



**AFRICAN UNION**  
**INTERAFRICAN BUREAU**  
**FOR ANIMAL RESOURCES**

## **TECHNICAL REPORT**

# **THINK TANK MEETING ON SUSTAINABLE AQUACULTURE DEVELOPMENT IN AFRICA**



**7-10 February 2016, Cairo, Egypt**



**EUROPEAN UNION**



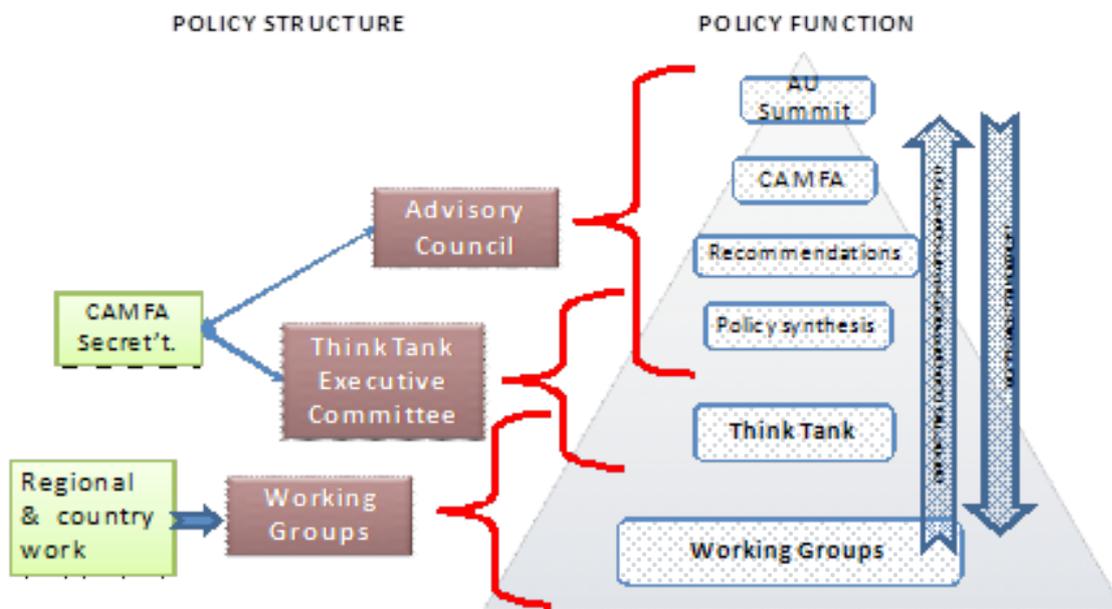
# FORWARD

The African Union InterAfrican Bureau for Animal Resources (AU-IBAR) is a specialized technical agency of African Union Commission. Its mandate To support and coordinate the sustainable development and utilization of animal resources (Livestock, Fisheries/aquaculture and wildlife) to enhance nutrition and food security and contribute to the wellbeing and prosperity of the people in the MS of the AU.

AU-IBARs core functions are to:

1. Facilitate and support the formulation, harmonization and implementation of coherent policies, strategies, guidelines, legislation and investment plans
2. Facilitate the formulation and adoption of common positions among MSs and RECs, RFMOs/ RFBs, for Africa’s leverage in negotiations and other global processes related to ARs;
3. Collect, collate, analyze, share and disseminate data, information and knowledge among relevant stakeholders;
4. Play an advocacy role on matters relevant to ARs, including for increased engagement of public and private sector as well civil society organizations;

## *African Fisheries Reform Mechanism*





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AAK	Aquaculture Association of Kenya
ACEA	Create African Centres of Excellence for Aquaculture
AFRM	African Fisheries Reform Mechanism
AfriFishNet	African Network of Fisheries Scientists
ANAF	Aquaculture Network of Africa () as well as Regional Organisation under the FARA systems (e.g. RUFORUM, ANAFE)
ANAFE	African Network for Agriculture, Agroforestry and Natural Resources Education
AU	African Union
AUC	African Union Commission
AU-IBAR	African Union Interafrican Bureau for Animal Resources
BMC	Broodstock Multiplication Centres
BMP	Management Practices
CAADP	Comprehensive Africa Agriculture Development Programme
CAFAN	Catfish Farmers Associations of Nigeria
CAMFA I	First Conference of African Ministers of Fisheries and Aquaculture
CAMFA II	Second Conference of African Ministers of Fisheries and Aquaculture
CCA	Climate Change & Agriculture
CEBEVIRHA	Commission Economique du Bétail, de la Viande et des Ressources Halieutiques
CLAR	Central Laboratory for Aquaculture Research
COMESA	Common Market for Eastern and Southern Africa
CSIR	Council for Scientific and Industrial Research
DRM	Disaster and Risk Management
EAA	Ecosystems approach to Aquaculture
ECASS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FDA	Food and Drug Administration
GIFT	Genetically Improved Nile Tilapia
GDP	Gross Domestic Product
HSG	African Heads of State and Government
IEIDEAS	Improving Employment and Income through Development of Egypt's Aquaculture Sector

IAVBC	International Aquatic Veterinary Biosecurity Consortium
IGAD	Intergovernmental Authority on Development
KSE	Knowledge, Skills & Experience (KSE)
KSA	Knowledge, Skills & Experience Assessment (KSA)
LTA	Lake Tanganyika Authority
LUANAR	Lilongwe University of Agriculture and Natural Resources
LVFO	Lake Victoria Fisheries Organisation
MS	Member States
NAPA	National Adaptation Programmes of Action
NSDS	National Strategy for the Development of Statistics
NEPAD	New Partnership for Africa's Development
NPCA	New Partnership for Africa's Development Planning and Coordinating Agency
NUACA	National Union of Aquaculture Associations
OFTPN	Organisation des Femme Transformatrice
OIE	World Organisation for Animal health
PFRS	Policy Framework and Reform Strategy for Fisheries and Aquaculture
PPP	Public-Private-Partnership
PRSPs	Poverty Reduction Strategy Papers
PVS	The OIE Tool for the Evaluation of Performance of Veterinary Services
RECs	Regional Economic Communities
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SARNISSA	Sustainable Aquaculture Research Networks in sub-Saharan Africa
SADC	Southern African Development Community
SEFFA	Sustainable Environmental and Fisheries Foundation
TIVO	Tilapia Volta Project
UMA	Maghreb Arabic Union
USDA	United States Department of Agriculture
WAFICOS	Walimi Fish Farmers Association
WRI	Water Research Institute
WRC	Water Resources Commission
WAVMA	World Aquatic Veterinary Medical Association
YFFP	Youth For Fish Programme
ZAMCOM	Zambezi Watercourse Commission

## 1.0. INTRODUCTION

The fisheries and aquaculture contribute 6% of the Africa's agriculture GDP (FAO, 2014<sup>1</sup>) African aquaculture is at various developmental stages and produces products of an estimated value of US\$3 billion per year. The potential for aquaculture growth in Africa has further been triggered by the shortfall in supply of fish and fishery products globally due to over-exploitation of the fisheries and increasing populations. Per capita fish consumption rates are consequently declining. In 2010 the estimated per capita fish consumption rate on the continent was 9.1 kg less than half of the global average (18.4 kg) (AUC/NEPAD, 2014)<sup>2</sup>. The projected decline in the supply of high value fish from harvest fisheries opens an opportunity to increase aquaculture production and a market share in the high value fishery sector.

Aquaculture is one of the fastest food producing sector worldwide. Global aquaculture production was recorded at 90.4 million tonnes (live weight equivalent) in 2012 (US\$144.4 billion). This included 66.6 and 23.8 million tonnes of food fish and aquatic algae respectively (SOFIA 2014). Globally, the annual aquaculture rate is growing at an average rate of 6.2% from 2000-2012; interestingly the growth rate is faster in Africa with 11.7% followed by Latin America and the Caribbean with 10% respectively. However, despite this growth rate in Africa, African aquaculture contributes only 2.23% to the global production with Egypt contributing 1.5% mainly from tilapia production followed by Nigeria which is the major producer of catfish on the continent.

The aquaculture sector contributes to employment, food and nutritional security, foreign exchange and economic growth. The sector is however faced with a number of challenges that are inhibiting the realization of its full potential. Some of these challenges are:

- Weak institutional and human resources capacity
- Application of low technology in production systems
- Weak capacity in institutional or regulatory frameworks for, example, disease control, movement of genetic materials, use of feed additives, etc.
- Limited resources (seeds, feeds, financial etc.) for aquaculture development.

In order to circumvent these continental developmental challenges, various high level continental platforms have prioritised the fisheries and aquaculture sectors. These include the Abuja Fish-for-All Summit, CAMFA I and II meetings. The African Union consequently developed a continental Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS), that was

<sup>1</sup> FAO, 2014. *The Value of African Fisheries*. FAO Fisheries Circular No. 1093. FAO. Rome, Italy.

<sup>2</sup> AUC/NEPAD, 2014. *Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa*. African Union Commission and NEPAD Planning and Coordinating Agency.

adopted by the African Heads of States and Governments during the 23rd AU Summit held in Malabo, Equatorial Guinea in June 2014. The overall purpose of the Policy Framework and Reform Strategy for Fisheries and Aquaculture is “to facilitate transformation of Africa’s fisheries and aquaculture for food, livelihoods and wealth”. One of the key policy objectives is “realizing the full potential of the aquaculture sector to generate wealth, social benefits and contribute to the development of the African economy”. The key policy arena on sustainable aquaculture development aims to “**jumpstart market-led sustainable aquaculture through a variety of strategies and support interventionist development approaches in aquaculture by strong strategic and implementation plans**”. It is envisaged that this shall be achieved through creating an enabling environment; creating African Centre of Excellence for Aquaculture and mainstreaming CAADP aquaculture strategies and plans into national development plans.

These development efforts need to be channelled appropriately to ensure potential of the sector is fully realised in compliance with the Malabo Declaration on Accelerated Agricultural (including Fisheries & Aquaculture) Growth and Transformation for Shared Prosperity and Improved Livelihoods (Doc.Assembly/AU/2(XXIII)) notably:

1. Commitment to Ending Hunger in Africa by 2025
2. Commitment to Halving Poverty by the year 2025, through Inclusive Agricultural Growth and Transformation
3. Commitment to Boosting Intra-African Trade in Agricultural commodities and services
4. Commitment to Enhancing Resilience of Livelihoods and Production Systems to Climate Variability and other related risks

It is against this background that the African Union Interafrican Bureau for Animal Resources (AU-IBAR), the NEPAD Planning and Coordinating Agency (NPCA), WorldFish and the Government of the Arab Republic of Egypt, with support from the European Union organised a consultative Think Tank meeting on sustainable aquaculture development in Africa which was held from the 7-10 February, 2016 in Cairo, Egypt.

The overall objective of the meeting was the formulation of a Pan African Plan of Action for sustainable aquaculture development to ensure the increased contribution of aquaculture to food and nutritional security, poverty alleviation and economic growth consistent with the Malabo Declaration that called for action on transformation of agriculture by 2025. Specifically, the objectives were to (i) Stock take aquaculture development strides in AU member states (ii) Reflect on the challenges and opportunities presented by the aquaculture sector (iii) Share lessons, best practices and innovations relating to ecologically sustainable commercial aquaculture (iv) Identify

priority actions to enhance aquaculture's contribution to the African Accelerated agricultural transformation goals and (v) Formulate action plans and charter the way forward for the sector's development road-map to meet CAADP's goal of 6% sectoral growth adopted by the Malabo declaration (2025).

The meeting was attended by over 100 participants including 42 African Union member states, 7 Regional Economic Communities, representatives of Regional fisheries bodies, Water Basin Commissions, non-State actors, women's' groups, youth and development partners, experts and African Union staff.

## **2.0. OPENING SESSION**

The meeting was facilitated by Dr. Simplicie Nouala, Chief Animal Production Officer, AU-IBAR. The agenda of the meeting was unanimously adopted.

The opening ceremony comprised four statements from the representatives of WorldFish, European Union, AU-IBAR and the Arab Republic of Egypt respectively as following:

Dr. Michael Philips, The Discipline Director, Aquaculture and Genetic Improvement, WorldFish, Malaysia, on behalf of the Director General of WorldFish, Dr. Nigel Preston, expressed appreciation to the Government and People of the Arab Republic of Egypt and the AU-IBAR for providing WorldFish the opportunity to collaborate in the organization of the think tank. He outlined the interventions of WorldFish in fisheries and aquaculture development in AU member states and underscored the importance of this meeting as a forum for sharing experiences. He noted the critical importance of research and training in aquaculture development and CGIAR, WorldFish commitment to reducing hunger and poverty through improving fisheries and aquaculture. He noted that the deliberations in the meeting would significantly help orienting the program of WorldFish towards the priorities of the African region, including strengthening capacity for fish disease detection and prevention, sustainable feeds and environmental management. Dr. Philips assured the partners, particularly AU-IBAR and NEPAD of the willingness and commitment of his organization to work jointly to support the priority actions that would emerge from the Think tank meeting.

The Representative of EU Delegation in Egypt, Mr. Diego Escalona Paturel, Head of Cooperation, thanked AU-IBAR, NEPAD and WorldFish for the organizing the meeting and the Arab Republic of Egypt for hosting the continental event. He acknowledged that Africa's growth is at a turning

point. He reiterated the support of the European Union towards Food and nutrition security as this was of high priority in Africa. He reminded the audience that the fisheries sector was increasingly becoming important as a livelihood source and food security instrument, citing that over 10 million households in Africa depended on fisheries as their livelihood source. He outlined the vision of the EU for Sustainable aquaculture development noting that it should encompass all the components of sustainability to become economically, socially and environmentally sound by properly addressing the challenges and externalities linked to the sector. He informed the participants of EU's support to AU-IBAR that included the funding for the Fisheries Governance and the Fish Trade projects. He underscored EU's historical support to AU-IBAR since the 1960's that had contributed to the Livestock and Fisheries sectors. He expressed the hope that all the organizations represented in the Think tank meeting would join forces in ensuring that the fishery resources in Africa are sustainably utilised for the benefit of the continent.

The Director of AU-IBAR, Professor Ahmed Sawalhy, on behalf of the Chairperson of the Africa Union Commission, Dr. Nkosazana Clarice Dlamini Zuma and the Commissioner of Rural Economy and Agriculture of the African Union Commission, Mrs. Tumusiime Rhoda Peace, expressed gratitude to the Government and people of the Arab Republic of Egypt for the cooperation with African Union by accepting to host this important event. He gave a brief historical review of the evolution of AU-IBAR, the expanded mandate as outlined in AU-IBAR's 2014-2017 Strategic Plan, in the area of animal resources development that is comprehensive covering livestock fisheries, aquaculture and wildlife. He informed the participants of the objectives of the meeting and the linkage with the Policy Framework and Reform Strategy for fisheries and aquaculture in Africa and the call for action for achieving the goals of the Malabo Declaration by the Heads of States and Governments in Africa. He expressed gratitude for the support of the EU to AU-IBAR in the animal resources sector, including fisheries and aquaculture, and the excellent display of institutional collaboration by WorldFish in the organization of this meeting.

The Director of Fisheries and the Chairman of the General Authority for Fisheries Resources Development (GAFRD), Dr. Mohamed Abdibaki, welcomed the participants, on behalf of the Hon. Minister responsible for fisheries and aquaculture, to the capital of the Arab Republic of Egypt, Cairo. He reminded the participants of the importance of aquaculture in food security and livelihoods and potential contribution to social stability. He informed the participants that Egypt was the cradle of aquaculture development on the continent and of the significant progress in Egyptian aquaculture that contributed to 70% to the Continent's total aquaculture production. Therefore, he noted that there was a great opportunity to learn lessons from Egypt's experiences as well as other African countries. He reiterated the support of the Arab Republic of Egypt in the

implementation of the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa. The Chairman extended appreciation to the partners, especially the EU, and the WorldFish for identifying themselves with the aspirations of the continent. He officially declared the meeting open.

## **3.0. TECHNICAL SESSIONS**

### **3.1. Setting the Scene**

The African Union informed the technical session by setting the scene through several presentations listed below.

#### **3.1.1. Background and objectives of the meeting – M. Seisay, AU-IBAR**

Africa is endowed with vast marine and freshwater resources are significant sources of animal protein, employment, especially for rural communities, and income. The fisheries and aquaculture sectors overall produce a total of 10.4 million mt of fish. 15% of this is attributed to aquaculture. Average per capita fish per year (kg/yr) is about 9.6 kg. The fisheries and aquaculture sectors contribute 1.26% of continental GDP and 6% of agricultural GDP. The continent imports an estimated USD 4,796,867,000 worth of fish and exports fish worth USD 11,036,031,000<sup>3</sup>.

Given the Continent's natural resource potential for fish production through aquaculture, aquaculture production remains low compared to that of other regions in the world albeit the increasing continental demand for fish in lieu of stagnating fishery yields, population growth and expanding markets. National economies across Africa are increasingly becoming market-based aiming at improving general socio-economic indicators in addition to food and nutrition security. Continental developmental approaches therefore now consider the development of commodity value-chains as among the tool for sustainable development. Commercial aquaculture has a clear role in value-chains for fish/seafood with potential attributes of freshness, consistency and value.

While notable progress and success has been registered in Africa's aquaculture development over the past two decades, this success has been limited only to a few Member States notably, Egypt and Nigeria. The expansion of aquaculture in Africa is faced with several challenges notably; weak institutional and human resource capacity, environmental biosecurity, low private-sector participation, trade and market challenges, inappropriate technology and limited resources. To overcome these continental developmental challenges, the fisheries and aquaculture sectors have prioritized in various high level continental platforms. Notable among these are the CAMFA I, CAMFA II and the Malabo Declaration.

<sup>3</sup> FAO, 2014. *The Value of African Fisheries*. FAO Fisheries and Aquaculture Circular No. 1093. Online: <http://www.fao.org/3/a-i3917e.pdf>

CAMFA II requested the AU, RECs and Member States to scale-up small-scale aquaculture as a means of increasing rural productivity and food security, strengthen the capacity of fish stakeholders along the value chain and urged Member States to prioritize aquaculture development for food security. The Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods by the African Heads of State and Government (HSG) in 2014 committed to:

1. Ending Hunger in Africa by 2025 by accelerating agricultural growth by at least doubling current agricultural productivity levels, by the year 2025 through creating and enhancing the necessary appropriate policy and institutional conditions and support systems.
2. Halving the current levels of post-harvest loss by the year 2025
3. Integrating measures for increased agricultural productivity with social protection initiatives focusing on vulnerable social groups through committing targeted budget lines within national budgets
4. Halving Poverty by the year 2025 through Inclusive Agricultural Growth and Transformation to ensure that the agricultural growth and transformation process is inclusive and contributes at least 50% to the overall poverty reduction target; and to this end we will therefore create and enhance the necessary appropriate policy, institutional and budgetary support and conditions
5. Boosting Intra-African Trade in Agricultural commodities and services to harness markets and trade opportunities, locally, regionally and internationally.
6. Enhancing the resilience of livelihoods and production systems to climate variability and other related risks to reduce the vulnerabilities of the livelihoods of the African population through building the resilience of production systems

The AU subsequently developed a continental 'Policy Framework and Reform Strategy for Fisheries and Aquaculture' (PFRS)<sup>4</sup> that was adopted at Malabo in Equatorial Guinea by the African Heads of State and Government in 2014. Sustainable aquaculture development is among the seven key policy arenas of the PFRS. The objective of this policy arena is to jumpstart market-led sustainable aquaculture through a variety of strategies and where appropriate, support interventionist development approaches in aquaculture by strong strategic and implementation plans.

The African Fisheries Reform Mechanism (AFRM) that comprises Think Tanks as a mechanism through which recommendations for policy and appropriate actions necessary to institute the changes required to achieve the PFRS goals is among the strategies for implementing the PFRS.

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<sup>4</sup> Online: [https://www.au.int/web/sites/default/files/documents/30266-doc-au-ibar\\_-\\_fisheries\\_policy\\_framework\\_and\\_reform\\_strategy.pdf](https://www.au.int/web/sites/default/files/documents/30266-doc-au-ibar_-_fisheries_policy_framework_and_reform_strategy.pdf)

## **Objectives of the meeting**

This 'Think Tank Meeting on Sustainable Aquaculture Development in Africa' was thus organised with the objectives of:

1. Reflecting on the challenges and opportunities presented by the aquaculture sector in line with the PFRS outcomes.
2. Sharing lessons, best practices and innovations relating to ecologically sustainable commercial aquaculture.
3. Identifying priority actions to enhance aquaculture contribution to the African Accelerated Agricultural Transformation Goals.
4. Formulating action plans and way forward for the sector's development to meet CAADP's goal of 6% and the PFRS sectoral growth within countries per annum.

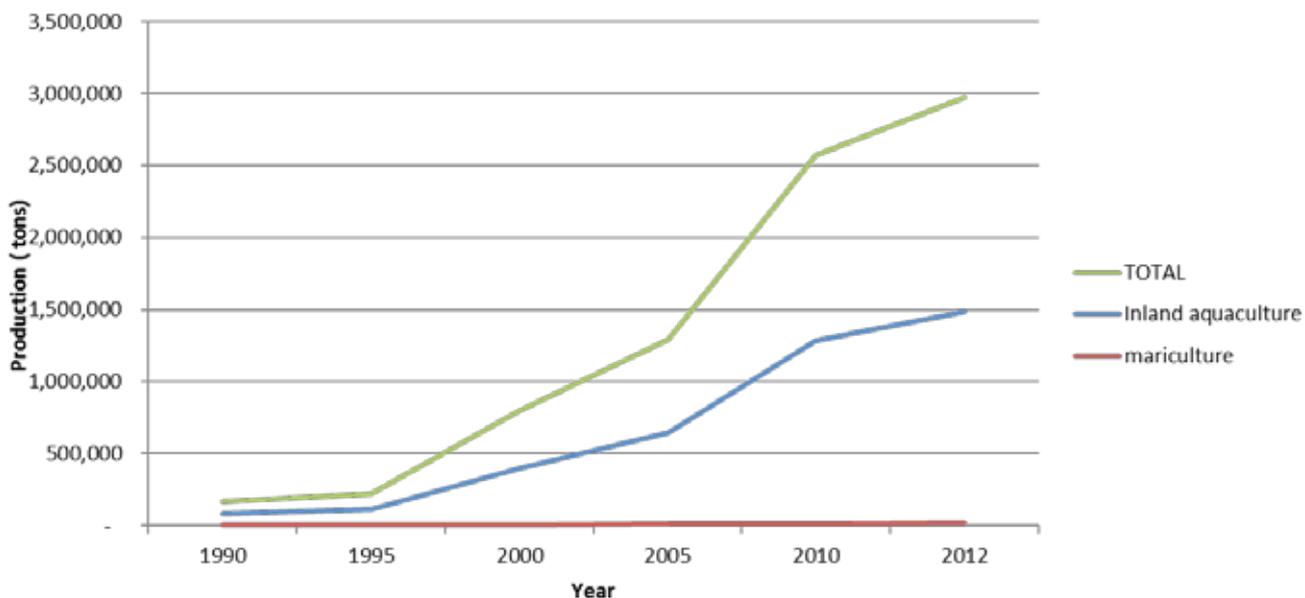
It is the hope that the outputs of this meeting shall result into the transformation of Africa's aquaculture into a sub-sector that generates significant food, nutrition and socio-economic benefits for the continents population.

### ***3.1.2. Keynote presentation on sustainable aquaculture development in Africa context- Setting the scene – N. Isyagi, AU-IBAR.***

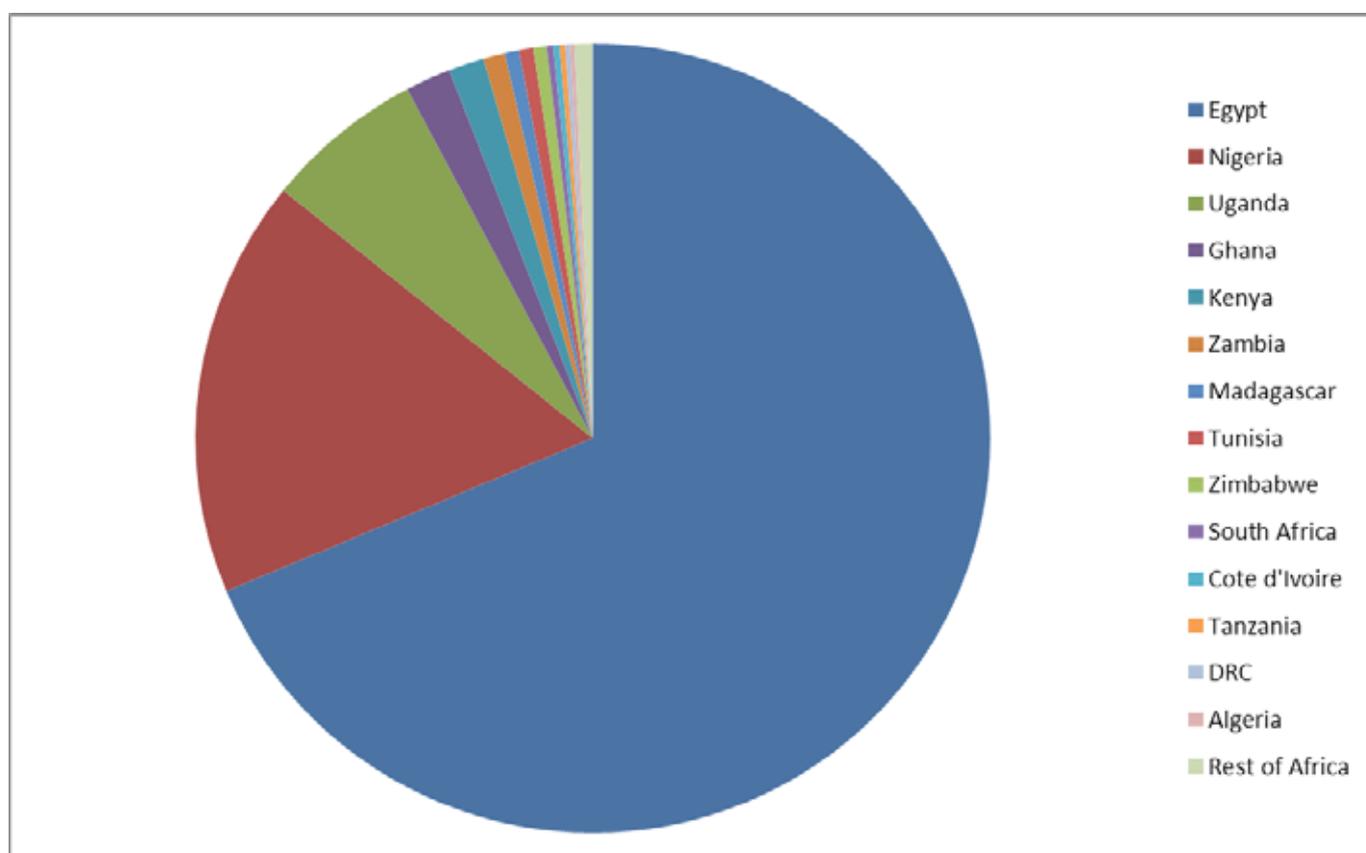
This presentation gave a general overview of the status and prospects for aquaculture development on the African continent.

While aquaculture is regarded as a 'novel' agricultural practice on much of the continent, there are records of the farming of aquaculture in Egypt dating 5,000 years ago. In addition, in West Africa, traditional Acadja system of penning fish has also been practiced. Between the 1950's and early 1960's smallholder subsistence extensive production in fish ponds was promoted and still is the practice for most rural farmers. However, last 20 years have seen aquaculture on the continent progressively change into a more commercial activity with an increasingly wider array of farming practices.

This has resulted into an almost 1,500% increase in total continental production over the last 20 years from 77,000 mt in 1990 to about 1.4 million tons in 2012. However, according to FAO (2014) this significant growth globally translates into 2% of global aquaculture production. More than 50% of Africa's aquaculture growth over the last 10 years however occurred in Egypt and Nigeria. FAO (2014) statistics showed Egypt and Nigeria respectively produced 68% and 17% of the continents total aquaculture production. The species that comprised most of this production were the warm freshwater species *Oreochromis niloticus* (tilapia) and *Clarias gariepinus* (African Catfish) (Figures 1 and 2).



**Figure 1.** Aquaculture Production Trends in Africa (adapted FAO, 2014)



**Figure 2.** Major aquaculture producers in Africa (adapted FAO, 2014)

Africa's natural resource potential (notably in terms of natural resources, human resources, potential species for aquaculture, potential to produce aquaculture inputs and market for aquaculture products) is huge. This potential is remains largely untapped. The following are among the major obstacles affecting aquaculture development on the continent:

- I. Constraints hindering optimal sustainable utilisation and management of available natural resources for aquaculture

2. Constraints in the availability and access to key inputs (e.g. feed, seed, human resources, appropriate technology, finance, etc.)
3. Constraints to accessing markets (e.g. lack of standards and certification for aquaculture produce)
4. Inadequate Infrastructure, both in terms of physical and soft-systems (e.g. policies, sectoral management – both public and private sector, etc.).

This state of affairs, which has greatly affected the ability of the aquaculture sub-sector to effectively contribute towards the realisation of the Comprehensive Africa Agriculture Development Programme (CAADP) goals, has drawn great concern of Africa’s Heads of State. The continents resources if optimally utilised and sustainably managed can result into the transformation of aquaculture whereby aquaculture expands and becomes a highly productive and profitable environmentally sound enterprise supported by the conglomerate value-chain segments that offer additional employment and enhance the market for aquaculture produce and products. It is envisaged that aquaculture has the potential to progressively supersede capture fishery production as the most sustainable option for increasing fish production to meet the fish demand of Africa’s rapidly growing population and markets. On the continent, this has been demonstrated by Egypt. Consequently as a result of the CAMFA deliberations and the Malabo Declaration, jumpstarting sustainable commercial aquaculture on the continent is among the key policy objectives of the PFRS. The PFRS approach and expected outcomes for sustainable aquaculture development on the continent are illustrated in figure 3 below.

