent such investments from happening in Haiti.

We should also keep in mind that relying exclusively on pelleted fish feed, whether imported or domestic, may not be an ideal solution as high temperatures and inadequate storage facilities are likely to spoil this costly and fragile product. Spoiled pellets no longer provide the necessary nutrients for optimal fish growth and may even cause major losses of stock due the oils going rancid. The recent surge in the prices of soy and corn, which are basic inputs for omnivorous fish (such as tilapia) feed, could drive the cost of feed significantly higher and curb the development of aquaculture.

6.7. Water requirements

Producing 25,000 t/ year will require large amounts of water, and good water quality. This objective has nothing to do with regrouping a few 85 sq m ponds, with a low water renewal rate linked to low-yield aquaculture techniques (0,8 t/ha/year) (FAO FAO Artibonite 1988).

The stakes are, by means of the considerable private investment expected (US $ 50M), to provide a large quantity of water that should be of the best possible quality in order to achieve the desired yields (40 t/ha/year).

If, as in Costa Rica, hyper-intensive techniques are used in earth ponds, the water renewal rate will range from 24 (wet season) to 48 (dry season) times a day. Water needs will thus range from **150,000,000 m^3** in the wet season to **300,000,000 m^3** in the dry season.

These considerable water requirements can be reduced by producing fish in floating cages.

6.8. Introduction of the Pangasius species in Haitian waters

The MARNDR has recently authorized the introduction of the Pagasius species (probably *Pangasius hypophthalmus)* in Haiti, convinced by the arguments of the Directorate of Fisheries and Aquaculture claiming that this species, if given quality feed, has a higher growth rate than tilapia. Given that Haitian fishfarmers have not yet been able to massively produce tilapia, and that aquaculture is stagnating primarily because of insufficient fingerling and lack of quality fish feed, this decision seems inconsistent. All the more so as the production of Pagasius worldwide is in the midst of a crisis and this species has a dreadful reputation on international markets (SeaFoodSource News. 2012). The authorization was accompanied by an obligation to enforce containment measures, but, quite likely, the said measures will fail to prevent fish from escaping and colonizing the Haitian waters. Such cases of escapes putting in jeopardy native fish species are numerous and well documented. Pangasius is an omnivorous fish and, in a natural environment, eats fish as part of its diet (IRD. 2008). The Haitian species *Cichiasorna haltiensis* would be in particular jeopardy if the pangasisus was to colonize Haitian waters.

The authorities in charge would be well-advised to think again about the risks linked to this introduction. If M. JP Réville, Team Leader in this project, was consulted, he would recommend eliminating the Pangasius, pursuant to the precautionary principle in environment matters. The Team could not collect further information on the Dominican Republic's stance towards this Haitian decision, yet the question arises as to whether the introduction of new species should be regulated by joint procedures as both countries share the same territory.

6.9. The Pond stocking program

The MARNDR's strategy includes a pond stocking programme targeting in particular the PNLCH hill reservoirs, with a draft budget of US $ 3 million. Most countries in the sub-region have abandoned such programs, as this approach has been many times proven unsuccessful. (for example, Nicaragua stopped its reservoir stocking programme in the late 80's). The MARNDR is still involved in this strategy, although the cost efficiency of such an approach is seriously questioned by all information collected.

"There is no rigorous monitoring system making it possible to objectively assess the impact of stocking policies on the productivity of lake ecosystems. However, there are serious reasons to believe that such strategies are not cost-efficient. Despite the claims of some reports, we can hardly think that a higher productivity in Etang Saumâtre can be obtained merely by stocking the pond with tilapia sp. fingerlings (probably hybrids), given that 80% of the captures are still *Cichiasorna haltiensis*, that the average weight of captured tilapias has apparently not changed, and exogenous intakes with eutrophication effect, likely to increase primary production, have not noticeably risen". (Bellemans,1999). Moreover, attention should be drawn to the fact that introducing and stocking ponds with exogenous and predatory

species, in the long term, causes the decline of endemic species like *Cyprinodon bondi* and *Cichiasoma haitiensis*.

Furthermore, introducing predatory species could actually undermine current efforts to stock ponds as the fingerlings introduced weigh 10 to 15 grams and are ideal preys for carnivorous fish. Bibliographical references also show that the populations of predator fish introduced in ponds tend to develop cannibal behavior after they have wiped out the endemic species. Great care should be exercised to make sure that such introduction programmes will not result in the irreparable destruction of the ecological balance in continental lakes and ponds" (Bellemans, 1999) (In Extenso from FAO/TCP/HAI/6712).

We recommend re-assessing the relevance of such a programme, taking into account that the fingerlings discharged – possibly uselessly- in lakes, are strongly needed by Haitian fish farmers who could on-grow them.

7 KEY-MESSAGES AND RECOMMENDATIONS

Based on their analysis, the team identified a series of key-messages and recommendations for the future development of aquaculture in Haiti.

7.1. Identification of physical favourable zones for pond aquaculture

The GIS modelling exercise led to the identification of a series of favourable zones for the development of ponds in the Artibonite valley, the central plain of Ouest Department, around Leogane, and the coastal plains of Nord and Nord-Est. The identification of these areas (covering in total 112,000 ha) was based on existing secondary data, and is therefore limited by the quality and spatial resolution of the data sets. In particular, this means that potential favourable micro-scale zones outside these main zones may also exist, which could support the development of successful aquaculture units. The favourable 112,000 ha identified by the GIS modelling indicate however zones where clusters of aquaculture units or Priority Aquaculture Zone (PAZ) could be developed.

