EAST AFRICAN COMMUNITY

LAKE VICTORIA FISHERIES ORGANIZATION
SECRETARIAT

STATE OF LAKE VICTORIA DAGAA (Rastrineobola argentea): QUANTITY, QUALITY, VALUE ADDITION, UTILIZATION AND TRADE IN THE EAST AFRICAN REGION FOR IMPROVED NUTRITION, FOOD SECURITY AND INCOME

REGIONAL SYNTHESIS REPORT

WorldFish

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The study was conducted by the members of LVFO Regional Socio-economics Working Group: Odongkara K, E (NaFIRRI). Yongo E (KMFRI) and F. Mhagama (TAFIRI), in June 2016; Coordinated by Dr. Rhoda Tumwebaze the LVFO Director, Fisheries Management and Development. It was funded by WorldFish with financial support from the European Union and technical support from Dr. Sloans Chimatiro, the Fish Trade Program Manager.

ACRONYMS

ARSO	African Organisation for Standardisation
BET	Board of External Trade
BMU	Beach Management Unit
BO	Boat Owners
BOT	Bank of Tanzania
CAS	Catch Assessment Survey
CGIAR	Consortium of International Agricultural Research Centres
DiFR	Directorate of Fisheries Resources
DRC	Democratic Republic of Congo
DSM	Demand Side Management
EAC	East African Community
FAO	Food and Agriculture Organization
FETA	Fisheries Education and Training Agency
ICEIDA	Icelandic International Development Agency
KMFRI	Kenya Marine and Fisheries Research Institute
KRA	Kenya Revenue Authority
KRA	Kenya Revenue Authority
LVEMP	Lake Victoria Environmental Management Project
LVFO	Lake Victoria Fisheries Organization
MCS	Motoring, Control and Surveillance
NaFIRRI	National Fisheries Resources Research Institute
SACCO	Savings and Credit Co-operative Organisation
SOP	Standard Operating Procedures
TAFIRI	Tanzania Fisheries Research Institute
TRA	Tanzania Revenue Authority
UBOS	Uganda Bureau of Statistics
UNBS	Uganda National Bureau Standards
UNDP	United Nations Development Programme
URA	Uganda Revenue Authority
URT	United Republic of Tanzania
USAID	United States Agency International Development
USD	United States Dollar

Exchange rates used

USD 1 = 3,300 UShs
USD 1 = 97.1 KShs
USD 1 = 2,125 TShs

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EXECUTIVE SUMMARY

The study of dagaa trade on Lake Victoria for improved nutrition, food security and incomes was conducted by members of the LVFO Regional Socio-economics Working Group from NaFIRRI, KMFRI and TAFIRI with funding from the European Union provided under Fish Trade Program of WorldFish, titled "Improving Food Security and Reducing Poverty through intra-regional Fish Trade in Africa." Dagaa was chosen due to its importance on Lake Victoria for nutritional values and as source of food security, incomes and foreign exchange earnings for the region. Effective trade in dagaa would enable the benefits be realized at the levels of fishers, processors, traders, consumers and other users.
However, little was documented on dagaa and, therefore, its true value and contribution to the region's food security and economy was not appreciated. The objective of the study was, therefore, to develop mechanisms for improved utilization and trade in dagaa through provision of information and trade networks for enhanced food security and incomes.

The study was conducted in Uganda, Kenya and Tanzania at selected landing sites, markets, industrial feed producers, supermarkets and border posts using Key Informant Interviews and questionnaire. Consultations were also made at key institutions involved with fisheries, statistics and trade administration to assess policies and data capture mechanisms in place.

Dagaa production on Lake Victoria showed a steady rise in volume from 418,590 to 674,616 tonnes between 2010 and 2015, attributed to increases in the stocks of dagaa, which attracted increased effort into the fishery. Uganda and Tanzania were exporters of dagaa while Kenya was an importer. The volume exported rose from 12,449 to 29,065 tonnes between 2010 and 2011 before it fell to 18,196 tonnes in 2015, attributed to increasing domestic demand for dagaa, especially in industrial feed production.

The main dagaa export destinations for Uganda and the average annual exports between 2010 and 2015 in tonnes were DRC (15,015 tonnes), Kenya (4,374 tonnes) and South Sudan (4,069 tonnes). Tanzanian exports were destined for Rwanda and DRC (31%) and Kenya (69%)

Kenya imported dagaa from both Uganda and Tanzania, the volumes rising from 6,199 to 7,809 tonnes between 2010 and 2011 and then declining to 4,228 tonnes in 2015. Dagaa was utilised in the region as human food in only a small proportion of less than 30% and the rest going into industrial feed mills as raw material for production of feeds for poultry, fish and livestock.

High post-harvest loss was a key feature of dagaa trade in the region, including rotting or spoilage of dagaa due to insufficient sun-heat to dry it, particularly during rainy seasons.

Dagaa operators' gender distribution was on average 55% males and 45% females; average age of 35.5 years, majority with completed primary education (44.5%), thus might not have acquired essential knowledge in business management, quality assurance or value addition. Participation of dagaa operators in groups was on average 62.5%, for collective purchase of inputs, training, saving and borrowing from each other. The main categories of dagaa operators were fishers, fisher/ processors, fisher/ processor/ traders, processors only, and processor/ traders, majority being fishers only (33.73%), followed by traders only (28.77%).

In production, the average number of days fished in a month were 14.5 and 17.0 during low and high catch periods respectively. Majority of fishers sold their dagaa fresh (57.6%), others sold dried but a few sold in both

forms. Most fishers sold at their beaches (94.7%), majority to processors, some of whom were also traders (64.4%).

The type of post-harvest loss most fishers experienced was rotting or spoilage (65.9%), caused by delayed landing of catch from the lake. This happened mostly during high catch seasons (87.8%). Part of the dagaa affected by post-harvest loss was sold for average of US$ 1.50 and 1.00 during low and high catch seasons respectively. To cope with the effects of post-harvest losses, most fishers ensured that their boats did not leak (50.7%). followed by early landing of catch (27.6%) and proper handling of catch (20.6%). The challenges in dagaa production varied from country to country, with bad weather and rains being the most common (19.6%) low dagaa catches (16.9%) and insecurity on the lake.

Processing of dagaa was dominated by processors/ traders followed by fisher/ processors and lastly, processors only, mostly drying dagaa on nets (72%), followed by on bare ground (31%). They processed an average of 54 and 148 kg of dry dagaa per month during low and high catch seasons respectively, realising average net earnings of US$ 158.76 and 413.66 during low and high catch seasons respectively. Processors had limited knowledge of improved technologies, mainly drying on nets to avoid sand contamination (42.1%) and drying on raised racks (25.2%). Majority did not produce any value added products (95.4%), due to lack of sensitisation and skills in value addition. Limited equipment was used in processing, namely raised racks, frying pans, troughs and basins. Only 25% of respondents used raised racks, owning an average of 1.5 units each.

Most processors sold their dagaa at the beaches (71.7%) and only a few delivered it to buyers away from the beach but within the country (26.1%) or took it to another country (6.7%). The main buyers from processors were traders who sold within the country (77.3%), followed by those who took it out of the country (16.9%).

Post-harvest loss types that affected procesors were rotting or spoilage (79.3%), followed by dagaa that was swept back to the lake by rain (10.3%) and loss of colour (3.4%). However, some 5.9% of the processors did not experience post-harvest losss, due to the coping mechanisms they had adopted. The dagaa affected by post harvest losses was sold at prices ranging from US$ 1.48 and 1.05 per kg during low and high catch seasons, mainly to poultry, piggery and fish farmers (60.0%) or to industrial feed manufacturers (33.3%). Coping mechanisms to post-harvest losses included spreading dagaa on clean nets and turning it over, using clean brooms (57.5%), followed by improved drying methods (50.0%), involving the use of raised drying racks and washing dagaa before drying.

The regulations most commonly observed in processing were obtaining trading licence (14.0%), prohibition of stepping on dagaa with shoes (39.0%), use of plastic cover over dagaa (26.7%) and cleaning ground surface before drying (26.7%). The main challenge experienced in processing was bad weather and rains (45.6%), to which processors recommended construction of raised drying racks (33.7%).

Most traders in dagaa business were those who operated within their own countries (62.5%), dealing mostly in sun-dried dagaa (88.9%). The averge quantites of dried dagaa handled per month were 630 kg and 1,669 kg during low and high catch seasons. The average net revenues were US$ 3,124.80 and 7,877.68 during low and high catch seasons respectively, showing a 152.1% rise between the seasons.

Equipment used by traders included bicycles, motorcycles or trucks for transportation and weighing scales for measurement. Operational monthly costs consisted of the sun-dried dagaa commodity as the highest cost item (US$ 1,212), followed by transport (US$ 152) and others included labour and storage. There was little involvement in trading value added dagaa products (Uganda 2.0%, Kenya 0.0% and Tanzania 4.8%). These

were deep-fried and salted and sun-dried dagaa.

Most traders sold dagaa away from the beaches but within their countries (60.6%), followed by those who sold at the beaches (36.0%) and only a few sold in other countries. They sold to other traders (49.5%) or to consumers (26.3%).

Their main type of post-harvest loss were rotting of the dagaa (43.3%), dagaa swept by rain (11.7%) and loss of colour (12.7%). Coping mechanisms adopted to post-harvest losses were quality assurance procedures with respect to handling, drying and storage of dagaa (77.5%).

The main regulation traders complied with was acquisition of trading licence. Their main trading challenges were price fluctuations associated with catch levels and number of buyers (28.8%), and bad weather (18.4%).

The main products of industrial feed producers were poultry feeds animal feeds fish feeds pharmaceuticals and food supplements. They sold on the domestic as well as regional markets. Their main challenges were that dagaa was often not well dried; eaten by mites and insects in storage; contaminated with sand and dust; presence of Salmonella typhii, E.coli, and Shigella; unclear quality control policy; tax and non-tax barriers to regional markets for feeds and border entry restrictions.

Supermarkets sold dagaa in various quantity packs, ranging from 200 grams to one kilogram. Prices ranged from US$ 0.91 for 200 gram packets to US$ 4.24 for a kilogram packet. The challenges faced by supermarkets were that it was not easy to enforce quality control as the dagaa products were delivered already packed. Weights labeled on the packages often did not match the actual weights of the products.Some dagaa was delivered not well dried and it got spoiled in storage. Some was affected by e-coli, shigella and ligula intestinali.

The roles of institutions in dagaa trade ranged from policy formulation, planning and implementation, sensitisation, fisheries management, quality assurance and market regulation and levying customs duties on dagaa export. They were mostly governmental, with some business and community organisations.

Data capturing was carried out at different levels but the main actors were NaFIRRI, KEMFRI and TAFIRI, which had the mandate for fisheries research, Fisheries management Institutions and the Bureaus of Statistics, which were the Government institutions for statistics, among others.

The challenges in dagaa data capturing were that dagaa trade was highly informal, with limited business records; data recording systems by the different players were not harmonised; data function was poorly manned and funded in the institutions and there was no feedback on data submitted to higher authorities.

In conclusion, the study has described the overview of the dagaa sub-sector. The main players along the value chains were identified and their activities, post-harvest losses, markets and challenges were analysed. Institutions related to dagaa trade were identified and their roles examined. Available data capture systems were identified and examined. In order to respond to the challenges and promote human consumption and value of dagaa through trade, recommendations have been made, addressing the informal business organisation among operators, improved management of dagaa resources, adoption of early landing and selling to minimise holding time before disposal to reduce post-harvest losses, promoting hygienic handling of dagaa for human consumption and adoption of improved processing, using raised drying racks and solar dryers for proper drying and avoiding contamination. Institutions should strengthen their presence on the ground and improve their data capture functions.

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01
CHAPTER ONE

INTRODUCTION

1.1. Background

The study of dagaa trade on Lake Victoria for improved nutrition, food security and incomes was conducted by members of the LVFO Regional Socio-economics Working Group from NaFIRRI, KMFRI and TAFIRI with funding from the European Union provided under WorldFish on the Fish Trade Program. WorldFish is a CGIAR with the mission to reduce poverty and hunger by improving fisheries and aquaculture. The title of the program is "Improving Food Security and Reducing Poverty through intra-regional Fish Trade in Africa," aimed at strengthening value chains with a focus on sustainability, giving better access to intra-regional markets and subsequently improving food and nutritional security and income in sub-Saharan Africa.

LVFO is an institution of the East African Community (EAC) which came into being through a Convention signed in 1994 by the three Partner States of Kenya, Uganda and Tanzania and has since been revised to accommodate all the Partner States of the EAC. Its mandate is to promote sustainable management and development of fisheries and aquaculture in the EAC for food security and wealth creation. Lake Victoria is a trans-boundary water body shared between three of the EAC Partner States, viz. Kenya (6%), Uganda (43%) and Tanzania (51%).

Dagaa (Rastrineobola argentea) is one of the three leading commercial species of Lake Victoria, together with the Nile perch (Lates niloticus) and Nile tilapia (Oreochromis niloticus). The stock of dagaa, given by its biomass, has increased in the last ten years making it an important fishery in the lake. Lake-wide acoustic surveys conducted to monitor the amount of fish in the lake show an increase from a contribution of 20% (253,054 tonnes) in August 1999 to 42% (911,000 tonnes) in August 2011 and to 44% (1,289,757 tonnes) in August 2014. The harvested dagaa from Lake Victoria has significantly increased and contributed 55% (509,598 tonnes) of the total annual fish production in 2014. However, this large volume is yet to contribute significantly to wealth creation if compared with Nile perch. The Nile perch which contributed 27% to total annual production in 2014 contributed 65% to the total value while dagaa which contributed 55% in volume contributed only 16% (USD 135 million) to total value.

Dagaa is dried using heat from the sun and mostly spread on the ground, nets and grass. During rainy seasons when there is less sunshine, post-harvest losses can be as high as 40%. In small-scale fisheries, quality losses account for more than 70% of total losses (FAO, 2014). The losses can be reduced through improved handling, processing and packaging and value can be enhanced with improved support to dagaa trade, especially for women actors of the value chain.

1.2. Importance of dagaa

Dagaa is an important fisheries resource in Lake Victoria for its potential in generating a number of benefits for the riparian communities notably in the areas of nutritional values, food security, incomes and foreign exchange earnings for the region (Figure 2).

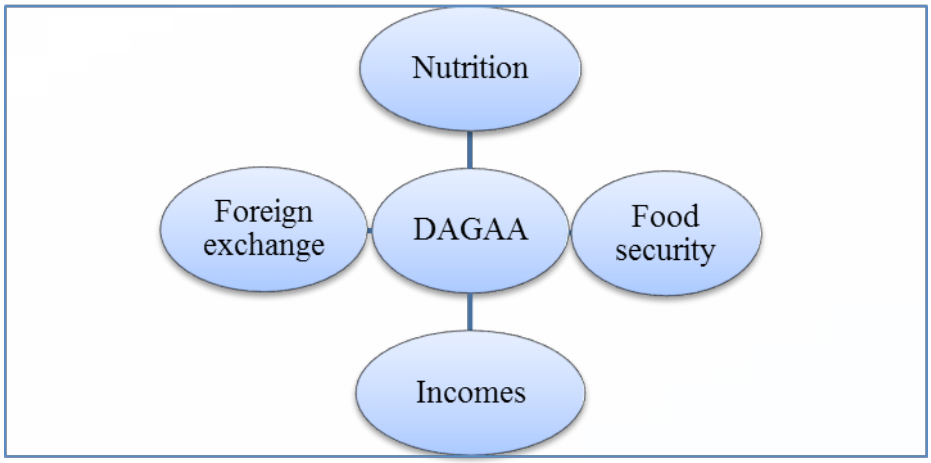


Figure 2: Types of benefits realised from dagaa

Dagaa has high crude protein content (47.9-58.8%) and is rich in iron (8.18-10.91mg/100g), zinc (4.07-10.25mg/100g) and calcium (1556.4-1866.5 mg/100g) (Kabahenda et al, 2011). Despite the high nutritive value, only up to 30% of the harvested dagaa is used for human consumption leaving the bulk (70%) for production of animal feeds. In 2013 as published by Society International Development, 42% of the 24 million under the age of 5 years of the children in EAC were reported to be stunted due to malnutrition. The 509,598 tonnes of dagaa harvested from Lake Victoria can contribute significantly to nutrition food security if fed to the children in EAC. This however requires deliberate effort to sensitize the public and the mothers as the majority of the people have a negative attitude towards dagaa and consider it to be food for the low income earners. Dagaa could also be used to fortify other foods in order to provide consumers with food varieties to choose from.

1.3. Role of trade in dagaa economy

Development of dagaa trade would stimulate improvements in quality of the commodity by fishers, processors and traders (Figure 3). It would also make the products more accessible to consumers, including through improved shelf life. Efficiency in the trade would lower costs and make it more affordable while at the same time improve market access to the traders.

Figure 3: Market attributes triggered by improved dagaa trade

In order to address issues of quality and value addition for wealth creation and of acceptability to consumers for food security and nutritional health; it is important to understand the trade and what challenges exist at local and intra-regional levels. Despite the large quantities of dagaa being harvested from Lake Victoria, and widely traded in the EAC region and across borders, little is documented and, therefore, its true value and its contribution to the region's food security and economy is not fully appreciated.

This is, therefore, a report of a rapid study carried out by the EAC Partner states of Uganda Kenya and Tanzania under coordination of LVFO Secretariat to improve the data and information base for developing networks for improved dagaa processing, utilisation and trade in the region.

1.4. Objective

The overall objective was to develop mechanisms for improved utilization and trade in dagaa through provision of information and trade networks for enhanced food security and income

The specific objectives were as follows:

i) Assess availability of information on dagaa production, utilization, industrial production, exports and existing data capture systems within the institutions.
ii) Determine the volumes of dagaa processed and stored, examine the current processing technologies and their adoption rates, facilities and challenges, with special reference to the participation of women.
iii) Assess utilization of dagaa for human consumption and other uses with a view to improving quality and value addition.
iv) Examine the trade practices including traded volumes, routes, markets, facilities, exit points and desti nations and effectiveness of the mechanisms to enhance livelihoods.
v) Assess the policies, regulations, standards, and institutions at the national and regional levels with a view to improving trade in dagaa.
vi) Present the results at a regional stakeholder forum for sharing information and developing networks for improved dagaa processing, value addition, utilization and trade in the region.

1.5. Expected outputs

i) Available information on dagaa production, utilisation, industrial production, exports and existing data capture systems within the relevant institutions assessed.
ii) Information on processing technology, volumes of dagaa processed and stored, technological adoption rates, facilities, and challenges, with special reference to the women group needs in up-scaling the dagaa products and accessing better markets availed.
iii) Information on proportions of dagaa which go for human consumption and other uses like feeds and industrial food and non-food products generated.
iv) Trade practices, traded volumes, routes, markets, facilities, exit points and destinations for dagaa identified and effectiveness of the mechanisms to deliver dagaa to enhance livelihood determined.
v) Policies, regulations, standards and institutions which support trade in dagaa identified and assessed.
vi) Findings of the study compiled, presented for stakeholder discussion and feedback and a regional synthesis report prepared.

02
CHAPTER TWO

METHODOLOGIES

2.1. Data sources and methods

Data under the study was collected from a number of sources using different methods as summarized below:

i) Secondary data searches were conducted on print and on-line sources from LVFO, Directorate and Departments of Fisheries, National Fisheries Research Institutes, Country Revenue Authorities, Trade Promotion Boards, Investment Authorities and Bureaus of Statistics, as well as the Food and Agriculture Organisation (FAO) to obtain macro-economic data on dagaa sub-sector in the region.

ii) Key Informant Interviews were conducted with beach leaders at 14 selected landing sites in Uganda, Kenya and Tanzania (Figure 1, Table 1) to obtain beach level information and data on production, processing, storage and trading in dagaa as well as the processing methods, types of buyers and trade destinations for dagaa products. Types and effects of post-harvest losses, needs of women groups and main challenges to dagaa businesses were also captured.

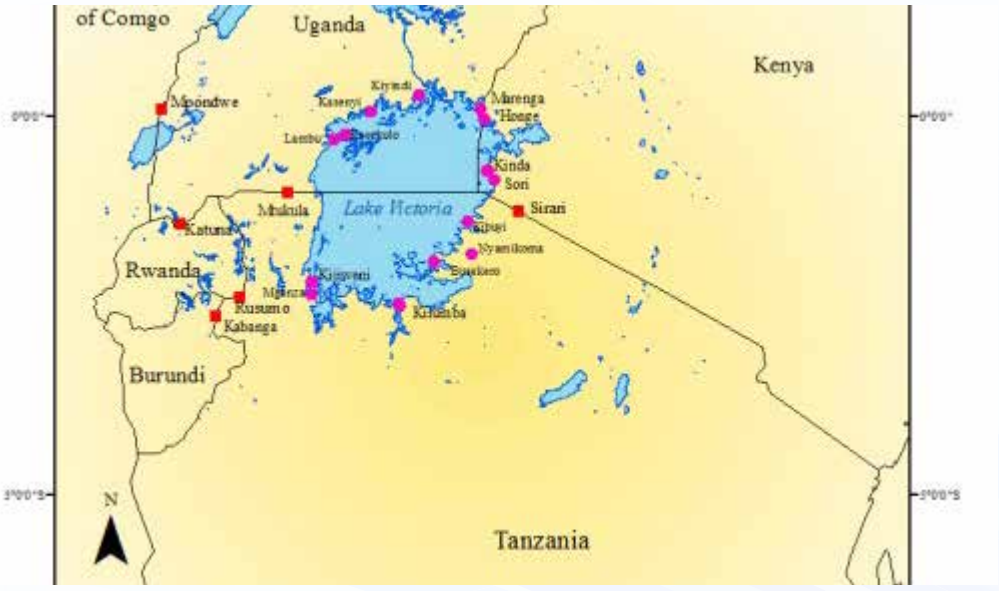


Figure 1: Sketch map showing Lake Victoria and locations of selected landing sites, markets and border posts where the study was conducted.

iii) Sample surveys were carried out at the selected landing sites to collect data on fish production, processing and trading, using a semi-structured questionnaire, covering 298 respondents (Table 1). The questionnarie also, enlisted information on magnitudes and returns from dagaa businesses, post harvest management, compliance with trade requirements and challenges in dagaa businesses.