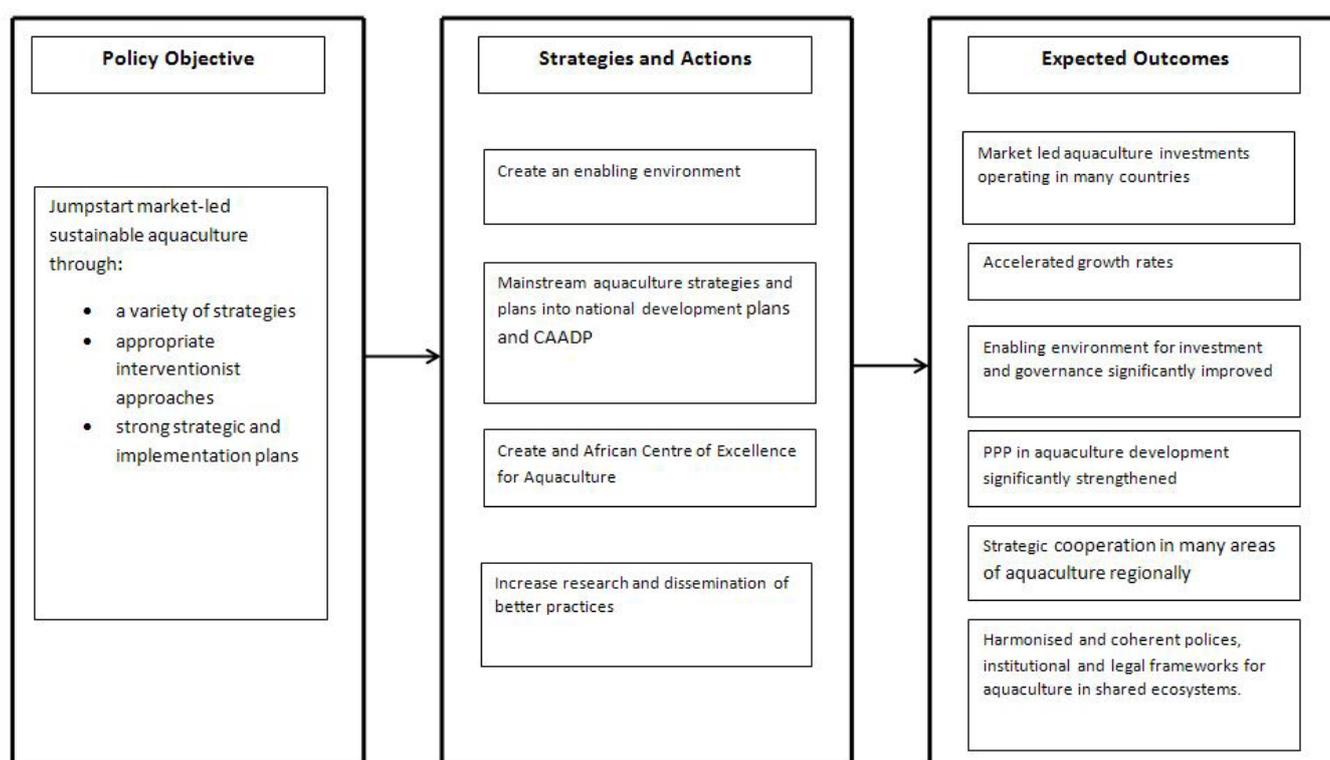


Figure 3. The PFRS sustainable aquaculture development policy objectives, strategies and outcomes

The overall purpose of this think tank therefore is to identify and prioritize key actions for implementation that would be necessary for the achievement of PFRS aquaculture goals in measurable terms as described in 'A Guide For The Implementation Of The Policy Framework And Reform Strategy For Fisheries And Aquaculture in Africa'<sup>5</sup> within the timeline of the CAADP.

### **3.1.3. Study On The Potential of Aquaculture In Africa - Emmanuel Kaunda, Bunda College, Malawi and S. Chimatiro, Fish Trade Project Manager, WorldFish, Zambia**

The above study was commissioned as part of the support of the Africa-Caribbean and Pacific (ACP) regional efforts to accelerate aquaculture development. The objective of the study, conducted jointly by CTA/NPCA, was to identify opportunities for aquaculture development for the ACP regions (of which Africa is among) and the drivers for success; as well as highlight needed interventions to accelerate the growth of the sector.

Aquaculture in Africa is rapidly expanding. Though it accounts for only 2.2 % of global aquaculture production from 2006-2010 grew at the rate of 18.6% per annum compared to 12.6 % per annum trend from 1970 – 2008. Currently Africa produces an estimated 1.4 million tons through aquaculture. Thus for Africa, aquaculture is developing into an industry with high potential to contribute towards regional and national food supply, trade and nutritional security. This growth has been influenced by i) the increasing demand for fish from the rising African middle-class and urban population and dwindling natural sources of fish; (ii) low supply of fish has improved environment for aquaculture enterprise making it more profitable; (iii) advances in technology and knowledge (particularly of tilapia and the African catfish) that have lowered risks of production.

### **The Significance of Aquaculture in Africa**

African aquaculture contribute to:

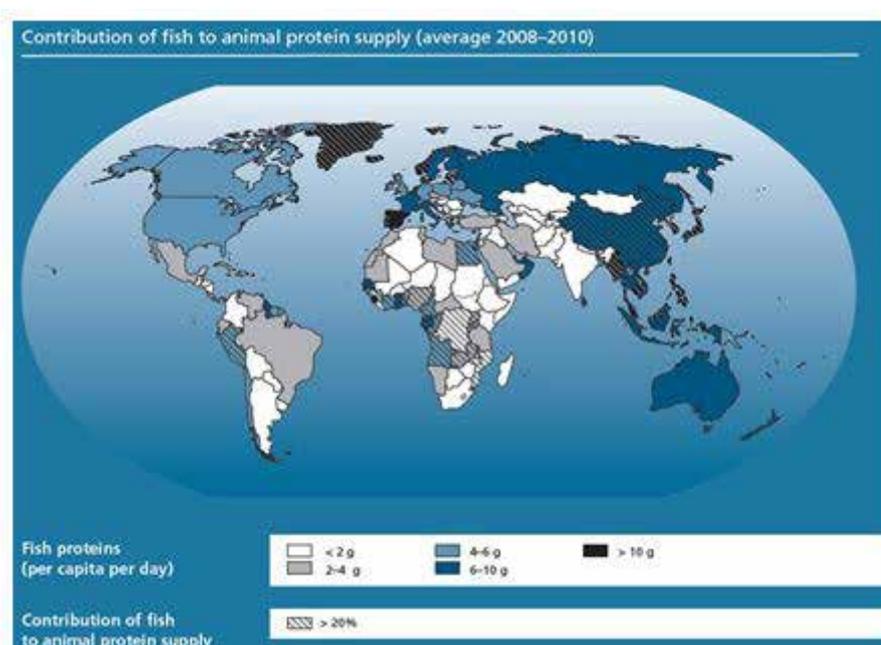
1. Food and nutrition security. Literally all of Africa's farmed fish is consumed locally. It is estimated that 200 million Africa depend on fish as source of food.
2. Fish a Major Source of Protein. While Africa's average fish per capita consumption are lower than the global average, fish protein still constitutes up to more than 30% of total animal protein supply in several countries (see table 1 and figure 3 below). In some of the countries stunting is more than 40 per cent. There is evident need to increase supply in order to meet nutritional needs for animal protein and other essential nutrients found in fish.
3. Contribution of Sustainable Fish Farming to Socio-Economic Development. The fisheries sector as a whole employs 12.3 million people as full-time fishers or full-time and part-time processors, representing 2.1 % of Africa's population of between 15 and 64 years old. Of these 42.4% are processors and 7.5% work in aquaculture. About 27.3 percent of the people engaged in

<sup>5</sup> Source online: [www.au-ibar.org/component/jdownloads/finish/5/2358](http://www.au-ibar.org/component/jdownloads/finish/5/2358)

fisheries and aquaculture are women, with marked differences in their share among fishers (3.6 percent), processors (58 percent), and aquaculture workers (4 percent). Work undertaken by the Development Initiative on Poverty Reduction (IDIPR) in Nigeria from 2001 illustrated how within rural communities aquaculture contributes to food security and improves livelihoods.

**Table 1:** African Countries Where Per Capita Fish Consumption Is Below the Global Average, but Fish Protein Makes Up More Than 30 percent of Total Animal Protein Supply

Country	Annual average per capita consumption	Fish as % of animal protein
Malawi	4.6	35.9
Democratic Republic of Congo	5.3	42.1
Togo	8.1	42.9
Nigeria	9	34.7
Benin	10.3	31.8
Guinea	11.1	38.6
Uganda	11.5	34.3
Cameroon	14.7	36.1
Cote d'Ivoire	15	35.4



**Figure 3.** Contribution to animal protein supply (2008-2010). Source: *State of World Fisheries and Aquaculture, 2014*; FAO

### The need for Accelerated Growth of Aquaculture in Africa

The need for accelerated growth in aquaculture arises from Africa’s rapid growing population and future demand for food and incomes. Based on population growth alone, it is projected that regional fish consumption could easily exceed 10 million metric tons by 2030, and if the region’s fish consumption were to rise to current global average consumption levels, the regional demand could reach at least 20 million metric tons. Therefore there is a need for comprehensive and evidence-based policy guidance on aquaculture development on the continent to meet this gap. This will entail:

- I. 1.0 A change in development outlook towards doubling of fish farming production based upon an enterprise-led strategy for sectoral growth.

2. Diversified development trajectory centred upon the CAADP framework whereby fish has been identified as one of the key drivers of the 6% agricultural growth target.
3. Alignment of development frameworks to ensure incremental change in production and productivity.
4. Impact monitoring. The quantification of the impact of aquaculture at farm, community and countries levels will enable NEPAD, AU and Member States determine the conditions needed for aquaculture to support drive rural economies and transformation.

## **Proposed Areas of Intervention in the next 5 Years: Key Drivers and Lessons for Scaling Up**

### **1. Use science to accelerate aquaculture growth and transformation**

The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa emphasizes the urgent need to strengthen the knowledge base of the sector and increase the capacity of key stakeholders to develop and implement a strategic perspective on its future. In this vein, the African Network of Fisheries Scientists (AfriFishNet) was launched the aim of enhancing the role of scientists in increasing the profile of fish issues in the country CAADP process (CAADP Expert Pool on Fisheries). Technical capacity needs to be built and strengthened both in terms of human resources particularly for the middle levels and institutional capacity. The capacity to adopt international best practices such as the Ecosystems approach to Aquaculture (EAA) need to be strengthened. Advantage could be taken of existing research and policy networks as AfriFishNet and Aquaculture Network for Africa (ANAF), the regional Forum for Agricultural Research in Africa (FARA) systems (e.g. RUFORUM, ANAFE)

### **2. Harnessing markets and trade opportunities**

Africa has become a net importer of fish and fishery product; with imports outstripping exports in terms of volume. To reverse this, the capacity to reduce fish wastage, diversify products and incomes through fish need be strengthened. The harmonization of regional fish trade policies & legal frameworks (such as through reducing tariffs or non-tariff barriers) would greatly enhance intra-regional fish trade and help strengthen trade capacities at country level. To facilitate regional trade, the implementation of eco-labelling mechanisms consistent with policies on aquaculture environment and biosafety requirements becomes a necessity. Likewise, so is the need to improve and strengthen capacity for a harmonised continental fish trade data management and information system for Africa.

### **3. Harnessing investment financing for Small and Medium Enterprises in aquaculture**

Small and medium enterprises struggle to obtain finance for their fisheries and aquaculture

businesses because banks are less inclined to fund business with small capital requirements. A concept for has been developed as an innovative source of funding for the SMEs. Innovative strategies to improve financial service delivery to aquaculture value chain SMEs need be investigated and developed (for example through setting up Impact Investment Fund for SMEs and Private-Public-Partnership (PPP) in African Fisheries & Aquaculture). This requires a deeper understanding of the aquaculture value chain and its auxiliary industries and services bearing in mind the needs of disadvantaged groups, youth and women. Specific actions, to improve access to financial services for aquaculture need consequently be included in the CAADP Country Compact Investment Plans. The strengthening of the operationalization of AFRM as an AU coordinating platform for coherence in aquaculture development interventions and investments by development partners provides an opportunity for addressing this challenge.

#### **4. Increase awareness of contribution of Fish and aquaculture to Food Security and nutrition**

A recent review of 84 East African country policy papers showed that 40% mentioned fish and very few food-security policy papers took fish products into account. Bearing in mind the concerning levels of animal protein and micronutrient deficiencies of Africa's under-five's, much more needs to be done to develop acceptable local fishery products for use complementary foods for young children. Aquaculture can play a significant role in providing the fish supply to address this gap while at the same time improving rural livelihoods. The benefits therefore of including aquaculture in national and regional policies and actions on food security as well as strengthening regulatory frameworks to protect operations of small-scale aquaculture cannot be understated. In supporting the development and implementation of sector-wide strategies that are EAA compliant at national level for the expansion and intensification of aquaculture that harness the opportunities for small and medium enterprise, expand domestic markets for fish that also cater for growing urban demand, training and infrastructural development for fish farmers and other entities along value-chain such as processing, trade and marketing, sustainable fish supply from aquaculture can be achieved.

#### **5. Resilience and risk management, including Climate Change**

The impact of climate change on aquaculture might be manifested through weakening supply and delivery of such inputs as feed and seeds and falls in pond productivity. The needs of aquaculture should be factored into existing Climate Change & Agriculture (CCA) and Disaster and Risk Management (DRM) policy and strategy processes notwithstanding the CAADP compacts, CAADP National Adaptation Programmes of Action (NAPA), in national communications strategies and Poverty Reduction Strategy Papers (PRSPs). Research in this area needs to

be strengthened with partnerships being built between the different relevant institutions to facilitate the development and adoption of appropriate resilient technologies that fulfill the requirements of EAA and other international environmental and climate-change best practices and standards. The establishment of early warning systems at local, national and cross-national levels thus, additionally becomes inevitable for sustainable aquaculture development (see figure 4).



**Figure 4.** *Climate Change effects in Dowa, Malawi.*

## **6. Data collection, analysis and dissemination**

African fisheries and aquaculture data-collection systems are not performing satisfactorily and do not deliver all the information required for assessing the appropriateness of fisheries and aquaculture policy and management decisions, for tracking the status of exploitation of fishery resources and the overall performance of existing fishery management measures. Data collection, management and analysis needs to be strengthened to factoring in the biological, economic, and social and governance dimensions of aquaculture. The capacity of personnel at all levels in this needs to be built. Aquaculture statistics need to be incorporated into the National Statistical Systems and the National Strategy for the Development of Statistics (NSDS). Mechanisms should be established or strengthened to ensure that aquaculture data contributes to the monitoring of the CAADP and the Global Strategy to Improve Agricultural and Rural Statistics.

## **7. Gender and youth**

Recent African fisheries data indicate that a total employment of the 19.2 million people employed in the sector, 34% who are women. Ninety-six percent of the female employment is in post-harvest activities, 3.1 % are fishers and 0.7 % are involved in aquaculture. Approximately 60 percent of the African population is younger than 35 which make it the 'youngest' continent. 200 million people in Africa are aged between 15 and 24 (see figures 5 and 6).

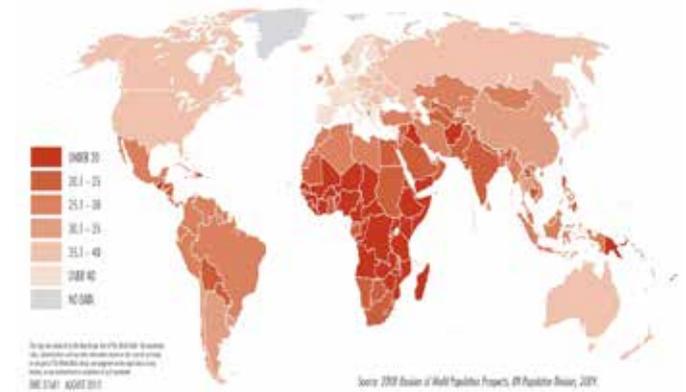
Regional distribution of global population by region, 2010 and 2050



Source: United Nations, Department of Economic and Social Affairs, World Population Prospects: 2012 Revision, June 2013, <http://esa.un.org/unpd/wpp/index.htm>

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**Figure 5.** Regional Distribution of Global Population growth projections.



Source: 2007 Revision of World Population Prospects, UN Population Division, 2007

**Figure 6.** Global Population Demographics by Age

Given Africa’s demographics, it is imperative that gender and youth considerations are included in all aquaculture policy, laws and that sectoral data is disaggregated by gender, age and occupational categories to facilitate evidence-based policy and development strategies that enable the effective engagement and participation of women and youth, including in decision-making processes. The use of value-chain approaches to define support for improving women and youth labour productivity right through the aquaculture from production to marketing, ensuring decent youth employment that includes access to financial services and youth friendly health services need be adopted for the sustainability of the industry. Facilitating the development of Women and Youth Forums on aquaculture at national and regional levels such as the Youth for Fish Programme (YFFP) in Malawi and other such fora elsewhere in Africa will greatly strengthen the voice of women and youth in aquaculture development.

## 8. Support Implementation of Continental Policy and institutions

The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS) has within it the AU-based African Fisheries Reform Mechanism (AFRM), an institutional mechanisms to support its implementation right from the grass-roots level. The onus now is to build capacity and develop institutions within both the public and private sectors in compliance with this to facilitate the successful transformation of the aquaculture sector towards the CAADP.

### 3.2. Public sector experiences: Aquaculture development status

In this session, experiences in aquaculture development were shared by Malawi, Kenya, Zambia, Tunisia, Mali, and the regional Lake Tanganyika Authority.

#### 3.2.1. Status of Aquaculture in Malawi - Hastings Zidana, Fisheries Department, National Aquaculture Centre, Malawi.

Aquaculture in Malawi is characterized by rural smallholder production in ponds. The major species farmed are the tilapias (*Oreochromis shinarus* and *Tilapia rendalli*), African catfish (*Clarias*

gariepinu), carp (*Cyprinus carpio*) and rainbow trout (*Oncorhynchus mykiss*). The latter is raised as a high value species.

## **Malwi's Aquaculture Policy and Institutional Environment**

The policy and institutional environment that guides aquaculture development in Malawi encompasses:

- 1. *The Fisheries Conservation and Management Act of 1997*** that contains the articles governing the management and utilization of the country's fisheries resources.
- 2. *The Fisheries and Aquaculture Policy (2001)*** that aims at (i) increasing and sustaining fish production from smallholder & commercial fish farming institutions, (ii) managing the fisheries resources for sustainable utilization, protection and conservation of aquatic biodiversity, (iii) monitoring the introduction of live exotic fish species unless and until scientific evidence justifies otherwise. Revisions have been made to this policy are currently awaiting review and enactment by parliament.
- 3. *The National Aquaculture Strategic Plan (2006-2015)*** whose priority areas are to (i) enhance the identification of viable indigenous species and (ii) Promote commercial fish farming and involve private sector
- 4. *The Presidential Initiative on Aquaculture Development (2012-2018)*** whose objectives are to (i) Increase and sustain aquaculture production, (ii) Increased fish availability from about 3,000 tons in 2012 to 6,000 tons by 2018 and (iii) Increase number of commercial private operators.

The cumulative efforts to advance aquaculture for livelihoods and nutrition in Malawi have resulted into an increase in total aquaculture production between 2000 and 2014 of about 800% from about 500 to 4,700 tons respectively. The total estimated value of aquaculture production in 2014 was USD 5,184,543 compared to USD 595,500 in 2000, an increase of 700%. The tilapia *O. shiranus*, is the major species farmed. During this time *O. shiranus* increased by 500%. However, over this same period the value per ton declined by 2.7% contrary to the positive total production and revenue trends (figures 7, 8 and 9).

## **Challenges**

The following are the major challenges that affecting aquaculture productivity and profitability, hence the overall performance and sustainability of aquaculture enterprises.

- i. Access to quality fingerlings and feed
- ii. Climate change-water shortage due to inadequate rainfall (figure 10)
- iii. Technology transfer from research to farmers

#### iv. Weak human and institutional capacity

### Success Factors

The demonstration of viable business models to farmers, willingness and commitment of farmers and efficient good-value markets and linkages between community, research and business are approaches that are providing positive results with respect to overcoming the above challenges. As a result, production levels and earning among rural poor smallholder fish farmers is beginning to steadily improve.

### Best Practices and Lessons Learnt

The best practices and lessons that have been learnt in the development of aquaculture in Malawi's are:

- i. Increase number of fingerlings stocked per area (3 to 6 fish/m<sup>2</sup>)
- ii. Increase in pond depth to 1 to 2 meters
- iii. Feed fish with formulated diets
- iv. The importance of predation control by fencing of ponds
- v. The importance of quality feed, fingerlings and management
- vi. The involvement of the commercial private-sector in aquaculture increases national production
- vii. The use community action research programs (CARP) improves adoption.

The overall impact of these approaches has resulted into an increase of average pond yields from 1.2 to 6 ton/ha/yr.

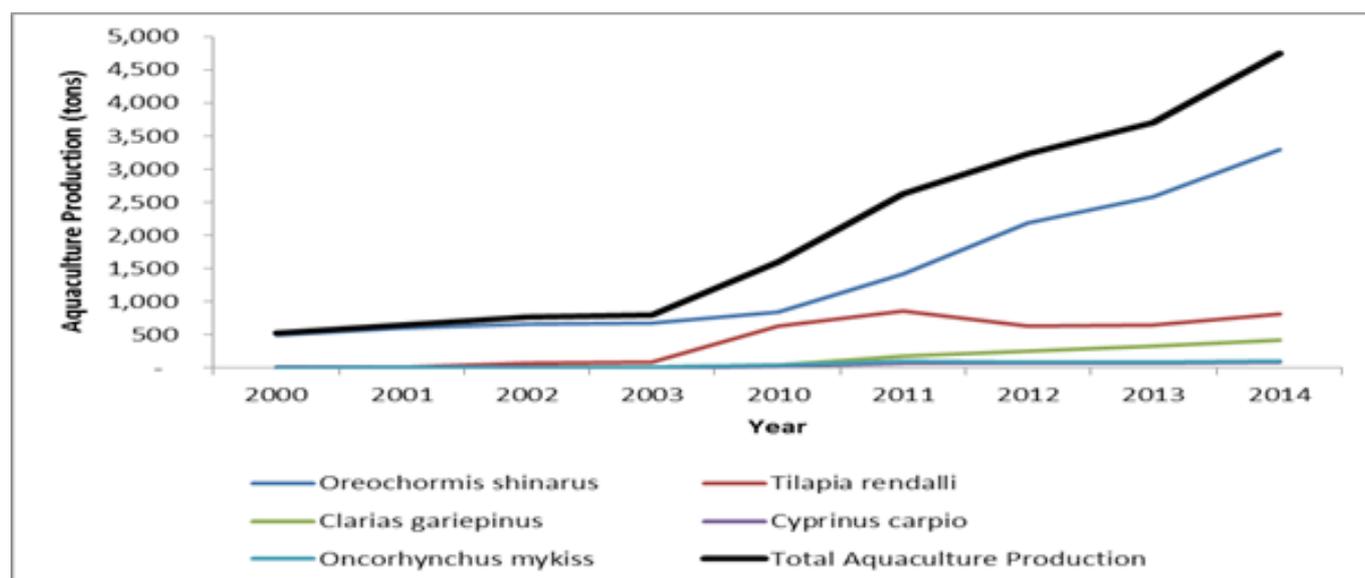


Figure 7. Trends in Aquaculture Production Trends in Malawi

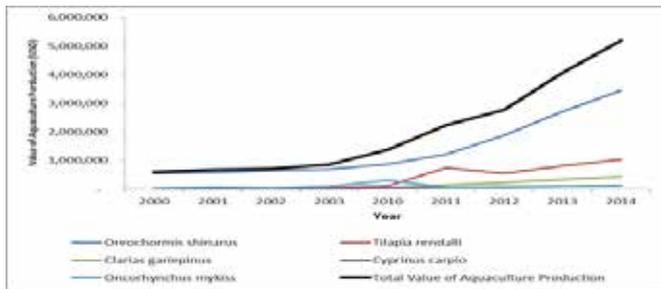


Figure 8. Trends in the value of aquaculture in Malawi

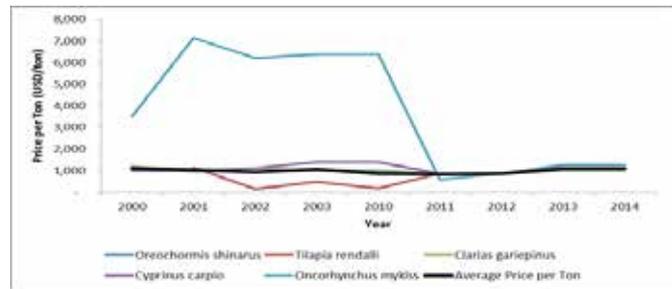


Figure 9. Trends in price per ton of farmed fish in Malawi

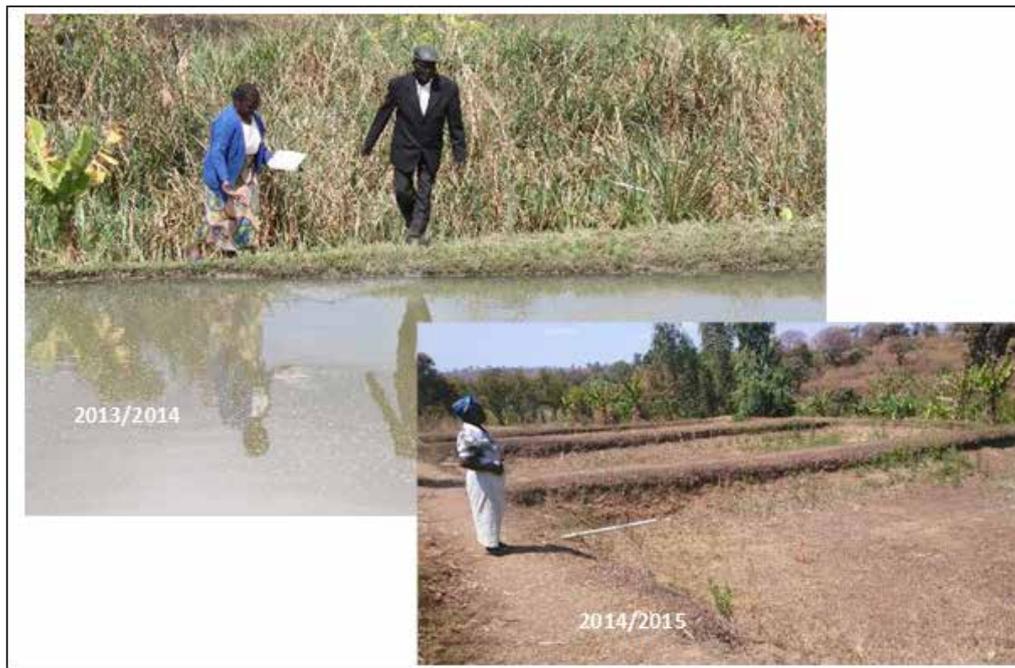


Figure 10. Climate change effects in Dowa, Malawi

### 3.2.2. Status of Aquaculture in Kenya – by Beatrice Nyandat, State Department of Fisheries, Kenya.

#### Policy and Institutional Environment

Kenya is administered under a decentralised system of governance comprising the national and county levels. All sectors are likewise administered. At the National level, the Ministry of Agriculture Livestock and Fisheries comprising the respective state departments guides agricultural development. The State Department of Fisheries has three directorates, namely Directorate of Policy, Directorate of Aquaculture Development and Directorate of Fisheries Resource Management and Marketing. The main responsibility of the Directorate of Aquaculture Technology Development is to administer and promote aquaculture through the development of policies, standards, guidelines for aquaculture development, and regulations in collaboration with Directorate of Policy.

The County Governments mirror the national set and also have departments of Fisheries. The role of the department of fisheries at this level is to implement the relevant policies and provide the necessary extension services.

The following policies guide aquaculture development in the country:

1. **Fisheries Act revised 2012** – This is the main act. However, aquaculture not well articulated.
2. **Fisheries Management and Development Bill 2014** – been adopted by parliament; in Senate, awaiting 3rd final reading;
3. National Oceans and Fisheries Policy 2008 – being reviewed
4. **National Aquaculture Policy (2011)**; to be reviewed in line with devolved system
5. **County Governments** – domesticate the National Laws and Policies

## Aquaculture Production

Aquaculture contributes 14% to Kenya's national fish production yields. The major fish species farmed in Kenya are the tilapia (*O. niloticus*), African catfish (*C. gariepinus*), carp (*C. carpio*) and rainbow trout (*O. mykuss*). Prior to 2007 total aquaculture production has stagnated for a long while at about 1,000 tons per year. Declining fish supply for the fisheries to meet local food and nutritional demand as well as the need to provide alternative livelihoods prompted the government's aquaculture stimulus program that spurred up aquaculture (Figures 11 and 12). As a result of the stimulus program, aquaculture production shot up. It was projected that 2014's production would be 46,000 tons.

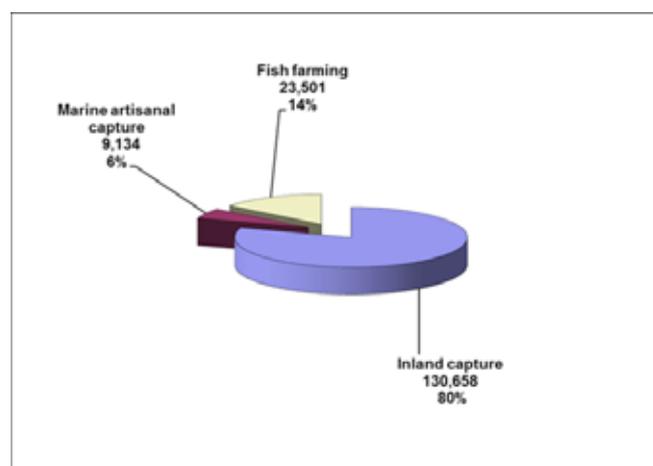


Figure 11. Kenya's national fish production by Fishery Category 2013

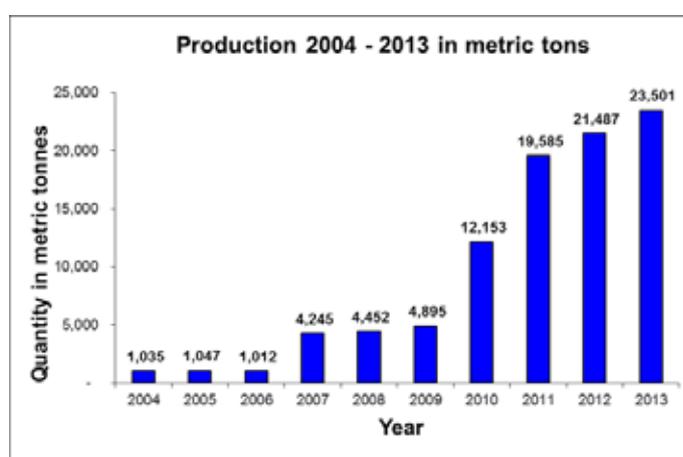


Figure 12. Kenya's national aquaculture production (2004-2013)

## Challenges facing aquaculture development in Kenya

Aquaculture still tends to be viewed as a subsistence activity by many Kenyans. The inadequate availability and distribution systems for quality fish seed and fish feeds that are key inputs is a major challenge. High feed cost is another factor. There is also a poor understanding by aquaculture producers of market dynamics for fish and their produce. This is augmented by the lack of access to appropriate information, hence the poor understanding of regulations and guidelines governing production methods, post-harvest handling, safety and quality and fishery products in the market. The latter affects producer's access to certain potential market outlets. The regulations for aquaculture are inadequate.

The weak linkages between research, extension and producers resulting in low adoption rates of recommended management practices. The poor understanding of general pond management for increased production is a concern. Greater attention needs to be placed on the economics of fish production to improve economic viability of enterprises. Furthermore, aquaculture is not a priority in most counties. It is the counties that determine whether budgets are allocated for aquaculture implementation and extension.

### **Success Factors/Opportunities**

The factors that have of recent influenced the growth in Kenyan aquaculture include:

- The high level of public investment (USD75m) raised the visibility of aquaculture and enhanced the political will in support of the sub-sector (increased funding to sector)
- The high demand for fish and fish products as a result of the widening supply demand gap.
- Population growth. It is estimated Kenya's population shall be over 60 million by 2030. Currently Kenya has an estimated fish supply deficit of 600,000MT.
- The decline in supply from the capture fisheries in Kenya due to overfishing and environmental changes. Most fish processing plants in Kenya are currently operating at less than 50% of installed capacity.
- Inadequate quality fish seed in sufficient numbers, and in some cases the high cost of seed.
- Water constraints exist and efforts to harness water resources need to be enhanced.
- The potential arising from unexploited local, regional and international markets
- Strong linkages with regional and international organizations in finance, trade, research and training

### **Lessons Learnt**

- Where there is good political will and government creates an enabling environment, the private sector will invest
- Marketing is a critical issue and producers should produce for the market
- Business and market-driven management skills need strengthening.
- Government extension staff should be well versed with latest technologies and information.
- Serious investors and small scale farmers will not wait for government extensionists for advice. They endeavour to obtain it from whichever source is accessible.