It is important to note that the GIS analysis and modelling exercise have been restricted to physical parameters only (land cover, geology, topography and water). Other key factors influencing the potential success (or failure) of aquaculture ponds development, such as social, economic, and infrastructural factors (access to electricity and other inputs, access to and level of competition in markets, and institutional limitations and/or supports), could not be integrated in the modelling -due to lack of available GIS data with national coverage and/or the difficulty in realistically capturing the spatial nature of such factors.

7.2. Institutional and socio-economic factors

In the absence of such social and institutional information, the second component of the project (field survey) was designed to complement the GIS analysis and generate data (at the site level) that assesses these social, economic, and infrastructural factors. The analysis of these primary data sets led to the identification of areas characterised by favourable and less favourable conditions, which are determined by factors such as access to technical support, access to energy (both grid electricity and generators), distance from the sites to the closest extension station (BAC), etc. For each of these factors, data were aggregated at the department level, thus allowing the creation of up-scaling maps. The data reveals for instance that on average only 7% of sites has access to EDH. When we include sites with alternative sources of energy (gasoline or diesel generators) the national average increases to 20%. In

other words, 80% of sites visited operate (or try to operate!) without energy. This empirical reality has obviously a decisive impact on the level of activity and on the operational dynamism of the sites.

In absence of detailed data on the financial situation of these sites, the level of operational dynamism of the various aquaculture sites was used as a proxy to evaluate the situation of the sector. The data reveals that only 34% of the existing sites are functioning normally. The analysis also demonstrated the statistical correlation between the level of operational dynamism and the index of geo-institutional marginalization, suggesting that a major factor explaining the lack of dynamism of the sector is the low level and poor quality of the support that the small-scale fish farmers isolated in the various rural areas receive. Interestingly, this lack of support is also the factor identified by the respondents themselves, as the main limiting factor for the development of their activities.

7.3. Political economy of aquaculture development in Haiti

An (endless) list of aquaculture projects have been funded by various development and donor agencies, international and/or local NGOs, and faith-based organizations in Haiti over the last 50 years (Table 4). Most of these initiatives have 'died off' as soon as the project's official completion date was reached and the international partners withdrew. It is time to stop this approach where a multitude of small activities and projects scattered all over Haiti are implemented without any clear long-term strategy and any coordination. These 50 years of abortive projects teach us that this 'sprinkling' approach is doomed to fail, as it re-produces, project after project, the same errors, each time in different communities/region. Until the donors and NGOs really interested in promoting aquaculture as a way to contribute to poverty alleviation and food security in Haiti decide to collaborate and to redirect their resources into one well-planned, long-term, initiative, Port-au-Prince's population will continue to feed themselves on imported salami instead of locally produced farmed fish, and money from tax-payers will continue to be wasted. Adopting this coordinated approach, which should be co-governed by a collegium of donors and NGOs, would also reduce the risk of seeing aid money contributing to feed the rent seeking behaviour of certain institutions and/or individuals in the sector.

The analysis of the current documents and plans elaborated by the DPAQ and the MARNDR reveals the total mismatch between the rhetoric of the central authorities and the reality on the ground. In order to reduce the risk of false expectations and ludicrous projects (e.g. introduction of new species such as Pangasius) and, instead, to create the right institutional conditions, identify the correct level of resources and publics and private investment necessarily to support a realistic and harmonious development of aquaculture in Haiti, a pragmatic plan of development need to be put in place. In particular the figure of 25000 t/an proposed recently as the new objective for the sector need to be seriously reconsidered.

Based on these different points and the rest of the results and analyses presented in the report, a series of recommendations can be made.

7.4. Promoting small-scale aquaculture in Haiti

Small-scale fish farmers are usually rural households who are able to invest small amount of capital in low intensity, low capital pond activities, as part of a multiple-activity livelihood strategy. These production systems are generally characterised by a relatively low productivity and absence of added value. A large part of –or often the whole- production is

kept for the family's self-consumption (subsistence-oriented activity). If, and when, surplus is produced, it is often sold on the near-by market. The main contribution of this type of aquaculture is therefore through the nutritional security that it creates for these producers and their family (through the consumption of nutrient-rich fish) and to some extent their wellbeing and food security, improved indirectly through the income that they derive from surplus. When a sufficient number of these successful small-scale fish-farmers operate in the same (rural) area (or around small towns), local benefits may emerge through the effects of income multiplier and through the regular supply of fish on the local market. However, unless a sustained effort to scale up this type of aquaculture system leads to its successfully development throughout the whole country, it is unlikely that the surplus produced by these small-scale producers will benefit the urban consumers in large cities (e.g. Port-au-Prince).

Two conditions would be necessary to enhance the chance of success of small-scale farmers in Haiti. As clearly highlighted through the various results of the field survey, a major limiting factor for these small-scale producers is the current lack of access to information and to technical support (Fig.11). The data indicates that when technical visits were implemented (which was only in a fraction of the cases), 10% of the sites only received weekly visits, while more than 45% received support less than twice a year. With only 39 staff trained in aquaculture (1 staff for 710 km^2), and a limited number of them posted in the various BACs across the whole country (on average 1 trained staff by BAC), Haiti is at present time not able to provide sufficient technical support to the households who wish to engage in small-scale aquaculture activities.

