



Secure Fisheries
Secure Futures



AQUACULTURE NEEDS ASSESSMENT MISSION REPORT

Nairobi - Kenya



INDIAN OCEAN
COMMISSION



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Aquaculture needs assessment mission report

Nairobi
Kenya

GCP/RAF/466/EC SmartFish Project

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Executive Summary

The *Aquaculture Needs Assessment of Kenya* was jointly organized by the Government of Kenya and the Food and Agriculture Organization of the United Nations (FAO), under the framework of the project GCP/RAF/466/EC "Implementation of a Regional Fisheries Strategy for the Eastern and Southern Africa and Indian Ocean Region", otherwise known as SmartFish. SmartFish is funded by the European Union (EU) through the Indian Ocean Commission (IOC) and co-implemented by the FAO. The needs assessment is one of the activities being implemented under Result 5M3.1 Sustainable Aquaculture Development Promotion, which responds to African countries' desire to contribute their efforts to transform aquaculture from a non-viable, subsistence and public sector driven economy, to a resourceful, vibrant, private sector led sustainable enterprise. The needs assessment was carried out at specific sites in the western part of the country.

The purpose was to assess the needs for aquaculture production and marketing in selected fish farmer organizations, so as to guide the support and investment choices for enhancement for sustainable aquaculture productivity and profitability in Western Kenya.

The study involved: a desk review for the purpose of having background information about the sector; the site selection of study areas for the mission; the development of assessment tools and approach, ensuring FAO approval for their use; the execution of field assessments in the selected sites; and the production of this report. This report outlines the training needs and a training delivery plan; legal registration and networking recommendations; input requirements; as well as a distribution plan and costing.

The desk review was done in the last week of June 2013. A field mission in Western Kenya was conducted over three weeks in August 2013. Report writing took three weeks in September 2013. The report was submitted in the third week of October 2013. Training of fish farmer groups, and provision of equipment and inputs to these groups, is scheduled for January and February 2014.

This needs assessment focused on training and inputs, such as equipment and materials that are required by fish farmer groups. The assessment took place with fish farmer groups in Kisii, Kakamega, Homa Bay, Vihiga, Siaya, and Busia counties in Western Kenya. The training modules identified include: Best Management Practices (BMPs); group cohesion and development; aqua-business skills; marketing; record and book keeping; and efficient production technologies. Equipment needs include: deep freezers; sampling and harvesting nets; secchi disks; cool boxes; harvesting baskets; hapa nets; and weighing scales.

From the study it is anticipated that the end point of the selected beneficiary clusters should be stand-alone, self-sufficient market structures that offer investors the best prices for inputs and products. It is also anticipated that once this end point is reached, the fish farm clusters should serve as the nuclei in an effort to expand market clusters to other small and medium enterprise investors across the country, and the region at large.

Recommendations include the following:

- The groups to benefit from capacity building and provision of equipment include: Central Kakamega Aquaculture Cooperative; Muungano Fish Farmers (Bidii Fish Farmers and Yala Fish Farmers Cluster); Tilapia Fish Farmers Group; Wangchieng Fish Farmers Cluster; and the Butula Fish Farmers Cooperative;
- The groups should be strengthened through training on group cohesion and market linkages;
- Documentation of the work in the form of a video documentary should be undertaken to serve as a training tool. The aim is to develop long-term market linkages that optimize profits for group members.

Résumé exécutif

L'évaluation des besoins en aquaculture au Kenya a été organisée conjointement par le gouvernement du Kenya et l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO), dans le cadre du projet GCP/RAF/466/EC "Mise en œuvre d'une stratégie des pêches pour la région Afrique orientale et australe - océan Indien" connu également sous le nom de SmartFish. SmartFish est financé par l'Union européenne (UE) et mis en œuvre conjointement par la Commission de l'océan Indien (COI) et la FAO. L'évaluation des besoins est une activité mise en œuvre par le résultat 5M3.1 « la promotion pour le développement d'une aquaculture durable » qui répond à un souhait des pays africains de contribuer à la transformation d'une aquaculture non viable, de subsistance et conduite par le secteur public en une entreprise vivante, fructueuse et durable du secteur privé. L'évaluation des besoins a été réalisée sur des sites précis à l'ouest du pays.

Le but de l'étude était d'évaluer les besoins en termes de production et de marketing dans les organisations de pisciculteurs sélectionnées, afin de guider les investissements futurs pour augmenter la productivité et les profits générés grâce à l'aquaculture dans l'ouest du Kenya.

L'étude a consisté en : un examen documentaire des informations de référence sur le secteur, la sélection des sites d'étude pour la mission, le développement d'une approche et des outils d'évaluation, ainsi que leur approbation par la FAO, l'évaluation de terrain sur les sites sélectionnés, et la production du présent rapport. Celui-ci présente le plan de la formation, la formation, les dispositions légales, les recommandations du réseau, les besoins et le plan de distribution et des coûts.

L'examen documentaire a été réalisé la dernière semaine de juin 2013. Une mission de terrain dans l'ouest du Kenya a eu lieu durant trois semaines en aout 2013. En septembre 2013, l'écriture du rapport a duré trois semaines. Le rapport a été soumis la troisième semaine d'octobre 2013. La formation des pisciculteurs et la remise d'équipement est prévue en janvier ou février 2014.

L'étude s'est concentrée sur l'évaluation des besoins des groupes identifiés en termes de formation, d'équipement et de matériel. L'évaluation s'est déroulée avec des groupes de pisciculteurs des comtés de Kisii, Kakamega, Homa Bay, Vihiga Siaya et Busia, tous dans l'ouest du pays.

Les modules de formation qui ont été identifiés sont : les meilleures pratiques de gestion (MPG), le développement et la cohésion des groupes, les outils d'aqua-business, le marketing, la tenue d'un registre et les technologies de production. Les besoins en équipement sont : des systèmes de congélation, des tubes à essai et filets de récolte, des disques de Secchi, des boîtes frigorifiques, des paniers de récolte, des filets de type « hapas » et des balances.

L'étude souligne que le but à atteindre pour les groupes bénéficiaires sélectionnés est l'autonomie et des structures de marché auto-suffisantes qui offrent aux investisseurs les meilleurs prix des matières premières et des produits. L'étude anticipe également qu'une fois ce point atteint, les groupes de pisciculteurs devront concentrer leurs efforts pour former un noyau et étendre ainsi le marché à d'autres groupes d'investisseurs de petites et moyennes entreprises dans le pays et dans la région.

Les recommandations sont les suivantes:

- Les groupes bénéficiant du renforcement de leurs capacités et des apports en équipement sont : *Central Kakamega Aquaculture Cooperative; Muungano Fish Farmers (Bidii Fish Farmers et Yala Fish Farmers Cluster); Tilapia Fish Farmers Group; Wangchieng Fish Farmers Cluster; et la Butula Fish Farmers Cooperative;*
- Assurer le renforcement de ces groupes par la formation, la cohésion de groupe et les liens de marché ;
- Documenter le travail sous forme d'un documentaire vidéo pour servir à la formation. Le but étant de développer des liens de marché sur le long-terme qui optimise ainsi les profits des membres des groupes.

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Acronyms and abbreviations

AAK	Aquaculture Association of Kenya
ADB	African Development Bank
ACP	Africa Caribbean Pacific
AFC	Agricultural Finance Cooperation
CASK	Commercial Aquaculture Society of Kenya
CBO	Community Based Organization
DFO	District Fisheries Officer
ESP	Economic Stimulus Program
EAC	East African Community
EU	European Union
FAO	Food and Agriculture Organization
FB	Fisheries Bulletin
FFEPP	Fish Farming Enterprise Productivity Program
FFEO	Fish Farming Extension Officer
GDP	Gross Domestic Product
GIZ	Gesellschaft für Internationale Zusammenarbeit
KMFRI	Kenya Marine and Fisheries Research Institute
LBDA	Lake Basin Development Authority
MESPT	Micro-Enterprise Support Program Trust
NGO	Non-Governmental Organization
NOFP	National Oceans and Fisheries Policy
TCP	Technical Cooperation Project
WB	World Bank

1. Background

The Food and Agriculture Organization of the United Nations (FAO) under the Implementation of a Regional Strategy for the Eastern Southern African-Indian Ocean Region Program (GCP/RAF/466EAC), and within the framework of FAO SmartFish Result 5, Output 5M3.1, 'Sustainable Aquaculture Development Promotion' undertook this needs assessment mission at specific sites.

The purpose of this study was to assess the needs of aquaculture producers and marketers in selected fish farmer organizations, to guide support and investment choices for the enhancement of sustainable aquaculture productivity and profitability in Western Kenya.

The study involved:

- A desk review;
- Site selection;
- Development of assessment tools and approach (approved by FAO);
- Execution of field assessments in the selected sites;
- Production of a report which includes:
 - training needs and training delivery plan;
 - legal registration and networking recommendations;
 - an input distribution plan and costing.

The detailed Terms of Reference are given in Annex A. This report describes the tools and approaches used in the assessment, the field mission, and the results obtained. The field mission took place in six counties in Western Kenya: Kisumu, Vihiga, Siaya, Homa Bay, Kisii, and Kakamega (see Figure 3). A large number of stakeholders and actors from the aquaculture sub-sector were met and engaged in discussions during the field mission (see Annex C).

2. Desk review

A desk review was conducted to consolidate and understand past and on-going national activities that were, and still are, focused on promoting aquaculture. The study was expected to provide the project with baseline information on past cooperation activities and ongoing activities in the area of food security and poverty reduction through aquaculture. This was helpful for the site selection process, the identification of lessons to incorporate in the assessment and future steps.

Overview of aquaculture development in the country

The National Oceans and Fisheries Policy of the Ministry of Fisheries Development (NOFP, 2008), which is now in the Ministry of Agriculture Livestock and Fisheries, identified the development of fish farming to be one of its core activities. This is because aquaculture has the potential to reduce fishing pressure on oceans, lakes and rivers, but can also enhance food security, create employment and wealth, and promote healthy living.

Kenya is a coastal state with an estimated population of 40 million and a surface area of 582,650 km². Of that, 13,400 km² is covered by inland water surface, while territorial waters cover 14,300 km² (Fisheries Bulletin (FB), 2009). All are suitable for different types of aquaculture development. The country has 1.4 million hectares of land suitable for aquaculture, with the capacity to produce 14 million tonnes of produce worth over Ksh 50 billion annually. Despite this huge potential for aquaculture, its contribution to the gross domestic product of Kenya is still dismal. Kenya is food insecure requiring imports of various food commodities, and does not export any aquaculture products. Though there are several hurdles (see Box 1) that need to be crossed, the government is committed to creating an enabling environment for the growth of the sector, as in the National Aquaculture Strategy and Development Strategy 2010-2015 and the National Aquaculture Policy 2011.

Box 1: Major aquaculture constraints

Major aquaculture constraints

The major factors that have limited aquaculture production include:

- Inadequate availability of quality fish seed;
- Inadequate availability of quality and affordable fish feeds;
- Poor understanding of market dynamics, and risk reduction;
- Poor understanding of general pond management for increased production;
- Lack of access to quality information on aquaculture technologies and slow transfer of information on proven practices through extension and training;
- Lack of access to capital;
- Inadequate attention to the economics of fish production.

In recognition of the national aquaculture potential, the Government of Kenya has invested Ksh 6 billion since 2009 in the implementation of the Fish Farming Economic Stimulus Program in 160 constituencies country-wide.

This has resulted in the construction of over 48,000 fish ponds of 300 m² each throughout the country. Through the same program, the government facilitated the participation of the private sector in the production of fish feeds and seed. As a result the number of fish farmers has increased tremendously from 4,700 in 2007 to over 49,050 in 2012.

The Kenyan Government aspires to create an enabling environment for a vibrant aquaculture industry. They hope that with a strong and efficient marketing system the aquaculture industry will allow for increased investment and economic gains in aquaculture and an increased contribution towards food security, whilst being supported by strong and efficient extension services and demand driven research.

Current status in terms of production volumes, species, and the locations of current projects

Prior to 2007, several fish farming initiatives in Kenya were executed by the Department of Fisheries. The main activities were geared towards using fish farming as a tool for poverty alleviation and food security, and were addressed through various project activities that included: pond construction and management; stocking density trials; feed trials; the integration of fish farming with other agricultural activities; brood stock management; seed quality; and the evaluation of growth performance of Nile Tilapia and catfish strains.

These initiatives had limited impacts due to the slow uptake of fish farming by entrepreneurs, emanating from a lack of information on fish farming technology and culture practices; limited funding by the Government; and limited political support from the policy makers. This is exemplified by the fact that in 2002, there were only 4,742 fish farmers with 7,471 ponds occupying 217 hectares (2,169,424 m²) producing only 962 tonnes of farmed fish. The contribution of farmed fish at that time was just about 1 percent of the national fish production in Kenya. Production has increased from as low as 962 tonnes in 2002, to the present production of 22,000 tonnes in 2012 (Table 1). Tilapia has remained the dominant cultured species in Kenya to date (Table 2).

Table 1: Production from aquaculture systems (2006-2012)

	2006	2007	2008	2009	2010	2011	2012
Total Production (MT)	4,218	4,245	4,452	4,895	12,153	19,584	22,000
No. of farmers	4,742	4,742	4,742	6,328	14,120	48,721	49,050
No. of ponds	7,477	7,471	7,530	9,116	15,529	45,745	69,998
Area of ponds (ha)	217	216	227	275	467	1361	
No. of dams/reservoirs	301	301	301	331	331	124	
Area of dams/reservoirs (ha)	497	498	498	547	547	74	
No. of tanks/raceways	248	149	156	161	161	161	
Area of tanks/raceways (m ²)	78,289	21,347	22,413	23,085	23,085	23,085	

Table 2: Species contribution to total production (metric tonnes)

	2007	2008	2009	2010	2011
Tilapia	2,965	3,113	3,442	9,115	14,689
Clarias	890	935	1077	2,188	3,525
Common Carp	338	355	373	729	1,175
Trout	47	49	51	122	186
Other	5				

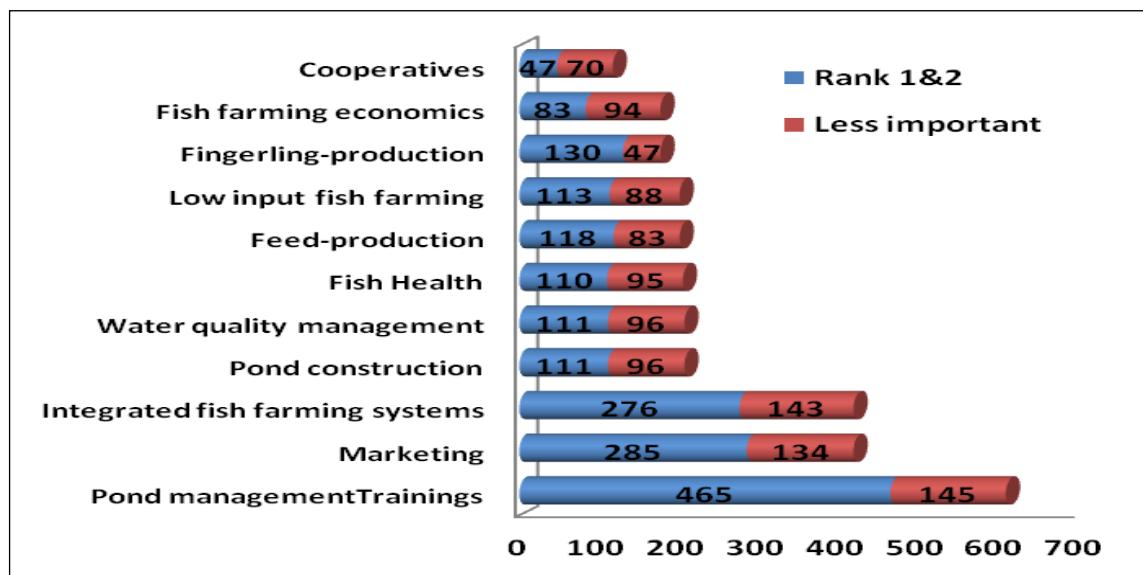
Source: *Fisheries Bulletins (2007-2011)*

Previous needs assessments, training, input provision and lessons learned

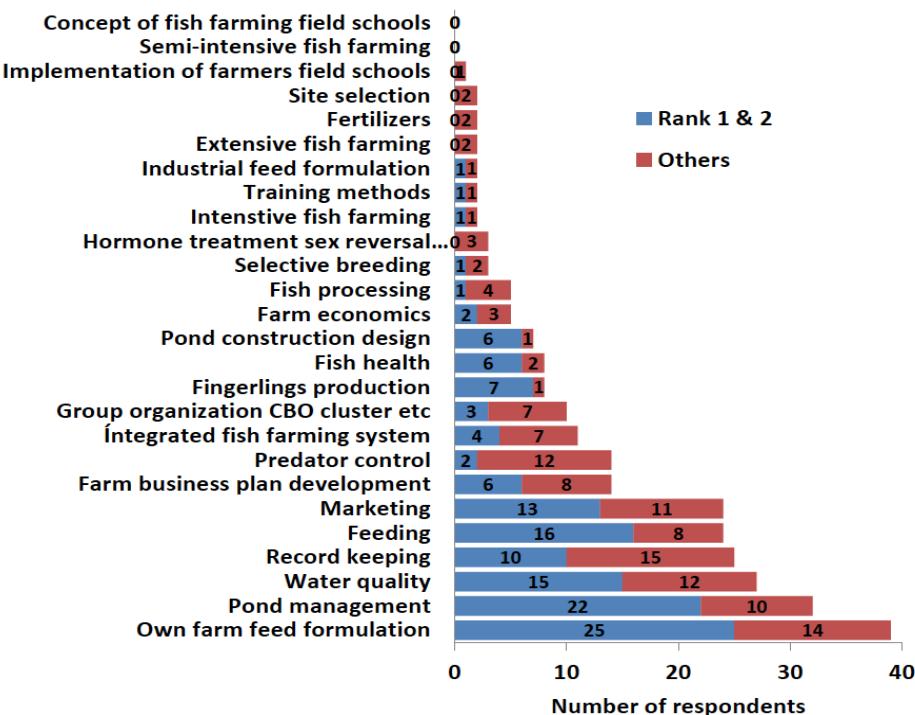
There has been no aquaculture needs assessment study within the Lake Victoria Basin to date. Only a baseline survey was conducted by the Trilateral Cooperation Tilapia project in Western Kenya in April 2013. This survey focused on the small-scale fish farmers who were supported under the Economic Stimulus Program. A summary of the baseline survey results is given in Figures 1 and 2. Three countries – Kenya, Germany and the State of Israel – are cooperating to promote aquaculture development in Kenya. The Trilateral project seeks to improve the Tilapia value chain in the Western Kenya region.

The aim of the baseline survey was to:

- Assess the actual situation of fish farming in the project location;
- Identify the main problems and challenges for fish farmers in the project location;
- Identify the training needs of fish farmers and extension officers.

Figure 1: Type of training required according to farmers

Source: *Final Report - Analysis of the Baseline Data Collection, Aquaculture in the former Nyanza and Western Provinces, Trilateral Tilapia Project, Kenya. April 2013*

Figure 2: Farmers' needs according to extension services

Source: Final Report - Analysis of the Baseline Data Collection, Aquaculture in the former Nyanza and Western Provinces, Trilateral Tilapia Project, Kenya. April 2013

3. Selection of sites and groups

The site selection process was influenced by its state of development, previous support and current objectives. The criteria developed and used for selecting the beneficiaries included:

- High dependency on aquaculture;
- Lack of previous support;
- Newly established in aquaculture business;
- Have previously received support and require additional assistance;
- Are already an established aquaculture cluster and have been operating for at least 2 years;
- Registered;
- Not registered;
- Membership of not less than 30 - 40 farmers;
- Have some form of guiding principles;
- Vulnerable to shocks and stresses.

Table 3. gives a synopsis of the groups that were selected based on the criteria mentioned above, including the process used, whilst Table 4. shows the training needs ranking for beneficiary fish farming groups.

