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Report of the

**CARICOM/CRFM/JICA First Regional Workshop on
Aquaculture Development Planning**



**Kingston, Jamaica
14 – 21 March 2011**

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Belize
2011

CRFM Technical & Advisory Document - Number 2011/3

Report of the CARICOM/CRFM/JICA First Regional Aquaculture Development Planning Workshop

14 – 21 March 2011
Kingston, Jamaica

Prepared and edited by: Terrence Phillips, Programme Manager, Fisheries Management & Development, CRFM Secretariat, Kazuo Udagawa, Deputy Director, IC Net Limited and Pamela Gibson, Administrative Secretary, CRFM Secretariat

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Report of the CARICOM/CRFM/JICA First Regional Aquaculture Development Planning Workshop, 14 - 21 March 2011, Kingston, Jamaica

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1.0 Background

The aquaculture sector is not well developed in the CARICOM region, with significant development limited to countries like Jamaica and Belize. Other countries like Guyana, Suriname and Trinidad and Tobago have begun to put more emphasis on aquaculture as an area for development. The practices mainly involve the use of ponds to culture such species as penaeid shrimp, tilapia, carp and cachama. Also, there is long line culture for algae in St. Lucia and the mangrove oyster in Jamaica.

Most CARICOM States have limited land and fresh water resources, however some, like Belize, Guyana and Suriname, do have ample supplies. On the other hand, most states have larger expanses of marine space than land mass, which offers the potential for the promotion and development of mariculture. As such, the approach to aquaculture development will have to be multifaceted in its focus, design and implementation in order to address the needs of those with ample land and fresh water resources and those with less of these resource endowments. The CRFM has identified the promotion and development of aquaculture as one of the programme areas within its Strategic Plan and Medium Term Plans 2004/2007 and 2008/2011.

The CARICOM/CRFM/JICA Project: Study on Formulation of Master Plan on Sustainable Use of Fisheries Resources for Coastal Community Development in the Caribbean has been developed with the aim to conduct a study and formulate a Master Plan on the Sustainable Use of Fisheries Resources for Coastal Community Development in the Caribbean. It is being funded by JICA under the CARICOM/Japan Cooperation Agreement and is addressing the following components: (i) pelagic resource development and management; (ii) aquaculture development policy formulation; (iii) regional fisheries database development; (iv) support for community-based management; and (iv) education and training in the component fields in the CARICOM States. The expected outputs are: (i) a Master Plan on Sustainable Use of Fisheries Resources for Coastal Community Development in the Caribbean; (ii) reports of Baseline and Pilot Studies conducted under the various components; and (iii) transfer of relevant technology to the institutions and staff of CRFM Member States and CRFM Secretariat during the course of the Study.

Following on the First Project Steering Committee Meeting in December 2009, and subsequent communication among the CRFM and JICA/IC Net Ltd, three (3) pilot projects were selected for implementation in 6 countries between April 2010 and October 2011. The Pilot Projects and countries where they are being implemented are: (i) Fish Aggregating Device (FAD) and Associated Pelagic Fisheries Resources Development and Management (Dominica and St. Lucia); (ii) Development of Fisheries Statistical System Models (Guyana and St. Vincent and the Grenadines); and (iii) Small-scale aquaculture training (Jamaica) and low cost small-scale aquaculture development (Belize).

In relation to the Small-scale Aquaculture Training, two regional workshops are scheduled during the period of pilot project implementation; the first in March 2011 and the second in August 2011. The inter-sessional period will be used by participants to review and finalize, in consultation with the relevant stakeholders, the draft action plans for sustainable aquaculture development for the respective Member States.

This volume contains the report of the *First Regional Workshop on Aquaculture Development Planning*, held in Jamaica from 14 to 21 March 2011. The objective of the Workshop was to provide training in project cycle management, including problem analysis and planning, and to assist in the preparation of draft action plans for sustainable aquaculture development in Belize, Guyana, Haiti, Jamaica, Suriname and Trinidad and Tobago. The expected outputs are: (i) Draft Action Plans for Sustainable Aquaculture Development; and (ii) twelve fisheries officers trained in Project Cycle Management, including problem analysis and planning.

2.0 Workshop Arrangements

The participants, drawn from the CRFM Member States of Belize, Guyana, Haiti, Jamaica, Suriname and Trinidad and Tobago, introduced themselves; identified chairpersons for the various sessions on the Draft Agenda; and reviewed and adopted the Workshop Agenda. The full List of Participants is given at Appendix I and the Agenda appears at Appendix II.

3.0 Country Reports

Each Member State presented a report on the status of aquaculture development in their country. The reports sought to address such aspects as a brief history, importance of aquaculture, description, including production and other statistics; current situation - policy, laws/regulations, existing plans and level of implementation, budget allocation, including donor funded projects; lessons learned; and challenges and constraints to aquaculture development. Summaries from each country report and the subsequent discussions are given below. The Country Reports are provided at Appendix III.

3.1 Belize

3.1.1 Report summary

Aquaculture production in Belize began in the early 1980's. Its (fisheries and aquaculture) contribution to GDP has varied from 5.0% in 2003 to 2.2% in 2008. The greatest financial investment and consequently production has been from shrimp farming, with 5 million pounds being produced in 2000, 18 million pounds in 2005 and 5.2 million pounds in 2008. The export values associated with such production were BZ\$9.2 million in 2000, BZ\$91 million in 2005, and BZ\$25.6 million in 2008. The second most important aquaculture commodity in terms of production biomass has been tilapia, with production going from 571,000 pounds in 2005 to 4.1 million pounds in 2008 and 1 million pounds in 2010. Cobia (*Rachycentron canadum*) is the third most important aquaculture commodity in terms of production biomass, with 850,000 pounds being produced in 2008.

Apart from the industrial scale commercial oriented tilapia operations, a number of semi-commercial and small scale back-yard farming operations have developed in Belize. The latest statistics shows that there were 65 small scale operations with a cumulative pond production area of 16 acres. The harvests from these operations have been mainly for local consumption.

The Fisheries Department is responsible for regulating the aquaculture sub-sector in Belize, which in large measure entails the articulation of policy and legislation as well as providing advisory support to developers and training. It also involves the production of seed stocks to sustain the small-scale tilapia farming initiatives. At present, there is no official policy or industry specific regulation to guide the development of aquaculture in Belize.

The aquaculture sector continues to face such challenges as the sustainability of the various farmed commodities given the high cost of production inputs and unstable market prices. In terms of diversification from the traditional aquaculture activities in Belize, there has been a growing interest by investors in tilapia cage culture, sea cucumber aquaculture and the farming of seaweed (algae). With regards to investment opportunities, the Government of Belize continues to offer various tax and concessionary land offerings incentives to attract direct foreign investment in aquaculture development, with the competitive advantage of Belize being its proximity to major regional markets.

3.1.2 Discussion

Following on the presentation by the participants from Belize, questions and comments were entertained. Based on these discussions, it was noted that although there was a rebound in shrimp prices, some shrimp farm facilities have remained closed, with some facing foreclosure by the banks

which were unwilling to write off outstanding debts. Banks with prior exposure were now reluctant to support further aquaculture investment.

It was pointed out that in order to avoid such financial difficulties, the banks and other investment agencies should develop their capacities to ensure sound project appraisal that is technically, economically and environmentally sustainable.

In response to queries concerning the development of the sub-sector, it was mentioned that offering a deregulated environment led to rapid, uncontrolled, unsustainable development which resulted in a possible boom/bust cycle. The roles of the Fisheries Department and Coastal Zone Management Authority in regulating the sub-sector were pointed out. It was indicated that as early as 2004, a draft national aquaculture policy and a draft aquaculture act, mainly industry inspired, were written. Unfortunately, they were never accepted due to possible sector self-interest and lobbying.

It was indicated that the environment NGO lobby in Belize was very influential and as such more rigorous and technically sound EIAs had to be undertaken as part of any aquaculture investment venture. The permit approval process often times acts as a disincentive to small scale farmers who are unwilling to go through the entire process given the low levels of production.

Among the other issues discussed were environmental outflow/loading associated with nutrient effluent; exposure to natural hazards and resource use competition. Also, it was noted that despite a precautionary approach to aquaculture development, the need to both generate and fast track investment and development projects could sometimes result in faulty decision making.

Exposure to natural hazards, specifically the threat of hurricanes and the relatively exposed nature of suitable sites, was identified as a major constraint for coastal aquaculture development, especially cage farming.

Insurance issues were raised but not fully explored. However, it was noted that possible risk exposure to natural hazards raised the reluctance of insurers to offer full or limited coverage to an aquaculture farm. On the other end, premium obligations of the insured could not be supported by their operations.

3.2 Guyana

3.2.1 Report summary

At present, there are forty-three (43) large scale producers most of whom reside on the coast of Guyana and approximately ninety-three (93) small and prospective aquaculture farmers. These farmers produce mainly red tilapia (*Oreochromis spp.*), Nile tilapia (*Oreochromis nilotica*), tambaqui (*Colossoma macropomun*), hassar (*Hoplosternum littorale*), black shrimp, mullet (*Mugil cephalus*), queriman (*Mugil liza*) and bashaw (*Micropogonias furnieri*). The industry can be considered to be growing through expansion of existing aquaculture farms and an increasing number of prospective farmers.

Aquaculture development is spearheaded by the Satyadeow Sawh Aquaculture Station (SSAS) of the Fisheries Department. The facility is used to execute research activities, train farmers, produce fingerlings and provides extension services to farmers. The Fisheries Department, through collaboration with agencies such as USAID Collaborative Research Special Project (CRSP) and the Brazil Technical Cooperation Agreement, has made some strides towards improving the development of the aquaculture sector in Guyana. However, there are certain key constraints that hinder the rapid development of the sector, namely:

- inadequate access to technical expertise and training to improve the technical capability of the technical staff of the Aquaculture unit,
- insufficient funding and research related particularly to quality feed formulation,

- unavailability of a suitable local feed,
- inadequate marketing of Guyana's aquaculture products locally, regionally and internationally, and
- inadequate policy development and execution and incentives to further stimulate the sector.

3.2.2 Discussion

Based on the discussions following the presentations, it was noted that aquaculture development was slow and primarily at the extensive level. It was also pointed out that there were some farmers who breached the sea defenses to let in brackish water with juvenile fish and shrimp into primitively constructed grow-out areas. With Guyana being a low lying country, this breaching of the coastal defenses in some areas could pose a serious challenge to the coastal flood management systems which would in turn threaten human life, property and traditional rice farming activity. Salinization of lands with brackish water would over time render lands unsuitable for traditional agricultural production activity.

Some of the major challenges to aquaculture development were identified as:

- inadequate development policy and legislation
- high energy costs
- feed (high cost, low quality, poor shelf life)
- low level of private/foreign capital investment
- insufficient human capacity
- inadequate project evaluation processes
- inadequate arrangements/mechanisms for brood stock development and seed supply
- praedial larceny
- inadequate natural hazards risk management
- inadequate information sharing and dissemination.

It was also opined that insurance coverage should be provided in the aquaculture sector to address risks resulting from the increased frequency and severity of natural disasters; climate change; and praedial larceny. Reference was made to the recently concluded 2010 Antigua and Barbuda Symposium on Disaster Risk Management (DRM), the Caribbean Catastrophe Risk Insurance Facility (CCRIF) and the suitability of the WINCORP model for aquaculture coverage in the wider CARICOM region.

3.3 Haiti

3.3.1 Report summary

Haiti's aquaculture is characterized by non-commercial subsistence scale activities with low input feed based, mostly for personal consumption or local sale. Tilapia is the main species used in aquaculture. Aquaculture (freshwater, brackish-water and marine) is very feasible in Haiti. There is good potential for aquaculture development in various zones in the country, with more than 23,000 hectares of land not suitable for agriculture being favorable for the development of commercial aquaculture fish farms.

In 2009, the government in Haiti, through the Ministry of Agriculture, Department of Fisheries and Aquaculture, established the necessary conditions for investment by the private sector in order to achieve increases over the next ten (10) years in the production of the marine fisheries from 16,000 tons to 35,000 tons; pond aquaculture from 400 to 5,000 tons, and inland water from 600 to 10,000 tons. They also intend to create 70,000 jobs during this development phase.

3.3.2 Discussion

Based on the discussions, it was indicated that Haiti currently has low levels of aquaculture production and is deficient in all inputs for development, except for favorable natural resources for

cage culture. Also, there is a need to provide for its nationals a guaranteed supply of affordable fish protein.

The country is currently benefiting from technical development assistance from Cuba, but has strong reservations regarding the roles of NGOs in their development processes.

It was mentioned that Haiti is quite open to external private sector investment, but lacks infrastructure and reliable public utilities which would pose development challenges. Despite the importance of aquaculture, there is competition for resources from several other sectors, especially since the earthquake.

3.4 Jamaica

3.4.1 Report summary

Jamaica is the third largest island in the Caribbean Sea. The main income generating sectors for the economy are exports of sugar, bananas, mining, tourism and remittances. However, recent contributions from the fishing industry, in particular aquaculture, have resulted in a 41.3% increase in contribution to GDP moving to 0.39%. Aquaculture production grew from 3,000MT in the 1990's to 5,776 MT in 2009, with an estimated value of US\$20 million. Some 300,000 persons benefit directly or indirectly from aquaculture activities.

Subsistence aquaculture was first introduced into Jamaica in 1948. However, commercial expansion of the industry began in 1976 through a USAID/GOJ project. Since 1976, the aquaculture sub-sector has grown steadily with production focusing on tilapia. At present, the industry includes an ornamental fish sub-sector, culture of marine shrimp (*Penaeus vannamei*) and freshwater crayfish (*Macrobrachium rosenbergii*), and small-scale production of the mangrove oyster (*Crassostrea rhizophorae*).

Despite the achievement in the industry, growth has been stymied due to competition from cheap imports from South East Asia, high input costs, high incidences of praedial larceny, high cost of credit, and the absence of a ratified policy and development plan.

3.4.2 Discussion

The Jamaica presentation was treated as a case study. However, it could be seen that it shared common challenges with the other countries such as:

- high production costs (energy, feed, seed, security)
- inadequate monitoring and enforcement
- inadequate extension support
- financing collateral requirements prevent uptake and stifle debt servicing
- absence of ratified policy and development plan
- poor cooperative structures/ unable to capitalize on cluster competitiveness.
- availability of cheap imports
- susceptibility to natural hazards.

It was pointed out that the development followed somewhat the same trend as the Belize shrimp industry displaying the typical boom and bust cycle. However, as a way forward the industry needed to diversify along the following lines:

- species produced
- cooperative management approach
- cheaper production technologies.

In terms of the lessons learned, the following were stated:

- There should be a reliable public seed supply to ensure quality and market stability

- The need for an aquaculture one stop shop
- There should be product diversification to ensure wider market penetration
- There is need to develop and get buy-in to a policy /development plan in keeping with national policy direction.
- There is need for improved feed.

3.5 Suriname

3.5.1 Report summary

Suriname has been involved in aquaculture activities since the 1800's. From that period to now there have been various studies and activities done in this field, but it was not until the 90's that there was a significant increase of aquaculture farms. The majority of these farms have since gone out of production for various reasons, such as inadequate marketing, insufficient expertise, bad management and financial constraints. At present, there is only one commercial aquaculture farm in production that is supplying the local market, although it is certified to export its products to the EU.

There are several ongoing projects that are all receiving support (financial and/or technical) from the FAO. These are:

- 1) Rice-fish project in Nickerie
- 2) Aquaculture station project at Oryza
- 3) Development of a disease monitoring plan for aquatic animals.

In the development of the aquaculture sector, Suriname faces challenges and constraints such as:

- inadequate knowledge in the areas of cultivation, aquaculture engineering and marketing
- insufficient expertise
- financial constraint and high production costs
- insufficient means of export
- inadequate government support
- insufficient inputs (parental brood stock, fry, feed, nets, etc.)
- outdated investment legislation;
- insufficient and/or outdated information on aquaculture.

3.5.2 Discussion

Based on the discussions, it was noted that despite the existence of favorable natural resources, Suriname is characterized by relatively low levels of aquaculture development, with aquaculture for local consumption facing considerable competition from the abundance of wild catch.

The commercial operations that grew tilapia and marine shrimp lost market access to the EU due to the absence of the ability to conduct requisite product residue testing. Although, this capacity was later installed, the decline in global prices and competition from South East Asian suppliers prevented a rebound for local commercial aquaculture interests.

The matter of quality control and accompanying phyto-sanitary issues were raised given the common experience of the rigorous and costly approval process to access the EU market. As such it was noted that development planning must factor in the shift to traceability and an eco-based production approach (as determined by Global Gap, WWF) as these are rapidly becoming prerequisites for market access.

It was pointed out that integrated rice and fish farming activity with no chemical usage improved rice production due to the fish eating unwanted plant pests, so this offered some potential at the pilot level for eco-labeling of product. However, Guyana's experience suggested that a careful approach to integrated rice fish culture activity would have to be taken as the larger scale rice farming operations tended to revert to pesticide use.

It was mentioned that although there was no clear policy for aquaculture development, the development process should center on the export market or on high value endemic and indigenous stocks both for food fish and ornamental production. There was also an acceptance of the fact that within the region many wild fish stocks are fully exploited and for some species overexploited and so the development of sound aquaculture technologies for traditional (commodities species) and other indigenous species represented a prudent and strategic plan for ensuring food sovereignty and diversification of the agricultural sector.

3.6 Trinidad and Tobago

3.6.1 Report summary

The history of Aquaculture in Trinidad and Tobago spans a period exceeding 60 years. Most attempts at commercial aquaculture have not been successful due primarily to improper planning, poor vision or scope, and inadequate or inconsistent management practices. The country has traditionally relied on fish caught from the marine environment to satisfy its fresh fish requirements. However, landings from marine fisheries have been decreasing whilst demands and prices for fish have been increasing. These factors have contributed to a resurgence of interest in aquaculture in Trinidad and Tobago. Other factors include global trends in demand and prices for fish, favorable economic climate, increased consumer acceptance and availability of technical information. However, with limited availability of suitable land for aquaculture, low availability of large quantities of suitable water on a continuous basis, the high cost of land, limited availability of dependable labor, high incidence of praedial larceny and general lifestyle changes have led to a paradigm shift in the traditional approaches and general thinking about aquaculture for the sector to be successful.

With an emphasis on addressing some of these issues, several models for tank based, intensive, re-circulating systems have been developed. Compared to extensive and semi-intensive earthen pond culture of fish, intensive aquaculture systems require small areas of land, low labor and water inputs, are easy to manage and secure but are relatively expensive to establish.

These models are being field tested to provide demonstration units and statistical and financial data to guide potential investors as well as farmers and financial institutions in decision making. Underpinning this strategy is commitment by the Fisheries Division for collaboration with key stakeholders in the sector to foster a better informed, organized and coordinated approach to the development of commercial aquaculture.

3.6.2 Discussion

Based on the discussions on the presentation, it was noted that despite several interventions within the food based aquaculture sector, it remained poorly developed in comparison to the ornamental fish sector.

In relation to the effectiveness of cross border bio-security screening and inspection, it was indicated that the Government's veterinary division had been identified as the responsible agency.

It was mentioned that although there was no ratified aquaculture policy, a developmental model which seeks to capitalize on an intensive recirculation system to produce tilapia was now been investigated, through stakeholder consultation. Despite the fact that tilapia is regarded as a cheap fish protein source the justification for the capital intensive approach is based on the following issues:

- high land cost
- land based facilities require buffer zones especially with respect to chemical use
- low energy costs
- reluctance of youth to work in traditional pond culture.

A lack of inter-agency cooperation was identified as a drawback to the necessary coordination and analysis. However, preliminary analysis of the intensive culture system is generating interest and the government is currently designing a package of incentives to stimulate investor commitment. Aquaculture development, if seen within the context of food security, necessitates specially designed financial and development assistance.

It was opined that there was need for the establishment of a regional database for aquaculture information, with such a database being seen as critical to training, developmental direction, and problem solving. It was also mentioned that the University of the West Indies could play a support role in this area, especially as several research projects targeted to support aquaculture development at the various campuses have been done.

4.0 Field Trips

As part of the Workshop Agenda, participants were taken on field trips to the following aquaculture and ornamental fish farms:

- Ministry of Agriculture and Fisheries, Aquaculture Branch, Twickenham Park Caribbean Mariculture Farms, a commercial shrimp farm
- Branches Fish Farm, an ornamental fish operation
- YS Valley Farm, a small scale integrated aquaculture farm
- Aquaculture Jamaica Limited, a commercial tilapia farm.

During these visits, the participants were taken on tours of the farms by the farm owners and/or managers who explained about their operations and answered any queries posed by the participants.

5.0 Aquaculture Development Planning

5.1 Project Cycle Management

Mr. M. Inuma, Aquaculture Consultant, IC NET Limited delivered an overview on the use of the Project Cycle Management (PCM) tool and indicated how it could be utilized in the analysis of the aquaculture situation in each country and the subsequent development of their respective Draft Aquaculture Development Plans.

PCM is a method designed to facilitate project development using a series of steps - Problem Analysis, Objective Analysis and Project Selection - to create a Project Design Matrix (PDM).

Prior to each planning session, Mr. Inuma provided a detailed presentation on the area of PCM that was going to be covered. Then, participants working as country teams applied the particular component of the PCM tool to their country situation. The PowerPoint presentations on the respective areas of PCM are provided at Appendix IV.

5.1.1 Practical: Problem Analysis

The participants identified the main problems affecting aquaculture development in their respective countries. The cause and effect relationships among the problems were set out as a problem tree. The main point that came out from these sessions was that despite the differences in prior and existing development activities, the issues facing all countries were for the most part identical. Such common issues included inadequate aquaculture development policies, high cost of production, mainly due to high feed and energy prices, and praedial larceny. The Problem Analysis for each country is provided in Appendix V.

5.1.2 Practical: Objective Analysis

By reversing the negative statements in the Problem Tree into positive statements an Objective Analysis Tree was created for each country. This process aids in the identification of problem solving options. The Objective Analysis Tree for each country is provided in Appendix VI.

5.1.3 Practical: Project Selection

Based on the Objective Analysis, different approaches to realizing the core objective were identified. Comparisons were then made among the different approaches using such criteria as priority of development policy, financial/economical aspects, cost efficiency, technical and general feasibility, needs of target group and the environmental aspects. Each country selected a particular approach to develop a project.

5.1.4 Practical: Project Design Matrix

After the series of analyses had been completed, the participants moved to the next planning stage. Based on the particular Objective Analysis Tree, a PDM template (see Figure 1) was used to set out a concrete project. The template consists of a narrative summary, objectively verifiable indicators, and means of verification, pre-conditions, important assumptions and inputs. Due to the time constraints, only the narrative summary and inputs were prepared during the workshop, with participants being tasked to complete their country's PDM in the inter-sessional period leading to the Second Regional Aquaculture Planning Workshop in August 2011.

Figure 1: Template of the Project Design Matrix (PDM)

Project Title:

Target Group:

Version:

Target Area:

Project Period:

Date:

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal			
Project Purpose			
Outputs			
Activities	Inputs		Preconditions

The Project Design Matrix (PDM) for each country is provided in Appendix VII.

6.0 Formation of a Regional Network of Aquaculture Organizations

6.1 Summary

The Programme Manager, Fisheries Management and Development, made the presentation entitled "Formation of a Regional Network of Aquaculture Organizations". In this presentation, he dealt with the definition of a network and the role it can play in building and cultivating relationships that provided one with a system to advance issues and meet specific needs. He then provided examples of regional and international networks such as LIAT, Al Qaeda and ICCAT.

Following on this he spoke about the *Network of Aquaculture Centres in Asia and the Pacific* (NACA) model, including the NACA Agreement, vision, structure, membership, partnership arrangements and core activities. Then, he outlined a proposal for the establishment of CARICOM/CRFM network of aquaculture organizations, including the likely objectives, composition and functions. The PowerPoint presentation on the Formation of a Regional Network of Aquaculture Organizations is provided at Appendix VIII.

6.2 Discussion

Based on the discussions following the presentation, it was opined that such a network would provide ample opportunity for regional cooperation and that it could be housed within the CRFM. It was recognized that funding for the operations of the network would have to be addressed, with it being mentioned that JICA could be seen as a source for support. As such, it was also suggested that the Proposal for the Network should be included in the CRFM Master Plan.

The participants requested that a concept paper on the Network be prepared by the PMFMD, and circulated for comments to the Workshop attendees before the follow-up Workshop in August 2011. It was also suggested that participants should play a role in sensitizing others to the goals, objectives and need for the Network.

7.0 Draft Idea for Master Plan for Regional Aquaculture Development

7.1 Summary

Mr. Udagawa presented the Vision, Goal, and the Strategy for the Master Plan for Region Aquaculture Development. He indicated that aquaculture is being considered as an alternative income generating source for coastal communities. It could also be seen as a means of providing income opportunities for inland farmers and so limit the migration of farmers into coastal fisheries operations. The Presentation is provided in Appendix IX.

7.2 Discussion

Based on the discussions following the presentation, it was noted that while the focus seemed to be on small-scale aquaculture development, the policy orientation/platform should also support commercial activity. It was indicated that the plan dealt mainly with tilapia production and should be adjusted to include other species such as the common carp.

It was opined that a regional aquaculture policy/strategy should address common issues and provide the best means of addressing them along the value chain components. It was pointed out that for small-scale operators to move beyond producing for the local consumers, the issue of quality assurance would have to be addressed so that such operators can satisfy national, regional and international SPS requirements and be more competitive.

The participants indicated that there was need to clearly understand what was meant by small-scale aquaculture and tasked some of the workshop members with researching and defining small-scale aquaculture during the inter-sessional period. The group identified comprised of: Mr. D. Brown, Jamaica, Mr. H. Lalla, Trinidad and Tobago, Mr. G. Myvett, Belize and Dr. C. Phillips, UWI.

In terms of aquaculture research and development, it was opined that more attention should be paid to the culturing of endemic and indigenous species both in terms of food security and the preservation of biodiversity.

The need to develop alternative/indigenous feed sources especially for small scale aquaculture was seen as being critical. As such, it was suggested that this matter should be seen as a priority area and be included in the Master Plan.

8.0 Potential Role of the University of the West Indies (UWI) in Regional Aquaculture Development

8.1 Summary

The University of the West Indies (UWI) consists of 16 member countries in the English-speaking Caribbean, with main campuses located in Jamaica, Barbados and Trinidad and Tobago. UWI states

that its mission is “to propel the economic, social, political, and cultural development of West Indian society through teaching, research, innovation, advisory and community services and intellectual leadership”. It employs faculty with expertise in the fields of Engineering, Humanities and Education, Law, Medical Sciences, Pure and Applied Sciences, Science and Agriculture, and Social Sciences. As such, the UWI possesses a wealth of resources that could serve to support and promote regional aquaculture development by providing expertise in a broad spectrum of industry-related activities ranging from initial project feasibility studies to farm and resource management.

Key areas in which the UWI could play strong supportive roles include information and resource sharing, undergraduate/graduate education, applied research, needs-based projects, including project development/management/monitoring, professional training, provision of diagnostic services, sustainability and environmental impact assessments, policy development, technology development, continuing education and the establishment of cooperative linkages between researchers and private sector/governmental stakeholders. With its vested interest in regional advancement, the UWI seeks to be an asset to the regional aquaculture industry and will partner with industry stakeholders to strive toward sustainability of this sector. The presentation is provided at Appendix X.