From the demand side, organizing small-scale producers into some form of producer organization or cooperative would have several advantages. First this could facilitate or improve their access to information and stimulate peer-to-peer learning, thus helping to reduce some of the issues related to the lack of access to information that hamper these small-scale producers. Second this could also improve their purchasing and negotiation power in relation to input supply (fingerlings, fish-feed) and commercialization of their products.

7.5. Promoting medium scale aquaculture in Haiti

Medium scale aquaculture refers to a production strategy based on "individual aquaculture plots", whose surface area (for earth ponds) or volume (for floating cages) provides sufficient income to a family deriving its main income from aquaculture.

Developing this form of aquaculture could notably improve food safety in the country. Indeed the tons of fish produced in medium scale fish farms will be sold on the national market. If low enough production costs are achieved, this production could compete with imported goods such as frozen marine fish or salami.

Full and part time jobs created in medium scale aquaculture are likely to be perennial, as they consist for the most part in "family employment", not subjected to restructuring plans that occsionnaly devastate industrial and trade sectors.

Among the factors curbing the development of aquaculture in Haiti, we can put forward a training deficit, the lack of qualified technical staff and the geographic scattering of previous projects. In addition to these unfavourable factors accounting for the repeated failures of previous attemps, we can mention the persistent inability to devise a support strategy targeting the profitability of aquaculture farms.

Proposals to support the development of medium-scale aquaculture:

The exploitation of earth ponds or floating cages will be managed by families of fish farmers, geographically grouped within a Priority Aquaculture Zone. This will help reaching a critical size, which is a prerequisite for the dissemination of technical knowledge and the emergence of specialized producers (fingerlings producers, on-growing farms), as well as to increase fish farmers' negotiating power when purchasing inputs, and strengthen their marketing capacities.

The survey identified the lack of technical training and support as the main obstacle to the development of aquaculture. Priority Aquaculture Zones are a well-adapted operating structure to provide reinforced training in aquaculture techniques and business management to the entrepreneurs. To do so, one training center should be implemented in each Zone.

7.6. Developing large-scale aquaculture in Haiti

Large-scale aquaculture is based on intensive techniques, including feeding fish with high-protein (over 30%) extruded feed. The stocking density can be 8 kg/m^3 in ponds (earth, cement, steel or covered ponds) and 20 kg/m^3 in floating cages.

These high yield techniques require optimal water quality. In the case of ponds, a gravity-fed water supply system is usually chosen, to save pumping costs. However, hyper-intensive productions such as in Opération Blessing could be supplied by water pumped from the groundwater table. The water renewal rate must be high, up to 1 to 3 times / hour. Despite this frequent supply in clean water, mechanical aeration systems are often required due to the stocking density, with high enery costs implied.

Due to persisting water quality problems in the country, implementing large-scale aquaculture exploitations in earth ponds with water supplied from a river will be extremely challenging.

Implementing floating cages in large ponds and lakes reduces energy costs, as the lake water contains enough dissolved oxygen to allow the desired yields. This type of production could be favoured in the country's largest water bodies.

This aquaculture agro-industry requires heavy investements and substantial working capital. Investors seeking fast returns on investment and high profitability usually target export markets: thus, this production does not positively impact food safety, but it can improve the country's trade balance. Such enterprises qualify to benefit from the CFI's tax policies. These advantages are designed to attract major foreign companies to Haiti, but should not be maintained over a long period so that these companies contribute to the country's tax base.

Shareholders in such agro-inustrial companies hire highly qualified experts and usually achieve high productivity levels. However, in some cases, only the less qualified jobs benefit to the local workforce. It would be desirable that, in exchange for tax advantages and other facilitation measures, such companies commit themselves to implement internal training policies targeting local staff.

Large-scale aquaculture companies create full and part time jobs which are an important economic asset. This applies in particular to jobs created in the export-related processing plants.

To achieve the highest social and economic benefits for the local community, 25% of aquaculture concessions for the implementation of floating cages should be reserved for national, medium-scale fish farmers. These farmers should be grouped together n a Priority Aquaculture Zone organized so as to derive the maximum benefit from the proximity of large-scale aquaculture enterprises. This proximity is likely to facilitate access to selected fingerlings, fish feed, technology transfer and markets.

7.7 Profitability: an absolute necessity

Several strategies have been developed in this perspective to initiate the growth of aquaculture in Haiti. However it is vital not to get investors from the business or financial sectors involved in aquaculture before an analysis is carried out to determine what the chances for profitability are. Each possible technique (semi-intensive in ponds, intensive in ponds or floating cages) must be thoroughly analysed, in the perspective of both domestic and export marketing. This rigorous profitability analysis should be based on technical and economic factors, but also concern itself with the political, legal, social and cultural environment.

There are always opportunities, for a few performant fish farmers, to make high profits on niche markets by selling a modest production targeting the wealthiest clientele. Nevertheless the profitability analysis should take into account the MARNDR's objective to produce 25,000 tons of farmed fish a year.

