



WorldFish

CGIAR Research Program 3.7 - Livestock & Fish

**UGANDA AQUACULTURE VALUE CHAINS:
STRATEGIC PLANNING MISSION REPORT**

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Acronyms

AAS	Aquatic Agricultural Systems
aBI	Agribusiness Initiative (Trust) – a multi donor fund set up by Danida
AFSPAN	Aquaculture for Food Security, Poverty Reduction and Nutrition
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASF	Animal source foods
ATAAS	Agricultural Technology and Agribusiness Advisory Service
AU-IBAR	African Union Inter-African Bureau for Animal Resources
AWG	Aquaculture Working Group – within PAF
CAADP	Comprehensive Africa Agriculture Development Program
CAPA	Commercial Aquaculture Producers for Africa
CGIAR	Consultative Group on International Agricultural Research
COMESA	Common Market for Eastern and Southern Africa
CIAT	International Center for Tropical Agriculture
CIP	International Potato Center
CRP	CGIAR Research Program
CRSP	Collaborative Research Support Program
Danida	Danish International Development Assistance
CRP	CGIAR Research Program
DFID	Department for International Development
DFR	Department of Fisheries Resources
DRC	Democratic Republic of Congo
DSIP	Development and Investment Plan (for the Agriculture Sector)
EA	East Africa
EAC	East African Community
EDF	European Development Fund
EU	European Union
FAITH	Food Always in the House – an NGO project
FAO	Food and Agriculture Organization (of the United Nations)
FCR	Food Conversion Ratio
FEMCOM	Federation of National Women's Associations
FISH	Fisheries Investments for Sustainable Harvest – USAID Project
FtF	Feed the Future – USAID program
GIZ	German International Cooperation
GoU	Government of Uganda
ICRA	International Centre for Research in Agriculture
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IIRR	International Institute for Rural Reconstruction
ILRI	International Livestock Research Institute
KARDC	Kajjansi Aquaculture Research and Development Centre
L&F	Livestock and Fish

LEAD	Livelihoods and Enterprises for Agriculture Development (USAID Project)
LVHD	Low Volume High Density
LVFO	Lake Victoria Fisheries Organization
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MOFA	Ministry of Foreign Affairs
MTEF	Medium Term Expenditure Framework
NAADS	National Agricultural Advisory Services
NaFIRRI	National Fisheries Resources Research Institute
NARO	National Agricultural Research Organization
NARS	National Agricultural Research System
NBDC	Nile Basin Development Challenge
NDP	National Development Plan
NEPAD	New Partnership for Africa's Development
NORAD	Norwegian Agency for Development
NUAD	Northern Uganda Aquaculture Development
PAF	Partnership for African Fisheries
PEAP	Poverty Eradication and Action Plan
PIRT	Presidential Investment Round Table
R&D	Research and Development
SCAPA	Sustainable Commercial Aquaculture for Poverty Alleviation
SLT	Senior Leadership Team (at WorldFish)
SME	Small and Medium-Scale Enterprise
SoN	Source of the Nile Aquaculture Farm
STARGO	Strengthening Aquatic Resource Governance
UGS	Uganda Shilling
UNADS	Uganda National Aquaculture Development Strategy
USAID	United States Agency for International Development
USD	United States Dollars
TOT	Training of Trainers
UNHCR	United Nations High Commissioner for Refugees
VC	Value chain
WAFICOS	Walimi Fisheries Cooperative Society

Executive Summary

This report presents the findings and recommendations of a strategic planning mission to re-evaluate the feasibility of WorldFish implementing a fish value chain research program in Uganda under the CGIAR Research Program on Livestock and Fish (L&F). The over-arching goal of L&F is to increase productivity of small-scale livestock and fish systems so as to increase availability and affordability of meat, milk and fish for poor consumers and, in doing so, to reduce poverty through greater participation by the poor along animal source food value chains. This will be achieved by making a small number of carefully selected animal source food value chains function better, for example by identifying and addressing key constraints and opportunities (from production to consumption), improving institutional arrangements and capacities, and supporting the establishment of enabling pro-poor policy and institutional environments.

Uganda was identified in 2010 as one of two candidate countries for the development of fish value chains under L&F (the other country being Egypt). However, it was subsequently discovered that the Ugandan aquaculture industry was much smaller than officially recorded, and opportunities to raise funds in the country were poorer than anticipated. It was therefore agreed that the strategic planning exercise should be undertaken to guide decisions on whether or not to go ahead as proposed for Uganda.

The key findings of the mission are as follows:

- Though available data do not appear to show a decrease, lake fish stocks and capture fisheries are widely thought to be in general decline¹ due in large part to over-fishing, compounded by environmental degradation and climate change / variability. There is widespread consensus among stakeholders that the widening supply-demand gap for domestically produced fish products can only be narrowed through aquaculture.
- While aquaculture production in Uganda is much smaller than official figures suggest, it is likely to expand rapidly in the next decade. Significant levels of commercial investments are planned to take place within the coming three years. An industry with around 10,000 tons production capacity will most likely emerge within the next three to five years.
- Uganda currently acts as a regional hub for the supply of aquaculture inputs (feed, seed, fingerlings) and small amounts of aquaculture-produced fish, along with large quantities of wild caught fish and fish products to neighboring countries, including the Democratic Republic of Congo (DRC), Rwanda, Kenya, and perhaps to a lesser extent South Sudan. There is potential for Uganda to take on a more significant regional role in the supply of aquaculture inputs and products in the future.
- Current government policies prioritize fish as a key investment opportunity over the medium term. Aquaculture development is on the policy agenda in the shape of a strategic aquaculture plan, and the government is planning to develop aquaculture parks in up to five gazetted areas including lakes and rivers in the central and western regions as detailed in the recently drafted Aquaculture Parks Policy. Although there are attempts to enhance the enabling environment for the sector, the governance capacity remains weak.
- It is the general perception among development partners that the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) is lacking capacity, incentives, drive and leadership. Both the Government and development partners see the

¹ The scale of the decline due to 'over-fishing' has perhaps been overstated since there are no industrial scale fisheries operations.

private sector and commercial investments as the main drivers of aquaculture, with the public sector providing the enabling context.

- A number of donors are actively supporting agriculture, with more apparently re-entering the sector. A smaller number currently focus on fisheries and/or aquaculture in Uganda and the region with the European Union (EU) being the largest player in Uganda at present. The EU is currently considering support to the aquaculture parks and indicated to the mission that although aquaculture is not a top priority it will not be left aside. If the EU decides to provide support to aquaculture, it is – according to the EU mission in Kampala – very possible that other donors may follow.
- The artisanal fisheries sector is extremely vibrant, but the smallholder aquaculture sector is still struggling. Despite earlier expectations, small and medium enterprise (SME) aquaculture has not yet taken off in Uganda. It remains difficult for producers to make a profit let alone break even. The main constraints and bottlenecks include: feeds (low quality, high prices, volatile supply); lack of market development; absent or weak business development services (e.g. advice, technology and capital); misguided/misinformed producers and new entrants expecting a quick return on investments.
- Farmers are currently being pushed towards high cost aquaculture production systems which potentially run at a loss and will not deliver fish for the poor. There is a need for lower feed conversion ratios (FCR), higher value production systems, and/or lower production (feed) costs. The production models for tilapia and catfish currently promoted are too expensive for smallholders and there is a need for cheaper alternative models, e.g. using locally produced feeds and relying more on natural pond fertilization. Larger, good quality cages are also recommended.
- Because of the very small amounts of farmed fish being produced, prices for are influenced by the relatively low wholesale prices of wild fish from the lakes. However, further away from the lakes, and at the retail level, fish fetches a much higher price. Also, preferences for different types of fish (tilapia; catfish) vary across the region.
- Marketing of farmed fish is a major challenge, despite the high demand for fish. The ‘hub-model’ with clusters of well-organized smallholders built under the USAID Livelihoods and Enterprises for Agriculture Development (LEAD) project offers some promise for further expansion. Aquaculture value chains in Uganda and the East African region are currently disjointed and ineffective; some would argue that there is no value chain at all, only temporal spot markets that occasionally link small numbers of actors who generally operate in inefficient ways. On the other hand, there are functional and well-developed fisheries value chains that operate at local, regional and international levels.

The planned investments from the private sector will support improvements in aquaculture input and output marketing, bringing in opportunities for value chain development that could have impacts on food and nutrition security at local, national and regional levels. However, until the anticipated expansion in aquaculture production actually occurs, we recommend that WorldFish should focus on the fisheries sector, for which there is ample scope for value chain improvements to benefit the poor. Although the study team was tasked to consider whether WorldFish should proceed with an aquaculture research program under the L&F CRP, we feel that confining the focus to aquaculture means that the organization as a whole is missing out on the large potential for research interactions on wild fisheries and fisheries products in Uganda and the region. Lake Victoria alone is one of the world’s largest freshwater fisheries employing many thousand poor fishermen, sustaining many more (poor) men and women working in the value chain and providing animal-sourced protein for poor people in Uganda and the region. The potential short-term and long-term impacts that could be achieved from a wild and farmed fish research-for-development program would be considerably greater than one focused solely on aquaculture value chains.

Specifically, the research objectives of WorldFish should be to:

1. Develop and test models for SME-based, pro-poor, gender equitable fisheries and aquaculture value chain development;
2. Increase access - geographic, but especially economic - to fish by poor consumers and assess nutrition outcomes at intra-household level, as affected by poverty, livelihoods, life cycle, health, ethnic and gender norms;
3. Address the growing environmental issues, in particular surrounding impacts of rapid expansion in lake-based cage farming and its effects on biodiversity and ecosystem services;
4. Address conflict and governance issues around common property resources, especially in relation to lake-based commercial cage farming; and
5. Generate knowledge for more evidence-based, planning, decision- and policy-making processes and help strengthen the emerging policy and regulatory framework for aquaculture and fisheries.

The mission finds that this could be an opportune time for WorldFish to engage in research for development in Uganda and the broader East African region under the L&F program. The commercial aquaculture sector is set to expand significantly in the coming years, albeit from a very limited baseline, stimulating market developments that could benefit poor producers and consumers. WorldFish should position itself ahead of these changes, to develop and strengthen its networks, establish its identity, anticipate and nurture pro-poor research and development opportunities, and gradually build a portfolio in Uganda (with a regional outlook) as a go-to research-for-development facilitator, knowledge partner, and broker of innovative partnerships in the aquaculture (and fisheries) sector. There is an opportunity to influence and help frame a much needed research agenda around key issues such as pro-poor value chain development, animal-source food and nutrition security, gender equity, and environment impact, before and during the early stages of this widely anticipated private sector take-off. These vital research and development issues, if not driven by agencies like WorldFish are in danger of receiving inadequate attention.

There are potential risks surrounding such an engagement, however, relating to a weak policy environment and the lack of clarity around commitment by the Government as well as development partners to financing the interventions needed to establish the enabling framework, secure public goods, and help drive the sector forward sustainably. There are signs though that a stronger enabling framework is emerging encouraged by the national leadership.

A key challenge will be in raising the necessary funds to establish a permanent in-country presence and build a sizeable portfolio if it is focused only on the aquaculture sector which, at present, makes a very limited contribution towards livelihoods, employment and the economy. It is therefore proposed that the initial focus should be on fisheries and aquaculture, until such time that the aquaculture sector has expanded sufficiently to warrant exclusive focus. Given this scenario, five options are presented:

1. Establish presence from early in 2013, initially for three years, under the umbrella of a CGIAR partner, with a **full-time representative**/Value Chain Coordinator based in Uganda;
2. Establish presence from early in 2013, initially for three years, under the umbrella of a CGIAR partner, with a **part-time representative**/Value Chain Coordinator based in Uganda;
3. No staff recruitment in 2013 but initiate activities in Uganda/East African region by **drawing on existing WorldFish staff** and others to undertake and guide initial

activities until such time that a more substantive portfolio and income streams have been generated;

4. **Delay decision** on Uganda/East African region and re-assess the situation in two to three years to see whether the planned private sector investments have led to increased aquaculture production levels and improved marketing and whether there is genuine commitment from the Government and development partners to provide necessary support; and
5. Undertake **another feasibility mission to another country** (e.g. Ghana, Nigeria, Malawi, Zambia) to determine whether or not there is a better alternative to Uganda/East Africa.

The first three options assume availability of L&F seed money to cover cost of staff and initial field work (e.g. rapid value chain assessments; market studies), until such time that additional income has been generated. Very recent information from the Consortium Office received via ILRI, however suggests non-growth for L&F with a 2013 budget identical to the 2012 budget, leaving insufficient funds to start up a Uganda presence for the time being or provide seed money for initial field research. The necessary funds will therefore have to be raised from other sources. WorldFish is already engaged in three large projects in Uganda/East Africa (ASARECA, AFPSAN, STARGO) and there are three more initiatives in the pipeline (EU-Fish Trade, ADRAS, COMESA-Women in Business), the first of which has recently received confirmation of funding. Planned activities under these projects offer a basis from which to expand.

Opportunities for further fundraising include the development of broad, regional proposals that address the 'big questions' prepared together with CGIAR partners and submitted to larger donors such as the Gates Foundation, IFAD², and others; working in partnership with national and regional bodies (e.g. NEPAD, COMESA, ASARECA, PAF, NARS) to develop joint proposals relating to the proposed research agenda³; private sector funding; and competitive research grants.

1. Introduction

1.1 Background

In 2010 WorldFish carried out an extensive prioritization exercise to decide in which two countries it would implement fish value chains as part of the CGIAR Research Program (CRP) on 'More Meat, Milk and Fish by and for the Poor' – now referred to as 'Livestock and Fish' or L&F (Annex 1). Uganda was identified as one of two candidate countries in view of the importance of fish, human population growth, yield trends from capture fisheries, and the presence and growth potential of its aquaculture industry.

The over-arching goal of the Livestock and Fish research program is to increase productivity of small-scale livestock and fish systems so as to increase availability and affordability of meat, milk and fish for poor consumers and, in doing so, to reduce poverty through greater participation by the poor along animal source food value chains. This will be achieved by making a small number of carefully selected animal source food value chains function better, for example by identifying and addressing key constraints and opportunities (from production

² ILRI sees potentially large, longer term opportunities for L&F with these two donors in East Africa.

³ During the mission ASARECA expressed keen interest to work more with WorldFish on resource mobilization for aquaculture research activities in the East African region.

to consumption), improving institutional arrangements and capacities, and supporting the establishment of enabling pro-poor policy and institutional environments (ILRI, 2011).

In the year preceding the start (January 2012) of the L&F program various activities were undertaken to build partnerships and mobilize resources. Five of the seven grant applications were successful, but generated only small amounts of funding for Uganda. Moreover two of the grants were subsequently switched to Egypt as there was judged insufficient WorldFish presence in Uganda to implement successfully. The donor mission carried out by WorldFish in May 2011 concluded that the opportunities to raise funds in the country were poorer than anticipated. Moreover, it was discovered that the rapidly rising aquaculture production estimates issued in recent years by the Ugandan authorities are not supported by activities on the ground. There are serious structural impediments holding back development of the aquaculture industry, including high costs and competition with wild fish in the market meaning that producers are either making losses or are only barely profitable.

It was subsequently agreed at the WorldFish Senior Leadership Team (SLT) meeting in January 2012 to carry out a strategic planning exercise during the second half of 2012 to guide decisions on selected fish value chains that will frame WorldFish interventions in the country, under the auspices of the L&F program. The terms of reference for the strategic planning mission are shown in Annex 2. The mission was funded by L&F, and the current report is a contribution to the L&F program.

1.2 Objectives of the mission

The objectives of the strategic planning mission and subsequent follow up were to:

1. Re-evaluate the feasibility of WorldFish implementing a fish VC research program in Uganda, considering (i) the state of the industry, its growth trajectory and the barriers to its development, (ii) partnerships, (iii) the policy environment and (iv) the likelihood of raising sufficient funds to sustain a viable program.
2. Should Uganda remain a viable prospect:
 - a. Develop an implementation plan, including the logistics of establishing and maintaining a presence in the country and the investments required.
 - b. Identify candidate value chains for future program interventions in two regions of Uganda (presently south/southeast and north of Lake Kyoga).
3. Should Uganda not prove viable, alternative or broadened (e.g. Kenya, South Sudan) locations will be considered.

1.3 Methodology

A team of four was deployed to Uganda with back-up support from Worldfish offices in Penang and Lusaka. The in-country mission took place from 10th to 18th September, 2012, and was followed by a de-briefing in Lusaka on 21st September, 2012. Team members included the following with responsibilities as shown, based on the considerations outlined in the Objectives above:

1. Jens Peter Tang Dalsgaard (Team Leader; Funding potential)
2. Kate Longley (Partnerships; Value Chains)
3. Malcolm Dickson (Aquaculture industry, growth and development)
4. John Jagwe (Policy environment)

Further support was provided by Malcolm Beveridge and Ban Swee Tan. In Uganda, Danilo Pezo (ILRI L&F Coordinator) and Emily Ouma (ILRI Economist) provided additional assistance and took part in a small number of meetings where support from ILRI was advantageous.

A list of stakeholders (Annex 3) was drafted in consultation with colleagues who have worked in Uganda, and contact was made with key individuals to arrange meeting appointments (Annex 4). Most meetings were conducted by the whole team, though it was necessary to split into pairs or meet as individuals in some cases. Where it was not possible to meet with key individuals, information was sought by phone and by email.

Team meetings were held at key points throughout the mission, and all members of the team contributed in drafting the report, with additional inputs from Malcolm Beveridge.