8.2 Discussion

Following on the presentation and discussions, it was noted that UWI through its campus network and faculty specialization could assist in research and development; technology innovation, design and adaptation; and promoting youth involvement through formal education and project fairs.

9.0 National Aquaculture Development Plan

Under this agenda item, each country presented the outline of a draft aquaculture development plan, each of which was followed by discussions. The Country Presentations are provided in Appendix VII.

10.0 Way Forward

Participants outlined the activities to be done prior to the follow-up workshop slated for the end of August. These activities are as follows:

Inter-sessional Activity	Deadline
Completion of PDM/Approaches	April 30
Review of the aquaculture network concept paper	April 30
Compilation of Draft Aquaculture Development Action Plan	May 15
Definition of small scale aquaculture, etc. by working group (Dr. Ayanna C. Phillips, Mr. George Myvett, Mr. Dehaan Brown, Mr. Harnarine Lalla)	May 31
In-country stakeholder consultations on the Draft Aquaculture Development Action Plan	June 30
Revision of the Draft Aquaculture Development Action Plan	July 16
Establish Yahoo group for aquaculture group (Mr. Iinuma)	ASAP
Preparation and submission of progress report and revised action plan	July 31

It is expected that the inter-sessional activities will be completed as scheduled and the outputs of these activities will be presented and finalized at the Second Workshop on Aquaculture Development Planning, scheduled to take place during August 29-31, 2011 in Kingston, Jamaica. The workshop will receive and review: (i) the Progress reports which set out the steps taken, including any difficulties encountered, to develop the Revised Draft Aquaculture Development Action Plan (ii) the Revised Draft Aquaculture Development Action Plans (project design matrix and plan of operation) which would have been modified and refined by consultations and discussion with stakeholders in respective countries; and (iii) the progress report and results of pilot projects on aquaculture

development in Belize (experiments on extensive fish culture) and Jamaica (training and extension of small-scale fish culture).

It was also suggested that the country participants for the follow-up workshop should be selected from among those who participated in this one so as to ensure continuity.

11.0 Closing Ceremony

At the end of the Workshop, closing remarks were made by the Director, Aquaculture Branch, Deputy Team Leader, IC Net Limited, CEO Fisheries Division, Jamaica and the PM FMD, with the participant from Guyana making the vote of thanks. The JICA representatives from Jamaica (Mr. Nishiyama) and CARISEC (Mr. Yoshida) were in attendance at the closing.

Appendix I: List of Participants

#	Country	Name	Position	Email
1	Belize	Mr. George Myvett	Senior Fisheries Officer	georgemyvett@yahoo.com species@btl.net
2		Mr. Miguel Sosa	Assistant Fisheries Officer, Aquaculture Section	aquaculturemiguel@yahoo.com species@btl.net
3	Guyana	Mr. Raulston Gillette	Fisheries Extension Officer	raul_gih2000@yahoo.com
4	Haiti	Mr. Jean Robert Badio	Director of Fisheries	robertbadio@yahoo.com
5		Ms. Murielle Felix	Head of Aquaculture	
6	Jamaica	Ms. Avery Smikle	Director of Aquaculture Branch	adgalbraith@gmail.com
7		Mr. Dehaan Brown	Senior Researcher	brown1_de@yahoo.com
8	Suriname	Mr. Rene B. L. Lieveld	Director of Fisheries (ag)	reneblieveld@hotmail.com
9		Dr. Anand Chotkan	Veterinary Officer	a_chotkan@hotmail.com
10	Trinidad and Tobago	Ms. Christine Chan-A-Shing	Director of Fisheries	cshing@malmr.gov.tt cchanashing@gmail.com
11		Mr. Harnarine Lalla	Fisheries Officer	h_lalla@hotmail.com
12	CRFM	Mr. Terrence Phillips	Programme Manager, Fisheries Management and Development	terrencephillips@vincysurf.com
13	IC Net Limited/JICA	Mr. Kazuo Udagawa	Deputy Leader of the Study Team	udagawa@icnet.co.jp
14		Mr. Mitsuo Iinuma	Member of the Study Team	iinuma@icnet.co.jp
15		Mr. Robin Hall	Project Coordinator, Pilot Project in Jamaica	robinhall63@yahoo.com
16		Ms. Natasha Clarke	Project Assistant, Pilot Project in Jamaica	natasha.clarke@hotmail.com
17		Dr. Ayanna Carla N. Phillips	Lecturer, UWI School of Veterinary Medicine	phillipsacn@gmail.com

Appendix II: Workshop Agenda

Date		Training Content	Venue
Mar. 13	Sun	Arrive in Kingston (Only Foreign Participants)	
Mar. 14	Mon	<p>Opening of Training Program</p> <p>09:00 - 10:00 Opening ceremony</p> <ul style="list-style-type: none"> - Permanent Secretary of Ministry of Agriculture & Fisheries - Ambassador of Japan - Representative of JICA Jamaica Office - Chief Executive Officer / Director of Fisheries Division <p>10:00 - 11:00 Coffee Break</p> <p>11:00 - 12:00 Course Orientation</p> <p>12:00 - 13:00 Lunch</p> <p>Session I : Country Report Presentation in Aquaculture Development (IC Net & CRFM)</p> <p>13:00 - 14:30 Country Report Presentation (2 countries)</p> <p>14:30 - 15:15 Country Report Presentation (1 countries)</p> <p>15:15 - 15:45 Coffee Break</p> <p>15:45 - 17:15 Country Report Presentation (2 country)</p>	Hotel Four Seasons, Kingston
Mar. 15	Tue	<p>Session II : Aquaculture Development in Jamaica (Fisheries Division Jamaica)</p> <p>08:00 - 09:00 Move from the Hotel to Aquaculture Branch</p> <p>09:00 - 10:30 Lecture: Aquaculture in Jamaica</p> <p>10:30 - 11:00 Coffee Break</p> <p>11:00 - 12:30 Observation: Activities / Facilities of Aquaculture Branch (Broodstock Culture, Monosex Fry Production, etc.)</p> <p>12:30 - 13:30 Lunch</p> <p>Session III: Observation of Fish Farming in Coastal Areas (Fisheries Division & IC Net)</p> <p>13:30 - 14:00 Move to Old Harbour</p> <p>14:00 - 16:00 Visit to Private Fish Farms in St. Catharine</p> <p>16:00 - 17:00 Move from Aquaculture Branch to the Hotel</p>	<p>Aquaculture Branch, Spanish Town</p> <p>Fish Farms, St. Catherine</p>
Mar. 16	Wed	<p>Session IV: Observation of Tilapia Farm and Ornamental Fish Culture in Mountainous Areas (Fisheries Division & IC Net)</p> <p>08:00 - 10:30 Move from the Hotel to St. Elizabeth</p> <p>10:30 - 12:00 Observation: Commercial Fish Farm (Aquaculture Jamaica Ltd)</p> <p>12:00 - 13:00 Move and Lunch</p> <p>13:00 - 14:00 Observation: Small-scale Tilapia Farms</p> <p>14:00 - 15:00 Move</p> <p>15:00 - 16:00 Observation: Ornamental Fish Farms</p> <p>16:00 - 18:00 Back to the Hotel</p>	Fish Farms, St. Elizabeth
Mar. 17	Thu	<p>Session V: Approach to Aquaculture Development Planning (IC Net)</p> <p>09:00 - 10:30 Lecture & Practice: Project Cycle Management</p> <p>10:30 - 11:00 Coffee Break</p> <p>11:00 - 12:00 Lecture & Practice: Project Cycle Management</p> <p>12:00 - 13:00 Lunch</p> <p>Session VI: Problem Analysis (IC Net & CRFM)</p> <p>13:00 - 13:30 Explanation of Action Planning Process</p> <p>13:30 - 15:00 Practice: Problem Analysis of Aquaculture Development in Respective Country</p> <p>15:00 - 15:30 Coffee Break</p> <p>15:30 - 17:00 Practice: Problem Analysis of Aquaculture Development in Respective Country (continue)</p>	Hotel Four Seasons, Kingston
Mar. 18	Fri	<p>09:00 - 10:00 Review and Revision of Problem Analysis</p> <p>Session VII: Objective Analysis (IC Net & CRFM)</p> <p>10:00 - 11:00 Practice: Objective Analysis of Aquaculture Development in Respective Country</p>	Hotel Four Seasons, Kingston

		11:00 - 11:30 Coffee Break 11:30 - 12:30 Practice: Objective Analysis of Aquaculture Development in Respective Country (continue) 12:30 - 13:30 Lunch Session VIII: Action Planning of Aquaculture Development (IC Net & CRFM) 13:30 - 14:30 Presentation: : Formation of a Regional Network of Aquaculture Agencies/Institutions(Mr. Terrence Phillips) 14:30 - 15:30 Selection of Approach 15:30 - 16:00 Coffee Break 16:00 - 17:00 Practice: Consideration of Program Purpose and Outputs	
Mar. 19	Sat	09:00 - 10:30 Practice: Consideration of Activities and Inputs 10:30 - 11:00 Coffee Break 11:00 - 12:30 Practice: Consideration of Activities and Inputs (continue) 12:30 - 13:30 Lunch 13:30 - 15:00 Preparation of Program Summary 15:00 - 15:30 Coffee Break 15:30 - 17:00 Preparation of Presentation Material	Hotel Four Seasons, Kingston
Mar. 20	Sun	Free Time Preparation of Presentation Material	Hotel Four Season, Kingston
Mar. 21	Mon	Session IX: Action Planning Presentation (IC Net & CRFM) 09:00 - 10:00 Draft Idea of Regional Master Plan in Aquaculture Development (IC Net) 10:00 - 10:30 Presentation & Discussion : Action Plan of Aquaculture Development (1 countries) 10:30 - 11:00 Coffee Break 11:00 - 12:30 Presentation & Discussion : Action Plan of Aquaculture Development (3 countries) 12:30 - 13:30 Lunch 13:30 - 14:30 Presentation & Discussion : Action Plan of Aquaculture Development (2 countries) 14:30 - 15:30 General Discussion 15:30 - 16:00 Coffee Break 16:00 - 16:30 Explanation: Activities after the Workshop Closing of Training Program 16:30 - 17:30 Closing Ceremony - Chief Executive Officer / Director of Fisheries Division - Representative of JICA Jamaica Office - CRFM Official - Member of IC Net Team	Hotel Four Seasons, Kingston
Mar. 22	Tue	Leave Kingston (Only Foreign Participants)	

Appendix III: Country Reports

BELIZE COUNTRY REPORT

Prepared by Miguel Sosa

INTRODUCTION

The development of commercial aquaculture in Belize dates back to the early 1980's when the farming of the Pacific White shrimp *Litopenaeus vannamei* was established through commercial experimentation. The success of this endeavor during the early phases of the industry led to the rapid expansion of shrimp farming to a total of 18 farms with a total production area of 6,888 acres in 2005. To date, seven farms remain operational with a production area of 3,082 acres. This is as a result of disease events and the major decline in global market prices in 2000 which continues to impact the financial sustainability of these operations.

By mid-2000, the species portfolio was expanded to the commercial production of Tilapia *Oreochromis niloticus* and Cobia *Rachycentron canadum*. Other species that have been attempted in the past were the culture of Red Fish *Sciaenops ocellatus*, African Lake Cichlids for the aquarium trade, Australian Red Claw *Cherax quadricarinatus*, Spiny Lobster *Panulirus argus* and the Queen Conch *Strombus gigas*. The most successful was the production of juvenile conchs between 1987 and 1992. The primary objective of the project was to develop laboratory techniques for the cultivation of Queen Conch larvae in an on-shore hatchery facility.

THE AQUACULTURE INDUSTRY IN BELIZE 2011

1. History of Aquaculture Activities in Belize

1.1. The Beginning of Belizean Aquaculture

Aquaculture in Belize formally began in 1982 with the development of ten (10) acres (4 Ha) of experimental ponds by a private company, in the southern part of the Country. Since that time, the industry has developed rapidly and has become firmly established as a significant contributor to the Belizean economy in terms of foreign exchange earnings, income generation, employment, nutrition, and food security.

In Belize, the aquaculture industry is primarily based on the production of the Pacific White Shrimp (*Litopenaeus vannamei*). Apart from the culturing of the exotic Pacific White Shrimp (*Litopenaeus vannamei*), the husbandry of other penaeid species has also been attempted in Belize. These include the exotic Pacific Blue Shrimp (*Penaeus stylirostris*), the exotic Giant Prawn of South-east Asia (*Penaeus monodon*), and the indigenous Caribbean White Shrimp (*Penaeus schmitti*). The culturing of these species had been attempted in the earlier phases of development of the industry. These trials however did not measure up to the expectations of producers and had been consequently abandoned.

Fresh Catch Belize Limited, the only commercial-oriented tilapia fish farming operation was formally inaugurated in December 2002. The facility has developed 150 acres (60.7 Ha) of production ponds. These facilities have a production capacity of 4,000 MT per annum with estimated annual revenues over Bz\$12 million (US\$6 Million).

Fresh Catch Belize Limited is based on the production of *O. niloticus* hybrids for the whole fish market and the fillet market. The farm is vertically integrated with production ponds, nursery systems, hatchery and processing facilities.

1.2. Other Farmed Species Attempted in the Past

Species that were tried in the past include the husbandry of: the freshwater Australian Red Claw Lobster (*Cherax quadricarinatus*), the Redfish (*Sciaenops ocellatus*), and a number of African Rift Lake ornamental finfish species such as *Haplochromis sp.*, *Labeochromis sp.*, *Melanochromis sp.*, *Tropheus sp.*, *Psuedotropheus sp.* and *Awlenocara sp.* and the Queen Conch (*Strombus gigas*). The most successful was the production of juvenile conchs between 1987 and 1992¹. This initiative was funded by the USAID and the Government of Belize.

The primary objectives of the project were to:

- a. Develop laboratory techniques for the cultivation of Queen Conch larvae in an on-shore hatchery facility;
- b. Restock nearby conch habitats that have traditionally sustained viable conch populations; and
- c. Conduct field exercises to estimate survival rates of hatchery reared juvenile conch.

The conch project in Belize was able to establish data in terms of the husbandry aspects from broodstock to juvenile stages. The hatchery process included the collection of egg masses from the wild, followed by laboratory rearing up to juvenile stages. Subsequently, juveniles were stocked in the wild and survival rates were monitored over a period of eight weeks. After a few years of experimentation, the project funds were limited which led to closure of the project.

2. Current Situation of Aquaculture Development

2.1. Shrimp Aquaculture

Although shrimp aquaculture expanded rapidly, shrimp farming operations experienced significant economic losses in the mid-1990's and early 2000 as a result of pathogenic diseases and declining market prices. The first recorded episode of pathogenic disease impact in Belize occurred in July 1995, with the Taura Syndrome Virus (TSV). Mortalities associated with this disease were as high as 80 – 90% in some locations.

In mid-2000 the Shrimp Farming sub-sector was also impacted by another viral disease, the IHHN Virus (Infectious Hypodermal Hematopoietic Necrosis Virus). In May 2001, the shrimp farms were again impacted by TSV².

In addition to the economic losses as a direct result of pathogenic diseases, there was a decline in the global market prices for farmed shrimp commodities in 2000³ for the major market destinations of the USA, Japan and the EU. Since then, prices have not been favorable for producing countries such as Belize. The decline in shrimp prices is directly associated with the larger volumes of farmed shrimp exported by the Asian countries at very low prices.

¹ Mauro Gongora – Conch Hatchery Manager-Belize, 1987-1992

² 2002 Status of Aquaculture in Belize

³ Figure 1: Farmed Shrimp Export & Value Trends

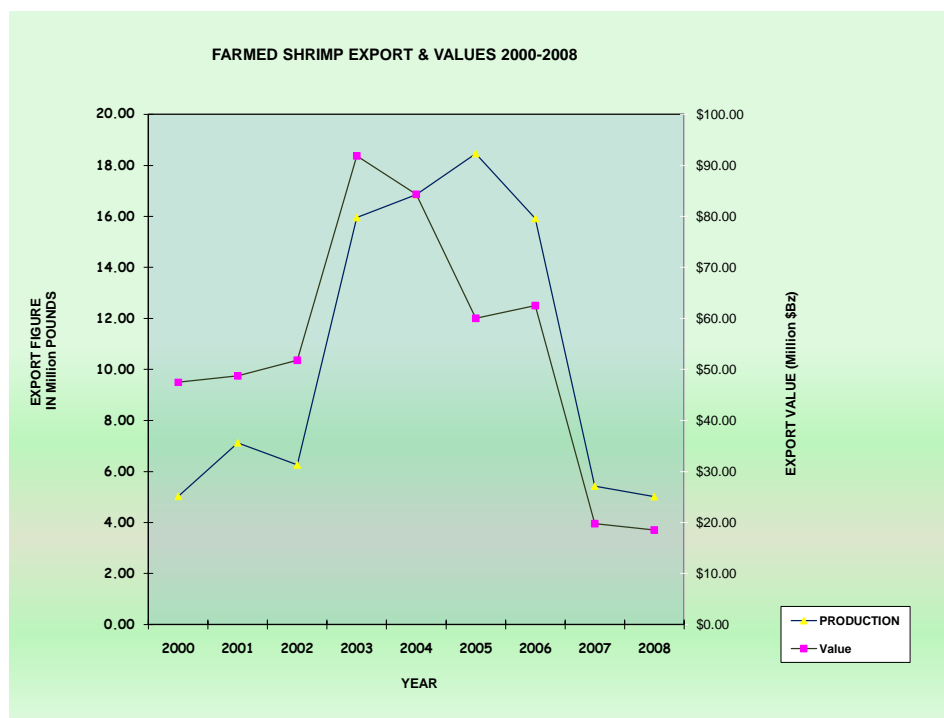


Figure No. 1. Farmed Shrimp Export & Value Trends

Given the various challenges in the shrimp farming sector, more than fifty percent of the production area has been out of production. In 2005, there were 18 shrimp farming operations with over 6,888 acres in production ponds. Over the last ten (10) years, eleven (11) shrimp farms have ceased operations. In 2010, there were seven (7) operating farms with a cumulative production pond area of 3,082 acres. Export volumes of farmed shrimp were reported at 2,280 metric tons valued at US\$9.25 million in 2009. The main market destination for shrimp commodities is the Mexican market, followed by the U.S. and the CARICOM.

2. 2. Tilapia Farming

Apart from shrimp farming, the commercial production of tilapia was established in 2002 by one commercial farm, namely Fresh Catch Belize Limited with 300 acres of production ponds in operation and total yields of 1,900 metric tons in 2009. The operation is vertically integrated with a hatchery and processing plant to compliment the pond production systems. First exports to the US market were made in mid-2004. This operation is currently being expanded by an additional 100 acres of production ponds. With the expansion, the total production capacity of Fresh Catch Belize Limited has been estimated at 4,000 metric tons per annum.

Table No. 1. Large Scale Tilapia Production from Belize

Months	2005	2006	2007	2008	2009	2010
JAN		67.4	79.2	163.4	141.5	87.74
FEB		102.2	72.4	150.3	149.5	97.73
MARCH		86.6	118.5	192	177.7	110
APRIL	10.2	71.5	54.5	131	106.6	30.38
MAY	19.6	70	85.6	161	120.18	27.8
JUNE	28.5	70	79.7	171.4	123.1	24.7
JULY	34.8	70	80.3	175.7	87.4	11.7

AUGUST	42.9	51	56	145.1	62.3	5.3
SEPT	41.7	32.3	66	150.6	53.36	
OCT	29.8	31	81	144.7	67.78	
NOV	38.7	27.4	75.1	135	77.19	28.3
DEC	13.3	13	72.4	144.8	76.77	32.1
Metric Tons	259.5	692.4	920.7	1865	1243.38	455.75
Lbs.	570900	1523280	2025540	4103000	2735436	1002650

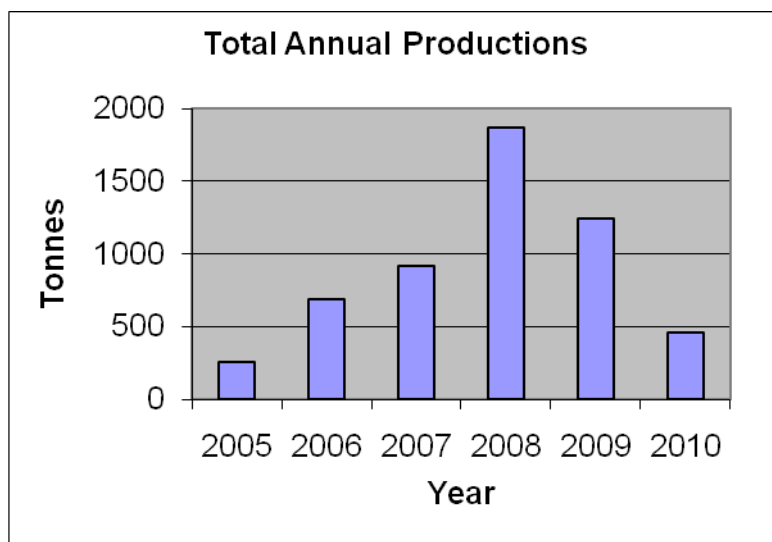


Figure No. 2. Large Scale Tilapia Production from Belize

The portfolio of products from Fresh Catch Belize includes both whole eviscerated fresh fish, as well as fresh frozen fillets. The fillets are destined for the US market, while the eviscerated fish is exported to Mexico and Guatemala. Fresh Catch Belize Limited is part of the 'Mountain Stream Tilapia Alliance', which is a conglomerate of fish farming companies from Costa Rica, Honduras and Belize exporting under one name brand.

2. 3. Cobia Farming

The other commercial aquaculture venture is Marine Farms Belize Limited. The facility is the only commercial Cobia farming operation established in Belize. The operation is based on marine cage farming using Norwegian Technology. The operations are conducted near the Robinson Point Cays, which are comprised of cage infrastructure ranging from 5 meter circumference nursery cages as well as 40, 60 and 100 meter grow-out cages. The farm was established in 2006 and by 2007 exports were initiated to the US market through a marketing company by the name of AQUA GOLD. The products exported are 'bullet' cuts whereby the head is removed and the fish is gutted. The production capacity during phase I & II of the operations has been projected at 2,000 metric tons per annum. In 2008, cobia whole fish production was 384.4 metric tons.

Marine Farms has fully established a hatchery operation near Dangriga. The broodstocks in the hatchery have been sourced locally and the first spawns were realized in July, 2009. The production capacity of the hatchery has been estimated at one (1) million fingerlings per annum.

2. 4. Small-scale Aquaculture

The history of the early phases of small-scale inland fish farming in Belize as well as its socio-economic contributions remains undocumented. Rural fish farming has been practiced in Belize on an experimental basis since the early 1990's. This has been mainly in the form of backyard farming operations with a focus on locally occurring Cichlids species. These species include: the Bay Snook (*Petenia splendida*), Crana (*Cichlasoma urophthalmus*), Mus-Mus (*Cichlasoma friedrichstali*), Tuba (*Cichlasoma synspilum*) as well as the exotic Tilapia (*Oreochromis niloticus*).

Table No. 2. Summary of small scale Tilapia farms in Belize 2010

District	Number of farmers	Total Fish Stocked	Production Area (acres)
Corozal	16	64,000	3
Orange Walk	12	35,000	2
Belize City	14	67,500	6.28
Stan Creek	6	9,000	0.76
Toledo	12	15,000	0.56
Cayo			
Grand Total	60	190,500	12.6

More recently, farmers have focused much interest in the farming of the red hybrid tilapia given the growth performance and local market demands. In 2009, there were a total of 55 farmers engaged in small-scale tilapia farming with a total area of 14 acres of production units ranging from 0.01 acres to 0.25 acres.

The Ministry of Agriculture & Fisheries' Biscayne Fish Farm & Hatchery Facility provided in 2010 over 100,000 all-male tilapia fingerlings for rural farmers.

3. Problems and constraints of Aquaculture Development

3.1. Feed Production

Although much of the feed for shrimp farming has been manufactured in Belize over the past 10 years, a significant quantity of feed continued to be imported from the USA, Guatemala and Honduras over the past years. It has been mentioned by various farm managers in the sector that the quality and quantity of feed produced locally were not meeting the requirements of the industry. The management of Belize Mills Limited has been working over the past years on improving feed quality and has resulted in reduced imports from the neighboring countries.

To date, the Feed Mill does not have the capacity to supply the needs of the aquaculture industry. In the short-to-medium term, it is envisioned that the in-country manufacturing of feed will remain fairly stable.

Also, floating fish feed is not produced in Belize and thus is a limiting factor to the growth of the small scale fish farming sector. All floating fish feeds used in the commercial and small scale fish farms has to be imported from Guatemala, Honduras or Mexico. This fact makes the supply unstable and costly. Floating fish feed in Belize is more costly per pound than sinking shrimp feed. Some small scale farmers have no other choice than to cultivate their crops with sinking shrimp feed.

3.2. Financing for Small & Medium Scale Aquaculture Project

The number of operational small and medium scale fish farms has not increased over the last two years in Belize due to the lack of attractive loan/financing plans in the country for aquaculture. Private financial institutions do not offer loans designed for the small and medium scale fish farmer. Fish farmers can only make loan payments at the end of grow out cycles which is when fish is sold on

the local market. Finally, the loan interest rates of 11% are currently too high for most small-scale fish farmers to afford.

3.3. Lack of Proper Marketing Facility

Belizean small and medium scale fish farmers complain of the lack of a seafood marketing facility. Farmers do not have a proper marketing and storage facility equipped with stalls for the wholesale and retail of aquatic and seafood produce. This facility must also be equipped with ice factories where flaked ice can be bought, and cold storage rooms where produce can be stored until sales are completed.

The marketing system itself needs to be organized. Farmers often find themselves selling directly to restaurants. Buyers often complain of sporadic and inconsistent supply. Finally, ‘middlemen’ often complicate the marketing system by selling fillet tilapia at the same price of fillet snapper which unfortunately influences buyers to prefer the saltwater species of fishes over the freshwater species.

4. Existing Projects / Programs for Aquaculture Development

4.1. OSPESCA

Through the Organization of Fisheries and Aquaculture in Central America (OSPESCA) being funded by the Government of the Republic of China (Taiwan), there are currently various activities that are been implemented in order to further strengthen the sustainable development of aquaculture in the region. An aquaculture working group has been established in early 2010 to coordinate the various activities.

Thus far, there has been a regional forum on aquaculture which was held in Panama in April, 2010 in which member countries presented the emerging trends with regards to successful projects in aquaculture. Through this initiative, some of the key issues affecting the development of aquaculture were discussed with the purpose of developing future plans to advance the development of aquaculture in the region.

Within Belize, OSPESCA plans to implement in 2011 a project which will provide an alternative source of income to fisher folk of the New River Lagoon through aquaculture. This is Belize’s largest fresh water lagoon and spans 3 three miles in length and 1 mile in width. The Project will work in two fishing villages and provide tanks, tilapia fingerlings, fish feed and technical assistance to fishing families that dwell on the shores of the lagoon. The project aims to assist fishers to feed their families while at the same time reduce the fishing effort on the New River Lagoon ecosystem.