The analysis may demonstrate that, under the current conditions, aquaculture production in Haiti cannot be profitable. The fact that Haiti imports dozens of tons of fish does not necessarily mean that domestic aquaculture production is sustainable. In this event, the deciding bodies will have to this situation into account and adjusting their policy.

7.8 Recomendations for a sustainable development of aquaculture in Haiti – Priority Aquaculture Zones (PAZ)

The constraints identified by this assignment and the conclusions of the report set out solutions to foster the sustainable development of aquaculture in Haiti. The team deems urgent action must be taken to initiate the growth of this agro-industry and make sure its development is in line with the actual aquaculture potential.

7.8.1 Institutional strategy

Several countries of the region have faced institutional challenges with innovative measures. This has triggered a fast and massive development of their aquaculture production. In Bazil, to promote the emergence of an efficient institutional environment and organization, the Fisheries and Aquaculture Departement was assigned directly to the President. Other countries entrusted their Prime Minister with the task of managing the national development of aquaculture. This option reminds of the recent decision to bring closer together the activities of the CFi and Prime Minister by holding council meetings in the same premises. Furthermore, although all interested parties agree on the necessity to review the fisheries and aquaculture regulations, there is no doubt that doing so will be a time-consuming and arduous task - all the more so as the work does not seem to have been initiated. The situation in the country pleas for urgent solutions to the current social and economic issues. Within the limits of legal possibilities, current regulations should be dusted off as soon as possible.

The law could be swiftly adapted to the current needs of aquaculture by the way of **ad hoc application decrees**.

7.8.2 Domestic market study

The MARNDR's ambition to massively develop aquaculture in Haiti is commendable. The objective of 25,000 tons a year aims to substitute local production to imported fish, which makes up most of the current consumption. "The program will target small entrepreneurs on the local market as well as large-scale businesses targeting both the domestic and exports markets." (MARNDR 2010). The study must be carried out in the perpective of a mass market, as the aim is to substitute production to imports, but could still usefully try and identify niche markets building on the wealthiest clientele's financial capacity to buy expensive but high quality products. The questions could be:

- What is the nature of the mass products consumed: fresh fish, frozen fish, salt fish, smoked fish? Marine or freshwater fish?
- For each product, how many tons a year are consumed?
- What are the bottom prices of each product at each stage of the marketing process? For example, what is the selling price of the grey mullet from the Gulf of Mexico?
- What are the supply trends worldwide for these products, at short and medium term?
- Could aquaculture products be substituted to currently consumed products, in terms of flavour and use in popular cooking recipes? For example, people used to Pwouasson Pepe may not like fresh tilapias. Among the species that could be farmed in Haiti's fresh waters, no aquaculture product is likely to substitute to salt fish.
- Can aquaculture products be substituted to other products belonging to the same market segment, in particular salami?

It will be essential to assess the risk of cheap tilapia imports from China. Chinese frozen tilapias on the export market are of good quality and sold at extremely competitive prices. They are able to beat locally captured and (even more so) farmed tilapias on the domestic market of several African countries such as Mali, Burkina Faso and Ivory Coast (ASC. 2008-2012).

7.8.3 Profitability study of aquaculture on the domestic market

This market study must in all cases be accompanied by a profitability study aiming to determine the production costs of fish produced with each of the possible techniques. This is a prerequisite to give a reliable answer to the question: **can aquculture production be profitable on the domestic market?**

7.8.4 Creation Priority Aquaculture Zones (PAZ)

PAZ or equivalent in the sub-region

Several countries, which have now become major producers, have implemented pro-active policies to foster a fast development of national aquaculture production, on the basis of specific areas exclusively dedicated to this agro-industry. In Chile, the authorities selected appropriate areas and created a favourable environment with attrractive tax and legal policies before making over these sites to private investors. As the country counts plenty of potential aquaculture sites, each investor could be granted the exclusive exploitation of a site (1 site = 1 company). In Asia, several countries, in particular the Republic of the Philippines, proceeded similarly by creating Aquaculture Parks (contrary to the Chilian sites, aquaparks were open to

several investors). This approach to prioritize aquaculture in a given area avoids the risk of conflict with other users of the site and other activities, for example animal husbandry, and agriculture. The findings of the survey show that aquaculture projects in Haiti are scattered accross the whole territory and far between, making up a plethora of disparate small activities. The spread of eligible areas has to be curtailed if technical and financial resources are not to be applied too thinly, so that the aquaculture industry can reach a critical mass.

To bring down most of the above described barriers, we recommend establishing **Priority Aquaculture Zones (PAZ).**

Creating PAZs will give the industry a chance to reach a critical mass in a region chosen for its aquaculture potential. The expected benefits are:

- Concentration of investments
- Concentration of aquaculture jobs, and greater availability of qualified labour for new aquafarming investments
- Concentration of technical resources
- Higher cost efficiency of input supplies (feed, fingerlings).

Definition

A PAZ is a well-defined area where aquaculture is strongly encouraged by a number of specific favourable mesures such as:

- Official status of PAZ that could be derived from the concept of free zone
- Specific environment laws and regulations
- Boundaries defined by topographical features delimiting plots for earth ponds and concessions on water bodies
- Guarantees of a secure ownership granted to the beneficiaries of the concessions.
- Pre acceptance of authorizations to produce (tons / year) to speed up the effective grant. (see example of floating cage concession in Appendix)
- useful infrastructure for aquaculture in the selected zones, which is currently missing: for example, service roads going all the way to the sites, electrical connection.
- customs prodedures adapted to the needs of aquaculture site owners, in particular to ensure an easy supply of imported fish feed (some oil companies already benefit from a comparable status)
- Other measures.