1.4 Structure of the report

Following this introductory section, Section 2 describes the institutional landscape, providing an overview of relevant policies and regulatory frameworks, recent and on-going programs and projects, and an assessment of potential partners. Section 3 provides a situational analysis of the state of the aquaculture industry and markets for farmed fish in Uganda and the region, barriers to development, and the future growth trajectory. Section 4 summarizes the main findings of the mission, outlines the key research issues that need to be addressed, and highlights candidate value chains that might form the focus of future research for development activities under the L&F Program, as well as potential threats to the proposed research. The recommendations of the mission team are put forward in Section 5, which offers four possible implementation options and proposes various funding channels.

2. The institutional landscape: policies, projects and partners

2.1 Policy and regulatory framework

The Government of Uganda has set a goal of meeting the country's requirements for fish through increased aquaculture production from the current official figure of 90,000 tons to a projected 305,000 tons by 2017/2018 (MAAIF, 2012b). This plan has been captured in the Ministry of Agriculture Animal Industry and Fisheries (MAAIF)'s Development Strategy and Investment Plan (DSIP, 2010-2014) which has prioritized fish commodity as one of the top investment opportunities over the medium term. The DSIP is the key policy document for the agriculture sector and is consistent with the broader National Development Plan (NDP)⁴.

The DSIP consolidates and harmonizes all the existing parallel policy frameworks in the agricultural sector into one coherent plan. The DSIP sets the priorities for the five-year period and these will be used as a basis for defining spending plans each year under the Medium Term Expenditure Framework (MTEF). The vision of the DISP is to have “a *competitive, profitable and sustainable agricultural sector*”. The mission is to “*Transform subsistence farming to commercial agriculture*”.

The DSIP highlights the problem of declining fish catches amidst growing demand. The National Fisheries policy drafted by the Department of Fisheries Resources (DFR) of MAAIF

⁴ The objectives of the National Development Plan (2010/11 – 2014/15) are to: (i) Increase household incomes; (ii) Enhance the quality and availability of gainful employment; (iii) Improve the stock and quality of economic and trade infrastructure; (iv) Increase access to quality social services; (v) Promote innovation and industrial competitiveness; (vi) Harness natural resources and the environment for sustainable development; and (vii) Strengthen good governance and improve human security.

in 2004 highlights the objective of aquaculture fish production being increased so as to reduce the gap between fish supply and the increasing demand for table fish. The DSIP also mentions lack of feeds to sustain improved aquaculture production.

The government of Uganda continues to support the National Fisheries Resources Research Institute (NaFIRRI) by providing the human resource and maintaining the research centers, though there is heavy reliance on development partners to help fund and conduct research activities. In 2008, FAO supported the preparation of a Uganda National Aquaculture Development Strategy (UNADS) whose aim was to guide the development of the sub-sector (UNADS, 2008).

The government is also pursuing the possibility of establishing 'Aquaculture Parks' though it is not yet clear how they shall operate. In January 2012, a policy for the establishment and operation of aquaculture parks in Uganda was drafted by a working group under the Presidential Investment Round Table (PIRT). The aquaculture parks policy aims at creating a conducive investment environment for aquaculture parks and to provide the required guidance for their implementation (MAAIF, 2012c). The policy is yet to be presented to cabinet and parliament. Further information about the role of the EU in the development of aquaculture parks is elaborated in Section 2.2.

Under the DSIP, the core mandate and functions of MAAIF and the sector is to ensure efficient and effective provision of critical agricultural public goods, services and support. The investments have been packaged under four Programs representing the key areas of opportunity: (i) Enhancing Production and Productivity; (ii) Improving Access to Markets and Value Addition; (iii) Creating an Enabling Environment, and; (iv) Institutional Strengthening in the Sector.

The National Agricultural Advisory Services (NAADS) will be transformed into the Agricultural Technology & Agribusiness Advisory Service (ATAAS), specifically focusing on research and technology transfer. Aquaculture is not captured under this arrangement, hence falling under the non-ATAAS Thematic areas. Task forces have been formed to discuss how to move forward with the non-ATAAS themes and twenty situation analyses and framework implementation plans have very recently been drafted for priority project areas including fish and livestock, outlining the operationalization of the non-ATAAS component of the DSIP (MAAIF 2012a,b). The process is being facilitated and supported by the World Bank.

According to the September 2012 'Operationalization of the non-ATAAS Component of the Development Strategy and Investment Plan - Draft Framework Implementation Plans: Sustainable Fish Production', reviewing the policy framework "...There had been no specific policies for aquaculture, the regulations were developed at a time when restrictions were being developed to safeguard the Nile perch export market and were made too restrictive to attract investors into aquaculture. A strategy for the sector was only recently drafted but needs clear implementable action plans. This program will prepare an aquaculture specific policy. It will review and improve the aquaculture regulations. The strategy and action plan will be refined and focused. These, once in place, will continually be updated from experiences gained from program implementation and should improve sustainability of the program" (MAAIF, 2012b).

According to the same report, MAAIF aims to have:

- a) An aquaculture policy developed and approved by 2014;
- b) An improved aquaculture strategy and action plan available by 2014;
- c) Aquaculture rules (2003) reviewed and rationalized by 2014;
- d) Guidelines for addressing other policies and regulations impacting on produced aquaculture by 2014;

- e) A policy on aquaculture park which includes clusters completed and approved by 2013; and
- f) Aquaculture parks and clusters identified and mapped 2014.

This introduces a specific program on aquaculture in MAAIF and Government in the DSIP has made provision of UGS 51 billion for water for aquaculture over a period of five years (ibid). Proposals will also be prepared to seek donor funding for specific activities.

In summary, despite the political desire of the Government of Uganda to promote aquaculture, the commitment in terms of financial resource allocation to move processes forward has been lacking so far. However, the intentions to change this in future appear to be there.

The required thrust may be obtained from development partners such as the EU, FAO and bilateral arrangements with countries such as China to take the industry forward (see Section 2.2). Strong participation of the private sector is important in such processes. MAAIF sees the private sector as the engine of economic growth. For aquaculture to develop to a commercial level the private sector has to play a central role with public sectors providing an enabling environment (MAAIF, 2012c). The program considers the private sector as being central to the success and sustainability of aquaculture in Uganda (ibid).

While the government may signal preparedness to consolidate its efforts towards a conducive regulatory environment which safeguards private sector investments while catering for national and regional social, economic and environmental concerns / interests, it also acknowledges that “Slackness in government decision making mechanisms and apparent lack of will to enforce laws both within and outside MAAIF has also affected aquaculture production and will need to be considered” (ibid).

The establishment of a Fisheries Authority (similar to those that have successfully been set up for coffee, cotton and dairy sectors in Uganda) might be considered to play a regulatory and promotional role for the entire fisheries sector. Such an authority could be instrumental in promoting aquaculture throughout the country and could also regulate the actors in the aquaculture sector to ensure better feed, seed and production systems. MAAIF has, however, so far apparently resisted the establishment of such an agency for fisheries and aquaculture, which would imply scrapping the Department of Fisheries Resources with all regulatory and promotional functions assumed by the new authority.

2.2 Key development partners, programs and projects

Despite the policies supporting aquaculture being in place, the Government of Uganda is yet to commit significant resources to the sector. Most of the funding support towards aquaculture development in Uganda to date has been made by development partners such as USAID, the Chinese government, African Development Bank, FAO and DFID. Some of the more recent donor-funded programs and projects are briefly summarized below. Further information about key donors can be found in Annex 5.

USAID has been very supportive of Uganda’s fisheries and aquaculture industry and in 2006 commissioned the Fisheries Investment for Sustainable Harvest (FISH) project, which was followed by the Livelihoods and Enterprises for Agricultural Development (LEAD) project (2008-2012) which supported aquaculture among other value chains. The LEAD project focused on feed, seed, farmers’ capacity and technology transfer with private sector taking lead. The project funded the establishment of a fish feed production line to the tune more than USD 300,000 in Ugachick, the largest manufacturer of chicken in feed in Uganda. LEAD also supported Source of the Nile with their selective breeding program for tilapia and sex-reversion, allowing for an increase in their fingerling production capacity from 200,000 to

800,000 fingerlings per month by closure of the grant period and 1,000,000 fingerlings per month to date (Olwo, 2012). Both FISH and LEAD developed the capacity of smallholder farmers for fingerling production and a small number of successful out-grower fish farmer groups with links to local and regional markets have been established. The LEAD mid-term review (i-TEC, 2011) reported that – for all selected value chains – the LEAD project had considerable success in increasing productivity, but was less successful in increasing trade capacity. No data are available for aquaculture gross margins due to the timing of the review (when fish had not yet been harvested). The final report for the fish value chain intervention (Olwo, 2012) reported that five catfish hatcheries were established with a combined production capacity of 3,120,000 fingerlings per year, sufficient to supply approximately 25% of the total national annual requirement. USAID's Feed the Future project, which builds on previous investments and defines USAID's support in Uganda, focuses narrowly on maize, means and coffee value chains.

Another initiative that intends to work directly with smallholders is Sustainable Commercial Aquaculture for Poverty Alleviation (SCAPA), a local company working with the UK-based development organization Business Minds and supported by the Dutch Government. The focus is on large-scale catfish aquaculture business and catalysing smallholder development through commercial investments. The project has been in operation for some 30 months, in partnership with the University of Stirling, and is currently preparing a technical-cum-business model to carry the project forward. At present SCAPA says it is supporting around 80 farmers in a cooperative to start growing fish commercially. The target is to involve several thousand farmers as shareholders and to establish a sales-and-marketing company linking farmers to input and output markets.

Despite a large number of NGOs in Uganda, aquaculture appears not to be getting much attention at present. This is likely a reflection of the little financial support currently provided by the Government and donors. The mission came across UAOGRESCUE, a Ugandan NGO engaged in cage culture in lakes Albert and Nakivale through its FAITH (Food Always in the House) project in collaboration with UNHCR targeting internally displaced people affected by events in the north. The project is part of a livelihood program to help affected communities via technology transfer. The organization runs another project under its FAITH project in Northern Uganda covering lakes Bisina and Kyoga and a water reservoir in the Karamoja region and named Northern Uganda Aquaculture Development (NUAD). Lessons learned and results of these projects are yet to be documented.

Under the China-Africa Forum, Uganda has benefited from bilateral aid from the Chinese government in form of establishment of a demonstration site for aquaculture at Kajjansi Aquaculture Research and Development Centre (KARDC). Phase I of the project began in 2009 with the construction of fish ponds and an administrative block with a laboratory. Phase II of the project, running from 2010 to 2014, focuses on: i) Demonstration of aquaculture technology; ii) Training and capacity building of farmers and researchers; and iii) Research on aquaculture (species improvement, feed and productivity). Under the second phase a feed mill and a hatchery have been constructed and are currently being managed on a semi-commercial basis by the Uganda Huaqiao Fenghuang Fisheries Company Ltd. The facilities at Kajjansi will be handed over to GoU/NARO-NaFIRRI in 2014, though there are concerns about the capacity of NaFIRRI to manage them effectively. The Uganda Huaqiao Fenghuang Fisheries Company Ltd that was sub contracted by the Chinese government under this bilateral assistance intends to make an additional investment of US\$172 million from 2014-2017 into commercial aquaculture using cages, ponds and tanks in order to produce 27,000 tons of fish (cat fish, tilapia, grass and silver carps) annually. A much larger feed mill and a processing plant are also planned under this new investment.

The EU Delegation is currently considering potential future funding to the Aquaculture Parks initiative. This follows on from a 2011 assessment of the feasibility of developing the commercial aquaculture industry in Uganda (Dickson and Macfayden, 2011). As a follow-up, the EU has commissioned a study, scheduled for November 2012, to assess the feasibility of

establishing two aqua-parks in Uganda to produce catfish and tilapia. The study is to specify the suitable location, the mode of operation (smallholder versus large commercial producers). The EU will then make a decision on if and how to go ahead and this may involve partnering with GoU and other donors. Once the European Development Fund (EDF) support for 2014 – 2020 is approved, aquaculture may be considered depending on discussions to be held by the thematic subgroups on the non-ATAAS DSIP priorities.

On the research front, the USAID supported AquaFish CRSP, working with Makerere University, NaFIRRI and others ended in 2011, with any further activities to be subsumed under the Feed the Future (FtF) program. The program works to enrich livelihoods and promote health by cultivating international multidisciplinary partnerships that advance science, research, education, and outreach in aquatic resources. An annual Fish Farmers Symposium & Trade Fair, organized by the Walimi Fisheries Cooperative Society (WAFICOS), provides a unique opportunity for fish farmers and partners in Uganda to network, learn new skills, and check out the latest in aquaculture equipment and products. The Symposium, the only one of its kind in the region where researcher and farmers get a chance to interact, is always well-organized and attracts a lot of interest and enthusiasm within the sector. WAFICOS, however, currently has limited capacity to be able to support its members.

WorldFish is currently a partner on two regional projects under L&F, the ASARECA-led 'Aquaculture Development in ASARECA Region' and FAO's Aquaculture for Food Security, Poverty Alleviation and Nutrition (AFSPAN). The Strengthening Aquatic Resources Governance (STARGO) project, mapped to AAS also operates in Uganda on Lake Victoria. Table 1 provides brief information on the ongoing and upcoming projects in Uganda/the region together with potential projects in the pipeline.

Table 1. Current and potential WorldFish projects in Uganda/East Africa

Project	Uganda budget 2012 (USD)	Uganda budget 2013 (USD)	Uganda budget 2014 (USD)	Project title and focus in Uganda / East Africa	Key Partners in Uganda / East Africa Region
Current projects					
ASARECA	51,208*	46,178*	N/A	Aquaculture Development in the ASARECA Region; focus on public-private partnerships.	ASARECA, NaFIRRI, SoN.
AFSPAN	68,718*	83,692*	23,789*	Aquaculture for Food Security, Poverty Alleviation and Nutrition (Sites: Asia & Africa).	Makerere University (Institute of Food Science and Biotechnology).
STARGO	319,899*	286,268*	34,746*	Strengthening aquatic resource governance (Sites: Lake Victoria, Lake Kariba, and Tonle Sap). Working with three fishing communities on Lakes Victoria and Edward,	Adelphi Research Gemeinnützige GmbH; Department of Fisheries Resources, Makerere University (Dept. of Biology).

Uganda.					
Upcoming projects					
EU Fish Trade project Total budget is \$5.5 million for four years, 50% of which will come to WorldFish (for all regions of Africa).	N/A	Not yet known	Not yet known	'Improving Food Security and Reducing Poverty through intra-regional Fish Trade in sub-Saharan Africa'. The project will gather data on six case study trade corridors, one of which will be in East Africa, and intends to lead to policy change in three corridors.	African Union's New Economic Partnership for Africa's Development (NEPAD); Agency, the African Union Inter-African Bureau for Animal Resources (AU-IBAR), Eco Mark Africa (EMA) and the Regional Economic Communities, COMESA and the East African Community (EAC). Within NEPAD, will collaborate with the DFID-funded International Partnership for African Fisheries Governance and Trade (PAF).
Pipeline Development					
ADRAS Expect funding decision Dec. 2012. Start Q1 2013 if funded.	N/A	126,000*	124,000*	'Equitable access to AFSs for the poor: the role of consumer-led value chain analysis'.	ILRI, Makerere University (Depts. of Nutrition and Agricultural Economics)
Women in Fisheries Business. Concept note submitted to COMESA: 5-year project worth ~ US\$7.5 million.	N/A	Not yet known	Not yet known	'Women in Fisheries Business: Breaking the Barriers for Improved Productivity and Wealth Generation in the COMESA Region'	Direct linkages will be established with the New Partnership for Africa's Development (NEPAD), Spanish Fund for African Women Empowerment in partnership, COMESA, the Federation of National Women Associations (FEMCOM), and the African Women's Business Initiative.

* Estimated figures.

The objectives of the 2011-2013 ASARECA project are to: i) Develop effective national fish breeding programs for the most important cultured fish species; ii) Develop management options for quality fish seed production and dissemination to farmers; and iii) Promote public/private sector investments in fish seed supply chains. KARDC is the research partner in Uganda.

The 2012-2014 AFSPAN project provides opportunities to cooperate with an international consortium conducting research on the impacts of aquaculture on poverty and food security. The research will provide science outputs that will contribute to CRPs 1.3 and 3.7 and help build partnerships with researchers and build our programs in key program countries, including Uganda and Zambia (and Kenya).

3. Situational analysis

Whilst policy documents and stakeholders commonly cite the declining production levels of capture fisheries as the impetus behind the need to increase aquaculture production, the official figures available appear to show fairly stable total production levels between 2007 and 2010, with variations in the contribution made by different groups of species (Table 2). This could be a reflection of the difficulties in collecting accurate production statistics rather than a true reflection of the capture fisheries situation, or it could suggest that the situation is not as grave as generally perceived.

Table 2. Uganda capture fisheries production 2000 – 2010 (tons)

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Carp, barbels and other cyprinids	12181	12182	12000	8261	22939	25714	22655	30850	35000	52500	73210
Miscellaneous freshwater fishes	110707	112372	111898	136219	210061	235469	207438	222300	218500	236500	257054
Tilapias and other cichlids	96468	96172	98000	97330	138789	155575	137006	178350	150000	123000	83541
Total production	219356	220726	221898	241810	371789	416758	367099	431500	403500	412000	413805

Source: FAO - Fisheries and Aquaculture Information and Statistics Service (Fishstat) online query

3.1 Status of aquaculture in Uganda

This section describes the different types of fish farmers, their levels of production, and the various inputs required for aquaculture production, i.e. feeds, fish seed and water or space in an existing water body for cage sites.

3.1.1 Fish farmers and fish production

The industry can be divided into three main sectors; large-scale commercial fish farms, small and medium-scale commercial fish farms and smallholder fish farms. While official statistics indicate rapid growth of the industry over the last five years in particular (Table 3), this is not apparent on the ground. Based on the experience of the EU study on commercial aquaculture in 2011, there is no reliable source of aquaculture production statistics in Uganda and the official figures bear no relationship to reality. The EU study concluded that in 2010/11 there was only one large-scale commercial fish farm, perhaps 50-100 small and medium scale commercial farms, many of which are currently operating well below their capacity and many thousand small-holder ponds that are largely unproductive (Dickson and Macfadyen, 2011).