4.2. JICA/CRFM

The CARICOM Regional Fisheries Mechanism is currently finalizing a Master Plan on sustainable Use of Fisheries Resources for Coastal Communities with support from the Japanese International Cooperation Agency. Under this initiative, there a various pilot projects being implemented. The results gathered during the study will be utilized in the finalization of the Draft Master Plan to be completed in February, 2011. One of the pilot projects is being implemented in Belize. This pilot project is focusing on developing low-cost alternative feeds for small-scale tilapia farming in Belize. The project was started in mid 2010 and will be completed in mid 2011. The project is being carried out at the Belize Fisheries Departments Fish Farm and tilapia Hatchery Facility.

5. Future Activities

The aquaculture sector continues to have its own challenges in terms of the sustainability of the various farmed commodities given the high cost of production inputs and unstable market prices. Shrimp producers are currently taking advantage of the high end markets and existing whole shrimp market in Mexico, and other niche markets in the E.U. and the CARICOM. For the tilapia sector, the Mexican and Guatemalan markets are also available for whole fresh fish and the U.S. market for fresh

fillets. The future expansion of Cobia aquaculture has been mired due to the limited supplies of hatchery-reared fingerlings. The company is therefore requesting the necessary permits to embark in the reproduction of other Atlantic finfish species such as snapper, Jack, etc. It is their hope that by diversifying their line of products that financial stability of the company can be secured.

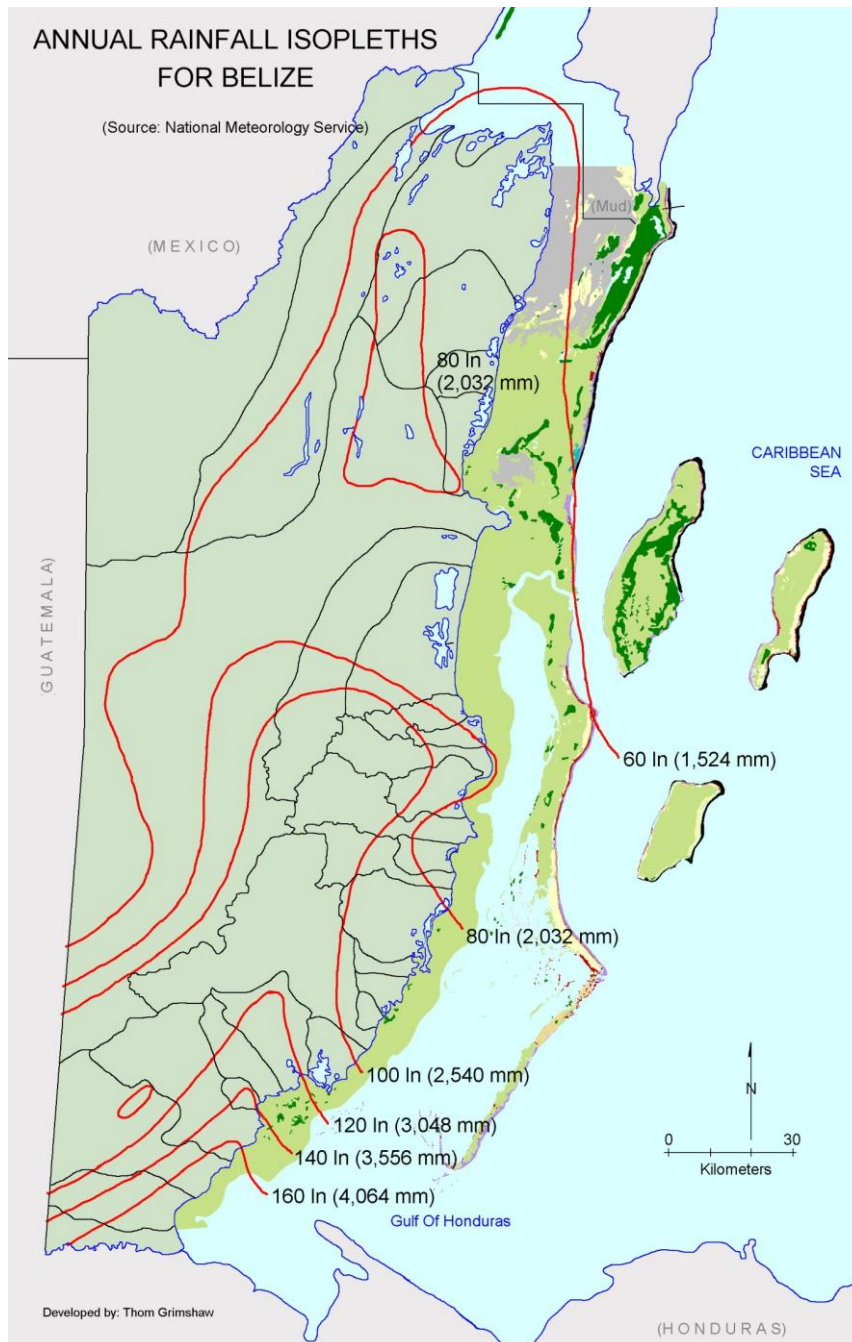
In terms of diversification from the traditional aquaculture activities in Belize, there has been a growing interest by investors in tilapia cage culture, sea cucumber aquaculture as well as the farming of seaweed.

With regards to investment opportunities, the Government of Belize continues to offer various development incentives for aquaculture. The competitive advantage of Belize is the proximity to the regional markets for supplying fresh products to the U.S. markets.

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2. Myvett G., Quintana R., National Aquaculture Sector Overview, Belize Fisheries Department, Ministry of Agriculture and Fisheries, Belize City, 2004.

ANNEX



GUYANA COUNTRY REPORT

Prepared by: Mr. Raulston Gillette

Introduction

Aquaculture development is spearheaded by the Satyadeow Sawh Aquaculture Station (SSAS) of the Fisheries Department. The facility is used to execute research activities, train farmers and produce fingerlings. The SSAS also provides extension services and free technical advice to farmers.

The Satyadeow Sawh Aquaculture Station was constructed with funding provided by the Government of Guyana, the Food and Agriculture Organization of the United Nations (FAO) and the Canadian International Development Agency (CIDA). The station provides information on site selection, pond preparation and farm management. Technology transfer and training are offered to the local farmer. The facility is also involved in the production of fingerlings of various species, and conducts trials on feeding, growth rates, and other parameters regarding species with aquaculture potential.

The Department of Fisheries continues to maintain and upgrade the Satyadeow Sawh Aquaculture Station and its extension services. Recently an excavator and vehicle was acquired for the unit to assist farmers in pond construction and to increase the extension services provided to farmers.

In Guyana the following species have been taken into consideration and are currently being produced throughout the coast and some inland regions of Guyana namely the Rupununi areas:

1. Red tilapia *Oreochromis spp*
2. Nile tilapia *Oreochromis nilotica*
3. Tambaqui *Colossoma macropomun*
4. Hassar *Hoplosternum littorale*
5. Arapaima *Arapaima gigas*
6. Swamp Shrimp (*Penaeus subtilis*),
7. Mullet (*Mugil cephalus*),
8. Queriman (*Mugil liza*)
9. Bashaw (*Micropogonias furnieri*)

Objectives

To ensure that aquaculture is developed in a sustainable and controlled manner optimizing economic and environmental benefits.

Key Responsibilities

1. Maintain and operate the Anna Regina Fish Culture Station, with the intention of establishing other stations to provide seed stock to farmers and to serve as centers for technical excellence.
2. Co-ordinate the development of the aquaculture industry at the national level.
3. Identify species to be cultured based on scientific information.
4. Collect and obtain disease free specimens for culturing.
5. Establish culture systems to determine food requirements, growth rates, environmental and tolerance, and rates of reproduction.
6. Identify incentives that will facilitate growth of the aquaculture industry.
7. Collaborate with other agencies regarding the development of aquaculture and use of resources.

Scientific Studies

At present collaborative studies are being and have been done with the Guyana School of Agriculture so as to improve the state of aquaculture in Guyana along with those carried out by the Aquaculture unit.

They studies are as follows:

1. A comparative study between the weight gain of red tilapia (*Oreochromis sp*) using three feeding regime.
2. To evaluate the effectiveness of bio-foul and stocking density on the growth rate of red tilapias (*Oreochromis sp.*).
3. Evaluate the growth rate of red tilapia (*Oreochromis sp*) using chicken grower and locally produced fish feed.
4. Comparison of the growth rate between Red Tilapia (*Oreochromis spp*) and Nile Tilapia (*Oreochromis niloticus*) in a controlled environment
5. Evaluating the growth rate, feed conversion ratio and mortality of the *Oreochromis sp.* using Rangen feed. This experiment is still on-going.

Background

Brackish Water Culture Potential

The brackish water activities involve the legal or illegal opening of the sea defense. Subsequently, taking advantage of the tidal inflows of high tides, juveniles, larvae, eggs, etc, are trapped in the coastal empoldered swamps and in some cases, specially constructed impoundments near the foreshore, where they are allowed to manure to marketable size.

It is recognized that brackish water farming activities make a great contribution to the livelihood of persons in Region 6, who depend on the yields of these farms for primary and secondary income, as well as a source of protein. Presently, there are two thousand one hundred and sixty-five (2165) acres of brackish water land under cultivation while there are two hundred (200) acres of freshwater land under Tilapia (*Oreochromis sp*) cultivation.

Many species are contained in the seawater that is trapped. Some of the targeted ones are Swamp Shrimp (*Penaeus subtilis*), Mullet (*Mugil cephalus*), Queriman (*Mugil liza*) and Bashaw (*Micropogonias furnieri*).

The Swamp Shrimp (*Penaeus subtilis*), Mullet (*Mugil cephalus*), Queriman (*Mugil liza*) and Bashaw (*Micropogonias furnieri*) are cultured in the same ponds but are harvested separately. The Mullet (*Mugil cephalus*), Queriman (*Mugil liza*) and Bashaw (*Micropogonias furnieri*) are not shrimp predators, and fetch a high price at the local market.

For the local market, partial harvest is practical, since the amounts of shrimps that are required are captured, and the rest of the shrimp population remains in the pond.

An interesting characteristic of the market is that most of the shrimps are sold at a juvenile stage (between 2.0 to 8.0 grams), and the price is more related to the shrimp color than to their size. The smaller and darker the shrimps are, the higher the prices as compared to the large white ones.

Total value of aquaculture production is estimated at three hundred and sixty six million three hundred and eighty eight thousand seven hundred and fifty nine (\$366,388,759) dollars.

Super-males

Presently, the YY super-males (Red Tilapia *Oreochromis spp*) are being used for fry production. These super-males produce approximately 99% all male fingerlings which ensure uniformity as it

relates to growth and size in the production life of the animals. The problem of unwanted breeding is also to a great extent reduced thus ensuring as stated before uniformity in growth, reduction in the instances of overstocking, uniformity in size at market weight and the efficient utilization of feed. It should be noted that the YY super-males utilized are imported due to the fact that Guyana does not have the necessary infrastructure to produce these fishes.

We are strongly considering the use of the YY super-male (Nile Tilapia *Oreochromis nilotica*) for the production of the Nile tilapia so as to diversify our aquaculture production and capabilities.

Besides the Satyadeow Sawh Aquaculture Station there are approximately four (4) other major producers of fingerling to be fed into the grow-out system.

Japan International Cooperation Agency (JICA Technical Cooperation)

Mr. Thom, JICA Consultant, was attached to the Satyadeow Sawh Aquaculture Station; he also did part time lectures at the Guyana School of Agriculture. Mr. Thom reviewed the brackish water techniques in Guyana and assisted in the identification of the brackish water shrimp species. However his period of attachment to the Aquaculture Station has been completed and he has been replaced by Dr. Shozo Yamamoto who specializes in aquaculture more specifically fish diseases. He is also going to assist in part time lectures at the Guyana School of Agriculture.

Brazil Technical Cooperation Agreement

The Ministry of Agriculture (Guyana) had signed an agreement with Agencia Brasileira de Coopercao (ABC), “Technique Transfer to Contribute towards the Development of Aquaculture Sector in Guyana”. The first series of training was conducted in Guyana during the 14th -17th July 2010. The Brazilians trained the technical staff on the theoretical aspects of Tambaqui and Arapaima Production. The training is on-going and will strengthen the physical and human infrastructure of the Satyadeow Sawh Aquaculture Station (SSAS) so that they can fulfill the objectives of the aquaculture station and also improve the Aquaculture Sector.

Collaborative Research Special Project (CRSP)

During the 2nd – 10th August 2010 Dr. Kevin Fitzsimmons and Dr. Jason La Camele representatives from CRSP Project the visited Guyana. The CRSP Representative also conducted a two day training course on Hassar (*Hoplosternum littorale*) and Tambaqui (*Colossoma macropomum*) Production at Bina Hill Technical Institute, Bina Hill, Annai, and Region #9.

Current situation

At present there are forty three (43) producers who regularly supply their production data to the Ministry of Agriculture Fisheries Department. Most of these producers reside on the coast of Guyana particularly Region 1 Barima-Waini, Region 2 Pomeroon-Supenaam, Region 3 Essequibo Islands-West Demerara, Region 4 Demerara-Mahaica, Region 5 Mahaica-Berbice, and Region 6 East Berbice Corentyne.

These farmers produce mainly:

- Red tilapia *Oreochromis spp*
- Nile tilapia *Oreochromis nilotica*
- Tambaqui *Colossoma macropomun*
- Hassar *Hoplosternum littorale*
- Shrimp
- Mullet (*Mugil cephalus*),
- Queriman (*Mugil liza*)
- Bashaw (*Micropogonias furnieri*)

These farmers are involved in both brackish and fresh water culture and a large portion of the production is sold locally in their respective villages as fresh products and a portion is either processed and sold packaged in various supermarkets or sold directly to hotels and restaurants for preparation for guests.

There are also approximately ninety three (93) and counting small and prospective aquaculture farmers who require the aid of the technical staff of the Ministry of Agriculture Guyana to guide them along as they endeavor to start or as the case might be increase their level of production thereby contributing to the overall good of the country.

As it relates to production the Black Shrimp and Tilapia have the highest recorded total production with figures of 61,642,503.08 kg and 17,041,976.60 kg respectively.

As it relates to demand there has been a gradual increase particularly in 2010 and this was brought about through the promotion of aquaculture and its products by the Ministry of Agriculture Guyana through the Grow More Food Campaign and the establishment of the Agriculture Export Diversification Project which encouraged the establishment of commercial aquaculture farms to meet international export standards and thus bring in much needed foreign exchange into the country.

Lessons learnt

1. In any aquaculture operation no matter the species or condition it is important that as much as possible a well balanced diet be made available. This in turn helps to speed up the overall growth rate, thereby shortening the production period thereby bringing the organism or animal to market weight earlier as subsequently reducing the overall cost of production thus increasing the profit margin.
2. The importance of good site selection as it relates to water availability, security (theft, and predators and flooding) and access to market.

Constraints Commonly Faced

- Access to technical expertise and training to improve the technical capability of the technical staff of the Aquaculture unit.
- The need for funding for aquaculture related research in Guyana.
- Unavailability of a suitable local feed.
- El Nino conditions resulting in decreased water supply, high mortality of fingerlings.
- La Nino conditions where which results in flooding in some coastal areas of Guyana.

HAITI COUNTRY REPORT

First Regional Workshop for Aquaculture Planning
Status on Aquaculture Development in Haiti
Jamaica , March 14 to 21 , 2011



by : Badio, Jean Robert
Director of Fisheries & Aquaculture in Haiti
Ministry of Agriculture / Haiti

COUNTRY PROFILE

Background: Haiti is located between Cuba to the Northwest , Jamaica to the Southwest, Puerto Rico to the East , Bahamas to the North, and Colombia to the south. Haiti is bounded on three sides by water. To the North by the Atlantic Ocean, to the south by the Caribbean sea, and to the west by the Windward passage.





DEMOGRAPHICS

Haiti total area	: 10,714 sq miles (27, 750 Km2)
Land area	: 27,560m2
Sea area	: 190 km
Population	: 10,000,000 with an average annual increase of 1,8 %
Capital	: Port au Prince , with 4,5 millions
Administrative	: Ten(10) Departments :
Climate	: Tropical climate with medium temperature 70 to 80 degrees Farenheit or 25 to 28 Celsuis.
Rainfall	: Annual rainfall varies from a high of 3,600 mm to a low of 600 mm. The rainy season begins in October continues till December.
Literacy Rate	: 53 %
Education	: By law , education is free and compulsory in Haiti for children between the ages of 7 to 13 . However access to that free education is limited to many people due to insufficient financial resources for parents to purchase the required school books and uniforms.

OVERVIEW ON AQUACULTURE IN HAITI



Coastline	: 1,535 km to 1770 km
Fishers population	: 52,000 fishers (part time and full time)
Fisheries production	: 16,500 tons (600 tons of lobsters; 200 tons of lambi and 50 tons of shrimps representing about 95 % of Haiti fisheries production; value 54 millions of dollars \$ US representing 1,5 % of the PIB)
Imports	: 12, 500 tons per annum to satisfy the local demand.
Aquaculture production	: 400 tons (mostly tilapia and carp)
Continental production	: 600 tons (more than 22 ,000 ha of body of water)
Hatchery production	: 3,5 millions of fingerlings per year
Cage production	: 160 tons
Consommation per capita	: 4,5 kgs per annum

LAND & CLIMATE CONDITIONS

Haiti presents ideal climatic conditions for the development of aquaculture. There is great potential for aquacultural development in various zones in the country. Throughout the ten (10) departments in the country, more than 23,000 hectares of land unsuitable for agriculture are very favorable for the development of commercial aquaculture fish farms.



CURRENT PRODUCTION



Currently aquaculture in Haiti is characterized by a non commercial subsistence scale, low-input, feed-based activities mostly for personal consumption or local sale.

EMERGING PARTNERSHIPS



The Direction of Fisheries and Aquaculture of the Ministry of Agriculture which is the body of the government responsible for the development of aquaculture in Haiti is trying through a technical cooperation with some Cuban experts to increase the production in ODVA hatchery and create new centers of fingerlings production

OBSTACLES:



- Lack of seedstock (for fresh or marine water)
- Lack of agricultural products for feedstock
- Low level of production and lack of commercial approach
- Lack of infrastructure development and services
- Scarcity of people with adequate training and experiments
- A model of aquaculture farm with proven profitability.
- No credit available
- Lack of information (limited data collection)
- Lack of research in the viability of aquacultural development in Haiti

RECENT DEVELOPMENTS

In 2009 the government of Haiti through 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 commercial trade policy
- The inventory all existing aquaculture activities in the country
- Exploration of mechanisms for promoting modern aquaculture.
- Evaluation of resources and aquaculture potential
- Conducting studies on conservation, transformation, and commercialization
- Production of fish feed
- Stocking of bodies of water
- Establishment of farms & production in cages and ponds
- Increased production in existing hatcheries
- The creation of new centers of production
- Rehabilitation of farms with established potential
- Training and technical assistance for fish farmers
- Monitoring and evaluating activities.



CONCLUSIONS

Aquaculture (freshwater – brackish –marine) is very feasible in Haiti . There is a real potential for the development of this sub-sector. The program outlined in this presentation will help create the necessary conditions for investment by the private sector in order to achieve in the next ten years the production of the marine fisheries from 16, 000 tons to 35 000 tons with pond aquaculture production increasing from 400 to 5000 tons and the inland water production from 600 to 10,000 tons .



The lines of action defined in this program will support the government particularly the Directorate of Fisheries and Aquaculture (DPAQ) of the Ministry of Agriculture and Natural Resources to better understand and manage resources; boost the sector; and contribute to achieving the millenium development goals—including food security, the fight against poverty, and the reduction of the risk of natural disasters in the sector .

Thus, on behalf of the Government of Haiti, we would like to ask that all future action taken in the sub-sector of aquaculture be based on the government program for a better implementation and control (planning and decision -making) of all resources in order to avoid costly, unresearched, poorly-planned, and poorly-executed “duplicate activities” in the sector.



MESI BOKOU

JAMAICA COUNTRY REPORT

1.0 INTRODUCTION

Subsistence aquaculture was first introduced into Jamaica in 1948; however, commercial expansion of the industry began in 1976 through a USAID/GOJ project. Since 1976, the aquaculture sub-sector has grown steadily with production focusing on tilapia. To-day the industry has grown in scope to include an ornamental fish sub-sector, culture of marine shrimp *Penaeus vannamei* and freshwater crayfish *Macrobrachium rosenbergii*, as well as small-scale production of the mangrove oyster, *Crassostrea rhizophorae*.

In 2010 the industry was valued at US\$20M with some 300,000 persons benefiting directly or indirectly.

2.0 GEOGRAPHY AND ECONOMY

Jamaica is the third largest island in the Caribbean Sea. It is located 898 kilometres southeast of Miami, 144.8 kilometres south of Cuba and 160.9 kilometres south west of Haiti and possesses national land area of 10,991 square kilometres and a coastline approximately 891 kilometres long. Jamaica is an Archipelagic State and as such its territorial waters cover an area of 12,000 square kilometres with a further 274,000 square kilometres appropriated as its Exclusive Economic Zone (EEZ). The diverse stock of flora and fauna found in these waters are of significant importance to the country's vibrant fishing industry.



Jamaica's population grew by 0.5 % to an estimated 2,624,700 in 2002 over estimates for 2001. Since 2007 Jamaica's economy has contracted with no growth in Gross Domestic Product (GDP). The employable labour force was 1,124.5M at the end of 2002 of which 15.4% are unemployed. The main income generating sectors for the economy are agricultural exports, including sugar and bananas; bauxite mining; and tourism. In addition, remittances from North America and the United Kingdom have played an increasingly significant role in recent times.

3.0 HISTORY OF FRESHWATER AQUACULTURE IN JAMAICA

Earliest records have revealed that *Tilapia mossambica* was introduced into Jamaica in the late 1940's. A breeding programme was started and the species was stocked in most major rivers and ponds. The

tilapia, locally known as African perch, soon became part of the local inland and brackishwater fisheries.

In October 1976 USAID and the Government of Jamaica started a project designed to promote inland fish culture. The following year the Government created the Inland Fisheries Unit (IFU) in the Ministry of Agriculture. The Unit was staffed by faculty members of Auburn University, Alabama, USA and local scientist.

In 1979, there were only fifteen subsistence fish farmers with ponds, excavated by hand, and having a combined area of only 0.1 ha. Farmers with ponds large enough to be commercially viable numbered 7 with a total of 3 ha. In 1980, when the IFU Extension Programme was expanded and the general public became aware of the potential of fish husbandry, a total of 28 farmers with 38 ponds totaling 14 ha were put into commercial production.

4.0 CURRENT SITUATION

A survey conducted by the Fisheries Division, Aquaculture Branch in March 2010 revealed that they are 183 fish farmers in Jamaica with total acreage of 2500.17. However, of this amount only 55.3% or 1,382.06 acres are currently in production. The industry is male dominated with females accounting for 8% of total framers. Culture occurs in earthen ponds ranging in size from 0.5-1.5 acres. Production methodology is extensive and semi-intensive with stocking rates for tilapia of 10,000-20,000 fingerlings per acres, respectively. Fish production is concentrated in the parishes of Clarendon, St. Catherine and St. Elizabeth; which accounts for approximately 90% of total production.

The average total capital investment in a Jamaican tilapia farm is approximately J\$1,030,000 or US\$ 11,976.74 and the estimated total cost of production is J\$102.00 per pound or US\$1.19. Profit margin range from a low of 15% to a high of 40%.

4.1 Production Statistics

Aquaculture production in Jamaica is centered on tilapia and shrimp with per capita consumption averaging 16.3kg/yr. Production has averaged around 5,200MT for the last eight years. The table below represents aquaculture production in Jamaica from 2001-2009.

Year	Production (Shrimp and Tilapia) (MT)
2001	5,000
2002	6,000
2003	4,350
2004	4,200
2005	5,670
2006	7,543.35
2007	5,600
2008	5,300
2009	5,776

4.2 Importance of Aquaculture

In 2009 the Fishing Industry in Jamaica contributed \$3,741.3 (current prices) million to the Gross Domestic Product. This represented 6.37 percent of the output of the Agriculture, Forestry and Fishing sector and 0.39 percent of GDP. The 2009 output represented almost a 41.3 percent increase in the GDP of the industry, moving from \$2,647.0 million in 2008. The increase in the output of the fishing industry reflects increased production of fish farms, as well as export-oriented fisheries which produce mainly shellfish such as lobster and conch.

The production of fish farms showed significant increases over the decade of the 90's, growing from 3 000 tonnes in 1992 to an estimated 7543.35 tonnes in 2006. Since then sector experienced a decline averaging approximately 5,800 tonnes. It is estimated that the industry is valued at approximate US\$20 million annually.

4.3 Tilapia Market Structure

A study entitled Jamaica Tilapia Market Study commissioned by the Ministry of Agriculture, PSDP and Jamaica Trade and Invest (JTI) in 2008 segmented the tilapia market as follows.

- | | |
|--------------------------------|----------------------|
| 1. Wholesalers/Retailers (62%) | 2. Restaurants (19%) |
| 3. Supermarkets (22%) | 4. Hotels (6%) |

4.4 Tilapia Demand

Demand for tilapia is greatest during the month of March and April, followed by August and finally December. It is estimated that demand increases by approximately 25%, 12% and 20% respectively.

5.0 POLICY RELATED TO AQUACULTURE

There is currently no policy document which outlines the development of aquaculture in Jamaica. The Ministry of Agriculture and Fisheries' Agricultural Policy contains general policy goals that are applicable to aquaculture. The Fisheries Division of the Ministry of Agriculture and Fisheries has drafted policy and legislation which includes strategies for the further development of aquaculture in Jamaica. A brief synopsis of the policy and legislation is outlined below.

5.1 Fisheries Policy and Legislation

The government of Jamaica has drafted a fisheries policy and legislation which will address the needs of the Industry. The formulation of aquaculture development/management plans will be paramount tool used to guide the development of the aquaculture sub-sector. Fishers and fish farmers will be registered and licensed and the organization of aquaculture stakeholders will be encouraged. The policy also speaks to the zoning of lands for aquaculture in order to ensure orderly development of the aquaculture sub-sector.

In order to ensure that fish farms conform to best aquaculture practices, standards will be developed for the certification of fish farms, sanitary standards will also be developed in order to maintain and improve the food safety standards practiced in the harvesting and post harvest handling of aquaculture products. The international trade in fish and fish products also requires that hygiene standards throughout the value chain are regulated. The draft Fisheries Bill also contains legislation related to the control of the importation and introduction of live fish into Jamaica.

6.0 REGULATIONS GOVERNING THE AQUACULTURE SUB-SECTOR

Fishing Industry Act (1975)

The Fishing Industry Act of 1975 and the Regulations (1976) were established to govern the growth of the Fishing Industry in Jamaica. The Act does not make reference to Aquaculture. The Fisheries Division has drafted legislation to deal with the development and management of aquaculture in Jamaica.

6.1 Regulations that impact on Aquaculture

There are several other agencies that have regulations that govern the development of aquaculture. These regulations relate mainly to the use of resources such as water and land. The legislation fall under a number of agencies such as the National Environment and Planning Agency, the Water Resources Authority, the Veterinary Services Division and the Forestry Department to name a few. These regulatory agencies deal with issues such as:

1. Licenses and permits for the abstraction and use of water for the sinking or alteration of a well (The Water Resources Act, 1995)
2. Permits for the discharge trade effluent into open bodies of water (Natural Resources Conservation Authority Act, 1991). An Environmental Impact Assessment may be required prior to the establishment of an Aquaculture Facility, depending on the acreage of land that will be cleared.
3. Removal of endangered species such as crocodiles and some species of birds are protected under the Wildlife Protection Act.
4. The use of the seafloor. This is important when considering the establishment of mariculture facilities (The Beach Control Act (1956)).
5. The Importation and exportation of live fish in Jamaica. The Animal (Diseases and Importation) Act establishes procedures for the quarantine of imported and in the case of diseased animals quarantine, control and slaughter of animals in the event of an outbreak of a communicable disease.
6. The export of fishery products and by-products from Jamaica is controlled under the Aquaculture, Inland and Marine Products and By-products (Inspection, Licensing and Export) Act, 1999.

