



# NATIONAL FISHERIES RESOURCES RESEARCH INSTITUTE (NaFIRRI)



**A CENTRE OF EXCELLENCE FOR FISHERIES  
INNOVATIONS**

**INSTITUTE PROFILE 2<sup>nd</sup> Edition  
2013**



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## Acronyms

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<b>APs:</b>	Aquaculture Parks
<b>ATAAS:</b>	Agricultural Technology and Agri-Business Advisory Services
<b>CBD:</b>	Convention on Biological Diversity
<b>DFR:</b>	Department of Fisheries Resources
<b>DSIP:</b>	Development Strategy and Investment Plan
<b>EAC:</b>	East African Community
<b>EAFFRO:</b>	East African Freshwater Fisheries Research Organization
<b>EAFFRO:</b>	East African Fisheries Research Organization
<b>FAO:</b>	Food and Agricultural Organization
<b>FIRI:</b>	Fisheries Research Institute
<b>FIRRI:</b>	Fisheries Resources Research Institute
<b>IDRC:</b>	International Development Research Centre
<b>LVBC:</b>	Lake Victoria Basin Commission
<b>LVEMP:</b>	Lake Victoria Environmental Management Project
<b>LVFO:</b>	Lake Victoria Fisheries Organization
<b>LVFS:</b>	Lake Victoria Fisheries Service
<b>KMFRI:</b>	Kenya Marine Fisheries Research Institute
<b>MAAIF:</b>	Ministry of Agriculture, Animal Industry and Fisheries
<b>MuZARDI:</b>	Mukono Zonal Agricultural Research and Development Institute
<b>NAADS:</b>	National Agricultural Advisory Services
<b>NaFIRRI:</b>	National Fisheries Resources Research Institute
<b>NARC:</b>	National Agricultural Research Council
<b>NARL:</b>	National Agricultural Research Laboratories
<b>NARO:</b>	National Agricultural Research Organization
<b>NARS:</b>	National Agricultural Research Systems
<b>NDP:</b>	National Development Plan
<b>PARIs:</b>	Public Agricultural Research Institutes
<b>TAFIRI:</b>	Tanzania Fisheries Research Institute
<b>UBOS:</b>	Uganda Bureau of Statistics
<b>UFFRO:</b>	Uganda Freshwater Fisheries Research Organization
<b>WHO:</b>	World Health Organization
<b>ZARDIs:</b>	Zonal Agricultural Research and Development Institutes

## Preface

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The fisheries sector has remained so significant in the economic development of Uganda to the extent that fish exports influence the strength of the Uganda shilling. Fish has been identified as one of 11 priority commodities in the Development Strategy and Investment Plan (DSIP) of the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). It is therefore essential for Stakeholders including Development Partners and Collaborators to understand where fisheries research in Uganda came from and where it is headed.

The first survey of the fisheries of Lake Victoria in 1927/1928 was followed by the establishment of the Lake Victoria Fisheries Service (LVFS) and subsequently the East African Fisheries Research Organization (EAFRO) in 1947. Fisheries Research in East Africa was then integrated under the East African Freshwater Fisheries Research Organization (EAFFRO) in the 1960s and from 1967 under the first East African Community (EAC).

The break-up of the EAC in 1977 was followed by the creation of the Uganda Freshwater Fisheries Research Organization (UFFRO) first, under the Ministry of Regional Cooperation, and subsequently under the MAAIF. The creation of the National Agricultural Research Organization (NARO) in 1992, absorbed UFFRO as the Fisheries Research Institute (FIRI) incorporating both capture and aquaculture fisheries research. In 2000, FIRI was renamed the Fisheries Resources Research Institute (FIRRI) recognizing all components of aquatic research (capture fisheries, stock assessment, fish biology and ecology, aquaculture, limnology, socio-economics, and Information Communication Technology (ICT)).

The reforms in agricultural research in Uganda led to formation of a National Agricultural Research Policy (2003) followed by the National Agricultural Research Act (2005), and the creation out of FIRRI of the semi-autonomous National Fisheries Resources Research Institute (NaFIRRI) which though still under the Policy Guidance of NARO has a more practical oriented approach to demand-driven research.



**Frans Witte**

12<sup>th</sup> February 2013

In this 2<sup>nd</sup> edition of the NaFIRRI profile we pay tribute to the late Frans Witte who contributed to the advancement of fisheries research in Uganda and in East Africa. His contribution as a prolific author of many publications on haplochromines (*Nkejje*), and as a mentor to many will be remembered for its impacts on fisheries research in Uganda.

This institute profile is intended to inform Stakeholders, Development Partners and Collaborators of the role of NaFIRRI at the local, national, regional and international level through its mandate: *“To conduct basic and applied research of national and strategic importance in Aquaculture, Capture fisheries, Water environment, Socio-economics and Marketing, and Information Communication Management, and any other emerging issues in the fisheries sector”*. In its current operations, NaFIRRI has consolidated its research under four major Research Programmes: *Aquaculture and Fish Bioscience, Capture Fisheries and Biodiversity Management, Fish Habitat Management, Innovations and Post-harvest Fisheries Research*.

**Dr John S. Balirwa**  
**Director of Research**

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# 1. THE FISHERIES RESOURCES OF UGANDA

The fishing industry is very important to the Ugandan economy and is the most important non-traditional agricultural export commodity. Fisheries contributes 12% to the Agricultural GDP and about 3.0 % to the National GDP. Fish generates about Ug. Shs 442 billion annually at the landings, and over US\$150 million in regional and international exports.

Uganda has the capacity to produce about 450,000 metric tonnes of fish annually from capture fisheries. The maximum catch is estimated at 600,000 metric tonnes but should be higher as the production from many lakes is not well documented. The fisheries sector employs 1 m to 1.5 m artisanal fishermen and over 5,000 people are involved in activities along the production and marketing chain.

Fish provides the most affordable source of animal protein with an average per-capita consumption of about 8 kg, accounting for more than 50% of the animal protein intake of an average Ugandan's diet. Although there had been earlier attempts to start industrial fish processing on Lake Victoria in the 1950s and on Lake George in 1960s, industrial fish processing only became well established on Lake Victoria in 1990s and there are currently about 14 fish processing fish plants specifically processing fish for export.