Table 3: Selection of sites and groups

Location/site/group	Reason for choice (selection criteria and other reasons)	Number of members, date of formation, main products, volumes, marketing process and main markets...	Consultation process and stakeholders involved in choice
Central Kakamega Aquaculture Cooperative Society	High dependency on aquaculture; An established aquaculture cluster; Has been operating for at least 6 years; Has received previous support and requires additional support; Registered; Vulnerable to market and input fluctuations.	33 men, 7 women Date of formation: 2007 Main products: fresh whole Tilapia and Catfish; Tilapia and Catfish fingerlings; Volume: 20.44 MT/Yr Collection centre and marketing outlets Main markets: farm site, market centres, hotels	Consultation with group; Consultation with stakeholders
Muungano Fish Farmers	For marketing purposes, Yala and Luanda (Bidii) have combined and registered a CBO; High dependency on aquaculture; An established aquaculture cluster; Has been operating for 3 years; Has received previous support and requires additional support; Registered; Vulnerable to market fluctuations.	30 men, 10 women Date of formation: 2010 Main products: fresh whole Tilapia and Catfish; Tilapia and Catfish fingerlings; Volume: 17.93 MT/Yr Collection centre and marketing outlets Main markets: farm site, market centres, hotels	Consultation with group; Consultation with stakeholders
Great Wangchieng Fish Farmers	High dependency on aquaculture; Establishing itself in aquaculture business; Has previously received limited support; An established aquaculture cluster; Has been operating for at least 4 years; Registered; Has guiding principles; Vulnerable to shocks and stresses (production, marketing).	61 men, 41 women Date of formation: 2010 Main products - fresh whole Tilapia (have a hatchery for Tilapia fingerlings in one of the sub-clusters) Volume: 6.8 MT/yr Main markets: farm site, market centres, hotels	Consultation with group; Consultation with stakeholders
Butula Pond Fish Farmers Cooperative Society Ltd.	High dependency on aquaculture; Establishing itself in aquaculture business; Has previously received limited support; Established aquaculture cluster has been operating for at least 4 years; Registered; Has guiding principles; Vulnerable to shocks and stresses (production, marketing).	70 men, 11 women Date of formation 2010 Main products - fresh whole Tilapia Volume: 8.3 MT/yr Main markets: farm site, market centres, hotels	Consultation with group; Consultation with stakeholders

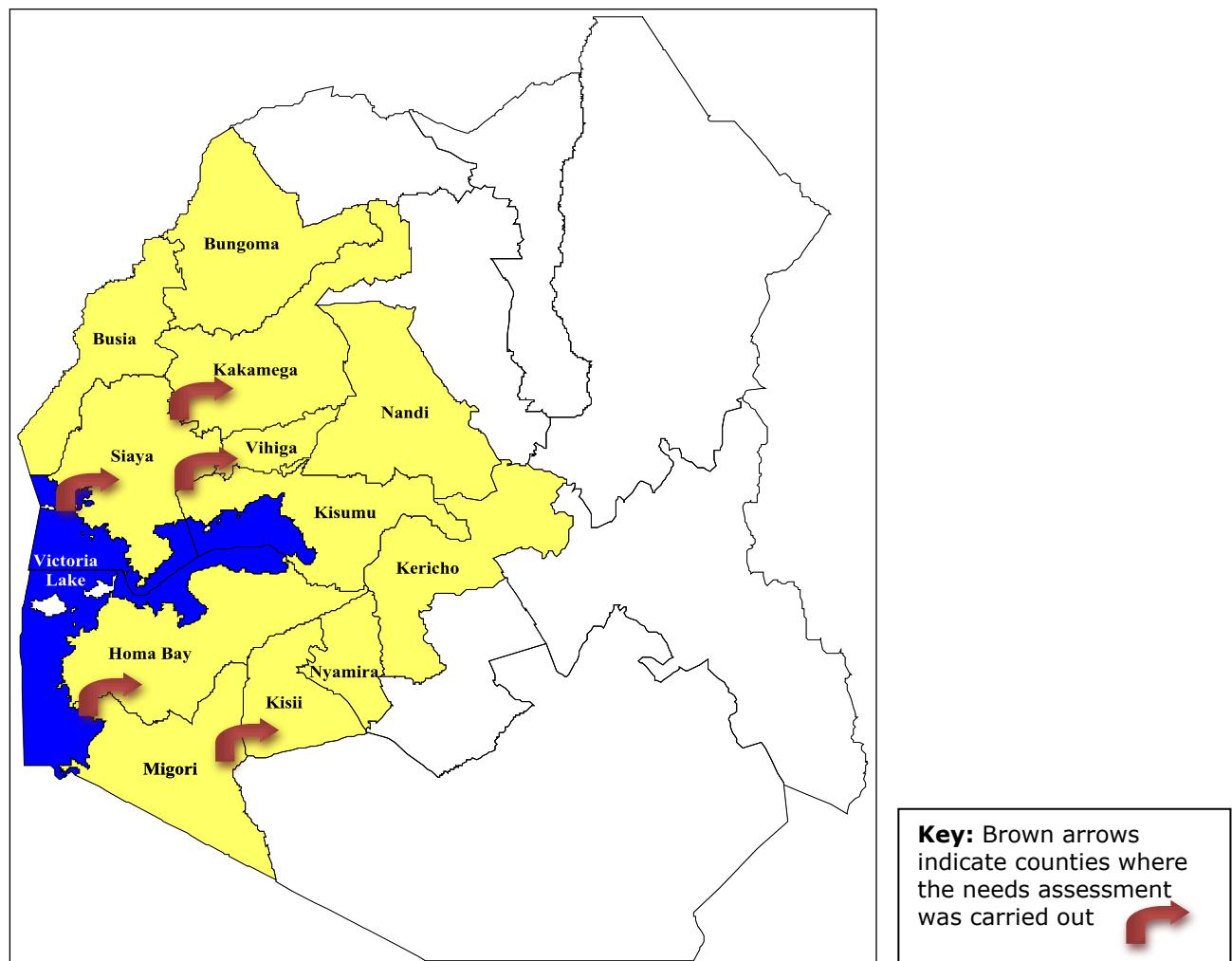
Table 4: Training needs ranking for beneficiary fish farming groups

Name of Group	High dependency on aquaculture	Lack of previous support	Newly established in aquaculture business	Have received previous support and require additional support	An established aquaculture cluster, have been operating for at least 2 years	Registered	Membership not less than 30-40 farmers	Have some form of guiding principles	Vulnerable to shocks and stresses	Total
Central Kakamega Aquaculture Cooperative Society	9	3	6	8	10	10	10	8	5	69
Tilapia Self Help Group	6	8	6	5	8	10	10	8	6	67
Muungano Fish Farmers	9	3	8	8	7	10	8	9	7	69
Butula Pond Fish Farmers Cooperative Society Ltd	4	4	8	6	7	10	10	6	8	63
Great Wangchieng Fish Farmers	3	4	8	8	6	10	10	6	9	64

Matrix ranking key:

Highest ranking 10

Lowest ranking 1

Figure 3: Map of Western Kenya

4. Needs assessment tools and approach

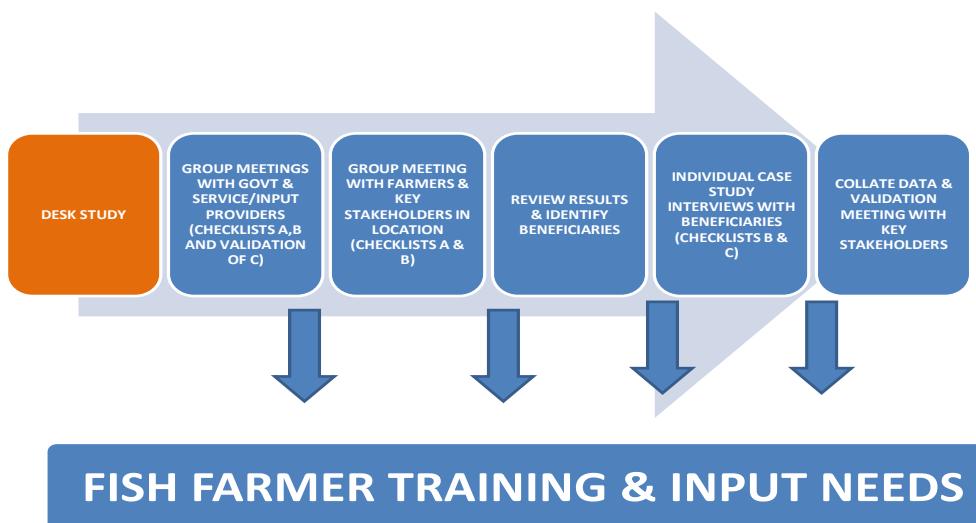
The field assessment was divided into three main components:

- Development of a general overview of the aquaculture situation including baseline data;
- Needs assessment covering training and inputs;
- Establishment of baseline indicators to measure the project's impact.

The overall approach was influenced by the desk review followed by a rapid and participatory appraisal that was dependent on semi-structured interviews with groups and individuals representing different interests, guided by checklists of key questions. These interviews and discussions will be augmented by the application of other field research tools such as stakeholder analyses, flow diagrams, seasonal calendars, and time line and matrix ranking where deemed appropriate. It is thought that the overall approach provided a holistic understanding of needs.

This section describes each of the three main components of the assessment approach with links to the checklists of key questions and issues. This is followed by the fieldwork schedule that highlights when each activity would be carried out and the approximate duration. Importantly, the results from the assessment were presented to key stakeholders for validation before the researchers left the assessment locations. Figure 4. summarizes the key elements of the field assessment process.

Figure 4: Summary of aquaculture needs assessment approach and process



General overview and baseline data

The general overview helped develop an understanding of the potential needs, as well as an understanding of the current situation with regard to aquaculture in the target areas. Whilst it was anticipated that some information could be obtained from the desk review and secondary sources of data (reports, studies, policy and plans), the main sources of information were the fish farmers themselves; the State Department of Fisheries; government extension services; and various input and service providers, for example feed and seed producers, fish traders, transport providers and veterinary service providers.

The most effective approach was holding a discussion with a mixed group of key stakeholders. Use of other field research methods and tools proved very useful. These were: semi-structured interviews; stakeholder analyses for the purpose of developing a profile of the different types of fish farmers; a flow diagram of production and value-chains showing key activities, inputs, markets and stakeholders; a seasonal calendar showing general changes in activities, inputs, costs, production, income and prices over a 12 month period; and a timeline to help describe the key changes that have taken place over time, i.e. the last five years. Checklists A (Annex D-1) provide a list of questions and topics that were used to guide discussions.

Needs assessment

The needs assessment focused on training and inputs, for example equipment and materials required by fish farmers and farmers groups. Whilst some information was available from secondary sources, the main sources of information were the fish farmers themselves; State Department of Fisheries; government extension services; as well as input and service providers. The approach established needs via group discussions, involving a cross section of key stakeholders and information was validated afterwards through a series of individual interviews with the potential beneficiaries, the fish farmers.

Semi-structured interviews, as well as ranking and prioritisation, were used (Table 4). A simple audit questionnaire (Annex D-2i) to test farmers' understanding of key production and marketing issues was designed and used during the process. These interviews helped identify the focus of subsequent capacity building activities. Checklist B (Annex D-2) provides a list of topics and questions that were used to guide the needs assessment. Many of the questions were based on those used in a standard training needs assessment.

Baseline indicators

Baseline indicators are those things that can be relatively easily measured pre- and post-intervention, and show whether or not a farmer's livelihood has potentially improved.

The indicators were measured with the fish farmers, using a semi-structured interview or a formal type questionnaire interview.

Other tools that were useful for this activity included: a seasonal calendar; matrix ranking; and a simple audit questionnaire to establish current knowledge and understanding and any subsequent changes post intervention (see needs assessment). Checklist C (Annex D-3) was used to guide the interview process and provide a list of potential indicators. It was prudent to validate these indicators as part of the assessment. A final pre-intervention baseline indicator survey could also be conducted at the same time, or immediately before, the delivery of inputs and training.

The field assessment process was carried out as follows:

1. Desk review. The desk review was guided by key questions using the following documents: project reports (ACP Fish, FAO, etc.); donor reviews and plans (WB, ADB, NEPAD, etc.); policy documents (Governmental fisheries development plan); research studies (non-government organizations, universities, etc.). The desk review took place over five days from 24 - 28 June 2013.
2. The field mission was undertaken from 8 - 23 August 2013.
 - Introductory meetings and interviews took place with the Assistant Director of the National Fisheries Office; the County Director from the State Department of Fisheries; and various stakeholders (input and service providers) in Kisumu county from 8 - 15 August 2013;
 - Group interviews with fish farmers, input and service providers in the target locations, other types of farmers and various stakeholders took place from 16 - 20 September 2013, after which the results of the group interviews were reviewed to identify individuals for follow-up discussions;
 - Individual case study interviews were carried out with a cross section of different farmers (large, small, male, female, rich, poor, highly dependent, and less dependent). This was done to cross check key issues and carry out a baseline survey validation meeting with beneficiaries to feedback the needs assessment results and proposals. These meetings took place on 21 and 22 August 2013;
 - The collation of information for presentation and discussions at a validation meeting with key stakeholders and beneficiaries were conducted on 22 August 2013;
 - A validation meeting with beneficiaries to provide them with the results and propositions of the needs assessment and identify in-kind contributions from the beneficiaries was also undertaken on 22 August 2013.
3. The mission left the site on 23 August 2013. A mission report with the following information has been developed:
 - specific training needs with a detailed training delivery plan;
 - specific actions with costing for the legal registration and networking of the groups;
 - list of groups and individual beneficiaries for the input distribution with a tentative costing per item.

5. Results of the needs assessment

Discussions were held with the Assistant Director of the National Fisheries Office in Kisumu, and the County Director of Fisheries, Kisumu County. Deliberations focussed on the need to ensure that aquaculture keeps its momentum in terms of shifting from subsistence to commercial enterprise with the goal of ensuring increased production.

Key issues raised include:

- The need to use a harmonized approach by different aquaculture development programs;
- The need to undertake an impact assessment;
- The need to carry out a survey to know the number of farmers still engaged in aquaculture after receiving assistance;
- Priorities that need to be addressed in terms of interventions.

An introductory meeting was also held with key stakeholders from 14 - 15 August 2013. The objective was to share and discuss progress made in aquaculture development over the past five years; understand and prioritise key constraints and opportunities in the development of aquaculture in Western Kenya; plan participatory ways to find solutions to these constraints; and plan the nature of support required for the sector to grow.

Identifying stakeholder groups

The first activity involved a stakeholder analysis of all participants present in the workshop. They included: fish farmers from various groups in Kisumu, Siaya, Luanda, Kakamega, Busia and Homa Bay; groups producing feeds; seed producers; aqua shop owners; County Directors; extension workers; researchers; the National Fish Farmers Association; training institutions; and regional bodies (Annex C). Participants were put into groups according to their shared perspectives; these were according to job description and institutional affiliation. Each group then worked together to prepare responses to the following questions:

- What are the priorities in terms of aquaculture development and business?
- How would you like the situation to be in 12 months time?
- What is needed, if anything, to help you reach this objective?
- What are the activities that you as a stakeholder need to change or do differently to improve your operations?
- What are the problems? What is causing the problem?
- What would you like this stakeholders meeting to achieve?

The questions encouraged participants to think through about what they could offer and what they could gain from the process, emphasizing the role of each participant in achieving expectations and harvesting the benefits (Table 4).

An adaptable process

A key step in the success of the stakeholder approach is the identification of different stakeholder groups. The workshop participants identified key groups, which were recorded on a flip chart. This was done in a plenary session during which participants were encouraged to call out names of individuals, groups of individuals or organizations who could affect, or would be affected by, the assessment.

The stakeholder approach can therefore be used as a pragmatic tool for defining research roles, or as a learning tool for exploring different perspectives. For each case, it might be useful to reconsider the formulation of stakeholder groups.

Issues brought out through discussion of the stakeholder matrix

When the matrix was complete (Table 5), discussion was facilitated amongst the groups to raise issues associated with participatory research and draw out participant preconceptions. The fact that different groups of people have different perceptions, expectations and potential contributions was addressed in the discussion. Each group was questioned by the others and asked to clarify what they had written. Some of the issues that were discussed and the different perspectives are highlighted below. The stakeholders' differences and the facilitation process enabled participants to debate on what they thought the priorities for the sector are; how they would like the situation to be in 12 months; what is needed to get there; the individual changes required; issues affecting the sub-sector; and their expectations. This process was carried out over two days.

The format of the stakeholder matrix makes their ideas about the assessment explicit, rather than simply plotting the groups along a particular axis. This provides a tool that, rather than emphasising conflict between stakeholders, offers possibilities for mutual learning.

Stakeholders also discussed the characteristics of fish farming systems and the nature of fish farming in Kenya, as shown in Tables 6 and 7.

Table 5: Stakeholder matrix

Stakeholders	What are the priorities in terms of aquaculture development/business? How would you like the situation to be in 12 months time?	What is needed, if anything, to help you reach this objective?	What are the activities that you as a stakeholder need to change or do differently to improve your operations/business?	What are the problems? What is causing the problem?	What would you like this stakeholders meeting to achieve?
Institutional/enabling environment stakeholders					
1. Management of co-operative/clusters	Planning and conducting research together with aquaculture experts to develop sustainable aquaculture suitable for all levels of producers including resource poor areas and communities	Conducive working atmosphere and working area	Create awareness on the income generating aspects of aquaculture	Poor marketing strategies, not working as one; weak group organization, individualism, lack of commitment by members	Develop understanding between researchers and communities. Research that is needs-based and sustainable
2. State Government	Ensure enabling environment for aquaculture development (appropriate policy, legislation)	Provision of adequate information about different aspects of aquaculture in the State. Provide manpower and other organisational support	Undertake enterprise as a business; ensure they keep and understand records	The art of making development participatory, which will be useful for better implementation of any programmes	Enhance interactions among different stakeholders to formulate a comprehensive package for aquaculture research and development
Technical support stakeholders					
3. National fisheries research institute	To achieve sustainable aquaculture to improve the rural economy and combat protein deficiency	Technical support (on-farm trials) on fish breeding, seed raising, composite fish culture, technology	Collaborate with fish farmers to carry out trials of new technologies	Farmers not engaging in research where necessary	To identify research needs and constraints. To refine modes of technology transfer
4. Training institutions	Vertical and horizontal expansion of aquaculture to achieve production of 2.5 T/ha/year in rural areas	Provision of relevant training for all stakeholders	Need to implement what they have been taught	Lack of adequate capital, commitment,	Farmers' difficulties should be made clear and a methodologies to solve them discussed
5. Local socio-technical/financial NGO	Appropriate and affordable technology packages for integrated aquaculture, developed with SDF (Management and Research). Build clusters' capacity to understand, evaluate infrastructure to encourage and support farmers adopting the technology	Co-ordinate NGO activities to support appropriate technology development, provide training, establish links between M&E.	Obtain an understanding of the problems of current and potential aquaculture adopters and development practitioners. Establish an association (engagement) with other stakeholders	Inadequate participation/engagement of NGO's in aquaculture stakeholder forums	Identification of stakeholders and their needs and constraints. Preparation of an action plan and logical framework, and agree milestones (business plans) of each producer
Producers stakeholders					
6. Fish farming clusters	Formation of consortium that includes all stakeholders in the production chain in every county. Establish fish marketing collection centres in every county	Capacity building of cluster groups, establish proper mechanisms for information flow	Attitude change on benefits of being in a group/cluster, improve group operations/cohesiveness	Not working as one; weak group organization, individualism, lack of commitment by members	Interactions among different stakeholders; how to work better as a cluster; know how to improve farmers' fish production and their returns on investment
7. Fish seed producers (individual)	Increased number of fish farmers, increased production from aquaculture	Training on fingerling propagation, Tilapia mono-sex production and cross cutting issues to ensure availability of quality seed	Improve management, ensure production of quality products	Production of low quality seed and inadequate numbers	Identify the best scientific and appropriate low-cost methods for sustainable aquaculture in local conditions
8. Grow out fish farmers (individual)	Increased fish production	Provide technical know-how to all levels of farmers especially resource-poor farmers	Improve management, ensure production of quality products	Poor pond management; inconsistent supply of fish	Know how to improve farmers' fish production and their returns on investment
Support					
9. Fish feed producers	Availability of affordable quality ingredients for production of feeds	Collaboration/partnership with crop farmers to ensure production of crops with high protein content (sunflower, cotton, soya)	Ensure production of quality affordable feeds	Low quality products and high cost of feeds; high cost of ingredients	Interaction with different stakeholders; How to ensure better collaboration with customers
10. Fish traders	Availability of adequate quality fish from fish farming; various sizes depending on market demand	Working together with fish farmers; standardization of fish prices within the country	Engage producers to ensure they produce products required by market	Lack of platform for producers and traders to engage	Interaction with producers and other stakeholders

Table 6: Characteristics of fish farming systems in Kenya

	Fish farming system	Characteristics
1	Subsistence farming	1. intermittent manuring and feeding 2. No fixed harvest cycle 3. Produce fish for sale 4. Have a pond dedicated to home consumption or consume what is left after sales 5. Initially produced own fingerlings but this is now prohibited by new government regulations which prohibits use of fingerlings from non-authenticated farms 6. Sell excess fingerlings in spite of the ban, manure and feed 7. Inconsistent harvest cycle
2	Small-enterprise (small-scale)	1. Produce fish for sale 2. None/minimal amount of fish used for home consumption 3. Purchase fingerlings and feed 4. Have improved fish husbandry inputs such as manure and feed programmes in place 5. Planned harvest cycle
3	Medium-enterprise (medium-scale)	1. Produce fish for sale 2. Produce own fingerlings, 3. Undertake sex reversal (Tilapia), artificial propagation (Catfish/Trout) technology 4. Purchase feed and manure 5. Planned harvest cycle
4	Large-enterprise (large-scale)	1. Produce fish for sale 2. Produce and sell fingerlings; 3. Use sex reversal technology; 4. Manufacture own feeds and manure regularly 5. Planned harvest cycle

Table 7: The nature of fish farming in Kenya

Farm system	Number of units	System yields (t/ha/yr)	Labour/farm	No. of people employed
Subsistence	4,627	2	Family (Tilapia)	4,627
Small-Enterprise (small-scale)	9,395	2 - < 6	2-3 part time employees (Tilapia, Catfish)	18,790 - 28,185
Medium-Enterprise (small-scale)	10	6 - < 10	5-20 employees (Trout, Tilapia)	50 - 200
Large-Enterprise (Large-scale)	1	> 10	20-90 employees (Tilapia, hatcheries)	20 - 90

General overview of each location

Central Kakamega Aquaculture Cooperative Society, Kakamega County

This Cooperative Society is located in Kakamega County and has been together for six years. The main purpose for their coming together was to have a platform to share ideas and knowledge; for collective marketing; and provide assistance for the acquisition of inputs.