Table 3. Aquaculture production statistics for Uganda (tons)

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Carp, barbels and other cyprinids	100	270	230	300	50	41	47	73	70	76	122
Miscellaneous freshwater fishes (mainly African catfish)	120	540	2728	3000	3827	6535	20955	34145	35050	55005	63208
Tilapias and other cichlids	600	1550	1957	2200	1660	4239	11388	16891	17130	21573	31670
TOTAL	820	2360	4915	5500	5537	10815	32390	51109	52250	76654	95000

Source: FAO - Fisheries and Aquaculture Information and Statistics Service (Fishstat) online query

Commercial fish farms

At present there is only one privately owned large-scale commercial fish farm in full operation, Source of the Nile (SoN) fish farm, a cage based fish farm at Jinja that produced around 40 tons of tilapia in 2010 and 300 tons in 2011. SoN have, until now, used a small cage (high density, low volume) rearing system, but will soon expand into off-shore, large cages at a new site and expand their production capacity to around 2,500 tons per year. As well as cages, SoN have a pond-based tilapia hatchery producing tilapia fry and fingerlings for their own use and also for sale to other fish farms. In recent years they have been able to sell large amounts of fingerlings to Kenyan fish farmers. However, this market has declined as Kenyan Government support for the scheme has been scaled back. SoN has faced many challenges in the six years since it was established. One of the main problems has been sourcing good quality feed which has led them to import at least some of their feed from a company in Mauritius. SoN is now part of African Century, the largest fish farming group in Africa, so its future is secure and planned increases in production will almost certainly take place. SoN is also planning to start feed production from 2013 onwards aiming for a capacity of around 5,000 tons of feed per year or enough to produce 2,500-3,000 tons of fish/year.

The only other sizeable commercial fish farm is the Chinese project at Kajjansi, which was established as a research and demonstration farm but is being managed on a commercial basis. The construction phase of the project was completed in early 2011. It is now being operated and managed by Chinese technicians in collaboration with Ugandan scientists. The center has its own ponds, hatchery, feed mill, laboratories and offices. It appears that good results are being achieved in the ponds with tilapia. The farm also sells feeds, supplies fingerlings and carries out farmer training. The Chinese company has plans to expand operations to 27,000 tons/year in a third phase development (2014-2017), which will be based on cage farming. It seems likely that this will be achieved.

It also appears that Chinese carps (grass carp, silver carp) have been brought in to test their performance against native species. We heard from the Acting Fisheries Commissioner that the Chinese have requested for several cage and pen sites in Lake Victoria where they would like to test the use of Chinese carps as well as tilapia. According to the Acting Commissioner permission to use Chinese carps in Lake Victoria has been refused but they offered sites on Lake Kyoga instead, as it is owned only by Uganda. This appears to be in conflict with international protocols on fish introductions signed by the Ugandan government.

Several other commercial fish farms are being planned at present, as presented in Section 3.4.

Small and medium sized commercial fish farms

There are perhaps 50 to 100 small and medium scale fish farms with the capacity to produce significant tonnages of fish (Dickson and Macfadyen, 2011) Some concentrate on tilapia production while others concentrate on catfish. Many have a hatchery and some operate wholly as hatcheries. Most are pond based; however, some are cage based. Many of these farms are not being actively managed as their owners have invested significant amounts in pond construction but failed to generate profits. This sub-sector received support under the USAID FISH and LEAD projects involving training and small grants, substantially increasing the production capacity of small and medium scale fish farmers and also highlighting the need for more time and resources to build well-functioning producer groups and organizations. Hatcheries were doing quite well when the Kenyan aquaculture development project (Box 1) was in full operation and there seems to be a strong market for catfish fingerlings, though a shortage of catfish hatchery feeds has curtailed operations at present.

Box 1. The Kenya fish farming enterprise and productivity program

The Government of Kenya has spent U.S. \$16 million since January 2010 through its farming enterprise and productivity program, which aims to increase the country's aquaculture production 15-fold. Designed in late 2009 by government fisheries officials, researchers and educators, the two-phased aquaculture project began in January 2010 and ended in xxx 2012. Phase 1 increased Kenya's aquaculture output by funding the construction of 28,000 fish ponds, boosting farm fish production from 1,000 mt in 2008 to an estimated 8,000 mt in 2010 and 15,000 mt in 2012. Phase 2 of the stimulus program began at the end of 2010 with an additional U.S. \$37.5 million of dedicated funds for the aquaculture sector and a promise to increase the number of fish ponds to 48,000 countrywide. The ministry is currently installing cold storage facilities where farmers are concentrated. A key partner in Kenya's increasing reliance on aquaculture is the Aquaculture & Fisheries Collaborative Research Support Program (AquaFish CRSP) funded by the United States Agency for International Development.

In less than a year, the demand for fingerlings in Kenya grew from 1 million to 28 million. Demand is outstripping supply, with many farmers still waiting for their new ponds to be stocked. To solve the problem, the government relied heavily on private industry. The enormous leap in fish farming brought on by the economic stimulus program has presented other challenges, as well. Fisheries officials admittedly were not well prepared when the full three years' worth of aquaculture stimulus money came all at once. In the rush to spend the money, fish ponds were not always well thought out, and more than a few were built in inappropriate locations. The sudden enthusiasm for aquaculture had another unexpected side effect; for each farmer funded by the stimulus program, there are three ponds being put up by non-funded farmers, all needing guidance and help.

Two underprivileged groups, Kenya's women and young people, are prospering under the new aquaculture initiative. While fish ponds continue to be owned almost exclusively by men, women are increasingly involved in all phases of fish farming, including feeding, fertilization, predator control and value added post-production techniques. Women also now predominate in the processing and marketing sectors. Kenya's vastly underemployed youths are also reaping benefits. They actually do the pond construction and are empowered with the knowledge, providing practical expertise in the extension service. In affecting a broad spectrum of the country's economy and its people, the economic stimulus program is changing the landscape of aquaculture in Kenya.

Sources: Hino, 2011, with additional information from Waithaka, 2012.

This mission visited two typical SME fish farms in Kampala. One had around 1 ha of ponds and was well managed. The farm has its own hatchery and produces both catfish and tilapia for sale in local markets. The farm is owned by a retired civil servant who rarely visits but is managed on a day-to-day basis by a young woman trained under the LEAD project. The other farm was smaller and poorly maintained. While it had a hatchery it had rarely been used. The owner/manager appears to be more interested in offering his services as a consultant than producing fish. He estimated his production as 500 kg, twice a year. While these two examples only offer a glimpse into the sub-sector they re-enforce the findings from the 2011 EU study that many SME fish farms are struggling. High feed costs, poor management, predation, erratic water supplies and small pond areas mean that most do not meet the production expectations of their owners. Also, while SME farms usually find a ready market for their fish, the price levels that they achieve often do not cover their operating costs. The result is that many SME fish farms are not being actively managed and some have even been abandoned. This makes it difficult to estimate actual production levels as opposed to production capacity.

One of the recommendations from the EU study was to support the development of fish farming groups, or production hubs for SME fish farms. An example, described by the Aquaculture Coordinator of the LEAD project is Kabeiura fish farmers in Bushenyi who concentrate on producing catfish for sale into DRC (Olwo, 2012). They are organized around

a lead farmer who helps maintain input supply and markets the fish from the group members. Clearly this is an example that could be followed in other parts of the country.

Small-holder ponds

Various attempts have been made over the years to count the number of fish ponds in Uganda - see FAO national aquaculture sector overview http://www.fao.org/fishery/countrysector/naso_uganda/en.

There are certainly many thousands, although most are highly unproductive. Although they are unlikely to generate significant quantities of fish they may make only a small contribution towards household livelihoods and provide small quantities of fish for household nutrition.

3.1 2 Species

The main species being produced are Nile tilapia (*Oreochromis niloticus*) and African catfish (*Clarias gariepinus*) however other species are or have been important in particular parts of the country including the alien common carp (*Cyprinus carpio*) and a smaller indigenous tilapia, *Oreochromis leucostictus* and the indigenous herbivore, *Tilapia zilli*.

3.1.3 Feed

As elsewhere, feed is the greatest cost item in most Ugandan fish farms. Feed raw materials are readily available in Uganda although there are variations in quality and seasonal fluctuations in price and availability. Dried fish (mukene; *Rastroneobola argentea*) from lakes Victoria and Kyoga, is the usual animal protein source used in fish feeds. Soya bean oilcake is the main source of plant protein although sunflower and cottonseed oilcakes may also be available. Wheat milling by-products such as wheat pollard are commonly used as the main feed base. Vitamin and mineral premixes are available from specialist suppliers, although may not be specific for fish.

The USAID FISH and LEAD projects spent a great deal of effort in making sure that high quality feeds are available in Uganda. This was mainly through support for the feed milling company, Ugachick. The projects paid for the installation of an extrusion processing line and provided technical assistance, allowing Ugachick to produce floating, pelleted fish feeds. Many farmers, however, complain of variable quality and high prices. This is thought to be largely due to the influence of Kenya's fish farming productivity program (Box 1). Ugachick has been exporting most of its production in recent years to Kenya, where the Government of Kenya was purchasing large quantities of feed for free distribution to farmers. As often happens with large-scale free inputs programs, the ready market in Kenya meant that there was little incentive for Ugachick to invest in the necessary quality controls or distribution networks to meet the need for the relatively low volumes demanded by Ugandan farmers,. The fact that many farmers are far from the Ugachick base in Kampala means that access to high quality feeds is effectively limited to those who can collect from the factory, and the comparatively low volumes demanded have not provided an incentive for Ugachick to set up local distribution channels. However, WAFICOS (a fish farmers' cooperative) has designed a distribution mechanism to deliver feeds to its members specifically.

The Ugachick investment has meant that less emphasis has been placed on producing on-farm feeds or locally made feeds. These could have considerable potential if locally available feed materials and cheaper processing methods such as conventional pressure pelleting are used to produce lower cost pelleted feeds.

Another aspect of feeds is the generation of natural food in fish ponds through fertilization. This is a low-cost strategy that is particularly suitable during the early adoption stages of

tilapia culture, especially by producers with limited experience and assets. However, it appears that there is very little emphasis on fertilization in current pond management systems. When combined with feeding, effective fertilization will reduce food conversion ratios.

3.1.4 Seed

While the availability of seed has often been quoted as a serious constraint on the growth of the Ugandan aquaculture industry, there are now, thanks largely to the FISH and LEAD projects, several hatcheries and hatchery technicians who can reliably produce tilapia and catfish seed. High demand from fish farmers in Kenya and Rwanda created a ready market for fish seed and the hatcheries responded. This boom in demand appears to have subsided although catfish hatcheries continue to produce fingerlings as bait for fishermen. There were complaints during this mission about a lack of hatchery feeds apparently caused by the former supplier deciding that it was not worth their while to import relatively small amounts of specialist feed.

The other main issue is seed quality. WorldFish could consider options to work with the private sector, to strengthen existing work on genetic improvement in Uganda, such as the work being carried out by SoN and other private and public partners, perhaps in conjunction with neighboring countries. WorldFish and partners earlier developed a proposal for a genetic improvement program for tilapia and other farmed species in various countries in Africa for IDRC. Although it was not approved, it should be considered where else to submit the proposal for funding.

Other species could be considered for culture in future, e.g. *Bagrus* catfish which fetches high prices in Ugandan markets and indigenous cyprinids (*Barbus* and *Labeo*) that have been investigated at Kajjansi.

The importation of Chinese carp into Uganda by the Chinese project conflicts with international protocols on fish introductions, signed by the Ugandan government. The same protocols would apply to the Abbassa strain of Nile tilapia developed by WorldFish.

3.1.5 Water & water space

Uganda has massive volumes of water in small streams, springs and swamps available for the development of pond-based fish farms, large rivers for pond, tank based or small cage based systems and lakes such as Victoria and Albert for large-scale cages. So water resources per se are not currently a constraint on development of the sector. According to WorldFish (2012) aquaculture is, however, vulnerable to climate change and variability. While a significant increase in mean annual rainfall is expected, changes in rainfall seasonality are expected as well and it is observed that rainy seasons are becoming increasingly erratic with wetter rainy season and drier dry seasons. Lake Victoria water levels are sensitive to climatic factors in the long term (Timmers, 2012).

Fish growth rates will tend to be better at higher temperatures so lower altitude parts of the country, such as Lake Albert and the northern sections of the Nile, have a comparative advantage.

There are always issues surrounding the acquisition of land for ponds and deciding on where cage sites should be situated. These should be explored with the upcoming Aquaculture Parks project. It is important for all types of farms to engage the local population (particularly fishing communities in the case of cage sites) as workers or perhaps even co-owners of projects because fish ponds and cages are very susceptible to malicious damage and theft. Also, there have been no attempts to consider the impacts of cage aquaculture on the environment and to determine environmental capacity.

3.2 Markets in Uganda and the East African region

Ugandans like fish; however, in the urban centers they are used to buying large, wild tilapia of 500g+. Nile perch is mainly for export and African catfish is only occasionally found in the market. Fish farms generally produce smaller sized tilapia and increasingly produce catfish. Of course, any fish will find a ready market in areas not currently supplied with fish, that is, in communities away from the main lakes and rivers. There is also seasonality in fish supplies because of closed seasons in the wild fishery and regional preferences; apparently catfish is most appreciated in northern and eastern Uganda but not in the south-west or central areas. This means that there are fluctuations in the market price that can be obtained by fish farms according to location and season.

Smaller fish farms may often be able to focus on local markets, informing neighbors that they will be harvesting on a particular day. However, this will undoubtedly affect prices. Larger fish farms need to be realistic about markets and market prices, targeting areas where the type of fish they produce is acceptable and selling when markets are undersupplied by wild fish. SoN are currently selling most of their tilapia to customers outside Uganda (Rwanda, DRC) who do not mind buying small fish. Consumers in the Central Region (possibly wealthier, middle class consumers) reportedly prefer to buy large fish which can then be cut into pieces to feed the whole family. The catfish farming group in Bushenyi apparently sells most of their catfish to DRC. Reasons for this market segmentation and an orientation outside of Uganda are not clearly understood at present and require more detailed market analysis. The Government of Rwanda is apparently taking aquaculture development seriously and upping its investments in the sector.

Various prices were reported to the study team. However these may be misleading as all price information needs to be carefully categorized according to its location in the value chain, physical location and season. SoN said they were selling tilapia at UGS 5750/kg at the farm. Jacob Olwo from LEAD said catfish was being sold at UGS 5,500/kg at the farm rising to UGS 7,000/kg at the DRC border. WAFICOS said catfish prices in Kampala ranged from UGS 4,500/kg at the farm to UGS 7,000 live in the market.

A number of recent market-oriented studies have been undertaken, including analyses of profitability, marketing, and pricing, as well as broader studies that examine prospects for expansion of the aquaculture sector in Uganda and regional market trends (Annex 6). Additional information relating to regional markets is provided below. In addition to the reports summarized in Annex 6, Aquaculture Consultants and Alabama A&M University are currently conducting a survey in Central Region to develop a database with more accurate statistics on aquaculture production and to assess profitability.

Recent market-oriented studies suggest that there is considerable potential for the development of markets for aquaculture products, both in Uganda and the East African region, largely due to rapidly declining catches of Nile perch and the high demand for fish. Efficient markets for the sale of wild fish exist, but very little farmed fish pass through these markets despite a large unmet demand for fish, and as a result the poor are in many places eating less fish. Very few small-scale fish farming enterprises have been shown to be profitable, and any profits are relatively small. There has so far not been enough production from aquaculture systems to make an impact on the Ugandan fish market and a sizeable portion of the fish produced goes to neighbouring countries where markets are more lucrative.

There is a lack of reliable data and statistics on aquaculture which is currently being addressed through the compilation of a farmers' database for the Central Region.

The first starting point for any intervention in Uganda should be to get a thorough understanding of the market for aquaculture produced fish. However, this will not be easy

until there is sufficient production for real aquaculture value chains to become established. Most fish farms in the country are only able to supply fish on a sporadic basis and must take whatever spot price they can get at a particular time.

Within the East African region (Burundi, Kenya, Rwanda, Tanzania, Uganda, plus DRC), Uganda is the largest producer for both capture fisheries and aquaculture (Table 4), and DRC is the largest importer of fish (SmartFish, 2012). Much of the farmed fish produced in Uganda is purchased by traders from Rwanda, DRC, and South Sudan who use ice to transport fresh, whole ungutted fish. There is also a trade in fry, fingerlings and fish feed from Uganda to Rwanda, DRC and Kenya. Fingerlings for use as live bait are produced in Uganda and exported to Tanzania (Dhatemwa, 2009). Data collected by Dhatemwa (2009: 2) suggest that ‘there is a strong regional trade from which fish farmers could benefit if governments in the region could harmonize their policies and regulations governing fish trade’. Much of the wild fish being sold into DRC consist of smoked or dried catfish, salted Nile perch or tilapia, and salted heads and frames of Nile perch (ibid.) Nile perch is exported from both Uganda and Tanzania into DRC, though since Tanzania does not allow the export of tilapia, much of the tilapia sold in DRC comes from Uganda.

Table 4. Aquaculture production in neighboring countries (tons)

Country	2000	2005	2009	2010
Congo, Dem. Rep. of the	2076	2965	2970	2970
Kenya	512	1047	4895	12154
Rwanda	270	386	488	628
Sudan	1000	1600	2200	2200
Tanzania, United Rep. of	1210	3012	5722	7338
<i>Uganda</i>	<i>820</i>	<i>10815</i>	<i>76654</i>	<i>95000</i>

Source: FAO - Fisheries and Aquaculture Information and Statistics Service (Fishstat) online query

3.3 Barriers to development

The aquaculture value chain in Uganda and the East African region is currently disjointed and ineffective; some would argue that there is no value chain at all, only temporal spot markets that occasionally link a very small number of actors who generally operate in inefficient ways. A summary of critical issues and factors constraining the sector is presented in Table 5, which looks at particular stages in the value chain.