Selecting PAZs

In the framework of this project, the team was able to identify areas or ponds with strong aquaculture potential, but the information gathered is insufficient to select confirmed PAZ areas, except maybe for Miragoane Lake. Defining PAZ boundaries will require a thorough preliminary analysis of each pre-selected site. The relevance of the choice made will determine the chances for perennial success and the profitability of aquaculture activities. When selecting a zone, technical aquaculture criteria will be complemented by other factors: for instance, inland PAZs should be, whenever possible, located on State-owned land, not impinging on farmlands, and in areas with no major social issues. The final selection criteria, still to be refined, must be designed in accordance with the needs of a sustainable and perennial activity.

Environmental Impact Assessment (EIA)

The final selection of a PAZ must take into account environmental impact asessments carried out in each of the pre-selected areas. The approach must identify possible negative impacts and also point to the benefits linked to aquaculture, such as the enrichment of water from earth ponds by nutrients useful to agriculture; or the increased productivity of Miragoâne pond. In all PAZ, a Codex for a sustainable aquaculture will be strictly enforced, so as not to fall victim of a smear campaign like the one currently ruining pangasius production in Viet-Nam.

Strategy to develop medium size aquaculture in earth ponds in PAZ

The key components of a succcessful medium scale aquaculture project with a strong social dimension could be:

- Professionalisation of aquafarming
- Concentrating actions on a given area
- Providing attractive revenues.

The aim is that a substantial number of fish farmers, grouped together in a specific area, can benefit from a package of favourable conditions so that they can achieve profitability and make sufficient income to support a family of aquaculture entrepreneurs.

Infrastructures and equipments

Ponds located on a specific area with a network of water supply channels (preferably gravity-fed), service roads, possibly an electricity network, homes for entrepreneurs and their families and all useful premises (warehouses, tool storage room, etc.)
A training centre for initial and further training of aquaculture entrepreneurs.

Specialized infrastructure to produce fish feed made, as far as possible, with local ingredients such as agricultural by-products (wheat and rice bran, etc.)

An ice factory growing along with the development of the PAZ and allowing for products to be marketed in good conditions.

Technical and economic references

The technical and eonomic references are business plans intended to determine:

- The minimum size of aquaculture plots (surface area and number of ponds, size of water area, percentage of land built on)
- Production techniques (species, level of intensification depending on the available feed, etc.)
- Marketing strategies
- Other issues
- Expected profitability depending on the characteristics of the PAZ.

Support to entrepreneurs

During a first phase, candidates will receive a short training in aquaculture techniques and management. The successful candidates will gain admission to the PAZ support programme.

Each entrepreneur or family will benefit from:

- A ready-to-use plot with ponds and a water supply system (if possible gravity fed)
- The possibility to gradually expand the exploited area
- A house conveniently situated on the plot
- Aquafarming gear and equipment
- Initial and working capital.

Entrepreneurs could be usufructuaries within the framework of long-term tenancy agreements rather than owners of the plots.

Obligations imposed on entrepreneurs

In exchange for those benefits, their obligations should be the following:

- Attend complementary training at the centre
- Make the best possible use of their plot
- Abide by the provisions of their contract, which are still to be refined. They could include the amount of the "rent" of the plot and the conditions for payment (one year free of rent until a sufficient income is obtained, etc.)
- Not sell the plot
- Other obligations.

In case of voluntary departure, entrepreneurs should be paid a fair price for any improvement made to the plot. Inheritance issues following the death of an entrepreneur should be organized by the long term contracts in a way that would avoid fragmenting the plot and losing the assets built.

Business plan for a pond production PAZ

This is a virtual PAZ business plan to illustrate the concept:

- Situation : **downstream part of the Artibonite valley, area of Estère**
- Area not used for agriculture, but with access to water supplies
- **Total favourable surface area : 100 ha of water, 150 ha altogether**
- **Entrepreneurs: 50 families**
- Infrastructures and equipments : training centre, service roads, electricity connection, feed production facility and later ice factory, 50 houses on plots etc
- Aquaculture infrastructures: 1,000 ponds of varied dimensions and water supply network
- Water needs: 2 renewals a day, i.e. 2,000,000 m^3 / day
- Asic inputs for feed production : wheat and rice bran
- Needs for fish feed : 880 tons/year
- Conversion rate: 2
- Production: 4.4 Tons/ha/year

- **Total annual production : 440 tons/an**
- Direct full time jobs : 50
- Direct part time jobs : 400
- Indirect beneficiaries: 2250 (FAO 2012.)
- **Total : 2700 beneficiaries**
- **Income generated: 1 280 400 US$.**

Strategy to develop floating cages aquaculture in PAZ

A similar approach can be used to ensure the development of floating cages exploitations in one of the country's three major lakes. These PAZ can be entrusted to major companies seeking high profits and targeting the export market. However, to make sure that aquaculture activities benefit to the local community while still meeting profitability objectives, a proportion of the concessions must be reserved for family exploitations.