Table 1:Number of respondents sampled at selected landing sites, Uganda, Kenya and Tanzania

Uganda		Kenya		Tanzania	
Kiyindi	24	Kinda	21	Chakazibwe	29
Kasenyi	12	Sare	5	Kibuyi	31
Lambu	24	Sori	12	Kijiweni	31
Kasekulo	25	Honge	17	Bwiru	28
		Sinyeye	18	Nyamikoma	21
Total	85	Total	73	Total	140

iv) Interviews and review of records were conducted at 3 Customs Border Posts and markets, namely Katuna, Mpondwe and Elegu on Uganda borders with Rwanda, Democratic Republic of Congo (DRC) and South Sudan respectively; Busia on Kenya-Uganda border and at Sirari on Tanzania-Kenya border. The interviews were held with Fisheries and Customs Officers to obtain information on export trade practices and magnitudes and countries of destinations.

v) Consultations were conducted at the Directorate/ Departments of Fisheries, Country Revenue Authorities and Bureaus of Statistics Headquarters to obtain information on policy, regulation and standard requirements for dagaa trade, data recording mechanisms and dagaa statistics recorded by the institutions.

vi) Interviews were conducted with selected industrial feed millers and supermarkets to obtain information on the dagaa products dealt in, issues of post harvest losses, economics of operations and challenges met in dealing in dagaa.

2.2. Data collection

The data collection tools used included a secondary data review checklist, beach and market Key Informant Interview schedules, and a detailed household questionnaire. The data collected covered the following parameters:

i) National production of dagaa
ii) Export trade
iii) Beach level production, processing, storage and trade
iv) Processing methods and technological improvements
v) Economic returns to dagaa fishing, processing and trade
vi) Industrial feed manufacturers utilizing dagaa
vii) Dagaa for supermarket channels
viii) Types of buyers and trade destinations
ix) Types and effects of post-harvest losses
x) Needs of women groups in up-scaling dagaa processing and marketing
xi) Main challenges to dagaa businesses
xii) Institutions relevant to dagaa trade
xiii) Existing data capture systems by institutions
xiv) Policies, regulations and standards for dagaa trade

2.3. Data analysis

The data was processed and analysed as follows:

i) It was entered using SPSS and Excel was also used for the analysis.
ii) Error tracking procedures were used for the data cleaning.
iii) Qualitative data was summarised using frequencies and cross-tabulations and presented as percentages or charts.
iv) Quantitative data was analysed using means and medians, depending on the data spread and possible outliers shown by the minimum and maximum values.

2.4. Report writing

i) The country teams produced draft national reports of the findings for discussion and feedback. Presentations were extracted and made at the stakeholder consultation workshop for their feedback.
ii) Based on the feedback, the final country reports were produced on the results.
iii) The regional synthesis report was then compiled from the national reports from the Partner States by the technical co-ordinator and Chairman of the Socio-economics Regional Working Group.

2.5. Quality Assurance and Quality Control

To ensure quality of results, the study was formulated and carried out in accordance with the LVFO Standard Operating Procedures (SOPs) for Socio-economics (LVFO, 2005). There was harmonisation in developing the proposal, data collection, analysis and preparation of the country reports for Uganda, Kenya and Tanzania, co-ordinated by the Chairman of the Regional Working Group for Socio-economics. Draft findings were presented to a forum of stakeholders for their input prior to finalisation of the national reports and thereafter, this regional synthesis report was produced.

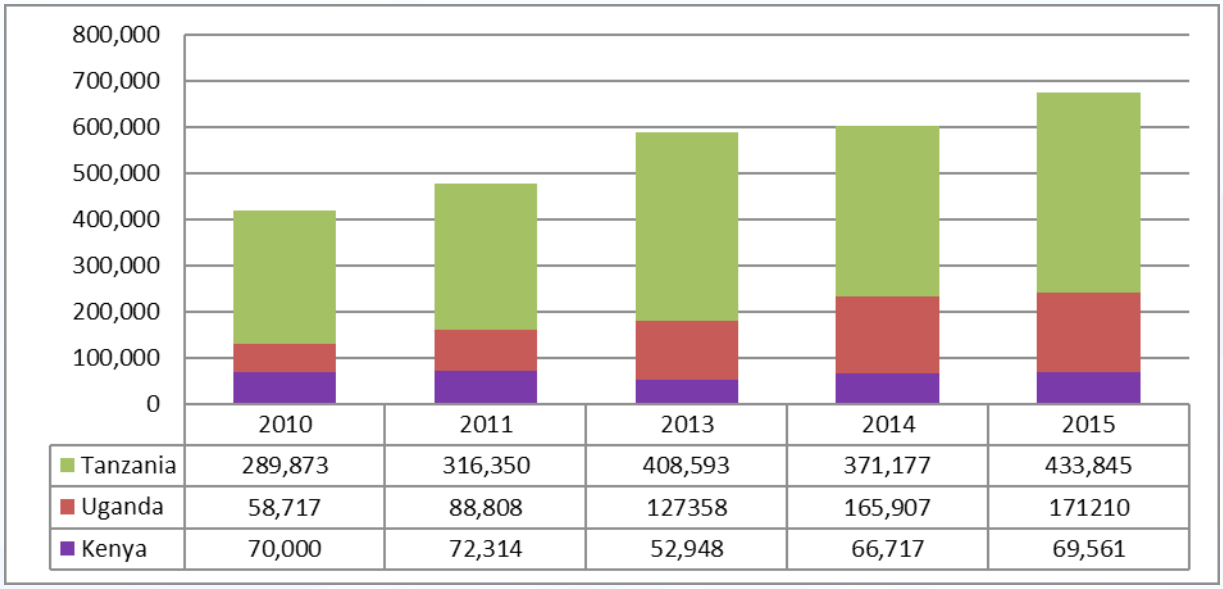
03
CHAPTER THREE

RESULTS AND DISCUSSION

3.1. Overview of dagaa of Lake Victoria

3.1.1. Production of dagaa

Dagaa production on Lake Victoria showed a steady rise in volume from 418,590 tonnes in 2010 to 674,616in 2015 (Figure 4). The rise was attributed to increases in the stocks of dagaa, which attracted more effort in terms of boats, fishers and gear into the fishery. Production in Uganda rose gently from 58,717 tonnes in 2010 to 171,210 tonnes in 2015, contributing the least proportion of 14.0% and 25.4% of the total volume of production on the lake in 2010 and 2015 respectively. Kenya's production fell slightly from 70,000 tonnes in 2010 to 69,561 in 2015, contributing 16.7% and 10.3% of the lakewide volume of produciton in 2010 and 2015 respectively. Tanzania was the largest producer, with volumes of 289,873 tonnes in 2010, rising to 433,845 tonnes in 2015. Its contributions were, however, 69.2% and 64.3% in 2010 and 2015 respectively.

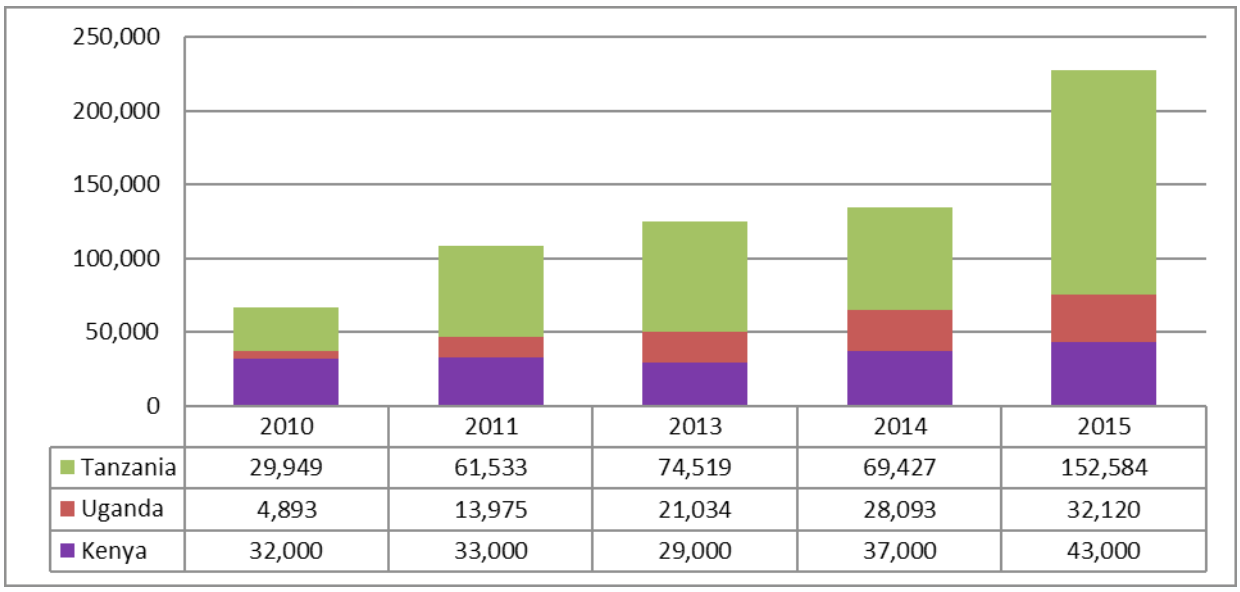


	2010	2011	2013	2014	2015
Tanzania	289,873	316,350	408,593	371,177	433,845
Uganda	58,717	88,808	127358	165,907	171210
Kenya	70,000	72,314	52,948	66,717	69,561

Source: LVFO, 2015

Figure 4: Annual production of dagaa on Lake Victoria by volume for the period 2010 to 2015 (tonnes)

The value of production increased rapidly from US$66.8 million in 2010 to 227.7 millon in 2015 (Figure 5). In Uganda the value rose from US$ 5.0 million in 2010 to 32.1 million in 2015, contributing 7.3% and 16.4% to the total value of production on the lake in 2010 and 2015 respectively. In Kenya, the value rose from US$ 32.0 million in 2010 to 43.0 million in 2015, contributing 47.9% and 22.0% to lakewide value of production in 2010 and 2015 respectively. In Tanzania, the value rose from 30.0 milion in 2010 to 152.6 million in 2015, contributing 44.8% and 78.0% to total lakewide value of production in 2010 and 2015 respectively.



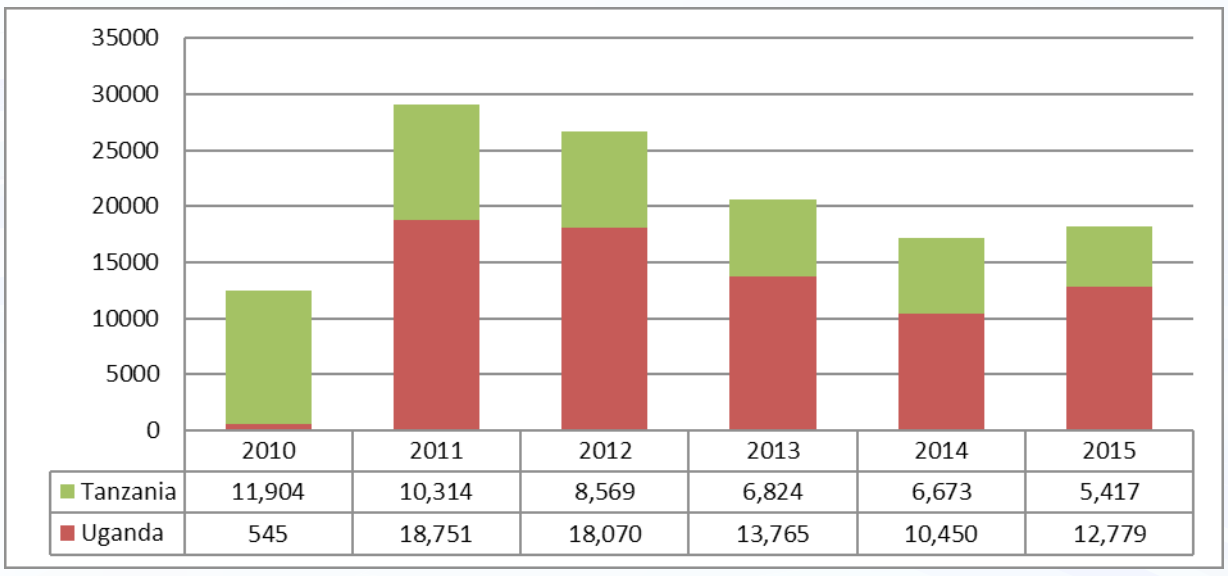
	2010	2011	2013	2014	2015
Tanzania	29,949	61,533	74,519	69,427	152,584
Uganda	4,893	13,975	21,034	28,093	32,120
Kenya	32,000	33,000	29,000	37,000	43,000

Source: LVFO, 2015

Figure 5: Annual production of dagaa by value for the period 2010 to 2015

3.1.2. Export and import of dagaa by Partner States

Two of the Partner States were exporters of dagaa, namely Uganda and Tanzania while Kenya was an importer. The volume of export rose from 12,449 tonnes in 2010 to 29,065 in 2011 before it began to fall to 18,196 tonnes in 2015 (Figure 6). The decline in export was attributed to increasing domestic demand for dagaa, through the industrial feed production in the two Partner States. In Uganda, the exports rose from 545 tonnes in 2010 to 12,779 tonnes in 2015, attributed to increasing production. Its contribution was 4.4% and 70.2% of the lake-wide volume of exports in 2010 and 2015 respectively. In Tanzania, export volume declined from 11,904 tonnes to 5,417 tonnes in 2010 and 2015 respectively. Its contribution declined from 95.6% to 29.8% in 2010 and 2015 respectively.

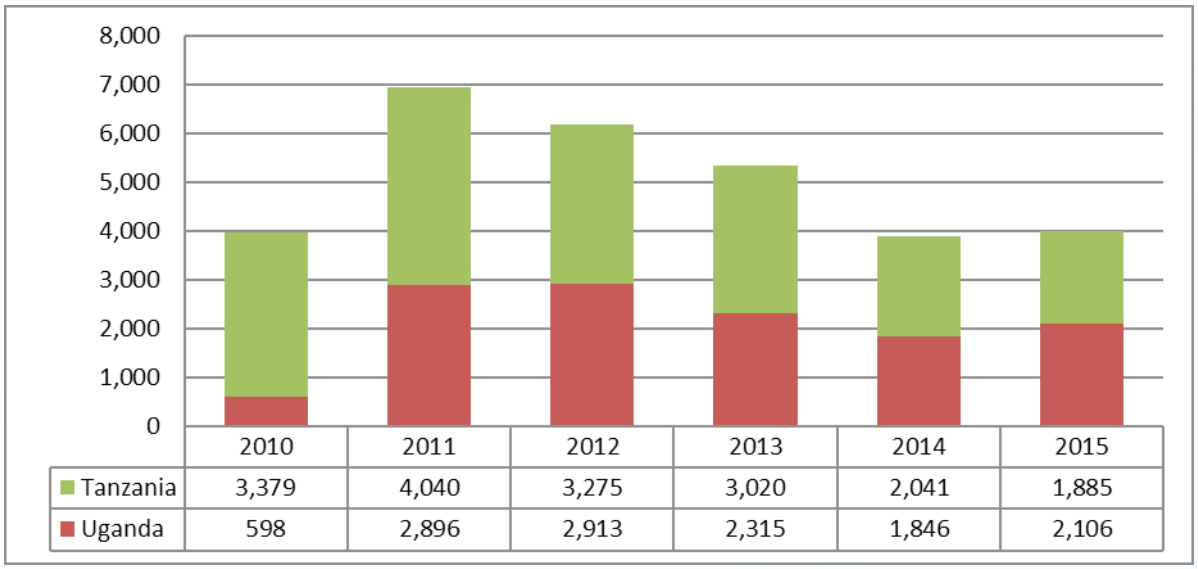


	2010	2011	2012	2013	2014	2015
Tanzania	11,904	10,314	8,569	6,824	6,673	5,417
Uganda	545	18,751	18,070	13,765	10,450	12,779

Figure 6: Annual export of dagaa by volume for the period 2010 to 2015

The value of dagaa exports rose from US$ 4.0 million in 2010 to 6.9 million in 2011 before declining to 4.0 million again in 2015 (Figure 7). This followed the volume pattern, implying that export prices for dagaa did not change much over the period. In Uganda, the value rose from US$ 0.9 in 2010, to 2.9 million in 2011

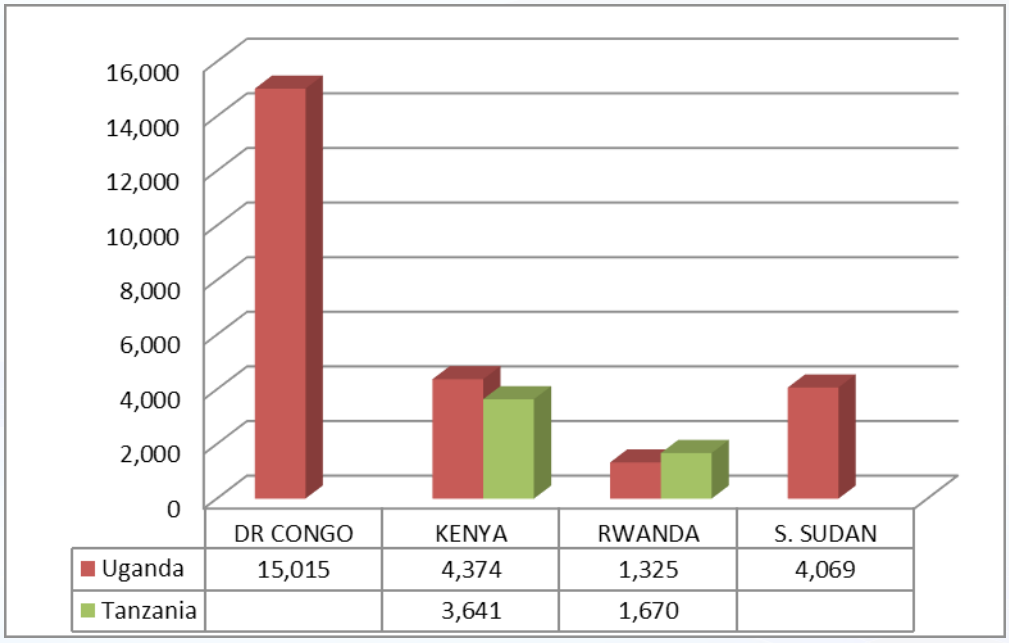
then declined to 2.1 million in 2015, contributing 15.0%, 41.8% and 52.8% to lake-wide value of export in 2010, 2011 and 2015 respectively. In Tanzania, the value rose from US$ 3.4 million in 2010 to 4.0 million in 2011 then declined to 1.9 million in 2015, contributing 85.2%, 58.9% and 47.2% of the lake-wide value of dagaa export in 2010, 2011 and 2015 respectively.



	2010	2011	2012	2013	2014	2015
Tanzania	3,379	4,040	3,275	3,020	2,041	1,885
Uganda	598	2,896	2,913	2,315	1,846	2,106

Figure 7: Annual export of dagaa by value for the period 2010 to 2015 (US$ '000)

The main export destination countries for Uganda dagaa, given by the average annual export between 2010 to 2015 in tonnes were DRC (15,015 tonnes), Kenya (4,374 tonnes) and South Sudan (4,069 tonnes) (Figure 8). Others included Rwanda, Tanzania and Burundi. For Tanzania, it was Kenya and Rwanda/ DRC.



	DR CONGO	KENYA	RWANDA	S. SUDAN
Uganda	15,015	4,374	1,325	4,069
Tanzania		3,641	1,670	

Figure 8: Average annual export by country of origin and destination, 2010-15 (T)
Source: UBOS 2016, NBS, 2014

In Uganda, the leading Customs Border Posts through which dagaa was exported from Uganda were Mpondwe, Bunagana and Odramachaku for DRC and Oraba for South Sudan and Malaba and Busia for Kenya and their average annual volumes (tonnes) were as indicated in Figure 9.

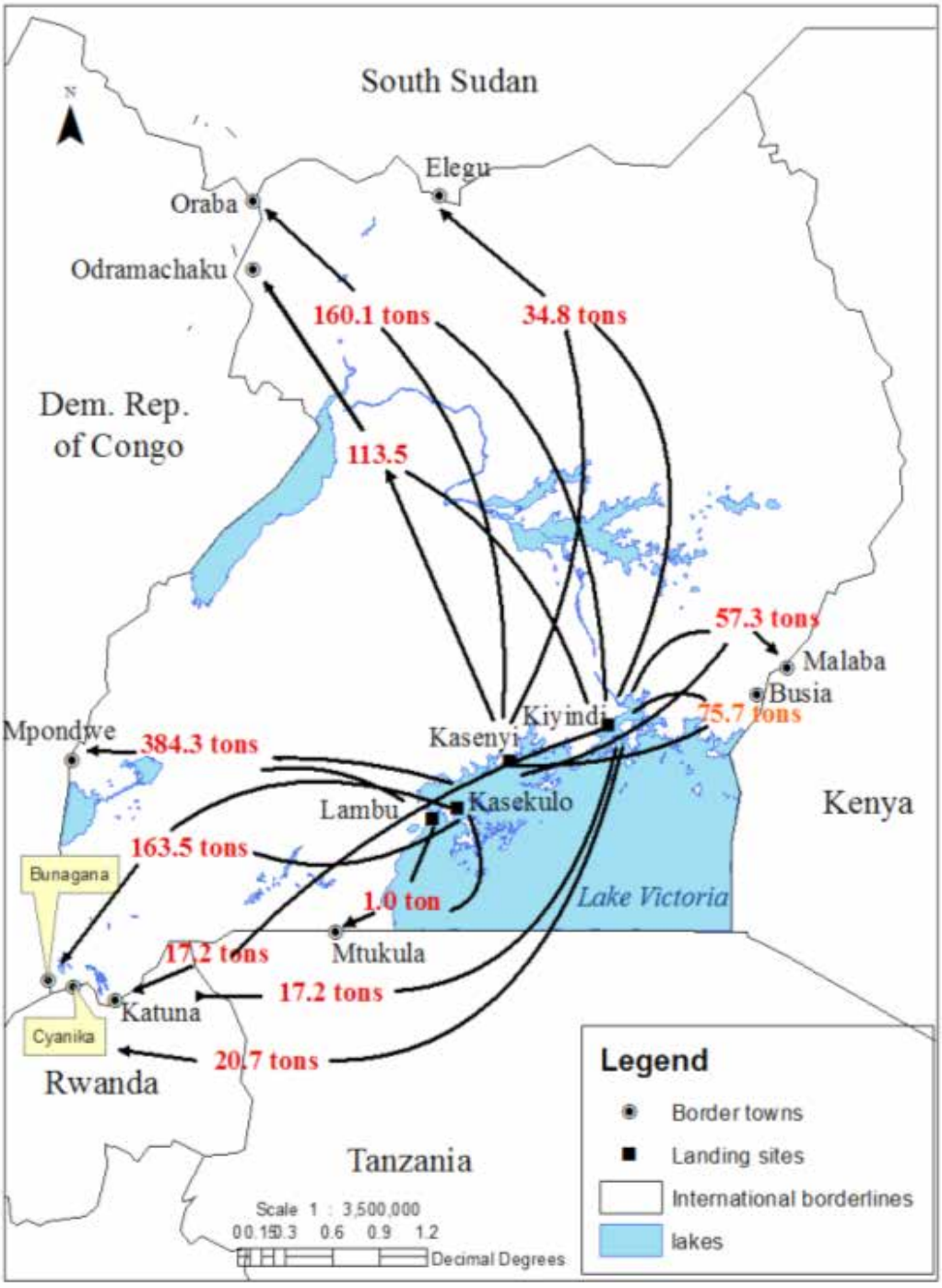


Figure 9: Map showing dagaa export routes and average annual tonnage for 2010-2015, Uganda

NB: The lines do not necessarily show the routes used to transport dagaa to the indicated export border points.