Table 5. Summary of critical issues and factors constraining the sector

Source and scope of Impact	Critical issue or factor
Things external to the value chain and affecting all stages of it	<ul style="list-style-type: none"> • Poor infrastructure (roads, power, water) • No single source of information for would-be investors • Capital inputs are expensive with high interest rates, and often not suited or available to aquaculture producers due to a lack of knowledge in the banks about the sector and perceptions of risk. Very little private sector equity in Uganda (e.g. venture capital) • Aquaculture Policy Working Group (APWG) not functioning well/regularly. The APWG comprises representatives from the

	<p>DFR, NaFIRRI, UIA, and UFPEA.</p> <ul style="list-style-type: none"> • Insufficient research into low-cost production methods and marketing • Low levels of human capacity in government for extension • 'Informal' costs of doing business
<p>Things affecting the availability, cost or quality of inputs sourced for production</p>	<ul style="list-style-type: none"> • Only one commercial feed mill, potentially impacting negatively on cost and reliability of feed. Specialist knowledge of feed formulation in mill is still weak, despite support. • Quality of hatchery fry may be poor due to broodstock used, and poor management. No certification of fry. • Land may not be readily available and ownership contested in the best locations for aquaculture production, there is no clear zoning policy for aquaculture, and there exists significant potential for conflicts between producers and other land and water users (e.g. fishermen) • Water quality in ponds sometimes not well-maintained due to pumping costs, but availability of water generally a competitive advantage in Uganda • Power is often not available, not reliable, and/or costly for input businesses and producers • Low levels of human capacity, technical knowledge and practical experience for production of inputs, farming methods and use of inputs, and marketing • Some equipment (e.g. nets) required is imported, and maintenance of the import duty exemption scheme available through the Uganda Revenue Authority is important
<p>Things affecting production</p>	<ul style="list-style-type: none"> • Lack of effective group organization which reduces ability to negotiate on cost of inputs and share experiences • Best Management Practices (BMPs) not formally adopted or used, leading to poor management practices on feeding, husbandry, etc
<p>Things affecting postharvest and marketing</p>	<ul style="list-style-type: none"> • Current production volumes are small, restricting access to markets and ability to engage in market promotion. • Domestic prices are low due to competition with wild fish and other sources of protein • Markets in other countries of the region offer potential but are not fully understood • No group organization for marketing • Marketing infrastructure is not in place • Key opportunity of existing unused processing capacity (developed for the now-dwindling Nile perch export market) is not being utilised

Source: Dickson and Macfadyen, 2011: 16 (with slight adaptations)

A Value Chain Assessment Report prepared for the LEAD project in 2009 concluded that the aquaculture industry was 'poised for takeoff', yet this has yet to occur. Past development efforts have either been based on misplaced premises (e.g. that aquaculture is profitable;

that markets exist⁵) or tended to focus on specific aspects of the value chain, whereas it has been argued that what is needed is a targeted and coordinated range of actions across the whole value chain (Dickson and Macfadyen, 2011). The LEAD project, for example, assumed that models for profitable commercial aquaculture had been ‘developed, tested, and proven’ and should be implemented on a national scale (LEAD, 2009; Box 1). However, a 2011 study found few examples of profitable aquaculture businesses (Dickson & Macfadyen, 2011) and more recent studies cast doubt on the levels of profitability of small-scale aquaculture production (Hyuha et al, 2011). Whilst the LEAD project achieved some successes in areas where a hub approach was realised, the inability of fish farmers to realise profits after two or three years of production led many to abandon aquaculture.

Box 2. Key findings from LEAD VC assessment

The Assessment Team concluded that the aquaculture industry in Uganda is poised for takeoff. A strong, proven local and regional market exists for aquaculture products. Land and water are abundant for its development. The foundations for a competitive feed industry are in place. A hatchery industry is established, though still small. The equipment and supplies necessary for aquaculture development are readily available in -country. Models for profitable commercial aquaculture have been developed, tested, and proven. The farmers who properly utilized these models are profitable. Many others are interested in implementing these proven models. Most importantly, trained local personnel and training materials have been developed to assure that those who implement the commercial aquaculture models do so in a manner most likely to result in their obtaining profits as soon as possible. Source: LEAD, 2009: p.iii

Reasons for the lack of progress were discussed with various stakeholders during the course of the mission, and a number of explanatory factors were offered:

- Lack of the necessary levels and volumes of production (and the consistency of production) to allow markets to develop – you need to have something to sell before markets will develop;
- Lack of investments in medium and large-scale aquaculture enterprises;
- High investment costs for small scale producers and the need to wait at least three years to see returns;
- Lack of profits from the production of farmed fish, whether small, medium or large scale – linked to this is the high cost and inconsistent quality and availability of feed;
- Low price of fish near lakes due to the availability of wild fish.

A study for the EU delegation to Uganda (Dickson & Macfadyen, 2011) highlighted two main reasons constraining aquaculture development in Uganda: (i) A policy and ‘cost’ environment which is not supportive of the sector at all stages of the value-chain; and (ii) A lack of sufficient emphasis on marketing (e.g. market segmentation, market infrastructure, price promotion, etc.) which ultimately constrains profitability (ibid.: p.iv). Details of the policy environment have been reviewed in Section 2.1; further information relating to marketing has been reviewed in Section 3.2. As mentioned above, the starting point for any future work should be a detailed market assessment at local, national and regional levels.

⁵ Several reports assume that markets exist because there is a high demand for fish, but this is not necessarily the case. The demand is there, but it is not being met.

3.4 Growth trajectory

In relation to the levels of production, the mission was informed about a number of planned and potential large- and medium-scale investments, as detailed in Table 5. The most advanced investment is a 500 tons/year cage-based fish farm that is being established by Ugachick in Lake Victoria. Other medium-scale investments are currently planned by SoN and Greenfields. The largest investment is that of the Uganda Huaqiao Fenghuang Fisheries Company Ltd which aims to become the largest farmed fish (tilapia, catfish and possible grass and sliver carp) producer in Uganda with a target of 27,000 tons/year. At the small-holder level, a Ugandan NGO-project, led by a Filipino, has started operating a cage based fish farm in Lake Albert and has plans to expand into Lake Kyoga and Lake Victoria. SCAPA (see above) is preparing a large catfish operation near Kamuli, north of Jinja that will also involve out-growers (i.e. small-scale producers who are contracted to produce fish at a fixed price in exchange for provision of seed and/or feed).

Although not all of the investments included in Table 6 will necessarily come to fruition, and others will take time to operationalize, in all likelihood an industry with approximately 10,000 tons production capacity will emerge within 3-5 years. This level of production, together with consistency of production should be sufficient to kick-start market development. It should then be possible for small-scale commercial farmers to benefit from these markets, both in terms of the associated increase in the availability and quality of feeds and seeds, and also in terms of fish sales.

Table 6. Future possible large- and medium-scale investors/investments

Investor / project	Focus	Planned fish production	Likelihood / timescale
Ugachick	Hatchery Cages – tilapia Feed production (already doing feeds but quality should improve)	500 tons	Land and lake access already arranged. Currently making cages.
Source of the Nile	Tilapia & catfish hatchery Cages – tilapia Feed production (new activity)	2,500 – 3,000 tons	Expansion will take place in 2013
Uganda Huaqiao Fenghuang Fisheries Company Ltd	Hatchery Feed production Tilapia, catfish, carp	27,000 tons	Investment of \$172 million planned for 2014-2017
Greenfields	Catfish hatchery already established Want to establish cages with 5 tons total harvest	?	Likely to go ahead, but not sure when
SCAPA	Catfish at Kamuli	?	Depends on funding and farmers joining the cooperative
Aquaculture Parks	Govt to make available land and lake access with basic infrastructure (roads, electricity) necessary to attract large scale	Depends on investors	Depends on feasibility study and EU funding; will take about three years to get started if it goes ahead

	cage and pond farming		
Mukwano	Big Ugandan company (cooking oil, etc). Have expressed interest in aquaculture in the past. Didn't meet them this time		
Tullow Oil or Total	Have expressed interest in aquaculture under their CSR strategy, though we heard that they're not serious about CSR. Kate to follow up by email.		
Ngege	Currently engaged in Nile perch processing. No plans as yet to go into aquaculture, though might be interested		

Additional information on some of these companies is provided in Annex 5.

3.5 Placing Ugandan aquaculture in the context of fisheries

It would make sense to develop WorldFish value chain initiatives on Ugandan fisheries in general, where there is huge potential for impact, rather than restricting opportunities to just aquaculture.

While aquaculture production is very weak in Uganda, the country has a strong wild fisheries sector. Knowing that aquaculture statistics are unreliable it would be unwise to place too much trust in fisheries statistics while still recognizing that wild fish is an important part of the Ugandan economy. Declining Nile perch stocks and supply shortages for the export processors are widely reported, however this represents only a small sub-sector of overall fisheries production. Other fish stocks; tilapia, mukene, catfish and cyprinids are readily visible in local markets and are also exported throughout the region. In other words, the supply of fish from wild fisheries is important to poor people (in terms of livelihoods, employment and nutrition) in Uganda whereas aquaculture is not, yet.

The vulnerability of wild fisheries may have been overstated. Uganda has very wisely restricted fishermen to using artisanal fishing methods; there are no industrial-scale fisheries operations on Lake Victoria or elsewhere. There is no doubt heavy fishing pressure however the sheer scale of resources such as Lake Victoria means that they cannot be completely fished out using artisanal methods. Easily fished areas may well be depleted but that still leaves more remote areas, where it is uneconomic or unfeasible to transport fish to market. This could mean that the anticipated decline in wild fisheries may take a long time to materialise so emerging aquaculture production, particularly of tilapia, will continue to face competition in the market for years to come.

4. Findings and conclusions: the role of WorldFish in Uganda and East Africa

4.1 Summary of findings

The key findings of the mission are as follows:

- Lake fish stocks and capture fisheries are generally thought to be in general decline due in large part to over-fishing, compounded by environmental degradation and climate change / variability. There is widespread consensus among stakeholders that the widening supply-demand gap for domestically produced fish products can only be narrowed through aquaculture. The official statistics however, do not show an overall marked decline. This could be a reflection of the difficulties in collecting accurate data rather than a true reflection of the capture fisheries situation, or it could suggest that the situation is not as grave as generally perceived.

- While aquaculture production in Uganda is much smaller than official figures suggest, it is likely to expand rapidly in the next decade. Significant levels of commercial investment are planned to take place within the coming three years. An industry with around 10,000 tons production capacity will likely emerge within the next three to five years.
- Current policies (e.g. DSIP) prioritize fish as a key investment opportunity over the medium term. Aquaculture development is on the policy agenda in the shape of a strategic aquaculture plan, and the government is planning to develop aquaculture parks in up to five gazetted areas including lakes and rivers in the central and western regions. Although there are attempts to enhance the enabling environment for the sector, the governance capacity remains weak (security of tenure at cage sites; weak civil rights; environmental issues).
- MAAIF is lacking capacity, drive and leadership. Working with government in the agriculture sector is not easy. Both the Government and development partners see the private sector and commercial investments as the main drivers of aquaculture, with the public sector providing the enabling context.
- A number of donors are actively supporting agriculture, with more apparently re-entering the sector. A smaller number currently focus on fisheries and/or aquaculture in Uganda and the region with the EU being the largest player in Uganda at present. The EU is currently considering support to the aquaculture parks. The EU indicated to the mission that although aquaculture is not a top priority it will not be left aside.
- While the artisanal fisheries sector remains very vibrant the smallholder aquaculture sector is still struggling. Despite earlier expectations, SME aquaculture has not yet taken off in Uganda. It remains difficult for producers (even relatively well-established commercial companies such as Source of the Nile) to make a profit let alone break even. The main constraints and bottlenecks include: feeds (low quality, high prices, volatile supply); lack of market development; absent or weak business development services (e.g. advice, technology and capital); misguided/misinformed producers and new entrants expecting a quick return on investments.
- Farmers are currently being pushed towards high cost production systems which potentially run at a loss and will not deliver fish for the poor. There is a need for lower FCRs, higher value production systems, and/or lower production (feed) costs. The production models for tilapia and catfish currently promoted are too expensive for smallholders and there is a need for cheaper alternative models, e.g. using locally produced feeds and relying more on natural pond fertilization.
- Prices for farmed fish are influenced by the relatively low wholesale prices of wild fish from the lakes. Further away from the lakes, where fish farming has not yet developed to meet the gap, fish fetches a much higher price, as would be expected. Preferences for different types of fish (tilapia; catfish) vary across the region.
- Marketing is a major challenge, despite the high demand for fish. The 'hub-model' with clusters of well-organized smallholders built under the LEAD project offers some promise for further expansion. Aquaculture value chains in Uganda and the East African region are currently disjointed and ineffective; some would argue that there is no value chain at all, only temporal spot markets that occasionally link a very small number of actors who generally operate in inefficient ways.
- Uganda is currently a regional hub for supply of capture fisheries and aquaculture products (feed, seed, fingerlings, live and processed fish) to neighboring countries, including the Democratic Republic of Congo, Rwanda, Kenya, and perhaps to a lesser extent South Sudan. There is potential for Uganda to take on an even more significant regional role in the future.

The conclusion from these findings is that the planned increase in commercial aquaculture production will most likely stimulate market development, expanding the current value chains (such as they are), and bringing in opportunities for value chain improvement that would have impacts on food and nutrition security at local, national and regional levels. Given the size of the existing capture fisheries and the anticipated emergence of a strong commercial aquaculture sector in Uganda, there is an opportunity for WorldFish to become a significant player in Uganda. This could be as a broker/facilitator of partnerships helping to identify, address and remove obstacles to private, commercial sector value chain development while ensuring that enough attention is given and knowledge generated around ASF and nutrition security, food safety, poverty, gender equity and environment issues and impacts – all vital research and development themes that otherwise are in danger of being ignored.

In the smallholder aquaculture sector WorldFish could build on the good foundation laid for instance by the USAID LEAD project with emerging smallholder hubs. At a technical level, there is a need for alternative, low-cost production models for smallholders in particular.

Persistent weaknesses on the government side, notably in MAAIF (to a lesser extent in NARO) and a rudimentary policy/regulatory environment, however present an important risk. There are signs though that the national leadership is prioritizing aquaculture as a future growth area. This all points towards engaging more with the private sector while cultivating good working relationships with public partners and government counterparts and seizing opportunities to help shape an emerging policy and regulatory environment for more evidence- and knowledge-based planning and decision-making.

Fundraising will be a major challenge. This can be partly addressed by adopting a regional approach rather than focusing on Uganda alone and by broadening the scope to cover both aquaculture and fisheries.

4.2 The role of WorldFish in Uganda and the East African Region

The overall aim of the Livestock and Fish CRP is to increase affordable ASF supplies to poor consumers by poor producers. The program selected its focal value chains and countries through a review process applying the following criteria: potential for market expansion; potential for the poor to benefit from the market expansion; existence of supply constraints which research could aid in addressing; supportive policy environment; and existing interest among stakeholders in working on improving the chain (see Annex 1). All of these factors currently exist in Uganda, suggesting that it is an appropriate country of focus for L&F. Regional linkages are such that the development of value chains in Uganda would benefit poor producers (through the supply of inputs) and consumers (through increased availability of fish products) in neighboring countries such as DRC, Rwanda and Kenya.

As stated above, the Ugandan aquaculture sector will likely undergo rapid and substantial growth in the coming years, driven primarily by the private sector and spearheaded by a few medium to large-scale commercial companies, including foreign investors. WorldFish can help ensure that essential research for development issues around poverty alleviation, food and nutrition security and related gender issues⁶, ecological footprints, and development and dissemination of international public goods get on to the agenda and receive the attention they deserve. While increasing availability of fish through development of the aquaculture sector is essential in improving nutrition and food security, increased consumption by those who need it most will only result if issues around access and utilization are also addressed. Much of the expansion of the commercial sector is likely to be through lake-based cage aquaculture, which unless properly planned and regulated can create environmental

⁶ The Uganda Nutrition Action Plan (GoU, 2012a) focuses on young children and mothers, emphasizing proper nutrition for women of reproductive age and laying a nutritional foundation for an intelligent, creative, and healthy population from which to build a better future.

problems and loss of ecosystem services (fishing, potable water), to the poor and vulnerable (Beveridge 2004, Beveridge & Brummett, in press), with consequent conflict.

The CGIAR Livestock and Fish Research Program aims to work with fish farmers at various levels to develop sustainable pro-poor, gender equitable value chains to improve the food and nutrition security of vulnerable consumers. WorldFish would seek to achieve this for aquaculture in Uganda/East Africa region by bringing its research and capacity building skills, its focus on gender and its approach to partnerships to bear on the sustainable development of the sector. This is entirely consistent with Uganda's current National Development Plan (see Section 2.1). Specifically, the research objectives of WorldFish would be to:

1. Develop and test models for SME-based, pro-poor and gender equitable aquaculture value chain development;
2. Increase access - geographic, but especially economic - to fish by poor consumers and assess nutrition outcomes at intra-household level, as affected by poverty, livelihoods, life cycle, health, ethnic and gender norms;
3. Address the growing environmental issues, in particular surrounding impacts of rapid expansion in lake-based cage farming and its effects on biodiversity and ecosystem services;
4. Address the growing conflict and governance issues around common property resources, especially in relation to commercial cage farming.
5. Generate knowledge for more evidence-based, planning, decision- and policy-making processes and help strengthen the emerging policy and regulatory framework for aquaculture

Possible research issues under these key areas are further elaborated in Annex 7.

