Value Chain of the Artisanal Oyster Harvesting Fishery of The Gambia

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Gambia-Senegal Sustainable Fisheries Program

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Abbreviations and Acronyms

AFDP	Artisanal Fisheries Development Project
BADEA	Arab Bank for Economic Development
CCLME	Canary Current Large Marine Ecosystem
CFC	Community Fisheries Centers
CMC	Central Management Committee
HACCP	Hazard Analysis and Critical Control Point
TOWA	The Oyster Women's Association

1.0 Introduction

The Government of The Gambia accords high priority to the development of the artisanal fisheries sub-sector because of its important role in providing much needed protein and employment opportunities, and to help reduce poverty, malnutrition and rural-urban migration.

The policy objectives of the fisheries sector are linked to key national development objectives as outlined in the Poverty Reduction Strategy Paper and the Gambia Incorporated Vision 2020, which are blueprints for eradication of poverty and the attainment of national social and economic development. National development objectives include increased food self-sufficiency and security; a healthy and productive population; enhanced employment opportunities for nationals; increased revenue generation and foreign exchange earnings; the attainment of national social and economic development; and the integration of women in the development process as equal beneficiaries and partners. The organization of fisherfolk communities into strong and viable interest groups and their active involvement and participation in all stages of the development process as equal partners and beneficiaries is key to the attainment of the sectoral policy objectives.

Oyster harvesting is an important source of income for poor families around the Tanbi wetlands and important food source in The Gambia. The purpose of this value chain assessment is to gain a better understanding of the artisanal oyster harvesting fishery and to identify opportunities to improve cooperation and effectiveness across sub-sector participants in order to increase wealth and equity. The value chain approach helps to enhance the competitiveness of sectors, identify and understand both the major opportunities for upgrading and the driving constraints to market growth, and to generate recommendations for priority actions that can result in increased benefits for oyster fishery sector participants.

2.0 The Oyster Value Chain Assessment Study

The objectives of the oyster value chain study are to:

- Assess the value of oysters as well as income generated at each level of the value chain
- Identify priority actions with the greatest potential to provide value-added benefits at each level of the value chain, including oyster collection and equipment, landing and handling, financial markets/credit, wholesale and retail sale, processing, and marketing
- Characterize the business enabling environment (national policies and regulations, organization of oyster collectors, public infrastructure, conflicts), competitiveness, and product quality
- Provide a good understanding of gendered roles in the value chain, including harvest, processing, marketing and sales
- Identify opportunities for new local markets at wholesale and retail levels and potential for export markets

The study focused on nine oyster harvesting communities in the Tanbi wetlands complex, a designated wetlands and Ramsar protected site in The Gambia. Interview questionnaires were drawn up (Appendix

1) and administered with respondents from nine selected oyster landing and processing sites. The approach used participatory rapid appraisal tools and methods such as focus group and key informant discussions and the administering of formal interview questionnaire to collect data and capture important information. Relevant research organizations, and industry groups and organizations were also consulted and discussions held with them. Finally, oyster buyers and consumers such as restaurant operators, food vendors, individual buyers and housewives were also interviewed and data collected on their purchase and use of oyster products.

Table 1:The nine Tanbi Wetlands oyster harvesting communities involved in the value chain assessment study

Oyster harvesting community sample sites	
1. Abuko	6. Kartong
2. Ibo Town	7. Kubuneh
3. Faji Kunda	8. Lamin
4. Jeswang	9. Mandinary
5. Kamalo	

The analysis took into account and built on other relevant studies and the work of other fisheries programs and projects and their activities, such as the USAID Wula Nafaa program in Senegal and its oyster component, and the USAID Ba Nafaa project activities in The Gambia, which also support the oyster industry.

Fig. 1: Interview and focus group discussions with oyster harvesters in Kartong (left) and Kubuneh (right)sites.

Six oyster harvesters were interviewed at each of the 9 sites. Six lime producers were also interviewed. The study initially was only focused on oysters, but aspects of cockle harvesting were later incorporated into the study because it is a main alternate activity of oyster harvesters.

Fig. 2: Focus group discussion session with oyster harvesters in the Kubuneh landing and processing site

Fig. 3: Interview with key informant producer of white lime from oyster shells on production site in Kubuneh

At the start of the study, the oyster harvesting season was still closed to allow oysters to grow to a more mature (bigger) size. This caused a delay as oyster harvesters during this time are not at the landing and processing sites and as a consequence are difficult to locate. However, the study continued into the re-opened harvesting season in March 2010.

3.0 Overview of the Oyster Fishery in The Gambia

The oyster fishery is an important and unique sub-industry of the artisanal fisheries industry and oysters are of significant economic importance in The Gambia. It provides employment and income, food and revenue. While men dominate fishing in general, the harvest and collection of oysters is dominated by women who carry out all the different operations of harvesting, processing and marketing. Many of the women are first and second generation migrants from Guinea Bissau and the Casamance, Senegal (Theisen, 2010). Occasionally men assist in the harvest in partnership with closely related women (usually their spouses and relatives), but processing and sales is entirely women.

Oyster harvesters exploit oysters for commercial purposes. The oyster meat when extracted from the shell is sold out to consumers and fetches income for the producers. The meat has a high protein content and is an important source of dietary protein. Oysters are harvested seasonally, normally in the dry season, from March to June when mature oysters are removed from the wild, processed and marketed. Oysters are found in the wild attached to mangrove growths (roots and branches) in the estuarine areas, on both banks of the River Gambia and its tributaries in many localized areas (mainly in inter-tidal zones).

The River Gambia which takes its source from the Futa Djallon Highlands in Guinea flows through east Senegal and down the entire length of The Gambia to empty into the Atlantic Ocean. As it approaches the Atlantic Ocean, the river slows down and forms a number of tributaries. The mixing of sea and fresh water inflows from the river results in the characteristic brackish waters of the Gambia River estuary that provides the right environmental factors for the growth and development of mangroves and oysters, and extends from the mouth of the River in coastal areas to about 160 kilometres inland, shifting above and below this limit depending on tidal and seasonal variations in water inflows (Figure 4).

The River Gambia runs centrally along the entire length of the country and hosts a diversity of fish species in the estuarine and freshwater regimes with shrimp and shellfish also in the estuary where mangroves fringe the river and provide ideal habitat for a diversity of aquatic organisms, particularly oysters that attach to mangrove root substrate. The river ecology provides important breeding and feeding grounds for fishery resources with potential for aquaculture development. According to a poverty profiling study of artisanal fisheries communities, fishing and fishing related activities including oyster harvesters, constitute the second most important livelihood activity after farming, in communities along the banks of the River Gambia (Njie et al, 2003/4).