In Tanzania, dagaa was destined for export through Rusumo, Sirari, Kabanga, Mtukula, Kasumulu and Tunduma border points (Figure 10). It originated from major markets, namely Mganza in Geita Region, Kirumba in Mwanza Region, Busekera and Mwaigobero in Mara Region. About 1,670 tonnes of dagaa from Mganza market and nearby landing sites were mainly exported to Rwanda and DRC through Rusumo Border Post in Ngara District Kagera Region between 2010 and 2015. About 2,915 metric tons of dagaa from Kirumba market were mainly exported to Kenya through Sirari border in Tarime, Mara Region. Export to Kenya formed about 69% while to DRC and Rwanda formed 31%.

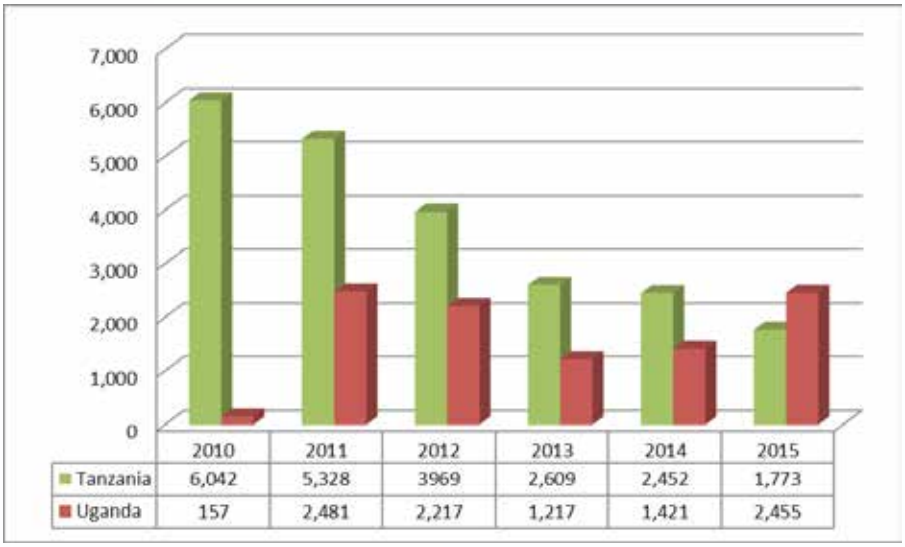
Figure 10: Map showing dagaa export routes and quantities, Tanzania

In Kenya, dagaa was imported from both of the neighbouring Partner States, namely Uganda and Tanzania. The volumes rose from 6,199 tonnes in 2010 to 7,809 tonnes in 2011 then declined to 4,228 tonnes in 2015 (Table 2). This was attributes to declining supply and increasing demand in neighbouring countries for feed production. Similarly, the values rose from US$ 2,148,894 in 2010 to US$ 2,946,397 in 2011 then declined to US$ 2,055,762 in 2015. The trend in values followed the volume trend because prices remained fairly stable during the period.

Table 2: Import of dagaa to Kenya by volume and value, 2010 - 2015

	2010	2011	2012	2013	2014	2015
Volumes (Tonnes)	6,199	7,809	6,186	3,826	3,873	4,228
Values (US$ '000)	2,149	2,946	9,672	1,468	852	2,056

Initially, Tanzania was the main source of dagaa imports to Kenya, amounting to 6,042 tonnes and accounting for 97.5% of Kenya's imports in 2010 but this declined to 1,773 tonnes or 41.9% in 2015 as Tanzania diversified its exports to Rwanda and DRC (Figure 11). Uganda's imports to Kenya began on a small scale, estimated at 157 tonnes or 2.5% in 2010 and it rose to 2,455 tonnes or 58.1% of imports in 2015, attributed to rising production in Uganda.



	2010	2011	2012	2013	2014	2015
Tanzania	6,042	5,328	3969	2,609	2,452	1,773
Uganda	157	2,481	2,217	1,217	1,421	2,455

Figure 11: Sources and volumes of dagaa imports to Kenya,2010 - 2015 (Tonnes)

3.1.3. Utilisation of dagaa

Dagaa was utilised in the region as human food and as raw material for production of animal feeds. Dagaa for human consumption was processed by drying on nets or raised racks to minimise sand and dust contamination. Some of it was prepared into value-added products, namely deep fried and powder products. Packaging of dagaa for human food was also improved and the products were sold through special trade outlets, including supermarkets. Efforts were made to comply with the food standards in the post-harvest handling of dagaa for human consumption.

However, there was concern that despite its nutritive value, necessary especially to overcome widespread kwashiorkor in the malnourished children in the region, only a small proportion of the dagaa was utilised for human consumption. It was estimated that less than 30% of production was used for human consumption, with much of the product going into industrial feed mills for production of feeds for livestock. Several farmers also utilised the product directly in locally formulating their feeds.

In Uganda, it was estimated that only 20% of dagaa was processed for human consumption (Figure 12) (FAO, 2010). Part of this was consumed domestically while part was exported to neighbouring countries. The remaining 80% of production was processed for feeds for livestock, fish and other uses. The feeds were produced for both domestic and export markets.

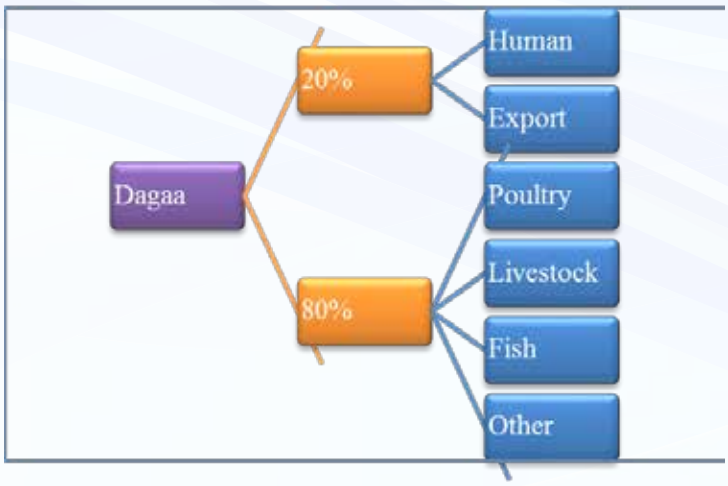


Figure 12: Proportions of dagaa processed for human consumption and other purposes in Uganda. Source, FAO 2010

In Tanzania, considerably more of the dagaa production was processed for human consumption. Percapita consumption of dagaa ranged between 7 and 10 during the period 2010 to 2015 (Table 3), supplemented by consumption of other species. Given that dagaa was the largest fish species stocks, these percapita consumption rates still fell short of the recommended rate for human consumption of fish. Kirumba International Fish Market was the largest market for dagaa destined to the domestic markets, including Dar-es-Salaam (38.6%), Mbeya (18.8%), Morogoro (9.9%), Dodoma (4.9%), Tanga (3.8%), Tabora (3.6%), and Singida (3.5%). The remaining regions, including Songea, Mtwara, Moshi and others accounted for 26.9% of dagaa from Kirumba. The dagaa also went for animal feeds, mainly destined to Iringa, Dar-es-Salaam and Mara.

Table 3:Dagaa consumption in Tanzania by volume, value and percapita, 2010 to 2015

Years	2010	2011	2013	2014	2015
Volume (tonnes)	221,578	246,858	401,588	364,007	428,349
Value (US$)	77,929,125	86,819,872	141,238,426	128,021,255	150,650,477
Percapita (kg)	7	8	9	8	10

3.1.4. Post-harvest losses

High post-harvest losses continued to be a key feature of dagaa trade in the region. The different types of losses experienced in different degrees included rotting or spoilage of dagaa due to insufficient sun heat to dry it, particularly during rainy seasons. This called for alternative approaches such as solar drying, smoking or deep frying of the dagaa. Loss of colour, resulting in unattractive look of dagaa among consumers, was another form of loss. Sweeping of dagaa away from drying grounds back to the lake by rain was also a problem. This occurred mostly when it was spread on rocks, bare ground or even on nets to dry. Sand and dust contamination affected dagaa as a result of spreading on sand to dry but sometimes traders added sand deliberately to increase the weight of dagaa for sale. Predators in the forms of birds, chicken, ducks and cows removed quantities of the dagaa when spread to dry. Rodents ate dagaa from stores. Lastly, dagaa often got broken into little pieces unsuitable for cooking and eating. This resulted from compressed packing by labourers stepping in the sacks or by loading other goods on dagaa during transportation.

In Uganda, post-harvest losses were categorised between physical and quality losses. Physical loss occurred when the product was removed from the users, such as washing away by rain, preying on by different agents, theft and dagaa thrown away due to excessive spoilage. Quality loss occurred when the product was spoilt but was still available for limited use, resulting in reduced value. This included rotting and contamination with sand or dust. Physical loss in Uganda was estimated at 26-40% of production, equivalent to 3,400 – 11,000 tonnes per year. Quality loss was about 2-5%, equivalent to 340 – 850 tonnes. (Table 4).

Table 4:Estimated dagaa annual post-harvest losses in Uganda

Types of loss	Percentage of catch	Quantity (T/year)	Macro impact: (US$, mill.)
Physical loss	26–40%	3,400–11,000	0.3 to1.5
Quality loss	2–5%	340–850	
FAO 2010			

In Tanzania, post-harvest losses were estimated at 40% of landed catch from Lake Victoria (Ibengwe, 2010; FAO, 2011). About 366, 696 metric tons of dried dagaa were subjected to post harvest losses for the year

2010 - 2015 (Table 5). The high financial loss was experienced in the year 2015, followed by 2013. The predominant losses were physical losses (30%) associated with damage during fishing, predation, discarded after prolonged rain, theft and sinking of sacks during transportation. Quality losses (20%) on the other hand were associated with presence of by-catch, quality degradation and segments which tended to down grade price of dagaa on the market.

Table 5:Post-harvest losses for dagaa in Tanzania for the period 2010 to 2015

Years	2010	2011	2013	2014	2015
Dry Wt (T)	60,062	64,806	81,336	74,631	85,861
Financial Loss/Value (US$)	42,023,317	45,343,023	56,908,518	52,217,272	60,074,632

Value chains in dagaa trading

The value chains in dagaa sub-sector are simple (Figure 13). Due to extensive vertical integration in the production, processing and trading functions, the components tend to overlap. Feed millers, however, stand out separate from the others. At the utilisation end are the exporters, consumers and farmers.

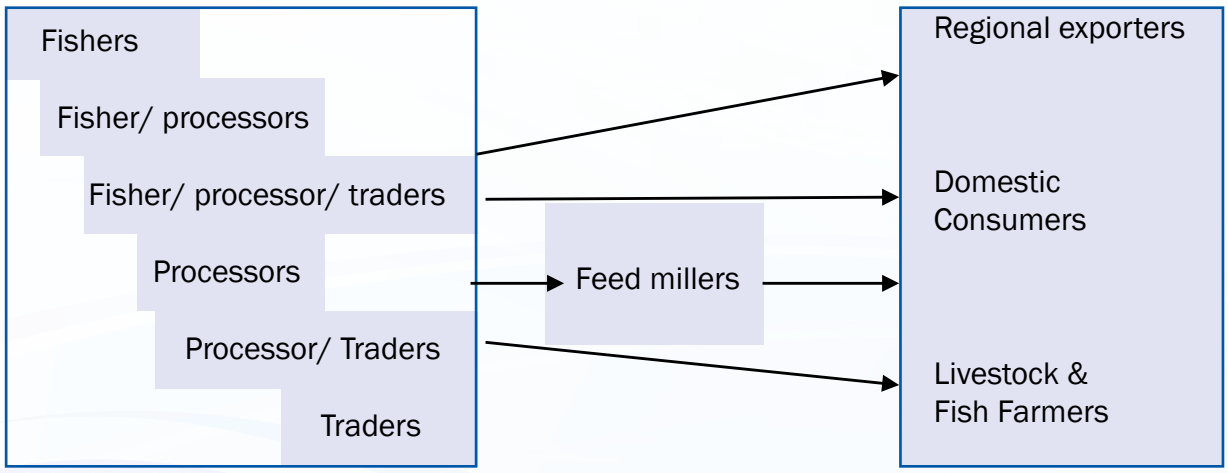


Figure 13: Components of dagaa value chains

3.2. Social characteristics among dagaa operators

3.2.1. Gender involvement

The study examined selected social characteristics of traders important in determining their behaviour and decisions with respect to technological adoption and improved business management in dagaa trade. Data on gender distribution revealed an average of 55% males and 45% females among dagaa traders (Figure 14). Females were of highest proportion in Kenya (64%) while males were highest in Tanzania (72%). These results indicated equitable sharing by women, who are a vulnerable group, in the opportunities and benefits from dagaa trade.

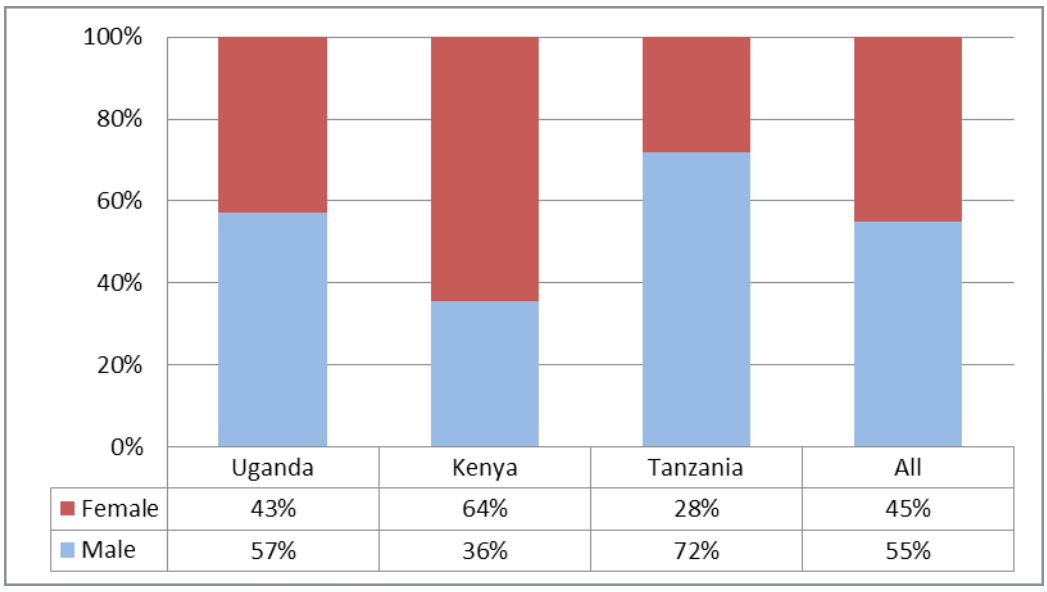


Figure 14: Gender distribution among dagaa operators

3.2.2. Age distribution of dagaa operators

The average age among dagaa operators was 35.5 years (Figure 15). Fishers and traders belonged to a category known as the youth (18-35 years) while processors were in the category of mature men and women (35-60 years). Children (below 18 years) and the elderly (above 60 years) were not reported. The advantage of having youths in the dagaa activities were that they were energetic to go fishing and move between landing sites and markets to sell dagaa. They were likely to be better educated and able to acquire knowledge and skills for quality control and business management. Mature people in the sub-sector, on the other hand, would have the advantage of having capital, either having saved it over the years or having collateral against which to obtain loans.

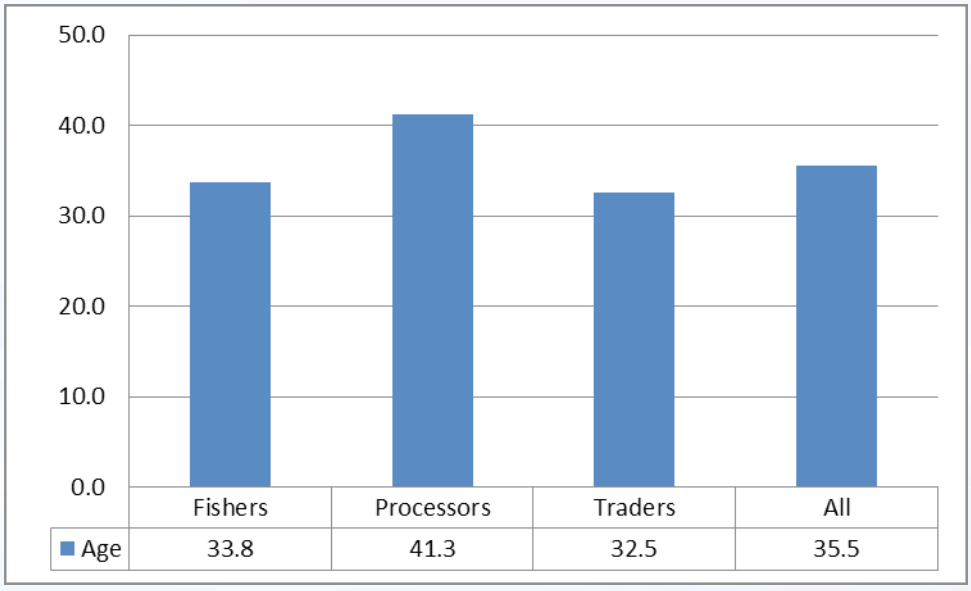
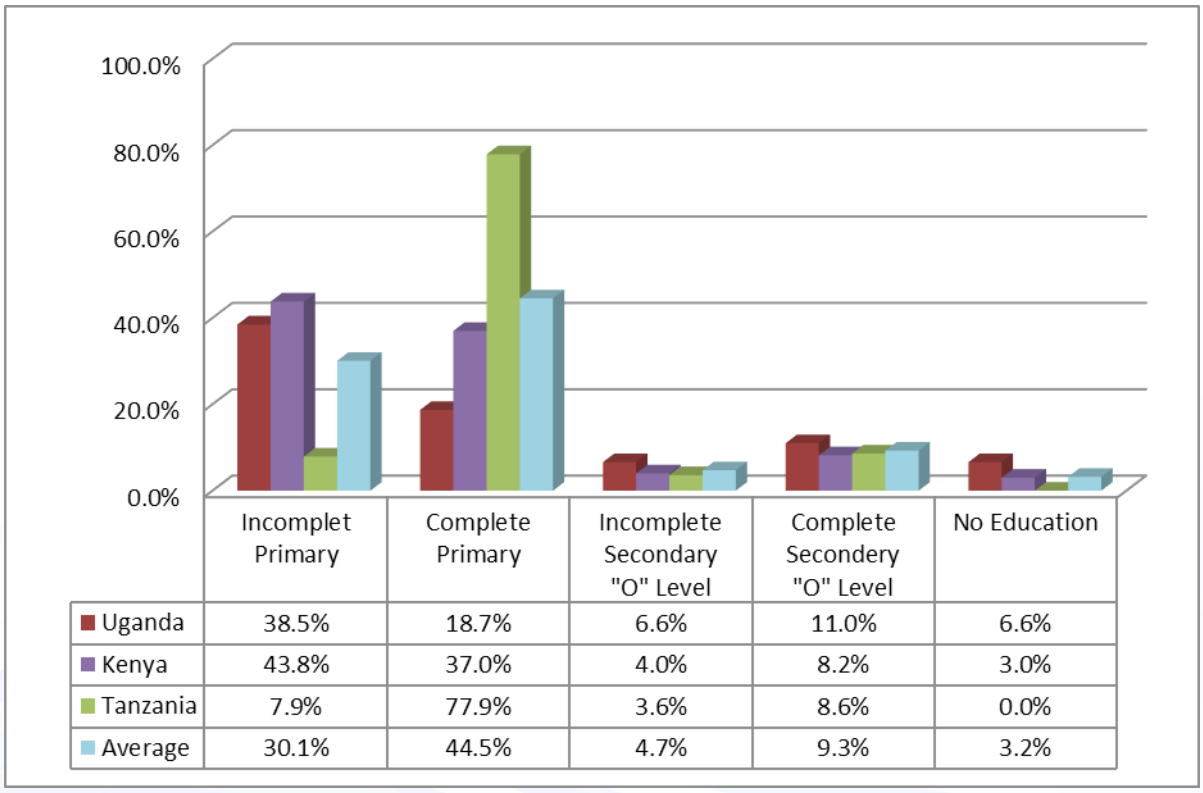


Figure 15: Average age of dagaa operators in years

3.2.3. Educational achievements

Educational achievements showed that majority of the operators completed their primary education (44.5%), followed by those with incomplete primary education (30.1%) (Figure 16). This was true of Tanzania but in both Uganda and Kenya, the majority were of incomplete primary education, namely 38.5% and 43.8% respectively. Other people had also obtained tertiary education (3.0%) or university (2.6%). There were also persons who had no education at all (3.2%). The little education observed was characteristic of fishing communities and was attributed to lack of motivation in parents, most of them uneducated themselves, to send children to school as fishing was perceived not to require education. It was also due to lack of sensitisation on the importance of education, limited and low quality educational facilities and lack of money to pay for scholastic requirements. The danger with limited education was that the operators would not acquire essential knowledge like business management, quality assurance or value addition skills. However, a few respondents also reported receiving tertiary and university education, which was a positive step for development of the trade.