## 1.1. Capture Fisheries

Water bodies, which are the most important sources of fish, cover about 20% of the country's surface area and comprise five major lakes (Victoria, Albert, Kyoga, Edward, George) and 160 minor lakes in addition to rivers and wetlands. The ecosystems within and around these water bodies are some of Uganda's richest sources of biodiversity. Uganda has a high fish species diversity of at least 500 unique and endemic species within its water bodies, especially in lakes Victoria and Kyoga and some minor lakes where ornamental fish are caught for sale and direct human consumption.

The main commercial species are Nile tilapia (*Oreochromis niloticus*), Nile perch (*Lates niloticus*), *Rastrineobola argentea* (Mukene), *Brycinus nurse* (Ragoge), *Neobola bredoi* (Muziri), *Bagrus docmak* (Semutundu), *Clarias gariepinus* (Male), *Hydrocynus* spp (Tiger fish), *Protopterus aethiopicus* (Lung fish, Mamba), and *Alestes* spp (Angara). There were a number of fish species such as the native tilapiines of lakes Victoria and Kyoga (*O. esculentus* and *O. variabilis*) and the riverine *Labeo victorinus* (Ningu) which were originally important and highly cherished food fishes but have either disappeared completely or their populations have been reduced to uneconomic levels due to unsustainable fishing practices and environmental degradation.



Aquaculture was introduced in Uganda in 1953 with the establishment of an aquaculture experimental station at Kajjansi off Kampala-Entebbe Road. The main objective of the station was to conduct research and extension services, and produce and distribute fish fry to farmers. The species initially farmed were the native tilapiines, Nile tilapia (*Oreochromis niloticus*), *Tilapia zillii* and the Catfish (*Clarias gariepinus*). Subsequently some foreign species, the Mirror carp (*Cyprinus carpio*), the Grass carp (*Ctenopharyngodon idella*), the Black bass (*Macropterus salmoides*) and Crayfish (*Procambarus clarkii*) were introduced. Of all these species, Nile tilapia, Catfish and Mirror carp became and have remained the most commonly cultured fish species in Uganda. Additional technologies are being developed to increase the list of cultured species to include species like *Labeo victorianus* (Ningu), *Barbus altianalis* (Kisinja) and *Lates niloticus* (Mputa).

During 1970s and 1980s, aquaculture in Uganda virtually collapsed. Most ponds were abandoned due to political instability and mismanagement. As a result, aquaculture production dropped from 900 t in 1965 to 30 t by 1986. The number of ponds countrywide dropped from 11000 in 1965 to 6000 by 1990. Virtually all the fish fry centres were run down. Rehabilitation of aquaculture resumed in 1986. Mirror carp and Nile tilapia remained the most popular aquaculture species. However, production increased slightly from 30 t in 1986 to 400-600 t in 1992 and 4,000 t by 2004. Since then, there has been a deliberate drive to promote aquaculture from an extensive subsistence system to semi-intensive and intensive commercial systems. Aquaculture production rose from 285 t in 1999 to an estimated 100,000 t including restocked water bodies in 2010/11, with 20,000 ponds existing throughout the country (DFR, 2010).

In an effort to increase aquaculture productivity and production from the current 100,000 t to a projected 300,000 t by 2016, the Government intends to create 'concentrated aquaculture production areas' known as Aquaculture Parks (APs). Through APs, the Government targets to move from predominantly subsistence aquaculture production to commercial production by identification, acquisition and service of sites for concentrated production that will be accessible by the commercial producers.

### **1.3. Fish processing and marketing**

It is estimated that out of the total quantity of fish landed (~ 450,000 t), about 60% goes to fish processing plants for export, while 20% is processed using traditional methods of smoking, salting, frying and sun drying. The marketing of fish is characterized by several channels of distribution serving the domestic, regional and international export markets. The majority of consumers purchase fish supplied through the distribution chain, although a significant proportion of consumers especially along lake shores and around the smaller water bodies obtain their fish for consumption directly by fishing or from fisherfolk.

Fish prices are characterized by unpredictable fluctuations due to several factors especially variability of supply and demand for different species around water bodies. Fishing, seasons and inner rhythms are some of the influences on fish supply. The processing industry has influenced market prices at various fish landing sites. Fish destined for processing has generally attracted higher prices than fish for the domestic and regional markets. Nile perch from Lake Victoria dominates Uganda's exports mainly as chilled and frozen in various product forms such as: whole gutted, headed and gutted, skin on and skinless fillets, and swim bladders (fish maws) (Table 1). The main export destinations for fish products include Europe, Australia, USA, Asia (Hong Kong, Singapore, Japan) and the Middle East. Cured, salted and sun dried fish is exported to the neighbouring countries. Smoked fish especially Tilapia, lung fish and catfish also has high internal demand.

### **1.4 Fish Exports**

Fish exports are now the second most important foreign exchange earner after coffee, but while these exports dramatically increased after 1991, they have recently declined sharply falling from a peak of 36,600 t in 2005 to about 20,562 t in 2012. This seems to be a consequence of over exploitation, environmental degradation and the rampant use of destructive fishing gears and methods.



**Table 1. Fish exports (chilled & frozen fillets, gutted & beheaded) from 1991-2012 (Source: MAAIF & UBOS)**

<b>Year</b>	<b>Volume (tonnes)</b>	<b>Value (US\$'000)</b>	<b>% Total Exports</b>
1991	4,751	5,309	2.9
1992	4,831	6,451	2.7
1993	6,037	8,807	2.7
1994	6,563	14,769	3.7
1995	12,971	25,903	3.9
1996	16,396	39,781	4.5
1997	9,839	28,000	4.7
1998	13,805	34,921	7.4
1999	13,380	36,608	5.2
2000	15,876	34,363	7.7
2001	28,672	80,398	17.3
2002	25,169	87,574	18.8
2003	25,111	86,343	17.0
2004	30,057	102,917	16.0
2005	36,600	143,618	17.6
2006	32,855	136,851	15.2
2007	28,400	117,364	9.3
2008	23,503	115,306	7.2
2009	17,253	87,655	7.9
2010	16,697	86,017	7.9
2011	17,332	91,447	6.3
2012	20,562	115,508	8.0

The trends in the volume and value of fish exports are manifestations of fishing trends ( including illegal fishing and the capture of immature fish) as well as the value of fish in the export markets (*cf* 2012 and 2007). The projections are that research will be enhanced to translate into increased production and productivity from both capture fisheries and aquaculture.