The shell fish fishery is classified under artisanal fisheries. It is characterized by oyster harvesting and cockles gathering with landing and processing sites also dotted along the river estuary, along tributaries (“Bolong”) of the river and lagoons and in wetland areas.

Data on oyster and other shellfish production, which are significant sources of livelihoods, are generally unavailable because it has not been part of the countrywide Frame survey design and data collection effort of the fisheries sector. Limited surveys have been conducted on the oyster and other shellfish fishery including on the oyster communities and their activities.

In the Tanbi Wetlands Complex, which is the main focus of this value chain assessment study, it was estimated that there are about 507 harvesters, predominantly women, who are involved in this laborious but valuable occupation for their living and that hundreds more could be involved in related activities including production of white lime from oyster shells.

Despite the important contributions of oyster harvesting to the social and economic conditions of coastal communities, fisheries development policy and planning have given little attention to the oyster fishery. There are no formal fisheries management and conservation measures specific to the oyster fishery. The Wildlife conservation and management Act, however, provides for conservation measures on the mangroves and other aquatic organisms of the coastal zone and the Fisheries Act 2007 allows for fisheries resource co-management.

With the fisheries policy objectives of increased food security and livelihoods' improvement for the rural population, one strategy involves the promotion of aquaculture (commercial and small-scale, including oyster culture) development. The expected outcomes under this strategy include increased generation of foreign exchange earnings from export of aquaculture products, sustainable oyster production (throught the rack-culture system), reduced destruction of mangroves, and increased local supply of oysters to meet demands both in the domestic and international market.

The development of oyster culture in The Gambia became a stated priority for Government from the 1980's. The Department of Fisheries conducted research studies on the culture of the mangrove oyster of West Africa *Ostrea* (*Crassostrea*) *tulipa* through a research project funded by Canadian International Development and Research Cooperation (IDRC). Results of the studies including monitored culture trials identified great commercial potentials for the products but the market was not adequately identified. The rack system of culture employed by the research project was indicated to prove a more efficient method for the exploitation of oysters and is a more sustainable alternative than existing harvest methods which are destructive to the mangrove ecology. Policy makers want to encourage less destructive methods, increase oyster production as well as improve access to credit facilities for low income producers.

Currently, an EU funded coastal management project and the USAID funded Gambia-Senegal Sustainable Fisheries Project (Ba Nafaa) are supporting oyster culture (rack system) in the Tanbi wetlands.

Fig. 4: The Gambia marine and estuarine ecosystems (courtesy of Department of Fisheries, 2006)

Mangrove oysters (*Crassustrea spp.)* are found in the brackish water areas and are important source of livelihoods for oyster harvesting communities. Apparently, only one species of oyster (*Crassustrea tulipa)* is found in The Gambia. Juvenile oysters or oyster spats from spawned oysters swim in the water and get attached to mangrove prop roots from where they feed as the tides rise and fall. Here they grow in competition with each other and other organisms to mature into adults that spawn to repeat the lifecycle, thereby continuing to provide valuable source of livelihoods to the specialized groups of mainly women harvesters in estuarine areas. These harvesters extract the mangrove oysters that are processed and marketed for income and food. The highly protein-rich oyster meat also provides a healthy source of protein supplement for families of oyster harvesters as for all consumers.

Fig. 5: Oysters growing in the intertidal zone on the mangrove prop roots system

3.1 Oyster Harvesting Practices

In the Tanbi Wetland Complex, oyster harvesting is seasonal, taking place during the dry season usually from November/December to June. In recent time, however, the closed season has been extended to March to allow for increased size of oysters. The season closes when the rainy season starts and this period can be a difficult time for many oyster dependent communities, who must engage in alternate livelihood activities for survival with their families. The closed season only applies to the Tanbi region. Other regions of the Gambia watershed do not have a closed season. Oyster harvesting techniques are traditionally the same and involves one, two or three women walking down (if the harvest site is close by), or paddling in non-motorized dug-out canoes to the harvest sites with their harvesting tools (cutlass, axe, protective wear, baskets and bags) to harvest the oysters and return to processes them.

Fig. 6: Oyster harvesters in oyster canoes en route to oyster harvesting on mangrove fringes

The harvest grounds used to be within close range during the 1950s to the 1970s. However, increased entry and harvesting intensity has compelled harvesters to now travel longer distance by canoe in search of less exploited oyster sites. The use of destructive harvesting techniques is a contributing factor to the rate of depletion of nearby oyster stocks.

Fig. 7: Over-exploited mangrove oyster harvesting site

3.2 Background to the Study Site – the Tanbi Wetlands Complex

The value chain assessment was focused on the artisanal oyster harvesting communities of the oyster industry of the Tanbi Wetlands Complex which is located on the South Bank of the River Gambia, in the vicinity of the capital of Banjul, and spreading southwards. The Tanbi wetlands complex was declared a Ramsar site in February, 2007 meaning that it is a protected area by the international convention for the preservation of wetlands and its natural resources. The geographic coordinates of Tanbi are: 13°26'N and 16°38'W. It covers a total area of about 6,300 hectares of which 4,800 hectares (76%) are covered by mangroves. There are small patches of saline mudflats between the mangroves and rice-fields, which border part of the site to the south and west. In the north, the main highway linking Banjul to the mainland roughly follows, for some 10 km, the boundary between the mangrove and the shifting sand beaches and tidal lagoons of the Atlantic coast. In the extreme northwest there is a small area of freshwater marsh around Cape Creek.

The widest expanse of the Tanbi is located a few kilometres to the southeast of Banjul. The northern most point skirts the Bund Road in the southwest periphery of the city of Banjul, created to stabilize the land around Banjul. Here, there are several shallow lagoons whose tidal ranges are controlled from a water pumping station on the Bund Road. There are large expanses of mudflats on the river immediately south of these lagoons and at the Mandinari flats, 5 km upriver. It also includes the Cape Creek in the Cape point in Bakau and encompasses the fringes of the island of St. Mary at its Atlantic Ocean side and down southeast to Lamin and Mandinari.