	Incomplet Primary	Complete Primary	Incomplete Secondary "O" Level	Complete Secondery "O" Level	No Education
Uganda	38.5%	18.7%	6.6%	11.0%	6.6%
Kenya	43.8%	37.0%	4.0%	8.2%	3.0%
Tanzania	7.9%	77.9%	3.6%	8.6%	0.0%
Average	30.1%	44.5%	4.7%	9.3%	3.2%

Figure 16 Educational levels of dagaa traders.

3.2.4. Membership of groups

Participation of dagaa operators in groups with a view to taking advantage of the benefits for dagaa trading was examined. The results revealed that on average 62.5% of the respondents belonged to groups. The highest proportion was in Kenya (87.7%), followed by Uganda (62.5%), with the least involvement being in Tanzania (37.4%) (Table 6). The majority of respondents belonged to traders' groups (29.6%), fishers' groups (28.9%) or women's groups (28.1%). In Uganda, the traders' groups were joined most, followed by the dagaa processors' groups. In Kenya most respondents belonged to womens' groups, followed by fishers' groups. In Tanzania, most of them belonged to the fishers' groups, followed by womens' groups.

The benefits of operators joining groups were that they could purchase inputs collectively; be provided with

training and sensitisation more easily as groups than as individuals; could engage in collective marketing and save and borrow from each other under a Savings and Credit Co-operative Organisation (SACCO). A case study of Kiyindi Mukene Multipurpose Co-operative Society Ltd. revealed that their main objectives were to sensitise members on hygiene and record keeping. In Kiyindi Women Fish Processors Association, members pooled resources to produce value added dagaa products, namely deep fried and powdered dagaa, which fetched higher prices than ordinary sun-dried dagaa.

Table 6:Membership and types of groups joined by dagaa traders

		Uganda	Kenya	Tanzania	Average
Members of group	Yes	62.5%	87.7%	37.4%	62.5%
	No	37.5%	12.3%	62.6%	37.5%
Types of group	Fishers'group	14.8%	16.4%	55.4%	28.9%
	Dagaa processors' group	20.4%	5.5%	7.1%	11.0%
	Womens' group	18.5%	42.5%	23.2%	28.1%
	SACCO	14.8%	9.6%	5.4%	8.1%
	Traders' group	29.6%	--	--	29.6%
	Welfare group	--	11.0%	--	11.0%
	Others	1.9%	14.5%	8.9%	5.5%

3.2.5. Main categories of dagaa operators

On average, the main categories of dagaa operators on the lake were fishers only (33.73%), followed by traders only (28.77%) (Table 7). In Uganda, the majority were traders only (57.6%), followed by processors (25.9%). In Kenya, the majority were traders/ processors (38.4%), followed by fishers only (24.7%). In Tanzana, the majority were fishers only (60.0%), followed by processors only (25.0%). Other opertors involved along the value chains were the industrial feed producers, supermarkets and poultry, livstock and fish farmers (Figure 12).

Table 7:Respondent's main category of dagaa operators

	Uganda	Kenya	Tanzania	Average
Fishers	16.5%	24.7%	60.0%	33.7%
Processors	25.9%	13.7%	25.0%	21.5%
Traders	57.6%	13.7%	15.0%	28.8%
Trader/Processor		38.4%		38.4%
Fisher/Processor/Trader		1.4%		1.4%
Fisher/Processor		8.2%		8.2%

3.3. Production of dagaa

3.3.1. Fishers of dagaa

Three categories of fishers were identified as illustrated in Figure 12. They consisted of fishers who only fished and sold their dagaa fresh. Others fished and also processed their catch, selling the processed products. Lastly, there were fishers who fished, processed and traded their processed dagaa. Different practices were observed at different landing sites.

A large number of boats fished dagaa at the selected landing sites, ranging from 120 to 300 in, most of them motorised. Daily catch ranged between 10 to 50 tonnes in low and high catch seasons. Motorised as well as hand paddled boats were used and fishing was done with seine nets of various sizes. (Plate 1).The recommended mesh size was 10 mm but few fishers complied with that requirement. To avoid excessive by-catch, fishers were advised to operate off-shore but many fishers still fished in in-shore waters, harvesting large proportions of juveniles of Nile perch and tilapia, resulting in conflict with fishers of these species.

3.3.2. Operations of dagaa fishers

Data on the operations of individual dagaa fishers revealed that there was little difference between the number of days fished in a month during low and high catch periods, given at 14.5 during low catch seasons and rising by 23.1% during high catch seasons. This indicated that dagaa was fished continuously during the year. However significant differences existed between the average catch per fishing trip during low and high seasons, being 227.9% higher during the latter. As expected, selling prices were higher during low catch seasons, falling by -47.4% during high catch seasons. Average gross revenues were low during low catch seasons but 134.0% higher during high catch seasons, thus making fishing more attractive during high catch seasons (Table 8).

Table 8: Average number of fishing trips, catches, prices and revenues of dagaa fishers during low and high catch seasons

	Low season	High season	% Change
Number of fishing trips carried out in a month	14.5	17.0	23.1%
Average fresh dagaa landed on a fishing trip (kg)	122	400	227.9%
Selling prices of fresh dagaa (US$/kg)	0.19	0.1	-47.4%
Average gross revenues per month (US$)	312	730	134.0%

Lake-wide, majority of fishers sold their dagaa fresh (57.6%) but in Uganda, majority dried it before selling (50.0%) (Table 9). A few individuals sold it both fresh and dry in both Uganda and Kenya. Fishers who sold dagaa fresh were discouraged by the amount of effort required to dry dagaa and the additional risks of post-harvest losses involved. Fishers who processed it before selling wanted to take advantage of the higher prices for processed dagaa compared to fresh dagaa, increasing their chances of breaking even or making profits.

Most fishers sold their dagaa at their beaches (94.7%) (Table 9). This was attributed to the inconveniences and transport costs involved in taking the dagaa to other markets. In doing so, fishers saved costs and time to do fishing, which was their main business. However, in selling at the beaches, they compromised on the prices they could get because beach prices were considered the lowest along the value chains.

Most fishers sold their dagaa to processors, some of whom were also traders (64.4%) (Table 9). This was because since it was fresh, the most appropriate people to handle it were the processors. There were also a few who sold to traders who were not processors. This was the case with fishers who processed their dagaa before selling. The percentage was highest in Uganda (57.1%) because of the incentive for fishers to process their dagaa due to the much higher prices of processed than of wet dagaa there.

Table 9:Forms, locations and to whom fishers sold dagaa

		Uganda	Kenya	Tanzania	Average
Forms of dagaa sold by fishers	Fresh	42.9%	58.0%	71.8%	57.6%
	Dried	50.0%	38.0%	28.2%	38.7%
	Both	7.1%	4.0%		5.6%
Where catch was sold	At beach	90.9%	95.2%	98.6%	94.9%
	Away from beach but within the country	9.1%	4.8%	1.4%	5.1%
To whom catch was sold	Processor/Traders	42.9%	71.4%	78.9%	64.4%
	Traders not processing	57.1%	52.4%	21.1%	43.5%

3.3.3. Post-harvest losses of fishers

The type of post-harvest loss most fishers experienced was rotting or spoilage (65.9%) (Table 10). This was caused by delayed landing of catch from the lake due to distant fishing grounds or turbulences on the lake that made movement difficult and slow. For fishers who sun-dried their dagaa, inadequate sunshine or rain often hindered dagaa from drying sufficiently and getting spoilt. Sand contamination, predators and other forms of losses were all mentioned. However, a few respondents did not report any post-harvest losses in their activities (17.1%).

With respect to the frequency with which fishers experienced the losses, the majority cited the rainy season (54.2%). For others it occurred after about three weeks (31.4%). Fishers reporting losses every week or every two weeks were highest in Uganda (16.7%)and (8.3%) respectively.
As to when the post-harvest losses occurred, the majority of fishers reported that it happened during high catch seasons (87.8%), with only a few reporting the worst losses during low catch seasons. This was attributed to the large quantities of dagaa, relative to available space and drying facilities, for fishers to handle during high catch seasons.

On average, 57.8 kg of fish was lost during the last time fishers experienced post-harvest losses, with the highest average loss being in Uganda (105.0 kg). The large physical losses implied that the rotting was so severe that parts of the catch had to be thrown away.

The parts of dagaa affected by post-harvest loss sold for US$ 1.50 and 1.00 during low and high catch seasons respectively, a 50% change that affected profit margins of operators.

In order to avert and cope with the effects of post-harvest losses, most fishers ensured that the boats did not

leak (50.7%). followed by early landing of catch (27.6%) and proper handling of catch (20.6%). In Uganda, however, efforts of most fishers were in early landing, followed by salting of the catch. However, some fishers did not take any precautions (10.3%), presumably those who did not consider to be affected by the losses.

Table 10: Features of post-harvest losses in dagaa fishing

		Uganda	Kenya	Tanzania	Average
Main post harvest loss types	Rotting	85.7%	50%	61.9%	65.9%
	Bad weathr/ rain		15%	23.8%	19.4%
	Sand contamination			6.0%	6.0%
	Predators		4%	1.2%	2.6%
	Others			1.2%	1.2%
	None	14.3%	31%	6.0%	17.1%
Frequency post harvest loss was experienced	Every three months	33.3%		29.5%	31.4%
	During rainy season	33.3%	75%		54.2%
	Every week	16.7%	4%	9.0%	9.9%
	Every two weeks	8.3%	8%	7.1%	7.8%
	Beyond 3 months	8.3%	13%	15.4%	12.2%
When loss experienced	High catch period	91.7%		83.8%	87.8%
	Low catch period	8.3%		16.3%	12.3%
Amount of fish lost the last time fishers experienced post-harvest losses (kg)		105.0		10.5	57.8
Prices fishers sold the part of catch affected by post harvest loss (US$/kg)	High catch seasons	0.06		1.88	1.0
	Low catch seasons	0.13		2.82	1.5
Measures fishers took to preserve fresh dagaa quality	Early landing	46.2%	8.7%	27.8%	27.6%
	Ensure boat does not leak		65.2%	36.1%	50.7%
	Salting	15.4%			15.4%
	Proper catch handling	7.7%.	21.7%	19.4%	20.6%
	Others		4.3%	19.7%	12.0%
	None	30.8%			10.3%

3.3.4. Challenges in production of dagaa

Fishers had the opportunity to identify the main challenges facing dagaa production in the region. The challenges varied considerably from country to country, with bad weather and rains being the most common (19.6%) and low dagaa catch (16.9%) (Table 11). In Uganda, leading concerns were with theft of fishing equipment, namely lanterns, nets and engines (50.0%), followed by social disharmony among fishers, exhibited by practicing of tribalism in decision making (25.0%). Other problems included low catches and bad weather or rains.

In Kenya, the challenges were with theft of fishing equipment (25.0%), followed by low catches (20.8%). Other challenges included bad weather and rains, price fluctuations and untrustworthy crew who sold fish

before landing, among others.

In Tanzania, the main challenges were grouped as economic insecurity (35.8%), a term referring to high cost of capital expenditure and operational cost including, engines, boat, fuel and wage for labour. This was followed by bad weather or rains (33.3%). which damaged fishing equipment and spoilt dagaa produce during fishing. Non-economic challenges were concerned with theft of equipment and dagaa.

Fishers in the different countries had different suggestions on how to cope with the challenges in dagaa fishing, with security on the lake (10.8%) being a common suggestion (Table 11). In Uganda, most respondents suggested reduction in nets and lantern as well as use of legal dagaa fishing gears for sustainable fishing to address fish scarcity; identification of market with high prices, reducing taxes on fishing equipment to improve profit margins of fishers, ensuring security on the lake and avoiding issues of tribalism.

In Kenya, coping mechanisms suggested by most fishers were closure of the lake (23.8%), improvement in drying techniques (19.0%) and promotion of good fishing methods (9.5%). Other suggestions included increasing prices of dagaa, provision of loans to dagaa fishers, promotion of the use of engine boats, bulk buying of fishing equipment, provision of adequate store facilities, identifying options for lowering the cost of operation and promoting the use of clean technology.

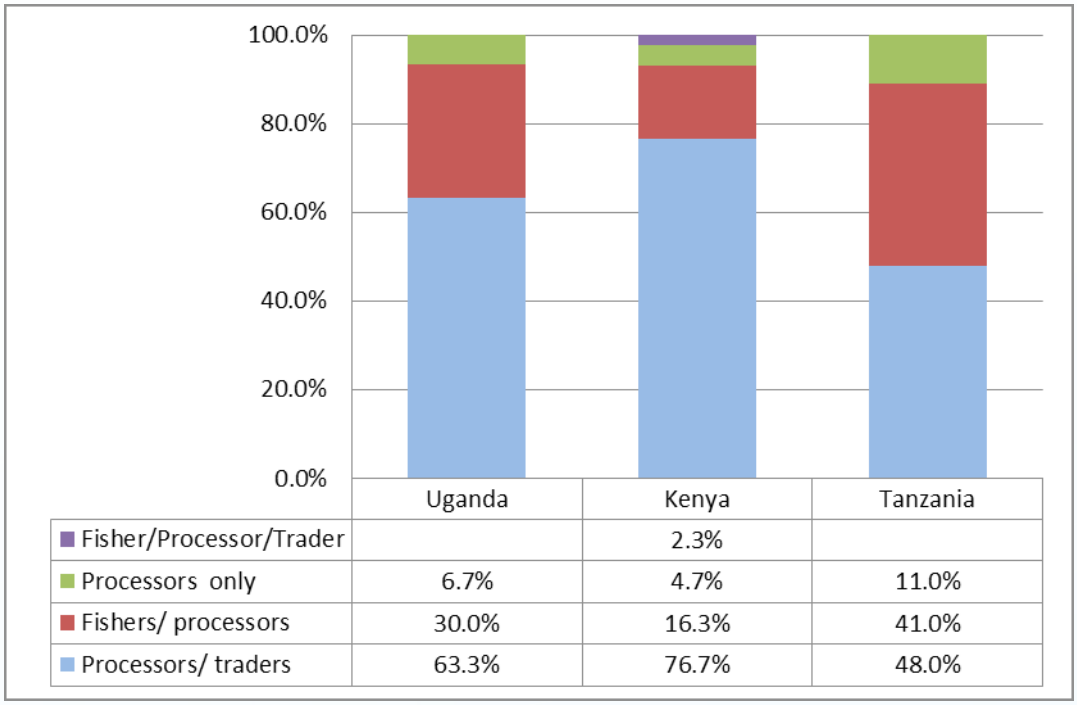
In Tanzania, most fishers suggested that Government should support dagaa production by playing its constitutional roles; fishers should adopt sustainable fishing and there should be proper handling of catch.

Table 11: The main challenges and coping mechanisms in dagaa fishing

		Uganda	Kenya	Tanzania	Average
Challenges most experienced in dagaa fishing	Low catches	13.0%	20.8%		16.9%
	Theft of lanterns, nets and engines	50.0%	25.0%		37.5%
	Bad weather/ rains	13.0%	12.5%	33.3%	19.6%
	Tribalism	25.0%			25.0%
	Economic insecurity			35.8%	35.8%
	Non-economic insecurity			30.9%	30.9%
	Untrustworthy crew sells fish before landing		12.5%		12.5%
	Price fluctuation		16.7%		16.7%
	Use a lot of fuel in fishing		4.2%		4.2%
	Lack of crews		4.2%		4.2%
	Harassment by Uganda authority		4.2%		4.2%
Fishers'coping mechanisms towards the challenges	Reduce nets and lantern	16.7%			16.7%
	Market with better price	16.7%			16.7%
	Use of legal dagaa fishing gears	16.7%			16.7%
	Reduce taxes on fishing equipment	16.7%			16.7%
	Security on the lake	16.7%	4.8%		10.8%
	Avoid issues of tribalism	16.7%			16.7%
	Government support			55.3%	55.3%
	Sustainable fishing			22.4%	22.4%
	Proper handling of catch			22.4%	22.4%
	Price increment of dagaa		4.8%		4.8%
	Provision of loans		4.8%		4.8%
	Use of engine boats		4.8%		4.8%
	Bulk buying		4.8%		4.8%
	Closure of the lake		23.8%		23.8%
	Good fishing methods		9.5%		9.5%
	Improvement in drying techniques		19.0%		19.0%
	Adequate store facilities		4.8%		4.8%
	Lowering the cost of operation		4.8%		4.8%
	Use of clean technology		4.8%		4.8%
	Don't know		4.8%		4.8%

3.4. Processing of dagaa

Processing of dagaa was dominated by processors/ traders, followed by fisher/ processors and lastly, processors only (Figure 17). This structure revealed the nature of vertical integration in the dagaa sub-sector, with processing integrated more forward with trading than backward with production.



	Uganda	Kenya	Tanzania
Fisher/Processor/Trader		2.3%	
Processors only	6.7%	4.7%	11.0%
Fishers/ processors	30.0%	16.3%	41.0%
Processors/ traders	63.3%	76.7%	48.0%

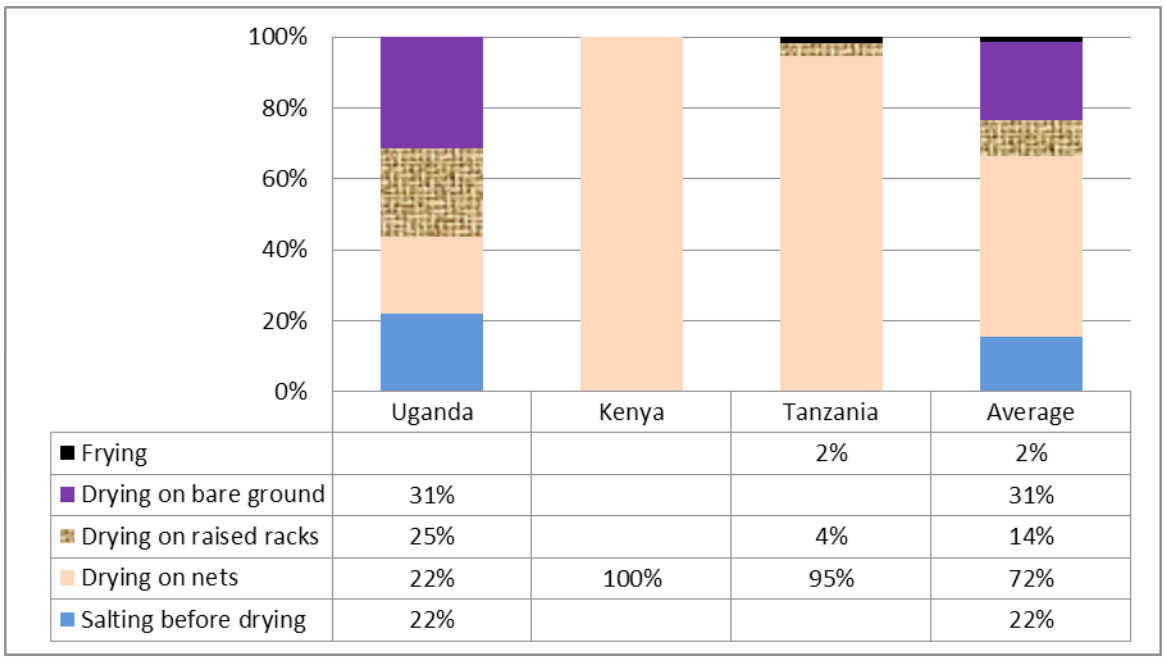
Figure 17: Most common categories of dagaa processors

3.4.1. Methods used in dagaa processing

Majority of respondents processed dagaa by drying on nets (72%), followed by on bare ground (31%) (Figure 18) (Plate 2). In Uganda, the majority dried dagaa on bare ground (31%), followed by drying on raised racks (25%). There was wider variety of methods used in Uganda than in the other Partner States, showing efforts to adopt improved methods and value addition. The methods also included salting before drying, deep frying and drying on nets.

In Kenya processors overwhelmingly reported drying on nets spread on the ground (100.0%). Although considerable efforts have been made to move away from drying on sand or bare ground, the use of raised drying racks or value addition had not been adopted.

In Tanzania, most processors also dried dagaa on nets (94.0%). The limited variety in processing methods was in drying using raised racks (4.0%), deep frying and smoking the dagaa. However, a few still dried on bare ground (2.0%)



	Uganda	Kenya	Tanzania	Average
Frying			2%	2%
Drying on bare ground	31%			31%
Drying on raised racks	25%		4%	14%
Drying on nets	22%	100%	95%	72%
Salting before drying	22%			22%

Figure 18: Methods used most in dagaa processing

3.4.2. Operations of dagaa processors

Operations of dagaa processors were examined to get information on their frequency, volumes handled, prices and earnings. The data revealed that it took an average of one day to carry out one round of processing (sun-drying) under normal circumstances during low catch but 2.5 days during high catch seasons (Table 12). This was attributed to the larger volumes of dagaa to process during the latter periods. In a month, an average of 4 and 6.5 rounds were carried out during low and high catch seasons respectively.

Processors obtained wet dagaa for processing and the dry equivalents processed per round were 54 kg and 148 kg during low and high catch seasons respectively, using a wet-to-dry weight conversion rate of 1:0.4 kg. Volumes processed during high catch seasons were 174.1% of that processed during low catch seasons.