7.0 Existing Plans and Level of Implementation

Currently there is no defined plan related to aquaculture development in Jamaica. The policy related to aquaculture development is outlined in the Draft Fisheries Policy. The Fisheries Division provides extension, training and research services to the aquaculture sector. The Agriculture Policy contains general strategic objectives for the development of agriculture in Jamaica; some of these strategies are applicable to aquaculture development in Jamaica.

7.0 CHALLENGES AND CONSTRAINTS TO AQUACULTURE DEVELOPMENT

The Aquaculture industry has evolved significantly since its humble beginning in the 1940s; however several constraints have stymied the development of Aquaculture. These Include:

7.1 Marketing

- Competition from Imports - Tilapia from the Far East
- Imports of other species (usually cheaper than Tilapia) eg. Banga Mary
- Absence of Marketing strategy
- No established market structure. Currently, most farmers sell directly to retailers and as such they dictate the offering price.
- Consumer perception of Tilapia – taste is inferior to that of marine fish

7.2 Production

- High Input Cost
- Feed – 49% of stocking cost
- Electricity – 19% (stocking with fry), 14% (stocking with fingerlings)
- Seedstock - 7% (stocking with fry), 24% (stocking with fingerlings)
- Labour – 23% (stocking with fry), 12% (stocking with fingerlings)

7.3 Praedial Larceny

High incidences of theft have and continue to negatively impact the profitability of framers.

8.4 High Capital Investment cost

Average initial capital investment for a farmer is US\$11, 900, very few farmers and by extension financial institutions are willing to invest in aquaculture based on the high incidence theft and ultimately failure.

8.0 CONCLUSION

Jamaica's Aquaculture industry has centered on the production of Tilapia, shrimp and ornamental fish, since its commercialization in the 1970s; with tilapia being the major product. There has been little growth in the industry since 1997. Production from 1997 to 2009 remained between 4,000 MT

and 6,000 MT except in 2006 when production was 7,543 MT. Since then, the acreage in fish production and the number of farmers has declined significantly.

Despite the industry's achievements, the need for a developmental plan for its continued existence and diversification of the industry is paramount. This plan must take into account the constraints of the industry, the financial environment and input costs.

It is envisaged that the Jamaican Aquaculture Industry will only achieved its full potential if a clearly charted road map is developed and implemented in short order.

SURINAME COUNTRY REPORT

General Information

Geography and Economy

Location	North of South America, bordering North Atlantic Ocean, French Guiana, Guyana and Brazil
Area	163,820 sq. km a. Land – 156,000 sq. km b. Water – 7,820 sq. km
Length of coastline	386 km
Shelf area (to 200 nm)	54,550 sq. km
Terrain	Varies from coastal swamps and tropical rainforest to savanna and hills
Climate	Tropical
Temperature	28°C (Average)
Population (2010)	486,618
Annual growth rate (2010)	1.108%
Languages	Dutch (official), English, Sranan Tongo (lingua franca)
Labor force	165,600
Unemployment rate (2004)	9.5%
GDP (2010)	SRD 15,758.4 billion (US\$4.704 billion)
GDP growth rate (2010)	3.5%
GDP per capita (2010)	SRD 33,165 (US\$ 9,900)
Currency unit (2010)	SRD 3.35 = US\$1
Agriculture	8% of GDP (2010). Products: rice, bananas, timber, shrimp & fish, and fruits
Export products	Rice, timber, shrimp, fish, fruits, gold, flowers, bauxite, aluminum, crude oil

The capital is Paramaribo. About 50% of the population lives in Paramaribo. Another 100,000 in semi - urban areas close to the capital. About 15% live in the southern Interior Rainforest, which accounts for 80% of the country's total area.

History

By the end of the 1800's some of the abandoned cotton plantations were used for a form of fish farming. At high tide the sluices were opened to let brood stock in. After that the sluices were closed and the fish were farmed with no further interventions. These plantations were rented from the governor by fish farmers for extensive aquaculture.

In 1949 there was an attempt to farm *Mugil spp.* (Kweriman) on one of these farms but it was not successful. In 1955 the method of farming was changed which lead to increased production, although a lot of problems remained. One of which was the irregular supply of brood stock. Another problem was a large amount of algae in ponds that were not in production. In light of this another species who would comply with the following requirements was sought;

- A herbivore which could feed on algae
- A production of brood throughout the year
- Ability to survive between the predatory species in ponds
- Survive in saltwater as well as freshwater
- Suitable for human consumption

Unfortunately none of the indigenous species complied with all the requirements and in 1955 three pairs of tilapia (*Oreochromis mossambicus*) were imported from Trinidad. The brood of this tilapia and some other coastal fish species were introduced in the ponds. These experiments (1957) were a success and paved the way for further exploitation of this species. In 1958 the amount of ponds was increased. The quality of the tilapia was accepted by the population (Lijding, 1958).

From 1956 to 1958 tilapias were released in the wild, the result was that within a few years these coastal swamps, lagoons and inland waterways had large populations of tilapia.

Other sources were less enthusiastic about tilapia farming. The forming of deposits in ponds and canals was one of the large problems. The fish was also not accepted by the population as was previously assumed (Kuiper 1974).

In 1965 the Japanese fish biologist, Mr. Yamashita, researched the possibilities of brackish water aquaculture in the Matapica area. The possibilities for oyster and shrimp farming were also researched. Experiments with the Mugil spp. were repeated, but the mayor problems were that predatory fish could not be kept out of the ponds as well as sludge deposits in the ponds. Yamashita concluded that the Matapica area had potential for brackish water aquaculture and proposed to place a sludge catcher between the canals and ponds to resolve the problem of sludge deposits. In 1970 Chinese grass carp was imported by Mr. Yamashita for cultivation and export to the Caribbean but this project was a failure.

In 1971 a plan for an aquaculture station was formulated, but was rejected.

In 1974 the possibility for fresh water aquaculture was researched in the Saramacca district. The species used were native swamp (*H.litorale*) - and catfish such as channel- catfish (*Ictalurus punctatus*) from the United States. The results of this experiment were satisfactory.

In 1980 a literature study was done for the possibilities for cultivation of *Macrobrachium rosenbergii*. Several native species of *Macrobrachium* (*M.surinamicum*, *M.amazonicum* and *M.carcinus*) were also researched. The first results in 1985 were promising while the native species gave less satisfactory results.

In 1986 the possibility for the cultivation of kwie-kwie (*Hoplosternum littorale*) was also performed. Surland N.V. entered into a joint-venture with a Chinese counterpart for the production of shrimp larvae. This project was done in Tawajari. Study on the production of larvae of *M.rosenbergii* and *H. littorale* was also done in laboratory conditions at Jarikaba-4 (Power,1990).

The Anton de Kom University of Suriname and the Celos Institute also did research (1982) on the biology and ecology of (*H.littorale*).

In Matapica experiments on the cultivation of sea turtles (*Chelonia mydas*) were also done (not published Berenstein 1984).

In the eighties a feasibility study on the possibilities of cultivating brackish water shrimp in the Commewijne district was done. The outcome of this study resulted in commercial cultivation of *P.vanamei*. Since then various attempts and studies have been done on the possibilities for aquaculture. The two species actually cultivated are the *Litopenaeus vannamei* and the red tilapia.

In the 90's there were several aquaculture farms which cultivated mainly red tilapia and *P. vannamei*. For over 10 years Suriname farmers went through a learning process with all the trials and tribulations that such a process involved. The culture of shrimp (*L.vannamei*) and Tilapia (Red hybrid and

Oreochromis mossambicus) in Suriname started gradually. There are some factors that have contributed to this success, these are:

- Treatment of pond bottom between two crops.
- Use of nursery tanks for post-larvae reception and acclimatizing.
- Use of fixed feeding trays.
- Use of aeration.
- Use of disease free strain.

Importance of Aquaculture

The worldwide catches of fish are not expected to grow anymore and in the recent years have started to decline and will not be able to satisfy the demand for fish and fisheries products. In the near future there will be a shortage of these products and this shortage could be supplemented by aquaculture production.

Development of aquaculture in Suriname is obvious for the following reasons. Studies have shown that the climate, as well as the physical-chemical condition of soil is favorable for aquaculture. Another reason is that water reserves (brackish and freshwater) are abundant.

Development of this sector can also give a great impulse to the Surinamese economy.

Description

In Suriname the main type of aquaculture is the cultivation in ponds.

Shrimp cultivation

In Suriname the shrimp ponds are stocked with larvae imported from the United States (SPF free facilities). The larvae arrive in plastic bags with a density of 1500 per liter. The larvae are acclimatized for a couple of days and are there after stocked into the ponds. The process ends over a five month period of cultivation. In this period the shrimp are fed with a high protein feed. The shrimp are harvested at weights between 18 and 20 grams. After harvesting the shrimp are deheaded for marketing.

Tilapia cultivation

The first step in the cultivation of tilapia is to produce larvae. The second step is to nurse these larvae into fingerlings, and the third step is to stock these fingerlings into ponds. The production of the larvae takes place in the spawning ponds where males and female tilapia are kept together. After the spawning has occurred the parents are moved from these ponds and the fish larvae are treated with methyltestosterone to transform the population into males. Males become bigger, and there won't be reproduction in the cultivation period. After these the fry's are moved to nursery ponds where they grow into fingerlings. The fingerlings are stocked in grow-out ponds at a density of 5-10 fingerlings per m². After a period of almost a year the fish can be harvested at a size between 500-750 grams.

Current situation

In Suriname the aquaculture is mainly focused on the cultivation of tilapia, shrimp and native swamp fish. In recent years however some individuals have expressed their interest in cultivating ornamental fish.

Some aquaculture production statistics over the last ten years are:

Export of Cultivated Shrimp		
	Net. Weight (tonne)	Value (USD)
2000	95.1	913,008.74
2001	219.1	1,697,975.59
2002	143.4	248,108.50
2003	211.3	785,147.52
2004	171.3	533,042.70
2005	108.3	225,161.40
2006	101.5	231,175.00
2007	19.2	
2008	0.1	

In the last years there have been no exports of aquaculture products. At the moment there is only one commercial aquaculture farm in production, Comfish N.V. located in the Commewijne district. Their production is currently destined for the local market and they have been Global GAP certified in the 2010.

Laws/Regulations

The concept Aquaculture legislation is in the process of approval.

Existing plans

Aquaculture station at Oryza

Currently there are plans for the construction of an aquaculture station to enable farmers to buy their brood stock and, if needed, they can receive training and guidance in their venture. The preliminary tests for water quality and location have been done and the results were satisfactory. This project is being co-financed by the FAO and has been approved for technical assistance by a FAO consultant. The location for this aquaculture station cannot be used at the moment and is actually on hold.

Rice-fish project in Nickerie

This FAO project started in 2004 as an experiment of simultaneously cultivating *H.litorale* and rice. The results were satisfactory and the project is now in the second phase. Some ponds need to be revised but cannot be repaired at the moment due to the fact that the rice fields are in production moment. This project is on hold till the harvest season.

Disease Monitoring Plan for Aquatic Animals

This is a project for monitoring the existence and prevalence of various diseases that can affect aquatic animals (including aquaculture species) that will be co-financed by the FAO. The Terms of Reference is currently at the FAO awaiting approval for funds for technical assistance.

Lessons Learned

Expertise

The expertise necessary for aquaculture is lacking for the most part in Suriname. The information that is available is outdated and expertise is usually imported, which makes it necessary to attract foreign consultants.

Marketing

In the past marketing was done mainly as an afterthought which led to many companies to produce aquaculture products with no market. This led to high losses and eventually bankruptcy for many of them. The necessity for certification of aquaculture establishments is also important for improvement of their position on the world market.

Inputs

Many of the aquaculture inputs need to be imported, which translates into higher production costs and decreased competitiveness.

Challenges and Constraints

The main challenges and constraints which the aquaculture sector faces are the following:

1. Lack of knowledge which can be classified as the most important problem. This Knowledge concerns the following aspects:

a. Cultivation

Insufficient knowledge (and expertise) in most cases leads to hybrids (not the correct aspect regarding; shape, color, taste). Even expert cultivators get serious problems when the desired product is not obtained. In the case of cultivation of ornamental fish, there is very little information on the breeding of the species of interest.

b. Agricultural Engineering

Insufficient know-how results in inadequate design of infrastructure (construction of ponds, water supply channels, etc.).

c. Marketing

The entrepreneurs must be well informed on the demands of the market, in order to avoid marketing failure, because without sales there is no need for production. Unfortunately underestimation of marketing is encountered. Marketing of the product is often seen as an afterthought. The required know-how is in most cases “imported” for a relatively high price by aquaculture entrepreneurs.

2. Lack of Expertise

Experience in other parts of the world has shown that a lack of expertise and qualified personnel is one of the main reasons for the failure of aquaculture projects. Personnel is needed on every level (University, mid-level and lower staff) of different disciplines. The management of small and large enterprises is very important and therefore training should be available.

3. Financial constraint

Aquaculture companies take huge loans for setting up as well as part of the exploitation costs. These companies have to pay high interest rates at the bank due to the high risk factor that the banks ascribe to these ventures. Since aquaculture needs large sums of money and does not constitute stable development it is clear that most entrepreneurs and small farmers because of the high interest rates cannot use these credit facilities.

4. Insufficient means of export

Entrepreneurs observed limitations in export, no reliable flight connections, high freight cost and insufficient freight capacity.

5. Insufficient cooling and storage facilities

Species that are being exported require adequate cooling and storage facilities. On the airport and port the facilities as well as the area to construct these are absent. In case of sea freight there is access to a storage facility and some ships have containers with built-in chillers.

6. Insufficient government support;

The government does not give financial nor institutional help to entrepreneurs and small farmers in the sector. The cumbersome procedures for the application of licenses (for starting up a venture as well as for export and import) are de-motivating and seriously delay the planning of entrepreneurs. Complicated procedural aspects around the imports can be disastrous for the import of sensitive inputs such as brood stock.

7. Lack of necessary inputs

Suitable inputs such as parental brood stock, fry, feed, nets, etc. are not available on the local market. The available inputs are of inferior quality and are expensive, which necessitates import of the inputs needed.

8. Outdated investment legislation

There is need of an investment code, which attracts local and foreign investors.

9. Lack of legislation

At the moment legislation for aquaculture is in the process of approval.

10. Insufficient availability of information

The information available at the ministry and in libraries is often lacking and/or outdated.

TRINIDAD AND TOBAGO COUNTRY RPEORT

Prepared by:

*Harnarine Lalla, Fisheries Officer &
Christine Chan A Shing, Director of Fisheries*

Introduction

The history of Aquaculture in Trinidad and Tobago spans a period exceeding 60 years. The Java Tilapia (*Oreochromis mossambicus*) was introduced to Bamboo Grove Research and Development Station during the 1950s. Previous attempts to cultivate rainbow trout (*Oncorhynchus mykiss*) and common carp (*Cyprinus carpio*) (in 1934 and then in 1947, respectively) were not successful. Red hybrid Tilapia was introduced from Jamaica in 1983 and super male technology was introduced in 2006.

Most attempts at aquaculture development in Trinidad and Tobago have not been successful, primarily due to improper planning, poor vision or scope in the approach to commercial aquaculture, and inadequate or inconsistent management practices. The most notable attempt which approached commercial viability was established by Caroni (1975) Limited (the former Sugar Cane Company), in 1989. The pilot phase consisted of a multipurpose hatchery and 9.5 ha (25 acres) of earthen ponds for grow-out operations. The project produced Malaysian prawns (*Macrobrachium rosenbergii*), cascadura (*Hoplosternum littorale*) and red hybrid tilapia. Production eventually focused on tilapia. Economies of scale were not met and significant profits were not generated. The project was discontinued in 2000.

Current Situation

The Fisheries Division of the Ministry of Food Production, Land and Marine Affairs, has the mandate to manage Fisheries and Aquaculture in Trinidad. The Department of Marine Resources and Fisheries of the Tobago House of Assembly has the similar mandate for Tobago, with a jurisdiction extending to six (6) nautical miles.

The Fisheries Division is headed by the Director of Fisheries. Technical work is supervised by a deputy director called the Senior Fisheries Officer. There is support from administrative and technical staff. The Division is comprised of four (4) functional units: Administration, Extension, Aquaculture and Research.

Other State Agencies which are involved in aquaculture include:

The Institute of Marine Affairs (IMA), Chaguaramas; The University of the West Indies (UWI), St Augustine Campus; The Sugar Cane Feed Centre (SFC), Longdenville; and The Seafood Industry Development Company (SIDC), Charlieville.

The major functions of the Fisheries Division's Aquaculture Unit, includes:

- Extension and training geared toward farmers in areas of earthen pond and tank based aquaculture.
- Dissemination of biotechnical information on aquaculture and aquaculture species.
- Conduct of training in commercial aquaculture.
- Administration of ornamental fish trade.
- Development and testing (where possible) of models for commercial intensive aquaculture.

Trinidad and Tobago has traditionally relied on catches from the marine environment to satisfy its fresh fish demands. However, within the last decade, prices have increased (due primarily to increased demand for fish and decreasing catches) so that prices for fish from aquaculture production are now comparable to less preferred marine species.

With a resurgence of interest in Aquaculture in Trinidad and Tobago partly due to national and global trends, favourable economic climate, increased consumer acceptance of tilapia and increase in fish prices from marine landings, there has been an increase in requests for technical information and assistance. However, a paradigm shift in the traditional approaches and general thinking about aquaculture is required for the sector to be successful.

With an emphasis on addressing some of these issues, several models for tank based aquaculture have been developed and are being field tested to provide demonstration facilities and statistical data to guide potential investors, farmers and financial institutions. Underpinning this strategy is commitment on the part of the Division and collaboration with key stakeholders in the sector. The aim is to foster a better informed, organised and coordinated approach to commercial aquaculture.

Presently the emphasis is on tilapia since it is relatively easy to cultivate and suited for the majority of inexperienced aquaculturists. Four (4) systems have been developed. Two (2) have been implemented and field testing is underway. Two other systems are awaiting field testing.

- i. A tank based pilot version of a large scale intensive commercial clear water re-circulating tilapia culture system comprised of 12 circular fibreglass tanks (20' in diameter and 4' in height) was set up at IMA in Chaguaramas. Some harvesting and marketing have already been done but a complete evaluation is yet to be prepared. The project was done in conjunction with IMA and financed by SIDC. (Photos 1 & 2).
- ii. A tank-based pilot version of a large scale commercial green water tilapia culture system comprised of six (6) circular fibreglass tanks (20' in diameter and 4' in height) has been set up at SIDC in Charlieville. This project was financed by SIDC. Some harvesting and marketing has already been done. (Photos 3 & 4).
- iii. A small scale intensive commercial green water re-circulating tilapia system comprised of 16 plastic circular tanks (5½' in diameter and 4' in height) has been developed by Fisheries Division. Implementation for field testing is underway. (Figures 1, 2 & 3).
- iv. A medium scale intensive commercial green water re-circulating tilapia culture system comprised of eight (8) plastic circular tanks (10' in diameter and 4' in height) has also been developed by Fisheries Division. This system is awaiting field testing. (Figures 4, 5 & 6).

Production Statistics-Food Fish (2010)

Producer	Lbs	Kgs	TT\$/Lb	USD/Lb	TT Earnings	US \$ Value
IMA	12775	5809	8	1.25	102200	15968
SIDC	3688	1676	8	1.25	29504	4610
Private Farmers	5000	2272	10	1.57	50000	7850
Total	21463	12021	-----	-----	181704	36278

Ornamental Fish (2010)

The Division's Aquaculture Unit is responsible for recommending the import and export of ornamental fish to the Ministry of Trade and Industry. This exercise also involves inspections of fish to be traded at the Piarco International Airport. For 2010- five hundred and four (504) such inspections were conducted. Seventy-seven (77) fish import applications were processed, amounting to 181,138 fishes valued at TTD464,021.67. Five hundred and twenty- nine (529) export applications were processed, amounting to 6,186,985 fishes valued at TTD1,202,437.41. Most imports were from the USA and South America of species from around the world. Exports were to the USA and CARICOM.

Ornamental Fishes (2010)

Airport Inspections	Trade	Applications Processed	No. of fishes	TT\$ Value
77	Import	77	181,138	464,021.67
	Export	529	6,186,985	1,202,437.41

Funding

For the current fiscal year, October 2010 to September 2011, the Aquaculture unit received TTD 300,000.00 (USD 47,000.00) for use in the following areas:

- i. Aquaculture Planning and Administration
- ii. Training and Extension support
- iii. Institutional strengthening
- iv. Development of New Culture Systems

There are no donor funded projects.

Challenges and Constraints

The Fisheries Division is in the process of acquiring physical facilities to establish aquaculture training, testing and demonstration facilities. In the interim, the Division has to rely on other agencies to implement and test models and systems it has developed. Aquaculture is considered to be a subset of the fisheries sector and as such there are no established incentives and subsidies for aquaculture. Established and potential aquaculturists are clamouring for market support since production is sporadic and markets are not developed.

The following have been identified as the major impediments to mobilising the sector so that its full potential to contribute to food security in Trinidad and Tobago can be realised:

- Testing, training and demonstration infrastructure.
- Provision of incentives.
- Market intelligence.



Photo 1: Shade house structure for clear water system at IMA



Photo 2: Clear water system at IMA



Photo 3: Green water system at SIDC



Photo 4: Growing tank and clarifier at SIDC

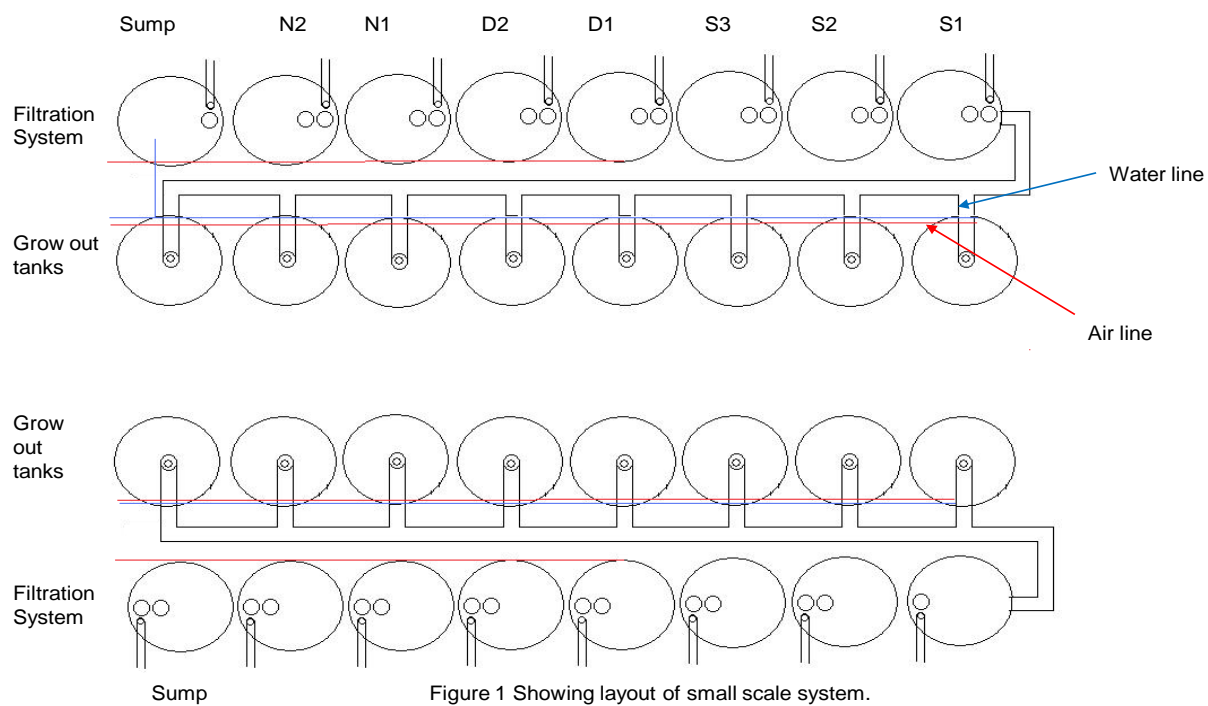


Figure 1 Showing layout of small scale system.

S1, S2, S3, – Sedimentation tanks

D1, D2, – De-gassing tanks

N1, N2 – Nursery tanks

Sump from where the submersible pump will return filtered water to grow out tanks.



Figure 2 Showing side view of grow out tanks

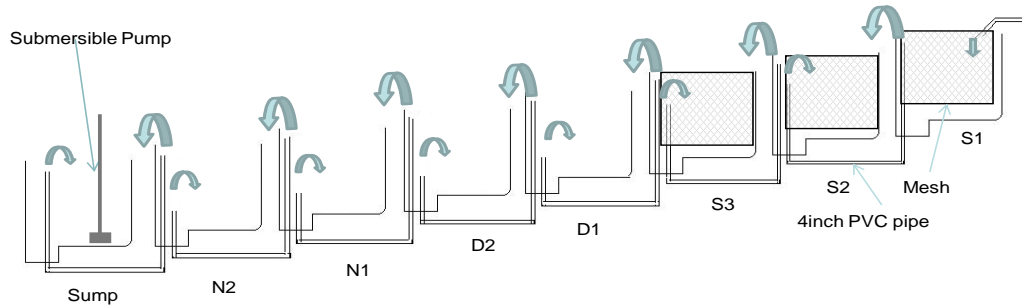


Figure 3 showing side view of filtration system S1,S2,S3, Sedimentation tanks. D1& D2 De-gassing tanks . N1,N2-Nursery tanks. Sump from where the submersible pump will return filtered water to grow out tanks.