The species of mangroves in the wetlands area include the *Avicennia africana, Alder Conocarpus, Laguncularia racemosa, Annona glabra* and the *Rhizophora*. The dominant mangrove species are the *Avicennia* mangrove shrub and the taller *Rhizophora* mangrove typically located near tidal creeks (or bolongs). Baobab trees and palm trees can be found in the Tanbi wetlands on more solid ground. The vegetation gradually changes to bare flats, salt marsh, and dry woodland or grass woodland to the west and south, with agricultural uses in the bordering zones. The Tanbi wetlands complex plays a key role in water retention and shoreline stabilization as it acts like a giant natural sponge for rainwater and tidal river flows.

A wide variety of animals inhabit the area, including small monkeys, crocodiles, lizards, and at least 360 bird species (including grey-headed gulls, malachite kingfishers, pigmy sunbird, red-necked falcon, pelicans and storks). Threatened or endangered animal species in the Tanbi include the West African manatee, Pel's fishing owl, the African clawless otter, brown-necked parrot and the Western Red Colobus.

The main activities in and around the Tanbi wetlands complex are shrimp fishing, vegetable gardening, rice growing and oyster harvesting. Oyster harvesting is a predominant trade practiced mainly by women during the dry season. Oysters are found attached to the mangrove prop roots which serve as substrate for young oysters (spats) to grow to maturity. Firewood is also collected from the area and used for the cooking and roasting of oysters as well as to cook household meals.

There is fast growing population in the area with several hundred thousand people living within 5 km of this wetland. Several hotels are located on the Atlantic coast and industrial development and sand mining take place with rice cultivation and vegetable gardening encroaching into the freshwater marsh. Shrimp fishing and oyster gathering are intensive in some areas. There is uncontrolled dumping around the edge of the wetland. The mangrove is vulnerable to large scale land reclamation due to the surrounding population density, urban development and commercial demand for land.

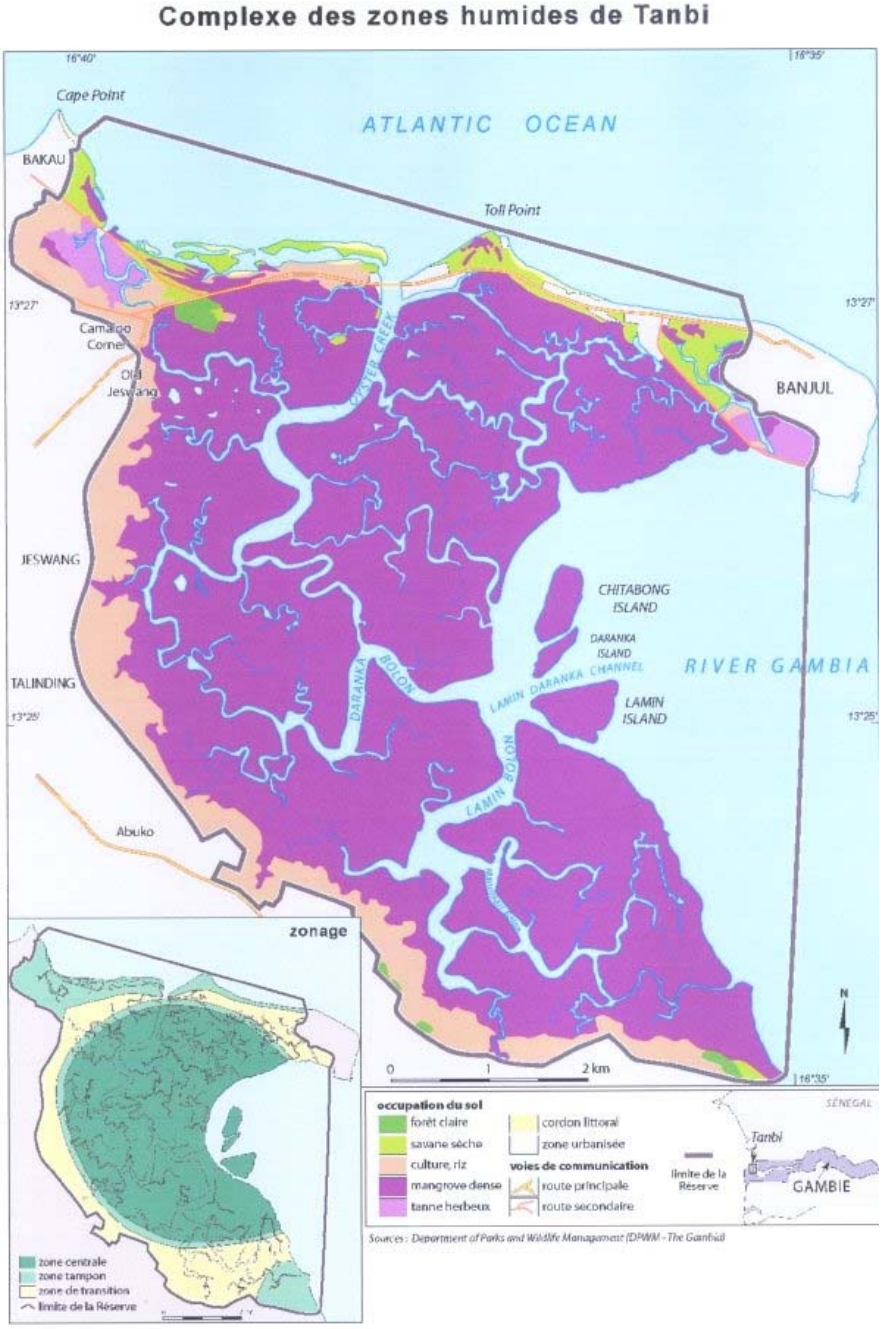

Fig. 8: The Tanbi Wetland Complex (Source.: http://www.ramsar.org/pictures/gambia-tanbi-map.jpg)

Some fifteen communities make up the majority of oyster and cockles harvesters concentrated in the Tanbi Wetlands. In recent years, with the support of sympathizers, the harvesters are now organized into a registered producer association called The Oyster Women's Association (TOWA), previously know as the TRY Association, which is an affiliation of various local community groups and individual oyster harvesters. TRY members have defined the issues that need to be addressed in the oyster industry. These include improved processing, quality and hygiene, as well as alternative livelihoods for members during the closed season for oyster harvesting. TRY and the women harvesters are preparing an oyster management plan that includes limiting access by establishing territorial use rights. The USAID funded Gambia-Senegal Sustainable Fisheries Project (Ba Nafaa) is providing support to the TOWA Association and oyster harvesting fishery in resource management planning, oyster culture, processing and sales, and capacity development..