Average buying price of wet dagaa for processing was US$ 1.11 during low catch seasons but -24.3% lower during high catch seasons, due to increased supply. Average selling price for processed dagaa was US$ 1.85 during low seasons but lower by -31.2% during high catch season for the same reason. Dagaa prices were, therefore, elastic to supply and processors needed to be mindful of that as it would affect their profits.

Processors' average cost in processing dagaa was US$ 239.76 for low catch seasons and this rose by 237.0% during high catch seasons, due to the large volumes processed. Average revenues were US$ 398.52 during low seasons, rising by 206.6% during high catch seasons. The net earnings of processors were, therefore, on average US$ 158.76 during low catch seasons, rising by 160.6% during high catch seasons. This explained why many operators went into processing during high catch months because they could get more than during low catch months.

Table 12: Average number of days, quantities, prices, costs and earnings in processing of dagaa

	Low catch season	High catch season	% Change
No. of days taken to do one round of processing	1.0	2.5	150.0%
No. of processing rounds carried out in a month	4.0	6.5	62.5%
Quantity of wet dagaa processed in one round in (kg)	136	371	172.8%
Dry dagaa equivalent processed in one round in (kg)	54	148	174.1%
Buying price of dagaa for processing (US$/kg)	1.11	0.84	-24.3%
Selling price of processed dagaa (US$/kg)	1.85	1.27	-31.2%
Processors' costs (US$)	239.76	808.08	237.0%
Processors' revenues (US$)	398.52	1221.74	206.6%
Processors' net earnings (US$)	158.76	413.66	160.6%

3.4.3. Knowledge of improved processing methods and value addition

In order to understand why the use of improved dagaa processing methods was limited, respondents were asked what improved methods they had knowledge of. The majority mentioned drying on nets to avoid sand contamination (42.1%), followed by drying on raised racks (25.2%) but few knew about salting dagaa before drying to preserve it (14.2%) (Table 13). In Uganda, majority knew about drying on raised racks, followed by drying on nets. In Kenya, the majority knew about drying on nets, followed by other unspecified processes. In Tanzania, majority knew about drying on nets, followed by drying on raised racks. However, a considerable proportion had no knowledge of any improved dagaa processing methods (11.0%), with the largest proportion being in Kenya (27.0%). More training would, therefore, be required in Tanzania and Kenya, as some of the dagaa processors had inadequate knowledge and negative attitudes and practices towards improved processing method and value addition.

The vast majority of processors on the lake did not produce any value added products (95.4%). This was attributed to lack of sensitisation and skills in producing the products. The few who did were involved in producing fried dagaa, dagaa powder and industrial feeds combining dagaa with other ingredients.

In Tanzania, however, some staff from Fisheries Education Training Agency (FETA) - Mwanza produced smoked dagaa (Plate 3). The indicative annual quantity of value added products was about 10,919 tonnes from the catches (LVFO, 2011).

The challenges in producing value added products from dagaa included lack of capital and equipment, inadequate skills and the need to comply with stringent standards in food production. Most respondents obtained their capital from own savings (100.0%), reflecting lack of financing sources for dagaa operations. Other sources cited included borrowings from savings groups and micro-finance institutions. There was no bank that could be identified with funding of dagaa activities (LVFO 2011).

Table 13: Processors knowledge of improved methods, value addition and sources of capital

		Uganda	Kenya	Tanzania	Average
Processors who were informed about improved dagaa processing methods	Salting before drying	15.9%		12.5%	14.2%
	Drying on net	27.3%	65.0%	33.9%	42.1%
	Drying on raised racks	52.3%	2.0%	21.4%	25.2%
	Others	2.3%	6.0%	28.6%	12.3%
	None	2.3%	27.0%	3.6%	11.0%
Processors who produced value addition products from the dagaa	Yes	3.2%	0.0%	10.7%	4.6%
	No	96.8%	100.0%	89.3%	95.4%
Processors' sources of capital	Own savings			100.0%	100.0%

3.4.4. Equipment used in processing

Data available indicated that limited equipment was used in dagaa processing on the lake. In Uganda, the equipment used by dagaa processors consisted of raised racks, frying pans and basins (Table 14). As given in Figure 17, only 25% of respondents used raised racks, owning an average of 1.5 units each (Table 14). The racks were established in batches in 1999, 2012 and recently in 2016. Their average expected lifetime was 3.3 years. Their unit cost was US$ 45.45. Funding for raised racks was initially by Government (57.1%), through the World Bank sponsored Lake Victoria Environmental Management Programme (LVEMP), United Nations Development Programme (UNDP) and Local Governments as well as private finances from owners' savings. Also mentioned were frying pans, used in deep frying of dagaa by a negligible proportion of processors in Uganda. The average number used was 1.0, most of them acquired in 2012 and 2016, with expected lifetime of 1.0 year. Its unit cost was US$ 4.55 and they were acquired through owners' savings or credit from informal financial services. Basins were a common dagaa trade item. It was used for measuring dagaa, both fresh and processed. It was also used for carrying dagaa from boats to drying grounds. The average number used by a processor was 2.0, obtained mostly between 2015 and 2016, with an expected lifetime of four months. The unit cost was US$ 2.73, which processors acquired from their own savings.

In Kenya, one of the equipment used for processing was a trough. One processor owned between 1 to 10 units, obtained in 2015 and 2016, with expected lifetime of six months. The trough was used for sieving dagaa of sand and dust contaminants (Plate 2). Its unit cost was about US$ 20.58. Processors also used dagaa fishing nets for drying. An average of one unit was used by a processor, obtained in 2015 and 2016, with expected lifetime of four months. Its unit cost was about US$ 102.88, obtained from processors' own savings.

Table 14: Average quantities, lifetimes, unit costs and capital sources of equipment used in dagaa processing

	Quantity (No.)	Year(s) of purchase	Expected life-time (Years)	Unit cost (US$)	Sources of capital
Uganda					
Raised racks	1.5	1999, 2012 & 2016	3.3	45.45	Public & own savings
Frying pans	1.0	2012 & 2016	1.0	4.55	Own savings & credit
Basin	2.0	2015 & 2016	0.3	2.73	Own savings
Kenya					
Troughs	1-10	2015 & 2016	0.5	20.58	Own savings
Nets	1	2015 & 2016	0.3	102.88	Own saving

3.4.5. Operational costs in processing

The basic operations of dagaa processors involved purchasing and sun-drying the dagaa. In Uganda, raw dagaa was the highest cost item, averaging US$ 121.21 per month (Table 15) but in Kenya, this was overshadowed by the large number of fishers/ processors who dried their own catch. In Tanzania, the cost of raw dagaa was US$ 177.05 per month. Other common cost items were labour, storage and transport. In Uganda, in order to maintain quality or add value, salting, deep frying and smoking had been introduced. These processes brought on board additional cost requirements, namely salt, cooking oil and firewood which were significant, thus explaining why their adoption had been slow. Transport was also a major cost in all three countries, especially Kenya and Uganda.

Table 15: Operational costs in processing (US$/ month)

	Uganda	Kenya	Tanzania	Average
Raw dagaa	121.21		177.05	149.13
Labour	31.82	102.88	39.56	58.09
Salt	136.82		78.36	107.59
Cooking oil	282.12		82.09	182.11
Firewood	10.76			10.76
Storage	15.15	10.29	16.79	14.08
Transport	71.97	102.88	17.54	64.13

3.4.6. Market destinations of processors

Most processors lake-wide sold their dagaa at the beach (71.7%) and only a few delivered it to buyers away from the beach but within the country (26.1%) or took it to another country (6.7%) (Table 16). While this pattern for selling away from the beach was true for Uganda, Kenya and Tanzania, in Kenya, a slight majority sold their dagaa away from the beach but within Kenya (51.2%).

The main buyers of dagaa from processors lake-wide were traders who sold within the country (77.3%), followed by those who took it out of the country (16.9%) and to direct consumers (7.5%) (Table 16). In Uganda, additional outlet through industrial feed millers represented diversification in the markets for processors. However, the little proportion of processors selling to industrial animal feed millers (2.3%), given that the bulk of Uganda's dagaa went to animal feed millers, indicated that the trade was handled by traders rather than directly by processors, a structure which feed millers had been trying to change and deal directly with processors in order to ensure quality.

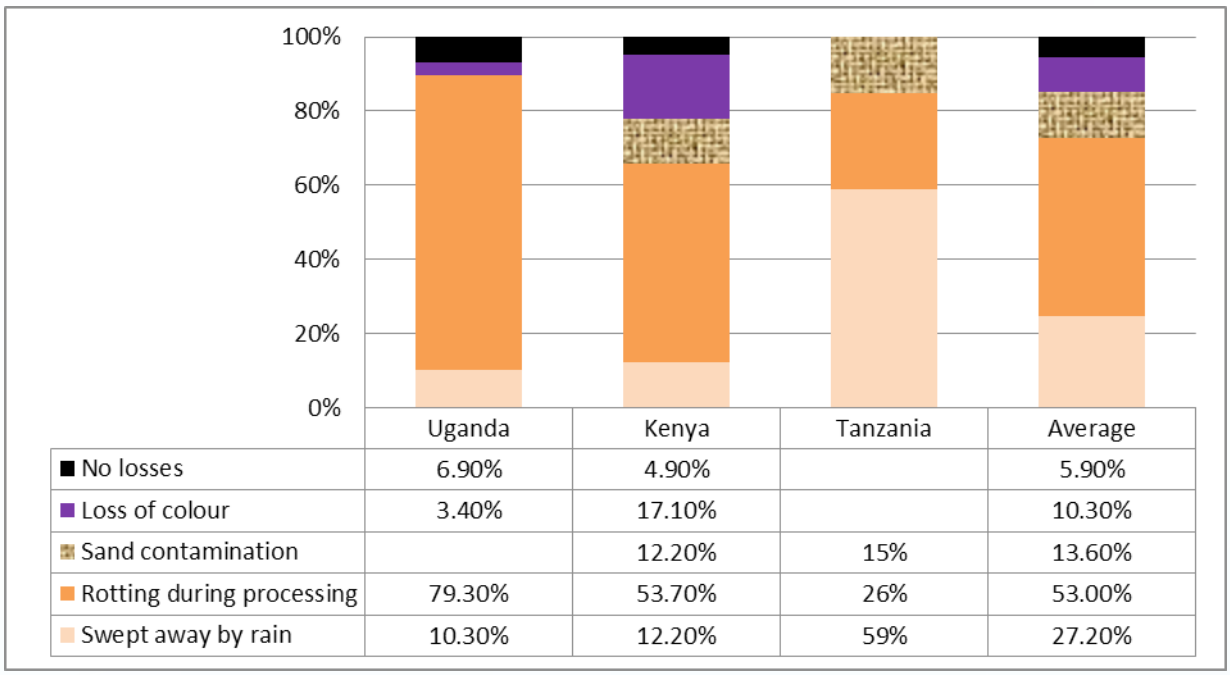
Table 16: Main destinations and buyers of dagaa from processors

		Uganda	Kenya	Tanzania	Average
Where processors sold processed dagaa most	At the beach	86.7%	48.8%	79.6%	71.7%
	Away from the beach but within the country	6.7%	51.2%	20.4%	26.1%
	In another country	6.7%			6.7%
To whom processors sold processed dagaa most	Traders who sold within the country	80.0%	79.1%	72.7%	77.3%
	Traders who sold outside the country	20.0%	16.3%	14.5%	16.9%
	Industrial feed millers		2.3%		2.3%
	Consumers		2.3%	12.7	7.5%

3.4.7. Post-harvest losses in dagaa processing

The study examined the main types of post-harvest losses most dagaa processors were affected by (Plate 4). The results showed that lake-wide, rotting was the most common type (53.0%), followed by dagaa swept away by rain during drying (27.2%) (Figure 19). The traditonal problem of sand contamination was downplayed by respondents (13.6%), because of the efforts being made to address it by drying on nets and raised racks. This pattern was observed in Uganda. In Kenya, rotting was followed by loss of colour in the processed dagaa, due to poor processing and handling, that made dagaa unattractive for consumers as food. In Tanzania, the leading problem was dagaa swept away by rain, followed by rotting. The highest proportion of processors reporting sand contamintin were also in Tanzania (15.0%).

To get indication of the magnitude of the losses, respondents were asked to estimate the amount of losses the last time they experienced it. The results revealed that the losses were highest at Uganda (285 kg), attributed to poor storage facilities, and lowest in Tanzania (8 kg), due to improved procesing methods and storge facilties.



	Uganda	Kenya	Tanzania	Average
No losses	6.90%	4.90%		5.90%
Loss of colour	3.40%	17.10%		10.30%
Sand contamination		12.20%	15%	13.60%
Rotting during processing	79.30%	53.70%	26%	53.00%
Swept away by rain	10.30%	12.20%	59%	27.20%

Figure 19: Main types of post-harvest losses of dagaa processors

3.4.8. Frequency of post-harvest losses among processors

In order to get a full understanding of the problem of post-harvest losses among processors, the frequency with which it was experienced among processors was examined. The results showed that lake-wide, most processors experienced it during rainy seasons (43.6%), as there was insufficient sun-shine to dry dagaa properly, resulting to various degrees of spoilage or outright rotting of the fish (Table 17). The frequency that followed was every three months (23.4%), indicating that episodes of post-harvest losses were spaced, hence some processors did not take adequate precautions. This pattern was exhibited among Ugandan and Tanzanian processors. In Kenya, however, apart from the rainy seasons, processors reported that the problem occurred every week, making it more urgent.

Parts of processed dagaa affected by post harvest losses were sold at prices betweenUS$1.48 and 1.05 per kg during low and high catch seasons.The parts of processed dagaa affected by post-harvest losses were sold mostly to poultry, piggery and fish farmers (60.0%) or to industrial feed manufacturers (33.3%), among others.

Table 17: Frequency of post-harvest losses among dagaa processors and buyers of affected dagaa

		Uganda	Kenya	Tanzania	Average
How frequently processors experienced post harvest losses	Every week	7.7%	14.6%	17.3%	13.2%
	Every two weeks		4.9%	7.7%	6.3%
	Every month	3.8%	12.2%	5.8%	7.3%
	Every three months	34.6%	4.9%	30.8%	23.4%
	Rainy season	38.5%	53.7%	38.5%	43.6%
	Others	15.4%	9.7%		12.6%
Buyers to whom processors sold the parts of processed dagaa affected by post-harvest losses	Traders who sold within the country		19.4%	31.9%	25.7%
	Traders who sold outside the country				
	Industrial feed millers	33.3%	33.3%		33.3%
	Poultry, piggery or fish farmer	66.7%	47.2%	66.0%	60.0%
	Others			2.1%	2.1%

Different coping mechanisms were adopted to respond to the problem of post-harvest losses among dagaa processors. They included spreading dagaa on clean nets and turning it over using clean brooms (57.5%), followed by improved drying methods (50.0%), involving the use of raised drying racks and washing dagaa before drying (25.0%) (Table 18). In Uganda, it was improved drying methods, followed by covering the dagaa.

In Kenya, it was spreading on clean nets and washing dagaa before drying. In Tanzania, it was covering the dagaa and cleaning the drying ground. Other measures of significance included spreading processed dagaa on clean surface, early processing, salting before drying and restricting animals from walking on dagaa. There were, however, some processors who did not adopt any coping mechanism (43.5%), especially in Tanzania where they formed the majority (73.6%) and to a lesser extent Uganda (13.3%).

The reasons for not adopting any measures were that some of dagaa fishers operated small hand-paddled and sail boats which limited them from adopting some of the measures, including lifting up catches on boat to avoid contact with water and early landing of catches due to their slow means of propulsion. Dagaa processors and traders lacked soft credits needed to implement coping strategies including the use of plastic cover, especially during rainy season. Some dagaa processors and traders were not well informed on available coping mechanism at the landing site and market place. There was also reluctance among some of them to change from traditional to improved processing methods.

Table 18: Measures processors adopted to maintain quality of processed dagaa

	Uganda	Kenya	Tanzania	Average
Improved drying of dagaa	50.0%			50.0%
Covering with polythene sheets/ tarpaulin	23.3%		15.1	23.3%
Salting before drying	3.3%			9.2%
Early processing	10.0%			10.0%
Cleaning a drying ground			7.5%	7.5%
Studying weather			3.8%	3.8%
Washing of dagaa before drying		25.0%		25.0%
Spreading them on a clean net and turning it using a clean broom		57.5%		57.5%
Restricting animals from walking on dagaa		2.5%		2.5%
Spreading dagaa on a clean floor after drying		15.0%		15.0%
None	13.3%		73.6	43.5%

3.4.9. Regulations in dagaa processing

Formal and informal regulations that operators were required to comply with in order to carry out dagaa processing were examined. These requirements related to fisheries management, quality standards and fish trade. The results showed that processors complied with basically different sets of regulations in the different countries (Table 19) (Plate 8). However, lake-wide, the most commonly observed regulations were trading licence (14.0%), prohibition of stepping on dagaa with shoes (39.0%), use of plastic cover over dagaa (26.7%) and cleaning ground surface before drying (26.7%).

In Uganda, majority of processors complied with obtaining health/ hygiene certificate (26.5%), followed by holding a trading licence (20.6%) and/ or fishing licence (20.6%). In Kenya, most respondents complied with no stepping on dagaa with shoes when processing (39.0%), discarding of used water for washing dagaa to the lake (14.6%) and wearing polythene on the foot when processing (14.6%). In Tanzania, most respondents complied with use of plastic cover over dagaa (26.7%), cleaning ground surface before drying dagaa (26.7%) and observing bad weather (20.0%).

Variations in compliance were attributed to levels of understanding due to limited sensitisation, low enforcement by the relevant agencies and limited facilities for meeting the requirements. Important regulations concerning quality assurance and packaging of the dagaa products were among the least complied with. There was also a significant proportion of respondents who did not comply with any requirements, notably in Tanzania (26.6%). There is, therefore, need for sensitisation and compliance to improve the dagaa trade (see Appendix 2).

Table 19: Regulations processors complied with in dagaa processing

	Uganda	Kenya	Tanzania	Average
Registration of business	11.8%			11.8%
Trading licence	20.6%	7.3%		14.0%
Health/ hygiene certificate	26.5%			26.5%
Proper packaging of dagaa	11.8%			11.8%
Strict monitoring and supervision by FOs	5.9%			5.9%
Quality assurance (sand free, use of racks)	2.9%			2.9%
Fishing licence	20.6%			20.6%
No stepping on dagaa with shoes when processing		39.0%		39.0%
Use of clean nets		9.8%		9.8%
Discard of used water for washing dagaa to the lake		14.6%		14.6%
Putting on overall, aprons, gloves, socks and lesos		12.2%		12.2%
Wearing polythene on the foot when processing		14.6%		14.6%
Use of clean sacks when packing dagaa		2.4%		2.4%
Use of plastic cover over dagaa			26.7%	26.7%
Cleaning ground surface before drying dagaa			26.7%	26.7%
Observing bad weather			20.0%	20.0%
None			26.6%	26.6%

3.4.10. Challenges experienced in dagaa processing

Challenges experienced in dagaa processing were examined and the results revealed that processors of dagaa were faced with different challenges. Lake-wide, rain or bad weather was reported as the main challenges (45.6%), because of its negative effect on drying of dagaa, resulting in spoilage or complete rotting of the product (Table 20). Price fluctuations (21.5%) and rotting (12.6%) were the other most common challenges.

Apart from the above, each country appeared to have its own set of peculiar challenges. In Uganda, it was bad weather/ rain and price fluctuations, but other concerns included scarcity of dagaa, lack of capital and predators. In Kenya the main challenge was bad weather/ rain, followed by price fluctuations. However, other issues were predators, rotting of dagaa, lack of market, theft and insecurity, high labour requirement, high taxation, lack of crews, customers defaulting to pay for dagaa received and dagaa swept by rain. In Tanzania, the majority were concerned about rain / bad weather, followed by economic insecurity in the dagaa sub-sector. Other issues included rotting of dagaa and non-economic insecurity as explained earlier.

Table 20: Main challenges experienced in dagaa processing

	Uganda	Kenya	Tanzania	Average
Rain / bad weather	42.9%	42.9%	50.9%	45.6%
Price fluctuations	28.6%	14.3%		21.5%
Lack of capital	2.9%			2.9%
Predators	2.9%	4.8%		3.9%
Weighing only done when selling but not buying	2.9%			2.9%
Fish scarcity	11.4%			11.4%
Theft and insecurity		4.8%		4.8%
Rotting		11.9%	13.2%	12.6%
Requires a lot of work		2.4%		2.4%
High taxation by BMUs &Fisheries staff		2.4%		2.4%
Lack of crews		2.4%		2.4%
Lack of market		9.5%		9.5%
Customers default to pay		2.4%		2.4%
Swept by rain		2.4%		2.4%
Economic insecurity			28.3%	28.3%
Non-economic insecurity			7.5%	7.5%

3.4.11. Suggestions to address challenges in dagaa processing

In order to address the challenges identified above, processors made several suggestions which varied between the countries. Lake-wide, the most common suggestions were to construct raised drying racks for dagaa processing (33.7%), identification of market or dagaa (9.9%) and Government support in provision of soft loans (4.6%) (Table 21).

In Uganda, most processors suggested that drying and handing methods should be improved. This would involve the use of raised drying racks and solar dryers. This was followed by market identification, aimed at addressing price fluctuations and limited demand for dagaa. Thirdly, the use of solar light in fishing should be banned and only lanterns allowed, because of the large proportions of by-catch landed with the dagaa, spoiling its quality and threatening sustainability of the other fisheries. Other suggestions included provision of soft loans by Government and sensitisation of operators on quality and trade business.

The price fluctuations were mostly associated with rotting of dagaa during fishing, processing and trading operations, leading to low product prices at landing sites and market places. Dagaa dried on sand also fetched low price compared to that dried on nets or raised drying racks. Furthermore, value-added dagaa products, namely deep- fried, spiced or smoked, fetched high prices. The price fluctuations were also associated with the supply and demand of dagaa at landing sites and market places during high and low catch seasons.