### **On-Going Developments in Aquaculture**

- Review of National Aquaculture Policy
- Promoting intensive systems – e.g. for catfish production
- Promoting Public Private Partnership

- Projects in the under-utilized marine resources
- Increasing per capita consumption of fish and aquaculture technology transfers through Eat More Fish Campaigns (10 per year)

### 3.2.3. Aquaculture Development in Zambia – by Alexander Shula Kefi, Chief Aquaculture Research Officer - Department of Fisheries

#### Policy and Institutional Environment

Aquaculture is managed within the Ministry of fisheries and livestock (see figure 13).

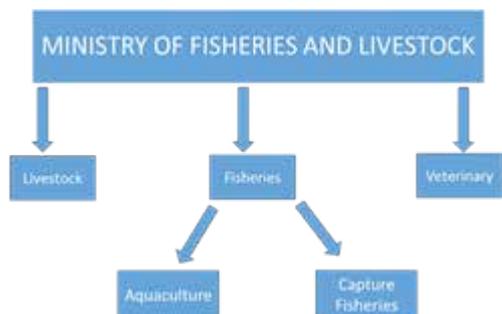


Figure 13. Zambia's Public Aquaculture Institutional Arrangement

Aquaculture development in Zambia is guided by the following legal framework:

- National Agriculture Policy
  - Currently a Fisheries Policy is being drafted. Stakeholder consultations are on-going.
- Fisheries Act No. 22 of 2011
  - Fisheries regulations SI No. 24 of 2012
  - Specific aquaculture regulations are being drafted.
- Other Acts
  - Environmental Management Act No. 12 of 2011
  - Water Resources Management Act No. 21 of 2011

#### Trends in Fish Production, Supply and Demand

Over the last five years, the country's deficit in the supply of fish has been increasing. Aquaculture development, hence production are steadily on the increase. On a per capita basis, aquaculture production is growing while that of production from the fisheries is declining. Despite this positive trend in aquaculture development, aquaculture's contribution to national fish supply is still very small. More fish is being imported into the country because of the increasing deficit in supply. In 2014, an estimated 55,000 tons of fish was imported into Zambia.

The Nile tilapia (*Oreochromis niloticus*) is the major fish species consumed in the country. Its supply comes from aquaculture, imports and some from the wild. The major wild species consumed are the breams and some catfish. The mirror carp is also farmed. The bulk of Zambia's farmed

fish supply from large scale commercial land-based and cage culture operations producing the Nile tilapia.

The status and trends of Zambia's aquaculture are illustrated in figures 14 to 20 below.

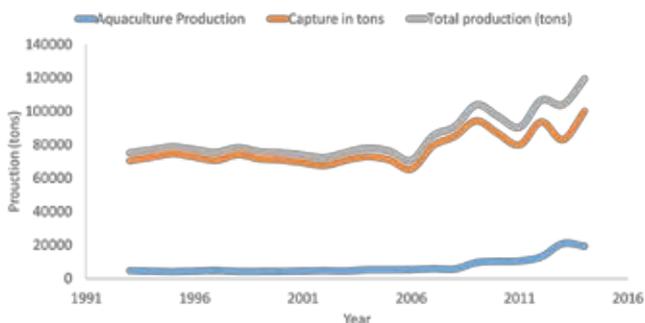


Figure 14. Total fish catch/production – Zambia (1990 – 2014)

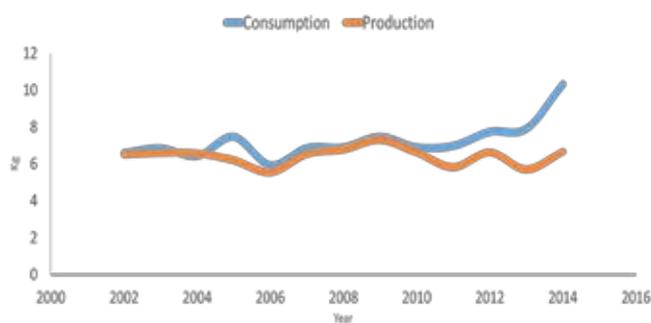


Figure 15. Per capita Production Vs Consumption (2002 – 2014), Zambia



Figure 16. Fish trade (2002 – 2014), Zambia

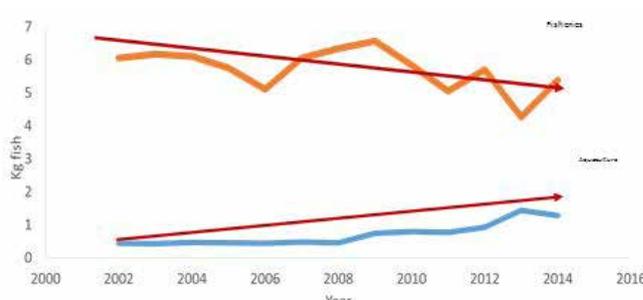


Figure 17. Aquaculture Vs Fisheries per capita production/catch (2002 – 2014), Zambia

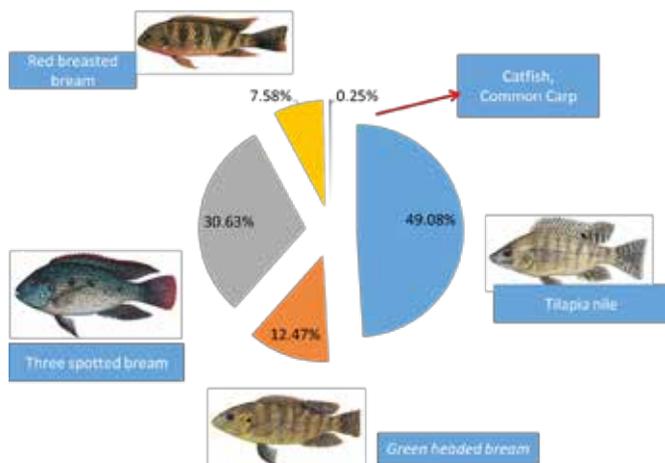


Figure 18. Major fishes consumed, Zambia

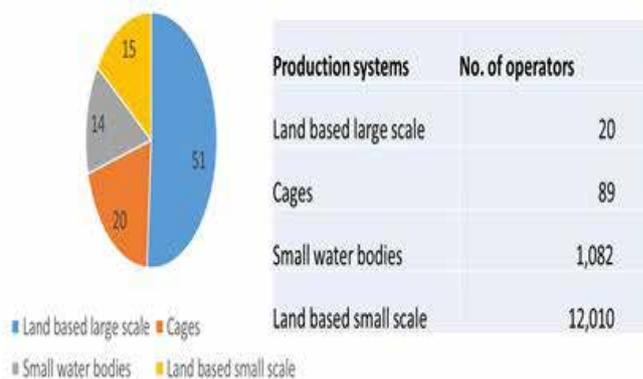


Figure 19. Major aquaculture production systems in Zambia and their contribution (%) to total aquaculture production (2014)



Figure 20. Aquaculture production in Zambia

## **Factors that have influenced success and the opportunities aquaculture in Zambia**

- Good political will
- Emergent input suppliers
- Widening supply demand gap
- Water resources (15m ha)
- Population increase
- 20.5 million in 2025 (246,889 tons required)
- Available of extension, training and research services around the country
- National documents – National Aquaculture Strategy and NADP
- Interest by cooperating partners to support aquaculture development

## **Major Challenges affecting Zambian Aquaculture**

The major challenges affecting aquaculture development are:

- Bureaucratic procedures in Environmental Assessments
- Inadequate supply of inputs notably seed, feed and other materials
- A weak aquaculture extension and research system
- Some of Zambia's regions are too cold
- Insufficient skill in fish farming
- The weak implementation of aquaculture policy and strategy
- Lack of strong local aquaculture tradition in all parts of the country
- Limited access to credit and finance
- Poor and/or hardly any strategies are integrated into development projects to ensure sustainability after project lifespans.

### **3.2.4. Aquaculture Development in Tunisia: Current status and mode of governance – by Alexander Shula Kefi, Chief Aquaculture Research Officer - Department of Fisheries**

#### **Status of Aquaculture Production – Accomplishments**

Between 2005 and 2014, Tunisia has registered a fairly rapid annual aquaculture growth averaging 17% per annum. In 2014, the estimated production was 11,670 tons which accounted for 10% of Tunisia's total fish production. Growth begun to steadily boom after the advent of offshore technology in 2007 which has since continued to dominate Tunisia's aquaculture scene.

The major aquaculture species sea bream (*Sparus aurata*), seabass (*Dicentrarchus labrax*), bluefin tuna (*Thunnus thynnus*), oysters (*Crassostrea gigas*), mussels (*Mytilus galloprovincialis*), Nile tilapia (*Oreochromis niloticus*), Mozambique tilapia (*Oreochromis mosambicus*), shrimp (*Penaeus vannamei*) and the seaweed *Spirulina* sp. Sixty percent of the investments into aquaculture is

international and these investments are largely into off-shore marine operations. Currently there are 23 offshore cage culture operation producing 10,000 tons, 5 Bluefin fattening operations producing 480 tons, 7 shell fish companies. Tunisia tilapia production comes from three intensive land-based tank farms. There are a total of 31 dams in the country and these produce 1,000 tons fish. 5 of these dams are operated by youth. A projected increase in aquaculture production of 78% is expected in 2016 (see figures 21 and 22 and table 2).

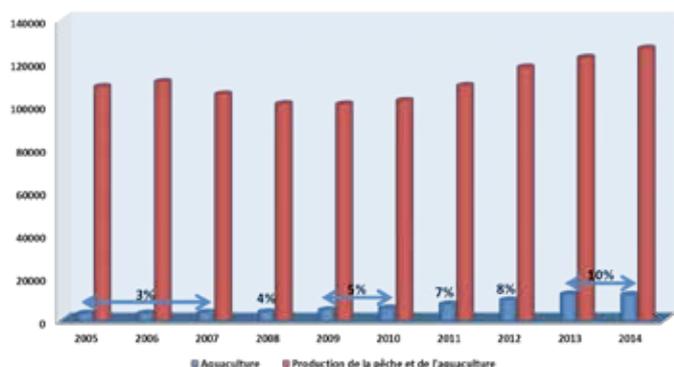


Figure 21. Relative contribution of aquaculture to national fish production in Tunisia

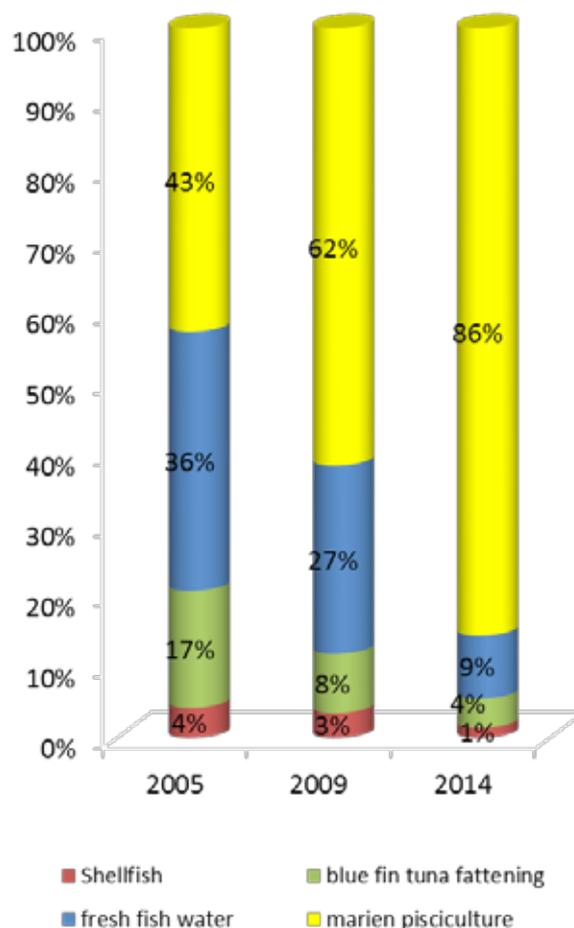


Figure 22. Characteristics of Tunisian aquaculture

Table 2. Profile of Aquaculture Investments in Tunisia

Type of Aquaculture	No. of Projects	Types of farms	The species
Marine fish and shellfish farming	2	In earthen basins	Sparus aurata, Dicentratux labrax
	23	In floating and submersible cages	Sparus aurata, Dicentratux labrax
	5	In floating cages	Thynnus thynnus
	7	Floating or submersible longlines or rafts.	Crassostrea gigas, Mytillus galloprovincialis
Continental Aquaculture	31	Dams and hill lakes (extensive)	
	3	tanks	Oreochromis niloticus, O. mossambicus
	2	tanks	Spirulina sp
	1	tanks	Penaeus vannamei

## The Policy and Institutional Environment: Interventions

The Tunisian government has endeavoured to create a conducive environment to promote commercial aquaculture. The specific policy and institutional reforms that were put in place to create a conducive environment included strengthening institution collaboration, reviewing legal framework to address the needs of aquaculture, improving access to finance directly and directly for investors, improving access to aquatic resources as well as to markets by elaborating standards. The emphasis was to tap into the lucrative EU market focusing on marine species for which Tunisia has a competitive advantage given its geographical location as opposed to freshwater species. Achieving the aquaculture development objectives necessitated that the following support was given to the emerging sector:

**Table 3.** Objectives for the sustainable development of the aquaculture sector

Objectives	Tools
1. Incentives for the creation of aquaculture projects especially onshore	<ul style="list-style-type: none"> <li>• Designation of areas allocated to aquaculture</li> </ul>
2. Improving farm profitability	<ul style="list-style-type: none"> <li>• Creation of a fund for the compensation of natural damages</li> <li>• Creation of a technical committee for evaluation and classification of dams</li> <li>• Development and implementation of a zoosanitary surveillance plan for ease of export</li> </ul>
3. Diversification of species and development of farming techniques	<ul style="list-style-type: none"> <li>• Support research and development projects in the sector.</li> </ul>
4. Establishment of an ecosystem monitoring and evaluation program	<ul style="list-style-type: none"> <li>• Creation of an environmental impact monitoring observatory</li> </ul>

This entailed policy and institutional reforms. The reforms made are summarized in table 4.

**Table 4.** Policy and institutional reforms to Support sustainable aquaculture development

Aspect	Action
1. Institutional Collaboration	<ul style="list-style-type: none"> <li>• Strengthen coordination among the various stakeholders in the sector to avoid duplication</li> </ul>
2. Legal Framework	<ul style="list-style-type: none"> <li>• Establish a specific legal framework for aquaculture</li> <li>• Review the Land Granting Act</li> <li>• Update of the National Aquaculture Sector Development Strategy</li> </ul>
3. Access to Finance	<ul style="list-style-type: none"> <li>• Review taxes and fees applied to aquaculture products</li> <li>• Review incentives for aquaculture projects</li> </ul>
4. Access to Aquatic Resources and Markets	<ul style="list-style-type: none"> <li>• Elaborate of specifications for the operation of dams to include aquaculture</li> <li>• Elaborate of specifications for certification / labeling standards for aquaculture produce and products</li> </ul>

## Current Institutional Arrangement

The sector specific institutional arrangement under which aquaculture development is managed in Tunisia encompasses the following key agencies:

### I. Sectoral Management:

- Directorate-General for Fisheries and Aquaculture (DGFA)
- General Directorate of Veterinary Services (DGSV)

- National Agency for the Protection of the Environment (ANPE)
2. Research and Training
    - National Institute of Science and Technology of the Sea (INSTM)
    - National Agronomic Institute of Tunisia (INAT)
    - Higher Institute of Fisheries and Aquaculture of Bizerte (ISPA)
    - Higher Institute of Biotechnology of Monastir
    - Agricultural Extension and Training Agency (AVFA)
  3. Technical Direction
    - Centre Technique d'Aquaculture (CTA)
  4. Producers
    - Private sector (ATA, SMSA,)
    - Tunisian Union of Agriculture and Fisheries

### **Specific Actions to Encourage Investment into Aquaculture**

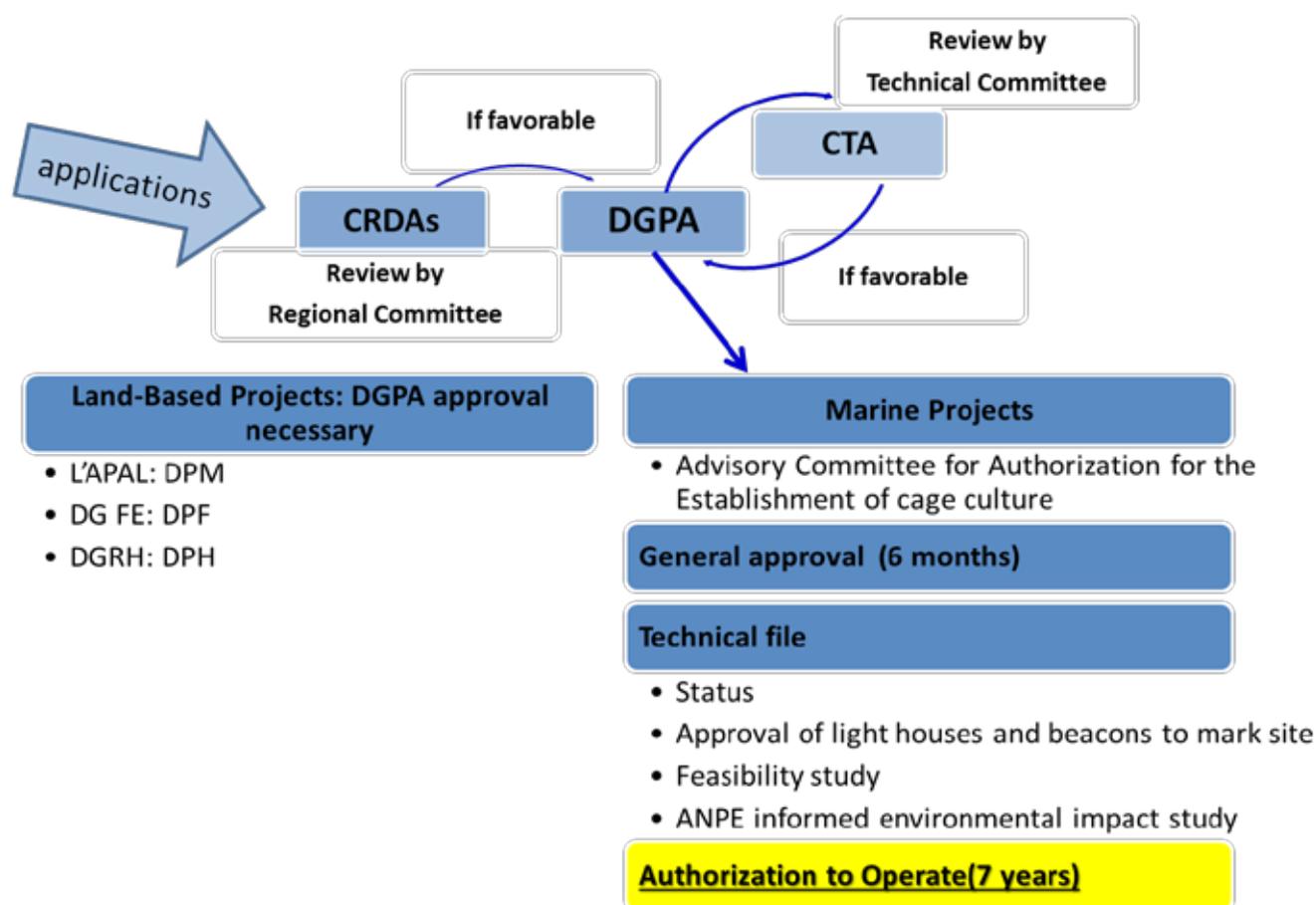
The state has additionally provided the following incentives to encourage and support aquaculture investment in the country:

1. **Fiscal incentives** comprising income tax rate application of 10% from the 11th year, deduction of income taxes during the first 10 years and exemption from customs duties and VAT for the import of equipment
2. **Financial benefits** that include assumption of partial or total infrastructure costs according to pre-established specifications, an investment bonus from 7% to 25% of the cost of the investments according to the categories of the projects and rebate on feasibility studies of 1% of the amount of the investments in the limit of 5000 dinars.
3. **Additional premium covering 6% of the cost of investments** in the form of refundable grant covering 70% of the self-financing required and granted for a period of 12 years with 5 years of grace and an interest rate of 3% per annum and the covering of the employer's contribution to the statutory social security system.
4. **Other measures** include contribution to feasibility study costs of the project up to 40% of the cost of the study capped at 40,000 dinars, an additional premium of 5% of the investment cost and exemption from customs duties and VAT for the importation of inputs notably fry and aquatic animal feed.

### **Framework for the Review and Approval of Aquaculture Projects**

The procedures for establishing aquaculture projects is illustrated in figure 23. The Advisory Committee for grants authorizations for aquaculture establishment after administrative inquiry. Two committees are involved in this review:

- a. **The Regional Advisory Committee (CRDA)** to review Applications for Aquaculture Projects initiated since 2014, at the level of each coastal governorate with aquaculture potential. The aim is to mitigate against issues and risks arising from different activities using the same space. This committee is responsible for reviewing applications for aquaculture projects and expanding existing projects in accordance with local priorities and needs.
- b. **The Aquaculture Technical Advisory Committee (CTA)** is responsible for the evaluation, analysis and monitoring of all Tunisian aquaculture activities and proposes the necessary provisions for its development. It is in charge of defining the technical criteria and evaluating the technical and economic feasibility of aquaculture projects.



**Figure 23.** Administrative procedures for carrying out an aquaculture project in Tunisia

### An Analysis of the Sector.

Tunisian aquaculture comprises

- i. Un-surveyed continental fish farming (artisanal fishing in dam reservoirs -20000ha);
- ii. Aquaculture in geothermal waters (Tilapia) is limited to a modest exploitation;
- iii. Shellfish farming in the Bizerte lagoon very vulnerable

Below is a SWOT analysis of the sector.



Figure 24. SWOT Analysis of Tunisian Aquaculture

### 3.2.5. Aquaculture Development in Mali: A Promising Sector in Mali – by Bocari Alliaye Kossibo, Deputy National Director of Fisheries, Ministry of Livestock and Fisheries, Republic of Mali.

#### The Potential for Aquaculture in Mali

The opportunity for aquaculture in Mali is good. The potential is also growing as a result of the influence of the following factors: (i) the gradual decline in catch volumes from the capture fisheries; (ii) the increasing demand for aquatic animal products; (iii) influence of climate change on aquatic resources; (iv) the unprecedented increased interest in fish farming; (v) good local market for fish. The various forms of traditional fish processing in Mali (smoked, dried, roasted) enhance the shelf-life allowing for the presence all year round supply, hence demand.

Additionally, Mali has significant natural resources that could be harnessed for aquaculture. It has a dense hydrological network covering nearly 4,500 kilometers that is part of the Rivers Senegal and Niger basins and Volta Fish farming area. A total of 894,335 ha comprising 5,512 sites is considered suitable for aquaculture. These include lakes, ponds, irrigation canals, bankotries, loans in all regions of Mali. Furthermore, Mali's aquatic environments are largely unaffected by significant pollution. Agricultural by-products that could be transformed as inputs for aquaculture are already being produced within the areas designated as good aquaculture potential areas. The presence

of local fish species such as catfish (*Clarias* sp.) and *Oreochromis niloticus* and carps with high growth potential add to Mali's potential for aquaculture.

### **The Status of Aquaculture in Mali**

Mali's current annual total fish production is estimated to be 100,000 tons. The estimated total aquaculture production is 3,000 tons, 3% of the total national fish production. The major systems of aquaculture production in Mali are:

- i. Extensive aquaculture conducted in ponds, shallow water basins and dam embankments. These are essentially temporary water bodies that are mainly stocked with *Oreochromis niloticus* and catfish.
- ii. Semi-intensive aquaculture conducted as integrated fish farming with irrigation or rice cultivation and avi-pisculture. The average production from these systems is 375 kg / ha.
- iii. Peri-urban semi-intensive and intensive systems conducted in ponds and impoundments along rivers filled with water using motorised pumps. The average production from these is 600 to 1000 kg/ha in ponds.
- iv. Floating cage in the officially designated areas with water control upstream within dams.

### **The Aquaculture Policy Environment**

There is political will in support of aquaculture development. This is manifest by the national policy and regulatory frameworks and structures in place, notably:

- i. The creation of a Ministry of Livestock and Fisheries and the National Directorate of Fisheries and its decentralized structures;
- ii. The Strategic Framework for Growth and Poverty Reduction is the national guiding development framework. It lays the foundation for all policies and development strategies within the fisheries and aquaculture sub-sector;
- iii. National Agricultural Development Policy;
- iv. The National Policy for the Development of Fisheries and Aquaculture;
- v. The Master Plan for the Development of Fisheries and Aquaculture;
- vi. The National Program of Investment in the Agricultural Sector (PNISA);
- vii. Agricultural Orientation Law (LOA);

The additional supporting regional policy framework ascribes to include:

- i. The West African Economic Monetary Union (WAEMU) agricultural policy. This provides a platform for the joint management of fisheries and aquaculture among member countries. Directives establishing a common ground for the sustainable management of fisheries resources and for the monitoring, control and surveillance of the fisheries are in place.

- ii. Economic Community of West African States (ECOWAS) agricultural policy;
- iii. Comprehensive Africa Agriculture Development Programme (CAADP).

## **Challenges**

Mali is currently grappling with endeavouring of achieve the following through aquaculture:

- i. Increase aquaculture production in order to effectively reduce fish imports.
- ii. Provide an alternative livelihood for Malian fishermen as a mitigation strategy against the negative impacts of climate change on Mali's aquatic resources and fisheries.
- iii. Increase the contribution of the sector to the national economy.
- iv. Improve the food and nutrition security status of the population by making fish available and accessible at all levels.

## **Factors that have influenced the successes achieved so far in aquaculture**

- i. Aquaculture has been integrated into the national research programs to make innovative technologies available to managers and producers;
- ii. Sufficient production of quality fry;
- iii. Making available of high-performance fish foods;
- iv. The inclusion of fish farming into national agricultural development programs;
- v. Mastering the technical parameters of production to increase the productivity and yield on farms;
- vi. Provision of qualified human resources to strengthen technical extension and supervision structures;
- vii. Promotion of public-private partnerships in aquaculture;
- viii. The availability of a financing system adapted for the sector;
- ix. The existence of a well-structured and well-equipped marketing channel in the cold chain that accomodates aquaculture produce

## **Good Practices and Lessons Learned**

The following are the good practices advocated for in the sector:

- i. Regular monitoring of production infrastructure;
- ii. Strict control of water quality
- iii. Fish feed management measures
- iv. The correct use of food additives and medicines
- v. Regular disinfection of operating equipment
- vi. Regular monitoring of fish health
- vii. The soundness of the farm management documents

### viii. Good planning of the production of the farm

For successful aquaculture, the following have been found to be essential needs:

- i. The timely availability of quality fingerlings;
- ii. The availability of high-performance fish foods;
- iii. Good quality of the water of suitable temperature, ph, oxygen-levels and minimal levels of ammonia;
- iv. The proper construction of fish production infrastructure be they ponds, floating cages and impoundments
- v. Good breeding practices.

### 3.2.6. Aquaculture in Lake Tanganyika and Its Basin: An Overview – by Kaitira Ibrahim Katonda, Director of Fisheries, Lake Tanganyika Authority

The Lake Tanganyika Basin has high potential for aquaculture production because of the following; numerous lakes, rivers and wetlands in the Basin; availability of suitable native species; locally available required inputs for feed production; suitable temperature for fish growth; and expanded local, regional and international market access and trade. Aquaculture, therefore, presents immense opportunities for socio-economic development in terms of improving food security; providing employment, income generation, regional economic growth and overall poverty reduction; improving livelihoods of the rural communities; and reducing pressure on the capture fisheries, which are already over-exploited as indicated by the aquatic resource map in figure 25.

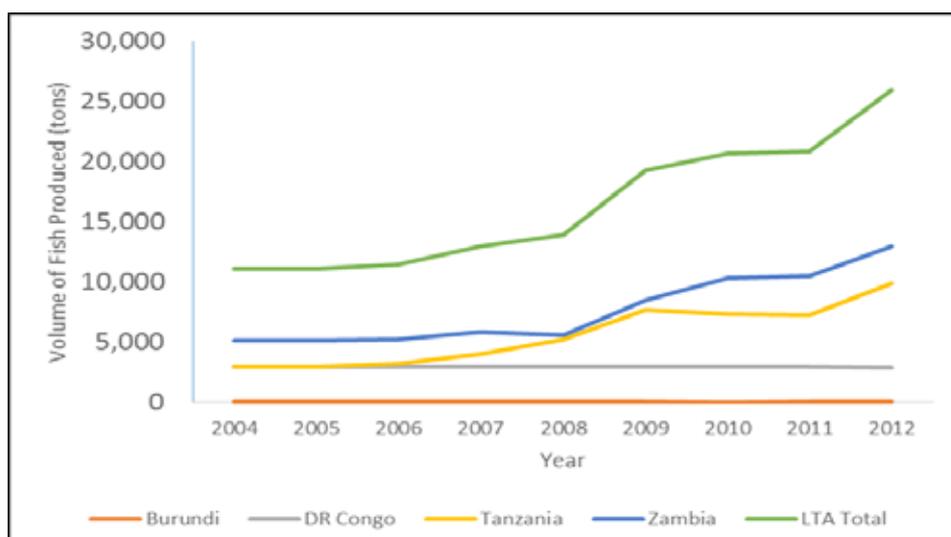


Figure 25. Lake Tanganyika and its Basin Figure 26. Trends in Aquaculture between LTA Riparian States

### Status of Aquaculture Production in the Lake Tanganyika Basin

Aquaculture is relatively undeveloped in the Lake Tanganyika Region although the countries are endowed with aquaculture potentials such as land, water, inputs and favorable weather conditions.

Aquaculture production, however, has been increasing almost in all the Lake Tanganyika riparian countries (figure 26). Among the top nine African aquaculture producers, are the riparian LTA states of Zambia and Tanzania that rank sixth and eight respectively.

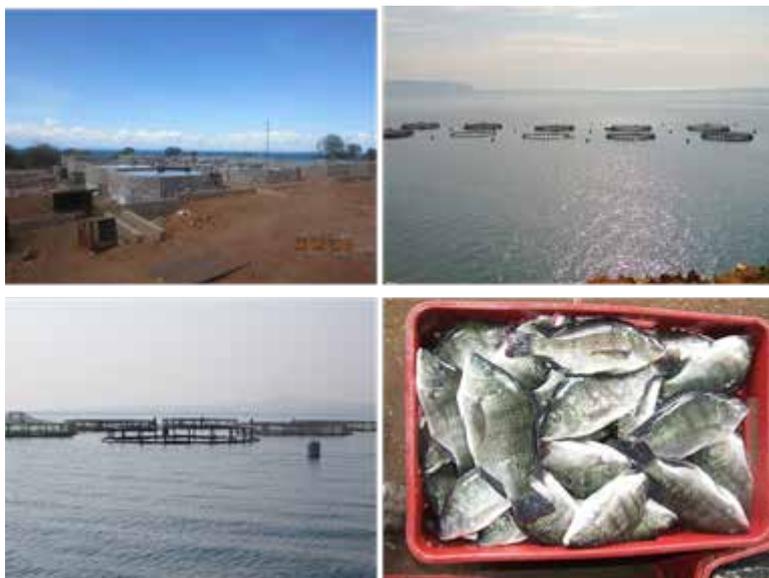
## **Policy and Institutional Environment**

The Lake Tanganyika riparian countries have adopted the following policy and legal frameworks:

- 1. Strategic Action Programme.** The Strategic Action Program (SAP) was first adopted by the four Lake Tanganyika riparian countries in 2000 and revised in 2011.
- 2. Convention on the Sustainable Management of Lake Tanganyika.** The objective of the Convention is to ensure the protection and conservation of the biological diversity and the sustainable use of the natural resources of Lake Tanganyika and its Basin by the Contracting States on the basis of integrated and co-operative management.
- 3. Country Policies and Legislation.** Each country has developed their Aquaculture Policy and Legislation.
- 4. Aquaculture Protocol.** An Aquaculture Protocol has been developed for the following objectives:
  - a. Achieve harmonized and sustainable aquaculture management in shared waters and strengthened cooperation among LTA Members.
  - b. Identify processes and priorities for review, adoption and implementation at national level
- 5. Code of Conduct for Responsible Fisheries.** The Code describes how fisheries should be managed responsibly; how fishing operations themselves should be conducted; and then addresses the development of aquaculture.
- 6. Ecosystem Approach to Aquaculture (EAA).** An Ecosystem Approach to Aquaculture (EAA) strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems including their interactions, flows and processes and applying an integrated approach within ecologically and operationally meaningful boundaries.