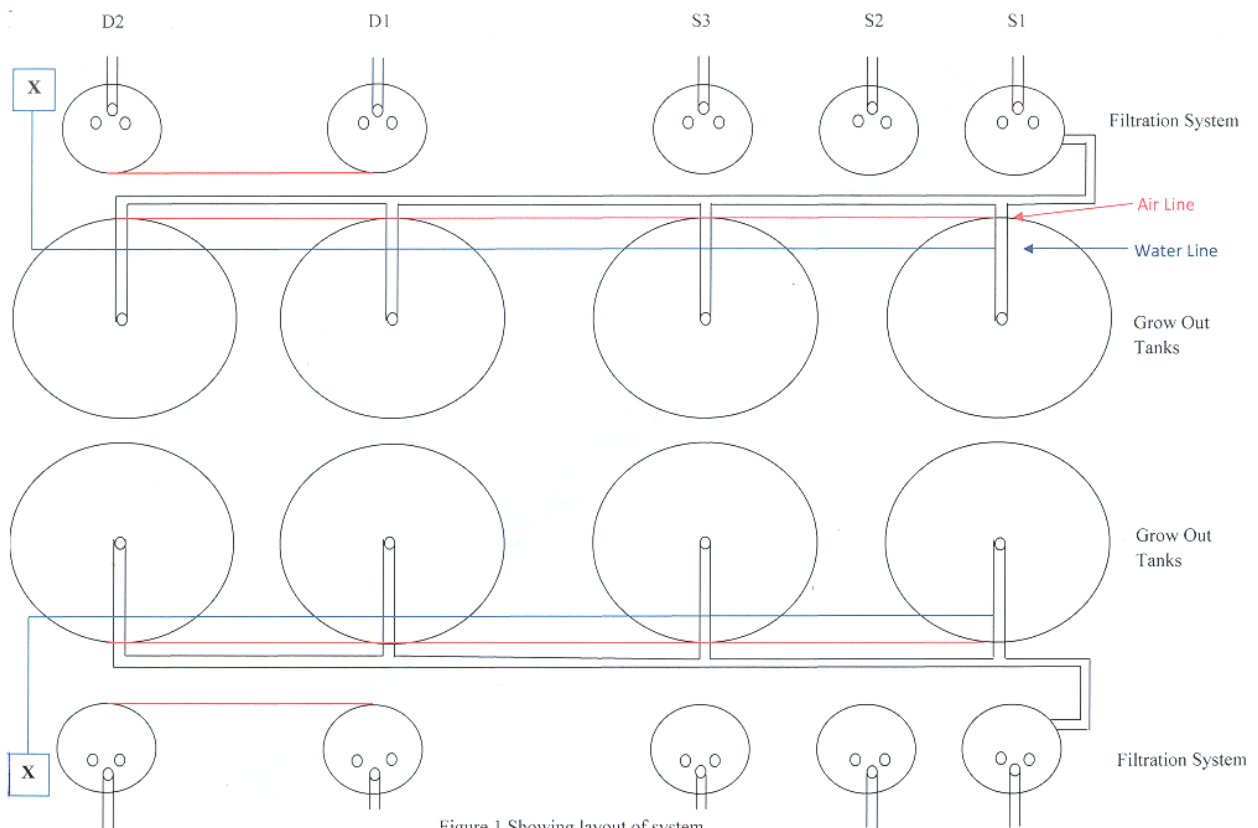


Figure 1 Showing layout of system
S1, S2, S3 Sedimentation tanks.
D1, D2, D3- Degassing tanks.
X- Submersible pump

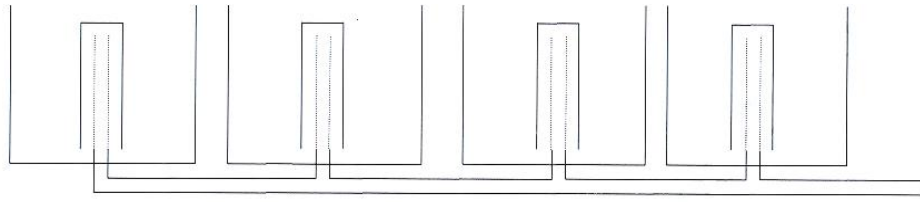
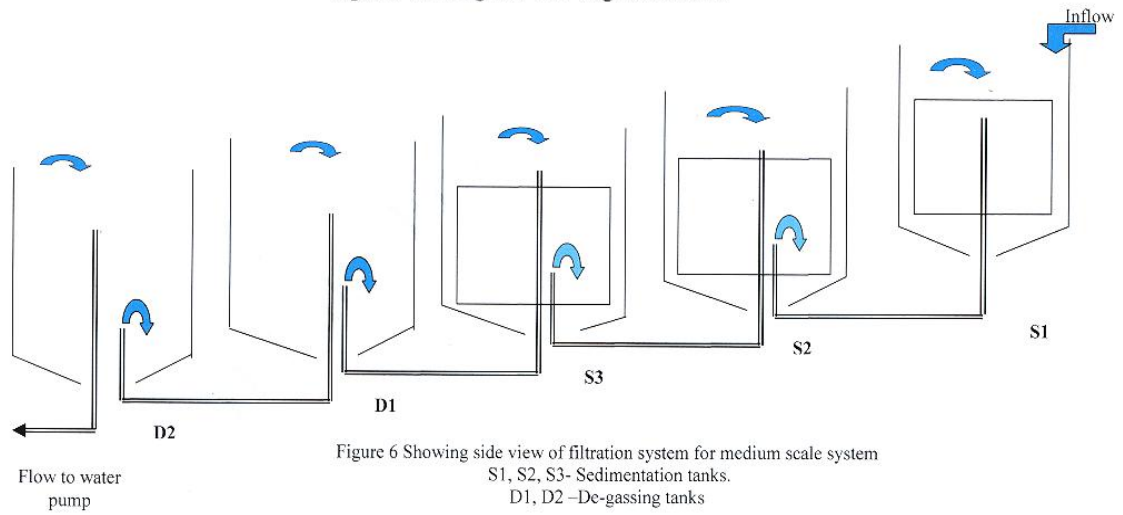


Figure 5 Showing side view of grow out tanks



Trinidad and Tobago





PCM

Project Cycle Management

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Orientation:

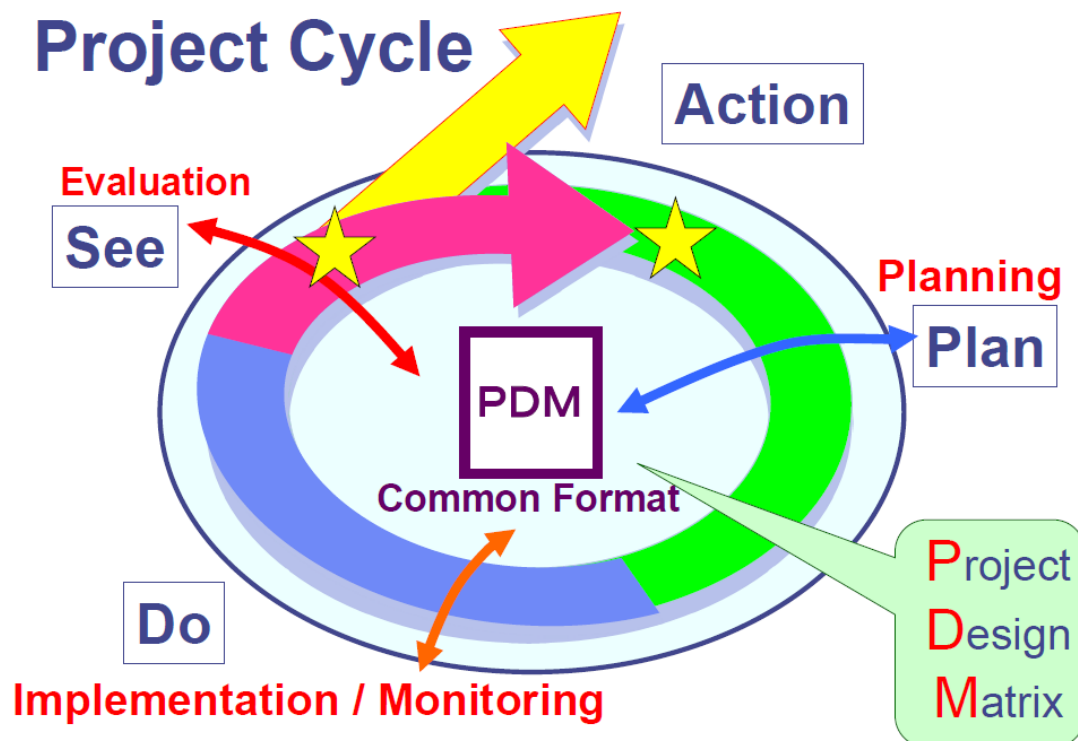
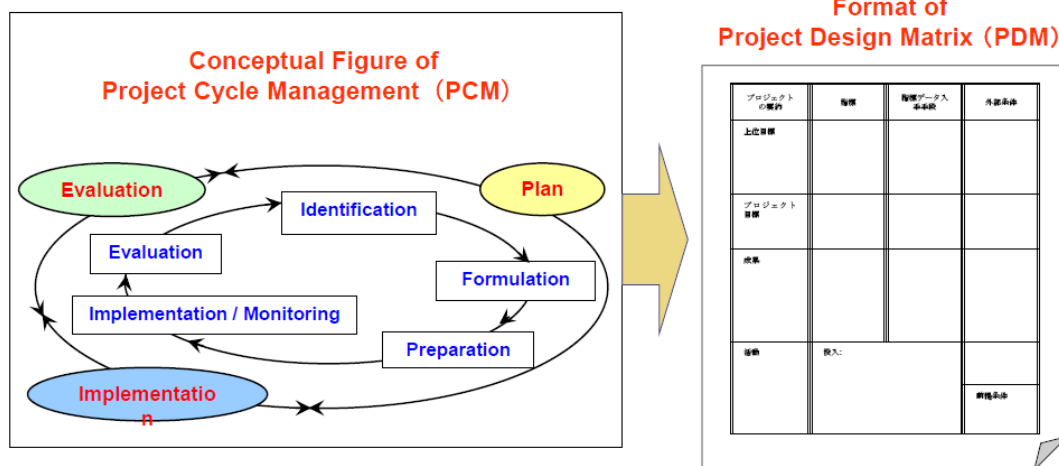
Goals of this session

1. To be familiar with the PCM method
2. To understand the Logic of 'Logical Framework' 'PDM'
3. To discuss and analyze the issues and problems related to your action plan

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Definition of Project Cycle Management

To manage the cycle of Development Project
 – Plan, Implementation, Evaluation –
 by using Project Design Matrix (PDM)



PCM Workshop

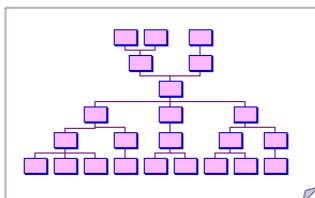


Participation

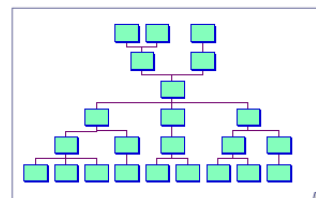
- ① Reflection of social necessity
- ② Fair opportunity
- ③ Consensus among all the participants

Planning Process

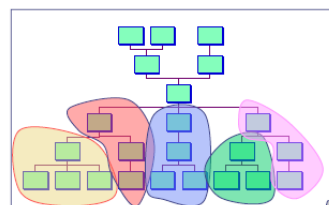
① Problem Analysis



② Objective Analysis



③ Alternatives Analysis (Project Selection)



④ Formulation of PDM

プロジェクトの 範囲	目標	目標データベース 参照	外部関係
上位目標			
プロジェクト目標			
成果			
活動	投入		関係関係

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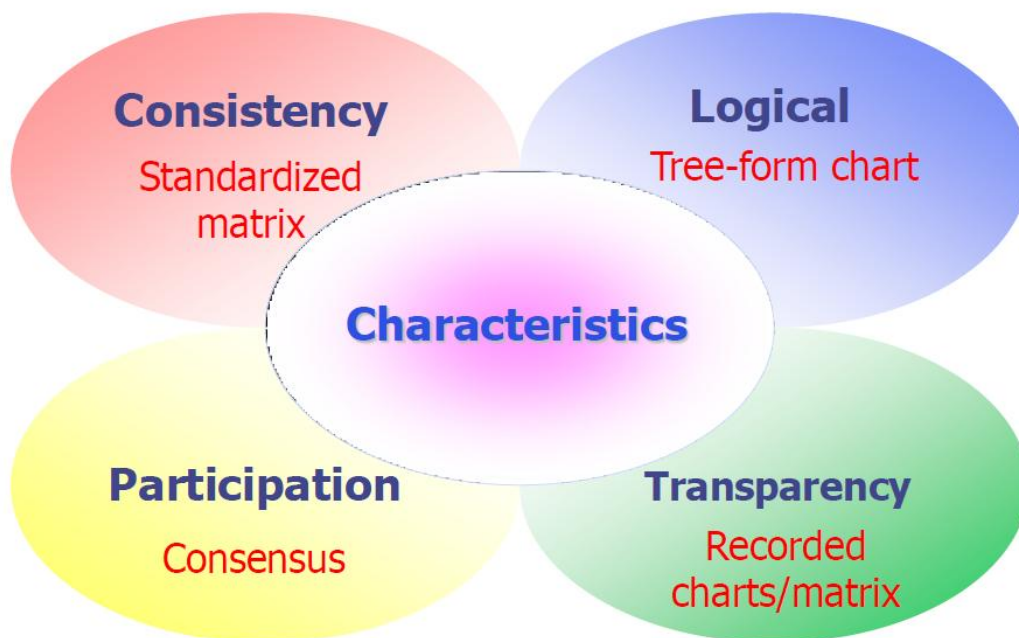
Project Design Matrix (PDM)

Project Title: _____ Target Group: _____ Version: _____

Target Area: _____ Project Period: _____ Date: _____

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal :			
Project Purpose :			
Outputs :			
Activities :	Inputs		
			Pre-Conditions

Characteristics & Benefits of introducing PCM





Problems Analysis

Analytical Stage 1

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Why Problem Analysis?

To solve problems,
we have to know the
problems better.



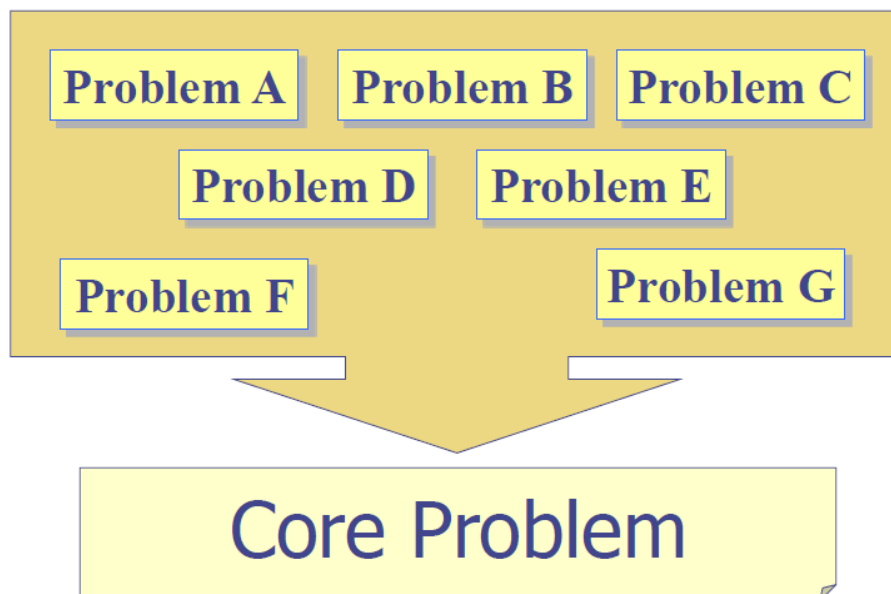
**Problems Analysis is
one of the methods.**

What is Problem Analysis?

Analyzing problems
by finding out
the causes and
effects.



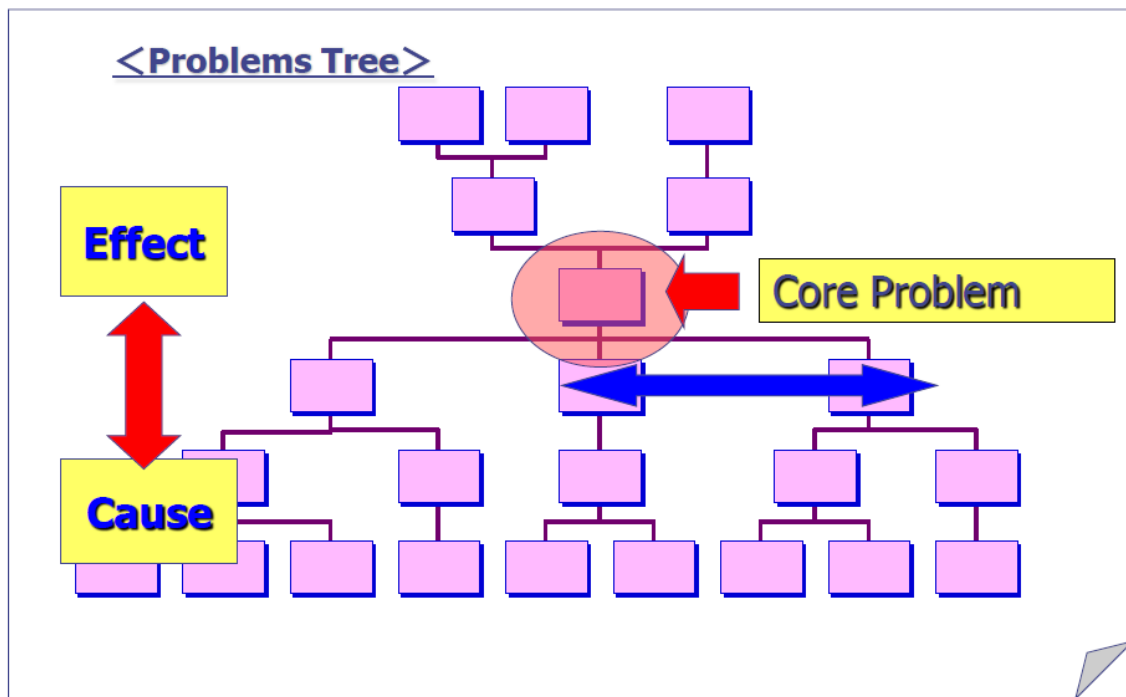
How can we start
Analyzing Problems?



Rule of card writing

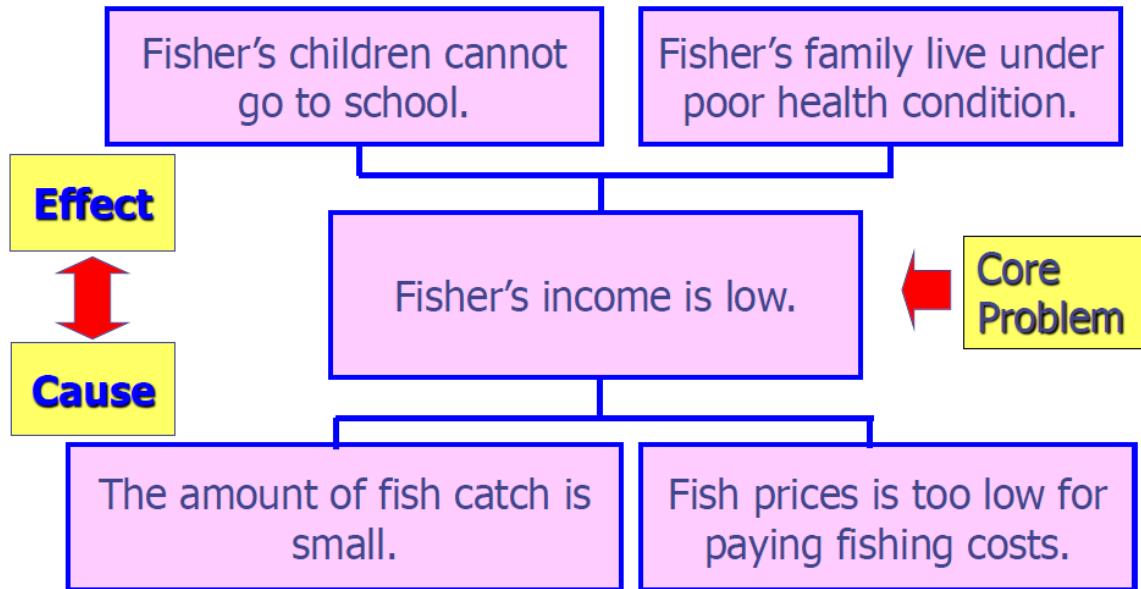
- (1) Write only existing problems.
- (2) Write one problem on one card.
- (3) Write in a sentence.
- (4) Avoid writing “There is no~”.

Problems Analysis



Problems Analysis

<Problems Tree>: Example





Objectives Analysis

Analytical Stage 2

Why Objectives Analysis?

To solve problems,
we have to set up
objectives to be
achieved.



**Objectives Analysis is
one of the methods.**

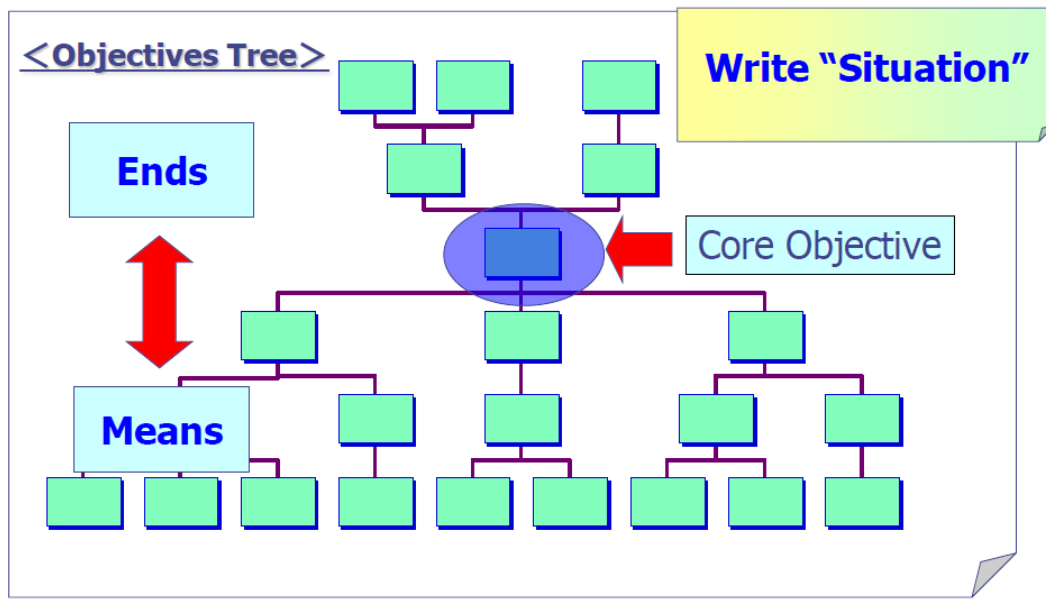
What is Objectives Analysis?

Analyzing objectives
by finding out
the means and ends
based on the **problems
analysis.**



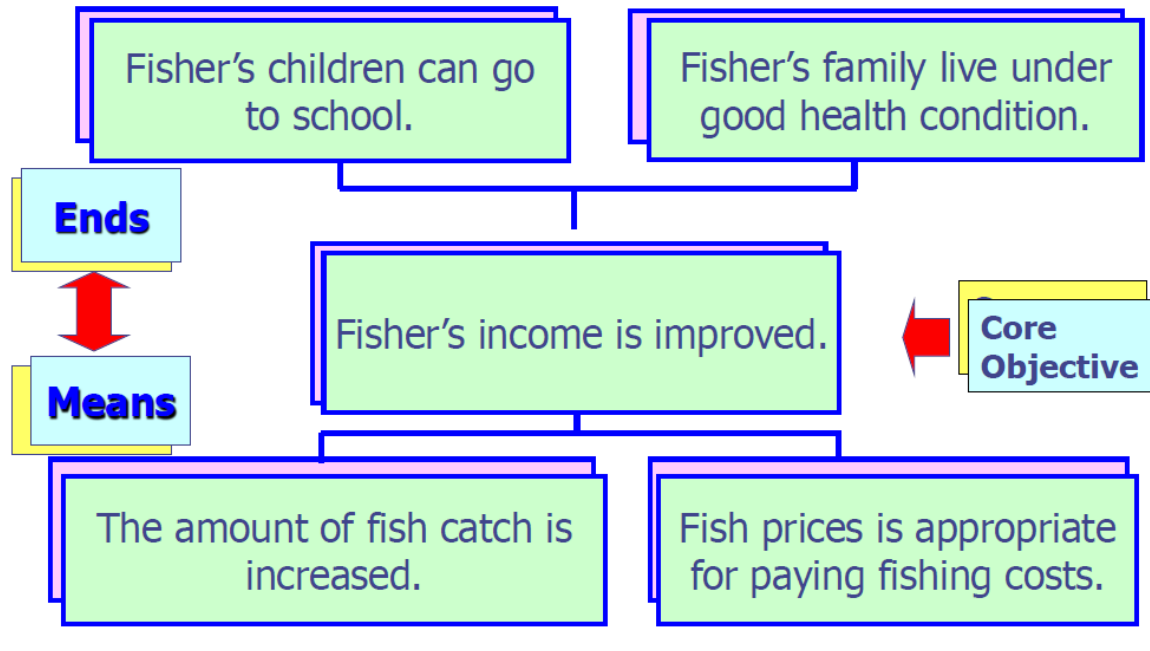
Objectives Analysis

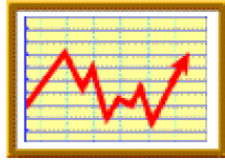
Practicability



Objectives Analysis

<Objectives Tree>: Example





Project Cycle Management

Project Selection & PDM

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Project Selection



<Objectives>

To draw up the project blueprint based on the previous analysis, budget, and personnel.

~Process of selecting the appropriate project~

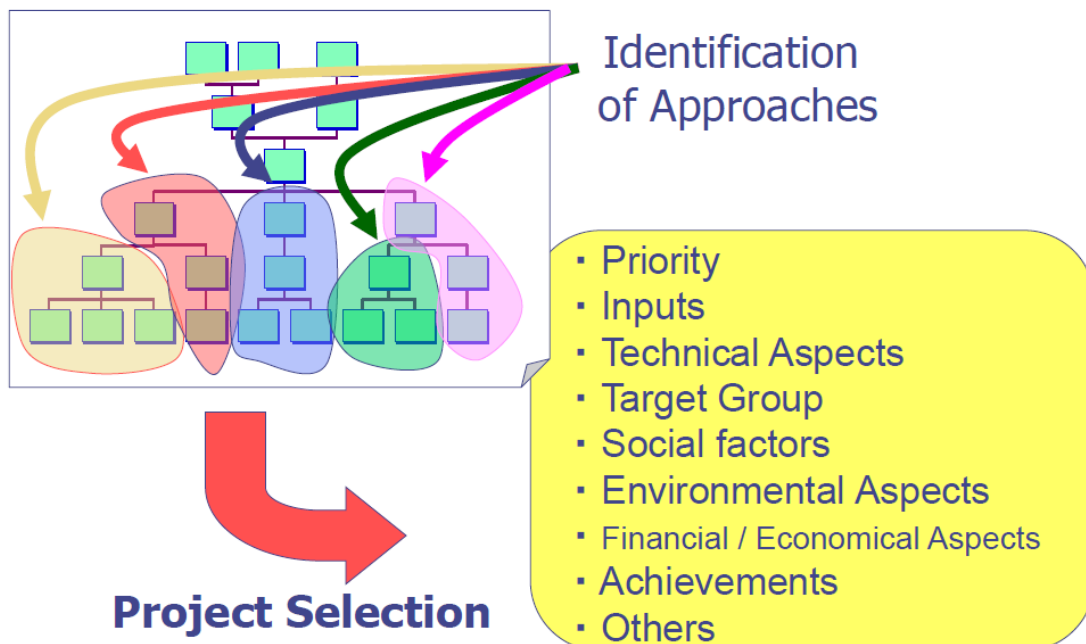
Identify the approaches (candidates for project) in the Objectives Tree, **compare** those approaches, and **select** one or some approaches as a project

Process of Alternative Analysis

1. Confirming possible constraints (e.g. budget, duration)
2. Identifying the approach in the Objectives Tree.
3. Naming each approaches
4. Comparing the approaches based on the set-up criteria.
5. Selecting one or several approaches as the project

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Alternatives Analysis (Project Selection)

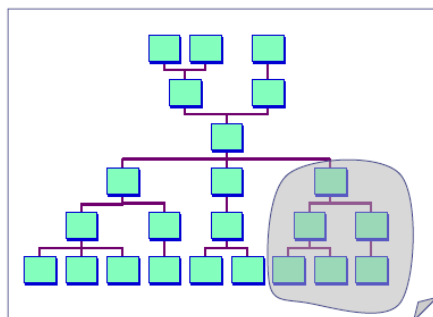


Project Selection

<Approach Comparison (Eg.) > * 1 to 4 scale Evaluation (except Cost)

	Effects on Core Objective	Cost	Feasibility	Emergency
"×△ Approach"	4	Low	2	3
"○△ Approach"	2	Low	3	3
"△△ Approach"	2	High	1	4
"×○ Approach"	3	High	4	1
"×× Approach"	2	Low	2	2

How can we plan a project based on the selected approach?