As elaborated in Section 3.5, the potential short-term impacts (within two or three years) that can be achieved from the proposed research program would likely be considerably greater if the research agenda were to focus on fisheries as well as aquaculture value chains, particularly in relation to objectives 1, 2 and 4 above.

4.3 Candidate value chains and geographical regions in which to work

Given the proposed research areas outlines above, the recommendation is to focus on Central/Eastern Region (due to SoN and Greenfields partnerships, environmental and governance issues on Lake Victoria, presence of active farmer groups and cooperative society (WAFICOS), anticipated sites for Aquaculture Parks, trade with Kenya and potential cross-border links with Kenya Gatsby Trust and the German-Israel-Kenya trilateral project), and Western Region (due to presence of active farmer groups, trade with DRC, environmental and governance issues on Lake Albert, willing partners and on-going work by partners, anticipated sites for Aquaculture Parks). Within each region, we may consider selecting sites that are both urban and rural, and that are located both near the lakes and further away from the lakes.

The points below provide some of the key criteria and associated possibilities for the identification of candidate value chains / geographical areas:

- Areas where SME farmers are already active and there is the potential for value chain development. The LEAD project has established out-grower fish farmer groups in Bushenyi and Kasese (Western Region), Kaberamaido (Eastern Region), Amuru/Gulu and Kitgum (Northern Region). Kabeiura Farmers Ltd (Bushenyi) is a particularly successful group that has good capacity for catfish seed production and has established profitable market linkages in exporting fish and seed to DRC. These groups may need further support in order to mature and be able to sustain themselves following the end of the LEAD project in October 2012. Other SME

groups are those supported by SCAPA (Central Region) and UAOGRESCUE (Lakes Albert and Nakivale in Western Region; Lakes Bisina and Kyoga in Northern Region; and a water reservoir in the Karamoja region).

- Areas where there is lack of geographic access to fish by poor consumers, i.e. further away from the lakes, or in areas where fish for consumption is simply not available, e.g. near the shores of Lake Albert where fish stocks are very low and mukene is harvested for animal feed, not for human consumption.
- Areas with large populations of poor consumers who lack economic access to fish. There is likely to be higher density of poor consumers in urban and peri-urban areas than in rural areas.
- Areas where environmental concerns are apparent. Such areas would include lakes where cage farming is expanding (e.g. Lake Victoria); any of the sites for the proposed Aquaculture Parks – the sites have yet to be determined; and also areas where oil fields are being developed (Lake Albert).
- Areas where there are growing conflict and governance issues around common property resources. Such areas would include lakes where cage farming is expanding (e.g. Lake Victoria; and any of the sites for the proposed Aquaculture Parks).

Other considerations in the selection of areas in which to work might include the presence of willing partners; possible overlaps with ILRI's pig value chain activities; areas where WorldFish and its partners have previously or are currently working (e.g. Blake's governance work on Lake Victoria; ASARECA project; AFSAPN; possible ADRAS project; SoN; Greenfields; Dr Kabahenda's nutrition projects; Aquaculture Consultants' farmers' database; cross-border links with Kenya Gatsby Trust and German-Israel-Kenya trilateral project, etc); and areas where cross-border linkages might attract funding for regional activities. We should also consider areas targeted by large-scale investors where opportunities for framing a pro-poor consumer and pro-environment agenda may emerge.

It will also be necessary to focus on areas to be identified by the Ministry of Agriculture, Animal Industry and Fisheries for the development of Aquaculture Parks. Potential sites are currently being explored, and the EU-funded COWI consultancy to take place in November 2012 will undertake the feasibility studies. In addition, MAAIF has identified 31 districts⁷ as suitable for fisheries and aquaculture development based on both natural and socio-economic factors. The districts identified are located around the country's major water systems including Lake Victoria Crescent, Lake Kyoga basin, River Nile catchment, Edward-George complex and the Koki lakes.

4.4 Potential threats to the proposed research / development agenda

The findings of the mission suggest that there are a number of potential threats to the proposed engagement in Uganda by WorldFish:

- Scarcity of funding for research. See Section 5.2 for an overview of fundraising approaches.
- Lack of effective extension services in Uganda and lack of practical aquaculture training among extension workers. This can be overcome by potential to work with LEAD lead farmers; adopting 'best practice' from organizations such as the International Centre for Research in Agriculture (ICRA); and working with NGOs and

⁷ These districts are: Mayuge, Jinja, Bugiri, Busia, Mukono, Mpigi, Wakiso, Masaka, Rakai, Mbarara, Bushenyi, Ntungamo, Kasese, Hoima, Masindi, Nebbi, Gulu, Adjumani, Arua, Kamuli, Soroti, Lira, Iganga, Tororo, Pallisa, Mbale, Apac, Kabiramaido, Kabarole, Kamwenge and Kyenjojo.

other agencies (e.g. WAFICOS) on the ground in collaboration with an emerging private sector.

- Weak capacity of government players and a general sense of malaise. Partnerships with private sector should be prioritized.
- Threat of conflict over access to resources – poaching, theft, weak social capital. Research should be undertaken into governance issues to find ways to address these problems.
- Political instability and civil conflict including possible political instability with next election (2015); potential insecurity in northern Uganda due to Lord's Resistance Army, tensions in South Sudan, etc. A more detailed analysis is required; if necessary, WorldFish should avoid working in the North and develop contingency plans for potential periods of instability.
- Within WorldFish, diverting scant resources on an over-stretched program may detract attention from other activities. This can be avoided with adequate funding.
- Are the Chinese a threat or opportunity? Weak institutional frameworks may result in introduction of alien species (carps) and pathogens and environmental consequences, as occurred in Zambia with introductions of fish from Thailand⁸. On the other hand, Chinese investments will bring opportunities for economic development and expansion of the aquaculture sector; market development; increased quality and quantities of seed and feed.
- The policy and regulatory framework around aquaculture is incomplete. While the intention is to put in place policies and updated regulations and guidelines the process may face both bureaucratic and political challenges and delays. At the same time this represents an opportunity for WorldFish and partners to influence decision-making.

5. Recommendations

Overall the mission finds that this could be an opportune time for WorldFish to engage in research for development in Uganda and the broader East African region under the L&F program. The commercial aquaculture sector will likely expand significantly in the coming years, stimulating market developments that may be of limited benefit to poor producers and consumers. WorldFish should position itself ahead of these changes to develop its network, establish its identity, anticipate and nurture pro-poor research and development opportunities, and gradually build a portfolio in Uganda (with a regional outlook) as a go-to research-for-development facilitator, knowledge partner, and broker of innovative partnerships in the aquaculture sector. There is an opportunity to influence and help frame a much needed research agenda around key issues of pro-poor value chain development, food and nutrition security, ecological services and impacts, and so forth.

Until the anticipated expansion in aquaculture production actually occurs, however, we recommend that WorldFish should focus on the fisheries sector, for which there is ample scope for value chain improvements to benefit the poor. Although the study team was tasked

⁸ The importation of live tilapia from Asia to southern Africa sometime around 2006 is thought responsible for the transfer of the fungal-based (*Aphanomyces invadans/piscida*) epizootic ulcerative syndrome (EUS) into the Zambezi River system, where it has infected some 25 fish species, with unknown effects on livelihoods (Bondad-Reantaso *et al.* 2012).

to consider whether WorldFish should proceed with an aquaculture research program under the L&F CRP, we feel that confining the focus to aquaculture means that the organization as a whole is missing out on the important potential for research interactions on wild fisheries and fisheries products in Uganda and the region. Lake Victoria alone is one of the world's largest freshwater fisheries employing many thousand poor fishermen, sustaining many more men and women working in the value chain and providing animal-sourced protein for poor people in Uganda and the region. The potential short-term and long-term impacts that could be achieved from a wild and farmed fish research-for-development program would be considerably greater than one focused solely on aquaculture value chains.

There are important potential risks surrounding such an engagement relating to a weak policy environment and the lack of clarity around commitment by the Government of Uganda as well as development partners to resourcing the interventions needed to establish the enabling framework and take the sector forward. The greatest challenge from a WorldFish perspective will likely be in raising the necessary funds to establish a real presence. Given this scenario, five options have been identified, and various avenues for future fundraising are put forward.

5.1 Options for implementation

Five options are presented in table 7 below, together with the advantages and risks associated with each. Suggestions for mitigating some of the risks have also been included. The first two options involve establishing a presence in Uganda; the third option involves establishing activities without a presence; the fourth option is to defer a decision until funding opportunities look more favorable; and the fifth option is to consider alternative countries. The cost implications of Options 1 and 2 are detailed in Annex 8. Note also that very recent information from ILRI suggests that the 2013 L&F budget will remain identical to the 2012 budget, leaving little room for seed money in Uganda.

Table 7. Options, advantages and risks

	Option	Resource Mobilization Strategy *	Advantages	Risks and management suggestions
1	<p>Establish presence early in 2013, initially for three years, under the umbrella of a CGIAR partner, with a full-time representative/Value Chain Coordinator</p> <p>Role of Coordinator would be to network among local and regional partners for fundraising purposes and also supervise initial research activities (see Note below). Coordinator would be local/regional recruit. Purchase admin/support staff services from ILRI or other CGIAR center. Pay for use/rent of ILRI or other center vehicles + use of taxis.</p> <p>Work under Bioversity's country agreement with MOFA until WorldFish has its own country agreement (same approach as ILRI).</p> <p>High cost, high risk option</p>	<p>'Soft launch' advisable for presentation reasons; 'hard launch' only possible once long-term funding secured.</p> <p>Scope funds for public-private R&D partnerships; scope within Uganda and in the East Africa region; work with ILRI-Uganda and ILRI-Kenya on development of L&F wide concept notes and proposals bringing in support from WorldFish Zambia and Penang offices</p>	<p>Local and regional networking would enhance fundraising efforts.</p> <p>Displays serious commitment to partners and L&F on the part of WorldFish.</p>	<p>If additional funding is not forthcoming then the presence may need to be closed after two-three years, with inherent reputational risk. To be managed by regular review.</p> <p>Careful partner selection and avoid becoming associated with the 'wrong' individuals/partners.</p> <p>Full time salary costs would limit available funding for initial research activities.</p> <p>Need to avoid possible (misplaced) assumptions among WorldFish staff that Coordinator is solely responsible for fundraising. Needs to be managed by ensuring that FTE and travel budget available for other L&F staff to support fundraising efforts.</p> <p>The Bioversity/ILRI compound is an option, but as other CGIAR centers (e.g. CIP) plan to recruit more staff, space may become scarce. We can also explore possible office space at the IFPRI compound.</p>
2	<p>Establish presence from Q1 2013, initially for three years, under the umbrella of a CGIAR partner, with a part-time representative/Value Chain Coordinator</p>	<p>As above. Money saved on full-time salary cost (\$80,000) could be spent on initial research activities and fundraising efforts by existing L&F staff and others.</p> <p>Local and regional networking would</p>	<p>Slightly less costly option than (1); money saved on staff costs could be directed towards fundraising efforts and initial</p>	<p>May be difficult to recruit suitable part-time staff who is committed long-term; use of consultant may have 'loyalty' issues in representing WorldFish. To be managed by regular review.</p> <p>Possible lack of continuity if funding is raised for permanent office – existing p/t staff may not want</p>

	Medium cost, slightly less high risk option	<p>enhance fundraising efforts.</p> <p>May allow for greater input from existing L&F staff and others to fundraising efforts, i.e. more of a team effort to fundraising; less reliance on in-country Coordinator.</p>	<p>research activities.</p> <p>Displays some level of commitment to Uganda on the part of WorldFish.</p>	<p>full-time job.</p> <p>If additional funding is not forthcoming then the office may need to be closed after two-three years, with inherent reputational risk.</p> <p>Would need to avoid becoming associated with the 'wrong' individuals.</p>
3	<p>No staff recruitment in 2013 but initiating activities in Uganda/the region by drawing on existing WorldFish staff and others to undertake and guide initial activities until such time that a more substantive portfolio and income streams have been generated</p> <p>Low cost, medium risk option</p>	<p>Money saved on salary costs could be spent on initial research activities and fundraising efforts by existing L&F staff and others. Would require regular review and elaboration of indicators necessary to determine when to establish presence / office (e.g. expansion in commercial aquaculture production; changes in policy environment; funding available; etc.).</p>	<p>Offers more flexibility in how existing L&F funds can be allocated: allows for initial research activities and fundraising efforts</p> <p>Fundraising would necessarily be a team effort by existing L&F staff and others.</p>	<p>Difficult to do local and regional networking; would have to rely on ILRI staff in Kampala (and Nairobi) as well as other partners.</p> <p>May be interpreted by partners as lack of commitment on the part of WorldFish.</p>
4	<p>Delay decision on Uganda/East African region and re-assess the situation in three years to see whether the planned private sector investments have led to increased production levels and improved marketing.</p> <p>No cost option with reputational risks</p>	<p>Explore options for transferring technologies and knowledge from Egypt to other parts of Africa (and beyond).</p>	<p>CRP resources to support Egypt VC work with consequent higher potential for success in Egypt,</p>	<p>Reputational risks: having already delayed decision once before, this will be interpreted by potential partners as lack of seriousness on the part of WorldFish. Might be interpreted by ILRI as WorldFish lack of commitment to L&F program?</p> <p>Future fundraising would be difficult without some kind of commitment from WorldFish. Future partnership building (in Uganda) might also become more difficult unless our intentions are clearly backed by commitment/ resources.</p> <p>Current staffing levels in Egypt are insufficient to be able to absorb additional resources. Risk of putting almost all resources into only one value chain (Egypt tilapia).</p>

5	<p>Undertake another feasibility mission to another country (e.g. Ghana, Nigeria, Malawi, Zambia) to determine whether or not there is a better alternative.</p> <p><i>Low cost, medium risk option</i></p>	TBD (mission would need to assess new resource mobilization options).	Opens up potential for identifying strong candidate value chains in country with clear commitment.	Delays to the start of the second value chain under the L&F research program would reduce potential for short-term impacts.
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* **Note:** Options 1, 2 and 3 would all involve the initiation of field activities with L&F funds and new bilateral monies, e.g. for an initial market study/value chain assessment, a follow-up on the USAID-LEAD smallholder project, and research on constraints/bottlenecks to value chain development (e.g. research on local feed options and feed quality including a CFFRC studentship shared between Egypt and Uganda), etc. depending on levels of funding. Recent news from ILRI indicate non-growth in the overall L&F budget from 2012 to 2013 potentially leaving no seed money for Uganda.

5.2 Resource mobilization

While there are opportunities for leveraging small amounts of research funding in the near future (e.g. from ADRAS (if successful), ASARECA, or the EU-funded Fish Trade Project), there are no apparent or immediate opportunities for large-scale funding. Building up a sizeable portfolio with a larger revenue stream may therefore take time and require a sustained presence and concerted effort.

The mission found no readily available funds from conventional bilateral donors in country at the moment. EU is the most likely option in 2013, if the Aquaculture Parks initiative goes ahead. If the EU decides to fund the Aquaculture Parks initiative, then other bilateral donors might come on board, but again this is all tentative. A clearer picture around the EU decision is expected during the second quarter of 2013.

Limited CRP core funds means that any allocation of CRP funds to Uganda / East Africa could detract from other WorldFish L&F activities.

The following funding alternatives should be explored:

- i) Develop broad, regional proposals with ILRI on ASF / health / nutrition and/or environmental issues that address the 'bigger strategic questions' under L&F. Possible donors might include Gates Foundation, IFAD (engage in on-going dialogue with ILRI) and others. Next steps might include a review of possible donors and their priorities; big 'think pieces' at high level (to bring issues onto the agenda) and at L&F component level (feeds, breeding, gender, etc.).
- ii) Strengthen and develop research-for-development networks / partnerships with national and regional bodies (e.g. NEPAD, COMESA, ASARECA, PAF, NARS) to develop joint proposals relating to the proposed research agenda. WorldFish may not be a key partner, but this is consistent with the current CGIAR approach to divert more support to local and regional bodies and can leverage funds. Another potential option is linking up with the Nile Basin Development Challenge (NBDC) as part of the Challenge Programme of Water and Food on joint activities under CRP5 on Water, Land and Ecosystems. Some of the interventions are about the creation of small reservoirs which should be exploited as Multiple Use Systems, and one potential would be to rear fish as an additional source of protein. Next steps might include a review of regional bodies and their engagement in aquaculture and – crucially - their capacity to deliver. The risk of this approach is that it may take us out of our priority areas of focus if potential partners have other priorities.
- iii) Possible private sector funds might include those listed below. Fundraising through the private sector requires a very different approach to fundraising through more conventional channels and can be enhanced by insights from fundraising consultants⁹ and others who are experienced in this approach and in forming public-private-partnerships within research.
 - a. Private funding for cooperative development, as has been achieved in Aceh and other parts of Southeast Asia (see Phillips et al, 2012) through the WorldFish Incubator business model.
 - b. Medium and large scale aquaculture companies that are interested in funding research and development on specific issues that would be of benefit to their company. For example, possible collaboration with Source of the Nile on genetic development.

⁹ Such as Dr Richard Steckel (see www.addventurenetwork.org/) who has worked with ICRISAT and other centres in the past.

- c. Corporate Social Responsibility funding through oil companies (Total, Tullow Oil) or through aquaculture players, e.g. Commercial Aquaculture Producers for Africa (CAPA).
- iv) Competitive research grants through calls for proposals – may offer limited funding for research, but grants are typically small and internal competition can limit the possibilities for Uganda/EA. Assuming a success rate of one in three, substantial time could be absorbed by pipeline development.

Whichever research funding options we decide on we will need to be strategic in terms of effort expended, likely returns, and partnership development potential.