Some of the strategies to address price fluctuations include establishment of cottage industry for value addition of dagaa products; training of dagaa fishers, processors and traders on how to improve processing and value-addition of dagaa products; and conducting of market surveys to improve information marketing channels for dagaa of Lake Victoria.

In Kenya the majority suggested that solar dryers be provided, followed by establishment of a dagaa factory by Government and promotion of proper handling of dagaa by fishers and processors. Other solutions included market search, provision of soft loans by Government, increase in dagaa prices, spreading dried dagaa on clean floor and establishing drying racks.

In Tanzania, the majority recommended that raised drying racks be established, followed by micro-project schemes to provide dagaa processors with credit and marketing services. Planned interventions for dagaa in the region should, therefore, be in line with the demands of the processors as discussed here.

Table 21: Suggestions to overcome challenges in dagaa processing

	Uganda	Kenya	Tanzania	Average
Improve drying methods and handling	65.2%			65.2%
Sensitise people involved in dagaa business/ fishery	4.3%			4.3%
Market searches	17.4%	2.4%		9.9%
Government should provide soft loans	4.3%	4.8%		4.6%
Ban use of bulbs but only lanterns for dagaa fishing	8.7%			8.7%
Increment of dagaa price		2.4%		2.4%
Provision of solar dryer		33.3%		33.3%
Government to create factory for dagaa		19.0%		19.0%
Spreading on a clean floor after drying		9.5%		9.5%
Proper handling		11.9%		11.9%
Need of racks for drying		9.5%	57.8%	33.7%
Micro projects scheme (credit and market)			26.7%	26.7%
Awareness creation			15.5%	15.5%
Don't know		4.8%		4.8%

3.5. Trading in dagaa

3.5.1. Categories of dagaa traders

Most of the traders in dagaa business lake-wide were those who operated within their own countries (62.5%), followed by traders who processed their merchandise (34.8%) and thoe who sold outside their countries (8.4%) (Table 22) (Plate 7). In Uganda, the majority were traders who sold within Uganda, followed by those who sold outside to neighbouring countries, particularly in Rwanda. In Kenya, the majority were traders who processed and sold at beach, followed by those who sold elsewhere but within Kenya. In Tanzania, the majority were those who sold elsewhere within Tanzania, followed by those who processed and sold within the beach.

The focus of traders on domestic market denied them opportunty to tap larger markets with higher prices and thus there was no incentive to improve quality and meet the standards. It was in Uganda that a sizeable proportion of traders sold outside the country (12.2%). The external destinations included Rwanda, DRC, South Sudan and Kenya. Tanzania also had exporting traders.

The product most of the traders sold was sun-dried dagaa (88.9%), followed by deep fried and salted and sun-

dried dagaa . The sun-dried dagaa was the lowest category of dagaa product and the traders were, therefore, prone to quality lapses and post-harvest losses. Salted and sun-dried product was sold by Ugandan traders (6.1%) while deep fried pfoduct was traded most by Tanzanian traders (27.3%). This represented a step in product improvement, resulting in quality maintainance and prolonged shelf life of the product. More traders could be encouraged to trade in improved dagaa products for improved nutrition, food security and incomes.

Table 22: Categories of dagaa traders and processed dagaa products traded

		Uganda	Kenya	Tanzania	Average
Categories of dagaa traders	Fisher/ processor/ trader		7.9%	4.5%	6.2%
	Processor/ trader		60.5%	9.1%	34.8%
	Traders who sold within the country	87.8%	31.6%	68.2%	62.5%
	Traders who sold outside the country	12.2%		4.5%	8.4%
	Others			13.6%	13.6%
Processed dagaa products traders traded in most	Sun-dried	93.9%	100.0%	72.7%	88.9%
	Salted and sun-dried	6.1%			6.1%
	Deep fried			27.3%	27.3%

3.5.2. Operations of dagaa traders

Business operations of dagaa traders were examined to assess levels of their financial performance, based on quantities of dagaa handled, buying and selling prices. The data revealed that on average, the numbers of days to do one round of trading were 3.5 and 2.0 during low and high catch seasons respectively (Table 23). This was because of the ready availability of product during high as opposed to the scarcity during low catch seasons. It took -42.9% fewer days to bulk consignment during high than low catch season. However, the number of rounds undertaken in a month remained the same at 8.0.

Strong variations were observed in average quantities of dagaa handled, estimated at 630 kg during low catch seasons but rising by 164.9% during high catch seasons. This was also attributed to fish availability.

Buying prices of sun-dried dagaa were US$/kg 2.05 and 1.34 during low and high catch seasons respectively, depicting a decline of -43.6% between the seasons. This was a reflection of the price electivity of supply of dagaa. Selling prices were higher than buying prices, estimated at average of US$/kg 2.67 and 1.93 for low and high catch seasons respectively. The latter was lower than the former by -27.7%.

Based on those quantities and prices, average trading cost was computed at US$ 10,332.00 during low catch seasons, rising by 73.2% during high catch seasons. Trading revenues were at US$ 13,456.80 and rising by 91.5% during high catch seasons. Net revenues of traders, were, therefore on average US$ 3,124.80 and 7,877.68 during low and high catch seasons respectively, showing a 152.1% rise between the seasons.

Table 23: Average number of trading days, quantities and prices of processed dagaa handled by traders and revenues and net earnings

	Low season	High season	% Change
Number of days taken to do one round of trading	3.5	2.0	-42.9%
Rounds of trading carried out in a month	8.0	8.0	0.0%
Quantity of processed dagaa handled in one round (kg)	630	1,669	164.9%
Buying price of processed dagaa (US$/kg)	2.05	1.34	-34.6%
Selling price of processed dagaa (US$/kg)	2.67	1.93	-27.7%
Trading costs (US$)	10,332.00	17,891.68	73.2%
Trading revenues (US$)	13,456.80	25,769.36	91.5%
Traders' net earnings (US$)	3,124.80	7,877.68	152.1%

3.5.3. Trading equipment and operational expenses

Dagaa traders made use of essential equipment in their operations, including bicycles, motorcycles or trucks as means of transport and weighing scales for measurement (Table 24). Ownership of means of transport was important because it enabled traders to deliver consignments to destinations of choice and conveniently. Details of equipment used were brought out in the study in Uganda. The results revealed that different traders owned an average of one unit of the equipment used. The equipment owned by most traders was the weighing scale. The item of highest cost was the truck; while that with the longest life time was the bicycle. Most respondents bought the bicycles in 2013 (50.0%), weighing scales in 2015 (50.0%) and truck in 2012. Own saving was the source of capital for most traders, depicting poor access to financial services by dagaa traders.

Table 24: Average quantities, expected life and cost of assets used in dagaa trading in Uganda

	Quantities	Expected life (Years)	Cost (US$)
Bicycle	1	6.5	45.45
Motorcycle*	1	1	606.06
Weighing scale	1	2	24.09
Truck*	1	5	15,151.52

*bought second hand

Operational costs of traders consisted mostly of the sun-dried dagaa commodity as the highest cost item (US$ 1,212), followed by transport (US$ 152) and others included labour and storage. (Figure 20).Traders used both owned and hired transport, including motorcycles, taxis, buses and trucks. Most transport used was for mixed goods, often including passengers and this often compromised the quality of the dagaa, as people sat on the bags, causing the product to crumple.

Labour was used for processing function where the trader processed dagaa as well. It was also used for packaging dagaa into sacks, carrying into and out of stores, loading and unloading trucks, retailing and spreading out to keep it dry. Some individual traders or trading companies hired labour to carry out the trading operations on their behalf, including purchasing, transportation and selling.

Storage was utilised both at the landing sites of supply, in transit and at market destinations (Plate 5). Some of them were proper stores constructed by Government and met the quality standards for storing fish for human consumption. Others were privately owned, ranging from buildings with cement floor, brick and cement walls and iron roofs, or those with earth floor or mud wall or roof with grass or polythene materials. Dagaa was also stored on sand and covered with tarpaulin. The stores were often infested with pests, rodents and other predators which compromised the quality of dagaa and caused physical loss as well.

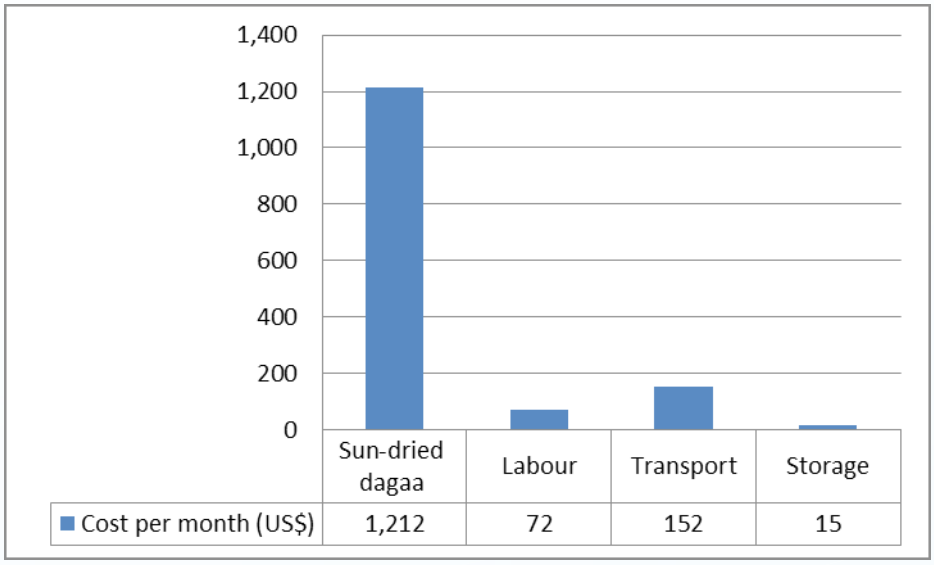


Figure 20: Average cost per month of operational items, Uganda

3.5.4. Trading in value added products

Examination of traders' involvement in trading value added dagaa products revealed minimal participation, given by the data for Uganda (2.0%), Kenya (0.0%) and Tanzania (4.8%). The value added products traded were deep fried dagaa and salted and sun-dried dagaa, both of which were produced on insignificant scale, compared to the volumes of dagaa produced. In Kenya, not a single processor was undertaking any form of value addition, saying one could not add value when all other people in the market didn't because one would be selling at a loss. This explained why the introduced solar driers by KMFRI had not taken off in Kenya. Furthermore, the volume of catch during high catch seasons required bigger driers than what had been provided. The main value added dagaa products were animal feeds produced by industrial feed millers but these did not fall in the realm of dagaa trade.

3.5.5. Destinations and buyers from dagaa traders

Most traders lake-wide sold processed dagaa away from the beaches but within their countries (60.6%), followed by those who sold at the beaches (36.0%) and only a few sold in other countries (Table 25). In Uganda, equal proportions of traders sold at the beaches and away from the beaches but within Uganda. However, it was only in Uganda that a significant proportion reported selling outside the country (10.2%). In Kenya, majority of traders sold away from beach but within country, followed by those who sold at the beach. A similar pattern was observed in Tanzania.

This revealed that dagaa trade was primarily a domestic activity. While this was good for nutrition and food security of the countries, incomes were compromised because of the limited demand and low prices on the domestic market. Traders who sold in other countries showed examples of better developed trade and ability

to meet the more stringent trade requirements of exporting than on domestic markets. Lakewide, majority of traders sold to traders within the country (49.5%), followed by consumers (26.3%).

Table 25: Locations and buyers from dagaa traders

		Uganda	Kenya	Tanzania	Average
Where traders sold most of their processed dagaa	At the beaches	44.9%	29.7%	33.3%	36.0%
	Away from beach but within country	44.9%	70.3%	66.7%	60.6%
	In another country	10.2%			10.2%
To whom traders sold most of their processed dagaa	Consumers	20.4%	10.8%	47.6%	26.3%
	Traders within country	28.6%	86.5%	33.3%	49.5%
	Traders selling outside country	14.3%		19.0%	16.7%
	Industrial feed millers	34.7%			34.7%
	Supermarket	--	--	--	--
	Poultry, piggery or fish farmer	2.0%			2.0%
	Others		2.7%		2.7%

In Uganda, the majority sold to industrial feed millers (34.7%). This reflected the low levels of quality management in the country, such that their products were mostly suitable for animal feeds. Traders who sold to consumers constituted 20.4% and the majority were from the landing sites where considerable effort had been made to improve dagaa quality, suitable for human consumption. The main destinations for dagaa included Kampala, Gulu, Arua, Masaka, Mbarara, among others (Figure 21).

Dagaa from Kiyindi went to Kabale and crossed into Rwanda through Katuna Border Post. Considerable quantities went to Arua and Koboko in West Nile, from where much of it crossed the border into DRC through Odramachaku Border Post and some to South Sudan through Oraba Border Post. Dagaa from Kiyindi also went to Gulu and Amuru, from where some of it crossed into South Sudan through Elegu Border Post. Some of the dagaa went to Busia and Malaba, from where it crossed into Kenya.

Kasenyi was not a fishing area for dagaa but received dagaa from the islands of Kalangala District. The dagaa from Kasenyi mostly went to the feed millers in Kampala. Some of it also went to Arua, Koboko and Gulu. It also went to Busia and much of it went to Masaka and Mbarara. There was little mention of dagaa from Kasenyi crossing into Rwanda, because it was not so well handled, as required by the Rwandan market.

Dagaa from Kasekulo went mostly to Kampala to the feed millers, due to its poor quality. Poultry, piggery and fish farmers also bought the dagaa directly for on-farm feed formulation. Many stores at Kasekulo were filled with dagaa because lack of market was a major problem for producers at the landing site.

Dagaa from Lambu went to Kenya through Busia Border Post, to Masaka and to Mbarara, mostly to feed millers. Some of it went to Kampala as well. The several farmers in the Central Buganda region also bought dagaa from lambu for on-farm feed formulation.

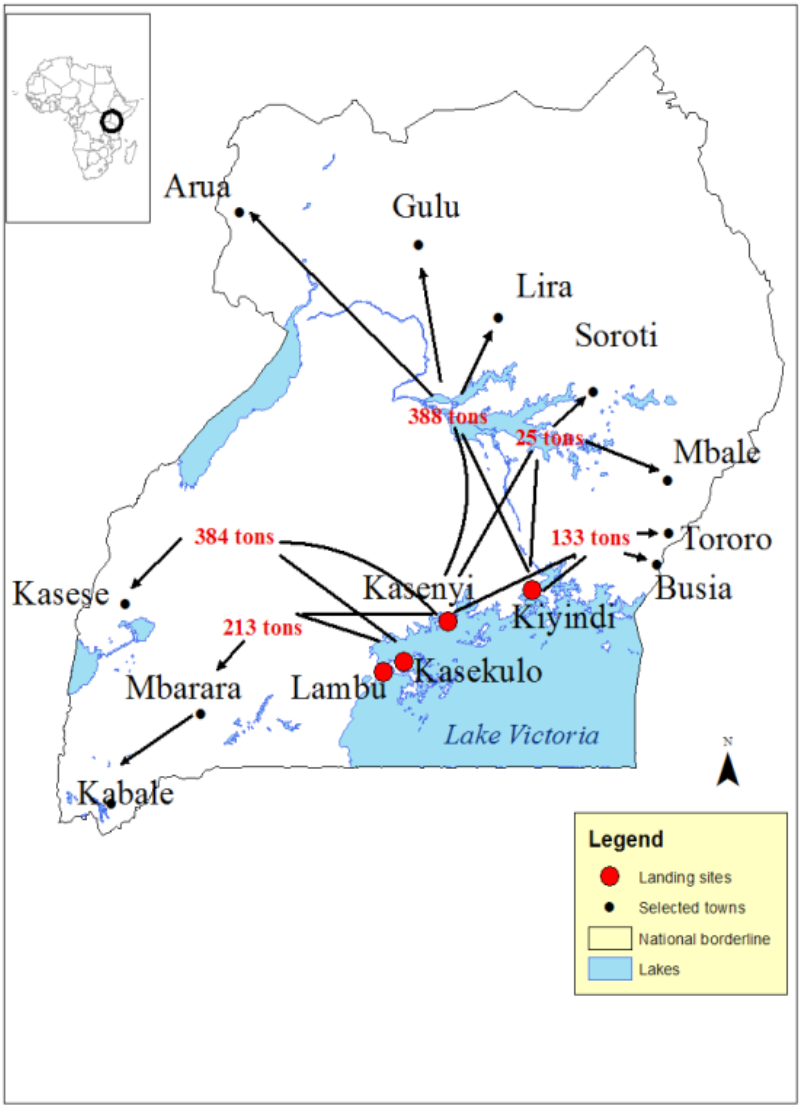


Figure 21: Map showing main destinations of dagaa and average annual tonnage trade in Uganda, 2010-2015

In Kenya, the majority sold to traders within the country (86.5%). This was mainly because of the little production relative to domestic demand, with the result that Kenya was an importer of dagaa. Dagaa imported from Tanzania went to mostly feed millers in Thika, Nairobi, Kitale and Nakuru (Figure 22). Dagaa from Uganda went to Malaba, Eldoret, Bungoma, Kanduyi and Nairobi.

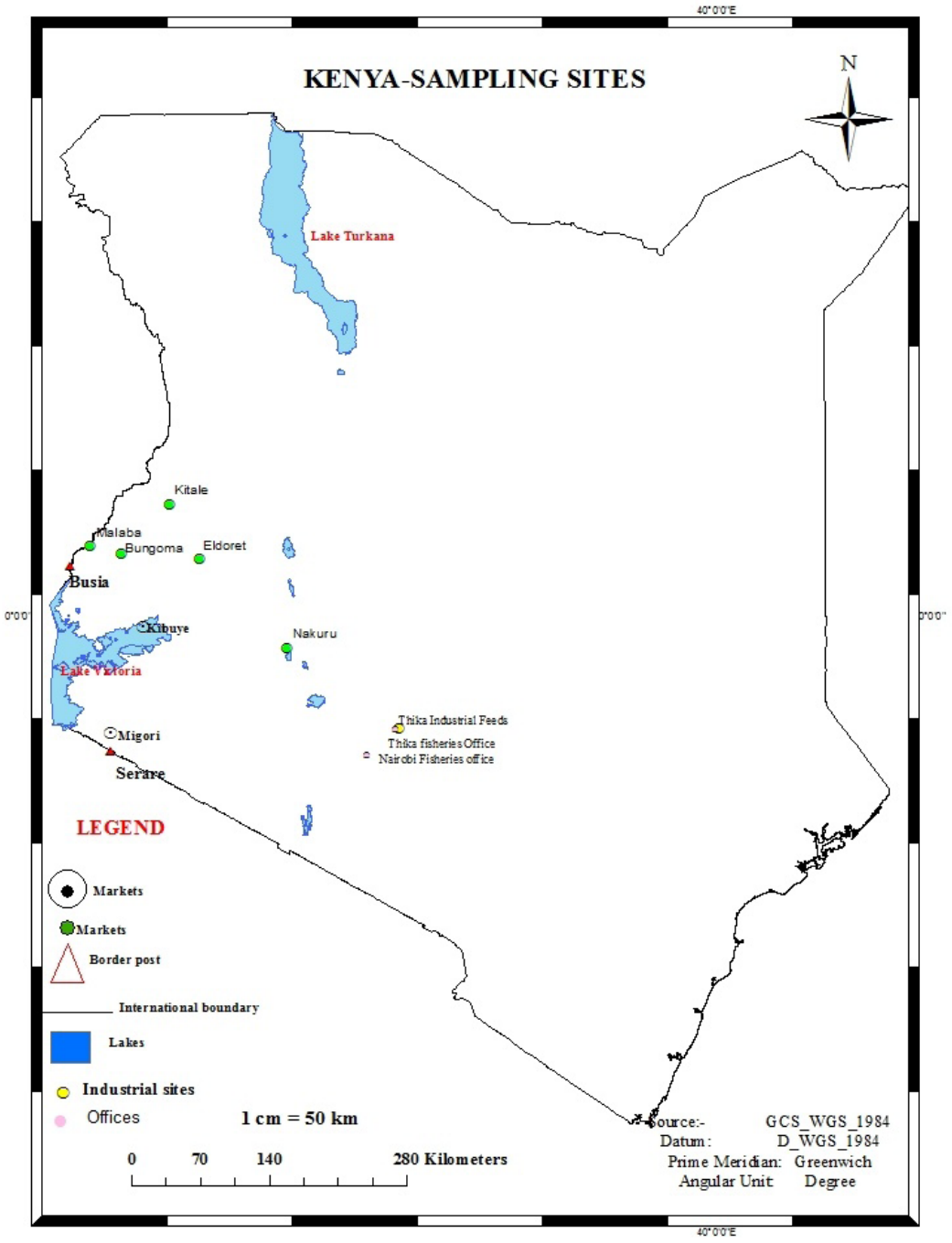


Figure 22: Map showing main destinations of dagaa trade in Kenya

In Tanzania, the majority sold to traders within country, followed by industrial feed millers. There was a small proportion of traders who sold to poultry, piggery and fish farmers (2.7%). Insignificant proportions sold to supermarkets, despite the fact that supermarkets offered the highest prices for dagaa as shown later. This was due to the stringent quality and trade conditions which most traders could not fulfil. There is need for linking the supermarkets with the processors, assisting them to improve the quality and comply with the requirements.

On the domestic market, dagaa from Kirumba Market and other sources on Lake Victoria were mainly destined to Dar es Salaam (38.59%), Mbeya (18.76%), Morogoro (9.93%), Dodoma (4.86%), Tanga (3.83%), Tabora (3.63%), and Singida (3.50%). The other regions accounted for 26.90%, which included Songea, Mtwara, Moshi, Arusha, Kigoma, Rukwa, Pwani, Njombe, Ruvuma, Simiyu, Mwanza and Iringa (Figure 23).

The dagaa for fish meal was mainly destined for Iringa (37.6%), followed by Dar-es-Salaam Region (24.6%) and Mara (22.4%). The rest of it (15.4%) was destined for Morogoro, Kigoma, Mwanza, Singida, Tabora, Arusha, and Moshi.