Selected Approach

PDM

プロジェクトの業務	目標	目標達成率	外部条件
上位目標			
プロジェクト目標			
成果			
活動	投入		制約条件

Project Design Matrix (PDM)

<Positioning of PDM>

- (1) To be the master plan of the project.
- (2) To be used as a basic tool of project management on all front.

<Objectives>

- 1.To design the project with clear image.
- 2.To express the project by using the common format for anyone to understand.



Structure of Project Design Matrix (PDM)

Project Title: _____ Target Group: _____ Version: _____

Target Area: _____ Duration: _____ Date: _____

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal :			
Project Purpose :			
Outputs :			
Activities :	Inputs		Pre-Conditions

Narrative Summary

Overall Goal

• A long term objective to be attained by the realization of the Project Purpose.

Project Purpose

• An objective to be realized by the end of the project period.

Outputs

• Sub-objectives need to be achieved to realize the Project Purpose.

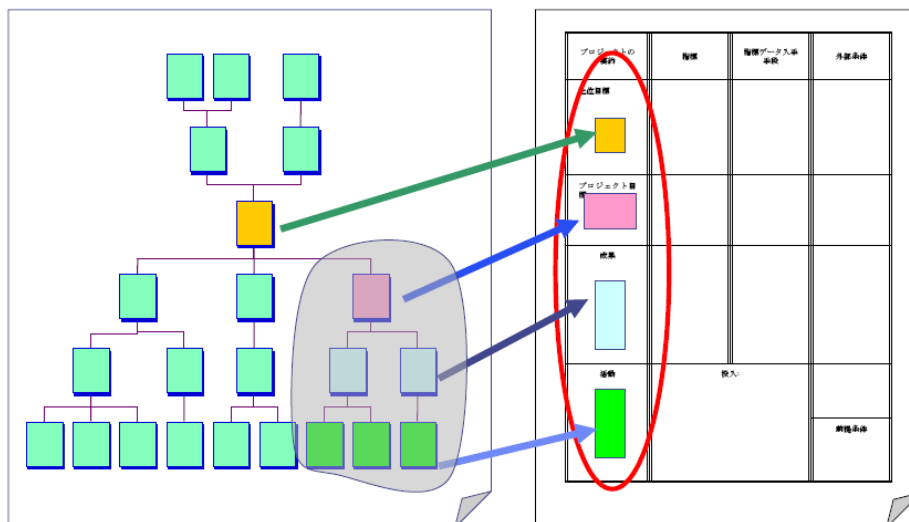
Activities

• Tasks to be undertaken to achieve the Outputs.



Do you see
“Means – End”
Relation?

How can we reflect the result of objectives analysis?



Important Assumptions and Pre-Conditions

Important Assumptions

- Factors (uncertain, external, and important) which are necessary to be satisfied to realize the upper level of goal.
- Conditions to sustain the development effect.

Project Title: _____ Target Group: _____
 Target Area: _____ Project Period: _____ Date: _____

プロジェクトの概要	目標	実施計画	外部条件
上位目標			
プロジェクト目標			
成果			
活動	投入		

Pre-Conditions

- Conditions that are necessary to be satisfied before starting the project.

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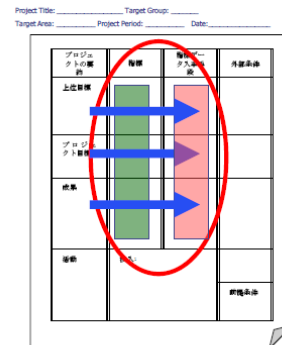
Reading PDM

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal :			Vertical Logical Relationship
Project Purpose :			
Outputs :			
Activities :	Inputs		Pre-Conditions

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Objectively Verifiable Indicators

What ?	Measuring figures
Of whom?	Target group
Of where?	Target area
How much?	Quantitative goal
How well?	Qualitative goal
By when?	Schedule



Means of Verification

- Reliable data source.
- Sustainable data source.
- If not available, include "data collection" in *Activities*.
- Beware of data collection costs.

An Example of Objectively Verifiable Indicator and Means of Verification

Objectively Verifiable Indicator:

By October 2005, fish catch of XX village increases 5% from the current level.

Means of Verification:

Fish landing data in Y district office

Inputs

Needed to start/complete the *Activities*.

- Personnel -
- Equipment -
- Materials -
- Facilities -
- Operational Costs -

Project Title: _____ Target Group: _____
 Target Area: _____ Project Period: _____ Date: _____

プロジェクトの概要	目標	目標グループの決定	外部関係
上位目標			
プロジェクト目標			
成果			
活動			関係者

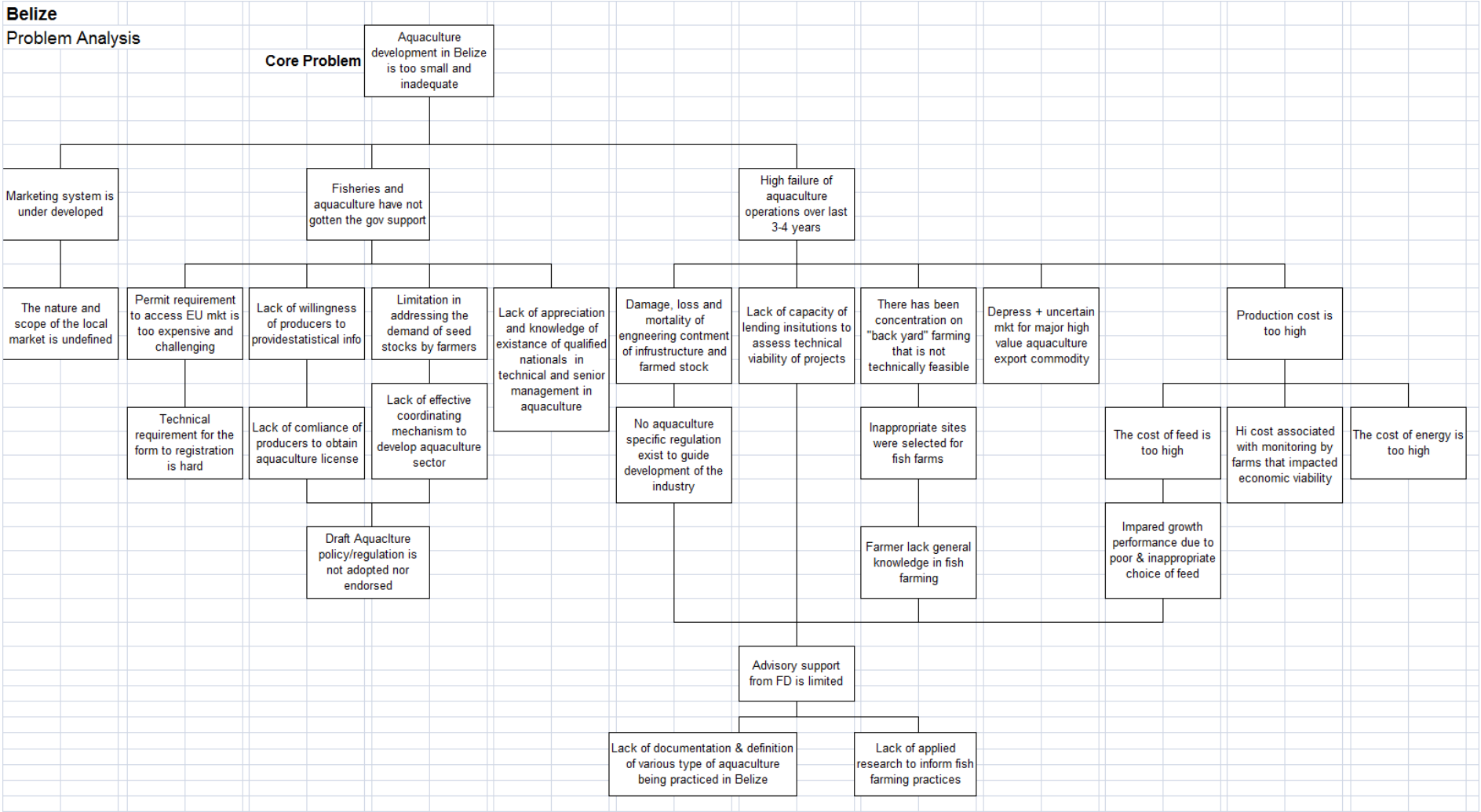
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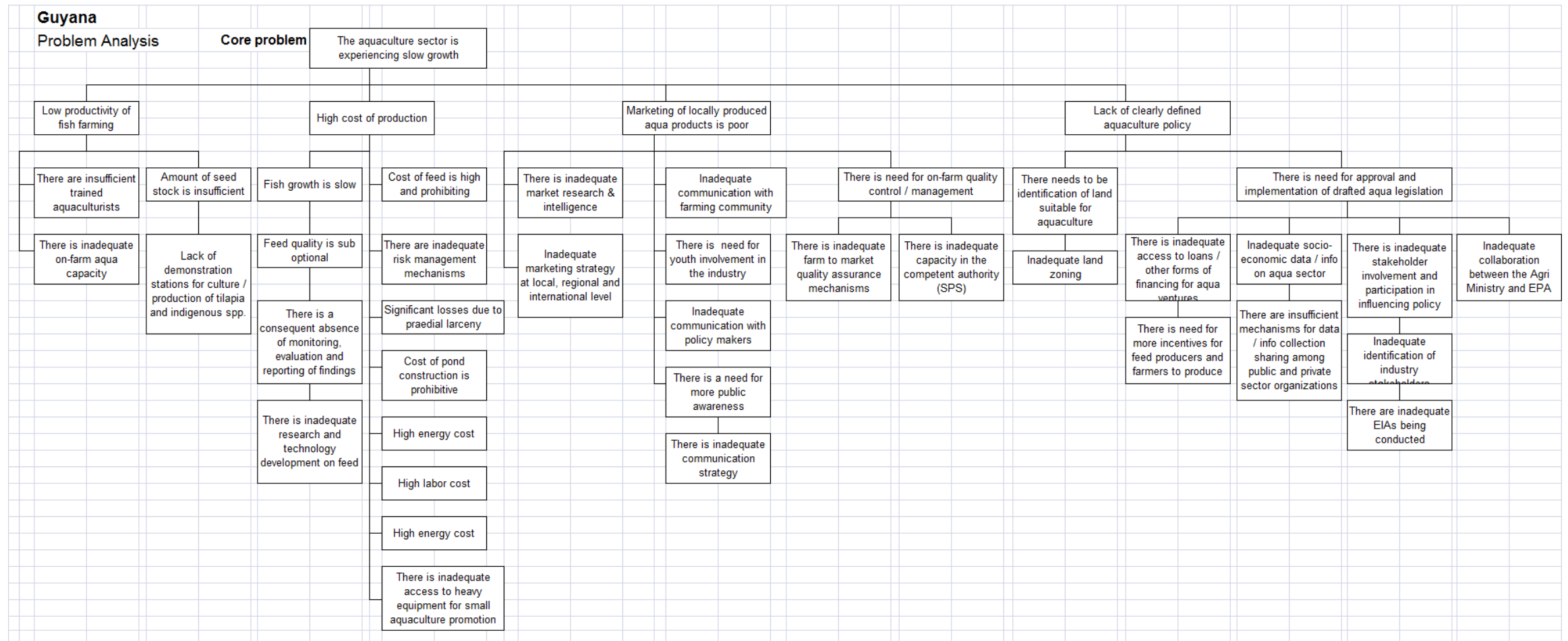
Project Design Matrix PDM

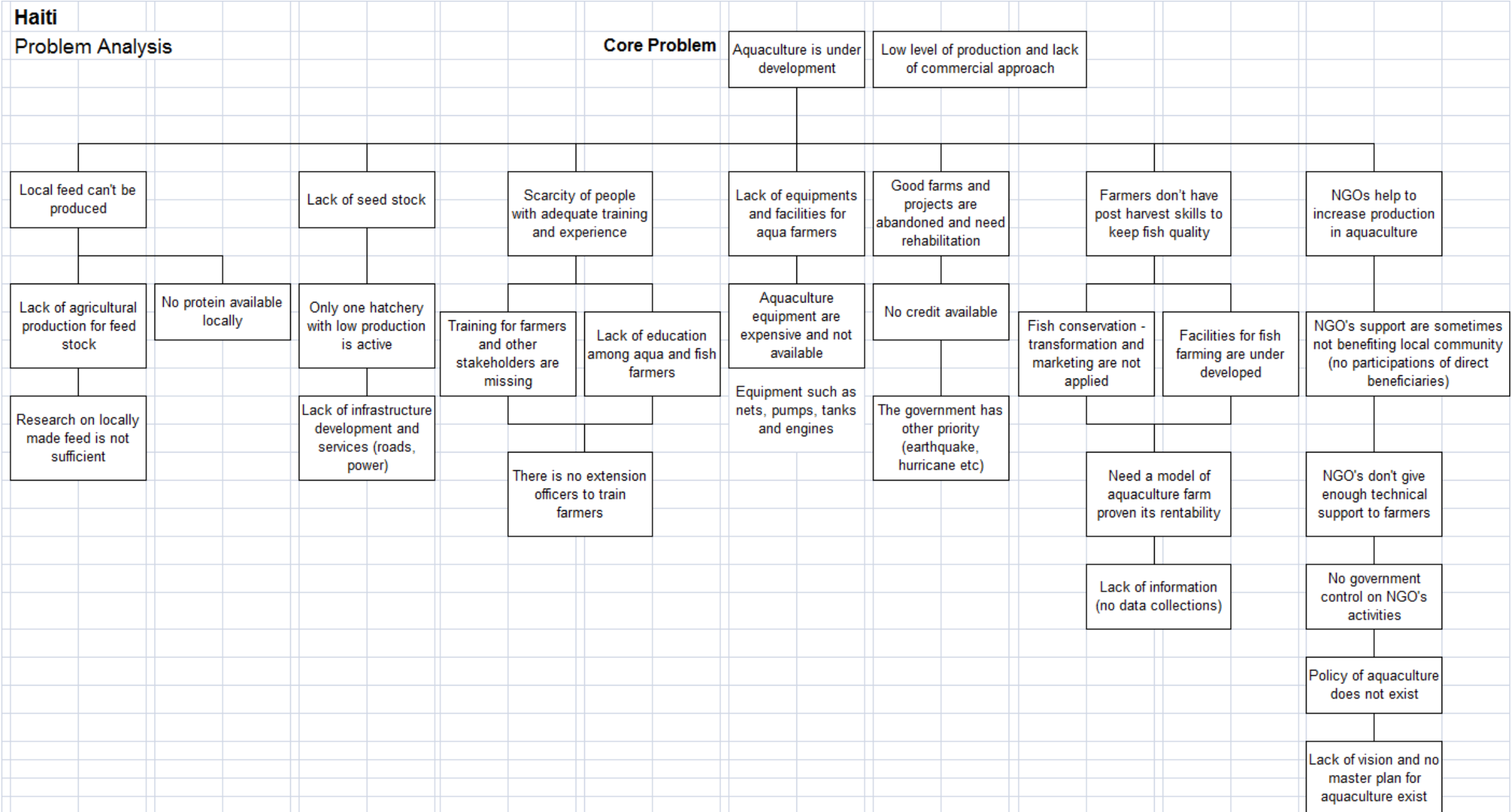
Project Title: _____ Target Group: _____ Version: _____
 Target Area: _____ Project Period: _____ Date: _____

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal :			
Project Purpose :			
Outputs :			
Activities :	Inputs - Experts (Indonesian / Japanese) - Facilities and equipment - Budget (Indonesian / Japanese) - Training in Japan - Other necessary inputs		Pre-Conditions

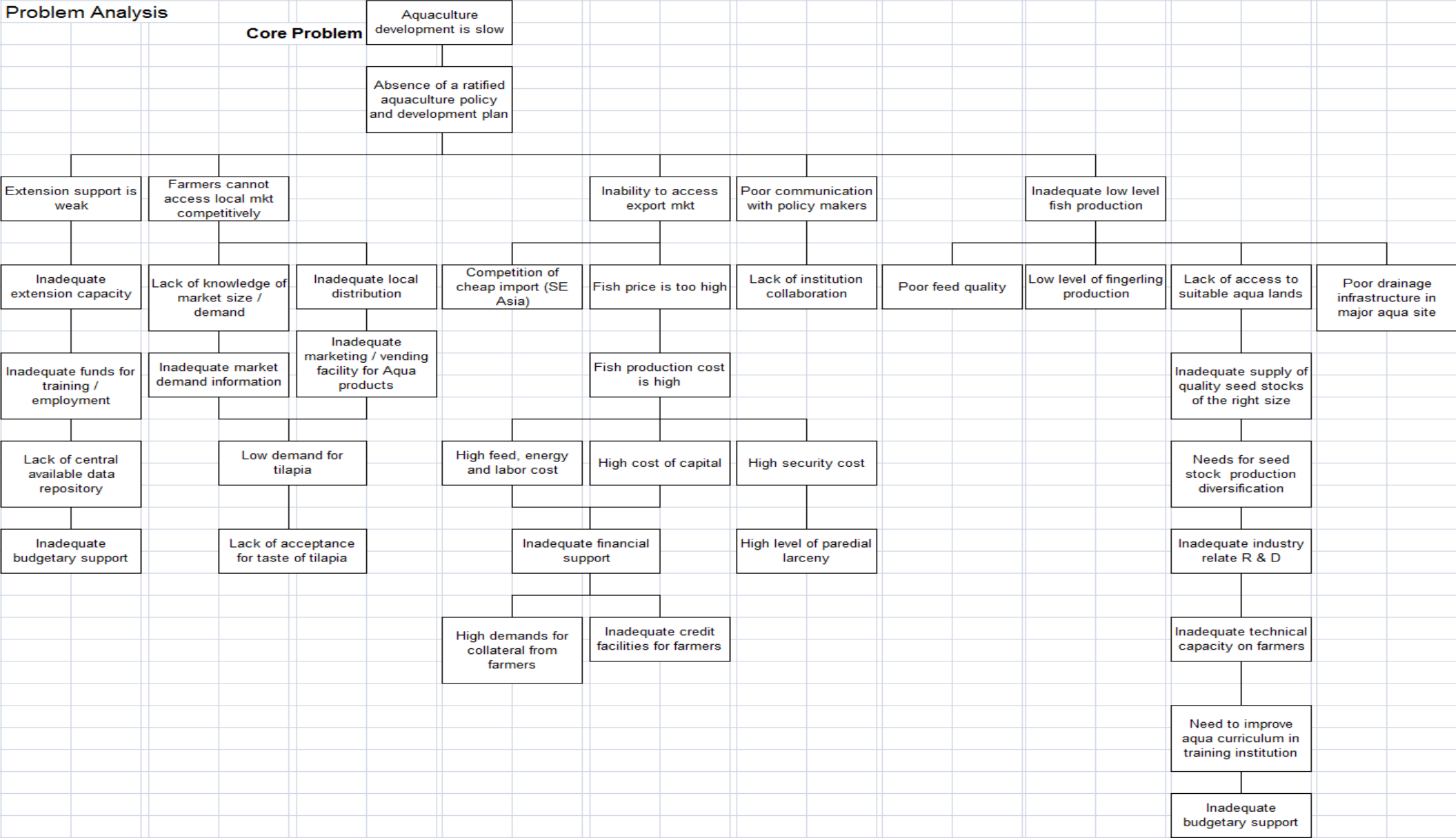
Appendix V: Problem Analysis

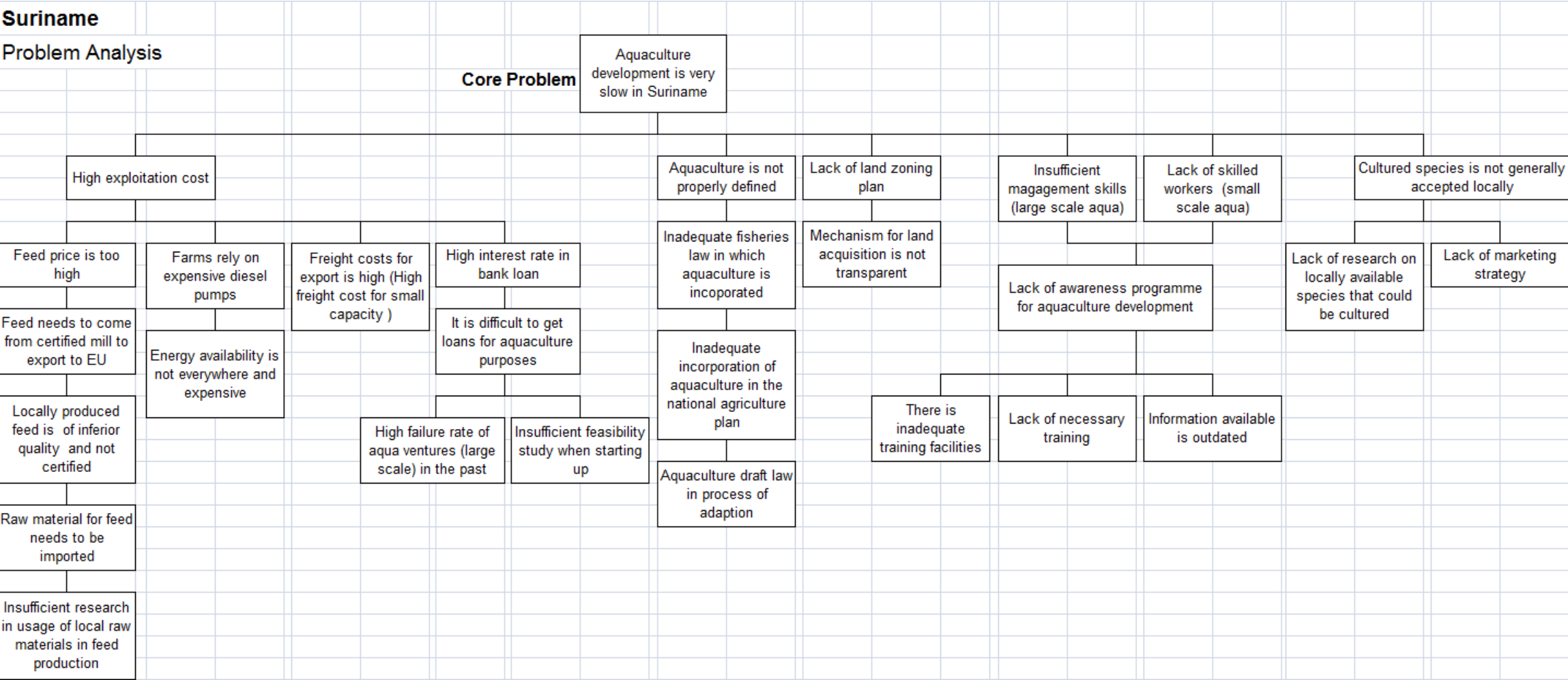






Jamaica
Problem Analysis





Trinidad and Tobago

Problem Analysis

Core Problem

Aquaculture is not well developed

Aquaculture production is low

Promotion of aquaculture is weak

Production costs are too high

Markets are not well developed (local)

Policy outdated and not approved

Dependable and reliable labor in short supply

Promotion of aqua on a commercial base is challenging

Improper documentation on projects when they have failed

Equipment, gears accessories are expensive and most are imported

Market promotion is weak (local)

Suitable land for large scale commercial aqua is not readily available

Water policy (availability & cost) is not defined

Legislation for aquaculture is not yet developed

Skilled and experienced technicians are short of supply

Farmers' approach to aqua is generally not an commercial bases

No local successful commercial case studies to reference

Pradial larceny is high

High quality feeds are expensive

Competition from marine fish and imported tilapia fillets is challenging

Real estate prices are high

Some impractical environmental requirements to satisfy - which form part of the financial criteria

Lack of facilities to implement demonstration projects

Investors who are considring projects sometimes choose to hire foreign consultants who over engineer systems and are not knowledgeable of local condition

Historically, aqua was promoted as a subsistence activity

Lack of cohesion among stakeholders

Limited incentives for aquaculture

Onerous criteria to access financial support

Potential farmers are not experienced

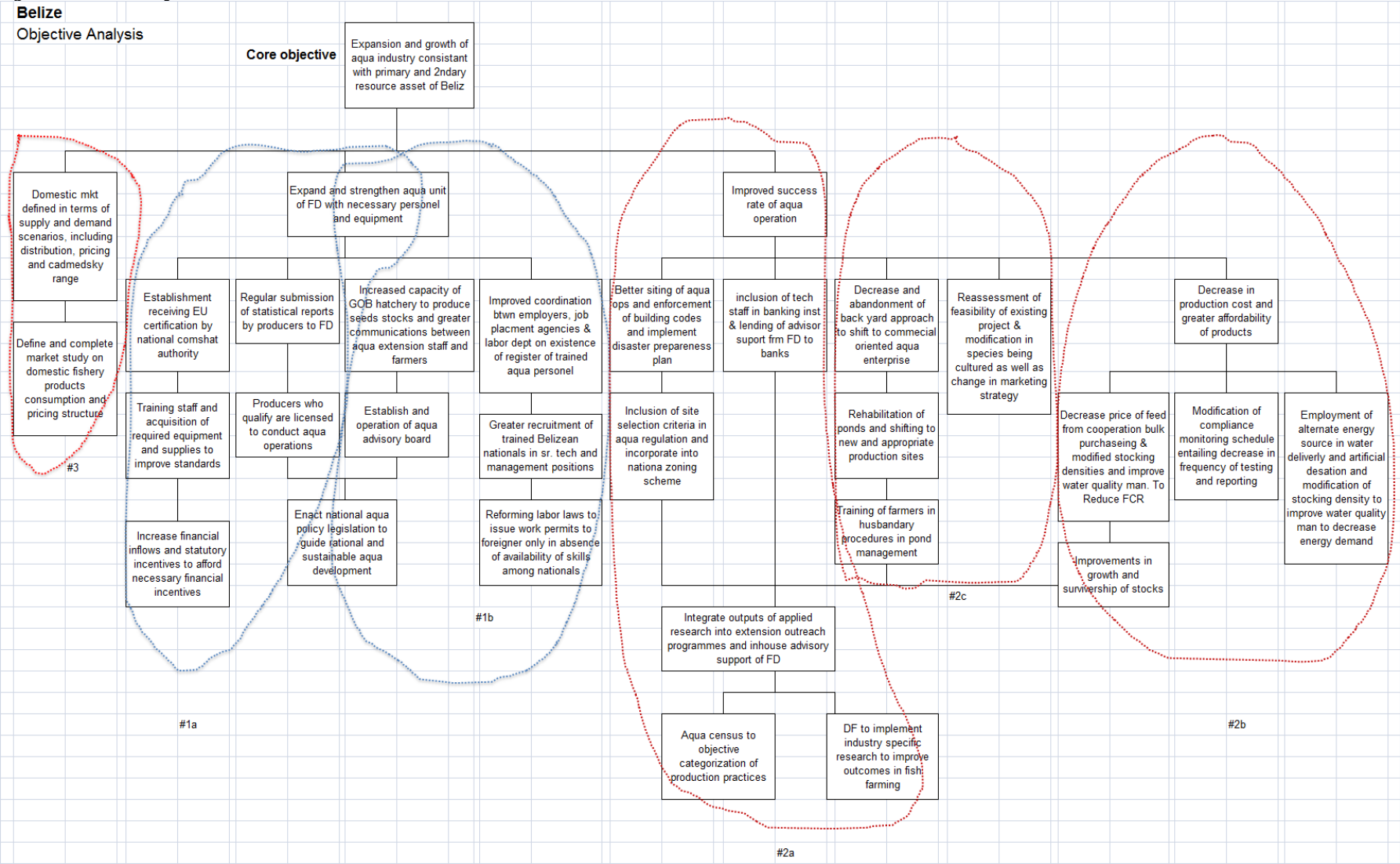
Ornamental fish farmers are diverse group which is different to organize