Other noteworthy initiatives and potential partnering and funding opportunities include: a newly initiated trilateral Kenya-Israel-Germany project on tilapia value chains, which might extend into Uganda in future; WorldFish is currently working with public and private sector partners in Kenya, Tanzania and Uganda in developing aquaculture in the region (see <http://www.worldfishcenter.org/our-research/ongoing-projects/african-aquaculture-development-beyond-the-fish-farm>). Although the project finishes at the end of 2013, there are further opportunities to apply for funding in 2014. NEPAD-FAO Fish Program has a strong focus on aquaculture, in support of the NEPAD Action Plan for the Development of African Fisheries and Aquaculture. The Aquaculture Working Group (AWG) is a region-wide body established within the Partnership for African Fisheries (PAF) to address challenges inhibiting aquaculture and fisheries research and development in Africa. It is also aligned to the NEPAD 'Fish for All' Abuja framework for aquaculture development.

Annex 1. L&F: Executive summary of the CRP proposal

Consumption of adequate amounts of meat, milk and fish is a proven way of achieving nutritional security which enables children to develop normally and reach their full potential as healthy, productive adults. However, productivity of these animal source foods in the poorest countries lags behind the rest of the world and consumption rates amongst the poor, women and children remain well below recommended levels. In many systems, opportunities for increased production and marketing of these commodities lie particularly with smallholder producers and other small-scale actors. This offers an opportunity for improved food security through better incomes and livelihood assets for the poor and women livestock keepers. The roles of men and women in production, processing and marketing and in household decision-making in resource allocation, technology adoption, marketing and consumption vary across the target countries of Africa, Asia and Latin America and there is great potential to use livestock and fish as a way for reducing inequities in access to resources, income generation and nutrition in these regions.

Vision

This CGIAR Research Program's vision is for the health, livelihoods and future prospects of the poor and vulnerable, especially women and children, to be transformed through consumption of adequate amounts of meat, milk and/or fish and from benefiting from the associated animal source food value chains.

CRP3.7 aims to realize this vision by seizing upon an unprecedented opportunity to integrate and exploit three ongoing revolutions – the Livestock Revolution, the Blue Revolution and the Gene Revolution. It will do this by fostering partnerships that harness the respective strengths of research and development partners, including the private sector, and also other relevant CGIAR Research Programs. The Program will be led by ILRI working closely with CIAT, ICARDA and the WorldFish Center.

MP 3.7 is testing the hypothesis that increased access to animal source foods by the poor, especially women and children, can be achieved at scale by strengthening carefully selected meat, milk and fish value chains in which the poor can capture a significant share of the benefits. Technologies and lessons generated through this focused approach will be applicable in broader regional and global settings.

Goal

The over-arching goal of CRP3.7 is to increase productivity of small-scale livestock and fish systems so as to increase availability and affordability of meat, milk and fish for poor consumers and, in doing so, to reduce poverty through greater participation by the poor along animal source food value chains. This will be achieved by making a small number of carefully selected animal source food value chains function better, for example by identifying and addressing key constraints and opportunities (from production to consumption), improving institutional arrangements and capacities, and supporting the establishment of enabling pro-poor policy and institutional environments.

Program objectives

The Program objectives that will contribute to the goal include to:

- increase sustainably the productivity of small-scale livestock and fish production and marketing systems

- increase access to affordable animal source foods to enhance food and nutrition security for the poor, women and children
- enable participation in and access to pro-poor and gender equitable production and marketing systems that promote uptake of productivity-enhancing technologies and increase value generation, with emphasis on addressing current gender disparities
- secure household and community livestock and fish assets for sustained livelihoods, and conserve livestock, fish and forage/fodder biodiversity as public good assets that will provide genetic diversity for continued growth and adaptation
- protect the natural resource base and its ability to continue providing ecosystem services
- strengthen capacity to enable public and private sector actors to support and exploit appropriate research and development efforts for sustainable intensification of small-scale livestock and fish production and marketing systems that provide equitable benefits to men and women
- facilitate scaling up and out by undertaking research and emphasizing learning and its communication

At the core of CRP3.7 are a small number of carefully selected national meat, milk and fish value chains. This focus is made in order to effectively implement the Program's innovative R4D approach and to maximize impact. The focus is on those value chains for which we judge there is a high potential for transformational improvement - from the producer to the consumer. The criteria by which these value chains have been selected include:

- a) Evidence of market opportunities for continued expansion of production, through growing demand for livestock and fish products
- b) Opportunities for smallholder producers to actively participate in and benefit from those opportunities, especially women and the poor, either as producers or as other actors in the value chains
- c) Productivity gaps and identified supply constraints that research potentially offers solutions to overcome
- d) A supportive policy and infrastructure environment to facilitate uptake and scaling out
- e) Existing momentum and experience, including key research and development partners, that can enable outcomes and impacts to occur within a relatively short timeframe

Based on these criteria and the evidence available, the selected value chains and countries are:

- Small ruminant value chains in mixed crop-livestock systems in Ethiopia and Mali
- Tilapia and catfish aquaculture value chains in Uganda and Egypt
- Smallholder dairy value chains in India (selected states), Tanzania and Nicaragua/Honduras
- Smallholder pig value chains in Uganda and Vietnam

The inclusion of multiple countries and regions, together with some common species of focus, will allow comparisons and cross-system learning that will support the development of strategic lessons,

methodologies and technologies of wide applicability, and the delivery of strong international public good knowledge outputs.

The program will have as its centre three Research Themes. These are organized so as to: a) provide significant critical mass and investment in generating improved productivity through technology development and adaptation in the main areas of feeding, breeding and animal health, b) ensuring that the technology development is driven by the real world context of agricultural value chains, and c) providing the cross-cutting analysis of development process and outcomes to ensure that target beneficiaries benefit.

These coherent research themes will also play a key role in generating the strategic and global public good outputs the lie at the heart of the CGIAR's comparative advantage, by working and employing harmonized approaches across the selected value chains and regions. The three themes are:

Theme One: Technology Development. This Theme is concerned with adaptation and generation of technologies to address priority constraints in the focal value chains, especially for feeds, genetics and health. Here a careful balance will be maintained between adaptive research to meet current pressing needs, and 'blue sky' research to provide transformational advances in the medium to longer term. Strong linkages between those responsible for technology generation and the value chain actors will be established to ensure that former address the real needs of the latter.

Theme Two: Value Chain Development. This Theme will provide a setting for integrating the technology adaptation and generation work, improving delivery systems, and developing value chains that promote intensification through new partnerships and innovation capacity. Strong emphasis will be on action research, and on working closely with development partners, including the private sector, and governance actors. Piloting and assessing interventions within the context of target value chains is required to avoid past failures that may have led to inappropriate or ineffective technologies and strategies.

Theme Three: Targeting, Gender and Impact. The final Theme is concerned with ensuring that gender and equity are mainstreamed in a transformative way in the whole Program; the Program has its intended impact among target beneficiaries, including women and vulnerable groups; monitoring and assessing the level and manner of that impact, and the outcomes that brought it about; understanding and supporting the processes of innovation and research to development, to improve the performance of the Program and its partners; understanding the political economy and governance of value chains; supporting the internal M&E, planning and decision functions, and the communication strategy of the Program to continually ensure efficiency, accountability and relevance.

In addition to achieving impact at scale in each of the selected value chains, it is anticipated that the research products and lessons generated will be applicable and, with adequate promotion, will be taken more broadly, such as in neighbouring countries. Some research products (such as new generation vaccines and improved varieties of dual-purpose food-feed crops) and lessons are also likely to have even broader applicability. So, while direct impacts are anticipated to benefit tens or hundreds of thousands of poor people for each value chain, broader regional impacts could reach millions, while international public goods could reach tens or hundreds of millions.

Finally, an organizational and implementation strategy and framework will be established to ensure the smooth functioning of the Program and its partnerships. The elements of this include:

- a Partnership Strategy for ensuring that the key partnerships that the Program will rely on are developed and supported, so as to make a strong contributions to the Program goals
- a Gender and Equity Strategy to ensure that the design, implementation, monitoring and evaluation address gender and equity, and distribution of Program impacts is particularly significant among those target groups of particular need
- a Communications, Advocacy and Knowledge Management Strategy to enable key potential users globally of the Program's knowledge products to make best use of those, to reach the decisionmakers and investors that can scale up Program outcomes, and to ensure the knowledge generated is organized and made available for wider user,
- a Capacity Development Strategy to maximize the potential for increase capacity for research for development among a range of partners, and
- a Management and Governance Structure that aims to both exploit the strong skills and capacity of the Program partners through joint processes of decision-making and implementation, while at the same time providing a streamlined structure to limit transactions costs of Program implementation.

After six years, this Program will have had direct impact on up to nine value chains which will result in significantly improved livelihoods for value chain actors and better nutrition security for poor consumers. It is anticipated that these direct impacts will benefit tens of thousands of households who will participate in more effective value chains, with larger numbers of consumers enjoying increased access to more affordable animal source foods.

Annex 2. Mission TOR

Background and Objectives of the Mission

The WorldFish Center will carry out a strategic planning exercise to guide decisions on selected fish value chains that might frame possible WorldFish interventions in the country, under the auspices of the CGIAR Research Program on 'More Meat, Milk and Fish by and for the Poor' – now referred to as 'Livestock and Fish'. The objective of a future engagement is to help increase farmed fish production to benefit poor consumers through interventions in the aquaculture value chain.

The objectives of the upcoming mission and subsequent follow up are to:

1. Re-evaluate the feasibility of the Center implementing a fish VC research program in Uganda, considering (i) the state of the industry, its growth trajectory and the barriers to its development, (ii) partnerships, (iii) the policy environment and (iv) the likelihood of raising sufficient funds to sustain a viable program.
2. Should Uganda remain a viable prospect:
 - a. Develop an implementation plan, including the logistics of establishing and maintaining a presence in the country and the investments required.
 - b. Identify candidate value chains for future program interventions in two regions of Uganda (presently south/southeast and north of Lake Kyoga).
3. Should Uganda not prove viable, alternative or broadened (e.g. Kenya, South Sudan) locations will be considered.

A team of four will be deployed in the field with back-up support from Worldfish Center offices in Penang and Lusaka. It is proposed the mission comprise the following members with responsibilities as shown, based on the considerations outlined in the Objectives above:

1. Jens Peter Tang Dalsgaard (Team Leader; Funding potential)
2. Kate Longley (Value Chains)
3. Malcolm Dickson (Aquaculture industry, growth and development)
4. ILRI representative/ Uganda Expert (Policy environment)

All team members will work together to identify possible partners and develop an implementation plan. Further support will be provided, as necessary, by Steve Hall, Malcolm Beveridge, and the AQ Business Management, Value Chain and Gender Teams, Penang.

This document provides a brief outline of the roles and responsibilities for each of the team members.

Team Leader

As the Team Leader for the Livestock and Fish (L&F) program at the WorldFish Center, Jens Peter Dalsgaard will lead the present mission , taking overall responsibility for its management, including planning, coordination, and the timely delivery of high-quality

outputs. In addition, Dalsgaard will be responsible for assessing the funding potential for future investments to a possible WorldFish L&F program in Uganda. He will meet with donors and potential private sector investors to determine the likelihood of raising sufficient funds to sustain a viable program. Working with other team members, he will draft an implementation plan, estimate the level of funding required, and identify donors and private sector players that might be approached for future investments.

Value Chain Specialist

Kate Longley is a WorldFish Value Chain Scientist working under the L&F program. As part of the current mission, she will review the literature available on value chains relating to the aquaculture [and fisheries?] sector in Uganda and will meet with key actors, stakeholders and other researchers. It is likely that some of these interviews will be conducted jointly with the aquaculture specialist. She will identify candidate value chains for future program interventions. Working with other team members, she will draft an implementation plan and identify potential partners that might be approached to work with the WorldFish Center in implementing the L&F program in Uganda.

Aquaculture Specialist

Malcolm Dickson is an Aquaculture Specialist and Project Leader of the WorldFish IEIDEAS Project in Egypt, the first of the two case study countries where WorldFish is implementing the L&F Program. Dickson will review the literature and data available on aquaculture in Uganda and will meet with key stakeholders to provide an overview of the state of the industry, its growth trajectory and the barriers to its development. Working with other team members, he will draft an implementation plan and identify potential partners that might be approached to work with the WorldFish Center in implementing the L&F program in Uganda.

Policy Specialist

It is expected that this person will have a Masters and/or PhD degree in agriculture, rural development, or social science and will have either worked in or researched Uganda's agriculture policy/regulatory environment. He/she should be a Ugandan national who is well connected with both government decision-makers and the private sector. As part of the current mission, he/she will review the literature available on the policy environment relating to the aquaculture [and fisheries?] sectors in Uganda and will meet with key actors, stakeholders and other researchers. It is likely that some of these interviews will be conducted jointly with other team members. He/she will provide the policy analysis necessary to evaluate the feasibility of the WorldFish Center implementing a fish VC research program in Uganda. Working with other team members, he/she will draft an implementation plan and identify potential partners that might be approached to work with the WorldFish Center in implementing the L&F program in Uganda.

Annex 3. Meeting schedule

	Mon 10 th	Tues 11 th	Weds 12 th	Thurs 13 th	Fri 14 th	Sat 15 th	Mon 17 th	Tues 18 th
MORNING	10am Team meeting @ ILRI office, Plot 106, Katalima Road, Naguru-Kampala	9.00am Maurice Ssebisubi, Aq Management Consultants, Plot 2D Nakasero Hill Road, Kampala 11am, Ben & Lovin, WAFICOS (next to the FAO office in Wandegeya, on Buganda Road)	9am @ LEAD project, Jacob Olwo, Plot 58 Lumumba Avenue PO Box 1709 Nakasero 11am @ USAID, Gaudensia Kenyangi (Ag. Dev. Specialist)	11am – 1pm @ NaFIRRI, Jinja (dept. from Kampala 8.30). Dr. Balirwa and colleagues	10am @ World Bank, 1 Lumumba Ave., Rwenzori House, 5th floor; Rasit Pertev 10am @ DOF Jaskson Wadanya and Andrew Alio; Legacy Towers Dept. of Fisheries office, Kyadondo rd. 11am @ Uganda investment Authority – Michael Mugabira	9am Kireka farm visit 11am Jean Kahwa, Shalom Farm visit Fish landing site visit at Port Bell	9.30am Makerere (Maurice to org.) 10am Makerere, Margareth Kabahende - Institute of Food Science and Biotechnology	9am @ Bioversity, Charles Staver (Report writing)
AFTERNOON	2pm, Warwick Thomson @ Danish Embassy, Plot 3, Lumumba Avenue 4 or 5pm, Philip Borel – Kampala or Entebbe?	2.30pm @ EU Delegation, 15th Floor, Crested Towers. Plot 17-23, Hannington Road; Patrick Seruyange and Bernard Crabbe	2pm @ Asareca, Jean Ndikumana 4.30pm, Todd Benson @ IFPRI, Plot 106, Katalima Road, Naguru	2.30pm @ LVFO, Dick Nyeko 4-5.30pm @ Source of the Nile <i>- Return from Jinja to Kampala late afternoon / early evening</i>	2pm @ Kajjansi (China-Uganda Friendship Ag. Technological Demo. Center)	(Report writing)	3pm @ NARO, Plot 11-13 Lugard Avenue, Entebbe; Emily Twinamasiko (NARO DG) and colleagues Fish landing site visit	(Report writing)

Annex 4. Stakeholder list

#	Organization	Contact Person	Address	Notes
DEVELOPMENT PARTNERS (DONORS)				
*1	EU mission (European Union)	Bernard Crabbé, Second Secretary, and Head of Agriculture and Rural Development e-mail bernard.crabbe@ec.europa.eu ; Patrick Seruyange, Operations Officer, Rural Development. E-mail patrick.seruyange@ec.europa.eu	European Union Delegation to Uganda 15th Floor, Crested Towers, Plot 17-23, Hannington Road, P.O.Box 5244, Kampala. Tel: +256 - 414 - 701000. Fax: +256 - 414 - 233708. Email: delegation-Uganda@ec.europa.eu	Contacts from Tabeth/Malcolm mission, May 2011.
*2	USAID (United States Agency for International Development)	<i>Gaudensia Kenyangi</i> (Agriculture Development Specialist) gkenyangi@usaid.gov <i>John Brighenti</i> (Agriculture Officer) jbrighenti@usaid.gov	(256)414-306-001-Ext-6551 (256)772-221-672 (cell)	Contacts from Tabeth/Malcolm mission, May 2011
*3	USAID-LEAD (Livelihoods and enterprises for agricultural development)	Mr. Jacob Olwo Fish Value Chain Manager T: +256 (0) 782 502876 E: jolwo@leadug.com olwoj@yahoo.com	Plot 58 Lumumba Avenue PO Box 1709, Nakasero, Kampala Tel: +256 (0) 312 216700	Contacts from Beth. Appears LEAD is no longer involved in fish?
		Mr. Samuel Orukan Fish Value Chain Development Officer Plot T: +256 (0) 776 985322 E: ??? sorukan@leadug.com		
*4	DFID (Department for International Development)	Enquiries ugandaenquiries@dfid.gov.uk	4 Windsor Loop, Kamwokya, PO Box 7306, Kampala Tel :+ 256 41 4331000 Fax :+ 256 41 4348732	Contact details from Fiona note, March 2011
*5	Danida (Danish International Development Assistance)	Warwick Thomsen (wartho@um.dk) - Danida Business Partnerships Program Coordinator	Plot 3, Lumumba Avenue, P.O. Box 11243, Kampala http://uganda.um.dk/en/ +256 (0) 312 263 211	
*6	GIZ (German International)	Mark Prein, Advisor, Program on Sustainable Fisheries and Aquaculture (HQ, Germany):		