The cooperative has 40 members, 33 males and seven females. Looking at the gender roles related to fish farming, it can be observed that most fish farms are owned by men; pond construction is carried out predominantly by men, although women also help; pond management is carried out by both gender; value addition and marketing is dominated by women, although a few men are also involved; and harvesting is mostly carried out by young people.

The membership structure consists of seven officials, with the rest of the cooperative made up of ordinary members. The membership fee is Ksh 500, share contributions are Ksh 10 (minimum 100 shares) and monthly contributions are Ksh 250. The organization has by-laws. The Cooperative Society is registered with the State Department of Cooperative Development and has a registration certificate.

Current benefits for members include attracting funding and training for its members, as well as assisting members with marketing their fish.

The current yield levels for different systems (stakeholder analyses) are as follows:

- Extensive system: 0.1 to 0.3 kg/m² per year
- Semi-intensive system: 0.3 to 0.6 kg/ m² per year

Equipment is available in shops but farmers lack adequate capital to purchase it. The main equipment used includes weighing scales, wheelbarrows, spades, jembes (hoes), secchi disks, nets, thermometers and cool boxes. Access to equipment could be improved through subsidies and grants.

Extension services are provided by the State Department of Fisheries.

The water used in the ponds is mainly sourced from springs and streams and is very good quality. Monitoring of pond water quality is not very common as most farmers lack any equipment to monitor water quality parameters. Pond wastewater is used in some instances to irrigate crops or is just drained out.

Some members source seed from authentic hatcheries, while others use their own seed. The cost of fingerlings is Ksh 5 per piece (US \$0.06) with the stocking density being three fish per square metre.

The farmers use a mixture of feeds, from aqua-shops, their own formulations, kitchen waste and potato leaves, etc. On-farm feed formulations are made using locally available materials, for example rice bran, Lake Shrimp (*Caridina niloticus*), cotton seed cake, etc. The Pearson's Square Method is used to calculate the quantities to be mixed together. Currently on-farm feed costs Ksh 50 per kg (US \$0.6), while those purchased from the aqua-shop cost Ksh 90 per kg (US \$1.04). Farmers normally purchase small quantities of one to five bags (one bag is 20 kg).

Most farmers in the group use family labour, occasionally hiring casual labour to carry out pond maintenance, harvest fish, sampling, etc. Casual labour is paid between Ksh 250 (US \$2.90) and Ksh 300 (US \$3.50) per day. Only a few farmers hire full-time labourers.

Although support from the extension services is good and useful, it is inadequate. Extension officers are few and provision of services is poorly funded. The number of extension officers needs to be increased and their movements need to be facilitated.

Credit facilities are available from lending institutions, for example at Equity or the AFC. However, conditions for obtaining credit are very tough. Available credit is not tailored for aquaculture, but for general agriculture. There is a need to tailor credit offered to suit the aquaculture farmers, as it is very different to terrestrial farming.

Access to markets and marketing of farmed fish is poor due to non-existent market linkages and poor market information flow. Transporting fresh fish to market is a challenge as roads are constantly in a bad state. There are no special handling or transportation facilities or equipment. Fish is sold at the pond bank, in open markets, at trading centres and at local hotels, but prices for farmed fish are low and fluctuate. Fish are sold fresh or fried per piece; 250 - 300 grams of fish sells for between Ksh 80 - 120 (US \$0.93 - 1.4).

The peak season for sales is December, around Christmas time. The lowest sales seasons are January, May, and September when the school terms begin.

Changes that have been observed in the last five years include: a tremendous increase in the number of fish farmers and group membership; an increase in the volume of fish produced, even though yields have not changed much; increased demand for fish with increased prices; and improved extension services delivery, as a result of an increase in the number of extension officers. The species farmed have not changed and are still Nile Tilapia and the African Catfish, however there has been a shift from the use of mixed sex Tilapia seed to mono-sex Tilapia seed.

Additional livelihood activities of fish farmers include crop farming (maize, beans, and sugar cane), dairy farming, bee keeping and poultry keeping. The group has various challenges and opportunities as outlined in Table 8 below:

Table 8: Challenges and opportunities for the Kakamega Group

Challenges	Opportunities
Expensive feeds	High demand for fish
Lack of adequate knowledge and skills for aquaculture	Diverse market segments
Theft of fish from ponds	
Marketing (low prices)	

The following would help overcome the challenges: training in areas of pond management and farming as a business; technical training to formulate and produce on-farm feeds; and use of the right equipment. In order to make the most of available opportunities it is necessary to build the capacity of the farmers to enable them to produce more fish to meet the higher demand.

Previous and current development support includes the FAO Technical Cooperation Project (TCP), capacity building, Economic Stimulus Program (ESP) by the Government and pond construction. The previous support assisted in training and the development of a business plan and working as a group, however what remains is ensuring the members work together and the Cooperative Society operationalizes the marketing collection centre.

Muuangano Fish Farmers – Siaya and Vihiga County

The Muuangano Fish Farmers group has been together for two years and is the result of a merger between two clusters, Yala and Luanda. The two groups were located in two different counties, Yala in Siaya County and Luanda in Vihiga County. The main purpose for their coming together was to have a common platform to access trainings; to improve marketing; to share ideas and experiences on fish farming; to tackle challenges as a group; and to practice fish farming as a business.

The group consists of 40 members, composed of 30 males and ten females. Looking at the gender roles related to fish farming, it can be observed that women do not own land and therefore do not own ponds; pond construction is done by both men and women; pond management is carried out by women and children; harvesting is carried out by men; and value addition and marketing is dominated by women.

Muuangano Fish Farmers charges a membership fee and collects monthly contributions from members. The members are made up of officials (Chairman, Vice Chairman, Secretary and Treasurer) and ordinary members. The operations are guided by a set of by-laws (constitution) developed by the group. It has in its ranks young people, the elderly, and cuts across poor and fairly well off members.

The group is registered as a community-based organization (CBO) and has a registration certificate from the Ministry of Youth, Culture and Social Services. It has not obtained the requisite trade licence and health permits for individual members.

Membership provides the following benefits: it helps members with the marketing of their fish; it encourages a staggered production within the cluster and collective marketing that ensures continuous availability of fish in the market; it ensures a stronger bargaining power and better prices for farmers; and it has improved access to training and development assistance for members. It is the policy of most development partners and the government to assist groups of people, rather than individuals, as it helps tackle welfare issues concerning group members.

Members of the group operate their farms at different management levels. These are: extensive levels (0.15 kg/m² per year); semi-intensive with mixed-sex Tilapia (0.5 kg/m² per year); and semi-intensive with mono-sex Tilapia, which yields 1 kg/m² per year.

Muungano Fish Farmers group owns one net, one weighing scale, three harvesting baskets and a marketing outlet. The aquaculture equipment and materials are available in local shops, but most farmers cannot afford to buy on their own. The group and its members have easy access to extension and consultancy services, and the provision of these services is currently good, but inadequate. Extension officers are thinly spread on the ground. It is of the opinion that access to equipment can be improved through grants and soft loans.

The majority of members source their pond water from springs and ground water. The quality of water is good. Pond effluents are released to irrigate crops.

The fingerlings are sourced from Jewlet Enterprises, Dominion Farms, the Ministry of Fisheries Farms and LBDA fry production centres. Fingerlings are sold at between Ksh 5 - 7 per piece. Most members stock fish at a density of three fish per square metre .

The members of Muungano Fish Farmers normally use feeds supplied by the ESP program from Ugachick and Sigma Feeds, priced at Ksh 80kg. They also use single ingredients like Lake Shrimp (*Caridina niloticus*) bought at Ksh 60 per kg (Goro Goro is 2 kg per tin). The group produces and uses on-farm formulated fish feeds. The ingredients used include Lake Shrimp, rice bran, maize bran, cassava, and vitamin premix. This product is sold at between Ksh 50 - 65 kg (crude protein 26 percent).

The fish farms are small in size, and consist of a few fish ponds each. Family labour is mainly used on the fish farms. Occasionally casual labour is hired at a daily rate of Ksh per person for help with pond maintenance and harvesting.

Extension services are provided mainly by the State Department of Fisheries. The information they provide is useful. However, extension officers are few and lack the necessary equipment and materials.

Access to credit is poor due to the high interest rates that lending institutions charge. The high cost of credit therefore scares away many potential aquaculture investors. Credit available is not tailored toward aquaculture. This situation needs to be improved by lowering interest rates.

The markets are available and are accessible, but meeting the requirements of supplying some market segments is difficult. The markets require a regular and reliable supply of fish, a condition that most small-scale fish farmers cannot meet. Fish handling is not up to standard. Fish is transported using bicycles and motorcycles and the fish is transported to the market using inappropriate equipment.

Fish is mainly sold per piece in local markets and at the pond site. Wholesale fish traders also buy, but are known to offer lower prices. Prices depend on size, but a table-sized fish of 250g is sold at a range of Ksh 70 - 150, depending on location and the market where it is sold. Prices and demand fluctuate and are seasonal. Demand is high during the school holidays.

Fish volumes have increased over time. Demand and markets have also increased. Species farmed remained the same (Nile Tilapia and African Catfish). Group membership has dropped as some people have abandoned fish farming. Extension service provision has improved. There are now more extension officers than there were five years ago. The availability of inputs has reduced.

Members of Muungano Fish Farmers also engage in crop farming (maize, beans), horticulture (vegetables, tomatoes), livestock and poultry keeping, and some run small businesses.

The challenges and opportunities faced by the members of Muungano Fish Farmers are outlined in Table 9 below.

Table 9: Challenges and opportunities for Muungano Fish Farmers

Challenges	Opportunities
Expensive and poor quality feeds	Increasing demand for fish and emerging new markets
Theft of fish in ponds	
Poor access to credit	
Poor handling and marketing of farmed fish	
The cost of credit is too high	
Inadequate knowledge and skills of fish farming	

A series of trainings on various aspects of fish farming would help. Empowering farmers to produce their own feed would also go a long way in easing the challenge of expensive and unavailable, industrially produced feed. Increase quality control measures on fish inputs would also be positive.

Training geared towards increasing fish production is necessary. There is also a need to provide the right equipment and infrastructure for the marketing of farmed fish. The formation and strengthening of a fish cooperative would also help make more opportunities available.

Muungano Fish Farmers has received some support from the FAO TCP and MESPT. This has been effective, but they still require support to operationalize the marketing collection centre.

Tilapia Fish Farmers Group – Kisii County

This group is located in Kisii County and has been together for four years. Their reason for coming together was to ensure access to market and quality inputs, using a group approach. They also intended to improve access to funding and assistance in general.

The group comprises 24 males and 14 females. In terms of gender roles and responsibilities, daily pond management and marketing of the fish is mainly done by the women; while the men carry out pond construction with assistance from the women.

The group consists of officials and ordinary members. It has by-laws that guide their activities. The group charges a membership fee of Ksh 200 and in addition, members contribute Ksh 300 per month for development and Ksh 100 per month as part of a merry-go-round (table banking) system.

The group is registered with the Ministry of Social Services and has a registration certificate, however it does not have the requisite licenses for marketing.

Currently the group helps members with marketing, pond construction and also tackles welfare issues.

The average yield for the group is from a semi-intensive system at 0.4 kg/m² per year.

Access to equipment is poor as members of the group do not own basic fish farming equipment. The most common equipment used includes seine nets, weighing scales and hapas. Access to equipment could be improved through government subsidies.

The source of water for most of the fish farms comes from streams and springs. These are year-round sources, of reasonable quality. Pond effluents are used to irrigate crops.

Seed is sourced from the Government Fish Farm in Kisii and Jewlet Enterprises in Kendu Bay. The fish are stocked at a density of three fish per square metre. Seed is bought at the fry stage at Ksh 6 per piece.

The farmers use manufactured feed (floating pellets) from the ESP program (Sigma and Ugachick feeds), costing Ksh 80 per kilogram. They also use farm-made feed and plant material, such as sweet potato leaves and cassava leaves. Single ingredients such as Lake Shrimp (*Caridina niloticus*) and rice bran are also used. Lake Shrimp costs roughly Ksh 50 per kilogram.

The group depends solely on family labour. Although extension services are available they are inadequate given the small number of extension officers. There is a need to engage more extension officers to increase the frequency of their visits.

Although credit is available in banks, the group has not yet sought any, mainly due to the high interest rates.

Access to markets is average with most of the fish being sold on site to neighbours or fish traders in Kisii town. Fish prices are seasonal with prices peaking when schools are open. The price of fish ranges between Ksh 250 - 300 per kilogram.

Group membership has increased from 32 to 38. The demand for fish, fish prices and markets have all increased over the last five years. The species farmed are Nile Tilapia and African Catfish. Over the past five years, despite inadequate extension services, there has been an overall improvement. This is a result of recent recruitment of more extension officers. Inputs have become more readily available and aqua-shops have been introduced in the area.

The group engages in a number of other livelihoods such as tea production, and maize and banana farming. They also breed poultry and livestock. The group's challenges and opportunities are outlined in Table 10 below.

Table 10: Challenges and opportunities for the Tilapia Fish Farmers Group

Challenges	Opportunities
Transportation of fish to the market	Increasing demand for fish
Lack of cold storage facilities	

In order to overcome these challenges there is need for support in terms of training, provision of pond management skills and marketing equipment. There is also a need to improve the fish farming infrastructure. Access to equipment and capacity building will help increase fish production.

Previous support received by a few members includes pond construction; provision of seed and feed through the Government of Kenya ESP program, under the Ministry of Fisheries; and the installation of pipes through the Ministry of Social Services.

Great Wangchieng Fish Farmers Community Based Organization, Homa Bay County

The Wangchieng group is located in Homa Bay County and has been together for 3 years. The group was formed to present a strong voice on fish farming issues. They seek to benefit from the strength of numbers in marketing.

The group is comprised of 61 males and 41 females. Most ponds are owned by the men as they own the land. Pond management is mainly done by the women whilst pond construction is carried out by the men. Both men and women conducted marketing activities. The group is comprised of old, young, male and female members. The organization has by-laws that govern group relationships and activities. Membership has two categories - officials and ordinary members. The group charges a membership fee to those wishing to join from outside the community.

The organization is registered as a CBO by the Ministry of Social Services. It does not however, have any premises for trade. Members also lack health permits that are required by law.

The group helps with marketing and provides security for the fish ponds. It is also a platform for information and ideas exchange.

Most Wangchieng CBO members practice semi-intensive fish farming. The average yield of this level of management is $0.45\text{kg}/\text{m}^2$ per year.

Currently the group has poor access to equipment. Wangchieng CBO hires a seine net when they want to harvest. Extension services are available, and equipment used includes a weighing scale, seine net, cool boxes, handling baskets and scoop nets. Access to equipment could be improved through the removal of value added tax (VAT).

Springs are the main source of water for the ponds and the quality is very good. Not enough attention is given however, to effluent disposal.

Seed is sourced from Jewlet Enterprises at the fry stage, which costs Ksh 7 per piece. The organization uses manufactured feed supplied under the ESP program by, Ugachick and Sigma feeds. Single ingredients such as Lake Shrimp and rice bran are also used. This homemade feed is sold at Ksh 40 per kilogram.

Farm sizes are small and they make use of family labour. Extension service provision is good but inadequate. The mobility of extension officer's needs to be enhanced and the number of extension officers needs to be increased.

Credit is available in banks but access is poor – costs are very expensive. A special package tailored to meet the unique conditions for fish farming needs to be developed. Market access is poor – there is competition between captured and farmed fish. Prices offered for farmed fish are quite low.

Nile Tilapia and African Catfish are the most commonly cultured. Group membership, production volumes, demand, markets and prices have dramatically increased over the last five years. Demand is seasonal and is highest in the month of August.

Outside of fish farming, members practice horticultural farming, produce maize and beans and are involved in breeding poultry and livestock. The challenges faced by this organization and the opportunities available to them are given in Table 11.

Table 11: Challenges and opportunities for the Wangchieng organization

Challenges	Opportunities
Flooding of ponds as a result of rising lake levels	Declining stocks in the lake
Low fish prices in some areas (marketing)	Favourable climate
Feeds are expensive	
Some inputs such as Lake Shrimp are seasonal	

Improved access to credit; the provision and supply of equipment at subsidized prices and an improved flow of marketing information and strengthened linkages are all necessary. Training is also crucial for success. Capacity building and subsidized inputs will help the group make the most of the opportunities available.

The Wangchieng CBO has previously received assistance from 2 groups. The Mango Group (NGO) constructed ponds, supplied seed and feed to group members. The Wangchieng CBO has also received heavy support from the Government ESP program, which constructed ponds, provided seed and feed, and trained members. The support was effective, but inadequate.

Butala Pond Fish Farmers Cooperative Society Ltd. – Busia County

The cooperative is located in Busia County and has been together for three years. It was formed to produce fish feed and alleviate fish feed shortage amongst members.

The Butala Cooperative now consists of 70 males and 11 females, of mixed ages. Men own most ponds. Women are better pond managers than men, but both conduct pond management. Pond construction is dominated by men. Women dominate fish marketing, but men also do it.

The cooperative is comprised of leaders and ordinary members. There are nine officials who form the management committee, three supervisory committee members, and the rest are ordinary members. The group charges a membership fee of Ksh 100. Members can also buy shares at Ksh 1000, and each member needs to buy a minimum of five shares. The cooperative comprises 14 fish farmer clusters. Those who seek to join must have an active pond. The group is registered under the Cooperative Act of Kenya. It has developed a set of by-laws that guide activities and govern relationships. It is a marketing tool and helps members with marketing their fish. Members can also request the cooperative for credit.

Most farmers practice fish farming under a semi-intensive level of management. The average yield is 0.67 kg/m² per year. Current access to equipment is poor. Access to extension services is acceptable. There is a lack of marketing infrastructure for farmed fish, and equipment used includes wheelbarrows, machetes, secchi disks, nets and scoop nets.