## **Best Practices and Lessons Learnt**

- 1. Aquaculture Governance and management.** Effective governance of aquaculture is essential for its continued growth and the achievement of its potential. This involves working towards optimal use of scarce inputs, to achieve the greatest production of aquatic products taking into consideration competing uses to which those inputs might be put by society.
- 2. Cage Culture in Lake Tanganyika by Mpende Fisheries Farm of Zambia.** Mpende Fisheries Farm in Zambia have established cage culture in Lake Tanganyika. In their cages, they are using the native Lake Tanganyika Tilapia species, *Oreochromis tanganicae*, and it is doing very well. Brooding stock of the native *Oreochromis tanganicae* are obtained from the Lake.



**Figure 27.** Mpende Fisheries Farm, Lake Tanganyika Zambia

## **Conclusion**

The Lake Tanganyika Region, with good water resources and an ideal climate, provides excellent opportunities for aquaculture development. However, the LT riparian governments and Development Partners need to provide stimulus packages to transform the sector to higher levels of commercial production.

## **3.3. Private sector experiences**

The following experiences were shared by private sectors practitioners giving an account of impacts of changing policies, markets and other sectoral dynamics on their enterprises for themselves and other practitioners.

- i. Private sector experience in Egypt - Prof. Ismaila Radwan
- ii. Private sector experience in Ghana - Mr. Jacob Ansa

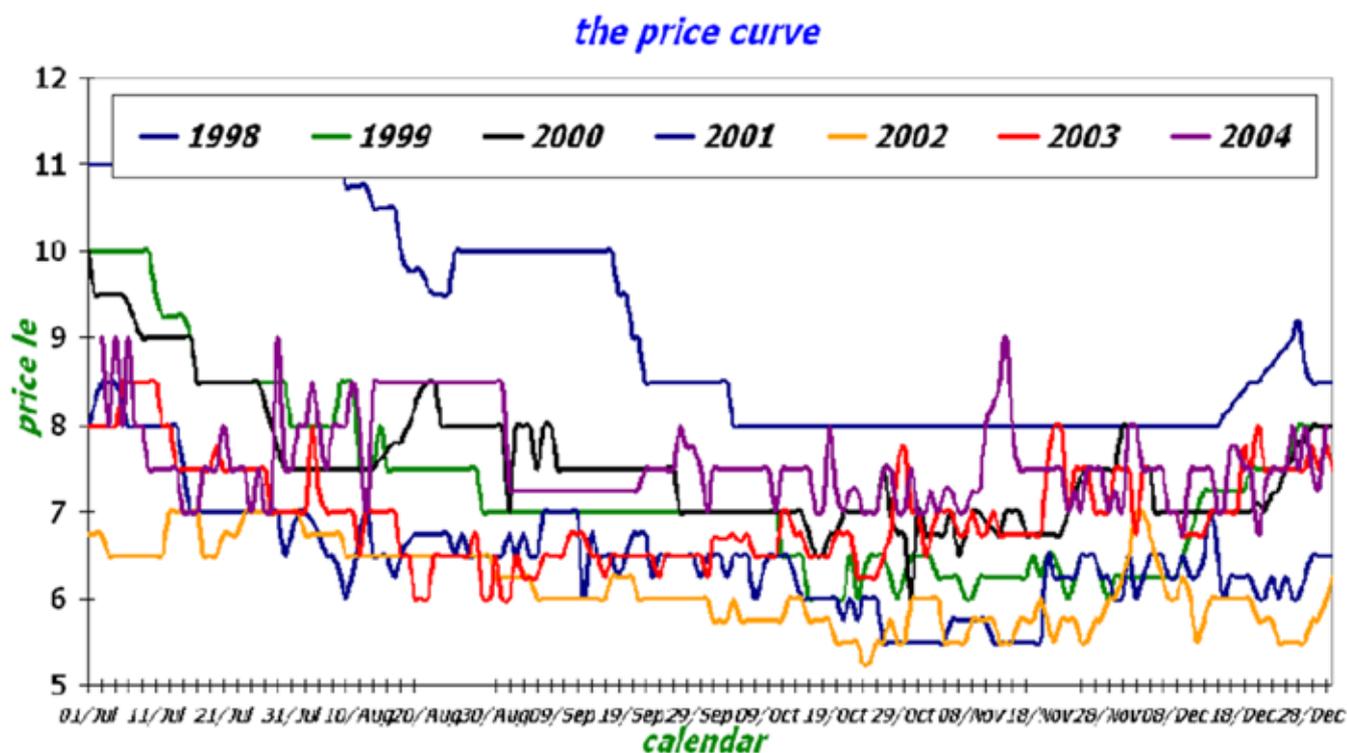
### **3.3.1. Aquaculture Development in Egypt 1980-2010 – by Prof. Ismaila Radwan, Egypt**

Egypt has experienced a tremendous transformation in aquaculture since 1980 that sprouted from incubation Research and Development projects initiated at Kafr El-Sheikh and Abassa based upon simple pond-based technology that ordinary farmers could easily adopt. A lot of emphasis was also placed upon education and training of both professionals and farmers.

Between 1990 – 2010 strategies to improve tilapia production in ponds centring on controlling reproduction through introduction of mono-sex techniques and management initiatives to enable farmers go through the cold Egyptian winter definitely had a positive impact on production, especially since the major farmed species was tilapia. Several trials and technology to increase productivity enabling producer intensify their production are among the positives. The increased

availability of better quality fish seed (the Abassa strain), good quality commercial fish feed and dissemination of improved management practices to producers has been key. Currently there are trials to improve the practicability and viability of Recirculatory Aquaculture Systems.

However, for producers, the sector has not been without challenges. Before the year 2000, farm-gate prices were higher. Fish prices have progressively declined so it is becoming more difficult for farmers to obtain good profit margins (figure 28). Marketing fish to fetch a good price has become more competitive for producers.



**Figure 28.** Fish Price Trends between 1998 and 2004, Egypt

### Lessons Learnt

The following are essential and key elements that have contributed to the success of Egyptian aquaculture, especially for producers for whom the viability of the business matters:

- i. Education and Knowledge:** Having a well-trained, skilled and experienced workforce with the skills to develop appropriate technology, provide the necessary technical support to producers and other service providers in the industry and pass on the necessary knowledge and skills to producers. The intensive practical training of farmers so that they know what to do, how to do it and obtain the resources to do aquaculture as a business has been an important lesson.
- ii. Designing and evaluating integrated aquaculture - agriculture systems:** It is important that the systems used are applicable to the farming environment. For example in Egypt, the ponds are part of the irrigation system so they can be adopted easily with a fish that can easily be sold locally, and not necessarily something high-tech that is out of reach of the would-be producers nor locally feasible and viable.

- iii. **Special equipment and tools (pumps, pipes, fittings, media, filters):** Local availability of the necessary equipment and tools at prices that the producers can afford (i.e. pay-off within their enterprise's budget).
- iv. **Qualification and Accreditation:** Service providers should be competent. The lack of competence results in losses for farmers and other service providers to the industry (e.g. banks, seed producers, etc.) which is a serious matter. Improvements have to be made on this and it is something to be advocated for.
- v. **Marketing:** As more fish is produced, prices fall. More markets need to be established and different marketing strategies adopted. This calls for investment in marketing as well as the development new market and distribution chains and new products so that the increasing volumes of fish produced can be absorbed in a manner that mitigates against sharp falls in prices.

### **3.3.2. Adaptation to Changes in the local industry: Opportunities, Challenges and Prospects for Small-Holder Commercial Fish Farmers– by Jacob Ainoo-Ansah, Ainoo-Ansah Farms, Ghana**

The experiences shared in this presentation were those of a private business, Ainoo-Ansah Farms and of other fish farmers in lieu of in the industry accruing to Government Policy, market dynamics and growth in the number of sectoral players.

#### **The Experience of Ainoo-Ansha Farms.**

##### **Company Profile**

**Location:** Okyereko, Central Region. Ghana

**Product:** Tilapia hatchery

**Production Capacity:** 600,000 fingerlings per month

**Sales:** 250,000 per month

**Markets:** local and some exports

**Innovation** – hatchery equipment from Thailand, Recirculation Aquaculture Systems (RAS),

**Collaborations:** UCC, UENR, Researchers, Local Feed producer, Training Institutions and schools etc.

**Ownership:** 100% local family business

**Governance:** Board with inclusion of UCC

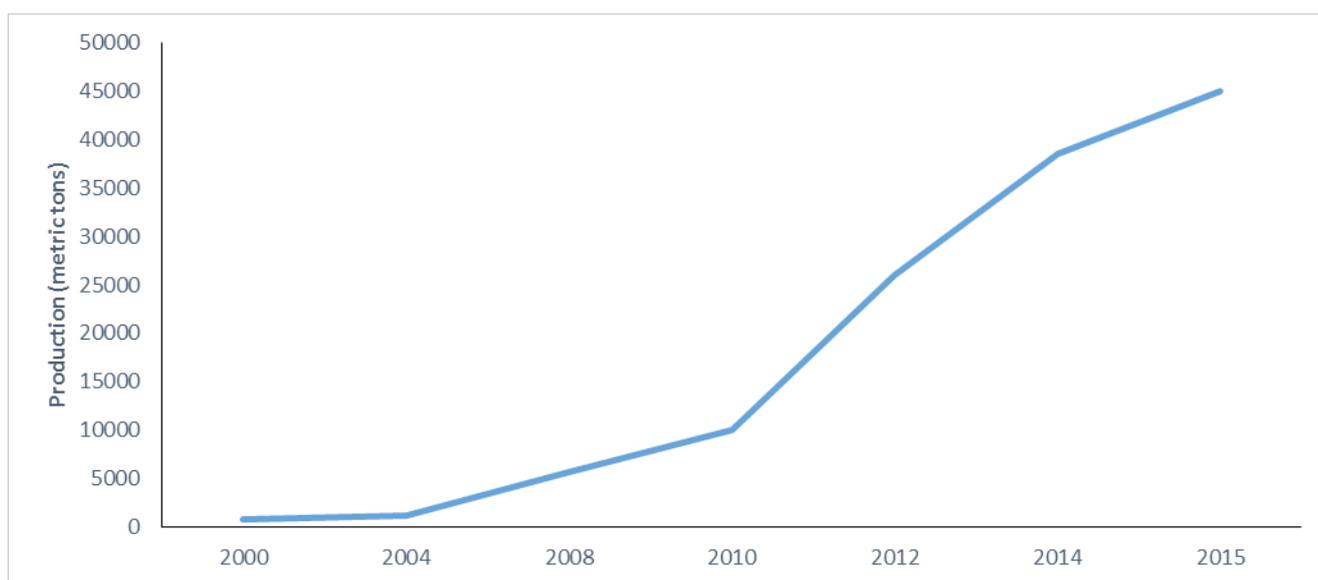
**Prospects:** Operate a fish farming training centre

Ainoo-Ansah Farms begun as a smallholder fish farm, farming tilapia in ponds. The produce was initially sold in local market. Over time as more people joined fish farming, it became necessary to seek markets further afield as prices of farmed fish within the fish farming areas were lower due to high supply. This also opened an opportunity to specialise into seed production whose demand had increased and due to shortfalls in supply, there was less competition. The farm therefore diversified to become a hatchery and provide practical demonstrations to out-growing farmers.

Policy changes to encourage commercial aquaculture have seen more private sector investments of different scales using a wider array of technologies. There are more farmers, service providers, feed mills establish in Ghana and aquaculture production has increased. Hence, as business there is need to become more innovative and become more specialised in order to secure market shares. The prospects for our enterprise have been Knowledge and skills transfer (conducting farmer-to-farmer technology transfer) and setting an aqua-shop. The benefits out of this to the farm have enable us sustain demand for our fingerlings, increased revenue from training other farmers and collaborating with researchers and our contribution towards development of industry in Ghana as a whole.

## **The Aquaculture industry and its opportunities in Ghana in Ghana – A Producers Perspective**

Figure 29 illustrates the rapid growth in aquaculture production that Ghana has experienced over the last ten years.



**Figure 29.** Aquaculture Production Trends in Ghanaian

## The Prevailing Environment for Aquaculture in Ghana

Ghana's potential for aquaculture is good because:

- i. Natural resources for production** – Ghana has vast water resources and suitable climate for aquaculture. The Volta Lake, where most of the tilapia cage culture is, covers an area of 8,500 sq. km and the Volta River stretches about 50km below the Akosombo hydroelectric dam. Along the 500km of coastline there are 90 brackish water lagoons totalling about 40,000 ha. Climatic conditions are suitable throughout the year for tilapia culture.
- ii. The Policy and Institutional Environment** - There are various policy, legal and institutional frameworks and programmes to support fish farming, the principle being the Fisheries Act, 2002 Act 625 that regulates the practice of aquaculture) and the The National Aquaculture Strategic Framework (2006). In addition the following policies and programs are in place (i) The Tilapia Volta Project (TIVO) (2006); (ii) Fisheries and Aquaculture Policy (2008); (iii) National Medium Term Policy Framework (2010); and (iv) Medium Term Agriculture Sector Improvement Program (2010).

In addition, the following are public institutions that provide technical services to the sector:

- A centre at the Water Research Institute (WRI) currently undertaking a comparative study of GIFT tilapia from WorldFish Centre and WRI's own improved tilapia strains.
  - Licences for aquaculture operations issued by The Fisheries Commission, Environmental Protection Agency (EPA) and Water Resources Commission (WRC) etc. to ensure the sustainability of the industry.
  - Public Universities and other institutions in Ghana provide courses in aquaculture and related areas up to Ph.D levels.
  - A number of certificate and diploma awarding colleges also offer courses in fish farming.
- iii. Market opportunities** – There is a high local demand for tilapia as a result of huge supply deficit of fish and local preference for fish. Ghana has a rapidly growing population with 60% of population below 24 years and a growing middle class with taste for tilapia who can buy fish. A kilo of tilapia fetches above USD 2.00.
  - iv. Financial services** – Farmers have access to financial services for aquaculture. However, among major current challenges associated with accessing credit for commercial farmers is the decline in the performance of the economy. Growth of the Ghanaian economy slowed down from 15% in 2012 to 4% in 2015. Inflation in December, 2015 consequently rose to 17.4%. Growth in agriculture in 2015 was about 4%. Interest rates on bank loans are about 32% pa. Exchange rate fluctuations and depreciating value of cedi against the US\$ and other currencies making it difficult for farmers to procure the necessary inputs, especially where these had to be imported or for which in their manufacture required imported input. The rapid fluctuation in the value of local currency caused increased withdrawal of Ghanaian Cedi's from banks and

increased savings in dollars. This made access local funding more constrained.

This status quo, notably depreciation in value of local currency resulted into an increase in the costs of inputs. Consequently in 2015 more local small scale farmers could not afford to complete feeding regimes for required fish sizes. A number of local cage farmers abandoned their cages. The position of larger operations on the other hand was slightly different. Larger foreign firms also have funding needs but are able to access credit due to more credible management practices and more favourable relations with their banks. Large fish farms too are able to negotiate with feed producers for respectable discounts as well as more favourable payment terms (table 4).

**Table 4.** Major challenges associated with access to finance Ghanaian farmers face

Challenges	Solutions
1. Limited knowledge and unfavourable perception of bank officials in fish farming business	<ul style="list-style-type: none"> <li>• Presentation of aqua businesses as attractive bankable projects.</li> <li>• Demonstration of strong technical and managerial abilities in aqua-business.</li> </ul>
2. Poor performing loans of fish farmers.	<ul style="list-style-type: none"> <li>• Profiling of successful fish farm businesses to enhance insights on key success factors in the business.</li> <li>• Develop or track industry indicators and benchmarks to guide Bank personnel</li> </ul>
3. Absence of identifiable fish farming value chain	<ul style="list-style-type: none"> <li>• Provide assurance of market for links in the aqua culture chain</li> </ul>
4. Limited development funding for training and for direct technical support	<ul style="list-style-type: none"> <li>• Governments and institutions should invest in fish farmers</li> </ul>

v. **Private Sector Associations** - organised at zonal, district regional and national levels also exist. The Ghana Aquaculture Association embraces all fish farmers associations and other stakeholders in the fish farming chain such as traders feed manufacturers, researchers, suppliers etc. The associations serve a platform that advocates and provide other support for their members.

### Major Challenges Faced by the Private-Sector Aquaculture Stakeholders

Table 6 provides a summary the major challenges affecting Ghanaian fish farmers and aquaculture service providers:

**Table 6.** Challenges and possible solutions to address issues associated with access to Non-Financial services

Issues	Challenges	Critical enablers
<b>1. Training and Technical Assistance</b>	<ul style="list-style-type: none"> <li>Limited know-how in fish farming</li> </ul>	<ol style="list-style-type: none"> <li>Fish farmers must pursue knowledge and skills in the science and business of the industry.</li> <li>Access to training inputs and extension must be available through public and private centres of training and knowledgeable individuals</li> <li>There must be investment in public and private operators who are providing training to middle level personnel in fish farming</li> </ol>
<b>2. Product Development</b>	<ul style="list-style-type: none"> <li>Cage and pond designs and construction</li> <li>Processed fish</li> </ul>	<ol style="list-style-type: none"> <li>There must be a source of information of standards, options, and models of production.</li> <li>Knowledge source on processing techniques must be available.</li> </ol>
<b>3. Input supply</b>	<ul style="list-style-type: none"> <li>Inadequate access to fish farming inputs</li> <li>High costs of inputs</li> <li>Inadequate knowledge on use of inputs</li> </ul>	<ol style="list-style-type: none"> <li>Knowledge source on inputs</li> <li>Aquaculture shops</li> </ol>
<b>4. Market</b>	<ul style="list-style-type: none"> <li>Undeveloped value chain side-lining processing and distribution</li> <li>Absence of marketing infrastructure; storage facilities for aquaculture produce and products, and market information</li> </ul>	<ol style="list-style-type: none"> <li>Investors and investment in marketing infrastructure and systems</li> </ol>

### **3.4. Experience from partners on lesson learnt and best practices**

There were presentations on the following partners:

#### **3.4.1. Overview of aquaculture issues – Dr. William Leschen, Sustainable Aquaculture Research Networks in sub-Saharan Africa (SARNISSA), University of Stirling, United Kingdom**

Aquaculture is at last developing in sub-Saharan Africa. Large amounts have been invested, including from external donors since the 1960's. Several meetings have also been conducted. However key for the sector are what has been the outcome of all of these efforts, what are the success stories and what lesson have been learnt. How much do we know about aquaculture in our own and other sub-Saharan African countries?

There are now 'bright sparks' from aquaculture emerging from the private sector. Notable among these is the growth the peri-urban *Clarias gariepinus* production in Nigeria, commercial tilapia farming in Ghana and Zimbabwe, cage culture is becoming established in Zambia, Uganda and Kenya, shrimp and tilapia culture with trials of sea cucumber in Madagascar and Mozambique, seaweed farming in Tanzania, oysters and mussels in Namibia, trout cage culture in Lesotho and production of *Clarias gariepinus* in recirculatory aquaculture systems in Benin, Cote d'Ivoire and

## On the road to African Aquaculture development

In September 2006 the FAO COFI (FAO Committee on Fisheries) sub-committee met in New Delhi to discuss the future potential for African aquaculture. The following were highlighted as being the five major constraints to aquaculture development in Africa: feed, seed, capital, markets and information.

SARNISSA was subsequently created as a network with support from EC FP7 funded Project in February 2008 and is now 7 years old. The project was for a duration of three years with the overall goal of creating a platform through which information on aquaculture in sub-Saharan Africa could be accessed and shared by all stakeholders. The network had nine original partners, out of which four were African (Malawi, Cameroon, Egypt, Kenya), one from Asia (Thailand), four from Europe (2 from UK, France and the Netherlands). The principle upon which the network was established is that information is knowledge which gives the power to act.

The funding for the project ended in 2011 upon which the network began to seek self-sustaining avenues. To-date SARNISSA is a self-sustaining network with over 2,700 registered stakeholders in its database comprising all actors of the aquaculture value- chain whose profile ranges from government personnel, research, academia, investors, donors, entrepreneurs, NGO's, students, other water users, agriculturalists and so on. It is bilingual serving both the English and Francophone speaking countries of Africa joined together by English and French email discussion groups. The project website is a bilingual interactive repository of information which has which has bridged a great regional gap in the exchange of information and experiences.

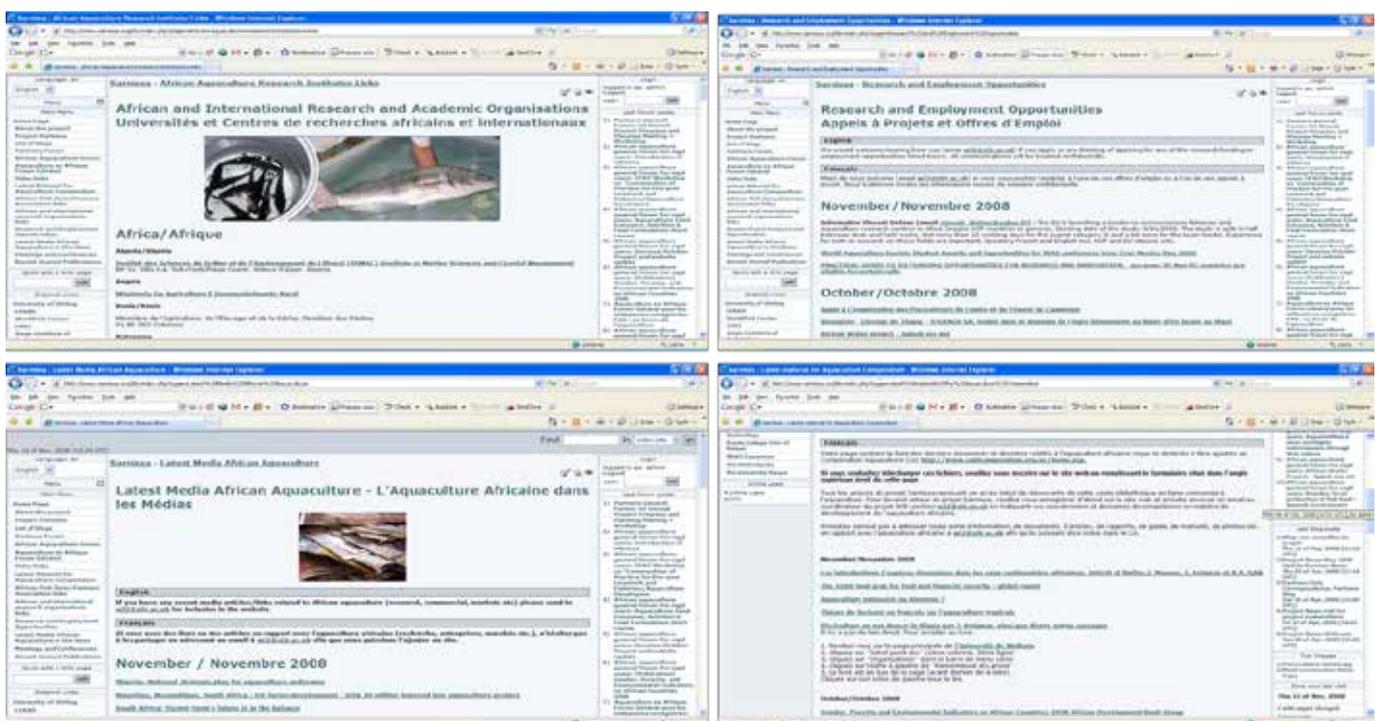


Figure 30. SARNISSA website ([www.sarnissa.org](http://www.sarnissa.org)) :A Repository of Information

The SARNISSA repository includes among others, information on: African Fish Farms, commercial suppliers and producer associations; African and International Research and Academic Institutions; latest research, funding and employment opportunities; thousands of publications related to aquaculture; video to videos on the various aspects of African aquaculture; latest meetings workshops and conferences; interactive African aquaculture discussion fora. By February 2016, the SARNISSA website received over 1,200 visits per month. Increasingly the website is being accessed through mobile phones.

The transformation telecommunications infrastructure within the region, notably placement of undersea fibre optic cables along the West African coast down to South Africa and the East Indian Ocean have opened possibilities for high speed internet which has resulted into more people subscribing to social media networks for information sharing & networking. By early 2016 for example 3.5 million Kenyans were on Facebook.

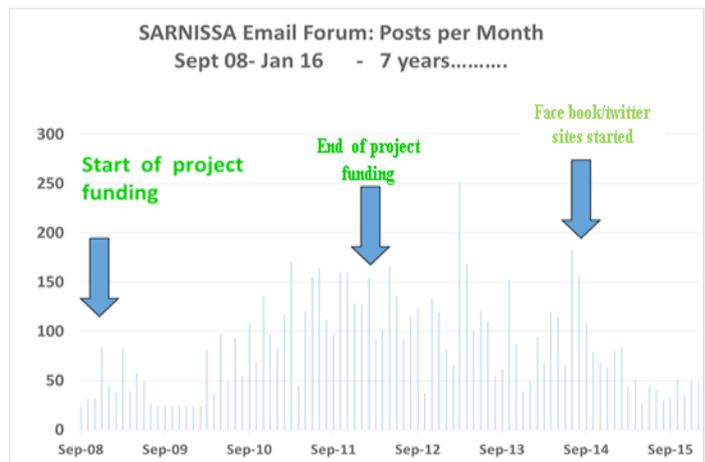
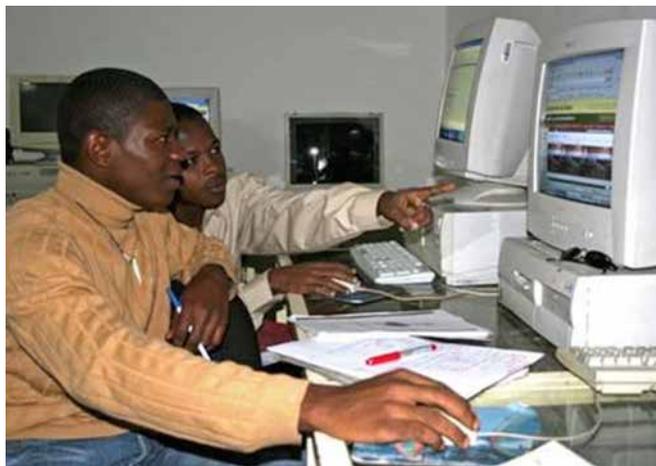


Figure 31. Channels used to disseminating and accessing information through SARNISSA

A wide array of prevailing issues and opportunities within the aquaculture subsector are discussed on the website. Examples of what have been among the most debated and discussed issues topics on the network include:

- **Viability of Aquaculture Enterprises:** Household level aquaculture can it be profitable? Sea Cucumber aquaculture Mozambique - is it viable? Improving value- chain Clarias sp. Nigeria? Throwing Stones .... The future of SS African Aquaculture??? Tilapia imports from China? Pangasius sp. and cheap Chinese tilapia into Africa
- **Fish Health:** Fish health services in Africa?? Developing regional labs.....? Catfish fingerling mortality after 2 weeks Nigeria? Tilapia mortalities Ghana .. Cause and effect.....
- **Extension and training:** Call Applications Netherlands Fellowship (NFP)? Aquaculture feed extrusion/formulation short course? Diseases Warm Water Fish Course June - Fish dying in Ghana? Further details on FISON conference Oct Badagry Nigeria? Use of mobile phones in aquaculture - 2.5 million Kenyans now on Facebook? Aquaculture extension - government or

private sector?

- **Breeding, Genetics and Biodiversity:** GIFT Niloticus threatens tilapia in Africa?? Gender control for tilapia production Kenya; Cross post why *O. niloticus*? Reproduction and potential of *Heterotis niloticus*? Sustainable Tilapia genetic resources in the Volta; Introduction of non-native species? *O. niloticus* needed in Malawi? Scientists Policy makers - Biodiversity against food for poor people? Discussions on All male tilapia production? Developing local species for aquaculture?
- **Jobs and Investment:** Job/Investment Opportunities with tilapia Senegal? What is the best investment approach? Credit strategies? Employment Research Assistant WFC? Aquaculture in Namibia: Consultant(s) for Feasibility study? Tilapia Farm Business Manager Required? Regional Aquaculture Equipment Suppliers? Credit provision for fish farmers in Malawi? Novatec – new feed company Zambia? Governments can provide for construction – access roads - cage culture sites? Solar powered hatcheries??
- **Feeds:** Tilapia feed composition Port Harcourt? Value chain analysis of aquafeed industry in Egypt
- **Water Quality Management:** Construct a degassing unit -borehole water hatcheries?
- **Course:** Design of Breeding programmes Wageningen
- **Production Systems:** Fish/rabbit systems Rwanda? Low cost Cage prototype Uganda? Nigeria Invitation First cage tilapia harvest Ikere Gorge? Semi-intensive ponds Optimum fertilisation Mozambique? Zambia: Integrated pig tilapia farms - 25 years success...? Nigeria Fish Farming estates – success or failure - for government or private sector to run ?
- **Policy:** National aquaculture strategy Ethiopia? Draft Abalone Farming Standards? Certification of hatcheries? Why has it taken so long.....?

### **SARNISSA's concrete outputs during EC funding 2008-2011**

The following include a profile of examples of SARNISSA's concrete outputs. All are available on the SARINSSA website.

- **Preparation and publication of user friendly Case Studies** of 10-15 pages giving Information and lessons learnt. Currently there is a portfolio of 35 titles have been produced that are available online, examples of which (i) Lake Harvest: Commercial Production of Nile tilapia on Lake Kariba (ii) Role of academic institutes in development of Seaweeds cultivation in Tanzania (iii) Royal Fish Farm, Benin :A commercial recirculatory *Clarias* sp. farm and hatchery.
- **10 Analytical In Country Aquaculture Status & Policy Reviews** that include reviews from Uganda, Malawi , Cameroon, Cote D'Ivoire, Ghana, S Africa and Kenya. The reviews provide an overview of the independent roles and linkages between government, research, academia, the private-sector, Policy and Planning, markets, investors, community projects. They highlight the

past history, current status, successes, failures and future prospects for aquaculture respectively. They contain many hyperlink contacts.

- **Facilitated Asian Study Tour for lessons learning from South Asia Reports** – Three African partners participated in a month trip to view different sectors of aquaculture development in three south Asian countries, namely: Thailand, Nepal and Bangladesh. The reports give overview of different dimensions of sector between the visited countries i.e. roles of government, commercial sector, research, academic, markets. Videos of the study tour are also available.
- **African Aquaculture in the Media: Keeping people informed** - SARNISSA provides service with a regularly updated African aquaculture media news on SARNISSA Facebook site that is updated daily in both English and French and linked to Twitter. Facebook tends to draw in younger students and the entrepreneurial audience. Facebook is increasingly being used by commercial companies and individuals. The number of Facebook SARNISSA users rose from 1,300 to 2,900 registered users between September 2012 and February 2016, a factor of 123% over approximately a three year period. This points towards the potential role of media in the future African Aquaculture Development.