	Development Cooperation)	mark.prein@giz.de		
7	AusAID (Australian AID)			
8	WFP (World Food Program)	Vincent K. Kiwanuka, Program Officer Vincent.Kiwnuka@wfp.org ? Charles Sembatya, Program Officer charles.sembatya@wfp.org ? Ojera Josephine Flora, Program Officer Josephine.Ojera@wfp.org ?		Contacts from Tabeth/Malcolm mission, May 2011
9	CIDA (Canadian International Development) Agency)			
10	SIDA (Swedish International Development Agency)		Tel: +256 414 340 970	
11	NORAD (Norwegian Agency for Development Cooperation)		Royal Norwegian Embassy in Kampala Plot 18B Akii-Bua Road, Nakasero. Phone: +256 417 11 20 00 (also for emergencies outside office hours) Fax: +256 41 4343936 E-mail: emb.kampala@mfa.no	Address from Fiona note, March 2011
12	JICA (Japan International Cooperation Agency)			
13	WB (World Bank)	Mr Rasit Pertev, Senior Agric Economist rpertev@worldbank.org	Office Phone: 256 414- 302220 DAMA Extension: 5393 - 2220	
14	IFAD (International Fund for Agriculture Development)	Line Kaspersen (JPO): l.kaspersen@ifad.org Tomas (t.donelly@ifad.org) Mr Pontian Muhwezi, Country Program Officer p.muhwezi@ifad.org	Plot 15B Clement Hill Road, Kampala	

15	Netherlands Embassy	Stephen Bayite Kasule, Policy Officer Agribusiness stephen.bayite@minbuza.nl	+256788730990	Contact provided by Ian Derry
16	IDRC			
GOVERNMENT AGENCIES				
*1	Ministry of Agriculture Animal Industry and Fisheries (MAAIF)	Alex Lwakuba, Asst. Commissioner alwakuba@yahoo.com / ps@agriculture.go.ug	Plot 5 / Legacy Towers Kyadondo rd, Kampala P.O. Box 34518, Kampala +256 414 255136/7 +256 772 402380 (cell)	Contact details from Tom
2	PMA Secretariat, MAAIF	Robert Bellarmine Okudi, Acting Director director@pma.go.ug r.okudi@yahoo.com	Mukwasi House Kyadondo Rd, P.O. Box 34518, Kampala +256 414 252263 +256 772 605480 (cell)	Contact details from Tom
*3	Department of Fisheries	Jackson Wadanya, Acting Commissioner Fisheries Andrew Alio, Acting Head Aq. Unit (Wilson Mwanja, Ex - Commissioner Fisheries wmmwanja@yahoo.com)	0772 482 076 lovewadanya@yahoo.com 0772 567 189 andrewalio@gmail.com Cell: +256 772 594923	
*4	National Fisheries Resources Research Institute (NaFIRRI)	Dr. John Balirwa, Director of Research/DG? director@firi.go.ug jbalirwa@yahoo.com William Okello wiokelo@yahoo.com Bwambale Mbilingi Socio Economist bwawinston@yahoo.com	Plot 39/45 Nile Crescent PO Box 343, Jinja +256 (0) 434 121 369 +256 (0) 772 620 505	Contact details from Beth
*5	National Agricultural Research Organization (NARO)	Dr. Emily Twinamasiko, Director General dgnaro@naro.go.ug or etwinamasiko@naro.go.ug	National Agricultural Research Organization (NARO), Plot 11-13 Lugard Avenue, P.O. Box 295, Entebbe, Uganda Tel.: +256-414-320512 or 320341/2 Fax: +256-414-321070 dgnaro@naro.go.ug / etwinamasiko@naro.go.ug Website: www.naro.go.ug	

*6	National Aquaculture Center/ Kajjansi Aquaculture Research and Development Center?	Ms. Gertrude Atukunda Research Officer, Socio-Economics gert_kunda@yahoo.com Dr. Mbabazi Dismas head of Aquaculture Research mbabazidismas@yahoo.com and 077239345	Kajjansi, 'China-Uganda Friendship Agricultural Technological Demonstration Center	
7	Uganda Investment Authority	Michael Mugabira		Aquaculture Parks
*8	Makerere University	Prof John Muyonga, Head of Institute of Food Science and Biotechnology Dr Margaret Kabahenda	+256 772 673153 (cell) +256 773 009747	
		Ann Akol, Sr. Lecturer, Faculty of Science, Dept. of Zoology Godfrey Kubiriza, Lecturer, Dept of Biological Sciences	+256 772 367727 +256 751902498; kubirizag@gmail.com	
9	National Agricultural Advisory Services (NAADS)	Dr Sam Mugasi, Executive Director mugasi@yahoo.com	Kampala	Sam Mugasi (did PhD under Tom)
PRIVATE SECTOR, NGOs, CIVIL SOCIETY				
1	Uganda National Farmers Federation/ Association? (UNFA)	Augustine Mwendya, Director, Agribusiness Development amwendya@yahoo.co.uk unfa@starcom.co.ug	Plot 27 Nakasero Rd Kampala, P.O. Box 6213, Kampala +256 414 230705 +256 772 616926 (cell)	
2	Aquaculture Management Consultants, Ltd.	Mr. Ssebisubi Maurice, Co-founder a.m.consult.ltd@gmail.com mauriceisnot@gmail.com	Plot 2D Nakasero Hill Road, Kampala <u>+256 (0) 783 185 981</u> <u>+256 (0) 312 110 314</u> <u>+256 (0) 782 728 028</u>	Contact details from Beth
*3	Green fields Uganda	Philip Borel Debithe, Managing Director		
*4	AquaFarm Consults Ltd.	Justus Rutaisire, Director info@aquafarmconsults.com jruta@aquafarmconsults.com	Plot 22C Namirembe Rd, Kampala P.O. Box 72406, Kampala +256 312 516513 256 772 501227	Contact details from Tom
5	Walimi Fish Farmers' Cooperative Society (WAFICOS)	Lovin and Ben waficos08@yahoo.com	Next to the FAO office in Wandegeya, on Buganda Road, Kampala +256 (0) 312 265896	Contact details from Beth

			+256 (0) 701 041160	
*6	Source of the Nile/Lake Harvest Uganda		Jinja	
*7	Lake Vic Fisheries Organization (LVFO)	Dick Nyeko, Executive Secretary	Jinja +256 772 721455 (cell)	
*8	Ugachick	Mr Aga Sekalala (Snr)	Tel: 256-414-250341	
*9	SCAPA project (Sustainable Commercial Aquaculture for Poverty Alleviation)		http://www.ugandascapa.com/	Project w. Stirling Univ.
10	Uganda National Farmers Association (UNFA)		Kampala	
11	Association for strengthening Agricultural Research in Central and Eastern Africa (ASARECA)	Dr Jean Ndikumana j.ndikumana@asareca.org	+256 414 323261 (work) +256 755 035 263 (cell)	
12	International Livestock Research Institute (IFPRI)	Danilo Pezo: D.Pezo@cgiar.org	Plot 106, Katalima Road, Naguru-Kampala +256 312 266250/53 +256 7755 11595	
*13	International Food Policy Research Institute (IFPRI)	Todd Benson: t.benson@cgiar.org	Tel: +256 424 285060 / 4	
14	International Center for Tropical Agriculture (CIAT)	Dr Robin Buruchara, Regional Coordinator	Tel: +256 414 567670 r.buruchara@cgiar.org	
15	FAO			
16	ACP Fish 2	Koane Mindjimba		
17	NIDA Nkoola Development Agency	Dan Kisauzi, Director dankisauzi@nida.or.ug	Tel: +256 414 530696 / +256 772708593	
18	Tullow (Irish Oil Company)			
19	Shalom Farm, Luzira	Jean Kahwa	07822 43453	From New Vision article
20	World Forum of Fish Worker and Fish Harvesters and Katosi Women Development Trust	Margaret Nakator: mnakato@worldfisherforum.org or nakato@katosi.org :	Mobile +256 772 748774	From Line Kaspersen, IFAD

Annex 5. Details of development partners and stakeholders

Donors

European Union (EU)

In 2011, the EU delegation responded to a request from the Government of Uganda (GoU) and supported an assessment of the feasibility of developing the commercial aquaculture industry. This assessment conducted by COWI/Poseidon and headed by Dr Malcolm Dickson concluded that aquaculture is feasible in Uganda either using ponds or cages. The study found that current market conditions are challenging and have held back development of the industry. The EU has commissioned a study, scheduled for November 2012, to assess the feasibility of establishing 2 aquaparks in Uganda to produce catfish and tilapia. The study is to specify the suitable location, the mode of operation (smallholder versus large commercial producers). The EU will then make a decision on if and how to go ahead and this may involve partnering with GoU and other donors. Once the EDF funding for 2014 – 2020 is approved, aquaculture may be considered depending on discussions to be held by the thematic subgroups on the non ATAAS DSIP priorities. The East African Community (EAC) is also developing a strategy for promoting aquaculture in East Africa with a French consultant.

United States Agency for International Development (USAID)

USAID has been very supportive of Uganda's fisheries and aquaculture industry and in 2006 commissioned the Fisheries Investment for Sustainable Harvest (FISH) project at NARO, Kajjansi, which was followed by the Livelihoods and Enterprises for Agricultural Development (LEAD) project which supported aquaculture among other value chains. The LEAD project focused on feed, seed, farmers' capacity and technology transfer with private sector taking lead. The project funded the establishment of a fish feed plant with a private sector actor (Ugachick). The LEAD aquaculture project concludes in October 2012 and unfortunately, the fish value chain was not included in the new Feed the Future (FTF) strategic plan of the U.S. Government's global hunger and food security initiative for 2011 -2015. FTF prioritizes a smaller number of value chains and focuses on maize, beans and coffee. Most nutrition funds are FTF funds. The Aquafish CRSP project with Makerere University has also ended.

USAID operates a partnership fund with the next, and probably final, call for proposals in October/November.

World Bank (WB)

Technology development and extension are traditional areas of World Bank support and the GoU has asked the WB to fund the Agriculture Technology and Agribusiness Advisory Services (ATAAS) which is to replace NAADS. The WB is currently supporting the process of developing twenty implementation plans for the non-ATAAS part of the DSIP, including a plan on fisheries/aquaculture. Final drafts are expected by the end of October and will be made publicly available. The plans aim to bring clarity on the way forward and are to be funded by the GoU with development partner support. The process will hopefully result in new WB funding. Farmers' organizations and the private sector are increasingly in focus and the WB envisages private sector led development also for the aquaculture sector. The WB plans to inject \$40 million into new projects focusing on seeds-fertilizers-mechanisation.

China-Uganda project

In 2006, the China-Africa Forum in Beijing commissioned an aquaculture project in Uganda as part of the China assistance to Africa. Phase I of the project began in 2009 with the construction of fish ponds and an administrative block with a laboratory. Phase II of the project, running from 2010 to

2014, focuses on: i) Demonstration of aquaculture technology; ii) Training and capacity building of farmers and researchers; and iii) Research on aquaculture (species improvement, feed and productivity). Under the second phase a feed mill and a hatchery have been constructed. The Uganda Huaqiao Fenghuang Fisheries Company Ltd that was sub contracted by the Chinese government under this bilateral assistance intends to make an additional investment of US\$172 million from 201-2017 into commercial aquaculture using cages, ponds and tanks in order to produce 27,000 tons of fish (cat fish, tilapia, grass and silver carps) annually. Target markets include Uganda, the region and Asia. The new investment will include another feed mill and a processing facility.

Danish International Development Assistance (Danida)

There are currently no fish interventions under Danida's Agribusiness Initiative (aBI Trust, <http://www.abitrust.com/>) which is a multi-stakeholder entity with funding estimated at Euros 42.1 million (for period 2010 – 2015) devoted to private sector agribusiness development specifically focusing on dairy, maize, and coffee value chains at the moment. There is currently no capacity at the moment in aBI for another partnership. It is the clear expectation that some other donors will line up behind the aBI Trust and provide additional funding although there are concerns among some development partners that the fund is growing too large and that alternatives are needed. It is not possible at this stage to predict if aquaculture value chains could be supported under the aBI trust fund. Despite a problematic business environment donors are coming back into agriculture in Uganda, e.g. Japan, Korea, and USAID. MAAIF suffers from weak leadership. Many good people have left and positions remain vacant.

International Fund for Agriculture Development (IFAD)

IFAD is currently not taking an interest in farmed (or other) fisheries activities in Uganda. The main interaction with fisher communities has been around Lake Victoria and alternative business and livelihoods opportunities, working through NGOs. IFAD is apparently active only in Mozambique with regards to aquaculture in Africa, at the moment.

German International Cooperation (GIZ)

GIZ is not involved in aquaculture in Uganda at the moment, but is part of a trilateral initiative to promote tilapia value chains in Kenya together with the Kenyan and Israeli Governments. This initiative could extend into Uganda in future. GIZ support may be possible through the 'BEAF mechanism'?

DFID

There are (still to be verified) rumours that DFID is coming back into agriculture in Uganda and the region. According to ASARECA, DFID has expressed an interest in aquaculture (contact persons are Rachel Lambert and James Muir). This needs to be verified. DFID is currently supporting PAF through NEPAD.

Government Agencies

Ministry of Agriculture, Animal industry and Fisheries (MAAIF)

The Department of Fisheries Resources caters for fisheries and aquaculture. The department has recently drafted a policy on aquaculture ready to be presented to cabinet and parliament for debate, and has also developed guidelines for cage farming. They are actively involved in the proposed establishment of aqua-parks though feasibility studies on mode of operation. Sites for Aquaparks have been identified however these will be reviewed by consultants later this year. The DFR have also been approached by the Chinese to allocate sites for commercial expansion. Lake Kyoga has been proposed as suitable site for them as they want to use Chinese carp species and this large

body of water it is not shared with other countries. The Department sees an important role for WorldFish in supporting value chain development through research.

National Agricultural Research Organization (NARO)

NARO is the government body mandated to conduct and oversee agricultural research in Uganda which includes fisheries. The fisheries and aquaculture research falls under the National Fisheries Resources Research Institute (NaFIRRI). NaFIRRI has two stations where aquaculture research is conducted at Jinja and Kajjansi. NaFIRRI believes aquaculture is poised to take off now due to the increasing depletion of fish in natural water bodies, high rate of population growth (3.5%) in Uganda, increasing demand for fish from neighboring countries, existence of supportive policies, an interested private sector, and the increasing price of fish, which should be an incentive to production. NaFIRRI welcomes WorldFish as a strategic partner to jointly attract funding for research to support aquaculture development.

Uganda Investment Authority (UIA)

UIA is a government semi-autonomous body charged with a mandate of attracting investments into all sectors of Uganda's economy. UIA has been involved in the development of the National Policy for Aquaculture Parks and is now working towards gazetting suitable areas for the aqua-parks. UIA reckons that environment management and society perception may be the main challenges to the establishment of aqua-parks in Uganda. UIA is the entry point for all foreign investors and as such a strategic partner to the aquaculture industry promoting private sector participation.

Regional bodies

Lake Victoria Fisheries Organization (LVFO)

LVFO is a regional body mandated to oversee fisheries activities in Lake Victoria. LVFO is jointly owned and managed by the governments of Uganda, Kenya and Tanzania. The organization may soon transform into an East African Fisheries organization to cater for other countries which benefit from Lake Victoria and extend its mandate to include marine culture. LVFO mainly works through task forces specifically addressing concerns related to fish capture, aquaculture and postharvest management. LVFO suggests that WorldFish adopts a regional outlook since most of the fish markets transcend the borders of Uganda.

Association for Strengthening Agricultural Research in Eastern and central Africa (ASARECA)

ASARECA is funded through a World Bank managed multi-donor trust fund with a budget of 1.2-1.5 million USD per year. The body represents national agricultural research organizations in the region. Proposals must as a minimum involve three countries and four institutions. There are plans to do more work in aquaculture in future. Support will be provided to Madagascar to build an 'aquaculture center of excellence'. ASARECA has a strategic plan 2009-2016 for its fisheries and livestock program and will be preparing a five-year overall operation plan 2014-2018. Jerome Lazard from CIRAD is adviser to ASARECA. ASARECA sees potential for more partnerships with WorldFish.

Private Sector

Uganda Huaqiao Fenghuang Fisheries Company Ltd y

Aiming to become the largest farmed fish (tilapia, catfish and possible grass and sliver carps) producer in Uganda with a target of 27,000 tons/year. See details under 'China-Uganda project' in the Development Partners section.

Source of the Nile Ltd (SON)

SON is Uganda's largest aquaculture farm producing 350 tons in 2011, up from 40 tons the year before. The farm has expanded rapidly and now has around 400 small cages (2.5m x 2.5m) in a near-shore area upstream from the outflow of Lake Victoria. The site was first developed around 2005. In recent years SON has acted as a fry/fingerling production centre and has a genetic improvement program in place for Nile tilapia with parent stock sourced from a range of lakes in Uganda. SON plans to expand into production by using larger cages and a larger site about 10 km away from its existing location and is awaiting for approval from the Fisheries Commissioner. The new site aims to produce 2500-3000 tons per annum with lower operating costs from only 12 large cages serviced by one or two boats compared to the large number of small boats used at present. SON plans to start own feed production from 2013 aiming for 5000 tons/year.

Sustainable Commercial Aquaculture for Poverty Alleviation (SCAPA)

SCAPA is a local company working with the UK-based development organization Business Minds and supported by the Dutch Government. The focus is on large-scale catfish aquaculture business and catalysing smallholder development through commercial investments. The project has been in operation for some 30 months, in partnership with the University of Stirling, and is currently preparing a technical-cum-business model to carry the project forward. At present SCAPA supports around 80 farmers in a cooperative to start growing fish commercially. The target is to involve several thousand farmers as shareholders. The plan is to expand the SCAPA facility for catfish production in tank-based systems and implement breeding program for improved quality broodstock. A sales and marketing company will be established linking farmers to input and output markets. Large production volumes will be critical to success. There is interest in working together with WorldFish e.g. on synergies around their out-grower program supplying fish for poorer communities. The sector needs coordination.