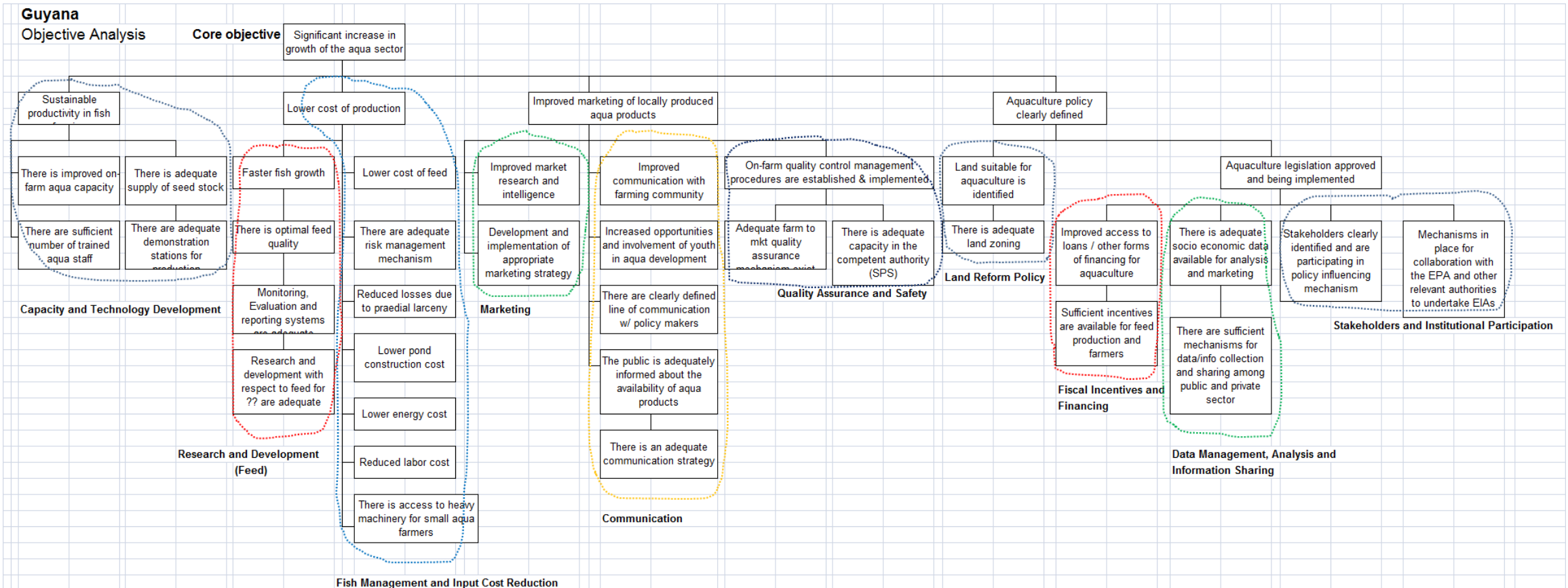
Persons believe that gov't is not serious about aquaculture and were not be supportive of such processors

Some persons see aqua projects on documentaries and on the internet, then base their decisions on what they have heard and seen

Some practicing aqua are not willing to accept advice and guidance from extension personnel

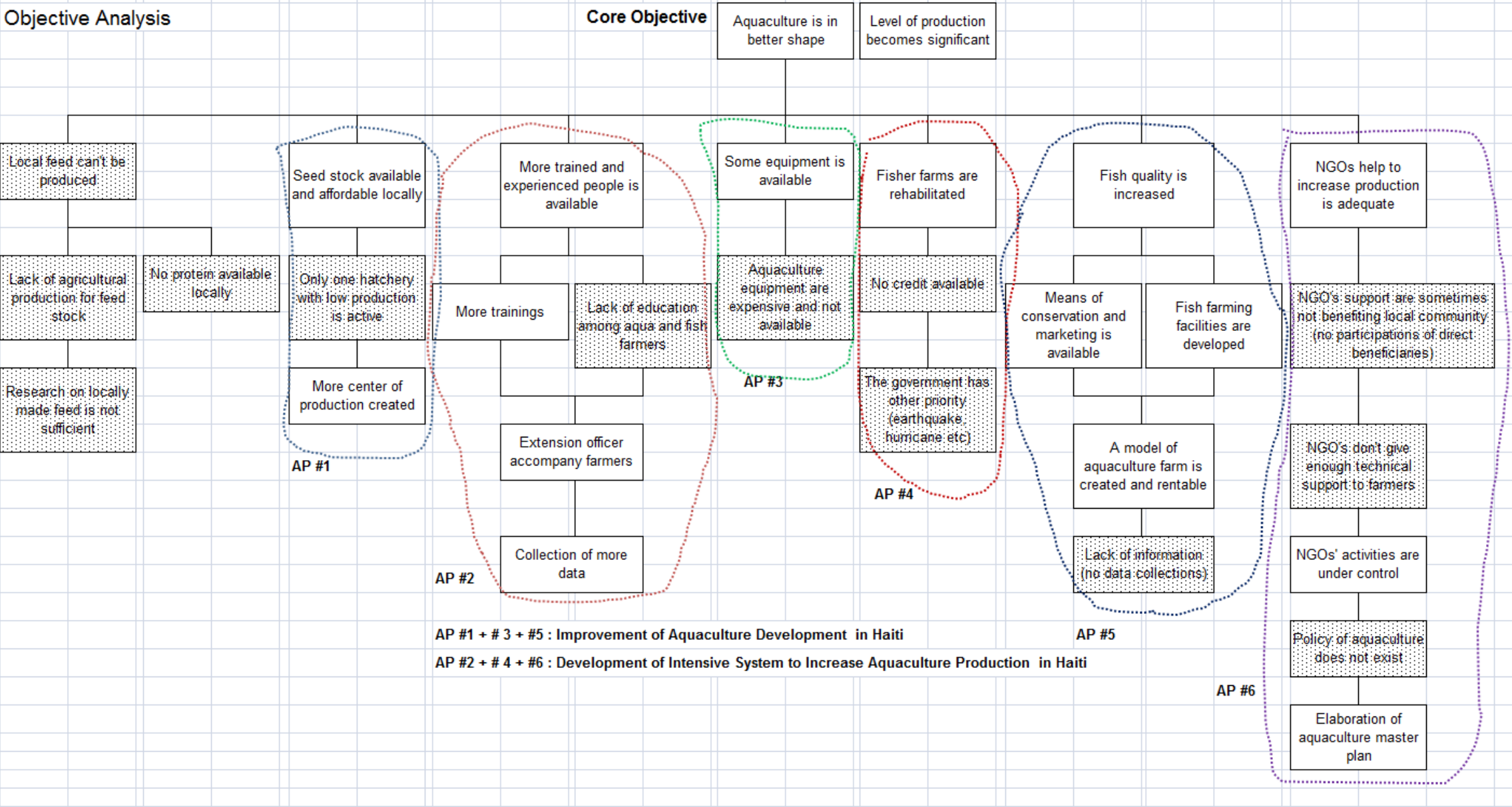
Appendix VI: Objective Analysis





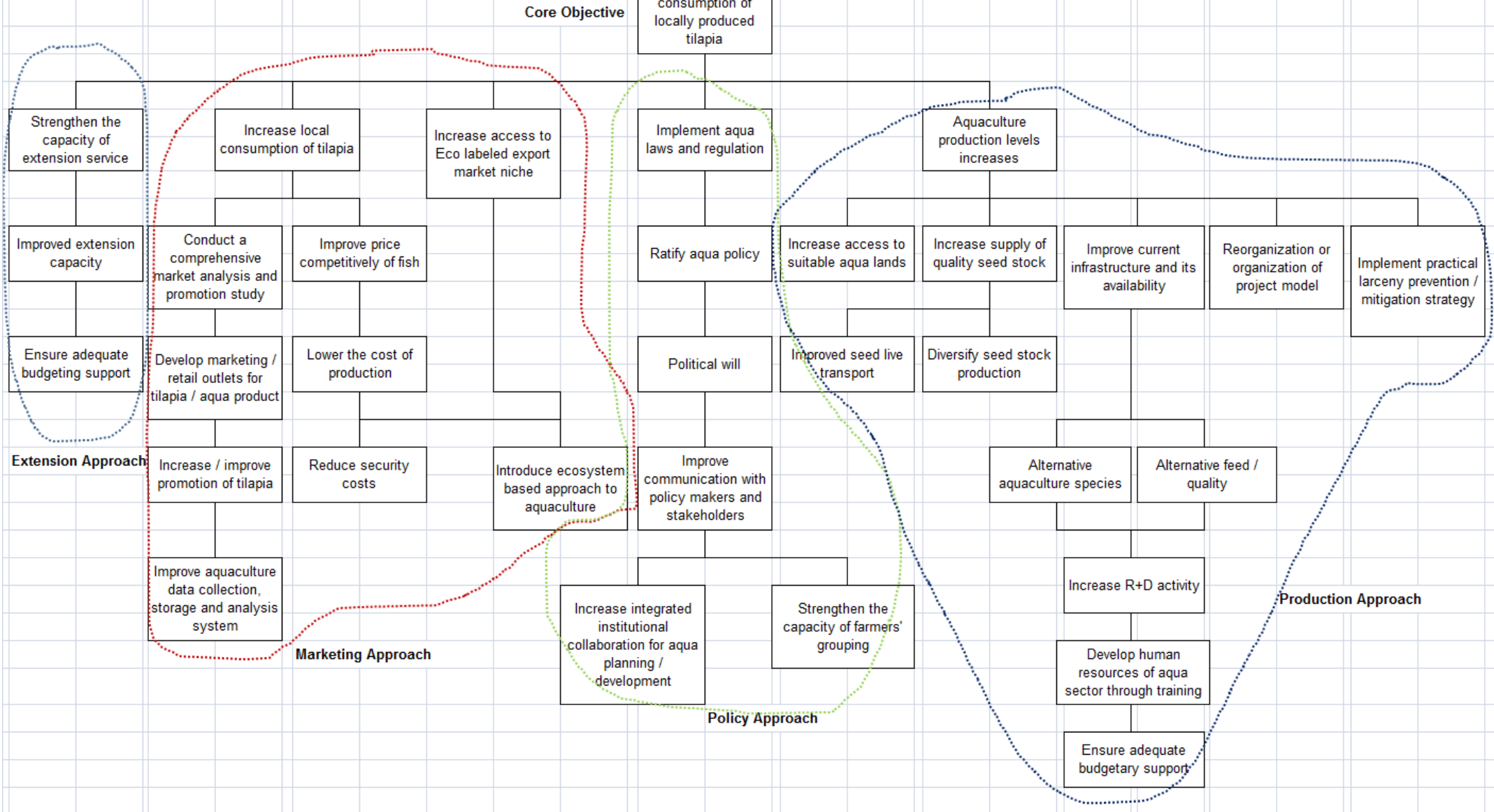
Haiti

Objective Analysis



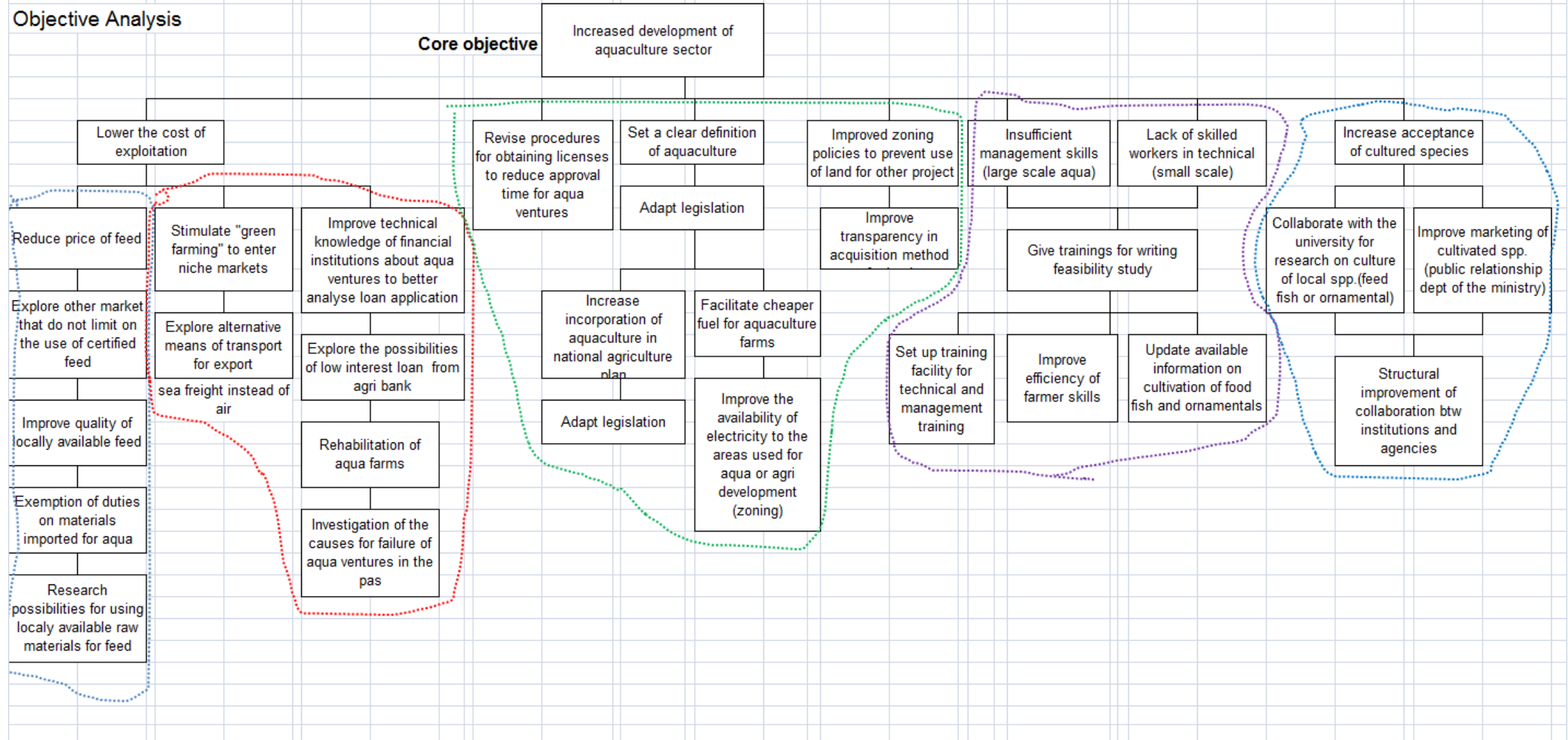
Jamaica

Objective Analysis



Suriname

Objective Analysis



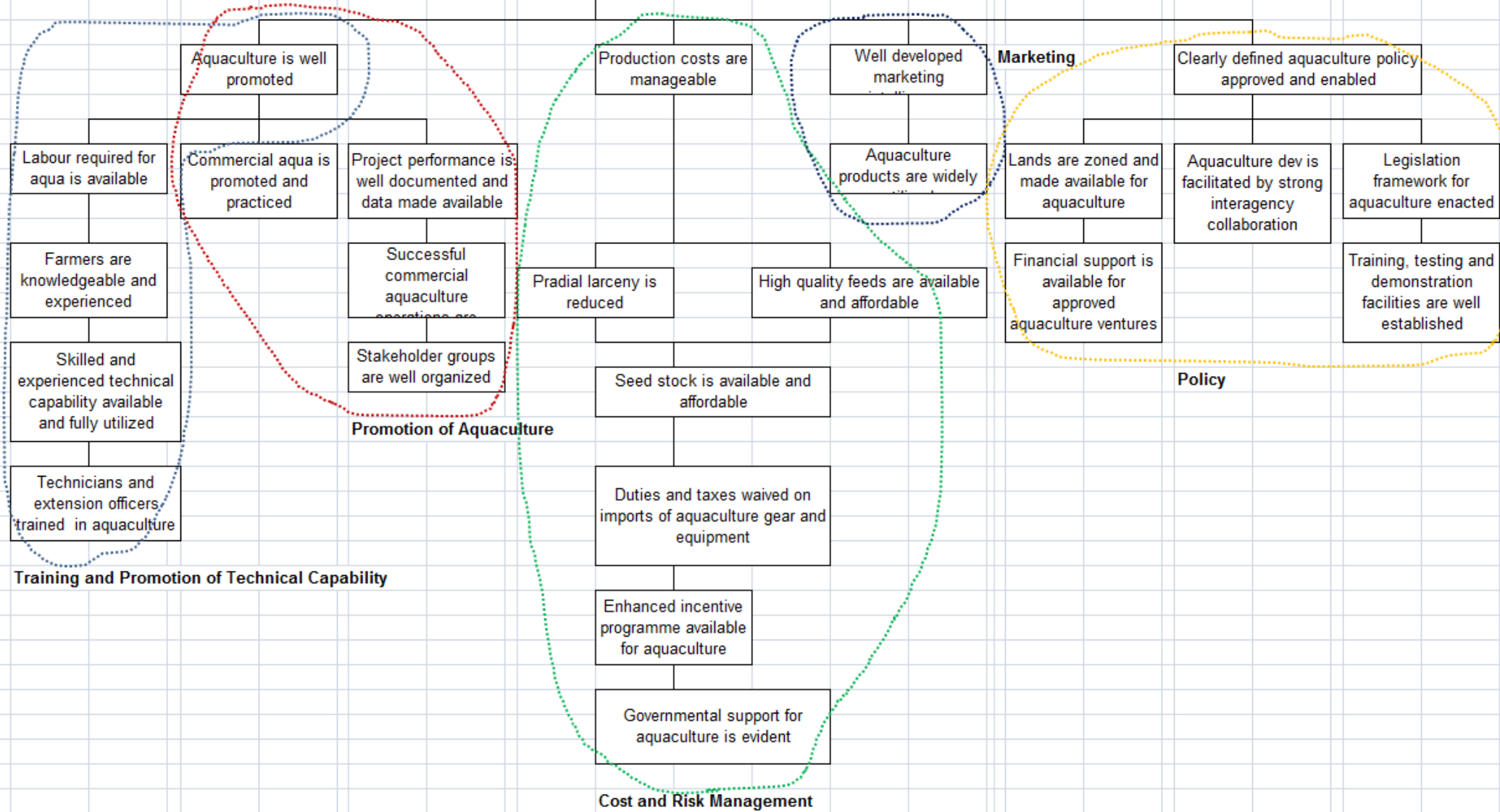
Trinidad & Tobago

Objective Analysis

Core objective

Sustainable aquaculture is developed

Aquaculture production is meeting with local demand with excess production for export



Appendix VII: Project Design Matrix

Country: Belize													
Project Title: National Aquaculture Revitalization						Target Group: Aquaculture Producers and Lending Institutions							
Project Period: 18 months						Target Area: Marine, Coastal & Inland Aquaculture Areas							
Narrative Summary												Indicators	
Overall Goal													
To expand the aquaculture industry on a sustainable basis.												1	Increase contribution of aquaculture to GDP.
												2	
Project Purpose													
Increase prospects for success of commercial aquaculture operations.												1	Decrease the foreclosure and default rate on loans by producers.
												2	
Outputs													
1	Improved siting of aquaculture operations.										1-1	Decrease in storm damage to fish stocks and impoundment infracture.	
											1-2	Decrease in insurance claims associated with storm damage by aquaculture operations.	
2	Improved screening of loan applications by banking institutions.										2-1	Improvement in Performance of loans associated with aquaculture.	
											2-2	Banking staff certified in basic technical and economic aspects of aquaculture.	
3	Decreased production costs.										3-1	Increase in profitability of aquaculture operations.	
											3-2	Increase in disposable income available to farmers.	
4											4-1		
											4-2		
Activities												Inputs	
1-1	Enact legislation with site selection criteria & include relevant clauses in Licenses granted to farmers.	2-1	Tech evaluation of Aquaculture loan application by Fisheries Department on behalf of banks.	3-1	Organization of Small Farmers into coops. To facilitate bulk purchasing of aquaculture feed & share costs on other services.	4-1		Personnel: Act #1 Senoir Aquaculture Mang. & Staff & Fisheries Research Licencing Officer, Fisheries Department					
1-2	Definition and implementation of national zoning scheme for Aquaculture	2-2	Workshops to train field officers of banking institutions on technical aspect of aquaculture.	3-2	Integration of Windmills as energy source to pump warer into reservoir & pond production system.	4-2		Act # 2 Senoir Aquaculture Mang. & Staff Act # 3 Aquaculture Staff Fisheries Department					
1-3	Research of nutritnt loading at cage culture sites & shrimp farming affluent stream.	2-3	Development of cost models on various species & producgion systems at varying scaels of operations.	3-3	Experimentation on 4 alternative diets bases on locally available materials to substitute or supplement expensive commercial diet.	4-3		Equipment and Materials: Act # 1 Computer, Act # 2 Computer & Audiovisual, Act # 3 computer, audiovisual & field testing equip.					
1-4		2-4		3-4		4-4							
1-5		2-5		3-5		4-5		Facilities: Act #1 Office Space & Transportation, Act # 2 Office Space & Transportation,					
1-6		2-6		3-6		4-6		Act # 3 Office Space, Transportation, Field Station.					
1-7		2-7		3-7		4-7		Operational Cost: Act # 1 Fixed Operational Cost; Act # 2 Recurrent & Fixed Operational Cost,					
1-8		2-8		3-8		4-8		Act # 3 Capital Cost, Operational Recurrent Cost & Operational Fixed Cost					
1-9		2-9		3-9		4-9		Others:					
1-10		2-10		3-10		4-10							

Country: Guyana								
Project Title: The development of capacity in aquaculture sector and research on quality feed formulation					Target Group: Fish farmers and fishing community			
Project Period: 5 years (2012-2016)					Target Area: Coastal zone			
Narrative Summary					Indicators			
Overall Goal:								
Significant increase in growth of the aquaculture sector					1	Growth of the aquaculture sector increase by at least 10% by the end of the project period.		
					2			
Project Purpose								
Sustainable production in fish farming					1	Greater than 90% of farms are successful through the second production cycle and can be deemed self sufficient and can maintain production/output in response to industry demand over time.		
					2			
Outputs								
1	There is improved on-farm aquaculture capacity.				1-1	At least 100 farms with on-farm aquaculture capacity, including trained personnel and equipment.		
					1-2	At least 300 farms with personnel equipped with adequate aquaculture skills.		
2	There are sufficient numbers of trained aquaculturists				2-1	At least 50 professionals and technicians trained in aquaculture and other required skills.		
					2-2			
3	Faster fish growth				3-1	A 1 lb fish in 5-6 months.		
					3-2			
4	There is adequate seed stock supply				4-1	At least 3 hatcheries established with required capacity at strategic locations.		
					4-2			
Activities					Inputs			
1-1	Undertake a survey to determine on-farm capacity requirements	2-1	Undertake a survey to determine the number of trained personnel required within the aquaculture sector.	3-1	Determine factors inhibiting fish growth within the national farming system.	4-1	Determine seed stock requirements for the aquaculture sector.	Personnel: a. Aquaculture research expertise (USAID/GTIS, JICA, FAO/UNDP)
1-2	Design and deliver required training program.	2-2	Assess the area for which training is required.	3-2	Conduct necessary research to determine strategies necessary to overcome. Identify critical factors.	4-2	Identify the best/most suitable location for hatcheries, based on zoning and other relevant factors.	b. Survey Design Expertise (with aquaculture experience) (JICA, FAO/UNDP, USAID)
1-3	Design and deliver schemes for farmers to acquire and access required equipment.	2-3	Design and deliver required training program, with professionals accessing local, regional and international training opportunities.	3-3	Disseminate research findings to relevant decision making authorities and other stakeholders.	4-3	Design appropriate hatchery facilities equipped with adequate capacity, depending on zoning requirement.	c. Design/Delivery Expertise (for aquaculture training program) (USAID/GTIS, FAO/UNDP, JICA),
1-4	Monitor + evaluator that effectiveness of the delivery of information/technology transferred.	2-4	Provide career opportunities and incentives for locally trained personnel within the sector	3-4	Promote the utilisation of research findings in the national farming system.	4-4	Select/collect broodstock (purchased, donation, wild caught)	d. Communication Specialist (USAID, FAO/UNDP)
1-5		2-5	Monitor + evaluator/assesses the impact of trained personnel on industry development.	3-5	Monitor + evaluator/assesses the impact of output of research findings on fish farming system, fish growth and make any required adjustments.	4-5	Initiate breeding program and distribute fingerlings to farmers	e. HRD Expertise (with aquaculture experience) (USAID/GTIS, JICA, IDB)
1-6		2-6		3-6		4-6	Monitor + evaluator/assesses seed production progress and make appropriate adjustment as needed.	f. Project Management Expertise (with experience in monitoring and evaluation) (JICA, IDB)
1-7		2-7		3-7		4-7		g. Design / Delivery Expertise (Procurement specialist with experience in aquaculture farming systems) (JICA/USAID, IDB)
1-8		2-8		3-8		4-8		h. Aquaculture (Hatchery Development) Expertise (JICA, FAO/UNDP, USAID)
1-9		2-9		3-9		4-9		Equipment & Materials: - Workshop equipment and materials, - Hatchery equipment,
1-10		2-10		3-10		4-10		- Vehicles - Materials for seed production - Field survey equipment