Production constraints in capture fisheries have increased in severity and threaten an export base worth an estimated US\$ 150 m annually, and a per capita consumption that has fallen to 8 kg which is below the recommended World Health Organization (WHO) levels of 17 kg person<sup>-1</sup> year<sup>-1</sup>. Climatic impacts are an emerging phenomenon in both capture fisheries and aquaculture.

## **2. THE POLICY AND LEGAL FRAMEWORK FOR FISHERIES DEVELOPMENT AND MANAGEMENT IN UGANDA**

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The overall policy framework for development and management of fisheries resources in Uganda is guided by the National Constitution of 1995 paragraph (xiii). The Constitution places the obligation on the State to protect important natural resources including land, water, wetlands, minerals, oil, fauna and flora on behalf of the people of Uganda.

### ***2.1 The Fisheries Sector Policy***

The overall development objective of the National Fisheries Sector Policy (2004) is to ensure that there is increased and sustainable fish production and utilization by properly managing capture fisheries, promoting aquaculture and reducing post-harvest losses.

The specific Fisheries Policy objectives are:

- a) Sustainable management and development of fisheries;
- b) Decentralization and community involvement in fisheries management;
- c) Promote partnerships between districts, sub-counties and communities in the management of shared fisheries and aquatic ecosystems;
- d) Identify and establish sustainable institutions and funding mechanisms for improved fisheries management;
- e) Promote investment in fisheries that is environmentally, socially and economically sustainable;
- f) Promote participatory planning and policy-making as a basis of fisheries management;
- g) Establish effective systems for the collection, compilation, analysis, storage and dissemination of information for planning, management, monitoring and evaluation purposes;
- h) Establish mechanisms to minimize adverse environmental impacts on fisheries;
- i) Increase aquaculture fish production to reduce the gap between fish supply and the increasing demand for food fish;
- j) Promote measures to ensure that the quality, wholesomeness, safety for human consumption and value of harvested fish and fishery products is secured and/or enhanced;
- k) Promote measures to achieve sustainable increases in the value and volume of fish marketed for national consumption and export;
- l) Promote comprehensive training and advisory programmes so as to build human resource capacity to increase levels of knowledge, skill and expertise in the public and private fisheries sub-sectors;
- m) Promote research in social, economic, environmental and technical issues pertinent to fisheries, including development of appropriate technologies, in response to fisheries development and management needs.

### ***2.2 Other sectoral and inter-sectoral policies relevant to the National Fisheries Policy***

- i. The National Environmental Management Policy (1994) aims at facilitating a comprehensive and coordinated approach to solving environmental problems in Uganda and emphasizes the need to conserve biological resources including fisheries.
- ii. The Wildlife Policy (1995) recognizes fishes as a form of wildlife. The policy objective is to ensure the perpetuity, for Ugandans and the global community, the wildlife resources within and outside the protected areas and to enable the people of Uganda derive benefits from wildlife. The policy builds into the Fisheries Policy in terms of creating strong links that are associated with exploitation of wild fish species.
- iii. The National Wetlands Policy of 1995 compliments the goals and objectives of National Environmental Management Policy with the aim to maintain an optimum diversity of uses and users from the wetlands especially as wetlands are habitats as well as breeding and nursery grounds for fish.

- iv. The Water Policy (1995) takes into account economic, liberalization, privatization and decentralization reforms and recognizes good quality water for the growth of the water biota including fish.
- v. The Development Strategy and Investment Plan of the Agricultural Sector (DSIP 2010) aims to raise rural household incomes and improve food and nutrition security of all Ugandans.
- vi. The National Agricultural Research (NARs) Act, 2005 provides for the development of an agricultural research system for Uganda, for the purpose of improving agricultural research services, delivery, financing and management.
- vii. The National Development Plan (NDP) 2010 seeks to significantly improve specific socio-economic development indicators associated with transformation to include: raising average per capita income levels, improving the labour force distribution in line with sectoral GDP shares, raising the country's human development indicators, and improving the country's competitiveness to levels comparable to middle income countries.

### 3. INTERNATIONAL AND REGIONAL OBLIGATIONS RELATED TO FISHERIES

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Uganda has a number of obligations under international law that are relevant to the fisheries sector and the National Fisheries Policy, a few of which are outlined below:

#### ***3.1 The FAO Code of Conduct for Responsible Fisheries***

The Code provides principles, practices and standards applicable to the utilization, conservation, management and development of all fisheries. It also covers the capture, processing and trade of fish and fishery products, fishing operations, aquaculture, fisheries research and the integration of fisheries research into coastal management.

#### ***3.2 The Convention on Biological Diversity (CBD)***

Uganda is a party to the CBD and is required to develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity.

#### ***3.3 The Treaty for the Establishment of the East African Community***

The Community brings together the three partner states of Kenya, Uganda and Tanzania. The treaty was signed on November 30, 1999 by the Heads of State of the participating governments. Article 114 provides for the management of natural resources. The Partner States agreed to co-operate through the adoption of common policies and regulations for the conservation, management and development of fisheries resources.

#### ***3.4 Convention for the Establishment of the Lake Victoria Fisheries Organization (LVFO) 1994***

The Partner States of Kenya, Uganda and Tanzania adopted the convention that established the LVFO in 1994. The objectives of the convention are to foster cooperation among the parties; harmonize national measures for the sustainable utilization of the living resources of Lake Victoria; and, develop and adopt conservation and management measures.

#### ***3.5 Protocol for the establishment of the Lake Victoria Basin Commission (LVBC)***

The signing of the protocol for sustainable development of the Lake Victoria basin on November 29, 2003 by the three partner states of Kenya, Uganda and Tanzania and its ratification in December 2004 cleared the way for establishment of the LVBC. The objectives and broad functions of the Secretariat of the Commission are to promote, coordinate and facilitate development objectives with the Lake Victoria basin.

#### ***3.6 The Ramsar Convention***

The Ramsar Convention on wetlands 1971 provides the framework for the national action and international cooperation for the conservation and wise use of wetlands and their resources. Uganda is a signatory to the convention and the conservation of wetlands with its habitats is important for the fisheries biodiversity.