Seasonal closure of oyster harvesting during the rainy season was initially linked to the traditional belief that eating oysters during this season is harmful (even though most oysters are heat treated by cooking before consumption). However, it is now becoming obvious to harvesters that seasonal closure of the fishery results in bigger size oysters and replenishes populations. TOWA Association members recently agreed for the first time to delay the 2009/2010 harvesting season until March 2010 (instead of December 2009), to allow for even greater growth of the oysters, protect wild mature oysters as a source of spat and to protect the mangrove from damage during the harvest of the wild stock.

4.0 Mapping the Oyster Value Chain Actors and Functions

The oyster value chain described below comprises harvesting, processing, markets, and sales. Appendix 2 describes in detail the generalized chain of activities in oyster harvesting, processing and marketing. The full value chain that is described in detail in this section is shown in Figure 9 below.

4.1 Oyster Harvesters

Harvesters collect the oysters from the mangroves and transport them to landing sites for processing. They are predominantly middle aged to older women. The average age of harvesters in the study sites is 40 years. Recently, younger women are becoming involved, such as in Old Jeswang and Kamalo. This increasing trend of involvement of younger people is explained as due to financial benefits derived from the industry.

In general, oyster harvesters are also those who process and sell the oysters. Hence, oyster harvesters are the same and sole actors along the oyster production chain. They operate in teams of between two and five members but generally in teams of three people.

Few groups of harvesters have canoes of their own. Therefore, most oyster harvesters hire canoes and take turns to go oyster harvesting with the hired canoes or use canoes collectively bought by TOWA Association members or donated by philanthropic people or organizations.

Table 2: Number of Oyster harvesting operators at selected sites

Oyster harvesting site	**Number of oyster harvesting operators**
Kamalo	45
Jeswang	50
Fajikunda	45
Kartong	76
Ibo Town	40
Kubuneh Bafuloto, Galoya and Kembujeh	45
Bund Road	28
Abuko	53
Lamin	78
Mandinary, Kerewan and Daranka	32
Kuloro and Mandinaba	15
TOTAL	507

Table 3: Number of canoes available to oyster harvesters in selected oyster landing and processing sites.

Site	**Number of canoes**
Kamalo	3
Kamalo	7
Fajikunda	5
Kartong	0
Ibo Town	2
Kubuneh, Bafuloto, Galoya and Kembujeh	9
TOTAL	26

Table 4: Social and demographic information on oyster harvesters

Oyster harvesting Site	Gender	Average Ages	Marital status	Number in household	Dependants	Ethnic Gruop	Nationality	Education	Reesidence
Abuko	F	40.2	Married	5	2.7	Jola	Gambian	None	Permnt
Bond Road	F	40.2	MWD	3	0	Jola	Gambian	None	Permnt
Faji Kunda	F	40.5	Married	4	1	Jola	Gambian	None	Permnt
Jeswang	F	42.5	Married	5	2	Jola	Gambian	None	Permnt
Kamalo	F	41.5	Married	7	4	Jola	Gambian	None	Permnt
Kartong	F	46.8	Married	6	3	Jola	Gambian	None	Permnt
Kumuneh	F	35.4	Married	10	0	Jola	Gambian	Grade 6	Permnt
Lamin	F	42.3	Married	4	2	Mandinka	Gambian	None	Permnt
Mandinary	F	31	Married	8	0	Others	Gambian	Grade 6	Permnt
Overall Avrge.	F	40	Married	6	2	Jola	Gambian		Permnt

An earlier study (Ngaido, 1990) of the oyster and cockle harvesting fishery in the Gambia found a higher percentage of male harvesters (19%). At that time, it may have been more lucrative and interesting for men, or perhaps the difference can be partially explained by the difference in study sites. A more recent study confirms that oyster and cockle harvesting in the Gambia is dominated by women (Cham and Touray, 2008). Also consistent with the findings of this VCA, the same study finds that the majority of oyster harvesters are illiterate.

Other groups of actors also depend directly or indirectly on oyster harvesting and processing. These include users of oyster shells for the production of white lime. The oyster shells and other shells (cockles, whelks, etc.) are burned to produce white lime, which is sold for use in construction. It also includes canoe owners who hire out their canoes to oyster harvesters, and sellers of firewood for cooking the oysters.