Businesss plan of a floating cages PAZ

- Situation : **Miragoâne Pond**
- Favouable surface area : 4 concessions of 1,000 tons/ha/year each
- **Entrepreneurs : 1 joint-venture Brazil/Haïti** owning 3 out of the 4 concessions and producing a total of 3,000 t/year pursuant to the authorization
- **Entrepreneurs: 100 Haitian aquaculture entrepreneurs** producing a total of 1,000 t/year
- Aquaculture infrastructures: Hatchery, floating cages, processing plant (HACCP), others
- **Investments : US $ 6,000,000**
- Fish feed : high quality imported fish feed
- Conversion rate : 1,5
- Needs for fish feed : 6,000 t/year
- Annual total production : 4,000 t/year
- Direct full time jobs : 314
- Direct part time jobs : 2,673
- Direct beneficiaries : 6,587
- Indirect beneficiaries : 13,500
- **Total : 23,000 beneficiaries**
- Market: 3,000 t/year of fish fillet exported to the USA and Canada (equivalent live weight)
- Market : 1,000 t/year of whole fish sold on domestic market
- **Income generated: US $ 10,400,000.**

Synergy between main aquaculture projects and medium scale aquaculture

The development of aquaculture in favour of low income populations and aiming to improve their living conditions is not jeopardized by the promotion of commercial intensive aquaculture, which, on the contrary, can have a lever effect.

Staff working in major production sites is trained in aquaculture and can disseminate this knowledge by sharing it or producing fish themselves. Inputs such as selected fingerlings and fish feed are likely to become more easily available. We can also consider that the main company could sell inputs to small producers, provide them with technical support and buy

their production in accordance with established specifications. Small producers would then benefit from a larger marketing network and increase their outreach.

TaskForce AquaHaïti

To make the most of the assets identified in some Haitian aquaculture sites, we recommend: **creating a TaskForce AquaHaïti.**

On the model of an innovative aquaculture project in Zimbabwe, this team would be responsible for creating conditions allowing the take-off of the aquaculture sector in Haiti. "The African Development Bank has recently approved a US $ 8M loan to finance the Lake Harvest Aquaculture project, a private initiative on Lake Kariba in Zimbabwe. The total amount of debt financing should be US $ 20M, granted by development financial institutions in partnership with the ADB. LHA should produce 20,000 tons of fish a year, generate 900 qualified full-time jobs by 2015 and bring an additional income of US $ 33m in present value to Government over the next 10 years (www.afdb.org. 31/10/2011).

We suggest that the CFI be in charge of implementing this strategy

The first stage of the strategy consists in determining the team profile, the financing options, clear objectives and a detailed schedule.

It appears that the deciding body of the task force should be an economic rather than technical entity. International donors and project managers have their own technical experts on whom they will rely to make their decisions. What they need before all is a clear assessment of the yields expected from their investment, which implies talking to economists.

It is vital throughout the process to keep in mind that international investors are trying to:

- **Obtain certainties**
  (Institutional, legal, customs-related, tax-related, technical, social and others)
- **Be able to make quick decisions**
  Major investors rarely study a case for a whole year. They usually need to be able to make a decision within a few months.

This strategy applies both to private investors and to development financial institutions

The objectives of the TaskForce would be:

- Rouse the interest of potential national and international investors ready to take a stake in the aquaculture industy, and convince international donors to support the project
- Obtain investment commitments for PAZ on pre-selected high potential sites
- Facilitate the creation of an Aquaculture Fund, financed by Government and international donors
- Accompany the development of production in major aquaculture sites.

Among the assignments to be carried out by the team or entrusted to specialized experts, we can mention (non exhaustive list):

- Make the mandate of the MARNDR, the Directorte of Fisheries and Aquaculture and the Environment Ministry more consistent with the ideal conditions for a major development of aquaculture in Haiti
- Review and improve the applicable laws and regulations and create tax incentives on aquaculture investments. (New application decrees adapting the law. Exemption from duties within the framework of the CFI, etc.)
- Set up a single desk where all the proceedings linked to the establishment of aquaculture production site can be quickly and smoothly done. The experience of the CFI will help in doing so
- Support the creation of a dedicated Fund for aquaculture agro-industrial investments. This fund should consist in guaranteed loans (commercial loans or loans with added benefits of subsidies). A pool of international donors/lenders should be sought: BID, World Bank, Canadian and Spanish cooperation, various foundations (Clinton, Gates, etc;), charities, religious communities, etc. In addition to these institutional investors, the national banking system and Haitian businessmen can be informed of the opportunity, in particular those already involved in the agro-industry and in exports, who should be asked about their "intended investments". Banks would then be solicited to take a stake in aquaculture projects and sell the shares to their clients, as was the case for LMH with unibank.

The Task-force should work in close cooperation with key stakeholders and Haitian businessmen. An aqua Haiti brochure could be released, including:

- A list of PAZ, showing the areas and water bodies dedicated to aquaculture production, their characteristics and priority ranking
- The "new environmental, tax and administrative measures" designed to support investments in commercial aquaculture
- A reminder of the proximity of the American and Canadian markets to sell fresh tilapia fillets. In 2010, the USA imported more than 460,000 tons of tilapia (equivalent whole weight) valued at more than $ 760M (Fitzsimmons 2011)
- A list of national investors interested in joint ventures in the aquaculture sector
- A presentation of funds made available to develop this agro-industry, their nature, subdidies, guaranteed loans whether subsidized or not, … and other points to be refined.