#### ***3.6 The Convention on International Trade in Endangered Species (CITES)***

The Convention on International Trade in Endangered Species of wild fauna and flora was entered into by states to regulate the international wildlife trade. In the past, unregulated trade had caused massive declines in the numbers of many species and ecological biodiversity. Member States act by banning commercial international trade in an agreed list of endangered species and by regulating and monitoring trade in others that might become endangered.

#### ***3.7 Technical Corporation for the Promotion of the Development and Environmental Protection of the Nile Basin (Teconile) 1992.***

Teconile was established by the Ministers of Water Affairs in the Nile basin from ten countries namely Burundi, Egypt, Ethiopia, Eritrea, Kenya, Rwanda, Sudan, Tanzania, Uganda and Democratic Republic of Congo. It provides for cooperation by the signatory countries in integrated and sustainable development and conservation and in joint use of the Nile waters.

## 4. THE HISTORY OF FISHERIES RESEARCH IN UGANDA AND THE EVOLUTION OF NaFIRRI

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The earliest approach to fisheries research in Uganda dates back to the first fisheries survey conducted on Lake Victoria by Mr. Michael Graham from 1927 and 1928. Based on his observations, Graham concluded that Lake Victoria was a tilapia lake dominated by *Tilapia esculenta* and *T. variabilis* (*Oreochromis esculentus* and *O. variabilis*) respectively. The introduction of the gill-net in the early 1900s was accompanied by a rapid decline in the catch per net per night from 30 prior to 1921 to about 6 in 1928.

Graham's 1929 report recommended the following and led to the establishment of fisheries research and fisheries management in Uganda:

1. Institution of the collection of special catch statistics for use as a measure of the annual yield of the fishery.
2. Complete control of the fishing power (effort)
3. Elimination of nets capable of catching small tilapia and the restriction of the fishery to the 5-inch net alone.

Graham's recommendations also led to the creation of the Lake Victoria Fisheries Service (LVFS) and subsequently the East African Fisheries Research Organization (EAFRO) at Jinja in 1947 with about five scientists investigating the Tilapia fisheries of Lake Victoria. From the 1950s, limnological factors started to feature in the lake productivity mechanisms with nutrients, rainfall and temperature forming part of the aquatic productivity processes. The declining Tilapia fisheries at the time led to considerations of stocking lakes Victoria and Kyoga with Nile perch and Nile tilapia as a solution to the shortage of fish supplies from these lakes. This increased the complexity of the fisheries and water environment and led to an ecosystem-based approach to research.

During the 1960s, EAFRO was turned into the East African Freshwater Fisheries Research Organization (EAFPRO), to investigate all freshwater fisheries resources in British East Africa. There was an increase in staff numbers as the focus of research switched from the declining Tilapias to other commercially important fishes from the diverse lakes (e.g. Turkana, Baringo, Rukwa) in the region. Exploratory studies on Lake Victoria and its satellite lakes revealed that haplochromine fishes (*Nkejje*) were much more diverse than previously thought by Graham and this led to the commissioning of the research vessel, MV Ibis in 1968 to carry out the first stock assessment on Lake Victoria. It also stimulated interest in the evolutionary aspects of cichlid species flocks using the British Museum of Natural History as the base for the investigations.

Towards the end of the 1960s and early 1970s, foreign scientists departed leaving behind the first local scientists led by John Okedi to handle the mainstream research on Lake Victoria and other lakes in East Africa. Simultaneously, two EAFPRO sub-stations were established in Kenya (KMFRI) and Tanzania (TAFIRI), and the Haplochromis Ecology Survey Team (HEST) started its activities in Mwanza Gulf to the south of Lake Victoria. EAFPRO was later passed over to the first East African Community (EAC), and after the breakup of the first EAC in 1977, it was taken over by the Government of Uganda as the Uganda Freshwater Fisheries Research Organization (UFFRO) charged with the responsibility for undertaking fisheries research in Uganda.

During the restructuring and reorganization of agricultural research in Uganda, the National Agricultural Research Organization (NARO) was created in 1992 and it absorbed UFFRO as the Fisheries Research Institute (FIRI) incorporating both capture fisheries and aquaculture research under its mandate. In 2000, FIRI evolved to the Fisheries Resources Research Institute (FIRRI) recognizing all components of aquatic research (capture fisheries, stock assessment, fish biology and ecology, aquaculture, limnology, socio-economics, information, etc). The period 1999-2003 saw FIRRI crystallize constraints in both capture fisheries and aquaculture as:

### 4.1 Capture Fisheries Production Constraints

- a) Open access to the fisheries;
- b) Environmental degradation of water bodies and thus of fish habitat;

- c) Decline in fish stocks and fish species diversity due to excessive fishing effort (over-fishing or over-capitalization of the fisheries);
- d) Use of destructive fishing gears and methods;
- e) Capture of immature fish and introduction of exotics;
- f) The spread and impacts of exotic fish species (Nile perch);
- g) Proliferation of invasive weeds, in particular, water hyacinth;
- h) Post-harvest losses (10-30% of the catch) due to poor handling, processing and storage;
- i) Ineffective management of the fisheries due to limited community participation;
- j) Inadequate investment skills among fishers.
- k) Inadequate access to information technologies and inefficient dissemination of technologies.

#### ***4.2 Aquaculture Production Constraints***

- a) Inadequate supply of quality seed (fry).
- b) Inadequate technical information on feasibility of commercial culture (e.g. intensive and extensive culture/polyculture systems).
- c) Limited supply of appropriate feeds and feeding technologies for commercial culture species.
- d) Poor application of research results.
- e) Lack of knowledge and information on economic and social feasibility of aquaculture especially cage culture.
- f) Lack of culture to involve investors into aquaculture for traditional species.
- g) Inefficient dissemination of technologies.

Through support of development partnerships (e.g. IDRC, LVEMP) training opportunities and collaboration with diverse local and international stakeholders (universities and Institutions), NaFIRRI was able to assess the environmental status, fish stocks, biodiversity and socio-economic issues for most production systems in the country. By 2002, there were projects in NaFIRRI dealing with capture fisheries and aquaculture. From 2003 to 2005, NARO went through reforms that impacted its operations but led to a more clearly defined national research agenda. To date, there are two main projects that support NaFIRRI research agenda:

- i. Agricultural Technology and Agribusiness Advisory Services (ATAAS), a Government program in partnership with World Bank and its objective is to increase production and productivity of farming enterprises for food security and household incomes
- ii. Lake Environmental Management Project (LVEMP), a regional program that aims at up scaling good water quality and environmental practices on Lake Victoria and monitors trends in the various environmental stressors so as to generate policy guidelines on managing the people, the fisheries and the environment.