Springs are the main source of water for aquaculture activities. The spring water quality is quite good. Seed is sourced from Uganda, purchased at the fingerling stage at a cost of Ksh 3 per piece. The cooperative produces its own farm made feed from locally available ingredients at Ksh 40 per kilogram. The group's pelletizer produces 20 - 50 kg of feed per day. Members also buy Ugachik feeds at a subsidized price of Ksh 60 per kilogram.

The fish farms mainly rely on family labour. Daily casual labour costs Ksh 200 per person, and is occasionally hired to maintain pond areas and to harvest fish.

Extension service provision is inadequate as there are not many extension officers. They do however, give useful information. Employing more, and training them frequently could improve the situation.

Access to credit for fish farming is poor – the cost of credit is very high (high interest rates). Lending institutions do not understand the economic potential of fish farming. There is a need to lower interest rates so that farmers can afford credit to expand their fish farming businesses.

Access to markets for fish farmers is also poor. Fish is sold either at the pond, at local open markets or transported to far off markets.

There are no special containers to transport the fish to market, and farmed fish is considered inferior to wild fish. There are no cold storage or cooling facilities. Fish is sold at Ksh 100 - 120 for fish weighing between 250 and 400g and is mostly sold fresh.

Membership of the cooperative has increased due to benefits received. Fish prices, volumes of fish produced and demand for fish have all increased. Nile Tilapia and African Catfish are the main species cultured. Share contributions have gone down as a result of the hard economic times. Extension service provision has improved, but not enough due to their limited number. Members of the cooperative, in addition to fish farming, practice crop farming, livestock and poultry farming, small-scale businesses, and some are in formal employment.

The challenges that the group faces and opportunities available to them are listed in Table 12.

Table 12: Challenges and opportunities for the Butula Group

Challenges	Opportunities
Feeds are of low quality and they are very expensive	Climate is favourable
Market accessibility is poor for farmed fish	Government support and goodwill
	Land is available

Marketing infrastructures need to be developed, such as refrigeration and cold storage facilities. Farmers need to be able to produce their own on-farm feed. Capacity building and training, and improved access to credit are crucial.

The group received feed subsidies and training from the Government's ESP project, and they also received a feed pelletizer. The trainings have been very useful and the pelletizer has helped reduce the cost of fish feed in the area.

Training needs: results per location

Training needs have been derived from the last step in the needs assessment process, which is the prioritization of issues to have an idea of which areas to focus on first (Annex H). This is not to say that some of the issues are not important – as they all have an affect on the economic performance of the fish farms, and by extension the community. By prioritizing issues, and with limited time and resources, this will determine: which issue to address; whether addressing one issue more comprehensively may help solve other issues; whether all issues should be addressed; or whether they should be left to others. Prioritization can help focus on new areas for funding, with implementing new strategies, developing more partnerships, integrating services and creating change.

What are the priorities in terms of aquaculture development and business?

The priorities in terms of aquaculture development and business that were identified during the stakeholders meeting, as well as from interviews with fish farmers who are operating at different levels of production, include the following:

- Training on fingerling propagation, Tilapia mono-sex production and cross cutting issues;
- Fish marketing collection centres established in every county;
- Capacity building of cluster groups;
- Access to improved technologies;
- Standardization of fish prices within the region;
- Formation of a consortium that includes all stakeholders in the production chain in every county;
- Establishment of proper mechanisms for information flow;
- Improved access to quality feeds;
- Increase in the number of ponds;
- Improved access to affordable credit;
- Fish farmers empowered to make their own feeds;
- Marketing linkages for fish farming products are developed – development of more marketing channels;
- Easy access to fish farming gear, inputs and equipment;
- Improved pond management;
- Availability of seed in terms of quality and quantity;
- Quality, reliable and harmonized extension services;
- Source of income and revenue collection;
- Source of employment;
- Source of food.

How would you like the situation to be in 12 months time?

The objective would be to see aquaculture production increase by 30 percent in the next 12 months through undertaking the following:

- Training of all stakeholders along the value chain;
- Subsidization of seed and feeds by the government;
- Development of a marketing structure for farmed fish;
- Vetting of farmers who want to engage in fish farming, ensuring their commitment.

What is needed, if anything, to help you achieve this objective (empowerment, training, inputs, enabling environment, other)?

Farmers felt that what they needed most to help them reach their objectives were:

- Motivation to help assist small-scale fish farming clusters to develop market linkages;
- Financial empowerment in terms of ensuring farmers access to affordable credit;
- Training on proper marketing linkages and contractual fish farming;
- An enabling environment in which they are able to easily access information; obtain licences; and get whatever is needed for investment in the industry.

What activities to the fish farmers need to change or do differently to improve their operations and businesses? What are the problems? What are causing the problems?

In terms of improving their operations, fish farmers need to embrace fish farming as a business. They need to: improve record keeping; strengthen their clusters so that the cluster can work for them; undertake farmer-to-farmer exchange visits; and ensure they develop proper market linkages.

The main challenges that the fish farmers are facing include poor marketing strategies and inadequate availability of quality feed and seeds. The main causes of this are dishonesty among suppliers: a number of producers are producing low quality products and supplying reduced quantities of seed and feed. There is lack of controlled competition and in a number of instances poor accessibility.

It is important to know the various roles being played by the relevant stakeholders and whether there is a need for them to adapt, and how. Some thoughts included:

- Feed producers should make age specific diets to ensure a proper diet to targeted fish;
- Hatchery operators should breed mono-sex Tilapia to help grow-out fish farmers control Tilapia breeding. This will help reduce in-breeding in overpopulated ponds;
- Input producers need to label their products;

- The government should intervene on the high cost of feeds – this can be done through tax exemptions on raw materials;
- Consumers need to change their attitude towards farmed fish (perceptions are that it is inferior to wild fish). The private sector should integrate value addition in marketing to enable access to different market segments;
- Intensification of quality feeding by farmers is done through the use of quality feeds;
- Extension workers need to make regular visits to fish farmers, and give farmers relevant and accurate information;
- The government should offer on-farm training for farmers to gain practical experience;
- Feed producers should improve the quality of their products;
- Fish traders need to give put farmed fish on a level playing ground with wild fish in the market;
- Farmers should be consistent in the management of their ponds and become more business oriented.

What level of farmer performance is required? What is the actual performance level now?

Currently the actual performance level in terms of yield is slightly below average when compared to the level required. Results of the assessment put the fish farmer groups at different levels as indicated below:

- Kisii Group: Level of performance should be at least 1 kg per m² per year. The actual level of performance is 0.5 kg per m² or below;
- Homa Bay group: Level of performance required is 240 kg per 300 m² per year. The actual level of performance is around 25 percent;
- Homa Bay farmers: Level of performance required is 240 kg per 300 m² per year. The actual level of performance is 160 kg per 300 m² per year;
- Kakamega: Level of performance should be at least 1 kg per m² per year. The actual level of performance is 0.9 kg per m² or below;
- Luanda/Yala Cluster: Level of performance should be about 240 kg 300 m² per year. The actual level of performance is around 50 percent.

What behaviour, knowledge, skills and attitudes do fish farmers need to carry out their work better or to the desired level?

The type of behaviour, knowledge, skills and attitudes that fish farmers need to carry out their work better or to the desired level includes the following:

- Dishonest suppliers of input should be checked frequently;
- Farmers should receive continuous training;

- There is a need to consider fish farming as a business;
- Cooperatives should be formed and members should purchase shares to access credit;
- Farmers should be enterprise minded, change subsistence attitude and have patience;
- Post harvest handling techniques should be improved, fish handling should be done with care;
- Farmers need training and have good public relations; need to know how to motivate and inspire employees; and how to produce quality products;
- Farmers should become business-oriented. They need basic accounting and book keeping skills, knowledge of record-keeping, be self-reliant, work hard and have a passion for the enterprise;
- Young people should be linked to or engaged in fish farming.

What is already in place that will help fish farmers learn and apply new knowledge and skills?

Fish farmers identified the following as what they felt was already in place that would help them learn and apply new knowledge and skills:

- A number of ponds, small scale feed production machines and fingerling production farms and hatcheries are in operation in the different counties;
- Trained clusters that could be used during exchange visits;
- Trained technical staff;
- Government interventions that bring in more players at different levels of the industry;
- A group or cluster approach that can be used to strengthen enterprises;
- Availability of raw materials for feeds;
- Availability of manpower;
- Availability and access to information, communication and technology;
- Existing extension networks and government farms for demonstration and learning;
- Clusters or groups that are in place, operational and can be used for learning.

What will make it difficult for fish farmers to learn and apply new knowledge and skills and why?

The following issues were identified as those that would make it difficult for fish farmers to learn and apply new knowledge and skills:

- Technical staff and trainer-of-trainers lack expertise to pass on information;
- Inconsistent information from different extension service providers;
- Preoccupation with challenges of life and the worries of livelihood;
- Illiteracy and language barriers, the farmers lack business language;
- The poor state of existing ponds is a bad example to other farmers as they reduce their interest to improve;
- When knowledge is not practically oriented;
- The distance between researchers, farmers and extension workers;
- A lack of fish farming equipment when it is needed;
- Attitude, a number of fish farmers are not taking fish farming seriously as a result of having other responsibilities or distractions;
- The level of education, culture and age;
- Lack of capital to invest in new knowledge, ideas and facilities;
- Lack of seriousness by some farmers;
- The loss of hope when the farmers cannot see the possibilities of making a profit.

What are the solutions to the problems that will make learning and applying new knowledge and skills difficult? This will include provision of equipment, materials, an enabling environment, market support, etc.

Fish farmers felt that appropriate solutions would be:

- A tax exemption or reduction of tax on inputs;
- The provision of input subsidies for farmers;
- Practical training for existing farmers to improve pond management (can also be based on age groups);
- Sharing of success stories from those who have made a profit, and exchange visits;
- Market support through development of market linkages and provision of marketing equipment such as deep freezers, cool boxes and weighing scales;
- Support in terms of pond management equipment, for example special gear, secchi disks, water pumps and liners;
- Recruitment of more qualified extension workers;
- Financial support through ensuring access to affordable credit.

Other than direct training, what other cost effective ways are there to achieve the desired improvements in knowledge, skills, attitudes and behaviour?

Other than direct training, farmers listed other cost effective ways of achieving the desired improvements in knowledge, skills, attitudes and behaviour as follows:

- Undertaking study tours to successful fish farmers and exchange visits between farmers;
- Practical trainings and field days;
- Frequent visits by extension workers;
- Creation of demonstration farms;
- Dissemination of information through media, and eventual establishment of a website.

What kind of training will best help farmers achieve their fish farming business objectives and improvements?

The farmers suggested that the kind of training that would best help them achieve their fish farming business objectives would be:

- A three-day theory session, followed by an on-farm practical training or study tour;
- Exchange visits between farms;
- Practical on-farm training on fish farm management, pond management, seed production, sampling techniques and production methods;
- Simplified accounting and book keeping sessions;
- Marketing linkages and strategies, business skills, value addition, entrepreneurship, resource mobilization and on-site feed formulation sessions;
- Group cohesion and networking.

What previous training have farmers had and by whom?

Previous trainings that fish farmers have undergone include:

- Site selection for ponds, pond construction, stocking, pond management, marketing, record keeping, harvesting, fingerling multiplication by GOK, FAO and Trilateral;
- Business planning by GOK, FAO and Farm Africa;
- Best Management Practices by USAID, FAO and Farm Africa.

What was good and what did you enjoy?

For the farmers, gaining new knowledge and skills was very exciting. The topics were informative and comprehensive, and were taught in a good environment. Topics enjoyed the most included:

- Aquaculture as a profitable business;
- Practical feeding lessons;
- Water quality testing;
- Issues of budgeting;
- Practical application of pond management skills;
- Farming of mono-sex as opposed to mixed sex Tilapia;
- Record keeping.

What did you find useful about any previous training?

Farmers stated the following as being useful from previous training:

- Learning how to manage ponds easily;
- Practical training;
- The cost effective way of feeding fish, as well as breeding;
- Sampling techniques;
- Budgeting and costing for business;
- Networking with new farmers that opened avenues for farming as a business;
- Group orientation.

What would you like to be done differently in any future training?

For future trainings, farmers suggested the following:

- The number of training days should be increased from one or two days to five days, with more emphasis on practical elements of operating performing fish farms;
- They should hear from successful farmers and see videos of successful projects elsewhere;
- Improve group dynamic trainings for cluster members;
- Training should be as practically oriented as possible and carried out on a fish farm;
- Trainers should speak both English and Kiswahili.

Which individuals need training and how much training is required?

The following individuals were identified as those who need immediate training:

- Farmers who have not attended any training and others with no practical experience;
- Feed producers, especially small scale feed producers;
- The leadership of clusters, and clusters with new members;
- Pond constructors;
- Farm and pond managers;
- Grow-out farmers;
- Seed producers, with a lot of practical demonstrations (especially new farmers);
- Extension workers;
- Fish handlers;
- Fish farmers also need continuous training on new technologies.

The priority ranking on who needs training, as well as the training needs modules, are given in Table 13 and Table 14.

Table 13: Matrix ranking of training needs of different aquaculture stakeholders

Group	Amount of Training Needed
Farmers who have not attended training and farmers with limited practical experience	5
Small-scale feed producers	4
Cluster leaders and clusters with new members	5
Pond constructors	4
Fish farm/pond managers	4
Small-scale, grow-out farmers	5
Seed producers	4
Extension workers	3
Fish handlers/processors	3

Key:

Least training required: 1

Most training required: 5

Table 14: Training needs

Beneficiary name	Contact details	Training Module
Central Kakamega Aquaculture Cooperative	BOX 1969-50100 Kakamega, Tel. 0716-052180	Hands on practical training - pond management (water quality monitoring), entrepreneurship/business skills, feed formulation, feeding regimes, value addition, marketing, resource mobilization, group cohesion, study tour/exchange visits to successful groups and/or fish farms
Yala Fish Farming Cluster	C/O Dephine Okota P.O. Box 19 Yala Tel. 0700240727	Hands on practical training - pond management (water quality monitoring) entrepreneurship/business skills, feed formulation, feeding regimes, value addition, marketing, resource mobilization, group cohesion; study tour exchange visits to successful groups and fish farms
Bidii Fish Farmers merged to Muungano Fish Farmers	BOX 215 Luanda, Tel. 0723117706 /0713359044	Hands on practical training - pond management (water quality monitoring) entrepreneurship/business skills, feed formulation, feeding regimes, value addition, marketing, resource mobilization, group cohesion; study tour exchange visits to successful groups and fish farms
Tilapia Self Help Group	C/O John Nyamache P.O Box 9 Tel. 40200 0733871151	Hands on practical training, fish farm management/pond management, seed production, sampling techniques, production methods, simplified accounting and book keeping; group cohesion; study tour/exchange visits to successful groups and fish farms
Great Wangchieng Fish Farmers	Maurice Opendo, P. O. Box 46 Kobala; Tel: 0726 024032	Theory and elaborate hands on practical training, fish farm management/pond management, seed production, sampling techniques, production methods, simplified accounting and book keeping, hands on on-farm training, marketing linkages and strategies; group cohesion study tour/exchange visits to successful groups and fish farms
Butula Pond Fish Farmers Cooperative Society Ltd.	P.O. Box 34 Butula Telephone. 0701129529	Theory and elaborate hands on practical training, fish farm management/pond management, business skills, marketing linkages and strategies; group cohesion, study tour/exchange visits to successful groups and fish farms

Modes of training will include:

- Lectures and discussions led by facilitators;
- Video on improved technologies;
- Hands-on practical problem-solving training;
- Visit to commercial farm for hands-on demonstrations.

Input needs results per location

The equipment or materials that fish farmers felt would help them achieve their business objectives include: deep freezer and cool boxes for their groups' marketing collection centre to ensure freshness and quality of products; harvesting and sampling nets to ensure continuous and timely supply of products to the market; pond liners to reduce leaks from the ponds, especially during dry periods; weighing scales for better record keeping and data management; and fencing material to control predation (Table 15).

Other inputs or equipment that would assist in improving their business and achieve their objectives include: quality and affordable feed and seeds; fertilizers, both inorganic and organic; agricultural lime; water testing kits; and secchi disks (Annex H).

Table 15: Input needs

Beneficiary name	Contact details	Item/input	Justification of beneficiary and input
Central Kakamega Aquaculture Cooperative	BOX 1969-50100 Kakamega, TEL: 0716-052180	Deep freezer; cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing scales.	These inputs will assist farmers in managing their ponds according to BMP guidelines, to produce quality products that are accepted in premium markets. The group is setting up a marketing collection centre
Yala Fish Farming Cluster	C/O Dephine Okota P.O. Box 19 Yala Tel. 0700240727	Deep freezer; cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing scales; harvesting baskets.	These inputs will assist farmers in managing their ponds according to BMP guidelines, to produce quality products that are accepted in premium markets. The group is setting up a marketing collection centre
Bidii Fish Farmers	George Ambuli P.O. Box 215 Luanda, Tel: 0723117706 / 0713359044	Deep freezer; cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing scales; harvesting baskets.	These inputs will assist farmers in managing their ponds according to BMP guidelines, to produce quality products that are accepted in premium markets. The group is setting up a marketing collection centre
Tilapia Self-help Group	C/O John Nyamache P.O. Box 9 Tel: 40200 0733871151	Cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing balances, harvesting baskets	These inputs will assist farmers in good management of ponds; records management; preservation of fresh produce for the market, hygienic handling
Great Wangchieng Fish Farmers	Maurice Oondo P. O. Box 46 Kobala; Tel: 0726 024032	Cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing balances, harvesting baskets	These inputs will assist farmers in good management of ponds; records management; preservation of fresh produce for the market, hygienic handling
Butula Pond Fish Farmers Cooperative Society Ltd	Alex Ouma Abwao P.O. Box 34 Butula Telephone: 0701129529	Cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing balances, harvesting baskets	These inputs will assist farmers in good management of ponds; records management; preservation of fresh produce for the market, hygienic handling

Registration needs per location

Registration or licensing is important for group management. It offers official recognition from the government and opens up avenues for access to credit facilities and financial support; markets; and the possibility to operate a bank account. In order for the clusters to be able to conduct their businesses legally and without disturbance from the authorities, they require a Traders Licence and a Public Health Certificate. Central Kakamega Aquaculture Cooperatives, Yala Fish Farming Cluster, Bidii Fish Farmers and Butula Pond Fish Farmers Cooperative Society require support to acquire the necessary licences (Table 16 and Table 17).

Table 16: Registration plan and costing

Beneficiary Name	Registration status	Licences and status	Support required	Benefits of this support	Costs of support (if any)	In-kind contribution
Central Kakamega Aquaculture Cooperative	Registered under the Cooperatives Act	They do not have trade licence or a public health licence for the collection centre	Traders licence is a public health certificate for the premises and for each individual working at the collection centre	The group will be able to conduct their business legally and without disturbance from the authorities	10,000/=	Group to pay 10% of costs
Yala Fish Farming Cluster	Registered with social services	They do not have trade licence or a public health licence for the collection centre	Traders licence is a public health certificate for the premises and for each individual working at the collection centre	The group will be able to conduct their business legally and without disturbance from the authorities	10,000/=	Group to pay 10% of costs
Bidii Fish Farmers	Registered with social services	They do not have trade licence or a public health licence for the collection centre	Need a traders license, health permit for the premises and a health certificate for individuals working there. Also need licence for running the feed pelletizer	The group will be able to conduct their business legally and without disturbance from the authorities	18,000/=	Group to pay 10% of costs
Tilapia Self Help Group	Registered with social services	Do not need any licence	Technical support on how to establish a collection centre			
Great Wangchieng Fish Farmers	Registered with social services as a CBO	Do not need any licence	Technical support on how to establish a collection centre			
Butula Pond Fish Farmers Cooperative Society Ltd.	Registered under the Cooperatives Act and its by-laws	They do not have trade licence or a public health licence for the collection centre	Need a traders license, health permit for the premises and a health certificate for individuals working there. Also need licence for running the feed pelletizer	The group will be able to conduct their business legally and without disturbance from the authorities	18,000/=	Group to pay 10% of costs

Table 17: Budget for registration and licence requirements

Name of Group	Amount Required Kshs	In-kind contribution (10%)	Total Amount Kshs	Total Amount US\$
Central Kakamega Aquaculture Cooperative	10,000	1,000	9,000	105
Yala Fish Farming Cluster	10,000	1,000	9,000	105
Bidii Fish Farmers	10,000	1,000	9,000	105
Tilapia Self-help Group	0	0	0	0
Great Wangchieng Fish Farmers	0	0	0	0
Butula Pond Fish Farmers Cooperative Society Ltd	10,000	1,000	9,000	105
Grand Total			36,000	419

Case studies per location and beneficiary

Case studies were carried out in Kisii, Siaya, Vihiga and Kakamega. The indicators were measured with the fish farmers at different levels of production and investment, using a formal type of questionnaire survey. Other tools that were useful for this activity include: baseline indicators; seasonal calendars for each location; matrix rankings; as well as an audit questionnaire matrix to establish current knowledge and understanding. The baseline indicators (Table 18) showed that farmers have different levels of investment as well as production. Their regard for fish farming is high as it is one of their main sources of income (Table 19) when compared to crops and livestock farming. The audit questionnaire matrix (Table 20) shows that almost all the 20 fish farmers who completed the questionnaire from the different locations have some level of understanding of fish spoilage and marketing.