The phases of implementation would be as follows:

Phase I
- Creation of the Task Force and beginning of activities

Phase II
- Preliminary activities to prepare the promotion of Haiti's aquaculture potential on the international stage
- Launch of activities to create a General Aquaculture Fund Haiti
- Release of the AquaHaiti brochure.

Phase III
- Contacts with potential international investors and promotion of Haiti's aquaculture potential

- Involvement in world events and congress bringing together all major players in industrial aquaculture worldwide
- For one year.

Phase IV

- Selection of projects qualifying for guaranteed loans
- Support to projects of Aquaculture Fund Haiti through guaranteed loans and other financial tools such as the issue of shares.

Phase V

- Beginning of investments and production.

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Appendix 2: Presentation, Port-au-Prince 31st August 2012

See Annex 8

Appendix 3: EXAMPLE OF ESTABLISHMENT CONTRACT

BETWEEN :

The Ministry of Agriculture, Natural Resources and Rural Development, below "MARNDR", represented by the Minister, domiciled in Damien, Route nationale # 1,

AND

The company COMPANY Ltd, Haitian Limited company, identified and registered under the number……. Represented by Mr YYY, registered under the number ……, duly authorized by the Board, herewith the minutes of the extraordinary Board designating him as authorized Representative for such purposes,

Having regard to the correspondence through which Mr YYY requests, on behalf the company COMPANY Ltd, the benefits of the Investment Code in order to establish an enterprise producing freshwater fish in floating cages, targeting mainly the export market;

This clause is essential to the grant of the advantages offered by the CFI and is a matter to be negociated as the national market is in deficit;

Having regard to the letter of February 27th, 2008, in which the Ministry of Agriculture, Natural Resources and Rural Development expresses full support to the project of COMPANY Ltd;

Having regard to the MARNDR's analysis report certifying that the project meets the requirements of the Investment Code;

Having regard to the minutes of the Interministerial Committee for Investments of August 12, 2008, specifying the tax advantages and relief from customs duties applicable to the company COMPANY Ltd, pursuant to articles 19, 27, 30, 31 and 47 of the Investment Code;

Considering that the production of animal protein is of vital importance for the population of the country, and given the importance of food security in the country's development strategy aiming to improve the well-being of the population;

Considering that the company COMPANY Ltd has a preference for the Miragoâne pond in the Nippes Department;

Considering that COMPANY Ltd requests, for the needs of its production in floating cages, the authorization to produce on a surface area corresponding to the concession number……. of the Priority Aquaculture Zone (hectares);

Considering that COMPANY Ltd also requests to be granted concessions on this surface area for successive periods of 10 years, unless a new agreement protocol is signed;

Considering that pursuant to Article 66 of the Decree of Nov 20th, 1978 on the exercise of the right to fish in Haiti, the MARNDR is empowered to make such decisions;

Considering that the Ministry of Agriculture, Natural Resources and Rural Development, in accordance with the provisions of Article 66 of the Decree of Nov 20th, 1978 on the exercise of the right to fish in Haiti, signed on August 20th, 2007 an agreement protocol with the company COMPANY Ltd for a ten year period on this concession;

Considering that the State of Haiti, through the Ministry of Agriculture, Natural Resources and Rural Development and in the framework of the fisheries and aquaculture sector policy, intends to strengthen private fish production structures on inland waters;

THE FOLLOWING HAS BEEN AGREED AND DECIDED UPON

I. Definition and location of aquaculture activities

Article – 1 The company COMPANY Ltd commits itself to submit to the MARNDR, as of the signing of the present agreement, the exact location and surface area of the aquaculture production site, which can currently be described as follows:

- One zone corresponding to concession number … of the PAZ, covering approximately 250 ha and intended for production in floating cages, the royalties for which will be paid to the Tax Authority (DGI)

- A piece of land corresponding to concession number …. of the PAZ, intended to support the require buildings and facilities, close to the water body and to the floating cages.

II. Commitments of the parties

Commitments of COMPANY Ltd:

Within the framework of this contract and the related advantages, COMPANY Ltd commits itself to:

Article -2 Abide by the environmental laws applicable to the planned field of operations;

Article 3- Implement appropriate monitoring and assessment programs to track and mitigate possible negative effects on the environment resulting from aquaculture activities and their social/economic consequences, and keep MARNDR technical officials informed;

Article 4- Preserve genetic diversity by not introducing in the pond new non-endemic species nor genetically modified aquaculture stock which could negatively impact endemic species, without prior ad hoc studies;

Article 5 – Strictly abide by all rules and regulations;

Article 6 – Use the benefits derived from the advantages and facilitation granted exclusively for the needs of the exploitation of the concession for which they were granted;

Article 7- Inform the Ministry and the CFI of any events liable to prevent it from achieving the objectives of the exploitation;

Article 8- Promote relationships with universities and vocational training centers by accepting trainees or students completing a thesis;

Article 9- Contribute to the implementation of measures liable to ensure proper compliance with the code of Conduct for Responsible Fishing" (FAO);

Responsibilities and commitments of the Haitian State:

Within the framework of this contract and the related advantages, the Haitian State commits itself to:

Article 10- Ensure that the company COMPANY Ltd complies with the responsibilities agreed upon in this establishment contract

Article 11- Strictly abide by the provisions of this contract

Article 12- Enforce, as of the signing of this contract, the agreement protocol agreed upon between the company and the MARNDR

Article 13- Grant the following advantages to the company COMPANY Ltd:

Tax advantages:

- Full exemption from tax on the company's income over a 10 year period;
- Partial exemption from tax on the company's revenues over the following 10 year period
- Exemption from tax on salaries and other direct internal tax over a 10 year period;
- Exemption from municipal property taxes apart from patent rights over a 10 year period;

Relief from customs duties:

- Relief from customs duties and tax exemption on raw materials and equipments imported for the needs of the implementation of the company and exploitation of the concession.