## 5. THE NATIONAL FISHERIES RESOURCES RESEARCH INSTITUTE (NaFIRRI)

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Through diverse processes and institutional structures such as EAFRO, EAFFRO, UFFRO, FIRI, and FIRRI, and reforms, fisheries research (both capture fisheries and aquaculture) in Uganda now falls under the mandate of the National Fisheries Resources Research Institute (NaFIRRI), which is one of the six semi autonomous Public Agricultural Research Institutes of Uganda under the policy guidance of the National Agricultural Research Organization (NARO) to provide agricultural research services. The NARO is the apex body for guidance and coordination of all agricultural research activities in the national agricultural research system in Uganda.

### ***Mandate***

To conduct basic and applied research of national and strategic importance in Aquaculture, Capture fisheries, Water environment, Socio-economics and Marketing, and Information Communication Management, and emerging issues in the fisheries sector”.

### ***Vision***

A Centre of Excellence in Fisheries Innovations and Impact Creation in collaboration with SMART partnerships.

### ***Mission***

To generate the knowledge base, develop and disseminate fisheries technologies for increased but sustainable fish production, conservation of the fisheries genetic resources, water quality and fish habitat, and to develop and manage the fisheries and required linkages with stakeholders.

### ***Goal***

To enhance the contribution of fisheries research to increased and sustainable fish production, economic growth, food security and poverty eradication through generation and dissemination of appropriate technologies, knowledge and information.

### ***NaFIRRI core values***

1. Inclusivity
2. Subsidiarity
3. Transparency
4. Integrity
5. Accountability
6. Excellence

### ***5.1. Specific Objectives***

The immediate objective of NaFIRRI is “to manage, undertake, promote and coordinate all aspects of research in aquaculture (quality seed, feed, culture systems and genetics), capture fisheries (biology, ecology and stocks), fish production systems (e.g. lakes, rivers, pond cages), water environment (aquatic ecosystem health), and fisheries socio-economics of the fisheries whilst conserving the natural resource base and to ensure quality product, dissemination and application of research results by end users.”

### ***5.2. Core Functions of NaFIRRI***

- a) Generation of knowledge and technologies of strategic importance for the management, development and conservation of fisheries resources and water quality.
- b) Establishment and management of the human, physical and financial resources of the National Fisheries Resources Research Institute.

- c) Provision of technical backstopping and capacity building to MAAIF, ZARDIs, NAADS and other Agencies dealing in fisheries research and water quality.
- d) Development and management of fisheries research information and ensuring collaboration with stakeholders.
- e) Planning, monitoring and evaluation of all fisheries research programmes undertaken by the institute to ensure conformity with national research strategy.
- f) Ensuring quality of knowledge and technologies developed, multiplied and disseminated through uptake pathways.
- g) Generation of periodic reports on fisheries and water quality research programmes to NARC and other stakeholders.
- h) Establishment of sustainable linkages and partnerships with Local, Regional and International Fisheries Research bodies.
- i) Participation in problem identification and prioritization of fisheries research demands for the national research agenda.

The functions as defined are used to address all fisheries issues in both aquaculture and capture fisheries of Uganda. NaFIRRI collaborates in national research priority settings with the other National Agricultural Research Institutes (NARIs) and Zonal Agricultural Research and Development Institutes (ZARDIs) especially in the area of aquaculture. Through a NARO-wide approach, the following themes form the basis for identifying research priorities and projects:

- Theme 1. Understanding people, their livelihood systems, demands and impact of innovations
- Theme 2. Enhancing innovation process and partnership
- Theme 3. Enhancing integrated management of natural resources
- Theme 4. Technological options that respond to demands and market opportunities
- Theme 5. Enabling policies and linking producers to markets

### ***5.3. Key Impact Areas for fisheries research***

From the National Agricultural Research System (NARS), through the institute's mandate, mission and goal, four key impact areas are addressed:

- a) Enhanced productivity.
- b) Enhanced utilization of research outputs
- c) Enhanced management and utilization of natural resources
- d) Enhanced market access

By the time the reforms were conducted, issues such as production constraints, priority commodities (fish species), priority production systems (lakes, rivers, wetlands, ponds, cages, tanks) had already been identified through the institute's own reform processes. Through participatory approaches, fisheries research has been re-aligned to policy principles for agricultural research in Uganda. These principles emphasize:

- a) Responding to market opportunities
- b) Empowerment of stakeholders
- c) Scientific integrity and professional excellence
- d) Decentralization of agricultural research services
- e) Promoting participation of private sector, civil society and farmers
- f) Mainstreaming social, human and environmental concerns
- g) Separating public funding from research services delivery
- h) Mainstreaming gender issues and concerns
- i) Quality assurance of research services.

### ***5.4. Research programmes addressed by NaFIRRI within NARO***

- 1. Aquaculture and Fish Biosciences
  - a) Fish feeds (natural and formulated)
  - b) Cage culture technology
  - c) Mapping of Aquaculture in Uganda



- d) Improvement of growth performance of Nile tilapia and catfish
- 2. Capture Fisheries and Biodiversity Management
  - a) Seed production, breeding and nursery areas for tilapia, Nile perch, Mukene, Semutundu and Kisinja
  - b) Fish stock dynamics and harvest technologies for recovery of Nile perch
- 3. Fish Habitat Management
  - a) Environmental (water quality) and socio-economic factors that facilitate fish production
  - b) Water weeds (water hyacinth, *salvinia*)
- 4. Innovations and post-harvest fisheries
  - a) Livelihoods and innovations
  - b) Markets and cost-benefits analyses of fisheries and aquaculture enterprises
  - c) Technologies for value-added fisheries products
  - d) Dissemination through ICT and linkages to reduce cost of service delivery

## 6. OVERVIEW OF CAPTURE FISHERIES AND AQUACULTURE RESEARCH IN UGANDA

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### 6.1. Objectives of Capture Fisheries Research

The capture fisheries research objectives are to generate technologies, methods and advice for: sustainable exploitation of fisheries; conservation and enhancement of aquatic biodiversity; integration of lake productivity processes into fisheries management; control of pollution and degradation of the aquatic environment; control of water hyacinth and other invasive weeds; management of fisheries with greater community participation; and optimization of socio-economic benefits from fisheries.