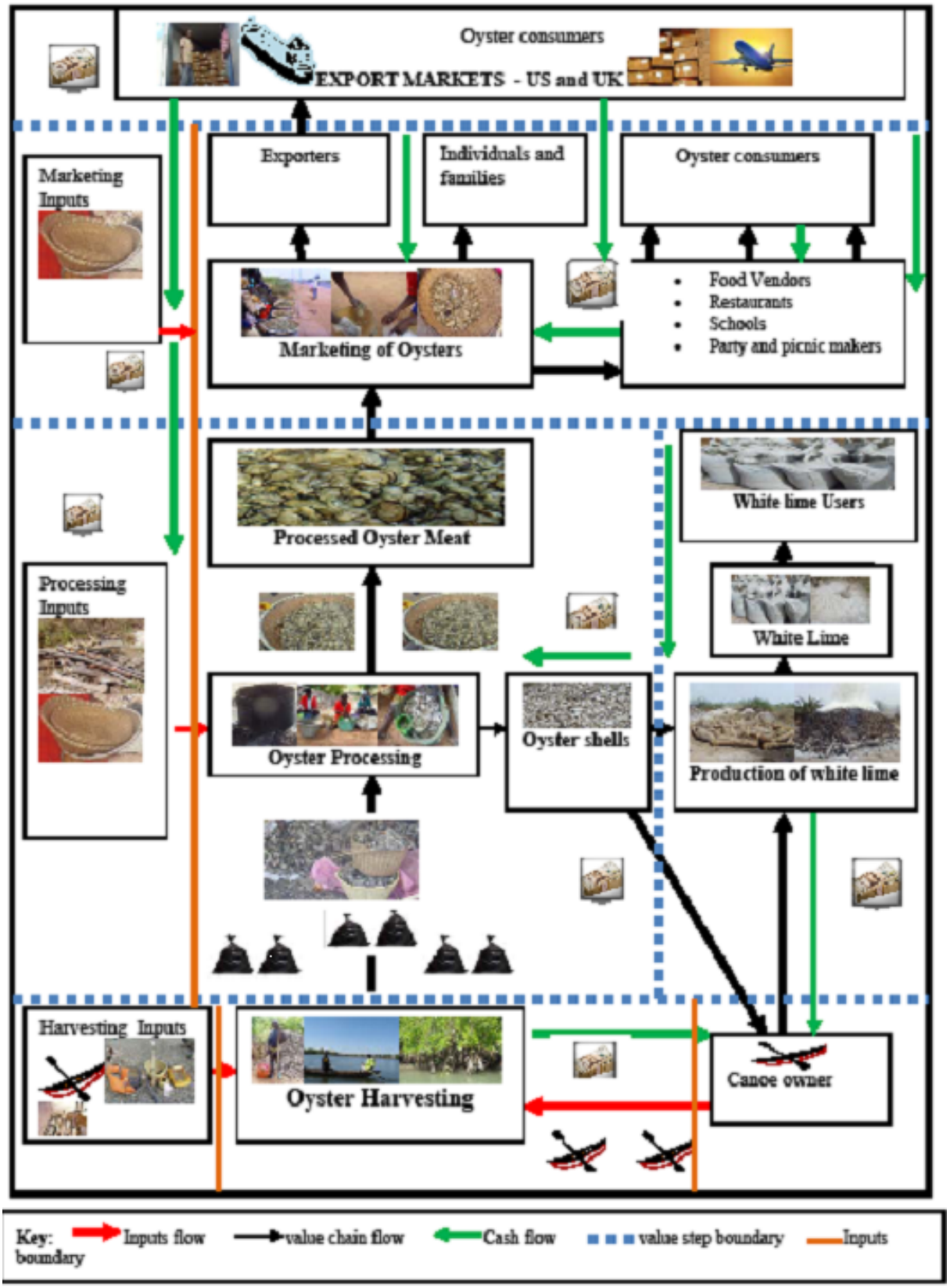

Fig. 9: The oyster industry value chain map

The total population of people involved in oyster harvesting and related activities is not well known because little or no special attention has been given to the industry in terms of research studies compared to finfish fishing. However, it was estimated during the study that there are about 507 harvesters it is known that many people, predominantly women, are involved in this laborious but valuable occupation for their living.

Statistical data relating to quantities of oysters harvested or landed per annum is not documented because it is not part of the catch and landings data of the fisheries sector. Until recently, little consideration has been given to the oyster harvesting industry in terms of policy and the development planning. No wonder, a poverty profiling study of artisanal fisheries communities (Njie et al, 2003/2004) ranked oyster harvesters as the poorest of the poor in the artisanal fisheries sector.

In the past, oyster harvesting practice involved the hacking of mangrove prop roots or branches to which oysters are attached. This practice has largely been eliminated and a large knife and other tools are used to scrape oysters off the roots of mangroves leaving the mangrove tree intact. With increased awareness about the destruction done to mangroves and reduced productivity, harvesters now take precaution against cutting off of mangroves parts. Harvest equipment and tools include canoe, paddles, knives, baskets, empty bags, protective clothing (multi-layers of clothing, socks, hats, and made-up shoes (old cloth and plastic wound around the feet), gloves and lifejackets (see Figures 10 and 11).

Fig. 10: Oyster harvesting and processing equipment and tools

Harvested oysters are transported on the bottom of the canoe or in baskets and bags to the processing sites where they are usually kept moist and alive overnight before processing.

Fig. 11: a) Oyster harvester dressed for a trip b) Harvester bails water out of canoe for the trip

Most oyster harvesters are also cockle gatherers. When it is closed season for oyster harvesting, it is open season for cockles, and vice versa. Both oyster and cockle collection may be combined with other off-season alternative livelihood activities.

Cockles are normally collected from the shallow parts of streams and lagoons during low tide. Collectors travel to collection sites where they wade in the water or walk in the muddy bottom as the tide recedes combing the bottom with bare hands or with the aid of tools to pick the cockles and collect them in hand baskets. Quantities collected vary widely according to the site, effort and time of the year. On average, a specialized woman may collect between 12-20 kgs of unprocessed cockles on a good day.

4.2 Oyster Processors and the Processing of Oysters and Cockles

Harvesters process their own catch. Until recently the processing of oysters involved cooking in water or roasting and smoking. However, steaming and boiling are more common now because it is more effective and consumes fewer resources (firewood, water, and time). The process begins with removal of foreign matter from the harvested oyster. The live oysters are then steamed in pans/drums for 30 minutes to 1hour during which the shells open up or the muscles soften up to ease opening of the shells and extraction of the meat.

Fig. 12: Collected firewood for oyster and cockles processing (cooking)

Fig. 13: Oyster cooking setup – steaming barrel on open stone fire (left) and pouring out cooked oysters from barrel (right)

If oysters are to be smoked (now rare in practice), they are placed directly into the burning fire or on a metal grill over the fire. In either case, the oysters are then split open with knives to extract the meat which, is collected in woven baskets and marketed often after they are washed clean or even reheated in some sites. A process flow diagram for oyster production is outlined in Figure 14.