Facilitation measures:

- Exemption from having to pay a deposit for the temporary admission of raw materials and packaging material;

- accelerated depreciation as defined by the second subparagraph of Article 27 of the Investment Code;

Article 14- The Haitian State commits itself, through Governement or local authorities, to support and uphold the inteests of the company COMPANY Ltd if any difficulties should arise in implementing the project.

III-Communications

Article 15- Any notice, request or communication adresed by the parties to each other within the framework of this contract will be sent in writing to the adresses above, unless otherwise stated in writing.

For the company: COMPANY Ltd, Haiti

For the MARNDR : Ministère de l'Agriculture, Boite postale No 1441, Route Nationale No 1, Damien, Port-au-Prince, Haïti.

IV-Resolution of conflicts

Article -16 Any conflict arising from the implementation or interpretation of this contract will be brought before the Court of Auditors and State Liability (Cour Supérieure des Comptes et du Contentieux Administratif, CSCCA)

V-Appendix

Article 17- Are attached to this contract and included in it:

1. The agreement protocol on a concession for the exploitation of floating cages on concession number…… of the PAZ.
2. Copy of the official authorization to operate granted to COMPANY Ltd.

3. Minutes of the extraordinary Board Meeting of COMPANY Ltd designating Mr YYY as the authorized person to represent the Company.

Annex 7: DPAQ questionnaire

Question	Oui	Non	Partiellement	Ne sait pas	Remarques
La procédure de vore recrutement vous semble t-elle avoir été adéquate ?					
Le salaire actuel vous satisfait-il ?					
Bénéficiez-vous d'avantages sociaux ?					
Si oui, vous satisfont-ils ?					
Un système de promotion est-il mis en appplication ?					
Vous satisfait-il ?					
Vous semble t-il clair pour l'évolution de votre carrière ?					
Une stratégie de développement de compétence existe-t-elle ?					
Vous semble t-elle clair pour l'évolution de votre carrière ?					
Vous satisfait-elle ?					
Un système d'évaluation de vos prestations existe-t-il ?					
Est-il opérationnel ?					
Vous satisfait-il ?					
La mobilité (changement d'affectation) est-elle appliquée ?					
Estimez-vous quelle est un atout pour votre carrière ?					
La communication interne de votre adminsitration existe-t-elle ?					
Vous satisfait-elle ?					
Le climat social interne (entre collègues de niveau similaire) vous satisfait-il ?					
Le climat social interne (avec vos supérieurs) vous satisfait-il ?					
Vous sentez-vous informé et impliqué dans les évolutions de votre administration ?					
Vous semble t-elle favoriser la fourniture de services et de produits aux					
La culture est-elle en adéquation avec les nouvelles stratégies du MARNDR ?					
Pensez-vous que les changements envisagés au MARNDR seront positifs ?					
Votre administration favorise t-elle le respect de valeurs intègres?					
Votre structure administration t-elle la prise d'initiative et de responsabilités ?					
La situation actuelle favorise t-elle la collaboration au sein de la structure ?					
Des actions ont-elles été appliquées pour évoluer certains aspects de la culture et des comportements ?					
Votre travail est-il défini par des procédures vous permettant d'exécuter votre					
Un système de planification de votre travail est-il mis en place ?					
Fonctionne t-il correctement ?					
Disposez-vous de bureaux pour vos activités ?					
L'état des bâtiments est-il satisfaisant ?					
Votre environnement de travail est-il stimulant ?					
Disposez-vous d'équipements informatiques adéquats fournis par votre structure ?					
Son état est-il satisfaisant ?					
Bénéficiez-vous d'un soutien technique gratuit pour l'entretien de ces équipements					
Ou devez-vous supporter les coûts de cet entretien ?					
Devez-vous rédiger et remettre des rapports régulièrement sur vos activités ?					
Si oui, recevez-vous des commentaires de la part des destinataires de vos rapports ?					
Une collaboration avec les autres structures gouvernementales existe-t-elle ?					
Si oui, son fonctionnement est-il satisfaisant ?					
La répartition des tâches vous semble t-elle satisfaisante ?					
La répartition des responsabilités vous semble t-elle satisfaisante ?					
Disposez-vous d'un moyen de déplacement ?					
Fourni par la structure ?					
Personnel ?					
Les coûts de fonctionnement sont-il fournis par la structure ?					
Si oui, les budgets sont-ils suffisants ?					
Si non, êtes-vous obligés de supporter ces coûts ?					
si non, êtes-vous contraints à ne pas vous déplacer ?					

Annex 8: Haiti Aquaculture questionnaire

Annex 9 : Presentation

Annex 10 : Raw Data