**Production constraints such as the rampant use of illegal fishing methods, increased nutrient loading, pollution and water hyacinth shown above affect fishes.**

## 6.2. Objectives of Aquaculture Research

Aquaculture research has moved to a new level now estimated to be about 100,000 t annually including production from ponds, cages and restocked small water bodies. The challenge is to generate and disseminate technologies and knowledge that should result into an increase in production to about 300,000 t of farmed fish annually within the next five years.

The aquaculture research objectives are to develop technologies, methods and advice for improvement of farming systems, increased commercial production of a variety of quality 'seed' fish fry; production of appropriate fish feeds; suitable pond management practices; prevention and control of fish diseases, parasites and predators; understanding economic feasibility of aquaculture; and socio-economics of fish farming communities.



**Cage farming, the technology being promoted by NaFIRRI in collaboration with the Uganda-China Aquaculture Technology Demonstration Centre**



**Fish harvest from cages being loaded into trucks**

The increase in aquaculture production will require transformation of culture systems from one dominated by earthen ponds to include cage culture.

## 7. NaFIRRI RESEARCH AREAS 2013 - 2016

NaFIRRI research projects under ATAAS approved by NARO Council.

Programs	Output
<p><b>1. Aquaculture and Fish Biosciences</b></p> <p>a) Sustainable utilization and management of natural fish food organisms and artificial feeds for Nile tilapia and African catfish</p> <p>b) Development of appropriate cage culture technologies</p> <p>c) Genetic improvement of growth of Nile tilapia (<i>Oreochromis niloticus</i>) and African catfish (<i>Clarias gariepinus</i>)</p>	<p>a) Cost effective feed formulae for Nile tilapia and catfish; and technologies for mass production of starter fish feeds development</p> <p>b) Appropriate cage design and development densities developed and recommended for different water bodies</p> <p>c) Fast growing genetically modified brood stock of Nile tilapia and African catfish developed</p>
<p><b>2. Capture Fisheries and Biodiversity Management research</b></p> <p>a) Optimization of seed production in commercial fish species (Nile tilapia, Nile perch, <i>Mukene</i>, <i>Ssemutundu</i> and <i>Kisinja</i>)</p> <p>b) Assessment of commercial fish stocks and determination of appropriate harvesting technologies on lakes, Victoria, Albert, Kyoga, Edward and George</p>	<p>a) Technologies and methods for high quality seed production and culturing developed for the different fish species and policy briefs for protection of fish breeding/nursery sites</p> <p>b) Fish biomass of the major lakes determined and appropriate fishing gears/methods for Mukene, Ragoogi, Muziri, Angara and Ngassia determined and recommended</p>
<p><b>3. Fish Habitat Management</b></p> <p>a) Determination of environmental and Socio-economic factors that influence optimal fish production levels</p> <p>b) The fisheries, socio-economics and environment of Lake Victoria</p>	<p>a) Methods and guidelines for riparian community management of water quality, aquatic weeds and nutrient content and quality developed</p> <p>b) Geo-referenced maps of fish breeding and nursery grounds, cage culture sites, aqua parks, pathogens and aquatic weeds developed, Fish biomass and value determined and policy briefs for optimal and sustainable exploitation developed</p>

<p><b>4. Innovations and Post harvest Fisheries</b></p> <p>a) Identification and prioritization of alternative livelihood options for fisheries on lakes Edward and George</p> <p>b) Market and cost benefit analyses of selected fisheries and aquaculture enterprises</p> <p>c) Development of appropriate technologies and marketing strategies for value added fisheries products in central, western and eastern Uganda</p>	<p>a) Profitable and acceptable enterprises for improved quality of life of fisher folks determined</p> <p>a) Profitability indices along the value chains of commercial fish species; Nile perch, tilapia, catfish. Mukene, Muziri and Ragoogi in lakes Albert and Kyoga determined and enterprise budgets for African catfish and tilapia in aquaculture determined</p> <p>b) Post harvest fisheries technologies that optimize quality, safety and profitability developed and promoted along the fish value chain.</p>
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#### **Long-term training topics**

**Optimization of artificial spawning and feeding ontogeny of early life stages of *Barbus altianalis*** (PhD by Cassius Aruho at Makerere University)

**Genetic characterization and artificial breeding of *Bagrus docmak* (Forsskal, 1775) from Uganda, East Africa** (PhD by Rose Basiita at David Cook University, Australia)

**Development of Improved fish farming extension approaches and farmers' livelihoods in Uganda** (PhD by Gertrude Atukunda at Makerere University)

**Implications of structure and functioning of fishing communities to spread of HIV/AIDS and water related diseases: A case of Lakes Albert and Kyoga** (PhD by Joyce Akumu at Makerere University)

**Determination of physico-chemical parameters of the saline Crater lakes of Western Uganda and their suitability to *Artemia* production as a means of enhancing aquaculture production** (PhD by Mujub Nkambo at Makerere University)

**Growth performance, feed efficiency, intestinal histology and microbiota of Nile tilapia fed diets containing different levels of different essential oil sources** (PhD by Margaret Aanyu at the University of Sterling, UK)

**Exploitation patterns and population structure of the Lake Albert & Albert Nile *Alestes baremose* and *Hydrocynus forskahlii* fisheries** (M.Sc. by Herbert Nakiyende at Makerere University)

## 8. FACILITIES, ASSETS AND LINKAGES

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NaFIRRI headquarters at Jinja houses the Director's Office and centralised functions of Finance and Administration, Procurement and Information Management in addition to a complex with 13 laboratories, two aquaria, one Aquatic Biodiversity Museum, two board rooms, one conference hall, a galley, the Socio-economics, and Fish Stock Assessment units. The Aquaculture Station occupies 45 acres of land on which are about 25 functional ponds, 62 concrete tanks, 6 laboratories, 3 dams, 2 hatcheries, 2 tractors, 2 hostels and a feed mill.

Under its Marine Section, NaFIRRI has three operational vessels: *MV Ibis*, *MV Cormorant* and *MV Hammerkop* in addition to several smaller boats located on Lake Victoria. *MV Ibis* and *MV Hammerkop* are dedicated to research in deeper ( $\geq 10\text{m}$ ) areas while *MV Cormorant* is for the shallower areas.