Figure 23: Map showing main destinations of dagaa trade in Tanzania

3.5.6. Post-harvest losses of traders

Lake-wide, the majority of traders reported that their main type of post-harvest loss was rotting of the dagaa (43.3%), dagaa swept by rain (11.7%) and loss of colour (12.7%) (Table 26). In Uganda, the issues for the majority were rotting, followed by loss of colour. In Kenya, the concerns for the majority were rotting, followed by mixing poorly dried with good dagaa.InTanzania, rotting was followd by dagaa swept away by rain. The problem of rotting affected the least proposrtion of traders in Tanzania (35.0%) becaue of their training in observing bad weather vis-a-vis dagaa operations. Other concerns included sand contamination, dagaa broken during transportation and weight loss during storage. A few traders did not report any post-harvt losses (8.3%), especially in Tanzania, due to their levels of preparedness for it.

The last time traders experienced post-harvst losses, the volumes of dagaa lost were on average 166 kg, the highest loss being in Uganda (200 kg). These volumes of loss were considered high and should be minimised.

The frequency with which traders suffered post-harvest losses varried but lakewide, the majority reported it occured duringrainy season (36.3%), monthly (23.7%) andevery three months (21.2%).In Uganda, majority experienced it every month, followed by every week. In Kenya, it was during rainy seasons, followed by every month. In Tanzania, it was during rainy season, followed by every month.

Table 26: The major types of post-harvest losses affecting dagaa traders

		Uganda	Kenya	Tanzania	Average
The major types of post-harvest loss that affected traders' dagaa marketing	Rotting	56.3%	38.7%	35.0%	43.3%
	Sand contamination	10.4%			10.4%
	Swept by rain	2.1%	12.9%	20.0%	11.7%
	Loss of colour	12.5%	12.9%		12.7%
	Broken during trasportation	6.3%	9.7%		8.0%
	Weight loss during storage	2.1%			2.1%
	Mixing poorly dried with good dagaa	2.1%	19.4%		10.8%
	Others		6.5%	30.0%	18.3%
	None	8.3%		15.0%	11.7%
Volume of dagaa traders lost the last time they experienced post-harvest losses (kg)		200		132	166
Frequency with which traders experienced post-harvest losses	Every week	23.8%	7.1%	15.8%	15.6%
	Every two weeks	9.5%	3.6%		6.6%
	Every month	35.7%	14.3%	21.1%	23.7%
	Every three months	14.3%	7.1%	42.1%	21.2%
	Rainy season	11.9%	60.7%		36.3%
	After three months	4.8%	3.6%		4.2%
	Others		3.6%	21.1%	12.4%
Prices at which traders sold the part of processed dagaa affected by post-harvest losses (US$/kg)		0.61		2.35	1.48

Traders have adopted various coping mechanisms to respond to post-harvest losses, with the lake-wide majority adopting quality assurance procedures with respect to handling, drying sufficiently and storage of dagaa (77.5%) (Table 27). This was the leading solution among traders in each of the countries as well. Related to this was the practice of covering dagaa with tarpaulin. Other measures included early selling, sensitisation of people doing the processing of the dagaa, covering dagaa with tarpaulins, studying the weather, observing hygiene, sieving dagaa and spreading on clean floor after drying.

Table 27: Measures taken by traders to control post-harvest losses

	Uganda	Kenya	Tanzania	Average
Early selling	7.4%			7.4%
Quality assurance	70.4%	87.1%	75.0%	77.5%
Sensitize processors	1.9%			1.9%
Cover with tarpaulins	18.5%			18.5%
Study weather			5.0%	5.0%
Wash dagaa before drying		3.2%		3.2%
Observe hygiene		3.2%		3.2%
Sieving		3.2%		3.2%
Spread on clean floor after drying		3.2%		3.2%
None	1.9%		20.0%	11.0%

3.5.7. Regulations in dagaa trading

EAC had come out with draft East African Standard (Appendix 1) and the individual countries also had their own standards set by their national standards bodies, laying down essential food safety regulations governing dagaa trade. In addition, there were trade regulations and local by-laws in place. However, compliance with the regulations and standards varied. The majority of traders lake-wide reported that they complied with acquisition of trading licence (29.4%) (Table 28). In Uganda, the majority complied with quality assurance measures governing proper handling, processing and storage of dagaa, followed by trading licence. In Kenya, the majority obtained trading licence, followed by the rule on putting on overall, apron and head scarf while drying dagaa. In Tanzania, the majority complied with trading licence and market dues but a large proportion of them did not obey any particular regulations (50.0%). However, few respondents complied with essential regulations concerning health certificate after inspection and fish movement permit after the fish management inspection, among others. Low compliance with trade regulations was attributed to resource and knowledge constraints, making traders unable to meet the trade requirements and was hindrance to improving dagaa trade. It was also due to poor enforcement of existing regulations by Government authorities.

Table 28: Respondents who complied with the regulations for dagaa traders

	Uganda	Kenya	Tanzania	Average
Trading licence	21.9%	41.4%	25.0%	29.4%
Fish movement permit	4.7%			4.7%
Quality assurance inspection	50.0%			50.0%
Business registration for trader	4.7%			4.7%
Health inspection certificate	18.8%			18.8%
Market trading fee			25.0%	25.0%
Should not step on the processed dagaa		13.8%		13.8%
Use gloves/polythene during package		6.9%		6.9%
Discard of use water for using dagaa		6.9%		6.9%
Spreading dagaa in a clean net		6.9%		6.9%
Putting on overall/Apron/Head scarf		24.1%		24.1%
None			50.0%	50.0%

Traders in the different countries experienced different types of challenges. However, the common ones were price fluctuations associated with catch levels and number of buyers (28.8%), and bad weather (18.4%) (Table 29). In Uganda, additional problems were poor quality product, attributed to rains and poor weather, inadequate raised drying racks, poor storage, high-taxation and asking for bribe by law enforcers, which reduced the profit margins of traders.

In Kenya, lack of customers, price fluctuations, bad weather and customers defaulting to pay for dagaa received were the main challenges. Traders also experienced insecurity on the lake, high taxation by BMU and fisheries staff and lack of capital for trading. Several other challenges were cited as listed in Table 29.

In Tanzania, most of dagaa traders were constrained by economic insecurity, including price fluctuations and market accessibility, followed by prolonged rain. The non-economic insecurity happened when sacks of dagaa sunk during water transportation as well as poor storage at landing sites and market places.

Table 29: Main challenges experienced in dagaa trading

	Uganda	Kenya	Tanzania	Average
Sub-standard weighing scales	4.5%			4.5%
Poor product quality	22.7%			22.7%
Over taxation and bribe among enforcers	10.6%			10.6%
Pouring water on processed dagaa	1.5%			1.5%
Tribalism	1.5%			1.5%
Untrustworthy dagaa suppliers	4.5%			4.5%
Price fluctuations (high catch, few buyers)	40.9%	16.7%		28.8%
Theft	4.5%			4.5%
Buyers prefer to buy from processors	6.1%			6.1%
Traders buy on credit	3.0%			3.0%
Bad weather		16.7%	20.0%	18.4%
Economic insecurity			70.0%	70.0%
Non economic insecurity			10.0%	10.0%
Over taxation by BMU/fisheries		5.6%		5.6%
Loss of dagaa during transportation		2.8%		2.8%
Customers default to pay		16.7%		16.7%
Insecurity		8.3%		8.3%
Swept by rain		2.8%		2.8%
Rotting		2.8%		2.8%
Predators		2.8%		2.8%
Lack of customers		22.2%		22.2%
Lack capital for trading		2.8%		

Traders made different suggestions on how to respond to the challenges identified. Lake-wide, the common solution identified was quality assurance (61.5%) (Table 30). In this respect, processors would be sensitised to dry dagaa properly. Use of raised drying racks would be promoted and adopted to minimise sand and dust contamination. Storage would be improved to avoid leakage when it rained and to eliminate pests.

In Uganda, this suggestion was followed by reduction in taxes, provision of soft loans to increase business, market identification and having an organisation for dagaa traders, among others. In Kenya, the first suggestion was establishing a factory to create market for dagaa, followed by provision of loan by the Government, establishing solar dryers and measures to reduce drying time, among others but there were also many who did nothing to address the challenges. In Tanzania, the majority of dagaa traders adopted proper handling of dagaa at landing sites and market level as coping mechanism for reduction of risk and uncertainty.

Table 30: Traders' solutions to the challenges in dagaa trading

	Uganda	Kenya	Tanzania	Average
Quality assurance (sufficient drying, use of racks, improve storage)	57.4%		65.5%	61.5%
Reduce taxes	6.6%			6.6%
Have closed dagaa seasons	1.6%			1.6%
Improve roads	3.3%			3.3%
Prices should be uniform	4.9%			4.9%
Provision of soft loans to increase business	6.6%			6.6%
Market identification	6.6%			6.6%
To have an organisation for dagaa traders	6.6%			6.6%
Strict law on traders to buy dagaa at the market	4.9%			4.9%
Timely payments	1.6%			1.6%
Government support			34.5%	34.5%
Reduce the drying time		6.9%		6.9%
Provision of processing facilities		3.4%		3.4%
Create market for dagaa (factory)		31.0%		31.0%
Use modern transportation equipment		3.4%		3.4%
Solar dryer		6.9%		6.9%
Provision of loan by the Government		13.8%		13.8%
Provision of storage facilities		3.4%		3.4%
Creating awareness on dagaa value		3.4%		3.4%
Don't know		27.6%		27.6%

3.5.9. Promoting human consumption of dagaa

Opinions of respondents were sought on how human consumption of dagaa could be promoted, vis-a-vis other uses of the resource. The common lake-wide suggestion was that the quality of dagaa products should be improved through complete drying and elimination of contaminants (66.9%) (Table 31). This was also the case in Uganda, followed by sensitisation of all including consumers on the value of dagaa as food. In Kenya, the suggestion was followed by the use of drying racks to observe hygiene. In Tanzania, the majority suggested product development involving quality and value addition and creating awareness on dagaa consumption at individual and household levels.

Table 31: Respondents' suggestions to improve human consumption of dagaa

	Uganda	Kenya	Tanzania	Average
Improve the dagaa product quality	78.2%	55.6%		66.9%
Value addition	3.6%			3.6%
Sensitisation	12.7%			12.7%
Need engines to fish mature dagaa for consumption	1.8%			1.8%
Use of modern technology (Solar/ machine)	3.6%			3.6%
Improve quality and product variety			73.3%	73.3%
Create awareness on dagaa consumption for protein			10.0%	10.0%
Use of drying rack observe hygiene		38.9%		38.9%
Wash before drying		5.6%		5.6%
None			16.7%	16.7%

3.6. Industrial feed millers of dagaa

In Kenya, a number of industries were identified as processing dagaa to produce poultry and animal feeds (Table 32). Most of the industries obtained their dagaa from Tanzania. Case study of Trust Feeds Ltd revealed that the quantities of dagaa utilized declined from 12.3 tonnes in 2012 to 7.1 tonnes in 2013 and by the first half of 2016, they had used 2.7 tonnes. The respective values were US$ 7.1, 5.8 and 2.3. This revealed a declining trend in dagaa utilisation for feed production in Kenya.

Table 32: Industries using dagaa for feeds, Kenya

Industry	Location	Source of /Dagaa
Chania Feeds (Millers)	Thika	Tanzania
Tarime Feeds	Nairobi	Tanzania
Tosha Feeds	Nairobi	Tanzania
Unga Millers	Nairobi	Tanzania
Pembe Millers	Nairobi	Tanzania
Kitale Best Feeds	Kitale	Tanzania
Wonders Feeds	Nakuru	Tanzania
Trust Feeds Ltd	Thika	Kenya

In Uganda, six industrial feed millers were consulted, namely Lucy Millers, Kyaterekera Poultry and Animal Feeds, Takuwah Best Feeds, Mutima Feed Millers, Eram and Nalukolongo Animal and Poultry Feeds. The range of products produced was as given in Table 33. Feed millers mainly bought processed dagaa from specified landing sites because they believed that their dagaa was of good quality, having responded to training and improved processing to attract higher dagaa prices They also reported that they dealt directly with farm owners for their products in order to avoid being corrupted by farm mangers.

Table 33: Products of industrial feed millers of dagaa and their challenges, Uganda

PRODUCTS	CHALLENGES
• Poultry feeds	• Dagaa often not well dried
• Animal feeds	• Sand and dust contamination
• Fish feeds	• Contamination with Salmonella typhii, E.coli, and Shigella
• Pharmaceuticals	• V.A.T on finished feeds too high
• Food supplements	• Unclear quality control policy
	• Tax and non-tax barriers to regional markets for feeds.
	• Border entry restrictions

Other components used with dagaa in producing feeds included cotton cake, sunflower, animal feed premix, salt, soya cake and shells. Dagaa percentage composition also varied from one feed miller to another and depended on the type of feed produced. The selling price for processed feeds which comprised of dagaa and other components ranged from US$1.27during low catch to 0.91per kg during high catch seasons.

Most feed millers interviewed reported rotting of semi-dried dagaa as the major type of post-harvest loss. They minimized losses through thorough cross checking of dagaa to ensure that it was fully dried and sand-free. Where dagaa contained some sand, it was first sieved and consequently the feed miller would pay for the dagaa that was free of sand.

It was indicated that sieving dagaa before processing was the main measure taken in order to maintain dagaa quality. However there were other measures taken to maintain quality as well, such as sticking to one landing site supplier whose reputation was known and encouraging Fisheries Officers to do continuous evaluation of quality controls of suppliers at landing sites.
Unlike some feed millers that did not comply with the fisheries rules and regulation, most of them possessed trading licenses for which they paid US$90.91 per year. Feed factories also complied with the poultry breeder policy (breeder bio-security) on raw materials to ensure that proper quality feeds were produced under UNBS standards.

3.7. Supermarket trade of dagaa

In Uganda, interviews were conducted with 6 supermarket outlets belonging to Mega Standard, Shoprite, Standard, Capital Shoppers and Splendid Supermarkets. Dagaa was sold at relatively better prices in supermarkets, compared to the prices at which it was bought at landing sites (Table 34).

Table 34: Supermarket dagaa prices, 2016 (US$/kg)

Supermarket (code)	Sun-dried	Powder	Fried
SM1	4.59		9.02
SM2	3.51		
SM3	4.24		
SM4	5.52	7.58	
SM5	3.03		3.03
SM6	3.03	4.85	4.55

In supermarkets, dagaa was sold in quantities ranging from 200 grams to one kilogram. Prices ranged from US$ 0.91 for 200 gram packets to US$ 4.24 for a kilogram packet (Table 35) (Plate 9). The forms of dagaa packed were whole dried and deep fried fish and powder. Supermarket reported high demand for dagaa as the reason they continued to deal in it.

The challenges supermarkets faced in dagaa trade were as follows:

i) It was not easy to enforce quality control as the dagaa products were delivered already packed.
ii) Stated weights labeled on the packages often did not match the actual weights of the products.
iii) Some dagaa was not well dried when delivered to the supermarkets, soit got spoiled after sometime in storage.
iv) Some dagaa was highly affected by e-coli, shigella and ligula intestinali so supermarkets were faced with these contaminations, and potential poisoning of customers.

Table 35: Packets and prices of sun-dried, powder and fried dagaa in selected supermarkets

	Sundried		Powder		Fried	
Supermarket Code	Packets (gm)	Price (US$)	Packets (gm)	Price (US$)	Packets(gm)	Price (US$)
SM1	500	2.18				
	80	0.61				
	800	2.88				
	500	2.18				
	150	0.45				
					50	0.64
					120	0.64
SM2	1,000	2.70				
	500	1.64				
	100	0.45				
SM2	1,000	2.70				
	500	1.64				
	100	0.45				
SM3	500	2.12				
SM4	500	2.18				
			200	1.82		
	100	0.67				
			100	0.61		
SM5	500	1.52				
					500	1.52
SM6			250	1.21		
					100	0.45
	500	1.52				
	1,000	3.03				

The supermarket outlets surveyed and suppliers of dagaa products to supermarkets identified were as given in Table 36.

Table 36: Sampled supermarket outlets and dagaa suppliers to supermarkets identified, Uganda

SUPERMARKET OUTLETS	DAGAA SUPPLIERS
1. Mega Standard Supermarket	• Arrow Aquaculture Africa
2. Shoprite Supermarket (Clock Tower)	• CVIS Super Foods
3. Shoprite Supermarket (Lugogo)	• J and M Family
4. Standard Supermarket	• Melchizcedec
5. Capital Shoppers Supermarket	• Morgans Enterprises
6. Splendid Supermarket (Kireke)	• Mutima Food Processors
7. Bweyogere Supermarket	• Nabala Food Processors
	• Realm Foods
	• SOZO Uganda Limited
	• ZM General Traders

In Tanzania, deep-fried dagaa packed in sealed polythene bags of different weights were the main value added products. They were sold in local markets especially in supermarkets in Dar-es-Salaam and Mwanza, while a small quantity was sold outside the country by using foreign and domestic distributors.

3.8. Institutions for dagaa trade

The study identified a number of institutions concerned with dagaa trade. The roles of the institutions ranged from policy formulation and implementation, sensitisation, fisheries management, quality assurance and market regulation and levying customs duties on dagaa export (Table 37).

In Uganda, DiFR was the main institution for dagaa trade. It sets the recommended net mesh-size of 10mm although it was not commonly adopted by fishers of dagaa. Fish management laws were being drafted, stipulating that no fish including dagaa would be exported without being processed. Species management plans were also being drafted. The National Fisheries Policy was under review, in which dagaa regulations were also expected to change. Projects funded under the Icelandic International Development Agency (ICEIDA), Lake Victoria Environmental Management Project (LVEMP) 11 and SmartFish had made interventions at selected landing sites in order to improve post-harvest handling. These resulted into good quality dagaa that was ending up in supermarkets and export markets especially to Rwanda. However, DiFR recognized that animal feeds still used a larger proportion of dagaa compared to that for human consumption, and this is an issue they were working on.

Table 37: Institutions for dagaa trade and their roles in Uganda

INSTITUTUTION	ROLES
Local Government (Fisheries Officers)	• Training • Resource management • Inspection
Directorate of Fisheries Resources	• Policy • Resource management • Inspection • Intervention projects
Uganda Revenue Authority	• Customs duty
Uganda National Bureau of Standards	• Standards for processed and value added dagaa products

3.8.1. Policy framework on dagaa fishery in Tanzania

In Tanzania, the dagaa fishery of Lake Victoria was governed and regulated by the National Fisheries Policy (revised in 2015), Fisheries Regulations (amended in 2015) and Fisheries Laboratory (amendment) fees of 2015 which spelt out the fish trading standards and procedures of trading on dagaa and fish products in Lake Victoria, Tanzania. The national fisheries policy, 2015, among others, addressed issues of fish and fish product utilization, processing and marketing for improved food security and increased income of riparian community. The fisheries laws and standards on the other hand provided information on appropriate mesh size, improved technologies and trading practice at local and regional markets. The Fisheries (Laboratory) Fees Regulation of 2012 which was amended in 2015 repealed an export permit movement fees for dagaa and fish products traded at local and regional markets. Currently, the export royalty for dagaa export for example was increased from US$0.042 to $0.084 under amended Laboratory Fees Regulation of 2015.

3.9. Dagaa data capture mechanisms at the different levels

The study examined the status of data recording at the different levels. The main actors were the fisheries research institutes, namely NaFIRRI, KEMFRI and TAFIRI, which had the mandate for fisheries research and the bureaus of statistics, which were the Government institutions for statistics, among others.
In Uganda, The study revealed that institutions for data recording were in place, as given in Table 38 (Plate 10). However, there were challenges as follows:

- Dagaa trade was highly informal, so the standard business records were not being kept by the operators as would have been the case with formal businesses.
- Data recording systems by the different players were not harmonised or co-ordinated, limiting comparison of data.
- The data function was poorly staffed and funded in some of the institutions, hence poorly performed.
- There was lack of feedback given to the data collectors from higher authorities to whom they were submitted, which was a disincentive to collect quality data.
- Frequently, the data collected was not used for any planning and decision making.

Table 38: Main data recorders on the dagaa value chain, Uganda

DATA COLLECTORS	TYPES OF DAGAA DATA COLLECTED
BMs	• Number of dagaa boats and fishers • Catch data • Number of processors and processing units • Fish movement records
Traders	• Volumes and values of transactions • Records of buyers • Number of transport boats and vehicles • Origins and destinations of consignments
Market masters	• Marketing data
Fisheries Officers	• Monthly, quarterly and annual data summaries
DiFR	• Annual data summaries
NaFIRRI	• Fish stock assessments • Frame surveys • Catch assessment • Market research
Uganda Bureau of Statistics	• Fishing statistics • Processing statistics • Trade statistics
Uganda Revenue Authority	• Formal export records

3.9.1. Data capture systems in Tanzania

In Tanzania, the Fisheries Directorate operated a specialized laboratory for fish quality control and a unit for fisheries monitoring, control and surveillance (MCS). These institutions played different roles related to data and information capturing on dagaa fishery on Lake Victoria. The National Fisheries Quality Control Laboratory was responsible for establishing quality standards for dagaa fish products. The two units worked together at border posts and markets to verify fish and fish products exported to the regional countries.

They also issued export movement permits and health certification to exporters at the border points and markets. The Fisheries Directorate would supply information on dagaa for export and domestic destination. Tanzania Fisheries Research Institute (TAFIRI) in collaboration with Fisheries Division, on the other hand were mandated to capture information on dagaa catch, biomass and number of fishing crafts deployed in the lake. The information was captured through Catch Assessment Surveys, Hydro-acoustic Surveys and Frame Surveys. Besides, Tanzania Revenue Authority (TRA) in collaboration with fisheries officers handled verification and clearance of dagaa products at respective border posts and fish markets. The National Bureau of Statistics (NBS) also supplied information on population growth which was captured through national population census. This information was important in computation of per capita dagaa consumption country-wide.