Table 18: Baseline indicators

Name of fish farm/Enterprise/Farmer	Patricia Amenyia (individual small-scale farmer), Nyaura Widows Group member, Kisii County	Mabro Fish Farm, Usigu Uwaria Beach (medium-scale commercial farm, Siaya County)	Jane Okoth (small-scale fish farmer), Siaya County	Dephine Okota Small-scale fish farmer), Siaya County	Wycliffe Makamu (individual small-scale farmer), Vihiga County	Evans Kibwasi (individual small-scale farmer), Vihiga County	Andrew Lumumba (small-scale fish farmer,) Kakamega County	Wilfred Makokha (Safe Fish Farm, small-scale farmer), Kakamega County
Farm characteristics	Single pond (300 m ²) semi-intensive	10 acre farm, 29 ponds (8,500 m ²), has a hatchery, mainly fingerling producer (semi-intensive for out grower)	5 ponds, 738 m ² Semi-intensive	2 ponds, 600 m ² Semi-intensive	3 earthen ponds (900m ²) semi-intensive	2 earthen ponds (900m ²), semi-intensive	7 earthen ponds (796 m ²) semi-intensive fish farming	9 earthen ponds (3,552m ²) employs semi-intensive management
Yield from fish farming operations	0.52 Kg/m ²	0.33 Kg/m ² ; 50,000 fingerlings per cycle of 6 weeks in 190 m ² pond	0.5 kg/m ²	0.57kg/m ²	0.71 kg/m ²	0.6 kg/m ²	0.51 kg/m ²	0.71 kg/m ²
Production volume (seasonal calendar)	157 Kg/every 8 months	Has just started grow-out phase and is yet to harvest	365 kg/8mths	285 kg/8mths	420 kg every 6 months	360 kg every 6 months	15 Kg/month January to August 20 Kg/month September to December	160 Kg/month August to March 140 Kg/month April to July
Costs of production (per kg of fish)	Kshs 160/Kg	Kshs 180/Kg	Kshs 200/Kg	Kshs 180/Kg	Kshs 50/kg	Kshs 65/kg	Kshs 200/Kg	Kshs 180/Kg
Price per Kg obtained in main markets (seasonal calendar)	Kshs 300/Kg	Kshs 200/Kg	Kshs 250/Kg	Kshs 250/Kg	kshs 120/kg	kshs 90/Kg	300 Kshs/Kg March to September 350 Kshs/Kg October to February	Kshs 300/Kg August to March Kshs 250/month April to July
Total income (seasonal calendar)	Kshs 57,800	Fingerlings Kshs 50,000 to 300,000 per month	Kshs 147,000	Kshs 130,000	Kshs 167,000 per season	Kshs 108,000	Kshs 30,000 March to September Kshs 14,000 October to February	Kshs 724,000 per year
Challenges and constraints and frequency of these over past 12 months (matrix ranking)	Expensive feeds, marketing (buyers offering low prices)	Low demand for fingerlings	Challenges frequency Quality feeds monthly predation 1 predation 2 theft 1 Quality seed 1 Quality seed 1 market 1 Value addition 1	Challenges frequency Quality feeds Every day predation 2 theft 1 Quality seed 1 market 1	Feed availability, daily; lack of equipment; poor markets - 5 times a year	Fish theft; flood waters	High price of feeds; Poor access to feeds; predation (throughout the year)	High fish feed prices (throughout the year) Lack of cold storage facilities (daily)
Knowledge of production and marketing (audit questionnaire)	Data not available	Data not available	Data not available	Data not available	Data not available	Data not available	Data not available	Data not available
What makes fish go bad (bacteria and enzymes)	Bacteria in the intestines	Microbes, enzymes	Bacteria	Bacteria	Bacteria	Bacteria	Bacteria	Bacteria
What can we do to stop fish going bad? (use ice, avoid contamination with dirty places and equipment, harvest when it is cool in the morning)	Use cold storage facilities (fridge), store in cool place	Refrigerator, store in ice/insulated containers	Use ice or store in freezer, avoid contamination with dirty places and equipment	Use ice or store in freezer, avoid contamination with dirty places and equipment	Use ice, avoid contamination with dirty places and equipment	Avoid contamination with dirty places and equipment	Store in ice, in cool place, refrigerate	Use ice, store in deep freezer, handle with clean equipment and hands
What can make our fish unsafe to eat? (not using chemicals and drugs in production properly, contaminating the fish with dangerous bacteria (pathogens) from dirty water, poor personal hygiene, dirty equipment or surfaces)	Poor handling after harvest, poor hygiene of fish handlers	Contamination, poor handling	Contaminating the fish with dangerous bacteria (pathogens) from dirty water	Contamination with dirt, exposure to high temperatures	Contaminating fish with dangerous bacteria (pathogens) from dirty water	Contaminating fish with dangerous bacteria (pathogens) from dirty water	Poor handling, hygiene of fish handlers	Contamination with dirt, exposure to high temperatures
What affects the price of fish? (quality, size, supply of fish on the market, demand for fish e.g. number of buyers)	Demand	Quality, size, appearance, demand and supply	Size, quality, demand	Size, demand, quality	Demand for fish e.g. number of buyers)	Size of fish	Size, demand, form of product (fresh or processed)	Quality, type of market, size, demand and supply
What do we mean by advertising? (giving clear attractive messages to our customers and future customers about our product, where they can buy it and product benefits)	Informing customers of our products and services	Communicating with customers on availability of our product, its benefits, and location	Giving clear attractive messages to our customers and future customers about our product	Communicating with customers on availability of our product, its benefits, and location	Giving clear attractive messages to our customers and future customers about our product	Giving clear attractive messages to our customers and future customers about our product	Informing customers about goods and services available	Sending messages to customers and potential customers about goods and services available

How can we keep our customers happy? (always supply what they want in terms of size and quality, deliver on time)	Quality product, delivery on time, processing	Producing quality products, doing follow ups	Quality product, on time delivery,	Quality product, on time delivery,	Always supply what they want in terms of size and quality	Deliver on time	Provide a good quality product	Produce what the customer wants in terms of quality and price
Income sources (matrix ranking)	Rental houses 1, fish farming 2, maize farming 4, cows 5, poultry 3	Horticulture 2, fish farming 1, feed production 3, other businesses 4	Maize 1 Fish 2 Cows 3 Horticulture 4	Maize 1 Fish 2 Horticulture 3 Cows 3 Poultry 4	Poultry farming 2,Fish farming 1, general farming 3, dairy farming 4	Fish Farming 1, salary 1, general agriculture 3, dairy farming 4	Horticulture 70,000 1 Aquaculture 45,000 2 Part time employment 40,000 3 (per year)	Aquaculture Kshs 524,000/year 1 Sugar cane 200,000/year 2
Income levels from different sources (seasonal calendar)	Rental - during school term, fish,livestock	Fish farming Kshs 50,000/month; Horticulture Kshs 10,000/month	Kshs 202,700	Kshs 280,000	Poultry farming - Kshs 224,000, Fish farming - Kshs 167,000, General farming- Kshs 166,000, Dairy farming - Kshs 108,000	Salary - Kshs 324,000 Fish farming - Kshs 216,000, General farming- Kshs 50,000 Dairy farming - Kshs 42,000	Horticulture income high between June to December Aquaculture income high from October to February	Income highest between August to March
Household expenditure general (seasonal calendar)	Kshs 15,000 per month	Kshs 10,000/month (fish farm manager's household)	Kshs 190,000 15,000/month	Kshs 180,000 15,000/month	Kshs 330,000 per month	Kshs 120,000 per month	Dec. - March Kshs 10,000/month April - November Kshs 8,000/month	Jan. - March Kshs 50,000/month April - Dec. Kshs 30,000/month
Household expenditure on food (seasonal calendar)	Kshs 10,000 per month	Kshs 5,000/month	Kshs 70,000 5,900/month	Kshs 120,000 10,000/month	Kshs 16,200/ month	Kshs 9,600/month	Dec. - March Kshs 7,000 April - November Kshs 5,000/month	Jan.- March Kshs 20,000/month April - Dec. Kshs 15,000/month
Type of food consumed	Ugali, rice, vegetables, fish fruits (oranges, apples, papaya), tea, porridge	Ugali, fish, vegetables, meat, rice	Ugali, fish, meat, milk, vegetables, beans, tea, bread	Ugali, fish, meat, milk, chapati, vegetables, tea, bread	Meat, rice, bread, maize meals, milk, vegetables	Farm produce, processed food, produce from market	Maize, potatoes, vegetables, meat and fish	Fish, chicken, meat, and farm produce e.g. vegetables, corn, etc
Frequency of meals	Breakfast, lunch, dinner	3 times a day (breakfast, lunch, supper)	3 times/day	3 times/day	3 times/day	3 times/day	3 meals a day	3 meals/day
Quantity of food consumed	2 kg/day	1.5 Kg/day	2.5kg/day	6kg/day	Eat till satisfied	Eat till satisfied	3 Kg/day	5 Kg/day
Fish consumption e.g. species, products, quantities, frequency	Tilapia and Catfish 6 Kg in week	1 fresh whole Tilapia/day (2 times a week)	Tilapia – three times/ week Catfish – twice a month Omena – twice a week	Tilapia – twice a week Catfish - once a week Omena – five times a month	Tilapia, Catfish - fresh; deep fried	Tilapia - fresh and deep fried	Tilapia once/week Catfish once/month Omena twice/week Nile Perch once/month	Omena once/week Tilapia once/week Catfish once/month
Ways of coping with shocks and difficulties	Her children help when times are hard	Cut down on expenditure/reduce consumption	Seeks help from fisheries extension officers and other group members	Seeks help from fisheries extension officers and other group members	Feed shortage - supplement with locally available raw materials; equipment - borrow from Fisheries Dept; Marketing problem - advertise early before harvesting	Theft - cluster members have joint night patrols; floods - raise the height of dykes and undertake regular de-clogging of the main stream	Feed: make own-formulated feeds Provide own labour	Bulk feed purchasing Seeks help from extension officers

Table 19: Matrix ranking sources of income

Source of income	No of times chosen as income source based on revenue				
	No 1 (highest revenue)	No 2	No 3	No 4	No 5 (lowest revenue)
Rental houses	I				
Poultry		I	I		I
Dairy farming				II	
Cows			I	II	
Maize farming	II				I
Fish farming	IIII	IIII			
Horticulture	I	I	I	I	
Part time employment			I		
Salary		I			
Sugar cane		I			
Feed production			I		
General farming			II		
Other business				I	

Table 20: Audit questionnaire matrix

		Tick correct answer(s) or explain	Kisii County	Homa Bay County	Siaya County	Vihiga County	Kakamega County
No.	Question	Answers					
1	What makes fish go bad after harvesting?	Bacteria	IIII	IIIIII	IIIIIIII	IIIIIIII	IIIIIIII
		Enzymes	IIII	III			
2	What can we do to stop fish going bad?	Use ice	III	IIIIII	IIIIIIII	IIIIIIII	IIIIIIII
		Avoid contamination with dirty places and equipment	IIIIII	II	III	III	III
		Harvest when it is cool in morning	II	I			
			1 – chose 2 answers	1 – chose 2 answers	3 – chose 2 answers	4 – chose 2 answers	4 – chose 2 answers
3	What can make our fish unsafe to eat?	Not using chemicals and drugs in production properly	IIIIII	II	I	I	I
		Contaminating the fish with dangerous bacteria (pathogens) from dirty water	III	IIIIII	IIIIII	IIIIII	IIIIII
		Poor personal hygiene	II	IIII	IIII	III	III
		Dirty equipment or surfaces	I			II	I
			2 – chose 2 answers each	1-chose 2; 1-chose 3 answers			
4	What affects the price of fish?	Quality	IIIIII	I	I		I
		Size	IIII	IIII		II	IIII
		Supply of fish on the market		II	II	IIIIII	IIII
		Demand for fish e.g. number of buyers	I	II	II	IIIIII	IIII
			2 – chose 2 answers	1 – chose 2 answers	1 – chose 2 answers	2 – chose 2 answers each; 1 chose 3	3 – chose 2 answers each; 1 chose 3
5	What do we mean by advertising?	Giving clear attractive messages to our customers and future customers about our product	III	IIIIIIII	IIIIII	IIIIII	IIIIIIII
		Where they can buy it	IIIIII		IIII	IIII	
		Product benefits	II	II	IIII	IIII	IIII
			1 – chose 2 answers each	1 – chose 2 answers	7 – chose 2 answers each	3 – chose 2 answers	4 – chose 2 answers each
6	How can we keep our customers happy?	Always supply what they want in terms of size and quality	IIIIII	IIIIIIII	IIII	IIIIII	IIIIIIII
		Deliver on time	IIII	II	I	II	II
			1 – chose 2 answers	1 – chose 2 answers			

Seasonal calendars

Seasonal calendars were developed with each group of farmers. These highlight the variations in a number of livelihood related issues over time. The calendars are presented in table form with descriptive text beneath each table.

Wycliffe Makamu (Vihiga County)

Household expenditure general (Ksh)												
Household expenditure on food (Ksh)												
Total income												
Income levels from different sources												
Production volume (kg)	420						420					
Price of fish per kg (Ksh)	120	120	120	120	100	100	100	100	100	100	100	100
School calendar												
Demand for fish												
Rain												
	December	January	February	March	April	May	June	July	August	September	October	November

Vihiga county receives 1,800 to 2,200 mm of rain per year. The long rainy season is from April to June, and the short rains are from September to November. December to March is the dry season. Demand for fish is highest during the December holidays. It is also high during crop harvesting when disposable incomes are high. The school calendar has three terms running from January to March, May to July, and September to November. The school holiday months are April, August and December. Fish prices are low without much seasonality. A slight increase is seen during the December holidays. Individual farmers produce 420 kg of fish every six months. Farmers receive a good income almost throughout the year due to diversification. Expenditure on household food is more or less constant. General expenditure increases significantly when children go back to school in January, May and September.

Evans Kibwasi (Vihiga County)

Household expenditure general (Ksh)												
Household expenditure on food (Ksh)												
Total income												
Income levels from different sources												
Production volume (kg)				360 kg						360 kg		
Price of fish per kg (Ksh)	100	100	100	100	90	90	90	90	90	90	90	90
School calendar												
Demand for fish												
Rain												
	December	January	February	March	April	May	June	July	August	September	October	November

Vihiga county receives 1,800 to 2,200 mm of rain per year. The long rainy season is from April to June, and the short rains are from September to November. December to March is the dry season. Demand for fish is highest during the December holidays. It is also high during crop harvesting when disposable incomes are high. The school calendar has three terms running from January to March, May to July, and September to November. The school holiday months are April, August and December. Fish prices are low without much seasonality. A slight increase is seen during the December holidays. Individual farmers produce 360 kg of fish every six months. Farmers receive a good income almost throughout the year due to diversification. Expenditure on household food is more or less constant. General expenditure increases significantly when children go back to school in January, May and September.

Patricia Amenya (Kisii County)

	December	January	February	March	April	May	June	July	August	September	October	November
Household expenditure general (Ksh)												
Household expenditure on food (Ksh)												
Total income												
Income levels from different sources												
Production volume (kg)												
Price of fish per kg (Ksh)	400 - 500		300	300	300	300	300	300	300	300	300	300
School calendar												
Demand for fish												
Rain												

There is plenty of rain almost throughout the year in Kisii County, except from December to February. The demand for fish is highest during December holidays, and continues in the dry months of January and February because vegetables are scarce during that part of the year. Price of fish per kilogram is also highest during the period of December to February because of high demand. Total income for a fish farmer is highest during the peak demand season of December, February and September, when another crop is harvested. Expenditure is highest when schools open and school fees and other related expenses are incurred. Income for Patricia Amenya increases a lot when schools are open as she has property to rent. Expenditure on food goes up during the dry months of December, January and February.

Mabro Fish Farm (Siaya County)

Household expenditure general (Ksh)												
Household expenditure on food (Ksh)												
Total income												
Income levels from all sources												
Production volume (kg)												
Price of fish per kg (Ksh)	350-400	250-300	250-300	250-300	250-300	250-300	250-300	250-300	250-300	250-300	250-300	250-300
School calendar												
Demand for fish												
Rain												
	December	January	February	March	April	May	June	July	August	September	October	November

Bondo is dry most of the year. Heavy rains are experienced between April and June, while short rains are fall from September to October. Demand for fish is rather uniform throughout the year, but peaks during the December holidays. The price of fish is highest during December, when demand is also the highest. Production volume is highest in December because most fish farmers' spend time harvesting to coincide with peak demand. Income for fish farmers peaks in December and diminishes during the dry seasons. Household expenditures are highest when schools open in January, May and September because of the need to pay school fees. Income from the production of fingerlings increases during the rainy seasons. Mabro is a hatchery; its income peaks during the rainy seasons when most fish farmers stock their ponds.

Wilfred Makokha (Kakamega County)

Household expenditure general (Ksh)	50000	50000	50000	50000	30000	30000	30000	30000	30000	30000	30000	30000
Household expenditure on food (Ksh)	20000	20000	20000	15000	15000	15000	15000	15000	15000	15000	15000	15000
Total income												
Income levels from different sources												
Production volume (kg)	160	160	160	160	140	140	140	140	160	160	160	160
Price of fish per kg (Ksh)	300	300	300	300	250	250	250	250	300	300	300	300
School calendar												
Demand for fish												
Rain												
	December	January	February	March	April	May	June	July	August	September	October	November

Kakamega receives an annual rainfall of between 1,250 and 1,750 mm. The long rains fall from April to June and the short rains from September to November. December to February is generally dry with rains beginning in March. Demand for fish and prices are slightly higher from August to March and slightly lower from April to July.

Production volumes for this particular farmer are slightly higher from August to March, with a slight reduction from April to July. Rise in demand coincides with the harvest of maize and beans in August, and this continues in the holiday month of December and extends to the dry months of January and February when vegetables are scarce. Income levels follow the same pattern as the demand for fish and rises considerably in April, when sugar cane is harvested. Expenditure levels both for the total and for food are highest from December to March. This coincides with the higher income from fish sales. The school calendar has three terms running from January to March, May to July, and September to November with the months of April, August and December being the school holiday months.

Dephine Okota (Siaya County)

Household expenditure general (Ksh)	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
Household expenditure on food (Ksh)	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Total income												
Income levels from different sources												
Production volume (kg)	285	285	285					285	285	285	285	285
Price of fish per kg (Ksh)	300	300	300	250	250	250	250	300	250	250	250	250
School calendar												
Demand for fish												
Rain												
	December	January	February	March	April	May	June	July	August	September	October	November

Yala, in Siaya County, receives a good amount of rain throughout the year. December to February are dry with the rains beginning in March. The long rains fall from April to June and the short rains from September to November. The months of July and August are cool but dry. The school calendar is similar to the rest of the country with three terms running from January to March, May to July, and September to November with monthly holidays in between in April, August and December. Demand for fish is higher in August crops are being harvested and disposable incomes are high, and in the holiday month of December and the dry months of January and February when other food sources, such as vegetables, are scarce. Fish prices are fairly uniform throughout the year but slightly increase when demand rises. Income levels from different sources for this farmer are fairly uniform through the year with a significant increase in August when maize is harvested and cattle are sold at the highest prices. Expenditure, both total and on food, are uniform across all months of the year.