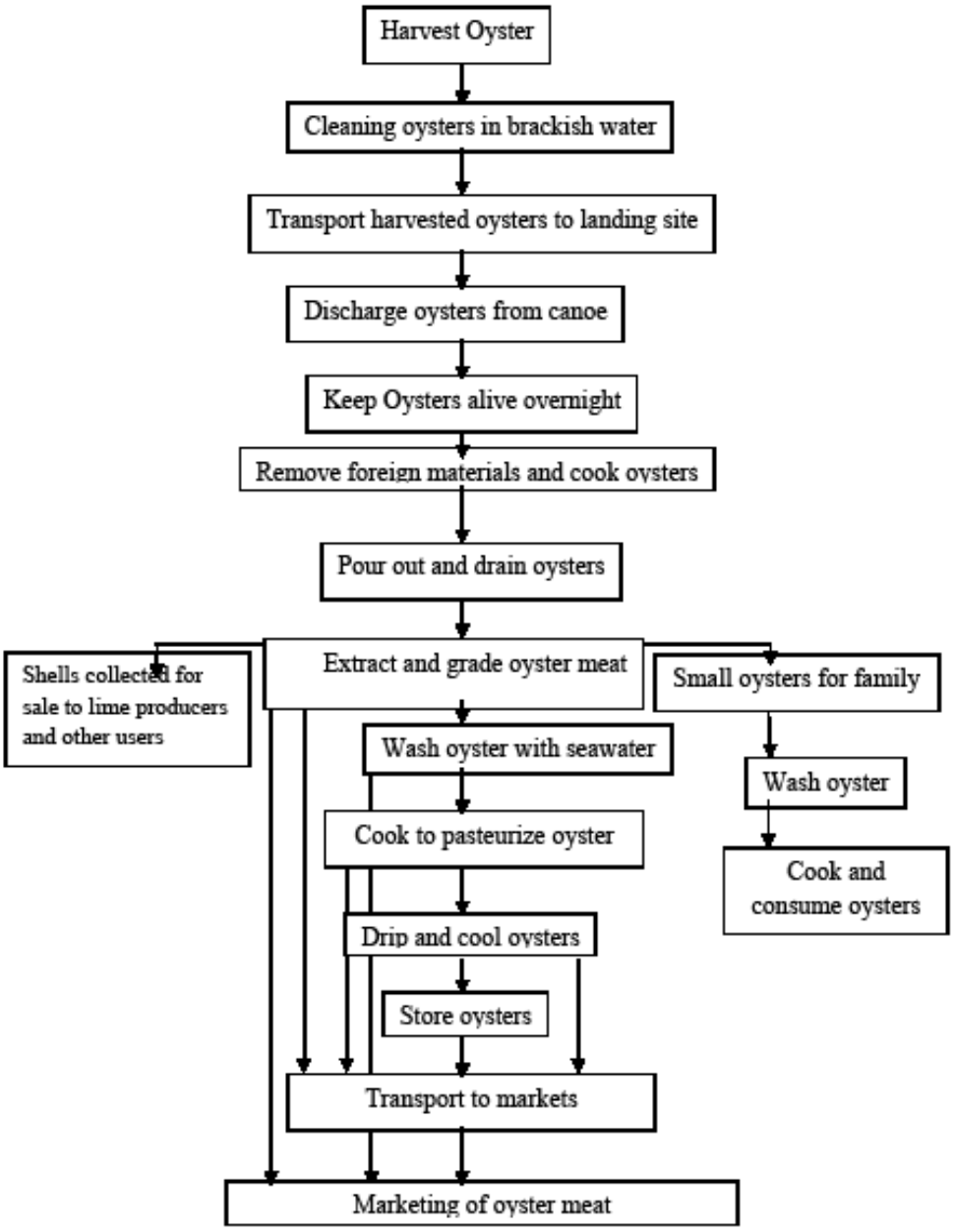

Fig. 14: Generalised process flow diagram for oyster production

Fig. 15: Extraction of oyster meat from shells after cooking and during processing –meat is graded by size.

Fig. 16: Two varieties of a day's harvest of oysters processed and ready to take to market for sale

In other places in the country, the meat is preserved by salting and sun drying to very low moisture content before they are marketed. Meanwhile the oyster shells are gathered in heaps and sold out for cash to users in the production of white lime, for brick making, the preparation of chicken feed and fertilizer, etc.

Fig. 17: Oyster harvesters relax in the shade of a tree on the roadside after processing, waiting for customers

The processing of cockles is similar to that of oysters. Cockles are normally processed by boiling/steaming in pots, pans or drums for about 30 minutes to 1 hour during which the shells open up and the cockle meat loosen up or fall out of the shell. After steaming, the cockle meat is usually sieved with perforated trays or they are shaken and separated by gravity when the meat falls to the bottom and shells gently scooped out from the top.

Fig. 18: Cockles cooking set-up for cooking operation during processing

Following separation, individual cockle meat pieces are picked out from the separated shells and returned to the sieved out meat and small shell that are seived through are also removed picked out by hand. These operations are shown in Figures 19 and 20 below.

Fig. 19: Sieving out and hand picking of cockle meat from cooked cockles during processing

Fig. 20: Washing and re-cooking of cockle meat during processing

The meat is placed in baskets and washed many times in sea water. Water is allowed to drip and the product is re-cooked before marketing. In some instances the product is salted and sun dried to very low moisture content before storage and subsequent marketing.

Fig. 21: Processed cockle meat following final wash and re-cooking – ready for market

4.3 Oyster Sellers and the Marketing of Oysters and Cockles

Oyster selling is also done by the oyster harvesters. However, it is not uncommon to find younger women (daughters or family members of harvesters) entrusted with selling processed oysters as can be found along the highway to and from the city of Banjul.

Processed oysters and cockles are marketed in diverse places including at the processing site and during processing. The main marketing points are in urban market places, along roadsides and other isolated places. Some producers carry the products on their head and sell from one home to another in the neighbourhoods.

Fig. 22: Oyster marketing ladies at an oyster selling point on the roadside along the highway

The unit of sale is an empty milk tin that contains about 150 grams of oyster or cockle meat. The price of this measure is generally the same in all places and in 2008 was GMD10. In the Kamalo area on the Banjul/Serekunda highway, the price varies based on quality (size grades). Here the large oysters were sold in 2008 for GMD15. The current price of oysters (in 2010) is generally GMD15. However the large,

handpicked grade of processed oysters is currently sold at GMD20, while the smallest grade is sold at GMD10.

Fig. 23: Medium size oysters (left) with measuring cup and larger size (right) oysters during marketing

Fig. 24: Measuring out oyster meat during marketing – operation observes hygiene rules

Most oyster sellers market their produce in urban areas around the periphery of markets in temporal, makeshift spaces.

Cockles are also marketed in market places either fresh or dried, or carried around on head and sold from home to home from one village or town to another. The price of fresh cockles is GMD5 and dried cockles are also sold at GMD10.

Fig. 25: Team of oyster harvesters complete the harvest cycle by successful sale of all processed oysters

4.4 Buyers and Consumers and the Utilization of Oysters and Cockles

There are diverse buyers and consumers of oysters and cockles and a diversity in food uses. Buyers are mainly individuals ranging from bachelors and housewives to street food vendors. Others are from school feeding programs, school lunch sellers, hotels and restaurant operators, and party makers as during school picnics and parties including the nowadays fashionable “Ebbeh Day” in schools. “Ebbeh” is a cassava and palm oil based food fortified with diverse other food ingredients, especially seafoods including oysters and cockles. Other buyers are exporters who send them in limited quantities in the dried or frozen forms.

Oysters are used in the preparation of various dishes and are part of a number of fashionable and popular recipes in the traditional Gambian society. Oysters are in increasing demand, especially for the preparation of family suppers and breakfasts and for snacks at home sold by street food vendors. In homes in the Gambia, oysters and cockles are ingredients to many dishes and an important source of protein. A notable dish is the popular “Benachin” (everything cooked in one pot) in which it is common to find cockles and oysters cooked with the rice.