Country: HAITI													
Project Title: Improving Aquaculture Development in Haiti						Target Group: Extensive system small-scal farmers low feeding + green							
Project Period: 12 months period renewable						Target Area: Departement West - South - Soutesst of Haiti							
Narrative Summary												Indicators	
Overall Goal													
Increase significantly the fish farmer productivity												1	
												2	
Project Purpose													
Increased production at a significant level												1	
												2	
Outputs													
1	Feed stock is available at affordable price										1-1	Farmers can buy feed and fish are feed at 3% of their body weight	
											1-2	More farmers engaged in fish farming	
2	Fish quality is increased										2-1	Growth increase significantly	
											2-2	Better quality of fish. Demande increase and cosumption	
3	Aquaculture Equipements are available										3-1	Construction of more facilities - more jobs create.	
											3-2	Good Aquaculture project are carried out	
4											4-1		
											4-2		
Activities												Inputs	
1-1	Rehabilited hatcheries facilities and other abandoned fish farms	2-1	Conducting studies on transformation conservation and commercialization	3-1	Establismet of farms productions in cages and ponds	4-1		Personnel: - One (1) Project Director - Two (2) Managers - Nine (9) Extensionistes					
1-2	Increased production in existing hatchery and creation of new centers of production	2-2	Hold meeting (training) for productors and sailors to learn new knowledge on conservation and transformation	3-2	Rehabilitation of farms with established potentials	4-2		- One (1) Secretary - One (1) Accountant					
1-3	Research of nutrient agricultural product existing in the country in order to make local feed	2-3	Evaluation of ressources and aquaculture potentiel	3-3	Training and technical assistance for aquacultors	4-3		Equipments and Materials: - Two (2) vehicules 4x4 - Nine (9) motobikes - Aquaculture materials					
1-4	Production of fish feed for stocking lake and distributions to private sectors	2-4	Distribution material of transformation and conservation	3-4	Survey the socio economic condition in different areas.	4-4		- Aquaculture equipments - Computers, Printers, Scanners - Administratives supplies- - Miscellaneous					
1-5	Stocking of water bodies (23,000 ha of lakes + 81 artificial barrages)	2-5	Conduct feasibility study for mariculture	3-5		4-5		Facilities: - 4 hectares of earthen ponds - 1,5 hectares of concrete ponds - Four circular tank in aluminium					
1-6	Develop broodstock management program	2-6	Conduct survey on marine species for mariculture	3-6		4-6		- Water, Electricity - Feeding machin to make pellets - 2 boats 21 feet and 2 /15 hp engines - Lab materials					
1-7	Distribution of seed to all stake holders	2-7	Collect data for better management and elaboration of a Master plan	3-7		4-7		- Storage room - Conservation facilities... etc.					
1-8	Advise hatchery management and laboratory management	2-8	Monitoring and evaluating activities	3-8		4-8		Operational Cost: US\$ 100,000.00					
1-9	Monitor seed production process	2-9		3-9		4-9							
1-10		2-10		3-10		4-10							

Country: Jamaica											
Project Title: Revitatzation of the Aquaculture Industry						Target Group: New and Existing Aquaculture Farmers					
Project Period: 5 years						Target Area: Central Jamaica					
Narrative Summary						Indicators					
Overall Goal											
Increase aquaculture production						1	Increased sales of live fish/fresh whole fish				
						2	Increased feed sales and fingerling supply				
Project Purpose											
Increase local consumption of locally produced tilapia						1	Consumption of tilapia increased by 25%				
						2					
Outputs											
1	Increase supply of quality seed stock					1-1	seed production increase by 50% in three (3) years				
						1-2					
2	Increased access to market					2-1	Three (3) new points of sales opened realizing 25% of overall sales				
						2-2					
3	Increase income generated by fish farmers					3-1	Net income per production unit increase by 25%				
						3-2					
4	Strengthen the capacity of extension services					4-1	25% of new and existing farmers adopt new production technologies and models				
						4-2					
Activities						Inputs					
1-1	Rehabilitate hatchery infrastructure	2-1	Conduct comprehensive market analysis and promotion study	3-1	Increase research and development activities	4-1	Assess the capacity of extension services to effectively transfer and monitor production technology	Personnel: - Seed production expert (short term), - Extension expert (long term), - Database development expert (short term).			
1-2	Rehabilitate production ponds	2-2	Identify areas for targeting marketing activities	3-2	Design comparative studies (fingerling vs. advanced fry, Feed comparison studies at all growth stages and comparative cost analysis; compare existing production methods vs ecosystem based approach to aquaculture)	4-2	Identify critical gaps	Equipment and Materials: - Vehicle for seed delivery - Live haul box and accessories - Pharmaceuticals - Aeration devices - Netting - Standby generator			
1-3	Acquire new broodstock	2-3	Develop promotional campaign for select public sector and private sector areas	3-3	Extension service implement programme to advise farmers on production models and efficiency	4-3	Develop a targeted extension programme which would provide advise to farmers on marketing trends, seedstock production and grow-out methodologies	- Feed - Laptop - Data analysis software - Projector - Projector screens			
1-4	Develop broodstock management programme	2-4	Implement campaign	3-4		4-4	Develop training programme in production management for farmers	Facilities: - Office space			
1-5	Hire and train staff in hatchery production technologies	2-5	Create retail outlets for tilapia/aquaculture products	3-5		4-5	Conduct training for farmers in and extension officers	Operational Cost: - Fuel for vehicle - Salary and allowance for local staff - Security			
1-6	Procure appropriate delivery apparatus and vehicles	2-6	Monitoring of retail outlets	3-6		4-6	Procure basic field production monitoring equipment	Contracts: - earth moving equipment, - rehabilitation of hatchery, - market survey, - promotional campaign,			
1-7	Develop private/public sector partnership for ongrowing of advanced fry ato 40g fingerlings	2-7		3-7		4-7	Design and implement a market and field production data collection and management system	- development of retail outlet; - procure equipment and supplies for retail outlets			
1-8	Identify farmer group for ongrowing	2-8		3-8		4-8		Others: - Broodstock - Feed			
1-9	Assess farmer group capacity	2-9		3-9		4-9					
1-10	Train farmer group in fry and fingerling management	2-10		3-10		4-10					
1-11	Replicate fingerling production model to farmer grouping/geographic area										

Country: Suriname									
Project Title: Establishment of a research and training center for aquaculture						Target Group: Aquaculture Farmers			
Project Period: 5 Years						Target Area: Coastal Area (Coronie and Commewijne district)			
Narrative Summary								Indicators	
Overall Goal								1	Gradual increase of aquaculture activities in Suriname
The development of Aquaculture in Suriname								2	
Project Purpose								1	Have at least 10 aquaculture farms in production after 5 years
Improve management and technical skills of aquaculture farmers								2	
Outputs									
1	Update information on the cultivation techniques of different species of food- and ornamental fish						1-1	Manual for the cultivation of different species of food- and ornamental fish in Suriname	
							1-2		
2	Increase awareness of aquaculture development						2-1	Three (3) training courses in aquaculture per year	
							2-2	Five (5) trainers, 15-20 Extension officers, minimal of fifty (50) skilled farmers	
3	Improve the efficiency of aquaculture farms						3-1	Increased productivity of aquaculture farms with at least ten Percent (10%) per year	
							3-2		
4							4-1		
							4-2		
Activities								Inputs	
1-1	Survey on native species in collaboration with the University of Suriname (ADEKUS)	2-1	With the help of aquaculture manual increase the awareness of (potential) farmers about aquaculture and it's possibilities	3-1	Evaluation of productivity of aquaculture farms by the ministry and extension officers	4-1	Personnel: Fisheries department extension officers and trainers		
1-2	Inventory of available information on cultivation of native species	2-2	Develop training programs for the cultivation of fish	3-2	Identify shortcomings in cultivation techniques and farming practices	4-2			
1-3	Literature and field studies on suitable species for aquaculture (food- and ornamental fish of economic interest)	2-3	Train extension officers and trainers in cultivation techniques and training	3-3	Implementation of solution models for these shortcomings with the help of extension officers and stakeholders	4-3	Equipment and Materials: Training manual and training programs. Materials to be used in training (pc, projector, copy machine, paper and office supplies)		
1-4	Selection of suitable species to cultivate based on literature and field studies on biology, habitat, feed, etc.	2-4	Start training courses for aquaculture farmers	3-4	Evaluation of the results of implemented solution models	4-4			
1-5	Pilot project for cultivation of previously selected species	2-5	At least three (3) training courses per year in the cultivation of food- and ornamental fish	3-5	Implementation of succesfull solution models and/or revision of models that did not give satisfactory results	4-5	Facilities: Aquaculture center building with training facilities and offices		
1-6	Evaluation of the results of pilot project(s)	2-6	The availability of trainers, extension officers and skilled farmers	3-6	Yearly evaluation of farms by the ministry with the help of extension officers	4-6			
1-7	Develop cultivation programs for selected species based on satisfactory results of pilot project(s)	2-7		3-7	Increased productivity and efficiency of aquaculture farms	4-7	Operational Cost: To be determined		
1-8	Compilation of a aquaculture manual for Suriname with the cultivation techniques that have been satisfactory	2-8		3-8		4-8			
1-9		2-9		3-9		4-9	Others: University professionals and students working in collaboration with Ministry		
1-10		2-10		3-10		4-10			

Country: TRINIDAD AND TOBAGO									
SUSTAINABLE AQUACULTURE DEVELOPMENT IN TRINIDAD AND TOBAGO					Target Group: PRACTISING AND PROSPECTIVE FISH FARMERS, EX				
Project Period: January to December 2012					Target Area: Trinidad and Tobago islandwide				
Narrative Summary					Indicators				
Overall Goal									
To create national capability in aquaculture expertise through trained and sentised stakehokders for aquaculture develoment					1				
					2				
Project Purpose									
To provide training to farmers, extension personnel and labourers.					1				
					2				
Outputs									
1	Farmers Trained				1-1 25 farmers trained				
					1-2				
2	Extension Staff Trained				2-1 5 extension officers trained				
					2-2				
3	Labour Force Sensitised and Prepared for Aquaculture Work on Aquaculture Enterprises				3-1 60 Labourers trained				
					3-2				
4					4-1				
					4-2				
Activities					Inputs				
1-1	Prepare awareness materials to promote training and availability of technical support	2-1	Develop job description and selection criteria for extension staff	3-1	Prepare awareness materials to promote opportunities in the aquaculture sector and availability of training	4-1	Personnel:		
1-2	Promote the availability of training for established and potential farmers	2-2	Conduct selection process and inform candidates	3-2	Invite farmers to nominate persons who they wish to employ or who are in their employ for training	4-2			
1-3	Conduct selection process if necessary to keep groups to a manageable size (may need to repeat cycles of training)	2-3	Identify trainers or institutions to conduct training	3-3	Develop training materials for the programme and a budget for the training	4-3	Equipment and Materials:		
1-4	Develop training materials for the programme and budget for achieving the output	2-4	Consult trainers to develop training curriculum and budget for programme	3-4	Conduct training and evaluation of training programme	4-4			
1-5	Conduct selection process if necessary to keep groups to a manageable size (may need to repeat cycles of training)	2-5	Conduct training for existing and incomming staff	3-5	Institute monitoring and feedback process with farmers to determine effectiveness of training programme	4-5	Facilities:		
1-6	Conduct training and evaluation of training	2-6	Prepare awareness materials to promote the availability of technical support services and further training for farmers and labourers.	3-6	Make adjustments to training programme where necessary	4-6			
1-7	Conduct monitoring and feedback to determine effectiveness of exercise and need for adjustments	2-7		3-7		4-7	Operational Cost:		
1-8	Make adjustments to training materials and programme where necessary	2-8		3-8		4-8			
1-9		2-9		3-9		4-9	Others:		
1-10		2-10		3-10		4-10			

Appendix VIII: Formation of a Regional Network of Aquaculture Organisations



Formation of a Regional Network of Aquaculture Organisations

by

Terrence Phillips

CRFM Secretariat

CARICOM/CRFM/JICA First Regional Aquaculture Development Planning Workshop

Jamaica , March 14 – 22, 2011



Outline

- **Definition of a network**
- **Examples of networks**
- **NACA model**
- **Proposed CARICOM/CRFM network of aquaculture organisations**



Definition of a network

Network - set of actors/entities (nodes) linked by specified relationships/interactions (ties).

Networking is the strategic effort to build and cultivate relationships that provide you with a system to advance issues and meet specific needs:

- Cultivate growth
- Communicate vision to partners
- Open and supportive.



Examples of networks

What are general examples of networks?

Networks are everywhere. We talk about them all of the time ...
network of friends, road network, telephone network, etc.

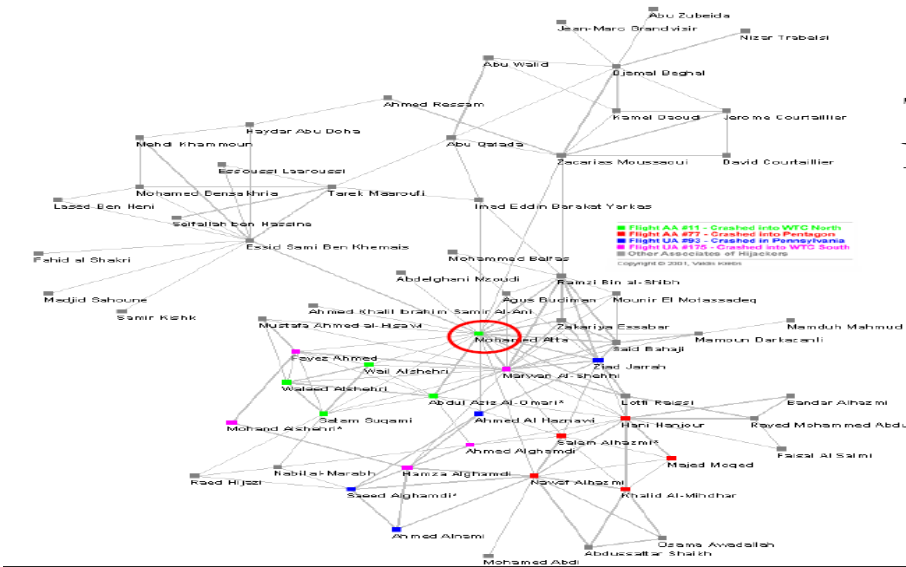
What they have in common are people and places joined together by relationships.

What are some other networks?

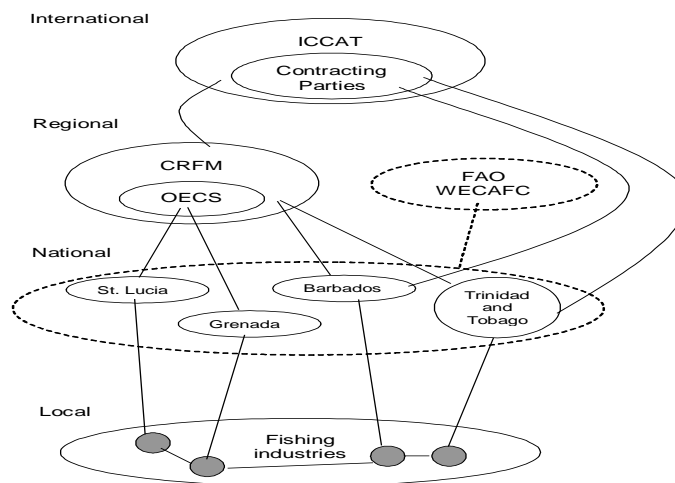
Examples of networks cont'd : LIAT – regional network of routes, hubs



Examples of networks cont'd : Al Qaeda – international network of terrorist cells



Examples of networks cont'd: ICCAT - international to local tuna management showing various levels of organizations



Network of Aquaculture Centres in Asia and the Pacific (NACA) model (Source: NACA website)

NACA agreement: formation, objectives and governance of NACA are set out in the Agreement

Vision

NACA is an IGO that promotes rural development through sustainable aquaculture.

Seeks to improve rural income, increase food production and foreign exchange earnings and to diversify farm production. Ultimate beneficiaries: farmers and rural communities.

Core activities of NACA are:

- Capacity building through education and training
- Collaborative research and development through networking among centers and people
- Development of information and communication networks
- Policy guidelines and support to policies and institutional capacities
- Aquatic animal health and disease management
- Genetics and biodiversity.

Network of Aquaculture Centres in Asia and the Pacific (NACA) cont'd

Structure

NACA policy is determined by the Governing Council composed of senior officials representing the member governments. GC meets once a year. Also, formulates NACA's 5-Year Regional Work Programme.

Agreement: Allows other international and government assistance agencies to be non-voting members by invitation. FAO is a non-voting member.

Members

Australia, Bangladesh, Cambodia, China, Hong Kong SAR, India, Indonesia, I.R. Iran, Korea (DPR), Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam.

Collaborating agencies

Partnerships with governments, donor foundations, development agencies, universities and a range of non-governmental organisations and farmers. For example UNDP, Asian Dev. Bank, World Bank, NORAD.

Proposed CARICOM/CRFM network of aquaculture organisations

Likely objectives (reference NACA agreement)

To assist in the regional and national efforts to expand aquaculture development mainly for the purpose of:

- increasing production
- improving rural income and employment
- diversifying farm production
- increasing foreign exchange earnings and savings.

To facilitate the achievement of these objectives:

- establish a network of aquaculture and related organisations to share the responsibility of research, training and information exchange essential to aquaculture development in the region
- strengthen institutional and personal links among national and regional organisations through the exchange of technical personnel, technical know-how and information
- promote regional self-reliance in aquaculture development through TCDC
- promote the role of women in aquaculture development.

Composition and functions of the network

Likely composition: DOFs, regional and national universities, other aquaculture related training and research institutions, national and regional aquaculture stakeholder organizations and the CRFM.

Likely functions

To achieve these objectives, the network could undertake the following:

- conduct disciplinary and interdisciplinary research on selected aqua-farming systems for adaptation or improvement of technologies, and for the development of new technologies
- train and upgrade core personnel needed for national aquaculture planning, research, training, extension and development
- establish a regional information system to provide appropriate information for development planning, research and training

Composition and functions of the network cont'd

Likely functions cont'd

- assist members in strengthening their national organisations linked to the regional organisations
- assist the national organisations in testing and adapting existing technology to local requirements and in the training of technicians, extension workers and farmers at the national level
- transfer to the national organisations appropriate aquaculture technologies and techniques developed at regional organisations
- facilitate the exchange of national experts, technical know-how and information within the framework of TCDC
- develop programmes for the promotion of women's participation in aquaculture development at all levels
- assist members in feasibility studies and project formulation.

Appendix IX: Concept Note for Master Plan for Regional Aquaculture Development

Draft Idea for Master Plan for the Regional Aquaculture Development

Kazuo UDAGAWA
JICA Study Team/IC Net Ltd.

Vision, Goal of Master Plan and Strategy

- Vision:
The sustainable use of fisheries resource by coastal community is promoted.
- Goal:
Coastal community and fisheries department take measures for the sustainable use of fisheries resources.

Strategy

- Diversification of Fishery
Artisanal fishermen can realize rational utilization of multi fisheries resource , in accordance with the resource condition and from the perspective of the sustainability.
- Creation of Alternative Income
Excessive fishing effort on the overfished fisheries resource in reef and island shelf resource is reduced.
- Encouragement of Local Community Participation toward Co-management.

Basic Understandings in Small Scale Aquaculture Development

- The market of the small scale aquaculture products is **domestic/local export market**. Aquaculture shall be considered as an income generating activity and beyond subsistence-back yard aquaculture.
- Tilapia is the main culture species. However, other species that have strong demand will be also considered.

Common Issues on Small Scale Aquaculture Development

1. Aquaculture Development Policy does not exist/ inadequate or not adopted.
2. Input cost of production is too high to compete in domestic as well as international market.
3. Aquaculture promotion and extension service is weak.
4. Quality and quantity of seed stock production is inadequate.

1. Aquaculture Development Policy does not exist/ inadequate or not adopted.
 - Political will is lacking
 - Inadequate communication among stakeholders
 - Inadequate communication with policy makers
 - Weak or unproven rationale to develop aquaculture (economic advantage compare to other agriculture products or other economic activities such as housing)
 - Many failures in the past.
 - Need to redefine the role of aquaculture development

Some Example of Aquaculture Development Policy

- Creation and or diversification of the job opportunity
- Food security and safety (nation as well as region)
- Fisheries resource management
- Land use and zoning for aquaculture development
- Financial support/credit for aquaculture development
- Import tax, excise tax exemption for equipment necessary for aquaculture

2. Input cost of production is too high to compete in domestic as well as international market.

- Feed cost is too high. Need to develop feed with locally available ingredients.
- Security cost to prevent theft is too high.
- Energy (electricity) cost is too high.
- Preparation for the hurricane damage

In some countries

- Labor cost is too high
- Land cost is too high

3. Aquaculture promotion and extension service is weak.

- Inadequate number of extension staff
- Insufficient training and follow up for extension staff
- Insufficient training and follow up for fish farmers
- Insufficient promotion to consume cultured fish
- Insufficient facility and equipment for demonstration pond

4. Quality and quantity of seed stock production is inadequate.

- Seed production capacity at the government hatchery is insufficient.
- Brood stock is inadequate.
- Intermediate size seed stock culture business has not been developed in the Private sector or community level.
- Seed stock production of alternative species is not sufficient.

4. Quality and quantity of seed stock production is inadequate.

- Seed production capacity at the government hatchery is insufficient.
- Brood stock is inadequate.
- Intermediate size seed stock culture business has not been developed in the Private sector or community level.
- Seed stock production of alternative species is not sufficient.

Regional cooperation through Aquaculture Network and Centers of excellences 1

- Utilizing regional institutions and private sectors as much as possible (collaboration of industry, public, and academia)
- Formulation of guideline/framework of aquaculture development policy
- Research and Development
 - Local Feed Development
 - Tilapia culture technical improvement
 - Alternative species culture development
 - Marketing survey
 - Socio economic survey

Appendix X: Potential Role of the University of the West Indies (UWI) in Regional Aquaculture Development

Potential roles of the University of the West Indies (UWI) in Regional Aquaculture Development

First Regional Workshop on Aquaculture Development
Planning

March 14-21, 2011

Jamaica, W.I.

ACN Phillips
UWI, St. Augustine


The University of the West Indies (UWI)

- Mona Campus (Jamaica)
- Cave Hill Campus (Barbados)
- St. Augustine Campus (Trinidad and Tobago)
- 16 member countries in the English-speaking Caribbean

The University of the West Indies (UWI)



- Anguilla
- Antigua and Barbuda
- Bahamas
- Belize
- Bermuda
- British Virgin Islands
- Cayman Islands
- Dominica
- Grenada
- Montserrat
- St. Kitts and Nevis
- St. Lucia
- St. Vincent and the Grenadines

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OPEN CAMPUS

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UWI Mission & Vision

The University of the West Indies

Over the last six decades, The University of the West Indies (UWI) has evolved from a fledgling college in Jamaica with 33 students to a full-fledged University with over 40,000 students. Today, UWI is the largest and most longstanding higher education provider serving over 20 countries in the English-speaking Caribbean, with traditional campuses in Barbados (Cave Hill), Jamaica (Mona) and Trinidad and Tobago (St. Augustine). UWI recently initiated its Open Campus, a multi-option and multi-mode online campus with over 40 physical site locations across the region in Anguilla, Antigua & Barbuda, The Bahamas, Belize, British Virgin Islands, Cayman Islands, Dominica, Grenada, Montserrat, St Christopher (St Kitts) & Nevis, St Lucia, and St Vincent & the Grenadines. UWI is an international university with faculty and students from over 40 countries and collaborative links with over 60 universities around the world. Through its seven Faculties, UWI offers undergraduate and postgraduate degree options in Engineering, Humanities & Education, Law, Medical Sciences, Pure & Applied Sciences, Science and Agriculture, and Social Sciences.

UWI Mission Statement

The enduring mission of The University of the West Indies (UWI) is to propel the economic, social, political and cultural development of West Indian society through teaching, research, innovation, advisory and community services and intellectual leadership. (UWI Strategic Plan 2007-2012)

INFORMATION SHARING

UWI- Computer Sciences/Information Technology



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Upcoming Events

Global Animal Health Conference: Global Availability of Veterinary Medicines - Providing a Climate for Science and Innovation, London, March 23 - 24, 2011

42st Annual IAAAM Meeting and Conference, Las Vegas, NV, May 7-11, 2011

AQUAVET I, Bristol, RI, May 29 - June 24, 2011

AQUAVET II, Bristol, RI, May 29 - June 10, 2011

Health and Colony Management of Laboratory Fish, Bar Harbor, Maine, August 15-19, 2011

ACZM Board Certification Exam, Raleigh, NC, October 7 - 9, 2011

IAAAM Conference News

Dear IAAAM members,

The Las Vegas Conference is just over 2 months away. I'm in the process of sorting submitted abstracts into sessions and getting them to the session chairs hopefully by the end of the week. The rest of the planning for the meeting is coming together nicely.

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IAAAM Diving Pacific Northwest Marine Life ID	Chris Harvey-Clark ,DVM	47	2	16 Mar 2010 04:17 PM
Hippo/cichlid pool pH	Marie-Josée Limoges ,DMV, MVSc	34	1	02 Jun 2010 10:43 AM



**RESEARCH AND
DEVELOPMENT**

**MONITORING AND
EVALUATION**



FEED QUALITY

FEED COSTS

FEED AVAILABILITY

UWI- Department of Food Production

■ ***Moringa oleifera***

(Miracle Tree, Horseradish Tree, Drumstick Tree, Ben Oil Tree)



UWI- Department of Food Production

- New feed formulations and analyses
- Digestibility studies
- Controlled clinical studies
- Lowered Feed Conversion Ratios (FCR)
- Dissemination of research findings

TRAINING WORKSHOPS

UWI- Department of Food Production School of Veterinary Medicine

- Aquaculturists
- Veterinarians
 - Production systems
 - System design
 - Fish health and fish health management
 - Principles of biosecurity
 - Updates on emerging diseases
 - Food safety

DIAGNOSTICS

UWI- School of Veterinary Medicine

- Aquatic Animal Health Diagnostic Laboratory
 - Necropsy
 - Bacteriology
 - Histopathology
 - Toxicology
 - Molecular diagnostics
 - Water Quality Testing

SUSTAINABILITY AND ENVIRONMENTAL IMPACT

UWI- Centre for Resource Management and Environmental Studies

- Research on sustainable development
- Ecosystems approach to aquaculture and species management
- Advisory services
- Applied consulting services

POLICY

UWI- Schools of Business and Law

- Training in principles and practices of project management
- Projects on policy development, revision of commercial trade policy
- Analysis, review and development of environment-related policies, and articulation of policy positions in response to emerging environmental issues and events

YOUTH INVOLVEMENT

UWI- Department of Food Production, SVM, CERMES

- Outreach/Awareness campaigns
 - Primary and Secondary Schools
 - Science Fair displays/demonstrations
 - Projects designed for various age groups
 - Bring aquaculture to the classroom
 - Undergraduates
 - Design a pool of research projects based on industry needs
 - Personal experience...

Additional Faculties/Departments

- **Engineering**
 - Region/climate-appropriate technology development

SUMMARY

The UWI can play a strong supportive role in regional aquaculture development through:

- Outreach
- Undergraduate/Graduate education
- Applied research
- Needs-based projects
- Professional training
- Continuing education
- Cooperative initiatives linking researchers with private sector and governmental stakeholders

THANK YOU

Ayanna Carla N. Phillips, DVM, MPhil, PhD.
Lecturer- Marine Mammal Medicine/Aquatic Animal Health
Coordinator- Aquaculture/Aquatic Animal Health Unit
School of Veterinary Medicine
Faculty of Medical Sciences
The University of the West Indies
St. Augustine Campus
Eric Williams Medical Sciences Complex
Champs Fleurs, Trinidad and Tobago, W.I.
Phone: 1-868-645-2640 ext.4232(office), ext.4385 (lab)
Email: Carla.Phillips@sta.uwi.edu; phillipsacn@gmail.com