There are 34 residential houses in Jinja, which are occupied by staff. Of these, 20 are senior staff houses and 14 junior staff houses. The institute has a total of 47 plots of land, 44 located in Jinja and 3 at Kajjansi. The plots are developed with staff houses, offices, laboratories, a Guest House/staff club, ponds, tanks among other infrastructure.



*NaFIRRI Headquarters in Jinja*



*NaFIRRI Conference Room*



**NaFIRRI water quality laboratory**



**NaFIRRI Data Centre**



**NaFIRRI pilot cage site**



**NaFIRRI Aquarium**



**Research vessel *MV Hammerkop***



**NaFIRRI canoes**



**Outside and inside view of a fish hatchery at Kajjansi for producing fish fry**



**Fish ponds at Kajjansi**

**Feed mill at Kajjansi for making fish feeds**



**Training and administration blocks at Kajjansi Aquaculture Research Development Centre established through the Uganda- China Aquaculture Technology Demonstration Centre**



## **Collaboration and Linkages**

NaFIRRI collaborates with other NARO PARIs (especially NARL for post harvest fisheries research and laboratory analysis, MuZARDI on sharing aquaculture research information). Non-NARO collaborators include: the Department of Fisheries Resources (DFR) through joint research and information sharing, the Lake Victoria Fisheries Organization (LVFO) through information sharing and research on Lake Victoria, Makerere University (MUK) through joint research, publications and journals, Directorate of Water (Resources Management) (DWRM) through joint research on water environment, the National Water and Sewerage Corporation (NWSC) through joint research on water environment , the National Wetlands Inspection Department (NWID) through joint research on wetlands, National Environment Management Authority (NEMA) through research on water environment, Uganda Fish Processors and Exporters Association (UFPEA) for information sharing and Uganda National Council of Science and Technology (UNCST) which funds some research.

Regional collaborators like Kenya Marine Fisheries Research Institute (KMFRI), and the Tanzania Fisheries Research Institute (TAFIRI), Lake Victoria Basin Commission (LVBC), Egerton University, Njoro, Kenya through joint research while Lake Victoria Environmental Management Project (LVEMP II), Lake Victoria Research Initiative (VicRes) of the Inter University Council of East Africa (IUCEA) and Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) the collaboration is through supporting research activities.

International collaborators such as the International Network for the Availability of Scientific Publications (INASP), McGill University (Canada), National Geographic Society, Toronto Zoo (Canada) Universities of Florida and Boston, Auburn University (USA) and World Fish Centre for research collaboration, E-journals and exchange of students.

## 9. STAFFING

### NaFIRRI Staff as of March 2013

The Institute has a total of 118 staff: 73 full time NARO staff comprised of 22 Research Scientists, 12 Technicians 6 marine Technicians and 33 support staff. There is in addition 45 other staff serving variously as Collaborators, Interns, Project staff or Volunteers in the diverse functions of the Institute.

	Sex	Name	Designation	
<b>Research Scientists:</b>				
1.	M	Balirwa John Stephen	Director	PhD
2.	M	Odongkara O. Konstantine	Principal Research Officer	PhD
3.	M	Mwebaza Ndawula Lucas	Senior Research Officer	PhD
4.	M	Wandera Sylvester Bwaku	Senior Research Officer	Msc.
5.	M	Wanda Fred Masifwa	Senior Research Officer	PhD
6.	M	Ogotu-Ohwayo Richard	Senior Research Officer	PhD
7.	M	Okello William	Senior Research Officer	PhD
8.	F	Akumu Joyce	Research Officer	PhD (candidate)
9.	M	Taabu A. Munyaho	Research Officer	PhD (candidate)
10.	F	Nkalubo N. Winnie	Research Officer	PhD
11.	M	Bwambale Mbilingi	Research Officer	MA
12.	M	Nakiyende Herbert	Research Assistant	Msc (candidate)
<b>Research Technicians:</b>				
13	M	Amiina Robert	Principal Research Technician	Dip. (Sc. Lab. Tech.)
14	F	Apama Twongo Elsie	Senior Research Technician	Dip. (Sc. Lab. Tech.)
15	M	Kiggundu Vincent	Senior Research Technician	MSc.
16	F	Nsega Monic	Senior Research Technician	MSc.
17	M	Ocaya Henry	Senior Research Technician	MSc. (candidate)
18	M	Bassa Samuel	Senior Research Technician	MSc. (candidate)
19	M	Muhumuza Elias	Research Technician	MSc. (candidate)
20	F	Naluwayiro Janet Sebuyira	Research Technician	Dip. (LST)
21	M	Pabire Gandhi Willy	Research Technician	Dip. (LST)
<b>Administrative Staff</b>				
22	M	Asangai Timothy	Human Resource & Administrative Officer	MA/HRM
23	M	Arinda Collins	Procurement Officer	BBA (Procurement)
24	M	Ekwang Robert	Senior Finance Officer	B. Comm., ACCA II
25	M	Mpero Samuel	Senior Internal Auditor	B. Comm
26	F	Nabbumba Lillian	Administrative Secretary	BSES
27	F	Najjuma Marion	Accounts Assistant	BSc. Finance
28	M	Ssentumbwe Francis	Accounts Assistant	MBA
29	F	Endra Alice	Information Specialist	MSc.
30	M	Waigolo Saul	Information, Communication and Outreach Officer	BA
31	M	Bwire Patrick	Asst. Systems Administrator	Dip. Computer Sc.
32	M	Sevvume Hudson	Stores Assistant	Dip. Stores Mgt
33	M	Tabura Kakuru Frank	Records Assistant	Dip. Mgt.
34	F	Twinomujuni Namara Jessica	Sec-Stenographer	Dip. Secretarial studies
35	M	Byaruhanga Robert	Driver	UACE
36	M	Ddumba David	Driver	UCE

37	M	Kajja Hannington	Driver	UCE
38	M	Bifamengo Moses	Driver	UCE
39	M	Mukasa M. Kosia	Driver	UCE
40	M	Kabalinzi Rose	Office Assistant	Certificate
41	M	Asonya Boniface	Office Assistant	Certificate
42	M	Edaku Wilson	Security Guard	UCE

### **Marine Section:**

43	M	Opolot Oula Stephen	Senior Marine Technician	Dip. Fisheries Mgt.
44	M	Musana Issa	Marine Technician	Cert. In navigation
45	M	Mukose Salim	Deckhand II	Cert. in diving
46	M	Baliise Charles	Deckhand	Cert. Accounts
47	M	Wanok Eginowanume	Deckhand	Cert. Swimming
48	M	Okwakol Moses	Marine Technician	Dip. Fisheries Mgt.