Street food vendors were interviewed and questioned about the food preparation of oysters, availability of oysters, and costs, among other things. High profitability in oyster food vending was found, but vendors still complained of the high cost of oysters from oyster sellers. Results of the interviews are shown in Table 5.

Table 5: Results of interview with five food vendors

Question	**Average response**
Buying frequency	5 days per week
Quantity bought	4.5 cups
Source from same person?	No
Relationship with the sellers?	Good
How much do you buy oysters for?	GMD15/cup of 150g
Oyster preparation	Stew
Size of the portion	½ cup (75g)
Cost of portion	GMDD21.00
Are your customers regular?	Yes
Does your preparation finish daily?	Yes
If there is any leftover, what do you do with it?	Consume
What other uses do you put oysters to?	Family meals
Selling oyster food profitable?	Yes
Selling price of oysters?	Fair
Buy oysters if price increases?	Yes
Oysters available year round?	No
Like to have oysters year round	Yes
Buy other shellfish (cockles, whelks etc…)?	Yes, cockles
Additional information or ideas about the oyster industry	Sanitation of processing site Size should be big Quality, packing and presentation need improvement

A measure of the profitability of oyster food vending is shown in Table 6. Food vendors cook the oysters into stew in which the oysters are fried with onions and other ingredients and water added to prepare the stew. This is then sold in portions in combination with bread. The portion is sold at an average price of GMD20. With average weekly expenses of GMD498 and income of GMD941 food vendors make an average profit of GMD444 per week from oyster food vending. This gives a monthly income of GMD1,776 and for the vendor can accumulate an income of GMD7104 during the four months of the oyster harvesting season.

Table 6: Oyster balance sheet for food vendor buying and selling of oyster food

	Average	**Expenditure on oyster**	**Expenditure on cooking ingredients**	**Total Expenditures per week**	**Income from oyster food preparation**	**Profit on oyster food before cost**
Buying frequency per week	5					
Daily quantity of oysters bought	4.5 cups per day					
Cost of oysters	D15/cup (150g)	337.5 /week				
Size of the portion	½ cup					
Cost of ingredients and fuel per preparation	D32/day		160 /week	497.50		
Price of the portion	D21					
					GMD941 per/week	GMD443.50 per week

4.4.1 International Markets for Oysters

Currently, limited quantities of oysters are exported by individuals who normally carry them as a gift to relatives or are informally sold to customers in the niche market. The main export destinations of these small exports are mainly the U.S.A. and the U.K., where buyers or recipients are mainly Gambians who have occasional preference for traditional foods.

Table 7 shows recorded exports of oysters.

Table 7: Annual export quantities of oysters (2003 – 2007)

Year	Quantity (Kg)	FOB Value (GMD)
2003	39	975
2004	3	75
2005	20	500
2006	4	100
2007	3.5	87.5
2008	0	0
2009	296	7400

According to oyster buyers, there is a large untapped market in both the export and domestic markets, for oysters, especially with improvements in quality including packaging and presentation. Already, some people are involved in occasional sending of oysters and cockles as traditional food products to the United States. In a recent (May 2010) shipment to the U.S. of a consignment of about seven tons of smoked and fresh fishery products and other traditional foods, 318Kgs were oysters. The domestic and international market could be expanded with guaranteed supplies based on better managed resources and the culture of oysters.

Sanitary requirements and control systems must be adequately met if oysters are to be legally exported, particularly to the European and American markets. Historically, no medical records have specifically linked any food-borne illness to consumption of oysters in The Gambia. However, the export market will require stringent food safety controls, including risk assessment and a sanitation plan.

4.5 Other Oyster Value Chain Actors

4.5.1 Canoe Owners/ Hirers of Oyster Harvesting Canoe

Most oyster harvesters do not have their own canoes in oyster harvesting. In some communities, such as the oyster/cockles harvesting communities of Kartong, no canoes are owned by the harvesters. Some of these harvesters therefore walk their way to oyster harvesting sites within reach. Due to depletion or over-exploitation of oysters, many harvesting sites get depleted soon and harvesters are compelled to travel by boat to grounds distant from the communities. Therefore, many oyster harvesters without canoes must rent canoes from canoe owners for their harvesting operations. These canoe owners normally hire out their canoes to oyster harvesters for a monthly rent of GMD300, which can be paid in cash or in kind (bags of oyster shells). These canoe owners collect and use the shells to produce white lime or sell the shells to white lime producers.

The relationship of canoe owners and oyster harvesters, particularly in Kartong, is quite pronounced and arrangements are such that, women processors put aside the payment in kind of the rental fee on the canoe. For each harvest and processing cycle (2-3 days), about a basket of oyster /cockle shells is measured and placed aside in a heap. The accumulated shells are occasionally collected by the canoe owner and transported by canoe to a white lime production site for lime production. The bag of empty shells is valued at GMD50 and therefore six bags of shells are gathered to pay for the canoe per month. Oyster harvesters and cockle gatherers often hire the canoes collectively and operate together but often each working for oneself and putting aside the amount of shells required for payment of the rent on the canoe.

4.5.2 Supply of Firewood for Oyster Processing

Oyster harvesters generally do not buy firewood for cooking the oysters. They normally collect their own firewood while harvesting and transport it in the canoe with the oysters. Firewood is also collected from dead tree branches and shrubs in the vicinity of the processing site.

4.5.3 Financing of Oyster Workers

Oyster harvesters do not have sources of credit and in the past have relied on their own personal savings or loans from relatives and group members. They are generally unable to access formal credit markets due to a lack of savings accounts with commercial banks and co-lateral. However, there are strong social relationships in oyster harvesting communities and harvesters assist each other in various ways including lending small sums of money to each other and through informal savings within associations of harvesters, neighbours or relatives. In some communities, harvesters form small associations of harvesters in which periodic savings are made and used for their own personal and family needs but also to invest in acquiring small equipment and utensils for their oyster production. At the same time utensils and equipment are shared amongst harvesters until each can acquire their own.

4.6 Production of White Lime from Oyster Shells

The discarded oyster shells are used to produce lime that can be sold for use in road construction, and landscaping of homes, driveways and other premises. White lime producers utilise both cockle and oyster shells as well as whelk shells. However, there is a preference for oyster shells which are claimed to be easier to burn down and cheaper or easier to obtain. Women oyster harvesters may engage in occasional production of white lime but the key actors in lime production are primarily older men. Most white lime producers operate close to the main oyster processing sites to minimize cost, and transport the product home or to other selling points for marketing.