04
CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions

Overview of dagaa sub-sector reveals that there has been a steady growth in production of dagaa on Lake Victoria but its value has remained low, compared to other commercial species. The volume of dagaa exported to Kenya, DRC, Rwanda, South Sudan and Burundi has been declining, due to increasing domestic demand for feed production. Utilisation of dagaa for human consumption is still below 30% of production with more dagaa going into feed production, despite the nutritional and food security requirements of eh riparian communities. High post-harvest losses characterise the dagaa sub-sector, consisting of physical and quality losses.

There is gender balance and the youth form the majority in dagaa production, processing and trading, offering livelihood opportunities to these vulnerable groups. Many of the operators in dagaa trade also belong to the middle age people, who are likely to have accumulated savings that can be invested in dagaa trade. The levels of education among operators are low, which hinder them from acquiring new knowledge and skills for quality control, value addition and business management. Membership of groups is high among operators, which enables them to purchase inputs collectively obtain training, save together and borrow from each other.

In production, fishers maximise their earnings by selling their dagaa fresh, processed or in both forms. The number of days fished per month does not vary significantly between low and high catch seasons, showing lack of alternative activities for the fishers. Net revenues of fishers vary from low to high catch seasons, due to the levels of production. There is a high risk of post-harvest losses during high catch seasons that fishers need to cope with by sealing leaking boats and early landing of catch. Dagaa fishing is constrained by bad weather and rains, low dagaa catches and insecurity on the lake.

Dagaa processing, largely done by drying on nets or on bare ground, still lacks equipment, improved technologies and value addition. Seasonal variations affect quantities, prices and net revenues of processors, leading to fluctuating incomes. Processors market their dagaa mostly at the beaches, which limits their earnings given the low beach prices, compared to elsewhere. Processors respond to the frequent post-harvest losses through rotting, dagaa swept away by rains or loss of colour through ineffective measures of spreading dagaa on clean nets, using raised drying racks and washing dagaa before drying. Most processors do not comply with the health and fish quality standards in place, limiting their ability to access high value markets for dagaa.

Dagaa is traded mostly by those who operate within their own countries, dealing mostly insun-dried products, with limited innovative practices. Great variations exist in quantiies, prices and net revenues of traders between low and high catch seasons, leading to fluctuatins in traders' incomes. The equipment used in dagaa trading are simple, including bicycles, motorcycles, trucks or weighing scales, showing limited investment in dagaa trading. Traders' constraint in storing dagaa well leads to post-harvest losses which affect their businesses. Traders' challenges are mainly in acquiring trading licences and price fluctuations at supply and demand sides.

There is a large demand for dagaa in production of poultry feeds, animal feeds, fish feeds, pharmaceuticals and food supplements. Industrial feed producers' have major challenges in dagaa supplied when not well dried; eaten by mites and insects in storage; contaminated with sand and dust and with Salmonella typhii, E.coli, and Shigella.

Supermarkets trade dagaa to high level consumers at high prices but have the challenges of poor quality of delivered dagaa, underweight packets and dagaa delivered not well dried that got spoiled in storage.

Institutions are in place to support dagaa trade through policy formulation, planning and implementation, sensitisation, fisheries management, quality assurance, market regulation and levying customs duties on dagaa export in some cases, they lack presence on the ground.

Data capture on dagaa trade is carried by different agents but the challenges are the informal nature of dagaa trade, lack of harmonisation among different data recording players and poor staffing and funding of data function within institutions.

4.2. Recommendations

In order to respond to the challenges identified under the study and promote human consumption and dagaa value through trade, the following recommendations have been made:

i) Governments should improve management of dagaa resource in accordance with the 10 mm fishing regulation for dagaa and provide security for fishers on the lake to improve production.
ii) Governments and civil society should sensitise and support formalisation of business entities among dagaa operators to improve compliance with standards and record keeping.
iii) Governments should consider reducing taxes on import of processing equipment and export of dagaa products and ease cross-border movement of goods and traders.
iv) Promotion of dagaa for human consumption at individual, household and public institution level should be carried out for improved nutrition and food security.
v) Operators along the dagaa value chain should be sensitized and trained on the best processing methods to reduce post-harvest losses and value-added products, which fetch high prices on both local and export markets.
vi) Dagaa operators, with support of Government, should provide suitable storage facilities for the products along the value chains to avoid leakage when it rains and to eliminate pests.
vii) Operators along value chain should adopt coping strategies to avert post-harvest losses through early landing, observing bad weather, proper handling of dagaa, improved processing methods and storage and quick selling of dagaa products..
viii) Dagaa trade networks should be developed to improve information and support among operators along the value chains.
ix) Institutions should increase their presence in supporting dagaa trade through training, market identification, supervision, inspection and improved technology (e.g. by encouraging universities to conduct research on appropriate technologies) through micro project schemes.
x) Data capture systems should be strengthened to improve information for palling in dagaa trade.

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APPENDIX 1

EXTRACTS FROM THE EAC STANDARDS FOR DAGAA PRODUCTS

Dried fish — Silver cyprinid (Rastrineobola argentea) — Specification

1 Scope

This Final Draft East African Standard specifies the requirements and methods of sampling and test for dried silver cyprinid (Rastrineobola argentea).

3 Terms and definitions

For the purposes of this standard, the following terms and definitions shall apply.

3.1 dried silver cyprinid

whole product presented as a dried fresh water fish which has not been gutted, beheaded or split and subsequently washed and dried

3.2 food grade material

packaging material, made of substances which are safe and suitable for their intended use and which will not impart any toxic substance or undesirable odour, colour or flavour to the product

3.3 sound

free from physiological deterioration or adulteration/contamination, that appreciably affects their appearance, edibility and the keeping quality of the dried fish

3.4 foreign matter

any material which is not of fish origin such as sand, stones, metallic chips, plant parts

4 Requirements

4.1 General requirements

4.1.1 Raw material

4.1.1.1 Dried silver cyprinid shall be prepared from fresh, sound Rastrineobola argentea which is of an acceptable quality and fit for human consumption.

4.1.1.2 Water used during fish processing shall be potable complying with EAS 12.

4.1.1.3 After washing, the fish shall be dried either in the sun or in artificial dryers until a satisfactory product is obtained.

4.1.1.4 The fish, while drying, shall be protected against contamination such as dirt, sand, birds, vermin and insects.

4.1.2 Finished product

Dried silver cyprinid shall:

a) have the characteristic silvery skin colour and dried fish odour;
b) be free from any indication of spoilage such as mouldiness, colour change; and
c) be free from foreign matter.

4.2 Specific requirements

4.2.1 Dried silver cyprinid shall comply with the specific requirements given in Table 1.

Table 1 – Specific requirements for dried silver cyprinid

S/N	Parameter	Requirement	Test method
i.	Moisture, %, max.	12	Annex A
ii.	Total ash, % max.	15	Annex B
iii.	Acid insoluble ash, % max.	0.5	ISO 5985

4.2.2 Dried silver cyprinid shall be presented not less than 90 % whole.

5 Food additives

Food additives may be used in the preparation of dried silver cyprinid in accordance with CODEX STAN 192.

6 Hygiene

6.1 The product shall be prepared and handled in accordance with EAS 39 and CAC/RCP 52 and shall comply with microbiological limits given in Table 2.

Table 2 — Microbiological limits for Rastrineobola argentea

S/No.	Type of microorganism	Maximum limit	Method of test
1	Salmonella in 25 g	Absent	ISO 6579
2	Escherichia coli, MPN/g	Absent	ISO 7251
3	Staphylococcus aureus, CFU/g	2 × 103	ISO 6888
4	Total viable count, CFU/g	105	ISO 4833-1
5	Clostridium perfrigens, CFU/g	Absent	ISO 7937
6	Yeast and moulds, CFU/g	103	ISO 21527-1
7	Vibrio spp.	Absent	ISO/TS 21872

6.2 The product shall be free from any parasites.

7 Contaminants

7.1 Heavy metals

Dried silver cyprinid shall comply with the heavy metal limits given in Table 3.

Table 3 — Heavy metal limits for Rastrineobola argentea

S/No.	Heavy metal	Maximum limit, mg/kg	Test method
(i)	Arsenic	0.1	AOAC 952.13
(ii)	Lead	0.3	AOAC 972.23
(iii)	Cadmium	0.3	AOAC 973.34
(iv)	Methyl mercury	0.5	AOAC 983.20

7.2 Aflatoxins

When tested in accordance with ISO 16050, the level of total aflatoxin in dried silver cyprinid shall not exceed 10 µg/kg.

7.3 Pesticide residues

Dried silver cyprinid shall comply with those maximum pesticides residue limits established by the Codex Alimentarius Commission for similar commodities.

8 Weights and measures

The fill and the weight of the product shall comply with Weights and Measures regulations of the importing Partner State.

9 Packaging

Dried silver cyprinid (Rastrineobola argentea) shall be packaged in food grade containers which will safeguard the hygienic, nutritional, and organoleptic qualities of the product.

10 Labelling

10.1 In addition to the requirements in EAS 38, the following specific labelling requirements shall apply and shall be legibly and indelibly marked:

a) name of the product as "Dried silver cyprinid" and/or local name (Omena/Dagaa/ Mukene/Indagala and Isambaza);
b) name and physical address of processor/packer;
c) net weight in grams or kilograms;
d) date of packaging;
e) batch number;
f) expiry date;
g) storage conditions; and
h) country of origin.

10.2 Nutritional labelling, nutrition and health claims may be made in accordance with EAS 803 and EAS 805.

11 Sampling Sampling shall be done in accordance with CAC/GL 50-2004.

APPENDIX 2

Photo gallery

Plate 1: Dagaa production from net preparation, to arrival, and disposal of catch using the recommended containers for carriage.

Plate 2: Transition of dagaa processing methods from bare grounds, to old net materials exposed to contaminants, to advanced recommended raised racks, sievers and solar dryers as a way of increasing economic returns

Plate 3: Smoking as improved technology for processing dagaa in Tanzania

Plate 4: Post harvest losses of dagaa due to rotting, contaminants from bare ground, birds, animals, poor storage on bare floor and packaging of sacks by stepping on.

Plate 5: Types of stores and improvised storage facilities used for dagaa along the value chains

Plate 6: Different forms of transportation in use for dagaa along the value chains

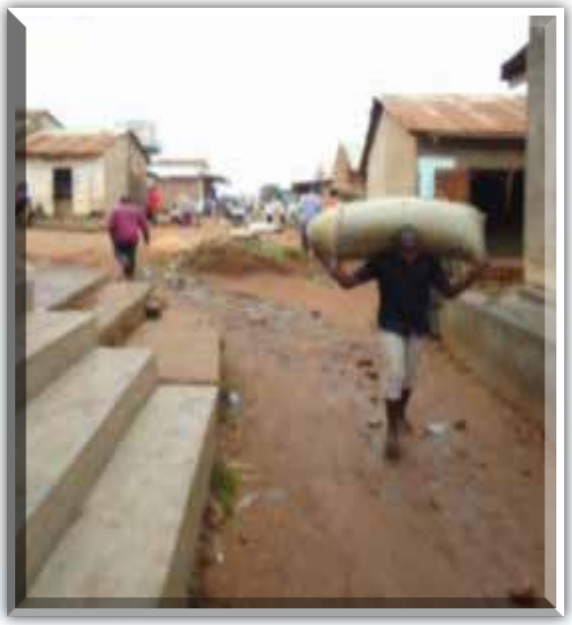
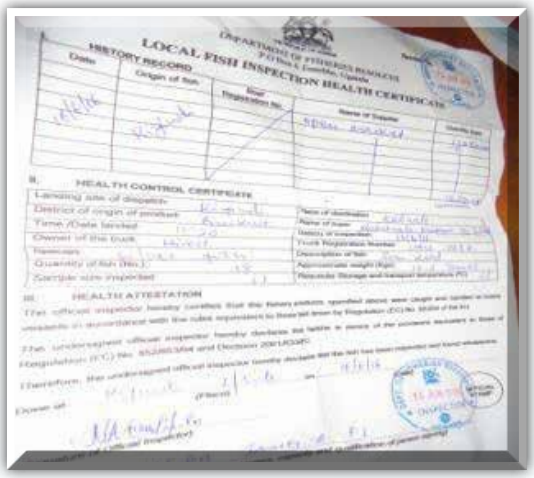


Plate 7: Different levels of trading along the value chain at various points from beach markets to export points.

Plate 8: Regulations and documentations to comply with in order to trade in dagaa both within and outside the country and the challenge of storing the documents.



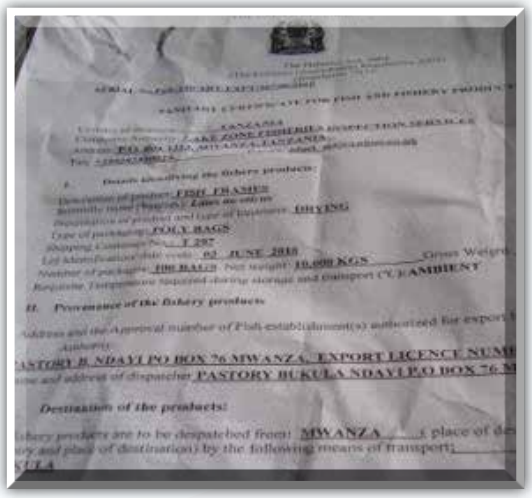


Plate 9: Supermarket value added products of dagaa and proper packaging to increase consumer acceptability and price.

Plate 10: The challenge of dagaa data capture and record keeping at beaches

APPENDIX 3

Questionnaire for Fishers, Processors and Traders of Dagaa

Date: _____

Name of interviewer _____
District _____
Sub-county _____
Landing site _____
GPS position _____
Name of respondent _____
Mob. No. _____

A. Social characteristics

1. Gender [1] Male [2] Female
2. Age: _____
3. Educational level [1] Incomplete Primary [2] complete Primary
[3] Incomplete Secondary "O" Level [4] Complete Secondary "O" Level
[5] Incomplete Secondary "A" Level [6] Complete Secondary "A" Level [7] Tertiary
[8] University
4. Are you a member of a group? [1] Yes [2] No
5. Type of group:
[1]Fishers' group [2] Dagaa processors' group [3] Women's group
[4] SACCO [5] Other (specify) _____
6. What main category of dagaa operator are you?
[1] Fisher (go to Section A)
[2] Processor (go to Section B)
[3] Trader (go to Section C)
[4] Supermarket (go to Section C)
[5] Industrial feed processor (go to Section C)
[6] Other (specify) _____

B. Production (for dagaa fishers)

7. On average, how much fresh dagaa do you land on a fishing trip (kg, basin, jerry can)	Low catch period _____ High catch period _____
8. How many fishing trips do you carry out in a month?	Low season _____ High season _____
9. Do you sell your dagaa fresh or do you process it before selling?	[1] Fresh [2] Dried (go to Qu 12)

10. If you sell fresh, what is the current price at which you sell (US$/ kg, basin, jerry can)	Low catch period _____ High catch period _____
11. Where do you sell your catch?	[1] At the beach [2] Away from beach but within the country [3] In another country
12. To whom do you mostly sell your catch?	[1] Processor/Trader [2] Trader who does not process [3] Industrial feed millers [4] Poultry, piggery or fish farmer [5] Other (specify) _____
13. What is the major type of post harvest loss that affects your dagaa catch?	[1] Rotting [2] Sand contamination [3] Swept by rain [4] Predators [5] Others (specify) _____ [6] None
14. What amount of fish did you lose the last time you experienced post harvest losses? (volume) (range)	
15. How frequently do you experience post harvest losses?	[1] Every week [2] Every two weeks [3] Every month [4] Every three months [5] Others (specify) _____
16. What price did you sell the part of catch affected by post harvest loss? (US$/kg, basin, bag)	Low catch period _____ High catch period _____
17. Was the loss experienced during high or low catch period?	[1] High catch period [2] Low catch period
18. What measures do you take to maintain the quality of you dagaa catch?	[1] Early landing [2] Boat doesn't leak [3] Proper catch handling [4] Other (specify) _____
19. What are the main challenges you experience in fish ing dagaa?	
20. What can be done to improve dagaa production?	_____ _____

C. Processing (for dagaa processors)

21. What category of dagaa processor are you?	[1] Fisher/processor [2] Processor only [3] Processor/ trader [4] Other (specify) _____
22. What method of dagaa processing do you carry out most?	[1] Salting before drying [2] Drying on net [3] Drying on raised racks [4] Frying [5] Other specify) _____
23. How many days do you take to do one round of processing?	Favourable weather _____ Unfavourable weather _____
24. How many rounds of processing do you carry out in a week?	Low catch period _____ High catch period _____
25. On average, what quantity of wet dagaa is processed in one round?	Low catch period _____ High catch period _____
26. If you buy wet dagaa for processing, what price do you pay? (US$/kg, basin, bag)+	Low catch period _____ High catch period _____
27. At what price do you sell the processed dagaa (US$/kg, basin, bag, tin)	Low catch period _____ High catch period _____
28. Which improved dagaa processing method/s are you informed about?	[1] Salting before drying [2] Drying on net [3] Drying on raised racks [4] Other specify) _____ [5] None
29. Do you produce value addition products from the dagaa?	[1] Yes [2] No
30. If Yes, mention them	

31. Give information on the capital equipment you use (Capital costs)

Item	Quantity	Year & month of purchase	Expected life-time (years)	Cost (US$)	Source of capital [1] Government [2] Own savings [3]Private sector [4] Other (specify
Raised racks					
Frying pans					
Basins/ buckets					
Solar dryer					

32. Give information on your operating expenses (Operational costs)

Item	Quantity	Cost for last processing (US$)	Cost per month
Raw dagaa purchased)			
Labour			
Salt			
Cooking oil			
Firewood			
Storage			
Transport			

33. How much do you pay in storage per round of processing? (US$)	
34. How much do you pay in other expenses per round of processing? (US$) (specify)	
35. Where do you sell your processed dagaa?	[1] At the beach [2] Away from beach but within the country [3] In another country (specify) _____ [4] Other (specify) _____
36. To whom do you mostly sell your processed dagaa?	[1] Trader who sells within the country [2] Trader who sells outside the country [3] Supermarket [4] Restaurant [5] Industrial feed millers [6] Poultry, piggery or fish farmer [7] Consumer [8] Other (specify) _____

37. What is the major type of post harvest losses affects your processed dagaa?	[1] Rotting [2] Sand contamination [3] Swept by rain [4] Predators [5] Loss of colour [6] Getting broken in transportation [7] Others (specify) _____
38. What amount of dagaa did you lose to the above the last time you experienced post harvest losses? (kg, basin))	
39. How frequently do you experience post harvest losses?	[1] Every week [2] Every two weeks [3] Every month [4] Every three months [5] Others (specify) _____
40. What price did you sell the part of processed dagaa affected by post harvest losses? (US$/kg, basin, bag)	Low season _____ High season _____
41. To whom do you sell the part of processed dagaa affected by post harvest losses?	[1] Trader who sells within the country [2] Trader who sells outside the country [3] Industrial feed millers [4] Poultry, piggery or fish farmer [5] Other (specify) _____
42. What measures do you take to maintain the quality of dagaa you process?	
43. What regulations do you have to comply with in dagaa processing?	
44. What are the main challenges you experience in dagaa processing?	
45. What can be done to improve dagaa processing	_____ _____ _____

D. Trading (for dagaa traders who are not involved in processing)

46. What category of dagaa trader are you?	[1] Fisher/ processor/ trader [2] Processor/ trader [3] Trader who sells within the country [4] Trader who sells outside the country [5] Supermarket [6] Industrial feed miller [7] Other (specify) _____
47. What processed dagaa product do you trade in most?	[1] Sun-dried [2] Salted and sun-dried [3] Fried [4] Smoked [5] Other (specify) _____
48. How many days do you take to do one round of trading?	Low catch period _____ High catch period _____
49. How many rounds of trading do you carry out in a month?	Low catch period _____ High catch period _____
50. On average, what quantity of processed dagaa do you handle in one round?	Low catch period _____ High catch period _____
51. If you buy the processed dagaa for trading, what price do you pay? (US$/kg, basin, bag)	Low catch period _____ High catch period _____
52. At what price do you sell the processed dagaa (US$/kg, basin ...)	Low catch period _____ High catch period _____
53. Do you trade in value added products from dagaa?	[1] Yes [2] No
54. If Yes, mention them	
55. To whom do you trade value added products from dagaa?	[1] Supermarket [2] Local market [3] Distributors who sells outside country [4] Other (specify) _____

56. What regulations do you have to comply with in your dagaa trading?	

1. Give information on the capital equipment you use (Capital costs)

Item	Quantity	Year & month of purchase	Expected lifetime (years)	Cost (US$)	Source of capital [1] Government [2] Own savings [3]Private sector [4] Other (specify
Bycicle					
Motorcycle					
Weighing scale					

2. Give information on your operating expenses (Operational costs)

Item	Quantity purchased	Cost for last transaction (US$)	Cost per month (US$)
Sun-dried dagaa			
Salted & sun-dried			
Fried dagaa			
Smoked dagaa			
Labour			
Transport			
Storage			

57. Where do you mostly sell your processed fish?	[1] At the beach [2] Away from beach but within country [3] In another country [4] Other (specify) _____
58. To whom do you mostly sell your processed fish?	[1] Consumers [2] Trader within country [3] Trader selling outside country (specify) [4] Industrial feed millers [5] Supermarket [6] Poultry, piggery or fish farmer [7] Other (specify) _____
59. What is the major type of post harvest loss that affects your dagaa marketing	[1] Rotting [2] Sand contamination [3] Swept away by rain [4] Predators [5] Loss in colour [6] Broken during transportation [7] Others (specify) _____

60. What amount of fish did you lose the last time you experienced post harvest losses? (quantity)	
61. How frequently do you experience post harvest losses?	[1] Every week [2] Every two weeks [3] Every month [4] Every three months [5] Others (specify) _____
62. What price do you sell the part of processed dagaa affected by post harvest losses? (US$/kg, basin, bag)	
63. What measures do you take to maintain quality of your dagaa traded?	
64.What are the main challenges you experience in dagaa trading?	
65. What can be done to improve dagaa trading?	_____ _____ _____ _____
66. What can be done to improve human consumption of dagaa?	_____ _____ _____

Thank you for your time and information

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