### **What else is SARNISSA doing?**

SARNISSA is now additionally functioning as an avenue for identifying and helping key members who can work together or collaborate in various aspects of aquaculture research, development or private sector activities. It helps members identify relevant funding and investment sources providing them information where to look and whom to contact. For example with help from SARNISSA West African Group of individuals developed & started Freshwater Prawn *Macrobrachium vollohovenii* farming Project Proposal and trial as well as hatchery and grow-out activities in Cameroun (figure 32).

### **Some final Reflections or Conclusions on SARNISSA**

SARNISSA is first and foremost a network of individuals. Its main strength comes from the range of members profiles, skills and experiences that are both good and bad (sometimes bad advice may be given). Its success has and will come as long as its members keep communicating with each other. It is providing a service that people want, hence it has been able to become “A self-sustaining Community of Practice”.



Enabling producers through network linkages access technical expertise



DFID funded Research into Use Aquashops project: working together with new non Aquaculture partners Farm Africa



SARNISSA Fish Farmers internet workshop Western Kenya in 2010



Helping producers organising study tours

Figure 32. Pictorial of some of SARNISSA's activities

## **Wider Reflections on Networks and Future of Agricultural Aquaculture Development worldwide**

SARNISSA's experiences including views arising from its member's discussions indicate a need to change the format and delivery for aquaculture extension and research in Africa to achieve effective outreach coverage and impact. Increasingly the influence of IT and improved communication is enabling access to information as has been highlighted from this presentation. The key facets that need to be addressed to enhance the dissemination and adoption of information by end users are:

1. Flow of information, goods and services from District level into urban markets
2. Flow of information and technology from researchers down to district level
3. Flow of information and interaction between from district to both researchers and policy makers
4. Enabling and providing capability to individual farmers to accommodate and adapt to vast changes occurring in the sector as it transforms from largely smallholder subsistence to increasingly more commercial sector with a more diverse value-chains.
5. Significantly improving accessing technical and market information
6. Taking advantage of mobile phones as a tool for enhancing the performance of aquaculture enterprises by exchange of information.

### ***3.4.2. Aquaculture in Africa – Unlocking the Potential by Mr. John Linton, Commercial Director, Natural Resources Institute, University of Greenwich, United Kingdom***

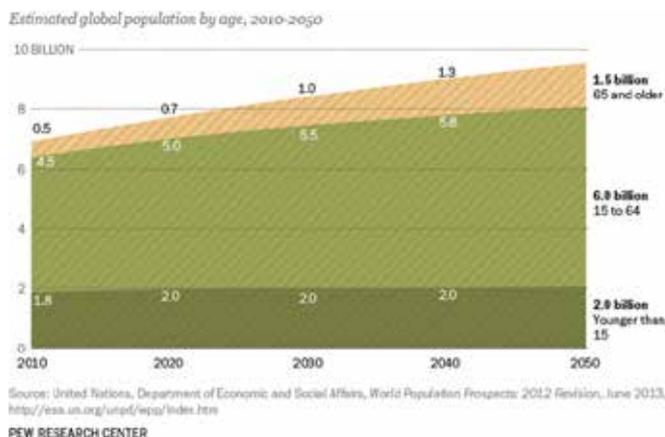
#### **Background**

The above research project funded by DFID under the Africa, Britain, China (ABC) Cooperation Programme (AgriTT) was conceived to accelerate technology transfer & information sharing between Africa and China ([www.agritt.org](http://www.agritt.org)). The Natural Research Institute (NRI) undertook this research in collaboration with the following institutions from Africa and China FFRC, SEFFA, UIBE, CSIR, LUANAR

Among the justifications for the research were the need to increase fish production in Africa to meet the rapidly increasing deficit in supply due to rising populations, declining fishery yields albeit the potential for aquaculture on the continent and evidence from China's experience that aquaculture can significantly contribute to meeting fish demand and improving rural livelihoods. There has been tremendous growth in aquaculture on the continent with a significant increase in yields. However, the current status is a far cry from projected needs and expectations. In 2012 for example, Vietnam alone produced 30% more fish from aquaculture than the entire African continent. Given the scope and diversity of Africa's natural resource base for aquaculture, Africa's aquaculture potential is tremendous. The question is then that with these resources can Africa

produce the extra 9 million tons of fish it needs annually to address the deficit from the fisheries to feed its peoples? (Figures 33 to 38).

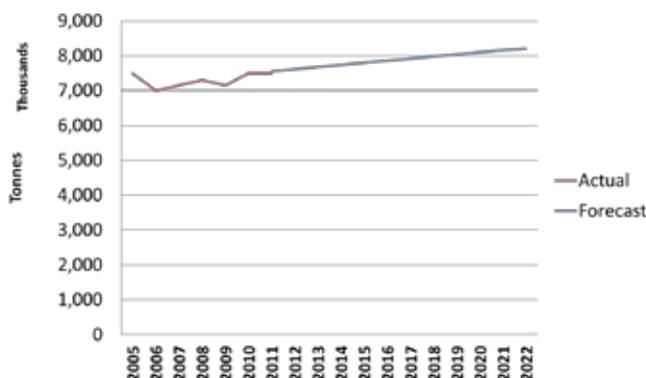
There are African success stories though. Among the African countries the greatest success in terms of aquaculture are registered in Egypt, Ghana and Nigeria. This research undertook a comparative analysis of the drivers for success between three selected sub-Saharan African countries (Ghana, Nigeria and Malawi) and China (figures 39 and 40).



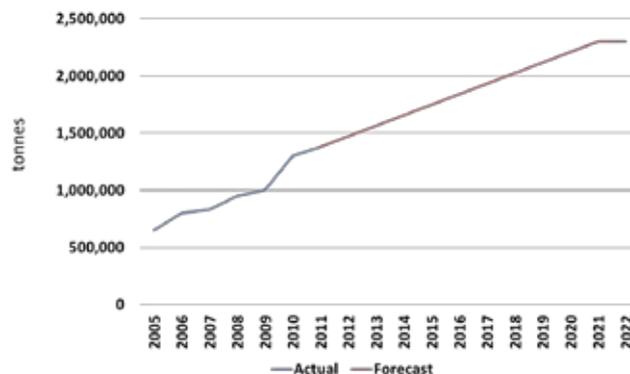
**Figure 33.** Global demographic trends indicating trends in demand for food and nutrients.

	Base period 2010-2012	2022 scenarios			
		Baseline	Intermediate	Optimistic	Mixed
<b>WORLD</b>					
Total fishery production	153,940	181,070	188,093	194,800	194,792
Aquaculture	62,924	85,134	92,402	99,330	99,330
Capture	91,016	95,946	95,692	95,474	95,462
Fishmeal production (product weight)	6,103	7,021	7,358	7,679	7,734
Fish oil production (product weight)	0,980	1,079	1,087	1,094	1,088
Fish trade for human consumption	36,994	45,082	45,565	46,237	46,566
Fish supply for human consumption	131,741	160,514	167,397	173,969	174,032
Per capita apparent fish consumption (kg)	18.9	20.7	21.6	22.4	22.4
<b>AFRICA</b>					
Total fishery production	9,037	10,427	10,528	10,634	10,296
Aquaculture	1,379	2,034	2,207	2,373	2,034
Fish exports for human consumption	1,874	1,933	1,765	1,628	1,514
Fish imports for human consumption	3,875	4,689	4,924	5,151	5,332
Per capita apparent fish consumption (kg)	10.0	9.0	9.4	9.7	9.5

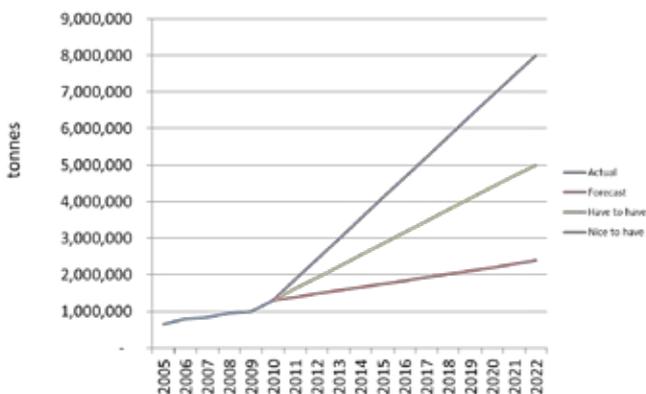
**Figure 34.** FAO'S Comparative analysis of Africa's projected 2022 estimates of fish production and consumption rates. Source: State of World Fisheries and Aquaculture, 2014; FAO



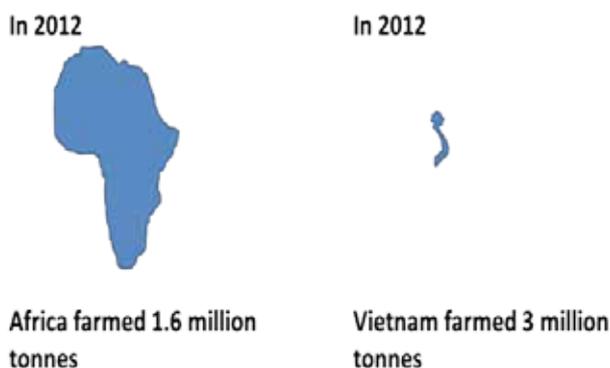
**Figure 35.** Food Production from capture fisheries is not likely to grow very much. Source: FAO State of World Fisheries and Aquaculture, 2014.



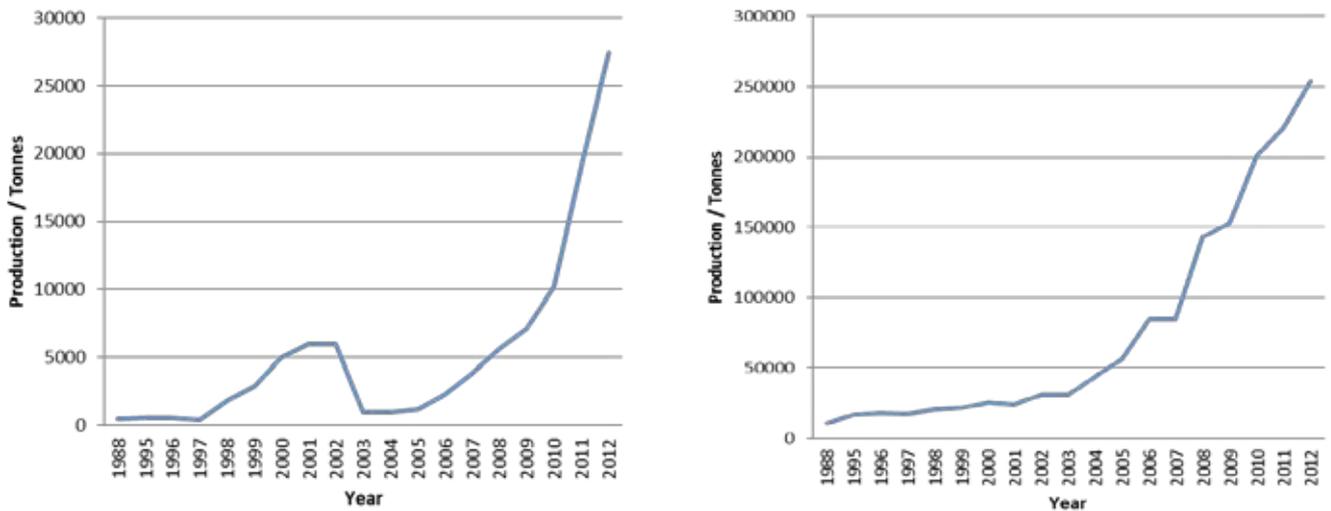
**Figure 36.** Aquaculture Production in Africa. Source: FAO State of World Fisheries and Aquaculture, 2014.



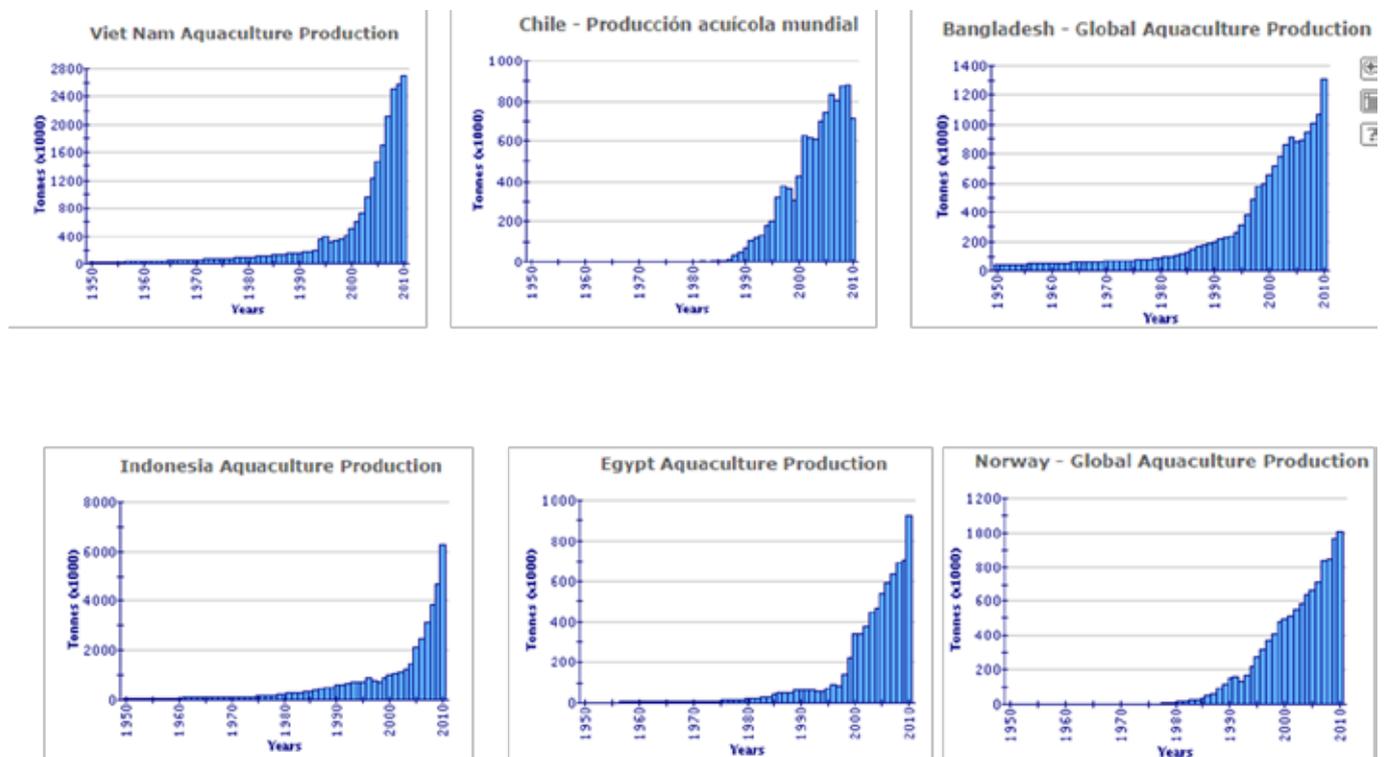
**Figure 37.** Estimated projections for fish from aquaculture in Africa based upon estimates of deficit in fish supply to meet basic needs and global standards respectively.



**Figure 38.** Graphic illustration of the status of Africa's aquaculture vis-à-vis the geographical scope of its natural resource potential to produce fish from aquaculture.



**Figure 39.** *Unlocking the Potential.* Ghana (right) and Nigeria's (left) success story. Source: *Aquaculture in Africa – Unlocking the Potential; 1st Interim Report , 2014*



**Figure 40.** *Unlocking the Potential for Aquaculture.* A global overview success stories. Source: *FAO Statistics and Various sources*

While Africa does have potential for aquaculture and a good market demand for fish, there are recognised constraints affecting supply and access to markets for fish products. Key among these arises from post-harvest losses. Fish is highly perishable. Fish has been traded throughout Africa for time immemorial. However, post-harvest losses have been regarded as a consideration that traders have had to factor into their business not as the constraint it actually is (figure 41). A robust value chain is required to resolve this.



**Figure 41.** An array of fish products on display at typical African market.

## **Unlocking the Potential? Research Rationale and Questions**

Additionally, it has been recognised that in an environment where inputs are expensive, hard to get, infrastructure is poor and the processes is sophisticated, aquaculture would indeed to a difficult enterprise to undertake. However, all these challenges notwithstanding, between 2003 and 2010 aquaculture growth in Africa ranged from between 12% - 166% year on year among states (table 7).

**Table 7.** Trends in aquaculture growth of a selection of Africa top-producing aquaculture countries.

Country	Tonnes 2012	% increase 2009 - 2012	% increase 2003 - 2012
Egypt	1,017,783	44%	129%
Nigeria	253,898	66%	728%
Zambia	12,988	53%	189%
Ghana	27,540	284%	2826%
Sub-total	1,312,209	50%	193%
Total All Africa	1,625,330	49%	166%

Source: Adapted from FAO (2014)

The questions therefore were:

- i. What makes the aquaculture value chain the entrepreneur's investment of choice in some places, not other?
- ii. What are the success factors?
- iii. What lessons can be learned by other countries seeking to expand their aquaculture production?

## **The Research Approach and Methodology**

We wanted to find out what drives growth: in China, Malawi, Ghana and Nigeria. The following structured approach was opted for based upon the value-chain illustrated below as a starting reference point of the element required for successful aquaculture (see figures 42 and 43 respectively).

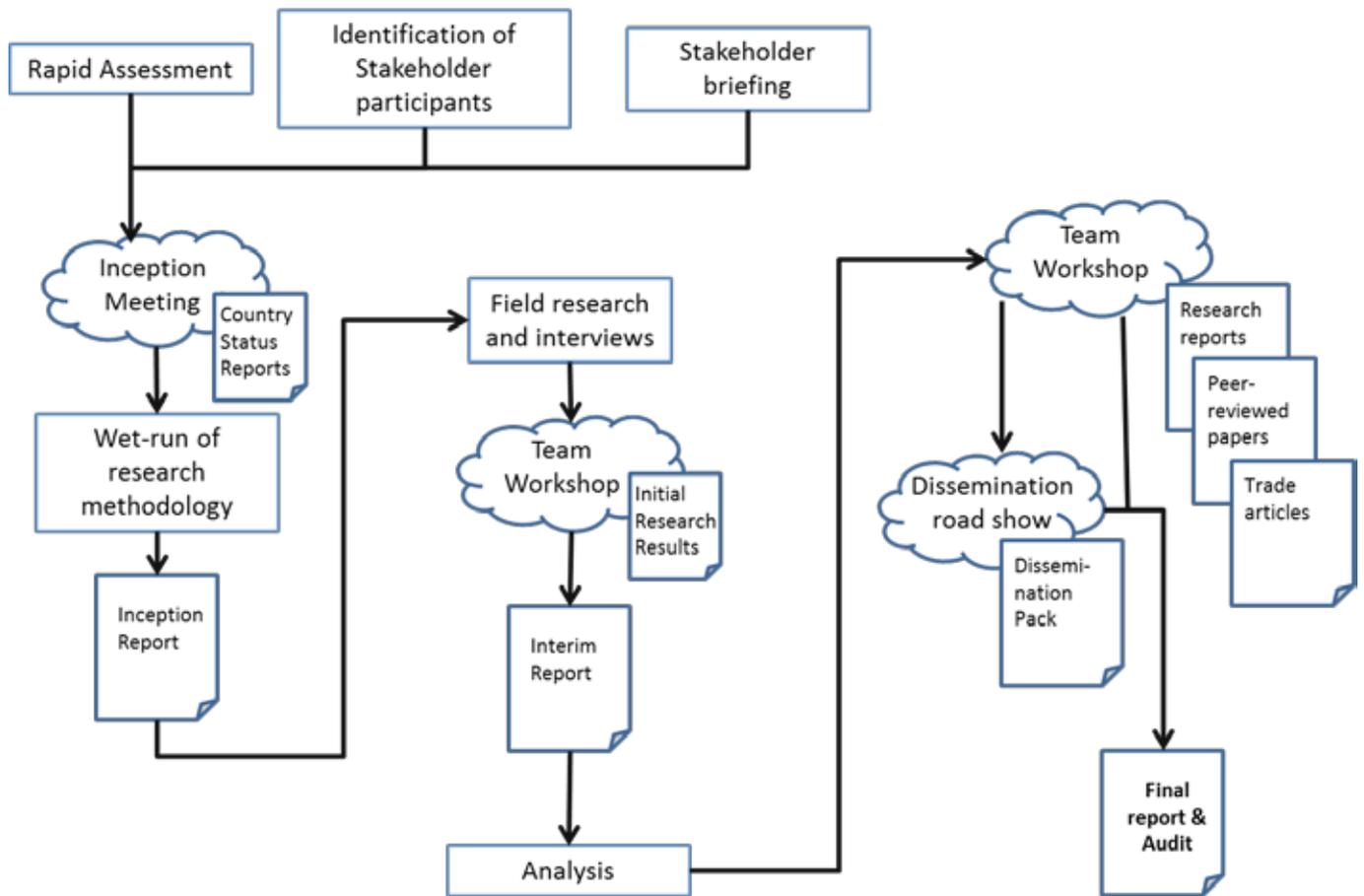


Figure 42. The Research Approach Used



Figure 43. The aquaculture value chain

An innovative participatory approach was used to collect data that involved the private sector at all stages, researchers from one country working the field work of another and sharing the results obtained with investors and entrepreneurs

## The Findings

### 1. Features of the Aquaculture Environment within the Different Countries.

The facets describing the aquaculture environment in the different countries in the study are listed in box below.

<p><b>This is what we found in China:</b></p> <ul style="list-style-type: none"> <li>• Highly productive</li> <li>• Profitable business</li> <li>• Strong Government support</li> <li>• Emphasis of quality – Input and output</li> <li>• Players are business driven</li> <li>• No magic bullet</li> </ul>	<p><b>This is what we found in Ghana:</b></p> <ul style="list-style-type: none"> <li>• High growth</li> <li>• Strong profitability</li> <li>• Vibrant market</li> <li>• Access to inputs improving</li> <li>• Private sector active &amp; vocal</li> <li>• Players who survive are business driven</li> </ul>
<p><b>This is what we found in Malawi:</b></p> <ul style="list-style-type: none"> <li>• Strong market demand</li> <li>• Stalled production</li> <li>• Underlying lack of profitability</li> <li>• No ‘shining example’.</li> </ul>	<p><b>This is what we found in Nigeria:</b></p> <ul style="list-style-type: none"> <li>• Vibrant, private sector-driven, pond based systems, servicing vibrant market.</li> <li>• High level of technical competence</li> <li>• Working for small scale, medium scale and large scale</li> <li>• Sector seen as ‘Route out of poverty’</li> <li>• Those who know about it want to be in it</li> </ul>

### 2. Dimensions of Production and Productivity

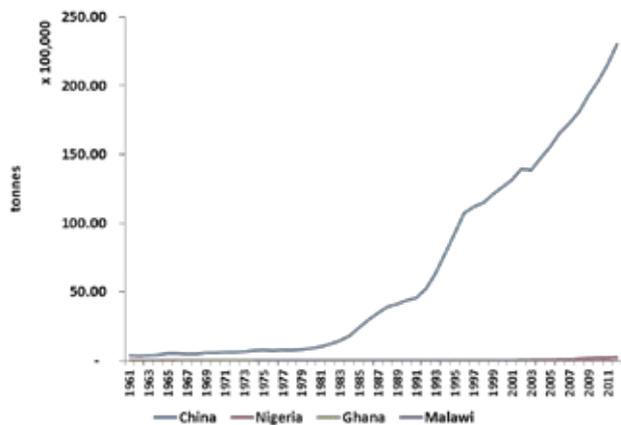
Based upon an evaluation of secondary information, field data, enterprise budgets (productivity, cost structure, income structure), enterprise management factors (fingerlings, feed, transportation, finance, full-time vs hobby farmer operator) and external enterprise factors (historical reason for promoting aquaculture, development assistance) the following is an integrated analysis:

- i. Value-Chain.** In all the four countries of the study, the following were to varying degrees, the key elements of the value chain. Most fish produced was consumed domestically and in the case of China, exports contributed significantly to the impetus for producing more fish from aquaculture (see figure 44 and 45). Access to key inputs (feed, fingerlings, knowledge and skills) and markets evidently ranked high.
- ii. Production and Productivity.** The presence of these elements likewise impacted on the levels of production. China’s producers are better skilled and have better access quality production inputs and markets. The objectives for development focussed on commercial rather than subsistence markets. Likewise, these elements are present in Nigeria, Ghana and Malawi in reducing degrees. As such overall production, production per capita and production produced per unit area are higher where these key factors are increasingly present (see figures 46 and 51).

- iii. **Access to Feed.** The results of the study indicated that in the studied countries where feed-based production systems were more prevalent, overall yields, and productivity per unit area and per capita were much higher. This is not surprising because fish growth is to a greater degree influenced by the quantity and quality of feeds fed. As a result, while retail market prices may have been lower in the higher producing countries, the turnover generated as a result of increased productivity and easier access to markets resulted into greater profits for farmers (see figures 48 and 54).
- iv. **Survival. Fish survival rates are another key element for production success.** Fingerlings stocked in good condition that are well cared for (ie. feed the right quantity and quality of feed, not exposed to undue stress during transportation to farms or within production units) during the production cycle are more likely to survive and perform better. Where there were shortfalls in these parameters, higher mortalities were experienced which in effect resulted into a significant increase in the economic cost of seed<sup>6</sup> at the enterprise levels. Where high, indications are that high average mortality rates had significant negative impacts on production, productivity and profitability. The natural tendency for farmers under such situations would be to increase fish prices which in turn, depending on the local market characteristics, can have a negative impact on rates of sale, hence turnover (53).
- v. **Feed Price versus Feed Quality.** The positive returns from feeding high quality feeds which were more costly on levels of production, productivity and returns were evident. For example the average feed cost among the countries in the study was in Nigeria. However, compared to the scenario in Malawi, on average more kg of fish were obtained per kg fed in Nigeria. The Nigerian systems were consequently more productivity, which in turn improved production efficiency. The increased productivity arising from the use of more costly high quality feeds in Nigeria (likewise China and Ghana) was at a level that offset farmers feed costs within their prevailing market environment. Figure 52 illustrates the benefits of access to quality feeds.

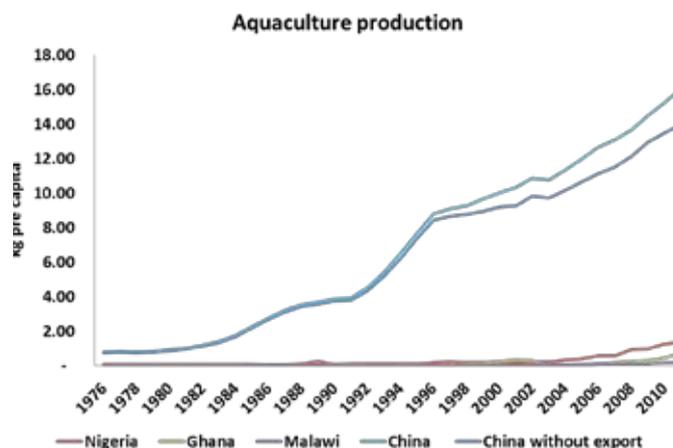
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<sup>6</sup> Economic cost of seed – The total cost of the actual number of fingerlings that have to be stocked to obtain optimum yields. Where fingerling mortalities are high, farmers often have to buy more fingerlings to replace what has been lost. This greatly increases the total cost of seed for the given production cycle affecting the variable cost structure.

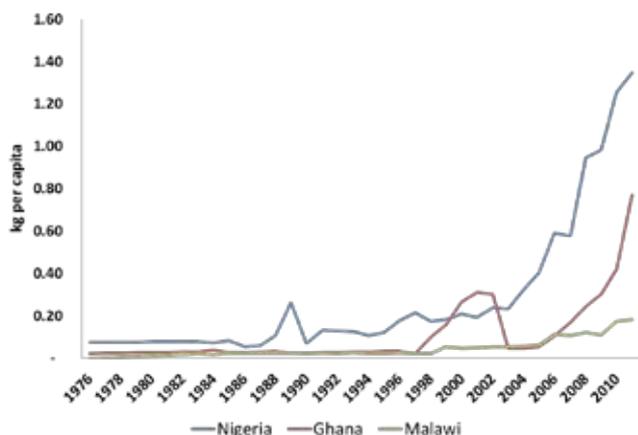


Data source: <http://www.fao.org/fishery/statistics/global-aquaculture-production/query/en>

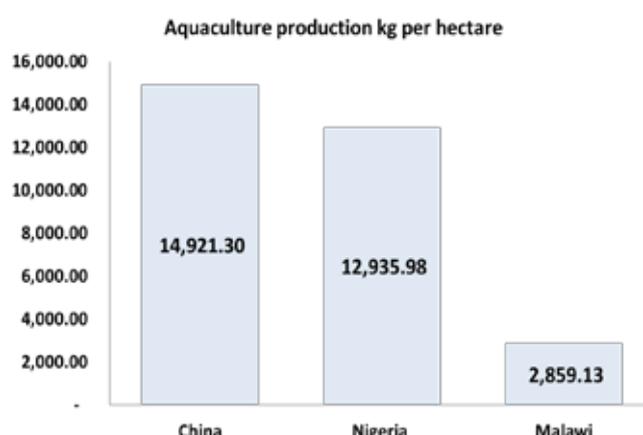
**Figure 44.** Gross Production among study countries. Data source: <http://www.fao.org/fishery/statistics/global-aquaculture-production/query/en>



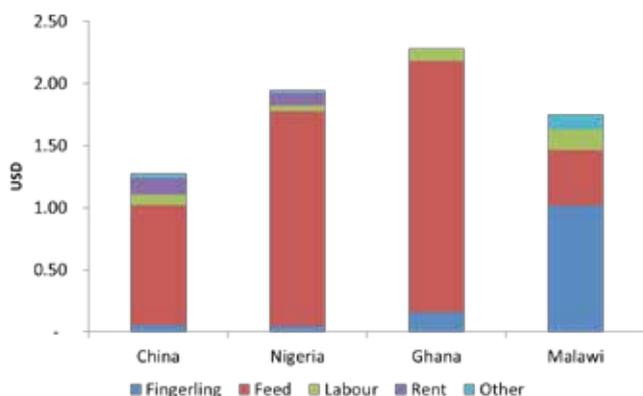
**Figure 45.** Production per head of population among countries under study. Data source: Aquaculture production from <http://www.fao.org/fishery/statistics/global-aquaculture-production/query/en>; Population from World development indicator (2014), data available on <http://data.worldbank.org/data-catalog/world-development-indicators>



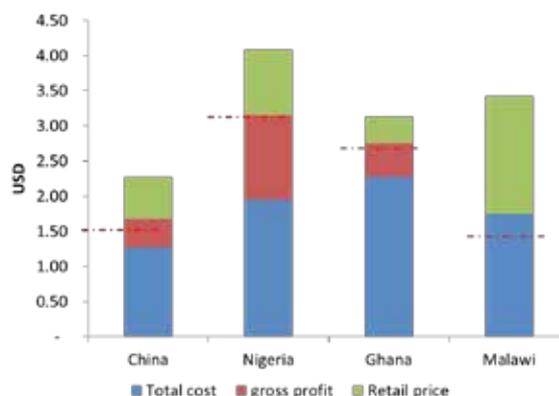
**Figure 46.** Production per head of population among selected countries of study. Data source: Aquaculture production from <http://www.fao.org/fishery/statistics/global-aquaculture-production/query/en>; Population from World development indicator (2014), data available on <http://data.worldbank.org/data-catalog/world-development-indicators>



**Figure 47.** Average productivity of aquaculture units among selected countries of study. Data source: Field research data, calculated using Sample production/Sample Pond area and averaged.