Greenfields

Greenfields is one of the leading exporters of Nile perch in Uganda. The company mainly exports Nile perch fillets to Europe although increasingly to Middle East and other countries in Africa. Also some tilapia fillets but these are from wild caught fish. Greenfields has established a catfish hatchery which originally was designed to provide bait for Nile perch fishermen, but now is increasingly responding to demand for catfish fingerlings for aquaculture.

Walimi Fish Cooperative Society (WAFICOS)

WAFICOS, initially established under the LEAD project with USAID support but now operating as an independent (but under-financed?) unit is a cooperative society with about 350 members throughout Uganda engaged in aquaculture. It offers services such as joint input purchases, joint marketing and technical advice to farmers. WAFICOS currently acts as an umbrella body for fish farmers in Uganda and could be a key strategic partner for R&D with smallholders. WAFICOS sees quality of feeds, seed, adoption of new technologies other than ponds and producer profitability as the key challenges to the industry at present.

Non-Government Agencies

UAOGRESCUE – Faith Project

UOGRESCUE is engaged in cage culture in lakes Albert and Nakivale through its FAITH (Food Always in the House) project. The project is part of a livelihood program to help communities via technology transfer. The organization runs another project under its FAITH project in Northern Uganda covering lakes Bisina and Kyoga and a water reservoir in the Karamoja region. The project is named Northern Uganda Aquaculture Development (NUAD).

Annex 6. Extracts from recent aquaculture market studies

Reference	Abstract / extracts
<p>Hyuha et al, 2011. Profitability analysis of small scale aquaculture enterprises in Central Uganda</p>	<p>The study had three overriding objectives. Firstly, to assess the profitability of small-scale aquaculture production enterprises in central Uganda; secondly, to ascertain the factors affecting profitability; and thirdly, to identify the constraints to fish farming in the region. The data were collected in June/July 2010 through a survey questionnaire administered to a random sample of 200 small scale fish farmers in the three major fish farming districts of Mpigi, Mukono and Wakiso in central Uganda. The analysis was carried out using descriptive statistics, enterprise budgeting and ordinary linear regression. Although the results show small-scale aquaculture enterprises to be profitable in the study region, the estimated profit margins are relatively small. Farming experience, fish price, record keeping, feed cost and volume of fish harvested were the most influential factors in explaining profitability. The key factors identified as hindrances to aquaculture development in the region included predators, unavailability of credit facilities, expensive feeds, shortage and poor quality of fingerlings.</p>
<p>Bukenya et al, 2012. Economics of Fish Marketing in Central Uganda</p>	<p>The study was conducted under a two-year small-scale aquaculture project funded by USAID-AquaFish Collaborative Research Program (CRSP). Survey respondents were drawn from a cross-section of wholesale and retail fish traders operating in nine markets (Kasubi, Busega, Mpigi, Mukono, Bwaise, Kawempe, Nsangi, Nansana and Wekembe) located in four districts (Kampala, Mpigi, Mukono and Wakiso). Survey data were collected in July 2011 from 74 traders selected randomly across the nine markets. Gross profit was estimated at US\$358.40/kg and US\$234.73/kg for wholesalers and retailers, respectively, with marketing margins of 19.32% and 16.67% for wholesalers and retailers, respectively. The market operational efficiency was 279.27 percent, implying high efficiency in fish marketing in the study area. The survey included a question asking traders if they sold farmed fish on top of capture fish. Almost all responded (92%) were not selling farmed fish and when asked why they did not sell farmed fish, the most frequent response was lack of supply (scarcity of farmed fish) followed by fish size.</p>
<p>Gordon & Ssebisubi, 2012. Vertical and Horizontal Integration in the Ugandan Fish Supply Chain</p>	<p>The purpose of this article is to report the results of a statistical investigation of links in the fish supply chain in Uganda. We are particularly interested in the extent of ex-vessel prices impacting links downstream in the fish supply chain. Our results show that ex-vessel prices are only weakly related to downstream markets. It is possible that both aquaculture and fisheries sectors have forward and backward linkages to postharvest handling, processing, and marketing that impact ex-vessel price of fish (Delgado <i>et al.</i> 2003). Strategic pricing can impact the magnitude of price pass through the market segments, the length of time to adjust to price shocks and asymmetric price response to positive or negative shocks. Thus, it is important to understand the welfare of fishermen in order to understand the price links and causality in price determination in the fish supply chain and the factors that impact the ex-vessel price of fish. The purpose of this research is to carry out a</p>

	<p>statistical investigation of market prices in the fish supply chain for Uganda. The data used in the statistical work is the average monthly real Ugandan Shilling price of five fish species, Nile perch (<i>Lates niloticus</i>), African catfish (<i>Clarias gariepinus</i>), mukene (<i>Rastrineobola argentea</i>), <i>Bagrus</i> (<i>Bagrus docmac</i>) and tilapia (<i>Oreochromis niloticus</i>). All species are wild harvest but African catfish and tilapia are also farmed and add about 50,000 tons to a total capture fishery of about 350,000 tons, annually.</p>
<p>Dickson & Macfadyen, 2011. Study on Promoting Commercial aquaculture in Uganda</p>	<p>This consultancy assignment was funded by DG EuropeAid and implemented by a consultancy team from Poseidon Aquatic Resource Management/Cowi. The main purpose of the assignment was to examine factors constraining aquaculture development in Uganda, and to propose actions and activities which would assist with development of the sector. Despite obvious potential there are few examples of profitable aquaculture businesses in Uganda. Perhaps the only thriving sector is hatcheries, producing catfish fingerlings for bait and tilapia and catfish fingerlings for stocking Ugandan, Rwandese and Kenyan fish farms. Profitable pond-based grow-out fish farms are much rarer. Many people have been disappointed with the returns from their investment in pond-based fish farms, however recent developments such as SON Fish Farm Ltd have shown that production from cage based farms can be expanded very rapidly. But aquaculture seems to have gained a reputation in Uganda as a 'difficult sector'. This report argues that the two main issues holding back development of the Ugandan commercial aquaculture sector are:</p> <ul style="list-style-type: none"> • A policy and 'cost' environment which is not supportive of the sector at all stages of the value-chain; and • A lack of sufficient emphasis on marketing (e.g. market segmentation, market infrastructure, price promotion, etc) which ultimately constrains profitability. <p>Any intervention to kick-start the industry needs to address both issues concurrently, as fish farmers will not develop their production capacity without the prospect of improved market opportunities. Also it is impossible to develop the market without a reliable source of high quality fish (being produced in an economically efficient manner) to offer on the market.</p>
<p>C.M. Dhatemwa, 2009 Regional Fisheries/Farmed Products Market Study East Africa</p>	<p>The overall objective of the study was to get a clear and documented vision of the freshwater regional fish market trends for selected fish and fish products, namely Tilapia fry, Tilapia brood stocks, Table size tilapia, Fry catfish for farmers, Catfish Fingerlings as bait fish, Table size catfish and Nile Perch dried and salted head. There is increasing demand for farmed table fish in the regional market of East Africa comprising of Uganda, Kenya, Tanzania, Democratic Republic of Congo and Rwanda. The regional trade in Tilapia is often affected by stiff competition from the capture fishery and in addition there are disparities in policies and regulations within the region. Tanzania does not allow the export of Tilapia while Uganda allows its export after adding value to it. The study has shown that there is an enormous potential for fish fry and fingerlings particularly in Uganda and in the DRC to cater for the growing</p>

	aquaculture industry in the region. Such is the demand that the emerging commercial aquaculture in Eastern DRC has resorted to sourcing fry from the wild. The long lining fishery in the water bodies of the region requires large quantities of bait.
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See References for full citations.

Annex 7. Additional suggestions around the proposed research areas

1. Develop and test models for SME-based, pro-poor, gender equitable aquaculture value chain development.

Work with SME aquaculture producers and develop value chains from the bottom up with emphasis on cooperative models and the social enterprise/business case for philanthropic investors who want to see long-term return on investments (see Phillips *et al.* 2012). Consider LEAD project carry-on, collaboration with the SCAPA project on producing fish for the poor; explore plans by private investors on venture capital involving small-holders who could ‘piggy-back’ on marketing channels developed by medium- and large-scale commercial enterprise (‘hub-type’ development).

Potential research areas:

- Comparing small, medium and large scale interventions and their effects on food and nutrition security, food safety, poverty reduction and the environment.
 - Investigating options for local feed production including low-tech pelleted feed production and enhanced use of natural fertilization for optimal FCRs and reduced feed costs.
 - Linking selected producer groups better to feed inputs (buying bulk) and markets (selling volume) and improved market information systems. Could be in the shape of a follow-up on the USAID-LEAD project working with selected hubs and LEAD lead farmers for carefully targeted interventions.
 - Engaging in selective breeding work for improved strains notably tilapia and catfish (e.g. partnering with Source of the Nile to enhance their current work on selective breeding of tilapia).
 - Support technology and knowledge transfer from Egypt and lessons learned exchanges. Promote information, knowledge and technology exchanges more widely between Egypt and Uganda (comparing and contrasting) and documenting lessons learned for wider dissemination and potential uptake in the East African region.
 - Developing production systems linking aquaculture with other agricultural production sectors (integrated rice-fish, poultry-fish, livestock-fish, aquaponics).
2. Increase access - geographic, but especially economic - to fish by poor consumers and assess nutrition outcomes at intra-household level, as affected by poverty, livelihoods, life cycle, health, ethnic and gender norms.

In other countries, medium and large-scale commercial companies tend to produce for middle-class, not poor consumers. The same is likely to happen in Uganda, but the M4P¹⁰ approach can be used to identify ways to support the poor at various levels in the value chain. This implies possible research agendas on:

¹⁰ Markets for the Poor (M4P) is a practical approach to reducing poverty grounded in best practice and guided by four underlying principles: systemic action; sustainable change; large-scale impact; facilitative role (<http://www.m4phub.org/>)

- Researching and identifying key lessons learned from large-scale commercial interventions and their wider implications, including for up-scaling.
- Facilitating/brokering public-private partnership models and identifying research and capacity building needs and opportunities.
- Researching the workings of regional market models and value chains (once the volumes are there). ASARECA could be a research partner, including food and nutrition safety issues.
- Impacts of increasing access to fish on health and nutrition – the role of the other pillars of food and nutrition security at intra-household levels (health, sanitation, adequacy of housing, etc.).
- Employment for socially marginalized people (women and youth) and ensuring that poor aren't exploited or trapped in poverty (equitable benefit sharing).
- Gender dimensions / gender transformation around animal source food value chains (livestock and fish).
- Influencing national and regional policy, planning and decision-making on biosafety/biosecurity, trade, etc. for more evidence-based approaches.

Annex 8. Budget information

Expenditure	Remark	Option 1: Full-time		Option 2: Part-time (50%) *	
		UGX	USD	UGX	USD
Personnel			110,897		55,448
VC Coordinator	Scientist Level		100,000		50,000
Administrative Assistant	Level 5 Administrative Assistant	27,187,489	10,897	13,593,745	5,448
Local Travel			28,500		14,250
Travel	3 trips within EA region		9,000		4,500
Car Rent & Taxi			18,000		9,000
Allowance	3 trips/month out of Kampala; each trip 3 days and 2 persons		1,500		750
Consumable			10,400		10,400
Internet / Mobile			2,400		2,400
Printing and stationery			8,000		8,000
Facilities					
Office Rent	In Bioversity or IFPRI compound		7,500		7,500
Capital Asset			3,000		3,000
Computer / Accessories			3,000		3,000
Admin Cost (By Host Center)			22,920		12,465
15% Admin Cost	Bioversity overhead rate	15%	22,920	15%	12,465
Total Cost			175,716		95,563

* Share Admin Staff, e.g. with ILRI

Additional points to consider: Changes in Director of Aquaculture location (from April 2014):

- If new appointment is based in Uganda, substantial savings could be directed to a Uganda office;
- If new appointment is based in Penang, savings of almost as substantial savings could be directed to a Uganda office

REFERENCES

- Beveridge, M. C. M. 2004. *Cage Aquaculture*, 3rd edn. Blackwell, Oxford.
- Beveridge, M. C. M. and R. Brummett (in press). [to be inserted]
- Beveridge, M. C. M., Thilsted, S. H., Phillips, M. J., Metian, M., Troell, M. & Hall, S. J. 2012. Meeting the food and nutrition needs of the poor: the role of fish and the opportunities and challenges emerging from the rise of aquaculture. *Journal of Fish Biology* (in review).
- Bukenya, James O. Theodora Hyuha, Julius Twinamasiko and Joseph Molnar, 2012. 'Economics of Fish Marketing in Central Uganda: A Preliminary Analysis'. *Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Birmingham, AL, February 4-7, 2012*.
- Dhatemwa, C. M. 2009. Regional fisheries / farmed products market study East Africa. Final Report. Contracted by Uganda Fish Processors Association.
- Dickson, M. and G. Macfadyen, 2011. Study on promoting commercial aquaculture in Uganda. Final Report to the EU Delegation in Uganda. EU and Poseidon Aquatic Resource Management Ltd.
- Gordon, D. V. and M. Ssebisubi, 2012. Vertical and horizontal integration in the Ugandan fish supply chain: Measuring for feedback effects to fishermen.
- GoU (Government of Uganda) 2008. Uganda National Aquaculture Development Strategy: A Guide to the Development of the Aquaculture Sub-sector in Uganda. GoU and FAO September 2008.
- GoU (Government of Uganda) 2010a. Uganda Nutrition Action Plan (2011 -2016): Scaling Up Multi - Sectoral Efforts to Establish a Strong Nutrition Foundation for Uganda's Development. GoU.
- GoU (Government of Uganda) 2010b. National Development Plan (2010/11 – 2014/15).
- Hino, J. 2011. 'Uncharted Waters: Kenya takes dramatic leap in aquaculture' *Global Aquaculture Advocate*, July/August 2011 issue: 19–21. Available at <http://pdf.gaalliance.org/pdf/GAA-Hino-July11.pdf> (accessed 26th September 2012).
- Hyuha, T.S., J.O. Bukenya, J. Twinamasiko and J. Molnar, 2011. 'Profitability analysis of small scale aquaculture enterprises in Central Uganda'. *International Journal of Fisheries and Aquaculture* Vol. 2(15), pp. 271-278, 23 December, 2011.
- ILRI (International Livestock Research Institute), 2011. CGIAR Research Program 3.7: More meat, milk and fish – by and for the poor (Proposal).
- IFPRI (International Food Policy Research Institute) 2007. Assessing the Impact of the National Agricultural Advisory Services (NAADS) in the Uganda Rural Livelihoods. IFPRI Discussion paper 00724, Washington DC USA.
- Isyagi Nelly, 2010. SARNISSA Uganda Policy Review Report, Eago Consultants, Uganda.

i-TEC, 2011. Uganda Livelihoods and Enterprises for Agricultural Development (LEAD): Mid-term Evaluation Final Report. USAID.

Ministry of Agriculture, Animal Industries and Fisheries (MAAIF) & Ministry of Health (MoH) 2003. *The Uganda Food and Nutrition Policy*. Entebbe: MAAIF.

MAAIF (Ministry of Agriculture, Animal Industry and Fisheries) 2004. *The National Fisheries Policy*. Department of Fisheries Resources, MAAIF/GoU, May 2004.

MAAIF (Ministry of Agriculture, Animal Industry and Fisheries) 2010. *Agriculture Sector Development Strategy and Investment Plan (DSIP): 2010/11 – 2014/15*.

MAAIF (Ministry of Agriculture, Animal Industry and Fisheries) 2012a. *Operationalization of the Non-ATAAS Component of the Development Strategy and Investment Plan (DRIP). Draft Final Situation Analysis Report: Fish Production (July 19, 2012)*

MAAIF (Ministry of Agriculture, Animal Industry and Fisheries) 2012b. *Operationalization of the Non-ATAAS Component of the Development Strategy and Investment Plan (DRIP). Framework Implementation Plan for Fish Production (September 24, 2012)*.

MAAIF (Ministry of Agriculture, Animal Industry and Fisheries) 2012c. *National Investment Policy for Aquaculture Parks in Uganda (August 2012)*.

Olwo, J. 2012. *Final Report for Fish Value Chain Intervention. Uganda LEAD Project*. USAID.

Phillips, M, Rogers, W, Downing, W, Beveridge, M C M, Padiyar, P A, Karim, M & Subasinghe, R. 2012. *Inclusive aquaculture – business at the bottom of the aquatic pyramid. FAO Fisheries and Aquaculture Newsletter* **48**, 44-46.

SmartFish, 2012. *Regional Market Assessment (“Supply and Demand”) June – August 2011. Report SF/2012/5. Implementation of a Regional Fisheries Strategy for the Indian Ocean, Eastern and Southern Africa (IRFS)*. European Union and Indian Ocean Commission.

Timmers, B. 2012. *Impacts of climate change and variability on fish value chains in Uganda. Project Report 2012-18*. Penang: WorldFish Center.

UNADS, 2008. *The Uganda National Aquaculture Development Strategy*, prepared by Peter Wathum and Justus Rutaisire, funded by FAO September 2008.

USAID - Livelihoods and Enterprises for Agricultural Development (LEAD), Uganda, 2009. *Fisheries Value Chain (VC) Assessment Report*.

USAID - Livelihoods and Enterprises for Agricultural Development (LEAD), Uganda, 2012. *Final Report for Fish Value Chain Intervention*.

Waithaka, J. 2012. *‘Kenya: Sh5.7 Billion Spent in Fish Farming Program’*. *The Star* newspaper, Nairobi, 22 September 2012. Available at <http://allAfrica.com/stories/201209230027.html> (accessed 25th September 2012).

WorldFish, 2012. *Impacts of Climate Change and Variability on Fish Value Chains in Uganda. Project Report 2012-18*.