### **Kajjansi Based Staff**

#### **Research Scientists:**

49	M	Mbabazi Dismas	Principal Research Officer/ Head, Aquaculture Research	PhD
50	M	Owori WadundeAkisoferi	Senior Research Officer	PhD
51	F	Atukunda Gertrude	Research Officer	PhD (candidate)
52	M	Aruho Cassius	Research Officer	PhD (candidate)
53	F	Aanyu Margaret	Research Officer	PhD (candidate)
54	F	NamulawaVicto	Research Officer	PhD
55	M	Nkambo Mujib	Research Officer	PhD (candidate)
56	F	Komugisha B. Rose	Research Officer	PhD (candidate)
57	M	Walakira John Kimerwa	Research Officer	PhD (candidate)
58	M	Mwanja Mathew Tenywa	Research Officer	PhD (candidate)
59	M	Sserwadda Martin	Farm Manager	MSc.
60	M	Byaruhanga Godfrey	Aquaculture Engineer	BSc. (Civil Eng.)

#### **Research Technicians:**

61	M	Masaba Anthony	Senior Research Technician	Dip. Fisheries Mgt.
62	M	Kityo Godfrey	Senior Research Technician	Dip. Fisheries Mgt.
63	M	Ondhoro C. Chobet	Research Technician	MSc. (candidate)
64	F	Ganda Egulance	Research Technician	BSc. Fish and Aquaculture

#### **Administrative Staff**

65	F	Mukiibi Caroline	Accounts Assistant	BBA
66	F	Najjuko Faith	Accounts Assistant	BBA
67	M	Galandi Michael Timothy	Asst. Systems Administrator	BSc. Computer Sc.
68	F	Kakoolwa Florence	Asst. Librarian	DLIS
69	F	Bazanya Florence	Secretary	Dip. Secretarial Studies
70	M	Namukasa Zahara	Stores Assistant	Dip. Stores Mgt.
71	M	Bagaga Vincent	Driver	UCE
72	M	Kalyowa Rogers	Driver	UCE
73	M	DrakumaTepherouson	Security Guard	UCE

### **NaFIRRI Project Staff and Collaborators**

	<b>Sex</b>	<b>Name of staff</b>	<b>Designation</b>	
74.	M	Natugonza Vianny	Research Assistant	MSc. (candidate)
75	M	Kamira Barry	Research Assistant	MSc. (candidate)

	<b>Sex</b>	<b>Name of staff</b>	<b>Designation</b>	
76.	M	Olokotum Mark	Research Assistant	MSc. (candidate)
77	F	Naula Elizabeth	Research Assistant	BDS
78	F	Matuha Maureen	Research Assistant	MSc. (candidate)
79.	M	Byekwaso Andrew	Research Technician	MSc. (candidate)
80	F	Nankabirwa Angella	Research Assistant	MSc. (candidate)
81.	F	Namatovu Sophia	Research Assistant	BDS
82	M	Ocibo Emmanuel	ICT Technician	BSc. Computer Sc.
83.	M	Ssali Peter	ICT Technician	BSc. ICT
84	M	Turyashemererwa M	ICT Technician	BSc. Computer
85	F	Kauma Prossy	Assistant Librarian	BLIS
86	M	Mutegaya Tina	Assistant Librarian	BLIS
87	F	Zilamuke Loy	Registry Asst.	BLIS
88.	F	Namusubo Faridah	Accounts Assistant	BBA
89	F	Nagawa Teddy	Accounts Assistant	B.Com
90	F	Kirabira Jackline	Accounts Assistant	BBA
91	F	Namulondo Berna	Accounts Assistant	BBA
92	M	Mutegeki Gad	Show ground Attendant	BSc. Agric
93	F	Naisanga Ritah	HR. Asst.	BA/HRM
94	F	Namayanja Justin	Procurement Assistant	Dip.(procurement)
95.	F	Byekwaso Martha	Secretary	Dip. Secretarial studies

	<b>Sex</b>	<b>Name of staff</b>	<b>Designation</b>	
96.	M	Nuwahereza Colleb	Cage Culture Technician	Dip. Fisheries Mgt
97.	F	Nasuuna Agnes	Research Technician	Dip. Acc.
98	M	Magezi Godfrey	Research Technician	Cert. Lab. Tech.
99	F	Akurut Hellen	Office Assistant	UACE
100.	F	Nimaro Joyce	Office Assistant	UACE
101	F	Naggayi Flavia	Office Assistant	UACE
102.	M	Kagoda Ramathan	Security Guard	Cert. Basic security
103.	M	Mugabe Herbert	Security Guard	UCE
104	M	Atiku Rajab	Security guard	Cert. (Basic security)
105	F	Nakaluuba Maureen	Office Assistant	Cert. Secret. studies
106	M	Mwogeza Hillary	Driver	UCE
107	M	Ogutti Milton	Office Assistant	UCE
108	M	Muweta Sinani	Driver	DM class B
109	F	Babalanda Munilu	Deckhand	Certificate
110	M	Kiligoola Sande	Deckhand	DM Class B
111	M	Madoi Muhammed	Deckhand	Certificate
112	M	Kabugo Fred	Driver	UCE
113	F	Nakabugo Annet	Office Assistant	UCE
114	M	Mubiru John		
115	M	Wasirwa David	Driver	UCE
116	M	Mukwaya John	Pond attendant	UCE
117	M	Katongole Frank	Casual labourer	UCE
118	F	Ochola Christine	Office Assistant	



**Vice President HE Edward Sekandi, State Minister for Agriculture Prof. Zerubabel Nyiira with other dignitaries visiting the NaFIRRI stall during the World food day celebrations at NaSARRI.**



**Minister for Agriculture, Animal Industries and fisheries Hon. Tress Bucyanayandi touring NaFIRRI pier in 2013**



**Fish farmers being trained on fish seed production in the NaFIRRI hatchery at Kajjansi**



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