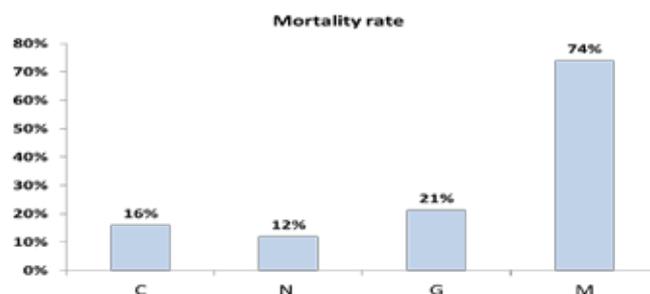
**Figure 48.** Cost structure of aquaculture enterprises among countries under study Data source: Field research data



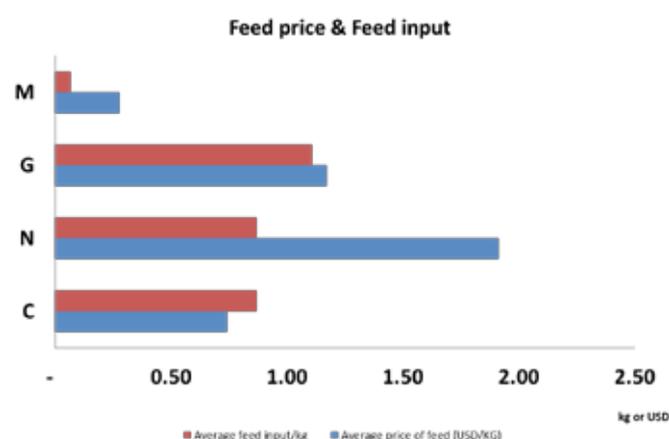
**Figure 49.** Income structure from aquaculture enterprises among countries in study Data source: Field research data

	China	Nigeria	Ghana	Malawi
No. of fingerling needed per kg production@100% survival rate	1.6	0.7	1.94	15.38
Fingerling unit price	\$0.03	\$0.06	\$0.05	\$0.02
Fingerling price /kg output (theoretical)	\$0.048	\$0.042	\$0.097	\$0.31
Actual fingerling cost /kg output	\$0.06	\$0.04	\$0.16	\$1.02

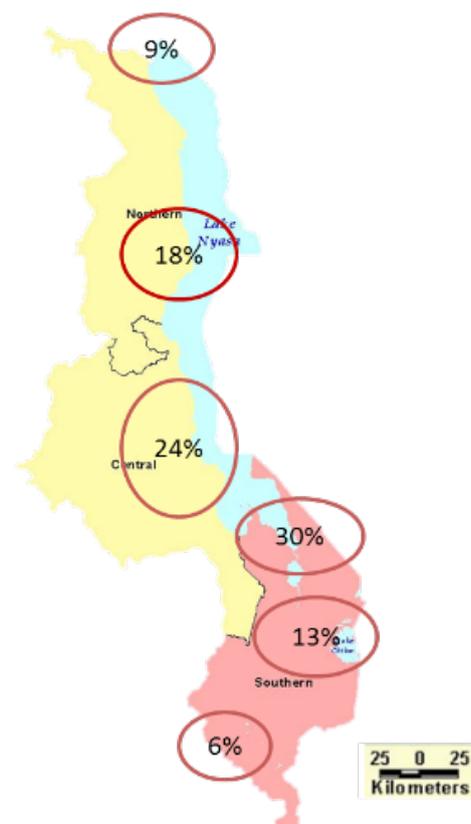
**Figure 50.** The price & cost of fingerlings among countries in the study. Data source: Field research data, Data from Malawi Partner



**Figure 51.** Fingerling mortality rates among countries in the study. Data source: Field research data. C – China, N – Nigeria, G – Ghana, M – Malawi



**Figure 52.** Cheap feed or good practice? The benefits from feed utilisation among study countries. Data source: Field research data. C – China, N – Nigeria, G – Ghana, M – Malawi



**Figure 54.** Status of access to markets for farmers across Malawi. Malawi data source: Malawi Government (2014), Annual economic report 2014



**Figure 53.** Transportation of fingerlings

## Conclusions

The following were found to be the success factors for unlocking the potential for aquaculture among the countries studied:

### Success factor I: A demonstrably viable business model

- Getting the business model right was found to be a critical activity during the first phase of development.
- Demonstrability was very important. If people don't see it, people won't replicate it.
- Sustainability was found to be a critical element of demonstrable viability.
- Likewise, so was flexibility.

- Viability was not limited to the pond – the whole value chain needed to be viable.
- Developing a demonstrably viable business model was not a quick fix. It involved many factors and demanded cooperation among all stakeholders.
- Aquaculture was found to be aspirational

### **Success factor 2: Competence**

- Almost without exception, all those operating in successfully in the value chain were enthusiasts.
- This commitment and passion was seen in the support services that serviced the value chain.
- Where this was the case,
- Farms were managed well and profitably
- The industry was resilient
- Actors in the value chain actively sought knowledge and innovation
- Actors in the value chain developed a voice
- Participation in the value chain became an activity and investment of choice
- The value chain became a National asset

### **Success factors 3-5: location, location, location**

- Location was found to be extremely important because other factors notwithstanding, it determined accessibility. Ease of access to natural resources for aquaculture (e.g. water be it in a rural or urban environment, land), inputs, technology, knowledge, services and markets depended on one's location.

### **Success factor 6: Value Chain Governance**

The status of value chain governance encompassing the following sectoral dimensions was among the key success factors noted:

#### **Inputs**

- Getting what you pay for
- Knowing what to ask for
- Having a choice

#### **Research & extension**

- Research linked to innovation and value addition
- Extension speaking to the thirst for knowledge
- Making best practice common practice

## **Public-private partnerships**

- Based on commitment to achieving mutual goals
- Responsive governments and a responsible Private sector
- The presence stakeholder and community voices

## **An appreciation of the value of R&D**

### **3.4.3. Status of fish trade and overview of WorldFish aquaculture activities in Africa: Dr. Sloans Chimatiro, Fish Trade Project Manager**

The WorldFish is an international, nonprofit, research organization, a member of the Consortium of International Agricultural Research Centers (CGIAR). Its mission is to reduce poverty and hunger by improving fisheries and aquaculture. WorldFish's vision is to be the research partner of choice for delivering fisheries and aquaculture solutions in developing countries. The organization at this stage is entering a new phase with the preparation of the CGIAR Research Program (CRP) on "Fish Agri-Food Systems".

The fisheries and aquaculture are important to Africa. There has been a great transition in the African aquaculture environment that has been influenced by several policy initiatives WorldFish's work in Africa has subsequently focussed on improving technology, enterprise viability, policy, genetic improvement and training. With respect to the above, the following are the specific activities WorldFish being undertaken in Africa (figure 55):

- 1. Aquaculture technology** – Research is on-going to improve tilapia and catfish strains, develop affordable and sustainable fish feeds and feeding systems, fish health and disease control and develop environmentally sustainable productive systems
- 2. Enterprise viability** – studies have been done to assess value chain analysis and development as well as business and enterprises.
- 3. Enabling policies and investments** – Findings from the above have been documented and shared to advise policy makers and investors.
- 4. Training for practitioners and entrepreneurs** – Training courses are provided at our Africa regional centers for practitioners and entrepreneurs. Through these courses findings from our research is disseminated directly the beneficiaries who are additionally equipped with the skills to adopt.
- 5. Genetic Improvement** – The following genetic improvement programs are ongoing (i) *O. niloticus*

Abbassa strain and African catfish Industry “strains” Abbassa program in Egypt, (ii) Comparative assessment of Akosombo vs. GIFT strains in Ghana, (iii) Ghana Independent program in Kenya and (iv) *O. shiranus* in Malawi.

### WorldFish Research Facilities in Africa and their Impact

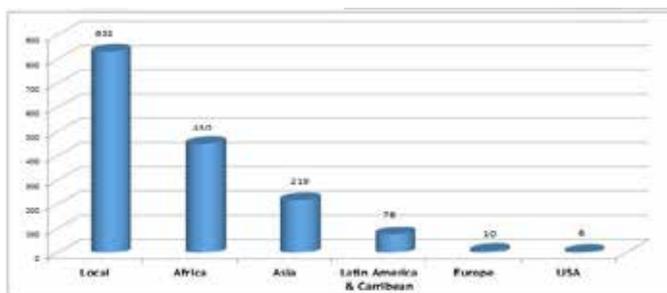
The Abassa Regional Research Centre, Egypt was set up in 1997. The Egyptian government made available to WorldFish part of its Aquaculture Research Center facilities at the Central Laboratory for Aquaculture Research (CLAR) at Abbassa in Sharia. The centre covers 52 hectares comprising 162 production ponds inclusive of plus small experimental ponds and 10 hectares offices, training facilities, laboratories, accommodation. Extensive refurbishment done with assistance from JICA. The greatest impact of the centers activities has been within Egypt and Africa (Figure 55).



Location of Abbassa, Egypt



Research and Production ponds, Abbassa, Egypt



Outreach: Reaching the world - Lessons from Abbassa



Undergraduate students at University of Ibadan. Picture courtesy of S. Chimatiro

**Figure 55.** Pictorial of WorldFish activities in Africa

The African Heads of State and Government’s Malabo Declaration of 2014, provides the policy guidance for WorldFish’s African Strategy. The Malabo Declaration seeks to enhance conservation and sustainable use of all of our natural resources including land, water, plant, livestock, fisheries and aquaculture, and forestry, through coherent policies as well as governance and institutional arrangements that contribute to the development of Africa’s economies. It further aims at tripling by 2025 the level of intra-African trade in agricultural commodities (including fish) and services. To accomplish this, the Malabo Declaration further seeks to by the year 2025 ensure that at least 30% of Africa’s farm, pastoral, and fisher households are resilient to climate and weather related risks.

## **Lessons from WorldFish collaboration with AU-IBAR and NPCA in the Fish Trade Project**

The African Union's CAADP targets to achieve a 6% growth GDP as a result of agriculture. Among the priority strategies for achieving this, is through equitable regional trade. Cognizant of Africa's continental agriculture as well as fisheries and aquaculture policy The Fish Trade Project was embarked upon in collaboration with AU-IBAR and NPCA with support from the EU with the aim of improving the policy environment to improve food security and reducing Poverty through intra-regional Fish Trade in sub-Saharan Africa.

The lessons that have been learnt within the sphere of fish trade so far from this on-going four year project that begun in 2014 are that in many countries are that fish prices for many species are high relative to fishing costs while the relative cost of fish farming is still high. Tentative findings indicate that as a result, there is overfishing and over-capacity in the capture fisheries and under-investment in aquaculture. Furthermore, tentative results show that while attention to aquaculture is on the increase, the small marine and inland pelagics from capture fisheries still remain a major source of fish. These findings indicate the need to balance the policy push for aquaculture against the trade-off on re-building fish stocks for food security.

A key lesson from the collaborative partnership in this research with African Union and NEPAD Agency is that WorldFish has been enabled to contribute to the delivery of evidence-based Pan-African policies and development priorities. In addition, support to the CAADP Expert Pool on Fisheries (through involving African Universities in this research) is strengthening the science capacity at national level and bridging the gap between tertiary education institutions, research institutions and their governments. Furthermore the resultant Capacity Gap Analysis being undertaken as a result of this innovative research process has created a platform for experiential learning among Trade & Aquaculture Associations in Africa. Additionally, through third party collaboration to global universities (such as through AgriTT), the value of going beyond value chain analysis to value chain governance has been realized as it enables the understanding of relationships among all players, including regulatory institutions.

### **The Next Steps**

The following are the envisaged possible next steps arising from WorldFish current activities in Africa:

- i. FishTrade Program might provide partnership foundation upon which the WorldFish African Strategy and the CGIAR core science programs could link with policy-makers, science/knowledge institutions, fish producers and traders

- ii. We are unlocking the knowledge on trade flows and value chains for farmed and capture species that might be valuable in targeting the technologies
- iii. The Peer-Mediated Learning (PML) approach we are developing with African Universities might be a model for creating a critical mass of scientists in areas where Africa has shortage (e.g. tilapia breeders)
- iv. Understand factors affecting the development, transfer, uptake and adaptation of aquaculture technologies.
- v. Support and develop market and governance that are conducive to investments.
- vi. Establish innovative investment financing for small & medium enterprises (SMEs) in aquaculture.
- vii. Explore options to create a platform to promote south-south learning in order to fast-track technology adaptation and adoption.
- viii. Support repackaging of existing technologies to leverage the new capabilities for emerging fish farmers.
- ix. Support alignment of production with diverse consumer preferences in order to enhance profitability of fish farms.

***3.4.4. Transformation of small-holder aquaculture to market led commercial and global industry; public policy and investment strategy, example of catfish industry; issues and challenges - Dr. Karen Veverica, Auburn University, USA***

The experiences that characterised the transformation Catfish aquaculture in the South-Eastern USA from a small-holder aquaculture activity to a global industry were shared in this presentation. The American catfish (*Ictalurus punctatus*), unlike the African catfish (*Clarias gariepinus*) is not an air breather and is less hardy. The American catfish has relatively large eggs, can begin feeding on formulated powder and can grow to market size in one year. However, because of the regions cold winters during which time fish growth is suppressed due to the cold water temperature, it usually takes two years to attain this marketable size. The fish has a white, mild tasting flesh. The US market prefers market is mostly for fillets. Fish meal powder, a major product of the catfish industry is produced from the by-products of filleting.

The demand US fish and farmed catfish. Average per capita seafood consumption in the US was only 6.6 kg per person per year in 2013. As a source of fish, farm-raised catfish ranks 8th behind shrimp, salmon and tilapia. US catfish production was highest in 2003 when it peaked 301,000 tons but has been contracting since due to issues of profitability for farmers, increased availability of alternative more competitive sources of fish and changes in consumer preferences. The average annual price received by producers was \$2.62/kg in 2014. Production is subsequently falling. The estimated total area under catfish production was 28,500 ha in January, 2015. Most catfish are

mostly raised in ponds ranging from 3 to 18 ha with variable rates of aeration.

## **The History of the American Catfish Industry**

The following were the key facets that contributed to the transformation and have influenced the characteristics of America's current catfish aquaculture industry.

1. Initially there was the discovery of the potential to farm the catfish mainly by the farmers with some support from researchers.
2. The development of this potential into a technically and economically viable agricultural activity was subsequently a joint effort between farmers, investors, research and extension.
3. Upon a few farmer's with demonstrable success, there was increased diffusion and adoption with support from extension services.
4. This success however, resulted into over□production.
5. This resulted into contraction of the then existing markets and and/or new markets had to be identified to sustain incomes from the enterprise.
6. The resulting reduction in profit stimulated specialization by producers as a mitigation strategy allow for concurrent increase in total volume more efficiently.
7. The industry has subsequently become more "stable" over time with occasional "house cleaning" whereby the inefficient farmers tend to go out of business.
8. Considering the characteristics of the national market whereby there are more species on the market and competition from imports of similar fishes, efforts are under way to diversify the sector by introduction new species. More of the smaller farms are now focusing on producing higher priced products or to operating purely as hatcheries in order to remain in business.

## **Success factors**

The following are among the factors that have had positive influence on catfish farming in the US:

1. Relatively inexpensive power that is very reliable. This has enabled farmers adopt aerate ponds and utilize other equipment during their operations to increase efficiency and reduce labor costs.
2. Very good infrastructure notably roads, transport trucks, processing plants hence fish can be transported rapidly in good condition
3. Low property taxes in Alabama, which implies producers can afford larger expanses of land for pond production as opposed to other states.
4. Much water available year round from high water tables or from rain (see figure of catchment ponds)
5. High technical capacity of farmers

6. High purchasing power of population.

## Current Challenges

The following are the major challenges currently affecting the sustainability of the sector:

1. Competition from fish imports of similar characteristics from China, Vietnam and Central America
2. Continued reliance on production technology geared towards inexpensive feed and water conservation, notably:
  - a. Farmers drain watershed ponds only once every 7 to 10 years
  - b. They stock these ponds every year and seine out every year
  - c. The use mesh size to allow smaller fish to escape seine or holding net
  - d. With channel catfish net about 70% of fish is caught in single seine haul
  - e. Result after 5 years is a fish ranging in size from 1 to 5 kg
  - f. Feed conversion is becomes high (on average about 2.3) due to larger fish and unequal size classes in the pond. The high feed conversion lowers profit margins tremendously.
3. Aging ownership of fish farms as younger population is not as interested in taking up aquaculture.
4. Increasingly there are more competitive uses for the land. More fish farmers in Mississippi consequently switched to row crops.
5. The seasonal growth of the Catfish in the US which results into a 2 year production cycle, whereas similar farmed fishes elsewhere in the world can get marketable size within 1 year.

Figures 56 to 62 below graphically give an overview of the status, opportunities and challenges faced over time within the commercial catfish farming value-chain.

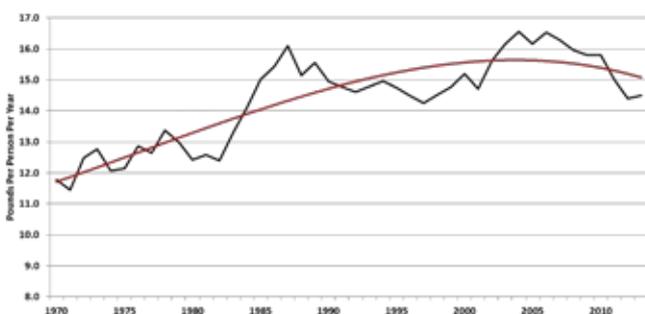


Figure 56. US seafood consumption



Figure 57. Ponds at Auburn

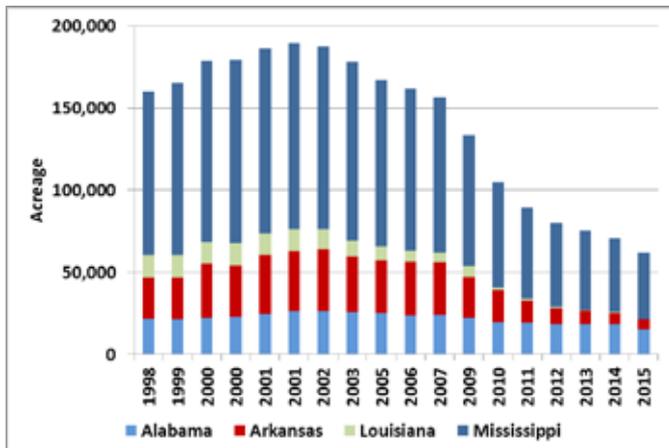


Figure 58. Acreage under pond catfish production among the major Catfish producing South-Eastern US States

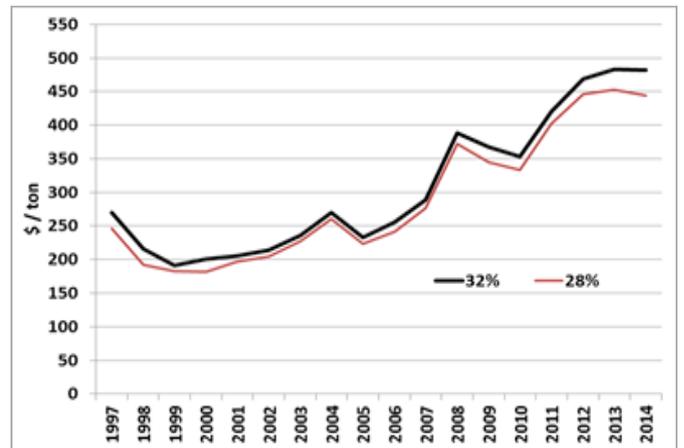


Figure 59. Prices for 28% and 32% Crude Protein, Floating Catfish Feed, 1997 and 2014.



Figure 60. Marketing -Auburn University

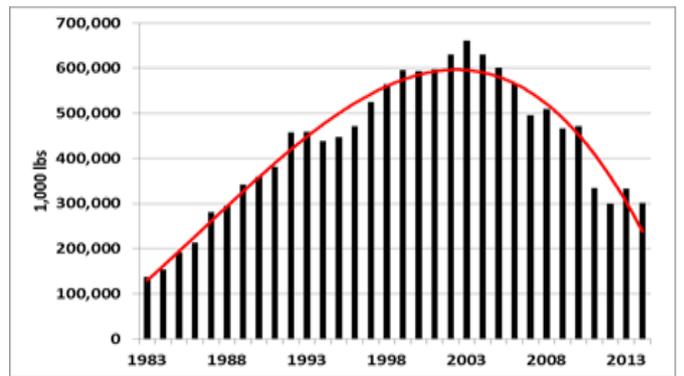


Figure 61. Amount of farmed catfish processed by U.S. Processors between 1980 and 2014

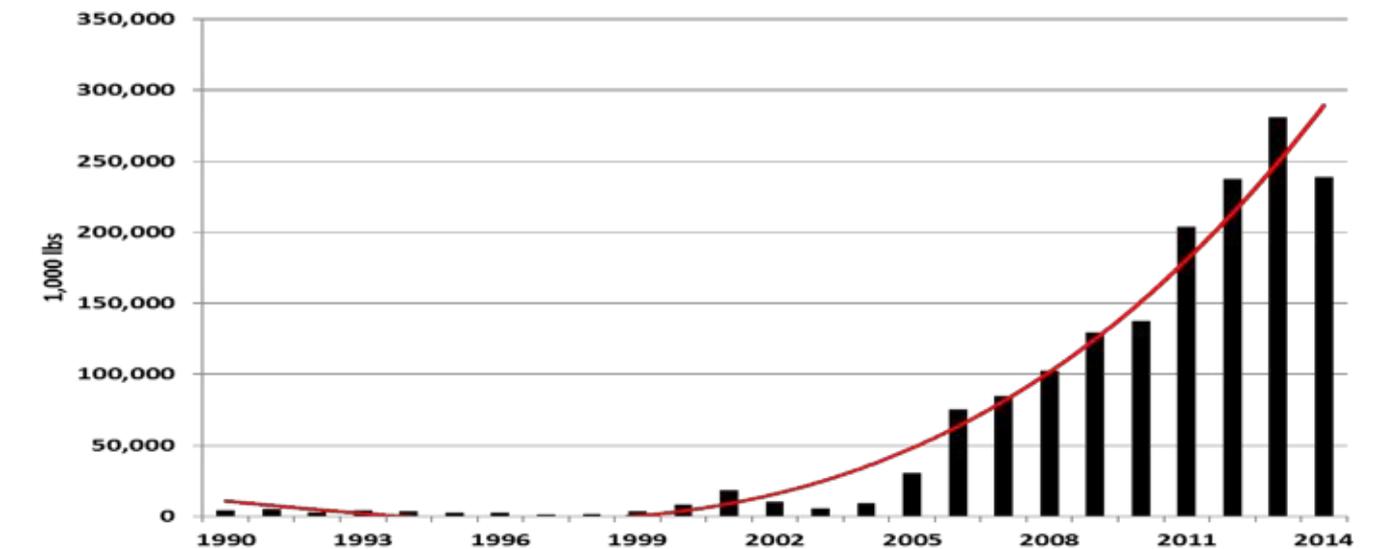


Figure 62. The competition -Volume of catfish imports between 1991 and 2014.

### Regulatory Issues

United States Department of Agriculture (USDA), Food and Drug Administration (FDA) and the Department of Interior are the federal agencies under which aquaculture practice is regulated. Data is collected from producers, process and feed mills. The States regulate transport of non-native fish species across state lines. There are only six drugs now approved for aquaculture and not all are for treating all diseases. New rules are coming on board for prescribing antibiotics and for processing plants. It takes a long time to approve drugs and vaccines depending on how long

it takes to validate these.

#### **3.4.5. Assisting Aquaculture Development in Africa – Dr. John Benzie, Principal Scientist/ leader fish genetics and Dr. Malcom, Dickson, Manager, Research programme WorldFish**

Among WorldFish global outputs is the Genetically Improved Farmed Tilapia (GIFT) which is proven success a proven success in over 9 countries where it's farmed. It grows 50 to 80% faster and has a high survival. In the Philippines, 70% of the farmed tilapia on the market is GIFT. The 'GIFT-technology' is used in other regions largely by private sector developments.

#### **Genetic improvement programs in Africa**

There are genetic improvement programs running in Africa, (i) on *O. niloticus* the Abbassa strain – Egypt, Akosombo strain – Ghana, GIFT strain under assessment – Ghana and an independent program in Kenya (ii) on *O. shiranus* – Malawi and (iii) African Catfish Industry “strains” Abbassa program – Egypt.

Introduce or genetically improved farmed strains can have negative environmental impacts over time. It is therefore important that such decisions be guided by a risk assessment. WorldFish experience indicates that such an assessment should comprise among others (i) the molecular characterization of wild genetic diversity that would enable the assessment of potential genetic impacts on native biodiversity, (ii) an impacts on fish communities, fisheries, livelihoods and economy, (iii) quarantine and strain comparisons to indigenous stocks and (iv) compliance to the Convention of Biological Diversity; Nagoya protocol, FAO Code of Conduct and National legislations.

High performance strains are a key input for aquaculture, hence the need for improved strains. In light of the environmental risks of new introductions strategies for the improvement of indigenous species are being developed subject too to risk assessments. The WorldFish is now measuring on-farm performance of improved strains to feedback to breeding programs. New characteristics related to robustness and disease resistance based on genomic tools integrated with other technologies are being investigated.

The level of selective breeding in Africa is low. The factors promulgating this are:

1. Fry and fingerlings from wild stocks are easily available and constitute a major source.
2. Lack of tradition and transfer of selection technology and knowledge of quantitative genetics for fish.
3. Shortage of well-trained quantitative geneticists.
4. A small, fractionated industry; little policy influence and inadequate seed value chains to facilitate

multiplication and dissemination.

5. Weak quality seed markets - willingness to pay for genetically improved seed means difficult to recoup investment.
6. Low profit margins for hatcheries and/or breeders.

### Quality seed: A whole value chain approach

A pre-requisite for successful commercial aquaculture is the availability of productive, healthy seed that is accessible to farmers in the quantities, sizes and at the time farmers need them. Accomplishing this entails a value chain approach to fish seed production and distribution (figure 61). Genetics is among the input and services of this value-chain.

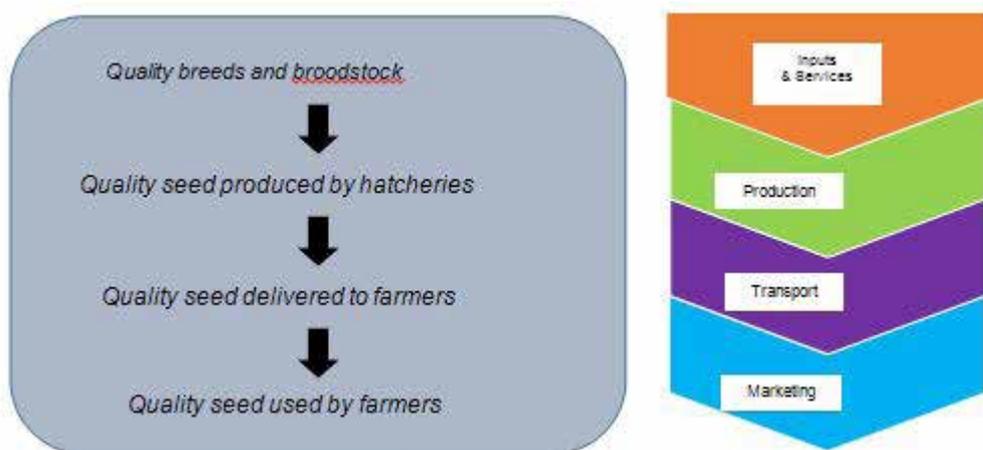
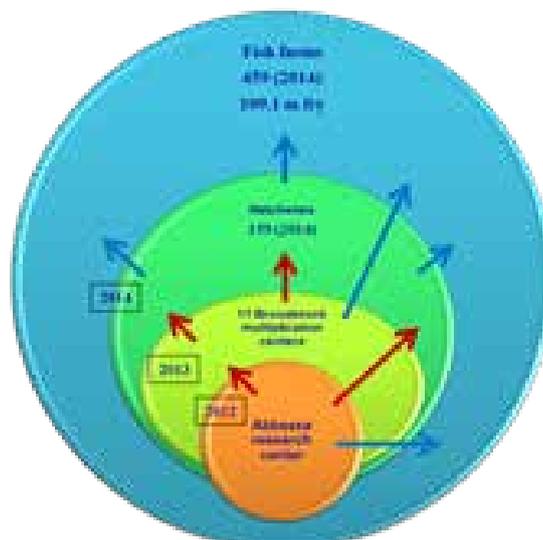


Figure 63. The fish seed value-chain

### WorldFish Experiences with the Development and Promotion of the Abbassa strain of Nile tilapia in Egypt

The Abbassa strain was developed at the Abassa Research Center, Egypt. Upon its development, mass production of the Abbassa strain was scaled up under the Improving Employment and Income through Development of Egypt's Aquaculture Sector (IEIDEAS) project through a network of Broodstock Multiplication Centers (BMCs) and Hatcheries (see figure...). from 2012 the broodstock supplied to Broodstock Multiplication Centers that multiplied broodstock for distribution to hatcheries within the fish farming areas. These hatcheries mass produced all-male fry for stocking on farms. In 2014, 459 farms were stocked. An estimated 2,000 farms were stocked with all-male fry were distributed from these registered hatcheries in 2015.



**Figure 64.** Abbassa strain dissemination strategy in Egypt under the IEIDEAS project

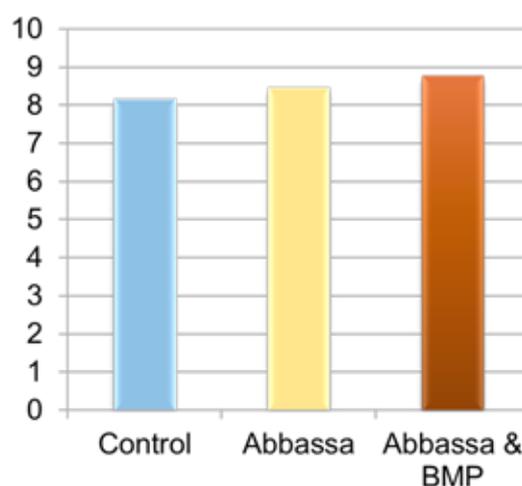
The IEIDEAS project also evaluated the impact of the Abbassa Strain. For farmers, the benefits of the Abbassa strain have been faster growing, better survival, better food conversion (hence lowered production costs), greater resistance of fish to diseases and more docile fish that are easier to handle during production such as when grading fish. While there were recognizably relatively small increases (5%) in yield from stocking the Abbassa strain, it was noted that the adoption of Best Management Practices (BMP) by farmers (notably stocking rate, feed rate, temperatures, preferred harvest size, market conditions, etc) affected yields more (see table 8 and figure 65 below). Higher yields and lower costs for the farms using the Abbassa strain resulted in greatly increased profits. Lower costs result from lower FCRs for Abbassa strain. On-farm growth rates during production of the strain have yet to be evaluated.

**Table 8.** Profitability (EGP/ha and % profit)

	Sales EGP/ha	Total Costs EGP/ha	Net profits EGP/ha	Profitability % of Total Sales
Control	100,941	81,659	19,281 <sup>a</sup>	13 <sup>a</sup>
Abbassa	104,530	72,073	32,457 <sup>b</sup>	31 <sup>b</sup>
BMP+Abbassa	115,268	79,023	36,245 <sup>b</sup>	34 <sup>b</sup>



**Figure 65.** Comparative yield between the Abbassa strain and Control



For the consumers, the major benefits have been improved access to a more affordable, nutritious and safe fish that is produced under environmentally friendly conditions.