6. Training delivery plan

Training is one of the key activities that has been identified by the fish farmer stakeholders as a priority if aquaculture development is to be accelerated. It is therefore important that the groups access markets for their products. The training delivery plan is elaborated in Table 21. The detailed budgets for the training needs identified for the five groups – Tilapia Self-help Group, Kakamega Cooperative, Muungano Group, Wangchieng Group and Butula Fish Farmers Cooperative – are given in Table 22.

Table 21: Training delivery plan

Beneficiary name	Contact details	Capacity building proposed	Justification	Cost	In-kind contribution	Remarks
Central Kakamega Aquaculture Cooperative	Box 1969-50100 Kakamega, Tel. 0716-052180	Group cohesion and organization, BMPs, market linkages, fish handling and hygiene	High dependency on aquaculture, established aquaculture cluster, have been operating for at least 6 years, have received previous support and require additional support, are registered and are vulnerable to market and input fluctuations	US\$ 8060 Kshs 693,168	The group is willing to provide technical and practical training venues	For the group to access niche market for their product, and to manage market collection centre efficiently they require training
Yala Fish Farming Cluster	C/O Dephine Okota P.O. Box 19 Yala Tel. 0700240727	Group cohesion and organization, BMPs, market linkages, fish handling and hygiene	High dependency on aquaculture, established aquaculture cluster, have been operating for at least 2 years, have received previous support and require additional, are registered and are vulnerable to market fluctuations	US\$ 7043 Kshs 562,640	The group is willing to provide writing material for training and training venue	For marketing purposes, Yala and Luanda(Bidii) have combined and registered a CBO known as Muungano Fish Farmers and has been operating for 2years for purposes of Marketing their produce together
Bidii Fish Farmers	Box 215 Luanda, Tel. 0723117706 /0713359044	Group cohesion and organization, BMPs, market linkages, fish handling and hygiene, fish farming economics	High dependency on aquaculture, established aquaculture cluster, have been operating for at least 9 years, have received previous support and require additional, are registered and are vulnerable to market fluctuations			For the Muungano group to access niche market for their product, and also manage the market collection centre efficiently they require training
Tilapia Self-help Group	C/O John Nyamache P.O Box 9 - 40200 0733871151	Group cohesion and organization, pond management, fish farming as a business, fish handling and hygiene	High dependency on aquaculture Limited previous support Establishing itself in aquaculture business, previously received limited support, Is an established aquaculture cluster has been operating for at least 4years Registered Have guiding principles and vulnerable to shocks and stresses (production, marketing)	USD\$ 6868 Kshs 590,648	Transportation	The group has not had any training on group cohesion and organization, pond management, fish farming as a business and also fish handling and hygiene
Great Wangchieng Fish Farmers	Maurice Opondio P. O. Box 46 Kobala; Tel. 0726 024032	Group cohesion and organization, Pond management, Fish farming as a business, market linkages, fish handling and hygiene	High dependency on aquaculture, limited previous support, establishing itself in aquaculture business, previously received limited support, is an established aquaculture cluster (82 members,) has been operating for at least 4 years, registered, has guiding principles and is vulnerable to shocks and stresses (production, marketing)	US\$ 6920 Kshs 595,120	Writing material/stationary, hiring of tent and seats	
Butula Pond Fish Farmers Cooperative Society Ltd	P.O. Box 34 Butula Telephone: 0701129529	Group cohesion and organization BMPs, market linkages, fish handling and hygiene, fish farming economics	High dependency on aquaculture limited previous support, establishing itself in aquaculture business, previously received limited support, is an established aquaculture cluster (102 members) has been operating for at least 3 years registered, has guiding principles and is vulnerable to shocks and stresses (production, marketing)	US\$ 8107 Kshs 697,202	Training hall and stationary	The group has not had any training on group cohesion and organization, pond management, fish farming as a business and also fish handling and hygiene

Table 22: Detailed budgets for proposed training

Kakamega Aquaculture Cooperative				
Item	Quantity	Cost/Unit (Kshs)	Total Cost (Kshs)	Remarks
Conference hall for 5 days	5	5,000	25,000	Group contribution
Lunch for 40 people for 5 days	200	500	100,000	
Morning tea for 40 people for 5 days	200	250	50,000	
Afternoon tea for 40 people for 5 days	200	250	50,000	
Mineral water (2x500 ml) for 40 people for 5 days	200	120	24,000	
DSA for driver	5	3,000	15,000	
DSA for 1 support staff	5	3,000	15,000	
DSA for 4 facilitators for 5 days	20	6,000	120,000	
DSA for consultant	6	11,528	69,168	
Opening ceremony by Fisheries Secretary	2	15,000	30,000	
Fuel	150	110	16,500	
Transport for 35 farmers for 5 days	175	600	105,000	
Transport for 4 facilitators	4	2,000	8,000	
Stationery (document wallet, notebook, pen)	40	150	6,000	
Printing paper	3	500	1,500	
Toner	1	8,000	8,000	
Air ticket business class and economy (16,000+29,000)	2		45,000	
Incidentals			30,000	
Total			718,168	
Total in-kind contribution			25,000	
Total minus in kind contribution			693,168	
Total US\$ (Kshs 86)			8,060	

Muungano Fish Farmers				
Item	Qty	Cost/Unit (Kshs)	Total Cost (Kshs)	Remarks
Conference hall for 5 days	5	5,000	25,000	Group contribution
Lunch for 35 people for 5 days	175	500	87,500	
Morning tea for 35 people for 5 days	175	250	43,750	
Afternoon tea for 35 people for 5 days	175	250	43,750	
Mineral water (2x500 ml) for 40 people for 5 days	175	120	21,000	
DSA for driver	5	3000	15,000	
DSA for 1 support staff	5	3000	15,000	
DSA for 4 trainers for 5 days	20	6000	120,000	
DSA for Consultant	5	11528	57,640	
Smartfish Focal Point	5	6000	30,000	
Fuel GK A 182 T	150	110	16,500	
Transport for 35 farmers	175	600	105,000	
Transport for facilitators	4	2000	8,000	
Stationery (document wallet, notebook, pen)	40	150	6,000	
Printing paper	3	500	1,500	
Toner	1	8000	8,000	
Incidentals			20,000	
Total			623,640	
Total in-kind contribution			31,000	
Total minus in kind contribution			598,640	
Total US\$			7,043	

Tilapia Fish Farmers Self-help Group				
Item	Qty	Cost/Unit (Kshs)	Total Cost (Kshs)	Remarks
Conference hall for 5 days	5	5,000	25,000	Farmers' contribution
Lunch for 40 people for 5 days	200	500	100,000	
Morning tea for 40 people for 5 days	200	250	50,000	
Afternoon tea for 40 people for 5 days	200	250	50,000	
Mineral water (2x500 ml) for 40 people for 5 days	200	120	24,000	
DSA for driver	5	3,000	15,000	
DSA for 1 support staff	5	3,000	15,000	
DSA for 4 trainers for 5 days	20	6,000	120,000	
DSA for Consultant	5	11,528	57,640	
Fuel	150	110	16,500	
Transport for 35 farmers	175	600	105,000	
Transport for facilitators	4	2,000	8,000	
Stationery (document wallet, notebook, pen)	40	150	6,000	Farmers' contribution
Printing paper	3	500	1,500	
Toner	1	8,000	8,000	
Incidentals			20,000	
Total			621,640	
Total in-kind contribution			31,000	
Total minus in kind contribution			590,640	
Total US\$			6,868	

Great Wang'chieng Fish Farmers				
Item	Qty	Cost/Unit (Kshs)	Total Cost (Kshs)	Remarks
Conference hall for 5 days	5	5,000	25,000	Group contribution
Lunch for 40 people for 5 days	200	500	100,000	
Morning tea for 40 people for 5 days	200	250	50,000	
Afternoon tea for 40 people for 5 days	200	250	50,000	
Mineral water (2x500 ml) for 40 people for 5 days	200	120	24,000	
DSA for driver	5	3,000	15,000	
DSA for 1 support staff	5	3,000	15,000	
DSA for 4 trainers for 5 days	20	6,000	120,000	
DSA for Consultant	5	11,528	57,640	
Fuel GK A 182 T	100	110	11,000	
Transport for 35 farmers	175	600	105,000	
Transport for facilitators	4	2,000	8,000	
Stationery (document wallet, notebook, pen)	40	150	6,000	Group contribution
Printing paper	3	500	1,500	
Toner	1	8,000	8,000	
Incidentals			30,000	
Total			626,140	
Total in-kind contribution			31,000	
Total minus in kind contribution			595,140	
Total US\$			6,920	

Butula Pond Fish Farmers Cooperative				
Item	Qty	Cost/Unit (Kshs)	Total Cost (Kshs)	Remarks
Conference hall for 5 days	5	5,000	25,000	Group contribution
Lunch for 40 people for 5 days	200	500	100,000	
Morning tea for 40 people for 5 days	200	250	50,000	
Afternoon tea for 40 people for 5 days	200	250	50,000	
Mineral water (2x500 ml) for 40 people for 5 days	200	120	24,000	
DSA for driver	5	3,000	15,000	
DSA for 1 support staff	5	3,000	15,000	
DSA for facilitators (4 people for 5 days)	20	6,000	120,000	
DSA for Consultant	6	11528	69,168	
Fuel	150	110	16,500	
DSA Fisheries Secretary (Closing Ceremony)	2	15,000	30,000	
Transport for 35 farmers	175	600	105000	
Transport for facilitators	4	2,000	8000	
Stationery (document wallet, notebook, pen)	40	150	6,000	Group contribution
Printing paper	3	500	1,500	
Toner	1	8,000	8,000	
Incidentals			40,115	
Air ticket - business class + economy class		29,000 + 16,000	45,000	
Total			728,283	
Total In-Kind contribution			31,000	
Total minus In-kind contribution (Kshs)			697,283	
Total US\$			8,107	
GRAND TOTAL			36,998	

7. Input distribution, registration plan and costing

During the needs assessment, the fish farmer stakeholders stated that in order for them to meet their business objectives there were various types of inputs they would require.

The equipment supplied by the project will be housed in the fish farmer groups' business premises. Most fish farmer groups have rented or leased business premises in their respective local trading centres. Officials, or a special committee formed specifically for this purpose, will manage the equipment.

A set of rules will be developed (either separate or included in their by-laws) to guide the up-keep, maintenance and loan of any equipment. The equipment will be hired out to members at a fee determined by the cluster. Monies collected will go towards equipment maintenance and eventual replacement. A number of clusters, including the ones in this project, have previously received some fish farming equipment from the Government. They have demonstrated responsibility with respect to equipment maintenance, safekeeping and general management. They have valuable experience in managing and maintaining equipment in a group set-up.

The justification of beneficiaries for inputs is given in Table 23, while a detailed budget for input requirements and their distribution can be found in Table 24. All the groups are registered by the Government, but for them to be able to operate the fish marketing collection centres they require trade and health licences. Table 25 provides details on the registration plan and costing, while Table 26 provides a detailed budget for the registration and licensing.

Table 23: Input distribution and estimated costing

Beneficiary name	Contact details	Item/input	Justification of beneficiary and input	Cost	In-kind contribution
Central Kakamega Aquaculture Cooperative	BOX 1969-50100 Kakamega, TEL: 0716-052180	Deep freezer; cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing scales.	These inputs will assist farmers in managing their ponds according to BMP guidelines, to produce quality products that are accepted in premium markets. The group is setting up a marketing collection centre	US\$ 10,375 Kshs 892,280	Payment of utilities, materials for packing, payment of sales and marketing employees
Yala Fish Farming Cluster	C/O Dephine Okota P.O. Box 19 Yala Tel. 0700240727	Deep freezer; cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing scales; harvesting baskets.	These inputs will assist farmers in managing their ponds according to BMP guidelines, to produce quality products that are accepted in premium markets. The group is setting up a marketing collection centre	US\$ 10,375 Kshs 892,280	Payment of utilities, materials for packing, payment of sales and marketing employees
Bidii Fish Farmers	George Ambuli P.O. Box 215 Luanda, Tel: 0723117706 / 0713359044	Deep freezer; cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing scales; harvesting baskets.	These inputs will assist farmers in managing their ponds according to BMP guidelines, to produce quality products that are accepted in premium markets. The group is setting up a marketing collection centre	US\$ 10,375 Kshs 892,280	Payment of utilities, materials for packing, payment of sales and marketing employees
Tilapia Self-help Group	C/O John Nyamache P.O. Box 9 Tel: 40200 0733871151	Cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing balances, harvesting baskets	These inputs will assist farmers in good management of ponds; records management; preservation of fresh produce for the market, hygienic handling	US\$ 8,458 Kshs 727,400	Payment of utilities, materials for packing, hire of sales employees
Great Wangchieng Fish Farmers	Maurice Opondo P. O. Box 46 Kobala; Tel: 0726 024032	Cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing balances, harvesting baskets	These inputs will assist farmers in good management of ponds; records management; preservation of fresh produce for the market, hygienic handling	US\$ 8,458 Kshs 727,400	Payment of utilities, materials for packing, hire of sales employees
Butula Pond Fish Farmers Cooperative Society Ltd	Alex Ouma Abwao P.O. Box 34 Butula Telephone: 0701129529	Cool boxes; harvesting, sampling and hapa nets; secchi disk; weighing balances, harvesting baskets	These inputs will assist farmers in good management of ponds; records management; preservation of fresh produce for the market, hygienic handling	US\$ 8,458 Kshs 727,400	Payment of utilities, materials for packing, hire of sales employees

Table 24: Detailed budget of input requirements and distribution

	No.	Kakamega	Total	No.	Yala	Total	No.	Luanda	Total	TOTAL
	No.	Kisii	Total	No.	Kendu Bay	Total	No.	Busia	Total	
Deep freezer 19 cubic ft	1	62,995	62,995	1	62,995	62,995	1	62,995	62,995	
Deep freezer 11 cubic ft	2	30,995	61,990	2	30,995	61,990	2	30,995	61,990	
Fridge guards	1	2,795	2,795	1	2,795	2,795	1	2,795	2,795	
Cool boxes	3	9,265	27,795	3	9,265	27,795	3	9,265	27,795	
	4	4,495	17,980	4	4,495	17,980	4	4,495	17,980	
TOTAL			173,555			173,555			173,555	
Seine net (harvesting) 40mts; (950/mtr)	2	38,000	76,000	2	38,000	76,000	2	38,000	76,000	
30mts (800/mtr)	3	38,000	114,000	3	38,000	114,000	3	38,000	114,000	
Sampling nets 40 mtr, 30mts (800/mtr)	3	32,000	96,000	3	32,000	96,000	3	32,000	96,000	
30mts	1	32,000	32,000	1	32,000	32,000	1	32,000	32,000	
Hapa nets - 4x2	18	4,000	72,000	18	4,000	72,000	18	4,000	72,000	
Hapa nets - 2x1	20	2,000	40,000	20	2,000	40,000	20	2,000	40,000	
Secchi disk;	8	1,500	12,000	8	1,500	12,000	8	1,500	12,000	
Weighing scales	5	3,500	17,500	5	3,500	17,500	5	3,500	17,500	
Harvesting baskets	10	500	5,000	10	500	5,000	10	500	5,000	
Total			464,500			464,500			464,500	
Transport			50,000			50,000			50,000	
Total Kshs			514,500			514,500			514,500	
Grand Total			688,055			688,055			688,055	2,064,165
US\$			8,001			8,001			8,001	24,002
	No.	Kisii	Total	No.	Kendu Bay	Total	No.	Busia	Total	
Deep freezer 19 cubic ft										
Deep freezer 11 cubic ft	1	30,995	30,995	1	30,995	30,995	1	30,995	30,995	
Fridge guards	1	2,795	2,795	1	2,795	2,795	1	2,795	2,795	
Cool boxes	3	9,265	27,795	3	9,265	27,795	3	9,265	27,795	
	4	4,495	17,980	4	4,495	17,980	4	4,495	17,980	
Total			79,565			79,565			79,565	
Seine net (harvesting) 40mts; (950/mtr)	2	38,000	76,000	2	38,000	76,000	2	38,000	76,000	
30mts -	3	28,500	85,500	3	28,500	85,500	3	28,500	85,500	
sampling nets; 40 mtr; 30mts (800/mtr)	3	32,000	96,000	3	32,000	96,000	3	32,000	96,000	
30mts	1	24,000	24,000	1	24,000	24,000	1	24,000	24,000	
Hapa nets - 4x2	18	4,000	72,000	18	4,000	72,000	18	4,000	72,000	
Hapa nets - 2x1	20	2,000	40,000	20	2,000	40,000	20	2,000	40,000	
secchi disk;	8	1,500	12,000	8	1,500	12,000	8	1,500	12,000	
Weighing scales;	5	3,500	17,500	5	3,500	17,500	5	3,500	17,500	
Harvesting Baskets	10	500	5,000	10	500	5,000	10	500	5,000	
Total			428,000			428,000			428,000	
Transport			14,800			14,800			14,800	
Total Kshs			522,365			522,365			522,365	1,567,095
Grand Total			601,930			601,930			601,930	3,631,260
US\$			6,999			6,999			6,999	20,998
Grand Total US\$		Kakamega and Kisii	15,000		Yala and Kendu Bay	15,000		Luanda and Busia	15,000	44,999

Table 25: Registration plan and costing

Beneficiary Name	Registration status	Licences and status	Support required	Benefits of this support	Costs of support (if any)	In-kind contribution
Central Kakamega Aquaculture Cooperative	Registered under the Cooperatives Act	They do not have trade licence or a public health licence for the collection centre	Traders licence is a public health certificate for the premises and for each individual working at the collection centre	The group will be able to conduct their business legally and without disturbance from the authorities	10,000/=	Group to pay 10% of costs
Yala Fish Farming Cluster	Registered with social services	They do not have trade licence or a public health licence for the collection centre	Traders licence is a public health certificate for the premises and for each individual working at the collection centre	The group will be able to conduct their business legally and without disturbance from the authorities	10,000/=	Group to pay 10% of costs
Bidii Fish Farmers	Registered with social services	They do not have trade licence or a public health licence for the collection centre	Need a traders license, health permit for the premises and a health certificate for individuals working there. Also need licence for running the feed pelletizer	The group will be able to conduct their business legally and without disturbance from the authorities	18,000/=	Group to pay 10% of costs
Tilapia Self Help Group	Registered with social services	Do not need any licence	Technical support on how to establish a collection centre			
Great Wangchieng Fish Farmers	Registered with social services as a CBO	Do not need any licence	Technical support on how to establish a collection centre			
Butula Pond Fish Farmers Cooperative Society Ltd.	Registered under the Cooperatives Act and its by-laws	They do not have trade licence or a public health licence for the collection centre	Need a traders license, health permit for the premises and a health certificate for individuals working there. Also need licence for running the feed pelletizer	The group will be able to conduct their business legally and without disturbance from the authorities	18,000/=	Group to pay 10% of costs

Table 26: Detailed budget for registration and licensing

Name of Group	Amount Required Kshs	In-kind contribution (10%)	Total Amount Kshs	Total Amount US\$
Central Kakamega Aquaculture Cooperative	10,000	1,000	9,000	105
Yala Fish Farming Cluster	10,000	1,000	9,000	105
Bidii Fish Farmers	10,000	1,000	9,000	105
Tilapia Self-help Group	0	0	0	0
Great Wangchieng Fish Farmers	0	0	0	0
Butula Pond Fish Farmers Cooperative Society Ltd.	10,000	1,000	9,000	105
Grand Total			36,000	419

Work plan

The consultant will oversee the implementation of both the trainings and input activities as drawn up in the work plan (Table 27). It is anticipated that a local private sector organization with the necessary capacity and experience in the sector, will be engaged by SmartFish to facilitate the trainings and distribution of inputs. The trainings will be provided by established commercial fish farmers that have in the past trained and are currently, training fish farmers in collaboration with the State Department of Fisheries under various projects.

The training needs identified during the needs assessment guided the consultant during the development of modules. The training materials that will be used include those that have been developed by the State Department of Fisheries in collaboration with training institutions and development partners.

Post input provision monitoring and extension will be carried out by both the consultant and the State Department of Fisheries to ensure that the fish farmers in the beneficiary groups are benefiting, and that they have been able to increase their production and ultimately their income.