### **Expected long-term impacts of the Abbassa strain**

The Abbassa strain is currently popular among farmers as it is the only 'improved strain' on the market. It is also popular among wholesalers because the fish looks good and crop is evenly sized. It is envisaged that once more farmers get used to it and the Abbassa strain becomes more available farmers, there may be up to a 20% increase in tilapia production. This improved performance would potentially translate into:

- i. 11,000 more jobs over a 5 year period (Within 5 years say 50,000 ha of ponds @ 8t/ha/yr producing 20% more fish, @14 jobs per 100 t/yr = 11,000 jobs).
- ii. A national added value @30% net profit (cf 13% for control) = \$100 million per year

The release G13 or G14 would result into more impact!

### **Dissemination of Best Management Practices**

Given the significant impact of BMPs on yields, the IEIDEAS project has also embarked upon the extensive dissemination of BMPs. The full training package constitutes 16 sessions that cover 10 subject areas right from site selection to post-harvest handling. Training is delivered via the farmer-to-farmer extension pathway in practical training sessions involving small groups. To-date, trainers have delivered over 3,200 training sessions, each session with around 10 trainees. Over 2,900 trainees reached, 2,200 of whom have completed full BMP training. 90 hatchery owner/operators have also been trained on hatchery BMPs.

The following are the findings from an Impact assessment of BMP training by IEIDEAS project:

1. Trained fish farmers concentrate on improving profitability by producing more efficiently - rather than increasing production.
2. Trained fish farmers stock fewer fish, control feeding and improve water management which gives more fish in the larger size grades namely tilapia super and tilapia I and mullet grade I
3. Wholesalers pays more for larger grades, resulting in increased profitability. Consequently there is a 27% net profit for BMP trainees as compared to only 13% for farmers who raised fish under control (i.e. as usual). This added profit is the equivalent of \$16,000 – 18,000/farm extra profit for each BMP farm!
4. It subsequently is estimated that the project impact shall be \$27 million/year in extra profits from BMP just training.

## **Lessons from Egypt for African aquaculture development**

The following are the major lessons learned from the IEIDEAS:

1. The two main factors that have led to Egypt's success in aquaculture are:
  - a. Commitment in terms of land (120,000 ha), training, legal framework, leasing system for land and equipment
  - b. The value chain has been profitable leading to private sector investment in farms and services (e.g. feeds manufacture, hatcheries, technical expertise)
2. There are still gaps and much more has to be done on market development, increase the adoption of BMP, genetics improvement of farmed strains.
3. For sub-Saharan Africa there need to identify and support profitable value chains (e.g. Egypt-tilapia, Nigeria-catfish, Zambia-tilapia) and create a conducive environment that provide the conditions for them to grow to scale and encourage private-sector investment.
4. Near profitable value chains need focused R&D efforts to achieve profitability notably of improved strains, BMP training, market development, new farming systems, etc.
5. Small-scale farmers will benefit from the services developed by large-scale fish farming.

### ***3.4.6. Aquatic animal health, diseases and seafood safety- an imperative for sustainable aquaculture development- Dr. David Scarfe, World Aquatic Veterinary Medical Association, United Kingdom***

The objective of this presentation provided a glimpse of the status of aquatic animal disease and its control globally in order to stimulate discussion and decisions in this area. Recent aquatic animal disease outbreaks, the rapid expansion of aquaculture and trade in aquaculture produce are among the major driving forces to ensure an adequate workforce to prevent, control & eradicate aquatic animal diseases, the increased global efforts to ensure an adequate infrastructure to respond to disease outbreaks and current initiatives to support aquaculture biosecurity. It is predicted that by 2050, half the animal protein consumed by people will come from aquaculture (Barry O'Neil, President OIE – May 24, 2009). While capture fisheries yields have been falling for some time (and in some cases to levels that may not or would take decades to recover), aquaculture (has been growing rapidly and currently almost equals that of the capture fisheries (figures 66 and 67). In comparison terrestrial livestock protein production has remained stable for a long time, and currently only pork production exceeds aquaculture production.

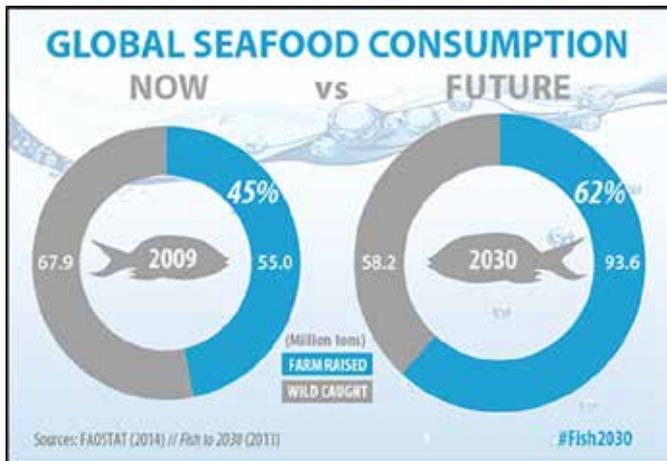


Figure 66. Aquaculture & Harvest Fisheries

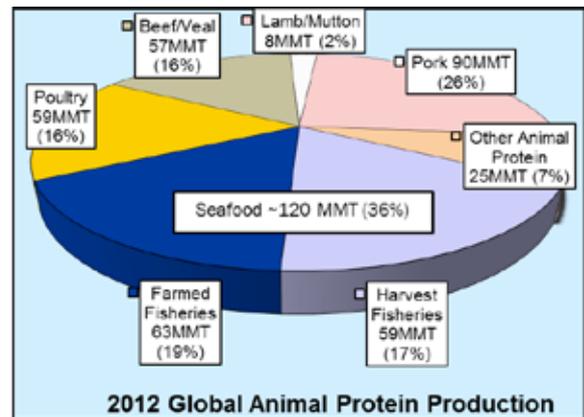


Figure 67. All Animal Industries Protein Production

By 2050 approximately 100% more food production shall be needed globally. The rapidly increasing demand for food security, food safety and supply has also influence a shift in global food (fish inclusive) import-export characteristics. This scenario for aquaculture has presented with increased risk & impact from aquatic animal disease and seafood safety. Hence the need to rapidly develop appropriate regulations to mitigate against what is now among the greatest threats to the rapidly expansion of the aquaculture industry – disease (see figures 68 and 69).

**Direct Losses from Aquatic Animal Diseases**

Thailand (1983-93)	US\$100M
China (1993)	US\$400M
India (1994)	US\$17.6M
Thailand (1996)	US\$600M
Ecuador (1999)	US\$280M
Global loss (1997)	US\$300M

**Shrimp Diseases – Americas**

WSSV (1999)	US\$ >1B
TSV (1991-92)	US\$ 1-2B
YHV (1992)	US\$ 0.1-0.5B
IHHNV (1981)	US\$ 0.5-1.0B

Figure 68. Trends in direct losses from aquatic animal diseases

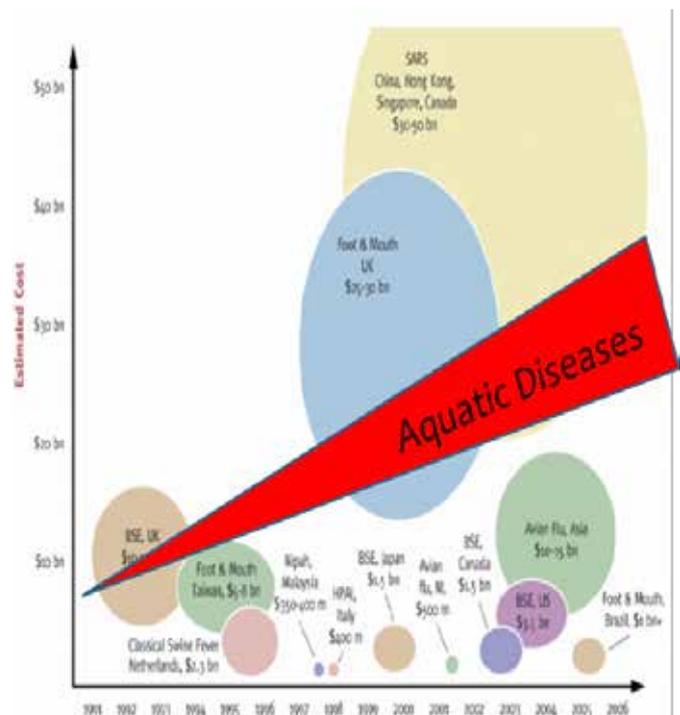


Figure 69. Trends in Cost of Aquatic & Terrestrial Animal Diseases. Adapted from K. de Balogh FAO (2010)

**What's needed?**

The capacity to control the occurrence, spread and consequent impacts of aquatic animal diseases needs urgently to be built. This shall entail the:

- I. A well Trained Veterinary Workforce comprising veterinarians, para-vets and technicians to deliver service to producers. The estimated global demand for a well-trained aquatic veterinary

work force is approximately 100,000. The OIE through its tool for the Evaluation of the Performance of Veterinary Services (OIE PVSTool) on “Day 1” Competency in Aquatic Veterinary Medicine identifies 9 core pre-clinical & clinical competency areas for all aquatic veterinarians; establishes Knowledge, Skills & Experience (KSE) & Assessment (KSA) requirements; identifies sources of KSEs (i.e. university courses, continuing education & professional development, self-study, etc.); recognizes (certifies) those with core competencies and supplements what is not generally available in veterinary curricula

2. Improved Government Veterinary Infrastructure to support the industry with regulatory functions and emergency disease outbreak responses.
3. Establishment of Integrated Veterinary Support Services to provide diagnostic services, epidemiology, surveillance, etc. Rapid response to disease requires efficient aquatic animal health laboratory networks for example.

The core principles for the control of aquatic animal diseases are outlined in the OIE’s Aquatic Animal Health Code and Manual of Diagnostic Tests for Aquatic Animals.

#### **3.4.7. A video by Dr. Ololade Adegoke, Sustainable Environmental and Fisheries Foundation (SEFFA) with support from DFID Aquaculture in Africa - Sharing a Success Story**

### **3.5. Site Tour**

#### **a. Visit to Skretting Fish Feed Factory, Egypt**

Participants were guided through the factories operation and set-up by the Operations Manager Dr. Alaa Dadr, Dr. Ahmed Assi of the company’s Veterinary Technical Services and Dr. Salah Abd Elkader from the Marketing & Sales Manager Fish Sector department.

The entire fish feed production and distribution process was discussed right from the sourcing and shipment of ingredients to the factory, their storage, feed formulation, feed processing, packaging, quality control, feed marketing and distribution that included the technical support given by the factory to producers (i.e. extension). The facilities used for each of these stages were shown to participants. The operation and maintenance requirements to run these facilities optimally discussed while at the same time ensuring quality control standards were being met was shared. The site facilities visited included the storage bins, feed plant, laboratory, distribution warehouses and training rooms. It was noted that most of the technical support to farmers and local owners/managers of feed outlets was largely done through practical demonstrations on-farm.

**b. Abbassa Research Center, Abbassa.**

A guided tour was given of the laboratory facilities (i.e. nutrition, water quality, and disease control), trial and production ponds, of the on-going Abbassa strain breeding program and facilities used to run this breeding programs, and the training centre.

The visits stimulated a lot of discussion among participants and were an eye-opener as to what infrastructure, technical and other services requirements would be necessary for a sustainable commercial aquaculture industry in Africa.





### **3.6. Group Discussions**

On day three, participants split into three groups to identify priority actions for the implementation of the aquaculture component of the PFRS. Two groups were derived from the Member States whose deliberations centred on the following key areas:

- i. Creating an enabling environment that would support growth, expansion and diversification of a private sector led and market-oriented aquaculture value chain at national and regional levels
- ii. Technological development
- iii. Services to the sector

- iv. Transboundary ecosystem management for aquaculture
- v. Capacity building.

See also Terms of Reference for Group Discussion in Annex 4.

The third group, the PanAfrican group constituted the continents development partners and global non-government aquaculture agencies that have conducted aquaculture activities in several Member States. The latter group focused on capacity building, technology development and transboundary ecosystem management.

In addition to sharing of personal experiences, the group discussion were informed by the experiences shared in the presentations given at the plenary and the study tour. The outputs of the group discussions are in Annex 5.

## **4.0. OUTCOMES OF THE MEETING**

### **4.1. General discussions and deliberations**

The meeting identified issues and strategic priority actions and formulated draft pan African plan of action for sustainable aquaculture development that are consistent with the policy framework and reform strategy for fisheries and aquaculture in Africa with respect to:

- i. Creating an enabling environment that would support growth, expansion and diversification of a private sector led and market-oriented aquaculture value chain at national and regional levels
- ii. Technological development
- iii. Services to the sector
- iv. Transboundary ecosystem management for aquaculture
- v. Capacity building

### **4.2. Way forward and recommendations**

1. The participants raised concern on the weak status of the Aquaculture Network for Africa (ANAF) in providing services to the people of African as a continental aquaculture organization. In the meantime, participants expressed the need for regional networks of aquaculture associations that would be owned by member states. The regional networks, which are owned by member states, would provide a platform for constituting or strengthening an overarching coordination body for the regional networks.
2. The participants re-iterated the need to have the priority actions constituted into a usable and actions plan by all continental stakeholders of the sector under supervision of AU-IBAR with

the support of the Aquaculture Working Group.

3. Participants also urge AU to ensure the implementation of the outcomes of the meeting since several of such meetings have been organized on the continent in the past but the recommendations not implemented
4. It was strongly recommended that level private sector participation in such meetings, given their practical experience and knowledge of and the heavy bearing of these upon the formation and successful implementation initiatives, should be increased.

Participants expressed gratitude to the Government and people of the Arab Republic of Egypt, AU-IBAR, NEPAD and WorldFish for a well-organized and timely workshop and assured the African Union for their continued collaboration in the sustainable development of the aquaculture sector for the overall benefits of the continent.

### **Annex I: Concept Note**

#### **CONCEPT NOTE TRANSFORMING AFRICA'S AQUACULTURE INTO A VIABLE AND SUSTAINABLE SECTOR**

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**Dedicated Think Tank Meeting on the African Aquaculture Development in the  
context of the African Agricultural Transformation Agenda**

**February, 2016**

**Venue: Egypt**

#### **CONTEXT AND JUSTIFICATION**

The fisheries and aquaculture contribute 6% of the Africa's agriculture GDP African aquaculture is at various developmental stages and produces products of an estimated value of US\$3 billion per year. The potential for aquaculture growth in Africa that has been further triggered by the shortfall in supply of fish and fishery products globally that has arisen due to the over-exploitation of the fisheries as well as increasing populations. Per capita fish consumption rates are consequently declining. In 2010 the estimated per capita fish consumption rate on the continent was 9.1 kg less than half of the global average (18.4 kg). The projected decline in the supply of high value fish from harvest fisheries opens an opportunity to increase aquaculture production and a market share in the high value fishery sector.

Aquaculture remains one of the food producing sector worldwide, hence the global aquaculture production was recorded at 90.4 million tonnes (live weight equivalent) in 2012 (US\$144.4 billion), which included 66.6 and 23.8 million tonnes of food fish and aquatic algae respectively (SOFIA 2014). The annual aquaculture rate is growing at an average rate of 6.2% from 2000-2012; interestingly the growth rate is faster in Africa with 11.7% followed by Latin America and the Caribbean with 10% respectively. The African aquaculture contributes only 2.23% to the global production with Egypt contributing 1.5% mainly from tilapia production followed by Nigeria which is the major producer of catfish on the continent.

The aquaculture sector contributes to job creation, food and nutritional security, foreign exchange and also to economic activities. The sector is however faced with a number of challenges that are

inhibiting the realization of its full potential. Some of these challenges are:

- Weak institutional and human resources capacity
- Application of low technology in production systems
- Weak capacity and institutional or regulatory frameworks for, example, disease control, movement of genetic materials, use of feed additives, etc.
- Limited resources (seeds, feeds, financial etc.) for aquaculture development.

In order to circumvent these continental developmental challenges, various high level continental platforms have prioritised fisheries and aquaculture sectors. These include the Abuja Fish-for-all summit, CAMFA I and II meetings amongst others. The African Union consequently developed a continental Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS), that was adopted by the African Heads of States and Governments during the 23rd AU Summit held in Malabo, Equatorial Guinea in June 2014. The overall purpose of the Policy Framework and Reform Strategy for Fisheries and Aquaculture is “to facilitate transformation of Africa’s fisheries and aquaculture for food, livelihoods and wealth”. One of the key policy objectives is “realizing the full potential of the aquaculture sector to generate wealth, social benefits and contribute to the development of the African economy by jumpstarting market-led sustainable development strategies”. The key policy arena on sustainable aquaculture development is expected to “jumpstart market-led sustainable aquaculture through a variety of strategies and support interventionist development approaches in aquaculture by strong strategic and implementation plans”. This could be achieved through creating an enabling environment; creating African Centre of Excellence for Aquaculture and mainstreaming aquaculture strategies and plans into national development plans especially CAADP.

These development efforts need to be channelled appropriately to ensure potential of the sector is fully realised in compliance with the Malabo Declaration on Accelerated Agricultural (including Fisheries & Aquaculture) Growth and Transformation for Shared Prosperity and Improved Livelihoods (Doc.Assembly/AU/2(XXIII)) notably:

1. Commitment to Ending Hunger in Africa by 2025
2. Commitment to Halving Poverty by the year 2025, through Inclusive Agricultural Growth and Transformation
3. Commitment to Boosting Intra-African Trade in Agricultural commodities and services
4. Commitment to Enhancing Resilience of Livelihoods and Production Systems to Climate Variability and other related risks

It is against this background, the African Union- Interafrican Bureau for Animal Resources (AU-IBAR) the NEPAD Planning and Coordinating Agency (NPCA) and WorldFish are organising a Think Tank meeting on African Aquaculture Development which will provide a platform for brainstorming and stakeholder consultations to identify key continental actions that are critical to accelerate the sectors development. The Think Tank meeting is planned to take place in Egypt in November 2015 and the ultimate goal would be the formulation of continental plan of action for sustainable aquaculture development.

## **OBJECTIVES**

The overall objective of the Think Tank meeting is to develop a continental plan of action for sustainable aquaculture development that would support the attainment of the goals of the Malabo Declaration. The specific objectives include:

- i. Reflect on the challenges and opportunities presented by the aquaculture sector in line with PFRS outcomes.
- ii. Share lessons, best practices and innovations for sustainable aquaculture development
- iii. Identify priority actions to enhance aquaculture contribution to the African Accelerated agricultural transformation goals.
- iv. Formulate action plans and way forward for the sector's development to meet CAADP's goal of 6% and the PFRS sectoral growth within countries per annum.

## **EXPECTED OUTCOMES**

1. Opportunities for sustainable market-led aquaculture development identified.
2. Consolidated lessons and best practices on sustainable aquaculture sector growth in Africa.
3. Priority actions identified to enhance aquaculture contribution to the agricultural transformation agenda of the African Union.
4. Strategic Partnership developed and proposed at national level (member state), Regional level (Regional Economic Community & Regional Fishery Body) and continental level (African Union Commission and technical & development partners).
5. Action plans and way forward developed.

## **MEETING METHODOLOGY**

The Think Tank will be conducted through expert presentations on salient issues and group discussions. The Think Tank will be held in English, French, Portuguese and Arabic. Simultaneous interpretation will be provided.

## **PARTICIPANTS**

The Think tank meeting would comprise of member states of the African Union, Regional Economic Communities, appropriate Regional Fisheries Bodies, Experts, Civil Society Organizations, private sector and development partners.

## Annex 2: Agenda of the Think Tank

### Aquaculture Think Tank Meeting 7th to 10th February, 2016 Cairo, Egypt

Time	Activity	Facilitator
<b>DAY 1: Sunday, 7TH FEBRUARY, 2016</b>		
<b>Session 1: Opening Session</b>		
09.00 – 09:30	<ul style="list-style-type: none"> <li>• Statement by AU-IBAR</li> <li>• Statement by World Fish,</li> <li>• Statement by EU</li> <li>• Speech by Director AU-IBAR</li> <li>• Statement by Egyptian Government</li> </ul>	Master of Ceremony
09.30 -09.40	Objective of the Meeting	AU-IBAR
09:40-10:00	Group Photo	
<b>BREAK</b>		
<b>Session 2: The Status and Prospects for Aquaculture on the Continent</b>		
10:00-10:30	Aquaculture and the Agriculture Transformation Agenda in Africa:Trends, Status and Prospects of Aquaculture Development on the Continent	AU-IBAR
10:30-10:50	Insights into NEPAD's Aquaculture Development initiatives	NPCA
<b>Public Sector Experiences</b>		
10:50-13.00	Experiences from the Continent <ul style="list-style-type: none"> <li>• Mali</li> <li>• Malawi</li> <li>• Zambia</li> <li>• Tunisia</li> <li>• Kenya</li> <li>• LTA (aquaculture on shared water bodies)</li> </ul>	Selected Member States
12.30 – 13.00	General Discussion of Member State Presentations	AU-IBAR
13.00 – 14.00	<b>LUNCH BREAK</b>	
<b>Private Sector Experience</b>		
14.00 -14.15	The Experiences of Private Producer and Aquaculture Association:	Ismail Radwan Egyptian Fish Farmers Association, Egypt
14.15 – 14.30	The Experiences of a Private Producer:	Jacob Ainoo-Ansah, Ghana Fish Farmers Association, Ghana
14.30 – 14.45	<b>TEA BREAK</b>	
<b>Experience from partners</b>		
14.45 – 15.00	On Overview of the Aquaculture Issues that have been discussed on the SARNISSA forum.	William Leschen, SARNISSA
15.00 – 15.15	Status of fish Trade and overview of World Fish Aquaculture Activities on the Continent.	World Fish Center
15.15 – 15.30	Experiences of DFID in Aquaculture Development in Africa	John Linton
15.30 – 15.45	Transformation of Small-holder Aquaculture to a Market-Led Commercial:The American Catfish Industries Experience	Karen Veverica, Auburn University
15.45. – 16.30	General Discussion Session and wrap up of days discussions	AU-IBAR
<b>DAY 2: Monday 8th February, 2016</b>		
<b>Session 4: Setting a New Foundation: Overcoming Stumbling Blocks and Identifying priority Actions</b>		
09.00 – 09.20	<b>Presentation of its specific activities by Partners</b>	AU-IBAR
09.20 – 09.30	<b>Terms of Reference for Group Discussions</b>	AU-IBAR

<b>Time</b>	<b>Activity</b>	<b>Facilitator</b>
09.30 – 15.00	<b>Group Discussions to derive actions on key issues</b> <ol style="list-style-type: none"> <li>1. Enabling environment for investment, governance and growth in the sector</li> <li>2. Technology development (R&amp;D) (production systems, feed, aquaculture products, new species, food safety, etc.)</li> <li>3. Services to the sector (inputs, technical, finance, trade and marketing, disease control, information, etc).</li> <li>4. Ecosystem management and zonation</li> <li>5. Capacity building (human resources, infrastructure, private sector capacities, etc.)</li> </ol>	AU-IBAR
15.30 – 16.30	<b>Wrap up Discussion and AWG compiling presentations</b>	AU-IBAR
<b>DAY 3: Tuesday, 9th February, 2016</b>		
<b>Session 5: Wrap Up Discussions</b>		
09.00 – 10.30	Film by John Linton Compilation of group presentations by AWG for Plenary	AU-IBAR
10.30 – 11.00	<b>TEA BREAK</b>	
11.00 – 12.30	Plenary discussions	AU-IBAR
12.30 – 13.00	Way forward	AU-IBAR
13.00 – 14.00	<b>LUNCH BREAK</b>	
14:00	<b>CLOSING SESSION</b>	AU-IBAR
<b>DAY 4: Wednesday 10th February, 2016</b>		
<b>Session 6: Field Tour</b>		
09.00 – 14.00	Visit Skretting Fish Feed and aquaculture activities in Abassa area.	AU-IBAR/World Fish

## Annex 3: List of Participants

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## **Annex 4: Terms of Reference for the Group discussions**

### **Objectives of the Discussion**

1. Deliberate to identify and prioritise actions that shall form a continental Aquaculture Action Plan for the sector's development to meet CAADP targets and PFRS sectoral growth within countries.
2. Share experiences and lessons to enable MS improve and partners streamline efforts to meet continental as well as MS goals.

There will be three working groups: English Speaking, French Speaking, and a Pan-African Group comprising non-member states – ie. Partners, regional bodies.

Preferably private sector spread across both.

**Methodology:** Brainstorming, sharing experiences, oriented discussion, note taking,

There are 5 thematic areas, notably:

1. Enabling environment for investment, governance and growth in the sector
2. Technology development (R&D)
3. Services to the sector.
4. Ecosystem management and zonation
5. Capacity building.

Under each of these areas:

1. Identify the Issues/Opportunities
  - Rank
  - Opportunities that resolving these issues may create
  - Geographical scale affecting these issues
2. Identify Priority Actions for each Issue/Opportunity
  - What actions are likely to result in positive change, alleviation or resolution of the issues identified
  - Suggested processes to through which action should be implemented to facilitate/institute change

Who should be the targeted stakeholders for the identified actions and processes:

1. Those who will influence change

## 2. Beneficiaries (primary and secondary beneficiaries)

- Geographical scale for proposed actions

**THEMATIC AREA 1:** Creation of an enabling environment that would support growth, expansion and diversification of a private sector led and market-oriented aquaculture value chain at national and regional level.

Guiding questions:

1. What are policy, institutional and governance issues in relation to:
  - a. Production and productivity
  - b. Access to markets and trade
  - c. Access to resources for aquaculture and aquaculture related activities such as land, water, knowledge and skills, investment capital, man-power, inputs, marketing, value addition, etc.
  - d. Environmental management for aquaculture
  - e. Biosecurity and public health
2. What are the priority actions that shall address these issues?

## **THEMATIC AREA 2: Technology Development:**

Guiding questions:

1. What are the technological issues affecting:
  - a. Production and productivity
  - b. Access to markets and trade
  - c. Utilisation of resources for aquaculture such as land, water harnessing, dissemination and utilisation of information, knowledge and skills; human resource development, inputs, value addition, marketing and access to markets
  - d. Environmental management
  - e. Biosecurity and public health
2. What are the priority actions that shall address these issues?

## **THEMATIC AREA 3: Services to the Sector:**

Guiding questions:

1. What are the issues affecting the development and delivery of essential services to the sector, notably:
  - a. Technical support eg. engineering services to design, install and fix facilities for production and marketing.
  - b. Financial services
  - c. Manufacture and supply of inputs for industry eg. feed, nets, cages

- d. Distribution of inputs and products (notably feed, live fish haulage, farmed and processed products)
  - e. Auxiliary services eg. power supply, road networks to aquaculture producing areas, public health (eg training personnel on farms to swim), insurance services
  - f. Public and private sector policy and governance eg. certification processes, labelling of products, agribusiness, etc.
  - g. Environmental management
  - h. Biosecurity
2. What actions need to be taken to address these issues?

#### **THEMATIC AREA 4: Transboundary Ecosystem Management for Aquaculture:**

Guiding questions:

1. What are the issues associated with transboundary siting, zoning and ecosystems management for aquaculture:
  - a. Legal and policy issues
  - b. Development issues
  - c. Joint management of these natural resources and other environmental goods and services for aquaculture sustainability eg. biodiversity, integrated watershed management, culture of fish in shared water bodies, introduction of foreign fish species, etc.
  - d. Biosecurity such as quarantines, etc.
  - e. Mitigation against socio-economic risks and changes
  - f. Environmental and climatic risks and vulnerabilities.
2. What are the actions to address these?

#### **THEMATIC AREA 5: Capacity Building:**

Guiding questions:

1. What are the issues associated with building capacity in:
  - a. Coordination
  - b. Human resources for all cadres
  - c. Networking between the different stakeholders
  - d. Institutional linkages (both private and public sector)
  - e. Non-state actors to associate, provide services, pool resources for development and marketing, engage in advocacy and policy making, establish/participate in PPPs, etc.
2. What are the actions to address these?

## Annex 5: Outputs of the Group Discussions

### GROUP I: FRANCOPHONE COUNTRIES

Policy, institutional and governance	Issues	Action Plan	Opportunities to be created	Beneficiaries
<b>THEMATIC AREA I: Creation of enabling environment to support growth expansion, diversification of a private sector led and market-oriented aquaculture value chain at national and regional level</b>				
Production and Productivity	-Absence of aquaculture supportive policies and governance guidelines in the some countries. -Where they exist there is weak implementation	Institution and implementation of private sector and government interaction on policies.	Will facilitate growth, expansion and diversification of products and production.	Farmers, stakeholders and the industry
Access to markets and trade	-Entry of large scale producers into retail markets -Lack of information on markets and market requirements -Lack of certification at various points of the value chain e.g. hatcheries, feed, fish and fish products	-Large scale producers to be limited to wholesale marketing -Sectors Ministries and farmers associations must have desks to gather and disseminate market related information (location and requirements) -Institution of credible certification scheme along the value chain -Establishment of market locations and infrastructure such as cold chains for farmers to facilitate trade.	-Maximisation of the value chain (Creation of opportunities for traders and small scale producers) -Maximised market through knowledge of existing markets and entry into new markets (export trade potential within Africa and beyond) -Expanded market for aquaculture input producers and products	-Small scale producers, fish mongers and middle men -Fish farmers, operators, feed producers, fish traders, jobs and livelihood creation for riparian communities and governments
Access to resources for aquaculture and aquaculture related activities (land, water, knowledge and skills, credit, inputs, value addition etc)	Insufficient policy covering various aquaculture resources availability and equitable access.  Availability and cost of capital is too high in some countries	-Governments should identify and zone suitable areas for various aquaculture systems and ensure equitable availability to all. -Identified aquaculture areas should be legalised and supported by provision of basic infrastructure services such as good roads, power sources, etc. -The government must facilitate acquisition of credit by farmers from financial institutions -The aquaculture producers must create confidence with the financial institutions	Access to credit by farmers for timely production activities Increased farm production and income	Aquaculture producers (hatcheries, feed producers, processors etc)

Policy, institutional and governance	Issues	Action Plan	Opportunities to be created	Beneficiaries
		-Private sector must acquire the capacity to develop a business plans to facilitate loan acquisition.		
Environmental Management	-Environmental management criteria non-existent in some countries -Expensive and long procedures demanded from aquaculture operators	-Countries without environmental action plans should adapt from countries which have. -Public sector to provide appropriate leadership and requirements to various farmers on environmental impact assessment at various levels -Government to identify suitable sites based on field and scientific data and these areas should be legalised. -Carrying capacities of water bodies should be determined, complied with, and a scheme of monitoring should be established.	Speed up creation of environmental action plans across the region	Aquaculture industry Riparian communities Environmental Sustainability for aquaculture
Biosecurity and public health	Lack of policy and guidelines for aquaculture in some countries	-Establishment and Implementation of biosecurity policy and regulatory framework in all countries -Guidelines to follow international practices Intensify monitoring and implementation of existing of law -Capacity development and information sharing for both private and public sectors	Reduced risk and enhances integrity on environment including that of aquaculture organisms and wild stocks	Industry, fisher folks, riparian communities
<b>THEMATIC AREA 2: Technology Development</b>				
Production and productivity	-Individual countries developing strains of already developed species -Cost of development of undeveloped shared species by individual countries -High cost of feed production and loss of wild fish because of fish meal in feeds	-Investigate possibility of adapting the developed strain. -Improved strain should be accompanied with appropriate feeds and feed management, etc.	-Sharing of human resources and reduced cost of the programme -Reduced cost of production and loss of wild fish	Fish farmers reference to cost of production

Policy, institutional and governance	Issues	Action Plan	Opportunities to be created	Beneficiaries
		<ul style="list-style-type: none"> <li>-Establish a common development programme for a shared species among neighbouring countries for cost reduction (human and material)</li> <li>-Evaluate and adapt feeds without fish meal</li> </ul>		
Access to markets and trade	Poor market information in relation to trade	Use improved technology to enhance market information sharing access and trade. Enhance		
Utilisation of resources for aquaculture such as land, water harnessing, dissemination and utilisation of information, knowledge and skills, human resource development, inputs, value addition, marketing and access to market	<ul style="list-style-type: none"> <li>-Energy is expensive and unavailable -</li> <li>-Water unavailability</li> </ul>	<ul style="list-style-type: none"> <li>-Develop alternative sources of renewal energy to support the sector</li> <li>-Identify appropriate production systems for the different types of aquaculture – raceways, tanks, ponds, cage etc.</li> <li>-Identify institutions for training and capacity building in aquaculture.</li> <li>-Specialisation in various sectors and national training centres</li> <li>-There should be public sector support for information and technology sharing and networking. E.g ANAF</li> <li>-Processing – what products can we get from our fish? Share information on the technology to make products from your fish from filleting to smoking – along the value chain. Product, prices and market</li> </ul>		
Environmental management	Lack of technical guidelines for development of different production systems	<ul style="list-style-type: none"> <li>-Develop technology guidelines for different production systems</li> <li>-Educate farmers on environmental management</li> </ul>		

<b>Policy, institutional and governance</b>	<b>Issues</b>	<b>Action Plan</b>	<b>Opportunities to be created</b>	<b>Beneficiaries</b>
Biosecurity and health	Lack of biosecurity guidelines in some countries	-Government to finance quarantined units to receive imported fish for production -Import certification programme to be put in place. -Enhance security at the borders for movement of fish.		
<b>THEMATIC AREA 3. Services to the Sector</b>				
Technical support	Quality of services to design, install and fix facilities for production and marketing	-Capacity development in engineering and design of aquaculture facilities	Local capacity building in aquaculture engineering services	Industry Job creation of personnel trained in this field
		-Public sector capacity development in these services should be incorporated in syllabuses of appropriate technical training institutions		
Financial Services	Lack of availability of credit and cost of credit	-Potential cooperative strategies by aquaculture operators -Public sector to facilitate financial institutions to provide affordable credit support banking -Growth enhancement support schemes – Joint financing by government and private sector	Enhanced opportunity for aquaculture operators to expand production Opportunity for financial institutions to expand their area of operation.	Aquaculture operators Financial institutions Consumers
Manufacture of supply and inputs for industry	-Absence of local/national feed plants -Lack of large markets for feed	-Maximise use of local materials -Availability of efficient equipment -Reduced taxes on imports for feed ingredients -Government to create enabling environment for aquaculture input producers -Government to enhance PPP to establish aquaculture input industry -Institution of policy for regional markets for feed -Production of agricultural inputs for shared feed plants among countries		

Policy, institutional and governance	Issues	Action Plan	Opportunities to be created	Beneficiaries
Auxiliary Services	Lack of infrastructure and extension services	-Addition of infrastructure (telephone, road network, security etc) to accompany zonation of areas for aquaculture -Creation of extension services		
Private and Public Sector policies	Unidentified roles of specification for private and public sector policies	-Enabling environment and specification of roles		
Environmental management and Biosecurity	-Poor knowledge of what is to be done by private and public sectors -Fees charged by government agencies for permitting	-Trained consultants Strategic environmental assessment -There should be inter agency agreement on the fees and permitting process		
<b>THEMATIC AREA 4. Transboundary Ecosystem Management for Aquaculture</b>				
Legal and policy issues	-Issues of disease transfer and pollution – lack of harmonised policies and laws -Lack of agreement n use of shared water bodies -Lack of coordination of use	Harmonisation of environmental laws, legal framework and policy issues governing shared water bodies		
Development issues	-There may be development issues which did not exist during the development of policies -New uses that did not exist originally	Look at the protection of the area and identify the appropriate use of the reservoir		
Joint management of natural resources	New uses that did not exist originally	-International laws governing shared water bodies should be applied. -Develop common policies to manage the resource Joint commissions for the management of the resources.		
Mitigation against socio-economic risks and changes	-Changes in government policies -Price fluctuation -Flooding of market from cheaper source -Over production of fish -Conflict between riparian communities and farmers	-Long term master strategic plan and policies -Regular dialogues between stakeholders and government for policy reviews -Government policies to protect local producers		

Policy, institutional and governance	Issues	Action Plan	Opportunities to be created	Beneficiaries
		-Proper guidelines to protect riparian communities		
Environmental and climate risks and vulnerability	-Flooding -Drought -Salt water intrusion into freshwater systems as a result of sea level rise -Loss of genetic resources (selected species)	-Seek and share knowledge on climate change effects and vulnerability -Establish monitoring regimes and potential risk areas -Capacity development on climate change		
	-Pollution and diseases lack of general knowledge and information on climate change impacts	-Develop of climate change mitigation measures Institute early warning systems		
<b>THEMATIC AREA 5. Capacity Development</b>				
Coordination	Poor information on specialised centres	-Exchange of information on training centres -ANAF – Aquaculture Network for Africa		
Human resources for all cadres		-Identify specialised training institutions across national, regional and continental training centres for specific/targeted training		
Networking	-Lack of associations of stakeholders at the national levels	-Exchange of information among stakeholder associations -Existing networks such as ANAF, InfoPeche, SARNISSA etc. should be strengthened and made known in all members countries. ANAF should have focal points in all countries -National fisheries offices should establish networking desks for information distribution and dissemination. -All AU members countries should be mandated to join ANAF.		

Policy, institutional and governance	Issues	Action Plan	Opportunities to be created	Beneficiaries
Institutional Linkages	Lack of database of sector operators	-All national and fisheries institutions should have dedicated and active websites Scheduled meetings of all stakeholders -Database of all stakeholders in the aquaculture industry		
Non-stake actors to associate, provide services, pools resources for development and marketing, engage in marketing and policy making	Non state actors operate as individuals and want all services from the public	-Aquaculture related associations to be encouraged to strengthen themselves -Concessions to established farmer associations		

## GROUP 2: ANGLO-PHONE COUNTRIES

Thematic Area	Priority Action	budget	Opportunities that resolving these issues may create	Geographical scale affecting these issues	Targeted stakeholders for identified action	Rank
<b>THEMATIC AREA I: ENABLING ENVIRONMENT FOR INVESTMENT, GOVERNANCE AND GROWTH IN THE SECTOR</b>						
<b>Policy, institutional and governance issues</b>						
Production and productivity	Zonation for aquaculture production areas – institutional capacity building/training for specialized expertise to carry out zonation	USD 250,000	Facilitate; infrastructure development; Reduce cost of EIAs; facilitate transfer of skills expertise and knowledge	National	Government	1
	-Capacity building/ Training; for both public and private sectors & sharing of information; training/ skills development for extension workers – on – farm attachments, on fish husbandry; fertilization	USD 100,000 per year over three years	Provision of Skilled labour	National, Regional – through exchange	Government, private and NGOS, Academia, research institution	2
	Credit access for SME; Tax incentives for aquaculture inputs; Insurance for aquaculture	Policy issue no budget	Financing- Increased investments	National	Government	3
	-Pilot farms (build and run it) for dissemination of aquaculture information (hatchery with 20 ponds)	USD 500,000	Increased knowledge transfer and best practice	National Regional	Government private sector	4

Thematic Area	Priority Action	budget	Opportunities that resolving these issues may create	Geographical scale affecting these issues	Targeted stakeholders for identified action	Rank
	-Quality control and surveillance feeds,					
	Access roads and infrastructure to both new and existing farms;	USD500,000	Increased investment; Increased economic returns; market access	National	Government	4
Access market	Standards development & certification for Farmed fish value chains	USD 300,000	Assurance of quality products Improved market access	National Regional	Government	1
	Technical services centres (development/upgrading access to certified laboratories for monitoring quality and safety of products and inputs) etc)	USD500,000 for new; USD 200,000 upgrading	Certainty of Product integrity	National	Government, NGOs, private sector	2
	Capacity building (training) on fish safety and quality issues (HACCP) including distribution along the value chain	USD 6,000 per participant	Food safety assurance	National, Regional	Government, NGOs	1
Access to resources	Curriculum Development for Aquaculture and testing- for skills development – specifically for extension workers	USD50,000	Develop required human capital to support aquaculture growth	National, Regional	Government NGOs, Academia Stakeholders	2
	Create policy to integrate aquaculture into other water uses (irrigation and aquaculture) amongst different users Harmonise and coordinate water use, (e.g Nigeria Farm Estates; Ghana, Egypt)	USD 10,000	Maximize productive benefits of water usage by recycling and re-use.	National	Government, Private sector, NGOs	1
Environmental Management	Build capacity in EIA and strengthen environmental management through regulation promotion of best practice; Train at least one person in a working internship in Europe, Asia or US in EIA	USD 5,000/ per person	Ensure sustainability for investments in aquaculture	National, Regional	Government/ NGOs Private sector	1
Bio-security and public health	Train personnel on bio-safety bio-security and public health issues	USD 6,000 per participant	Control fish disease outbreak and spread.	National	Academia, Research, Government	1

Thematic Area	Priority Action	budget	Opportunities that resolving these issues may create	Geographical scale affecting these issues	Targeted stakeholders for identified action	Rank
<b>THEMATIC AREA 2: TECHNOLOGY DEVELOPMENT</b>						
Research and Development And Transfer	Intra and inter training on hatchery management, fish feed development, aquaculture facility design	USD30,000 to set up program USD 1500 per participant	Assure integrity of genetic make- up of fish seeds	National	Academia Private sector	1
	Support three months working internship on renewable energy related to hatchery and grow out systems	USD 5,000/ person	Maintain supply and utilization efficiency in aquaculture; minimize carbon footprint in aquaculture	National; Regional	Private sector, Research, NGOs	2
	Train personnel to develop and manage online platform for aquaculture trade, e.g. Nigeria yahoo catfish farmers' forum	USD 3,000	Leverage online networking to improve market access and product pricing	National; Regional	NGOs Private Sector IT Specialists	3
	Facilitate Internet training workshops in local internet cafes for fish farmers e.g aquaculture enterprise in Malawi	USD 500	Improve functional IT literacy to enhance aquaculture business	National	NGOs Private Sector IT Specialists	2
	Training on value addition each country to facilitate training on value addition (value added processing) through facilitation from e.g, Zambia, Uganda, Kenya, Nigeria; 2 weeks – regional approach	USD 5,000	Learning from models and practices within the region	Regional; National	Private sector, NGOs, Government Academia	2
Environmental Management	Train personnel and transfer technology in water treatment and RAS in hatcheries, and grow out; (to solve water & energy supply problems), e.g Egypt (3months)	USD 100 per day  USD 10,000	Maintaining water quality and supply for hatchery operations	National	Private sector, NGOs, Government Academia Research	2

Thematic Area	Priority Action	budget	Opportunities that resolving these issues may create	Geographical scale affecting these issues	Targeted stakeholders for identified action	Rank
Biosecurity and Public Health	Support training of personnel in biosafety and use of immune stimulants (probiotics) Train personnel in new technology on fish health and disease control, Support working internship with Fish Health group with Vets in Thailand or various countries Improve safety in terms of fish, feed, humans (e.g swimming))	USD 18,000  USD 6,000	Improving fish health	National	Private sector, NGOs, Government Academia	1
<b>THEMATIC AREA 3: SERVICE TO THE SECTOR</b>						
Production and Productivity	Fish value chain development		Enhancing aquaculture and related businesses; generate employment	National	Private sector, NGOs, Government Academia	1
Technical Support	-Specialized training for artisans in plumbing, masonry, electrical, post harvest and processing, fish handling and transportation technology for aquaculture systems installation and maintenance -Refresher course – 3months Develop the course curriculum and set it up e.g training facilities in Ghana for fish cage construction	USD 10,000  USD 20,000	Developing manpower to support aquaculture value chain development	National	Private sector (construction industry), NGOs, Government Academia	2
Financial Services	-Provision of Credit through the banks for concessional lending to farmers; Creation of specialized funds for aquaculture		Improving investment in aquaculture value chain	National	Government Specialized Financing NGOs, Cooperatives/ associations	1
	Specialized training for bankers on processing of aquaculture loans, e.g FAO/NGO in Nigeria; production of information fact sheets in relation to aquaculture for Banks;	USD6000 per session	Improving lending to support aquaculture business	National	Private sector, NGOs, Government Financial experts Investors	1

Thematic Area	Priority Action	budget	Opportunities that resolving these issues may create	Geographical scale affecting these issues	Targeted stakeholders for identified action	Rank
	Linking certification of hatcheries, fish farms, feed millers, to financial loan provision		Promoting compliance to fisheries and fish product quality standards	National	Research Government NGOs	2
Manufacture and supply of inputs for industry	Support Piloting/ Leveraging of Aqua shops and distribution in some Countries; training, including in handling and traceability	USD 200 per person		National	Private Sector Government	2
<b>THEMATIC AREA 4: TRANS-BOUNDARY ECOSYSTEM MANAGEMENT FOR AQUACULTURE</b>						
Legal and Policy Issues	Training of border post personnel on aquaculture products for facilitation of easy movement e.g. 2 weeks	USD 3,000 per person	Harmonising policy on movement of fish seed and products across borders	National;	Government Private sector, Academia Research	2
	Regional border coordination through development of guidelines		Harmonising policy on movement of fish seed and products across	Regional	Government	1
	Review and enforcement of licensing for ornamental fish imports/exports		Regulation of cross border movement of fish genetic material	National	Government Private sector	2
	Establish one stop shop for harmonizing all requirements for import and export		Reducing bureaucracy related to importation /exportation of fish seed and fish products	National	Government Private sector	1
Joint Management	Establishment of protocols for the assessment and decision making on introduction of foreign species; Including Material Transfer Agreements (MTA) and Nagoya protocol, e.g. Mozambique, Zambia; Nigeria and Japan	USD 50,000  AU or OIE matching funding?	Promoting benefit sharing and conservation of genetic resources	Transboundary water basin Authority; National Regional	Government Research	1
	Piloting designs/ strengthening and development of facilities for live fish quarantine		Controlling spread of fish diseases	National	Private sector Research Construction Specialists	2

Thematic Area	Priority Action	budget	Opportunities that resolving these issues may create	Geographical scale affecting these issues	Targeted stakeholders for identified action	Rank
Mitigation against socio-economic risks and changes	Including Socio-economic impacts assessments in licensing process of cages alongside EIA, zonation should also be considered to allocate space for cages etc		Avoiding resource use conflicts	National	Private Sector Government Research Academia	1
Environmental and climatic risks and vulnerabilities	Each country to establish a Working Group on climate change and collaboration with existing agencies; including facilitation of access to climate change funds	USD 10,000	Adapting aquaculture to climate change vulnerabilities	National	Government NGO Private Sector Research	2
	Training on alternative livelihoods to mitigate climate change impacts		Adapting to climate change vulnerabilities	National	Private Sector Government Research Academia	2
<b>THEMATIC AREA 5: CAPACITY BUILDING</b>						
Coordination	Development of standardized aquaculture training programs;		Enhancing expertise and capabilities in aquaculture business	National Regional	Academia Private sector	2
	Facilitation/ Promotion of regular regional coordination meetings; (every six months), involving private and public sector; each government to facilitate their delegation; with reports for dissemination to Member States for action	USD2,000 for 2participants per meeting	Sharing of knowledge, skills and best practice	Regional	Government Private Sector	2
	Inter ministerial committee to hold regular meetings (twice a year); including representative from farmers association		Ensuring adequate water resource allocation for aquaculture development	National	Government Private Sector	1
	Strengthening of farmers associations		Strengthen advocacy for aquaculture development	National	Private Sector NGOs Government Development Partners	2

Thematic Area	Priority Action	budget	Opportunities that resolving these issues may create	Geographical scale affecting these issues	Targeted stakeholders for identified action	Rank
	Facilitation of networking and association between different stakeholders, e.g SARNISSA, Yahoo Catfish farmers forum/ WALIMI Fish farmers forum in Uganda, Zimbabwe Fisheries Aquaculture WG, Aquaculture Zimbabwe Trust		Networking and dissemination of best practice and accessing market opportunities	National; Regional	Private Sector IT Specialists	2
Institutional Linkages	Provide platforms for aquaculture development (research dissemination, application of research findings, demand driven research, dissemination of findings, discussion of pertinent issues –e.g DFID Research into use funding program, Nigeria, Kenya, Ghana. Possibility of future similar program; Ref WFC Aquaculture funding document via SARNISSA	Funding by both public and private sector	Providing learning platform and identifying demand driven research areas	National	Government Private Sector Investors Development Partners Academia Research	2
Non-state actors to associate, provide services, pool resources for development and marketing, engage in advocacy and policy making	Facilitation of successful models of fish farmers associations for aquaculture development; Aquaculture Zimbabwe, Ghana Aquaculture Association, WALIMI Uganda, Catfish Farmers Association of Nigeria, Aquaculture Association of Kenya, Aquatic Union Egypt, Sustainable Environment Fisheries Foundation (SEFFA)- Nigeria, Renapib- Benin, With regular exchange visits, networking, for development of aquaculture	USD2,000 per person	Networking to support growth of aquaculture value chain	Regional; National	Private Sector NGOs	2

## GROUP 3: PAN-AFRICAN GROUP

Issues	Opportunities	Priority Actions for Issues/ Opportunities	Actors/Change Influencers
<b>Thematic Area 5: Capacity building</b>			
<p>Coordination/coherence/harmonization</p> <ul style="list-style-type: none"> <li>-Many players making coordination difficult</li> <li>-Institutional capacity limitations at international, regional and national level</li> <li>-Domestication of AFRS at country level</li> <li>-Limited experience sharing among countries</li> <li>-Low awareness of allied sectors (ministries of finance, banking/financial institutions, Regional --Institutions (RECs, RFBs, regional financial institutions, Non-State Actors)</li> <li>-Inadequate laboratories</li> <li>-Inadequate capacities to disseminate research/information</li> <li>-Shortage of resources (information, personnel and funds)</li> </ul>	<p>AU-IBAR/NEPAD AFRM already in place to facilitate coordination and coherence</p>	<ul style="list-style-type: none"> <li>-Sensitization of the stakeholders about AFRM</li> <li>-Build capacity of the working groups to generate and/or disseminate research to inform the AFRM process</li> <li>-Identify and engage potential agencies/stakeholders (higher and lower level)</li> <li>-Strength/establish Reference Centre(s) and Centres of Excellence (specialization and technology transfer)</li> <li>-Improvement of diagnostic, research/educational facilities (regionally and nationally) to support aquaculture</li> <li>-Make use of ICTs and existing networks (SARNISSA, ANAF, AFRIFISHNET, NARS ) to disseminate information</li> <li>-Guided exchange programmes for learning and transfer of processes and technologies</li> <li>-Operationalize working group by allocating resources</li> <li>-Establish/strengthen at least one centre of excellence in each region on the African continent and provide resources for twinning.</li> </ul>	<ul style="list-style-type: none"> <li>-AU-IBAR to use RECS, RFBs as entry point to align AFRM to regional and national strategies</li> <li>-AU-IBAR to empower, give direction and allocate resources to the working groups</li> <li>-Working groups to develop the information, AU-IBAR to disseminate</li> <li>-AU-IBAR in collaboration with RECs and RFBs to identify requirements, solicit proposals, empower, give direction, secure and allocate resources attached to the Centres of Excellence</li> <li>-AU-IBAR and NEPAD to assess, coordinate, strengthen and support networks to collect and disseminate information ;Working groups to synthesize specific information</li> <li>-AU-IBAR and NEPAD to draw lessons from successful approaches (such as AgriTT) and catalyse member states to design similar systems; Centres of Excellence; AU-IBAR and NEPAD to encourage Member States to promote their success stories</li> </ul>
		<p>Proposed Centers Of Excellence</p> <ul style="list-style-type: none"> <li>-Research and improved technology</li> <li>-Technology transfer and extension services</li> <li>-Education and training</li> <li>-Diagnostic labs (diseases and food safety)</li> <li>-Aquatic Animal health, veterinary and bio security training programmes and services for vets, government employees and producers</li> <li>-Aquatic Genetic Resources</li> <li>-Product development and marketing</li> <li>-Business development of aquaculture</li> </ul>	<ul style="list-style-type: none"> <li>-AU-IBAR, NEPAD, Partner Organizations, RECs, Member States</li> <li>-AU-IBAR and partner organizations should develop guidelines for creation and recognition of the Centres of Excellence.</li> <li>-Centres of Excellence should be included in regional strategies</li> <li>-Draw lessons and build from existing systems at AU/WB on identifying sustainable centres of excellence</li> </ul>

Issues	Opportunities	Priority Actions for Issues/ Opportunities	Actors/Change Influencers
<b>Thematic Area 2: Technology Development (R&amp;D)</b>			
<ul style="list-style-type: none"> <li>-Application of technologies that don't match local conditions</li> <li>-Inadequate critical mass of aquaculture specialists</li> <li>-Low production and productivity</li> </ul>	<ul style="list-style-type: none"> <li>Availability of technologies</li> <li>-Successful cases of genetic improvement programmes;</li> <li>-Successful cases of feed improvement programmes</li> <li>-Success stories of developed value chains</li> </ul>	<ul style="list-style-type: none"> <li>-Create inventory of technologies suitable for specific conditions</li> <li>-Share success stories of technology application</li> <li>-Invest in breeding technologies and human capacity (based on needs assessment)</li> <li>-Supporting development of policy frameworks for responsible use and management of new and introduced aquatic genetic resources</li> <li>-Invest in responsible dissemination programs including PPPs</li> <li>-Invest in improving husbandry</li> <li>-Enhancing economies of scale to access inputs and output markets for SMEs</li> <li>-Research in quality feed development</li> <li>-Assessing the feasibility of different production systems</li> <li>-Research to incorporate market and product development</li> </ul>	<ul style="list-style-type: none"> <li>-AWG and their networks;</li> <li>-Centres of Excellence</li> <li>AWG and their networks;</li> <li>-Centres of Excellence to test and adapt technology</li> <li>-AU-IBAR, NEPAD, Member States in collaboration with regional and International Research Organizations</li> </ul>
<ul style="list-style-type: none"> <li>Environment management</li> <li>-impacts on biodiversity (use of improved strains, introduction of exotic species, policy studies)</li> <li>-impacts on eco-system services e.g. cage farms</li> <li>-impact of greenhouse gases</li> <li>-Climate change vulnerability and impact</li> <li>-Feed pollutants</li> </ul>	<ul style="list-style-type: none"> <li>-Success stories across the region where lessons can be drawn</li> </ul>	<ul style="list-style-type: none"> <li>-Adapting available systems for conducting EIA</li> <li>-Capacity building in risk management</li> <li>-Conducting policy studies</li> <li>-Strengthening national frameworks for environment management</li> <li>-Align national frameworks to regional and international conventions like CBD</li> <li>-Publicise/share existing policies on species movement/introductions</li> <li>-Guidelines to promote responsible commercial aquaculture</li> </ul>	<ul style="list-style-type: none"> <li>Member States</li> </ul>
<b>Thematic Area 4: Ecosystem management and zonation</b>			
<ul style="list-style-type: none"> <li>Trans-boundary Ecosystem Management</li> <li>-Use of shared water bodies</li> <li>-Threat of pollution and introductions</li> <li>-Effects to wild capture</li> <li>-Lack of implementation of existing commitments and protocols on trans-boundary resources</li> <li>-Few champions for aquaculture development</li> </ul>	<ul style="list-style-type: none"> <li>-Existing protocols and commitments to shared resources</li> </ul>	<ul style="list-style-type: none"> <li>-Domestication of regional and international protocols and commitments</li> <li>-Develop and implement internationally accepted standards for trans-boundary jurisdiction issues</li> <li>- Development of case-specific guidelines for trans-boundary issues that are Harmonized with regional and international protocols</li> <li>-Understand why strategies are not integrated at national level</li> <li>-Integration of aquaculture strategies into CAADP processes</li> <li>-Have champions to drum up implementation</li> </ul>	<ul style="list-style-type: none"> <li>Member States</li> <li>-Member States in collaboration with international partners</li> <li>-RFBs</li> <li>-AU-IBAR, NEPAD and international partners</li> <li>-NEPAD in collaboration with regional and international organizations</li> <li>-RECs, AU-IBAR Member States</li> </ul>

## **Annex 6: Outputs from Preliminary- regional meetings for the Action Plan**

During the respective Regional Consultative Workshops on Environmental Management for Aquaculture held in 2015, the opportunity was taken in a separate session to seek views on regional priorities for aquaculture development by participants. This was to ensure as wide a grass-root stakeholder consultation as possible that would contribute too to the Think Tank. The profile of participants to these meetings included representatives from national aquaculture and environmental managers, the respective RECs, RFB's and private sector practitioners that included farmers. The following were the outputs:

### **A] Eastern Africa and Great Lakes Region**

#### Objectives/Agenda

1. Needs assessment, gaps and action plan.
2. Setting priorities for the next actions

#### **What are the three priority areas that need to be addressed?**

##### **IGAD**

1. **Move from subsistence to commercial aquaculture.** IGAD would like to start with small and medium enterprises as a start up with some experiences from the region, e.g. In Kenya there is cluster aquaculture program; Uganda has similar experience with groups of fish farmers (cooperative).
2. **Have a critical problem of manpower.** There are well educated professors with specialists. What is missing is hands on practical training. They need a centre of excellence in the region that can provide hands on practical on-the-job training. Not MSc necessary. Vocational, practical that can offer consultancy services. Therefore always need consultants to provide this service. This needs to be included in the planning. Need to develop action and investment plan for this.
3. **To have investors are interested in the region.** The investors often have money but do not have the practical knowledge. Need to establish business-to-business partnerships between north and south. This will help address big investors. Hence foreign and direct investment will be attracted and will enable the sectors grow, eg. The flower industries in most of Africa. The floriculture has now transferred and local people are consequently because of the experience so gained, investing in floriculture themselves. The development of floriculture could be used as a good development model for aquaculture in the region.

## LVFO

1. **Zoning for aquaculture.** Private investors need to know which areas are appropriate and where they can establish their facilities. No regional guidelines and standards for them to follow.
2. **Market.** Once there is a good market, the private sector will work to feed that market. Need better understanding of the markets, market linkages, and requirements as well as make it easier for cross-border trade of inputs and products. For example, one country may produce a lot of something but the other may not have. Investors had wanted to invest into feeds within Uganda – however, the question was would they be able to sell to the neighbouring countries in order to justify their level of investment?

## Training and Research, Kenya

1. **Need for support (funding) action oriented research.** The funds researchers are often able to get are usually not targeted to local needs. Need funds that shall support research in local needs...
2. So that research can inform practice and practice can in turn inform research.

## ETHIOPIA

1. **Research.** Need to focus on our own indigenous materials. We should be able to generate and adapt giving emphasis to our indigenous species.
2. **Upscaling.** The upscaling of projects/programs/systems should be based on full package Target different groups (small holders, etc.) Coordination between stakeholders is also important.

## LTA

1. **Indigenous species.** LTA – there is farmer with good land and water but there are no hatcheries. We need to develop hatcheries for indigenous species. *O. niloticus* easily available. No hatchery of *O. Tanganyika*...
2. **Feeds are a real issue.** Most of the fish farmers, are now importing feed from Mauritius for the young stages. Within the region need to invest in feed production for the whole range of stages of production. Here regional cooperation to address this as collectively a sizeable market can be create to support investment in feed plants.

## UGANDA

1. **Development does not just happen because there are farmers.** Africa must deliberate find money for regional ... resource persons (eg. 6 months to 1 year – give them certificate and the tools to implement what they have learnt. They should fit and be able to provide services

within the value chain. Government can facilitate if it invests with the youth and equip them with skills and tools to work and generate results = this will facilitate the private sector and help them move forward. Development Approach should be proactive and interventions.

2. **Problem in capital.** From subsistence to commercial – how do you transit if there is no finance? Need to set up regional agricultural banks through which appropriate financing can be accessed.

## **SUDAN**

1. Disease control programs are a must.
2. Awareness of aquaculture by community and public at large.

## **KOFI**

1. Development should include raining of the technicians because they are the basis of everything.
2. Need to invest in the basic infrastructure otherwise all we are talking about will amount to nothing. We need to improve infrastructure. Eg. East DRC has basic infrsturcture – communicate, share information, etc.

## **LEONE**

1. Sharing of experiences is important. Some are ahead and exchange visits would help.
2. Inspection and controls at the borders. Some countries do not have the facilities to allow exchange of products to occur.
3. Capacity building of intuitions so that people can work with the private sector and others.
4. Cooperatives do not have access to inputs, cannot access loans and credit.

## **SUMMARY**

1. Research and Knowledge Sharing platform
  - a. Action research
  - b. Basic research
  - c. Research and knowledge platform
  - d. Knowledge sharing
2. Seed, broodstock and feed
  - a. Define Roles and responsibilities of each institutions. Government can own broodstock hatchery, then private sector hatcheries for seed to stock production units.
  - b. Who should finance what? PPP? –What kind of PPP arrangements should be made? Need to have good PPP models.

- c. Capital/finance is a critical problem. It is difficult to set up new banks. Encourage banks to start lending for aquaculture – what needs to be done?

## LVFO

1. Business platform – Private sector led – have a business platform for investors.
2. Intra-regional trade. Facilitate cross-border trade for inputs and products.
3. Zoning for aquaculture.

## CHECHE

1. When do we expect the frameworks we are developing to be final. When can the frameworks be signed? If they are not taken up, what shall happen to our environment?
  - a. After development, then next step will be validation.

## B] Central Africa

Contribution of the Central Africa group towards identification priorities for the development of aquaculture

Assets	Weaknesses	Constraints	Opportunities
-A natural and geographical environment favorable to the process of development of aquaculture -The strong will of the decision-making bodies of the ECCAS and a political environment conducive to the emergence of aquaculture market orientation	-Low organizational and technical capacity of farmers -Absence of a document on the development of the aquaculture sector policy framework -Low dissemination of the results of research that it is almost non-existent in the sector -A shortfall in human resources, whether education, training or research -A lack of technical knowledge on the technical routes adapted to the natural, economic and social conditions of Chad -The very low number of aquaculture farms market orientation -The persistence of a bad perception of the role of the State on the part of the promoters in the process of development of aquaculture -Fledgling nursery activities -A legal framework to promote -Motivation of developers following the failures of past experiences -Low financing of the sector -non availability of good quality food	-Climate change -Nature of terrain -Pollution risks -Competition from imported farmed fish	-An enabling economic environment characterized by an increasing demand in fisheries products -Continuous development of the communications infrastructure and the existence of regional potential markets -The availability of agricultural by-products for feeding fish. -Creation of a center of regional excellence in aquaculture in Limbe in Cameroon

## Priority actions:

1. Establishment of a legislative and regulatory framework
2. Sector funding advocacy
3. Organization of the aquaculture sector
4. Private public partnership development
5. Creation of the Regional Centre of Excellence in Aquaculture

## C] West Africa

### Major Issues for Sustainable Aquaculture Development in West Africa

No.	Issues	Action Plan
1.	Quality Feed	Strategic establishment of fish feed plants in the five regions of Africa
2.	Breeding and selection of significant culture species	Establishment of breeding and selection programmes for production of quality broodstock material and fingerling for culture
3.	Capacity building	Development of capacity building programmes at all levels of aquaculture functioning at existing selected regional/national training centres
4.	Research and Development	Identification of regional centres for enhancement of research in different issues on aquaculture (feed formulation, feed efficiency, seed production, diseases, environmental quality, farming systems)
5.	Public sector investment to support private sector	Create enabling environment for aquaculture development (eg. Access roads, electricity, telecommunication)
6.	Enhancement of domestic production	Provision of Incentives (Cost of capital, subsidy, tax incentives, market price guarantee)

## References

1. FAO, 2014.



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