Table 27: Work plan

8. Conclusions and recommendations

The continued growth in aquaculture operations in Kenya made the undertaking of a needs assessment necessary so as to ascertain the gaps, and the appropriate interventions required for sustainable accelerated growth.

This assessment concluded that despite the many challenges that farmers face, the fish farming industry is still economically viable and attractive to those who wish to invest in it. The policy thrust is therefore, for the private sector, in collaboration with the Government, to establish an aquaculture stakeholders' platform to engage with and share information between the various players.

Emphasis was also made on the need for the Government to subsidize some of the commercial inputs and encourage the establishment of producers' organizations. These will assist the farmers to purchase inputs in bulk and increase their availability, as well as improve marketing distribution channels.

The priorities in terms of aquaculture development that were identified by the stakeholders who are operating at different levels of production include the following:

- Training on fingerling propagation, Tilapia mono-sex production and cross cutting issues;
- Establish fish marketing collection centres in every county;
- Clearing aquaculture policy to guide fish production, trade, etc.;
- Capacity building of cluster groups;
- Standardization of fish prices within the region;
- Formation of a consortium that includes all stakeholders in the production chain in every county;
- Establishment of proper mechanisms for information flow.

It is anticipated that the end point of the selected beneficiary clusters should be stand-alone, self-sufficient market structures that offer their investors the best prices for inputs and products. It is anticipated that once this end point is reached, the clusters should serve as the nuclei for an effort to expand market clusters to other small and medium enterprise investors across the country and region at large.

The following are the recommendations from the assessment:

- The following groups should be the target beneficiaries of capacity building initiatives and for the provision of equipment so that they can enhance their aquaculture activities: Central Kakamega Aquaculture Cooperative; Muungano Fish Farmers (Bidii Fish Farmers and Yala Fish Farmers clusters); Tilapia Fish Farmers Group; Wangchieng Fish Farmers Cluster; and the Butula Fish Farmers Cooperative.

- The clusters need additional reinforcement. There is need to undertake some intermediate measures to strengthen the sustainability of the clusters through the provision of support for strengthening the group functionality and market linkages. Such support includes the provision of the following equipment or materials: deep freezers; cool boxes; harvesting and sampling nets; weighing scales; harvesting baskets; and secchi disks.
- In terms of training, a potential programme could include the following:
 - Introduction and evaluation;
 - Group cohesion and organization;
 - BMPs;
 - Marketing linkages;
 - Fish handling and hygiene;
 - Fish farming economics;
 - Pond management;
 - Fish farming as a business.
- The aim should be to develop long-term market linkages that optimize profits for cluster members. To attract and maintain these markets, clusters must function as effective marketing units by exhibiting proper coordination, production, planning and collective marketing over a specific period of time. For the case of Muungano Group (Bidii Fish Farmers) and Kakamega Fish Farmer Cooperative, the proposed period was three years as indicated in their marketing plans (Consolidated Marketing Report, May 2013).
- A video or documentary could be made to document the work and serve as a training tool to others.

9. References

Ministry of Fisheries Development, National Aquaculture Strategy and Development Plan (Kenya), Edition 1, 2010.

Ministry of Fisheries Development, National Aquaculture Policy (Kenya) 2011.

Ministry of Livestock and Fisheries Development, Department of Fisheries, Fisheries Development, Fisheries Bulletins, 2006.

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Final Report, Analysis of the Baseline Data Collection, Aquaculture in the former Nyanza and Western Provinces, Trilateral Tilapia Project, Kenya, April 2013.

Consolidated Marketing Report; Bidii (Muungano) and Kakamega Fish Farmers Clusters, Ref No. FAO/SFE-2012/82; May 2013.

Annex A. Terms of reference

Name:	
Job Title:	National Aquaculture Consultant
Division/Department:	Fisheries and aquaculture policy and economic division, Fisheries and Aquaculture Department
Programme/Project Number:	9.1.1.1.1 GCP/RAF/466/EC Baby project, Result 5
Location:	9.1.1.1.2 Home station plus two field missions in selected sites
Expected Start Date of Assignment:	20 June 2013
Duration:	45 days from 20 June to 20 September 2013, WAE
Reports to:	Name: Davide Signa, SmartFish Fisheries Officer

Description of tasks

Under the direct supervision of Davide Signa, SmartFish Fisheries Officer, within the framework of the SmartFish Result 5, the consultant will technically contribute to the implementation of activities under the *Output 5M3.1 The Promotion of Sustainable Aquaculture Development (Act.5M3.1.1)*.

They will carry out a needs assessment on specific sites, follow up and supervise the delivery phase of the required actions.

Specific Tasks:

Phase 1: Preparation of the needs assessment and planning (3 days, June, home-based)

1. Identify, in consultation with supervisors, FAO and the relevant institutions, the pre-selected sites to target for the field assessment activities;
2. Develop the needs assessment tools and a draft template for the action plan and submit to FAO for technical clearance to be obtained before initiating the mission;

Phase 2: Field mission and reporting (20 days, July)

3. Carry out the field mission (15 days in the sites) to identify specific needs at the group and individual level in terms of:
 - group empowerment and legal registration;
 - further trainings on business/group/cooperative management related issues;
 - inputs/equipment/materials needed at group level and/or individual level.
4. Submit a mission report (5 days, home-based) with a detailed action plan, using the agreed template, for each group with:
 - specific training needs with detailed training delivery plan;
 - specific action with costing for the legal registration and networking of the groups;
 - list of groups and individual beneficiaries for the input distribution with tentative costing per each item/input.

Phase 3: Follow up and delivery mission (5 days, home-based, August -September)

5. Coordinate the procurement process assisting FAO with all technical specifications for the items to be procured and name and contact of at least three possible suppliers including

printing of the Aquaculture Manual.

6. Follow up on the findings and needs of the selected groups:
 - Elaborate specific training packages/materials for the issues identified during the needs assessment;
 - Collect and compile all documentations needed for the legal registration and networking of the groups;
 - Develop a detailed input distribution plan with names and details of the beneficiaries;
7. Travel to the sites and deliver the specific trainings identified in the needs assessment and supervise the input distribution, collecting all receipts and relevant documents ensuring that press coverage and donor visibility (20 days, 10 per each site, August-September);

Phase 4: Reporting (home station based 4 days before 20 September)

8. Consolidate all documents in a detailed end of assignment report, using the FAO SmartFish template provided, which includes detailed list of activities carried out as well as recommendations for future SmartFish and FAO Aquaculture interventions

Expected Outputs:	Required Completion Date:
1. Detailed mission plan and assessment tools submitted	25 June 2013
2. Mission report with work plans and procurement plan attached	20 July 2013
3. Training packages, documents for registration and technical specifications for procurement completed	1 August 2013
4. Additional training delivery and input distribution completed	15 September 2013
5. End of assignment report submitted	20 September 2013

Annex B. Proposed mission plan

Date	Location	Groups/individuals	Field work activities/ activities
7 August 2013	Kisumu	-	Travel to Kisumu
8 -15 August 2013	Kisumu	Stakeholders (public & private)	Introduction meeting and interviews with County Directors - State Department of Fisheries and key stakeholders including input & service providers (feed, vet services, fry/fingerlings, transporters, traders) (2 days);
	Vihiga	Kakamega	Group interview (farmers, input & service provides) in location/site, different types of farmers - stakeholder analyses, group discussion (5 days)
	Siaya Kakamega	Luanda Yala	
16 August 2013	Kisumu		Review results of group interviews. Identify individuals for follow-up interviews/discussion
17 - 23 August 2013	Kisii	Siaya	Carry out a series of individual case study interviews with cross section of different types of farmers...large, small, male, female, rich, poor, highly dependent, and less dependent to cross check key issues and carry out baseline survey (6days)
	Kendu Bay Bondo Kakamega Siaya	Kakamega Kisii Kendu bay Bondo	
24 August 2013			Validation meeting with beneficiaries to feedback needs assessment results/proposals (2 day)
2 - 6 September 2013			Depart site
	Nairobi	N/A	<p>Submit mission report (5 days home based) with a detailed action plan, using agreed template, for each group with:</p> <ul style="list-style-type: none"> a) training needs with detailed training delivery plan; b) specific action with costing for the legal registration and networking of the groups; c) list of groups and individual beneficiaries for the input distribution with tentative costing per each item/input.

Annex C. List of persons met

Kisumu County		
	Michael Obadha	Assistant Director of Fisheries/ National Liaison, Kisumu
	George O. Osure	Principal Fisheries Officer, National Liaison Office, Kisumu
	Jonam R. Etyang	County Director, Kisumu County
	Susan Adhiambo	Senior Fisheries Officer, Kisumu County
Kisii County		
	Edwin Muga	County Director, Kisii County, P. O. Box, Kisii
	Jashon Ochola	Fisheries Assistant, Kisii County, P. O. Box Kisii
Kisii Tilapia Fish Farmers SHG		
	John Nyamache	Chairman, Box 9, Kisii
	Henry Ratemo	Member, Box 3735, Kisii
	Esther Mokeira	Member, Box 3735, Kisii
	Evarline Mora	Member, Box 3735, Kisii
	Linet Bonareri	Member, Box 3735, Kisii
	Prisira. B. Onsare	Member, Box 9, Kisii
	Samson Oirura	Member, Box 9, Kisii
	Evans O. Morike	Member, Box 3735, Kisii
	Penina M. Ratemo	Member, Box 3735, Kisii
	James Nyamache	Member, Box 9, Kisii
	Zadrack. O. Aruya	Member, Box 230, Kisii
	Priscah Mora	Member, Box 230, Kisii
	Winfridah Mora	Member, Box 3735, Kisii
	Yobensia M. Maragnga	Member, Box 230, Kisii
	Ndege Obare	Member, Box 9, Kisii
	Williheight Nyamache	Member, Box 9, Kisii
	Bernard Onduso	Member, Box 9, Kisii
	Jemima K. Oyunge	Member, Box 9, Kisii
	Charles Nyamao	Member, Box 230, Kisii
	John O. Makori	Member, Box 3692, Kisii
Nyaura Widows Fish Farming Group		
	Patricia B. Amenya	Box 825, Kisii
	Elizabeth Ratemo	Box 640, Kisii
	Susan K. Omwata	Box 640, Kisii
	Esther Monyenye	Box 640, Kisii
	Josephine Ratemo	Box 640, Kisii
	Florence N. Aminga	Box 640, Kisii
	Josephine Ndubi	Box 640, Kisii
	Concilia Morara	Box 640, Kisii
	Annah Mogekoyo	Box 640, Kisii
	Elimelider Okeyo	Box 640, Kisii

Homa Bay County		
Rachuonyo Sub-County		
	Henry M. Nzinga	Sub-County Director, Rachuonyo, Box 193, Kendu Bay
	Kevin O. Ochieng	FFEO, Box 193 , Kendu Bay (Rachuonyo)
	Zachary Winam Oreko	FFEO, Box 98, Kadongo
	Enos Were	Director/ Farmer, Jewlet Enterprise, Box 171, Kendu Bay
	Jedidah A. Nyongayo	Fish Farmer, Box 171, Kendu Bay
Wangchieng Farmers Group, Kobala, Kendu Bay		
	Maurice Oondo	Chairman, Box46, Kendu Bay
	Moses Akach	Member, Box 46, Kendu Bay
	Nerea Oremo	Member, Box 46, Kendu Bay
	Emmerculate Achieng	Treasurer Box 1- 40301, Kendu Bay
	Tobias Onyango Seko	Committee Box 46, Kendu Bay
	Margaret Ngesa	Member Box 46, Kendu Bay
	Joseph Ogola	Committee Box 25, Kendu Bay
	Tobias Juma Otula	Member Box 46, Kendu Bay
	Joseph Oluoch	Member Box 10, Kendu Bay
	James Were	Member Box 46, Kendu Bay
	Mr. Daniel O. Okuta	FFEO, Oyugis
Kokulo Fish Farmers		
	Joshua O. Andala	Member, Box 50-40223, Kadongo
	Wilson K. Owino	Member, Box 44-40223, Kadongo
	Domitila Abook	Member, Box 97, Kadongo
	Peter Augo	Member, Box 125, Kadongo
	Judith Otieno	Treasurer, Box 125, Kadongo
	Michael Ogai Onduto	Member, Box 173, Kadongo
	Emilly Ogweno	Member Committee, Box 98, Kadongo
	Dickson Okumu	Member, Box 167, Kadongo
	Josephat Mwalo	Chairman, Box 167, Kadongo
	Herine Otieno	Member, Box 167, Kadongo
Mbita Sub-County		
	Michael D. Omondi	Sub-County Director of Fisheries, Box 125 Mbita
	Michael Ogumbo Akoko	FFEO, Box 125, Mbita
	Joseph Ondijo	Fish Farmer, Box 30, Mbita
	Kennedy Mboya	Fish Farmer, Box 28, Mbita
	Consolata Ochuodho	Morning Star Fish Farming Women Group, Mbita
Kakamega County		
	Aggrey Busiega	County Director, State Department of Fisheries, Box 186-50100, Kakamega
	Susan Odinga	Senior Fisheries Officer, State Department of Fisheries, Box 586-50100, Kakamega

Commercial Fish Farmers		
	Charles Omuroka	Fish Farmer/ Secretary General AAK, Box 1487-50100, Kakamega
	Joyce Makaka	Fish Farmer, CASK member, Kakamega
Lurambi Fish Farmers		
Kakamega Cluster/group		
	Wilfred Makokha	Farmer, Member Kakamega Fish Farmers Cluster, BOX 1969-50100 Kakamega
	Andrew Lumumba	Farmer, Member Kakamega Fish Farmers Cluster, BOX 1969-50100 Kakamega
	John Nyapola	Farmer, Chairman, Kakamega Fish Farmers Cluster, BOX 1969-50100 Kakamega
	Josephat Amunga	Farmer, Member Kakamega Fish Farmers Cluster, BOX 1969-50100 Kakamega
	Christine Omido	Farmer, Member Kakamega Fish Farmers Cluster, BOX 1969-50100 Kakamega
	John Malenya	Farmer, Member Kakamega Fish Farmers Cluster, BOX 1969-50100 Kakamega
	Daniel Okumu Tari	Farmer, Member Kakamega Fish Farmers Cluster, BOX 1969-50100 Kakamega
	Philip Wafula	Farmer, Member Kakamega Fish Farmers Cluster, BOX 1969-50100 Kakamega
BUSIA COUNTY		
	Nemuel Onchonga	Deputy County Director, State Dept of Fisheries, Box 142 Busia
	Dominic N. Manyala	Seed Producer. Box 719, Busia
Butula Fish Farmers – Cooperative		
	Alex Ouma Abwao	Chairman, Butula Fish Farmers – Coop (Fish Feeds producer) Box 719, Busia
	Gilbert N Ndiru	Manager; Butula Fish Feeds Coop, Box 51, Bumala
Vihiga County		
	Wilson Munala	Principal Fisheries Officer, Vihiga County, Box 954, Maragoli
	Elishama Njeli	Fisheries Assistant, Vihiga County, Box 954, Maragoli

Bidii Fish Farmers/ Luanda Cluster		
	Dickson C. Demba	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	George O. Ambuli,	Farmer Luanda, Chairman, Bidii Muungano Group, Box 215, Luanda
	Luke Kundu	Farmer, Luanda, Treasurer, Bidii Muungano Group, Box 215, Luanda
	Jacktone Onjiri	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Selphah Okwemba	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Christopher Omasaba	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Moffat Ombele	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Ann Omenda Owuor	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Daniel J. Ebole	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Ronald Anyangu	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Ernest Amed	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Dorcus A. Joshua	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Stephen E. Olwamba	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
	Justus Obed Ameyo	Farmer, Luanda, Member, Bidii Muungano Group, Box 215, Luanda
Commercial Aquaculture Society of Kenya (CASK)		
	Okello Otieno	Chairman, CEO Thinquabato, okello@mweb.co.za Fingerlings and Food Fish
	Suzanne Njeri	Vice Chair, Director Kamiti Fish Farm, Box 38816-00623, Nairobi. Fingerlings and Food Fish
	Enos Were	Member, Director Jewlet Fish Farm, Box 171-40301, Kendu Bay. Fingerling and Feed producer
	Diana Maikuri	Member, Box, 4461, Kisumu. Gear Supplier
Siaya County		
Yala cluster		
	Aggrey Nyakalo	Farmer, Yala, Member, Bidii Muungano Group, Box 207, Yala
	Margaret Achieng	Farmer, Yala, Member, Bidii Muungano Group, Box 207, Yala
	Lucas Malubi	Farmer, Yala, Member, Bidii Muungano Group, Box 207, Yala
	Philip Otieno	Farmer, Yala, Member, Bidii Muungano Group, Box 207, Yala
	Dephine Okota	Farmer, Yala, Member, Bidii Muungano Group, Box 207, Yala
	Jane Okoth	Farmer, Yala, Member, Bidii Muungano Group, Box 207, Yala
	Martin Odhiambo	Farmer, Yala, Member, Bidii Muungano Group, Box 207, Yala
	Apolo Adhola Abang	Farmer, Yala, Member, Bidii Muungano Group, Box 207, Yala
	Elvis Erick Odhiambo	Manager, Mabro Fish Farm enterprises, P.O. Box 211 – 40601 Bondo, mabrose11@yahoo.de

Participants at stakeholders meeting 14 - 15 August 2013

No	Name	Address
1	Joel Aduma Achuth	Secretary, Kahawa Fish Farmers; Box 8003, Dago, Kisumu
2	Susan Clare Adhiambo	Fisheries Officer, County Fisheries Office, Box 4031, Kisumu
3	Joseph Sieko Omondi	Secretary, Hesao Fish Farmers; Box 1770, Kisumu
4	Elizabeth Chienjo	Fish Trader, Box 6737, Kisumu
5	Henry M. Nzinga	Principal Fisheries Officer, Box 193, Kendu Bay
6	Edwin Muga	Principal fisheries Officer, Box 700 - 40200 Kisii
7	George O. Ambuli	Chairman, Bidii fish Farmers; Box 116, Maseno
8	Jackline A. Abayo	Fish Trader, Kisumu
9	Dephine N. Okota	Secretary, Bidii Fish Farmers; Box 207, Yala
10	Wilson M. Munala	Principal Fisheries Officer, Vihiga County, Box 954, Maragoli
11	Beatrice A. Okumu	Fish Farmer, Box 1158, Kisumu
12	Caroline A. Onyango	Fish Farmer, Kendu Bay
13	Saul D. Odenyo	Aqua-Shop operator, Funyula, Busia County
14	Joyce Makaka	Director, AFIC Fish Farm, Box 2866, Kakamega
15	Enos Were	Director, Jewlet Fish Farm; Box 171, Kendu Bay
16	Aggrey Busiega	County Director, State Department of Fisheries, Box 186-50100, Kakamega
17	George O. Osure	PFO, National Fisheries Office, Kisumu, Box 1084-40100, Kisumu
18	Charles Ngala	Fisheries Extension Officer, LBDA, Box 1516 Kisumu
19	Faith M. Buluma	Aqua-Shop operator, Funyula, Busia County
20	Kenneth O. Oduor	Head Of Fisheries Department, RIAT; Box 1738, Kisumu
21	Elisha O. Nyamwaya	Fish Farmer, Hatchery Operator, Ahero
22	John Okechi	Researcher, KMFRI; Box 1881-40100, Kisumu
23	Dalmas Odhengo	CEO, BIG Consultants Ltd; Box 1536, Kisumu
24	Jedidah Nyongayo	Fish Farmer, Box 171, Kendu-bay
25	Michael Obadha	ADF, National Fisheries Office, Kisumu, Box 1084 - 40100, Kisumu
26	Jonam R. Etyang	County Director of Fisheries, Box 4031, Kisumu
27	Teresia Aloo	Fish Trader, Box 1, Kombewa

Annex D. Checklists and tools

Checklist A

- a. Characteristics of different types of fish farming businesses/groups and production structures/systems including species, markets, yields, seasonal changes (stakeholder analyses, seasonal calendar)
- b. Length of time the group has been together
- c. Initial reasons/purpose for coming together/forming a group
- d. Number of members (gender disaggregation)
- e. Gender issues and roles related to fish farming (stakeholder analysis)
- f. Membership structure, fees, by-laws and characteristics of members
- g. Is the group/individual registered/licensed or not and details?
- h. Current benefits of group membership
- i. Current production/yield levels for different systems (kg per annum) (stakeholder analysis)
- j. Current access to equipment, services and infrastructure and how could this be improved? What equipment is used? What services are available?
- k. Source of water and water quality, including monitoring and disposal of wastewater
- l. Source of seeds/fry, quantities and costs
- m. Source and use of feeds, quantities, costs of feed, details of production of local and on-farm feeds
- n. Characteristics of labour employed, family, seasonal, part-time, full-time, costs (stakeholder analysis)
- o. Support from extension services, what is the current status, is it adequate/useful and how could it be done differently/better?
- p. Access to credit, current status, is it adequate, does it need to be improved, if so how?
- q. Access to markets and marketing, handling, transport. Including key markets prices, products, seasonality, etc. How is fish sold and distributed?
- r. Changes you have seen in the last 5 years? E.g. number of farmers, volume of fish production, yield, species farmed, inputs, extension services, group membership, demand, markets, prices (time line)
- s. Additional livelihood activities of fish farmers
- t. Challenges and opportunities
- u. What do you think would help overcome the challenges?
- v. What do you think would help you make the most of the opportunities?
- w. Previous and/or current development support e.g. projects, government, private sector and how effective were these?

Checklist B

- a. What are the priorities in terms of aquaculture development/business? How would you like the situation to be in 12 months time?
- b. What is needed, if anything, to help you reach this objective (empowerment, training, inputs, enabling environment, other)?
- c. Which activities do fish farmers (operators) need to change or do differently in terms of improving their operations/business? What are the problems, what is causing the problem? What level of farmer performance is required? What is the actual performance level now?
- d. Who should do what differently, why and how?
- e. What behaviour, knowledge skills and attitudes do fish farmers need to carry out their work better/to the desired level?
- f. What is already in place that will help fish farmers learn and apply new knowledge and skills?
- g. What will make it difficult for fish farmers to learn and apply new knowledge and skills and why?
- h. What are the solutions to the things that will make it difficult (this should include provision of equipment, materials, enabling environment, market support, etc.)?
- i. Other than direct training, what other cost/effective ways are there to achieve the desired improvements in knowledge, skills, attitudes, behaviour?
- j. What kind of training will best help farmers achieve their fish farming business objectives/improvements?
- k. What previous training have farmers had, and by whom?
- l. What was good/did you enjoy?
- m. What did you find useful about any previous training?
- n. What would you want to be done differently in any future training?
- o. Who specifically/which individuals need training and how much training is required?
- p. What equipment or materials would help you (fish farmer/group) achieve your business objectives and why?
- q. Are there any other inputs or anything else that will help you (fish farmer) improve your business and achieve your objectives?
- r. In terms of registration and licensing, what opportunities for support are there and what benefits would such give?

Audit Questionnaire- Knowledge of production and marketing

- a. What makes fish go bad after harvesting? (bacteria and enzymes)
- b. What can be done to stop fish going bad? (use ice, avoid contamination with dirty places and equipment, harvest when it is cool in morning)
- b. What can make our fish unsafe to eat? (not using chemicals and drugs in production properly, contaminating the fish with dangerous bacteria (pathogens) from dirty water, poor personal hygiene, dirty equipment or surfaces)
- c. What affects the price of fish? (quality, size, supply of fish on the market, demand for fish e.g. number of buyers)
- d. What do we mean by advertising? (giving clear attractive messages to our customers and future customers about our product, where they can buy it and the product benefits)
- e. How can we keep our customers happy? (always supply what they want in terms of size and quality, deliver on time)

Checklist C

- a. Yield from fish farming operation
- b. Production volume (seasonal calendar)
- c. Costs of production (per kg of fish)
- d. Price per kg obtained in main markets (seasonal calendar)
- e. Total income (seasonal calendar)
- f. Challenges and constraints and frequency of these over past 12 months (matrix ranking)
- g. Knowledge of production and marketing (audit questionnaire)
- h. Income sources (matrix ranking)
- i. Income levels from different sources (seasonal calendar)
- j. Household expenditure general (seasonal calendar)
- k. Household expenditure on food (seasonal calendar)
- l. Type of food consumed
- m. Frequency of meals
- n. Quantity of food consumed
- o. Fish consumption e.g. species, products, quantities, frequency
- p. Ways of coping with shocks and difficulties

Annex E. Training modules

Beneficiary Name and Number of Members									
No.	Training need	Category of farmers	Duration of training (days)	Central Kakamega Aquaculture Cooperative	Muungano Fish Farmers/ (Yala and Bidii Clusters)	Tilapia Self Help Group	Great Wangchieng Fish Farmers	Butula Pond Fish Farmers Cooperative Society Ltd.	By whom and mode of delivery
1	Group cohesion and organization	All group members	0.5	40	35	40	40	40	Local experts, lectures, theory
2	Fish pond management (water quality, feed formulation, feeding regimes, disease management, predator control, sampling techniques, stocking, fish grading)	New group members, seed producers and out growers; Refresher for old farmers to learn new techniques and share experiences	1	40	35	40	40	40	Consultant/local experts, hands on practical training
3	Best Management Practices (BMPs), Intensive fish culture (catfish)	All categories	1	40	35	40	40	40	Consultant/local experts, hands on practical training
4	Fish handling and hygiene and quality control	All categories	0.5		35	35	35	30	Consultant/local experts, hands on practical training
5	Fish processing and value-addition	Grow out	0.5		30			35	Local experts, hands on practical training
6	Marketing linkages	All group members	0.5	40	35	40	40	40	Local experts, lectures, theory
7	Fish farming economics/ Aqua-business, resource mobilization	All categories	1	40	35	40	40	40	Consultant/local experts, lectures, theory
8	Farmer exchange visits	All categories	1	40	35	40	40	40	Consultant to guide

Annex F. Input list and specifications

No.	Item	Specifications	Unit of measure	Qty
1	Deep freezer	Westpoint Freezer #WBQT 5312-(19Cuft)	Piece	3
2	Deep freezer	Westpoint Freezer #WBQT 2112-(11Cuft)	Piece	12
3	Fridge Gaurd	Sollatek	Piece	15
4	Cooler Box	Mega Cool Box 48L MG/206	Piece	6
5	Cooler Box	Cooler Box 30L #101004 (F)	Piece	1
6	Seine net (harvesting)	Mounted Seine Net (Blue): Mesh size ¾ of inch, 2 metres deep - 40metres	per metre	24
7	Seine net (harvesting)	Mounted Seine Net (Blue): Mesh size ¾ of inch, 2 metres deep - 30metres	per metre	24
8	Small mounted fingerling net (sampling)	Mesh size 10 mm, 1.5 metres deep - 40 metres	per metre	24
9	Small mounted fingerling net (sampling)	Mesh size 10 mm, 1.5 metres deep - 30 metres	per metre	24
10	Hapa nets	4x2x1metres, net is 20psi (material strength), 20holes per inch	Piece	60
11	Hapa nets	2x1x1metres, net is 20psi (material strength), 20holes per inch	Piece	60

Annex G. Beneficiary details

Beneficiary name	Contact details
Central Kakamega Aquaculture Cooperative	John Nyapola - Chairman BOX 1969-50100 KAKAMEGA, TEL: 0710287699 / 0716-052180
Yala Fish Farming Cluster	Dephine Okota -Secretary; P.O. Box 19 Yala Tel. 0700240727
Bidii Fish Farmers	George Ambuli - Chairman, BOX 215 LUANDA, TEL: 0723117706 ,0713359044
Tilapia Self Help Group	John Nyamache - Chairman, P.O Box 9 - 40200 0733871151
Great Wangchieng Fish Farmers	Maurice Oondo - Chairman, P. O. Box 46 Kobala; Tel: 0726 024032
Butula Pond Fish Farmers Cooperative Society Ltd	Alex Ouma Abwao – Chairman, P.O. Box 34 Butula alexouma5@gmail.com Telephone: 0701129529

Annex H. Baseline data for beneficiaries

	Kisii County – Group and individual farmers	Homabay County – Group and individual farmers	Kakamega County – Group and individual farmers	Busia County – Group and individual farmers	Luanda/Gem Sub-Counties Group
A. What are the priorities in terms of aquaculture development/business?	Affordable quality feed, harmonized extension services, information, marketing, access to credit and inputs	Availability of quality and affordable feed, availability of seed in terms of quality and quantity, quality and reliable extension service, market infrastructure development (harvesting of fish and marketing every month), production level to be at 300kg/yr/300m ² , security of fish in ponds, security of fish ponds, access to improved technologies, harvesting gear per 10 members of a cluster	Fish farmers empowered to produce their own seed, availability of quality seed, availability of cold storage facilities, availability of affordable quality feed, seed quality, extension officers providing authentic information, good market prices for table size fish, improved pond management, improved record keeping	Market linkages developed, availability of harvesting gear for easy access by group members, improved pond management	Improved access to feed, market infrastructure (deep freezers, fish marketing outlet), increased numbers of ponds, improved access to credit, knowledge and skills to make own feed
B. What are the activities in which fish farmers (operators) need to change or do things differently in terms of improving their operations/business?	Management skills, source for information on new technologies, improve group operations	Improve quality of ponds constructed, need to reduce production period per cycle, update their knowledge base regularly, keep records, Take fish farming as a business, be serious, and diversification of livelihoods.	Improve management, improve group operations/ cohesiveness, Improve management, keep records	Need to invest more in fish farming, increase farm sizes, and keep good records. Strengthen group operations	Have organised harvesting (stop premature harvesting), improve management, need to improve record keeping, embrace group approach-sharing ideas.
i. what are the problems, what is causing the problem	Poor pond management, poor record keeping; lack of capacity in business skills, inadequate equipment and lack of affordable quality inputs e.g. gears, feeds	Poor pond management(poor feeding, poor quality seed), Fish farming being taken as a part time job	Lack of group meetings, poor pond management Lack of business attitude	Poor pond management, not taking fish farming as a serious business Lack of adequate capital to invest in fish farming	Groups not cohesive due to farmers being used to individualism approach in farming, records not being kept; Lack of interest, not taking fish farming as a business, capital investment very low, lack of proper management, inadequate capacity
ii. What level of farmer performance is required?	Level of performance should be at least 1kg/m ² /yr;	Level of performance required is between 1- 1.3kg/m ² /yr (300 to 400kg/300m ² /yr)	Level of performance should be at least 1kg/m ² /yr;	Be about 0.8 – 1kg/m ² /yr (250 -300kg/ 300m ² / year).	Level of performance should be about 0.8 – 1kg/m ² /yr (250 -300kg/ 300m ² / year).
iii. What is the actual performance level now?	The actual level of performance is 0.5kg/m ² or below	Actual level of performance is 0.5kg/m ² /yr (160/kg/300m ² /yr), at average	The actual level of performance is at 0.9kg/m ² and below	The actual level of performance is at 40%	The actual level of performance at 50%
d. Who should do what differently, why and how?	Feed producers should make age specific diets; Hatchery operators/ seed producers should produce mono-sex tilapia, Extension workers should give farmers relevant and accurate information	Intensification of quality feeding by farmers -use of quality feeds, Extension workers should give farmers relevant and accurate information, government should offer on-farm training for farmers to experience real practice, farmers should become more business oriented, Government should intervene on the high cost of feeds; Consumers need to change their attitude on looking at farmed	Extension workers need to make regular visits, input producers need to label their products, farmers need to improve on pond management, , farmers should become more business oriented,	Feed producers to improve on quality, extension workers need to visit farmers regularly, Fish traders need to give farmed fish a level playing ground with fish from the Lakes in the market	Farmers should be consistent in the management of their ponds, Consumers need to change their attitude on looking at farmed fish as inferior to Lake fish, , farmers should become more business oriented,
e. What behaviour, knowledge skills and attitudes do fish farmers need to carry out their work better/to the desired level?	Need to consider fish farming as a business, (change subsistence attitude); better their fish pond management (sampling techniques);	farmers need to be serious, hard working, need to be enterprise minded (change subsistence attitude); better their fish pond management (sampling techniques);have patience; improve their post harvest handling techniques, have their knowledge base increased, through continuous training (pond management and	Farmers should become business-oriented, self reliant, hard working, independent	Need to be trained; have good public relations; need to know how to motivate and inspire farm employees, and also how to produce quality (premium) product.	Need to have basic accounting/ book keeping skills, knowledge on record-keeping, feeding, etc; have self reliance, patience, hard work and a passion for the enterprise
f. What is already in place that will help fish farmers learn and apply new knowledge and skills?	Government intervention that brought in more players into the industry; Group/cluster approach;	Existing extension structure/network and government farms, Group/cluster approach; availability of raw materials for feeds, ponds, manpower and	Clusters/groups in place that are operational, extension service provision	State dept of Fisheries extension service already in place; Group/cluster approach;	Extension service provision network; Group/cluster approach;

g. What will make it difficult for fish farmers to learn and apply new knowledge and skills and why?	Inconsistent information from different extension service providers	Preoccupation with challenges of life; worries of livelihood; if knowledge is not practical oriented; the distance between the farmers and extensionists; illiteracy; lack of fish farming equipment, they lack the business language (understanding); poor state of existing ponds are a bad	attitude- fish farmers not taking fish farming seriously; other responsibilities- distractions; level of education, culture and age; lack of capital/ facilities	Lack of seriousness by some farmers; loss of hope when losses are made; lack of capital to invest in new knowledge and ideas	If the farmers cannot see possibilities of making profit; level of education; lack of capital
h. What are the solutions to the things which will make it difficult (this will include provision of equipment, materials, enabling environment, market support etc)?	Tax exemption/ reduction of tax on inputs;	Training farmers in practical fish farming; based on age groups; Provision of inputs subsidies; Market support (coolers, weighing balances); Support in terms of equipment – gears, water pumps, liners; Supported	More training; Provision of inputs	Need for financial support; Need for market support- development of market linkages; Need for support in terms of equipment and materials	Sharing of success stories from those who have made profit, Exchange visits; Supported with marketing equipment
i. Other than direct training, what other cost/effective ways are there to achieve the desired improvements in knowledge, skills, attitudes, behaviour?	Establishing a website; Dissemination of information through media	Demonstration farms; Exchange visits, Study tours, Practical Trainings;	Exchange tours; Field days/ field schools; Demonstration/model farms	Frequent farmer meetings; Farmer exchange visits; Frequent visits by extension workers;	Study Tours to successful farmers, Exchange visits
j. What kind of training will best help farmers achieve their fish farming business objectives/improvements?	Hands on practical training	Three day theory workshop followed by elaborate site practical's, On - Site training, Study tour/ exchange visit; Fish farm management, seed production, sampling techniques, production methods, simplified accounting and book	Business skills; Feed formulation; Value addition	Pond management; How to market fish; Networking;	Pond management – water quality monitoring, Entrepreneurship; Feed formulation, feeding; Marketing; Resource mobilization; Group Cohesion
k. What previous training have farmers had, and by whom?	Pond management - GOK and other Devt Partners - FAO;	Pond management- GOK, FAO, GIZ; Business planning – Farm Africa; Pond construction and mgt - fingerling multiplication; GOK Triilateral;	Pond management, pond construction, marketing, stocking, record keeping, harvesting	Pond management – GOK; Best Management Practices (BMPs), pond construction, marketing - Farm Africa	Pond management, Site selection for ponds, fish feeds, record keeping, stocking densities/stocking, predators - GOK;
l. What was good?	Practical application of Pond management skills; Whole programme;	Aquaculture as a business that is profitable; Gaining new knowledge and skills; Practical feeding lessons; Water quality	They were comprehensive, Taught in good environment;	Informative and educative;	Farming of mono-sex as opposed to mixed sex; Record keeping
m. What did you find useful about any previous training?		Practical orientation; Cost effective way of feeding fish and their multiplication (breeding); Sampling techniques; Enterprise budgeting and costing; How to manage ponds easily and	Opened avenues for farming as a business; Business focus; Group orientation;	Gained valuable knowledge and skills on fish farming;	Learning about how to fertilize, maintenance of pond area/ controlling predation
n. What would you want to be done differently in any future training?	Trainings should be done at a Fish Farm	Days of training to be increased from between 1-2 to 5; Practical training on a farm that is doing well; hear from successful farmers and have videos of successful farmers elsewhere; Improve on group dynamic trainings for cluster members;	Trainings to be both in theory and practical ;	Training should be as practical oriented as possible and done in a fish farm; Trainers should use both English and Kiswahili languages to train;	Training should be more practical oriented, should be done at a fish farm; Should have fish farming equipments for demonstration;
o. Who specifically/ which individuals need training and how much training is required?	Farmers – continuous on new technologies;	Those farmers who have not attended any training and others with a lot of practical demonstrations (especially new farmers); Extension workers; Seed producers; Feed and New members of clusters;	Pond constructors need to be trained more; Seed producers; Feed producers; Farm managers	Grow out farmers – a lot of training; Small scale Feed producers – a lot of training; Pond constructors; Seed producers – some training;	Pond constructors; Fish handlers; Farm /Pond managers;
p. What equipment or materials would help you (fish farmer/group) achieve your business objectives and why?	Nets (gears); Water quality kits; Cooler boxes for transporting fish to market; Harvesting and sampling nets; weighing scales for sampling and marketing, Fencing, material for hatchery;	Cooler boxes for transporting fish to market; Harvesting and sampling nets; weighing scales for sampling and marketing, hose pipes, Solar water pump; Water quality testing kits; Pond liners; Fencing material;	Deep freezer – for cluster/group marketing collection centre; Weighing balances – farmers to weigh their fish during harvest for proper records; Pelletizer/ feed mill- to make on farm-feeds at reasonable price; Transport – motor bike (for offering extension service to group members);	Cool boxes; Seine nets; Weighing balances – farmers to weigh their fish during harvest for proper records;	Cool boxes – fish taken to market can maintain freshness for longer period; Nets (harvesting, scoop, hapas) – for sampling, harvesting, and holding fish as and when needed/ on time; Secchi disk, water quality testing kit – ensure and maintain good water quality throughout.;
q. Are there any other inputs or anything else that will help you (fish farmer) improve your business and achieve your objectives?	Water testing kits/ Secchi disk; Feeds; Market; Labour;	Quality feeds (seed and feed sub)	Electricity connection should be made easier; Fencing;	Availability of Quality seed; availability of Fertilizer and lime;	Availability of Quality affordable feeds; Availability of Fertilizer and lime;
r. In terms of registration and licensing, what opportunities for support are there and what benefits would these give?	Government very supportive in encouraging registration of groups	Registration and licensing of clusters important for authenticity, important in for group management, collective bargaining; It opens up avenues accessing funds; support, markets; Official recognition by government, access to credit facilities; access to support; bank account;	Group is registered;	Member of a registered Cluster;	No big challenges with registration; Benefits include access to funding, loans, grants, marketing;

Annex I. Photos

Photo 1: Wangchieng cluster meeting



Photo 2: Tilapia Fish Farmers meeting (Suguta, Kisii County)



Photo 3: Visit to Mabro Fish Farm (Siaya County)



Photo 4: Members of the Central Kakamega cluster



Photo 5: Alex Ouma, Chairman of Butula Cooperative, in the feed production centre



SmartFish is a regional fisheries project managed by the Indian Ocean Commission, funded by the European Union and co-implemented by the Food and Agriculture Organization of the United Nations. SmartFish, which operates in 20 countries throughout the East and Southern Africa - Indian Ocean region, focuses on fisheries governance, management, monitoring, control and surveillance, trade, and food security.

This report presents the initial findings of an assessment on the needs for aquaculture production and marketing in selected fish farmer organizations in Western Kenya. The purpose of the assessment was to guide support and investment choices to enhance sustainable aquaculture productivity and profitability.

The Ministry of Agriculture Livestock and Fisheries identified the development of fish farming to be one of its core activities as aquaculture has the potential to reduce fishing pressure on oceans, lakes and rivers, but can also enhance food security, create employment and wealth, and promote healthy living. The Kenyan Government therefore aspires to create an enabling environment for a vibrant aquaculture industry.

This report outlines the training needs and a training delivery plan legal registration and networking recommendations; input requirements; as well as a distribution plan and costing for selected fish farmer clusters. Findings from this assessment anticipate that ultimately selected fish farm clusters will serve as the nuclei in an effort to expand market clusters to other small and medium enterprise investors across the country and the region at large.



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