During processing of oysters, processors collect the shells separately and heap them in mounds around the processing site. In the past, the shells used to be of little or no value to producers. In recent times however, producers are aware of the extra income they can derive from the shells and therefore ensure their collection and identification in heaps. These heaps of shells are left at processing where the shells dry out and get cleaned-up by sunshine and rain respectively. Because of low number of lime producers and the fact that lime production is not practiced at all processing sites, large quantities of shells can be found at processing sites, sitting for several years before they are bought and used. In fact, lime producers also prefer older shells that are already well washed and are brittle-dry. Hence it could take several seasons before shells get used up. The quality of the final lime product is determined by the cleanliness/whiteness of the shells. In some sites lime production is becoming so important that shell piles are removed more quickly. Lime production usually intensifies towards the end of the dry season as the rains approach.

Previously, the shells could be taken for free, but now the women processers sell them for extra income. Shells are generally sold per heap or truck/tractor load. The size of the heap may vary and price is agreed through bargaining. In general, the cost of a heap sufficient for production of a batch of lime costs about GMD1,500. Costs and revenues from the production of white lime from oyster shells discussed below in Section 5.

Lime production does not take place at all 9 value chain sample sites and the number of producers varies per site. The number of producers interviewed ranged from 1 in Mandinary to 5 in Kartong. A total of 21 producers were interviewed in seven of the 9 sample sites.

It was found that the average lime producer has a household size of 8 people. All the lime producers interviewed are Gambians and the majority belong to the Mandinka ethnic group, followed by the Jola and Fula ethnic groups. Most of the producers had no formal education. Seventy-eight percent said lime production is profitable, but they also believe that the oyster resources are decreasing.

Lime producers generally work alone with occasional help from family members and dependants. However, due to the labor intensity of the work, some hired labor is usually obtained (such as for cutting fuelwood and loading the shells on the burning platform.

Fig. 26: Oyster shells being accumulated by oyster harvesters for selling to producers of white lime

4.6.1 The White Lime Production Process

The process involves a number of steps. Tree logs are used as fuel for burning the shells and they are transported in tractor loads or on horse or donkey carts to the production site. They are arranged on the ground as a burning platform with grass straw and plant stalks interspersed between the logs to facilitate lighting. The shells are then loaded on the burning platform (Figure 27).

Fig. 27: Lime producer using his own donkey and cart to transport firewood logs for the lime production process

A gallon of gasoline is sprinkled over the shells and wood platform. As the wood catches fire and burn, the shells heat up and crumble down. As the fire increases in intensity, the shells become red hot and burn from the inside as just like a furnace.

Fig. 28: Lime production setup with tree logs bedding (left) and burning shells during production process

The setup continues to burn for 4-7 days with occasional plunging of a long stick into the burning shells to stir up them up so that those in the upper layers in the pile fall into the fire (Figure 29). By the end of the process, all the wood and shells are burnt down. Water (usually sea water from nearby streams) is added to the burnt mass by sprinkling and churning to ground the mass into a kind of muddy paste.

Fig. 29: Lime production in process: stirring the shells (left); burning pile of shells (right)

The mass is then heaped and left to dry under the sun for three days after which it is churned again and beaten into a caked mass of white lime product, which is ready for bagging into 50Kg bags.

Fig. 30: Filled bags of white lime produced from oyster shells

On average, the lime producer gets about 100 bags of white lime per batch produced. About 2 cycles of lime production are completed per month. On average, lime production takes place during a period of three to four months of the year (in the dry season only). So an average of 8 batches is produced per lime production season (per annum) if production is continuous throughout the season. The bags are sold to retail buyers.

5.0 Costs and Revenues in the Oyster Harvesting and Lime Making Value Chains

5.1 Costs and Revenues in the Oyster Harvesting Value Chain

Costs are separated in this section according to the three main steps of the oyster production chain: harvesting, processing and marketing of oysters. Each stage of the production chain requires a number of inputs and fixed and variable costs (or operating costs). Revenue is obtained only at the point of sale. Since the oyster harvester performs all three steps of the value chain, from harvesting through to marketing of the final product, these are together considered as a single business enterprise. All analyses are based on seasonal values during the 4 month harvesting season, during the year 2010.

The analysis considers two scenarios involving: *a)* harvesters acquire their own canoes by purchase (the canoe considered as a fixed capital asset); and *b)* harvesters hire the canoes and pay rent to canoe owners (cost of hiring the canoe considered as operating cost).

The values for costs and revenues were collected from respondents in each of the 9 sample sites. Cumulative averages were then worked out for each cost and revenue item in the respective value chain step. Fixed assets were depreciated based on average lifespan also obtained from information collected from respondents.

5.1.1 Fixed Assets in Oyster Harvesting

The fixed assets and their cost for oyster harvesting per season in the first scenario (with purchase of a canoe) are presented below in Table 8.

Table 8: Fixed assets in oyster harvesting/season (with canoe) – first scenario

Asset	**Quantity**	**Unit cost**	**Total Cost**
Canoe	1	4,500	4,500
Big Baskets	2	150	300
Empty rice bags	5	5	25
Paddle	1	100	100
Axe	2	100	200
Cutlass	1	100	200
Protective sweater	1	100	100
Masking hat	2	25	50

Asset	Quantity	Unit cost	Total Cost
Life jacket	1	150	150
Pair of gloves	3	25	75
Torch light	2	25	50
Socks	3	25	75
Used clothes	1	100	100
Total			**5,925**

The fixed assets and their cost of oyster harvesting per season in the second scenario (without a canoe) are exactly the same as the first scenario, with the exception of the canoe. Therefore, the total fixed cost is GMD 1,425.

5.1.2 Fixed Assets in Oyster Processing and Marketing

The fixed assets involved in oyster processing and marketing (selling) are presented below in Table 9. These values are the same in both scenarios (with and without canoe ownership).

Table 9: Fixed assets in oyster processing per season

Asset	Quantity	Unit cost	Total Cost
Empty 200L barrel	1	300	300
Empty rice bags	4	5	20
Used blankets	2	150	300
Pouring stick	1	75	75
Knives	5	25	125
Processing baskets	2	150	300
Empty rice bag	4	5	20
Cooking pot/pan	2	75	150
Total			**1,290**

In Table 10, the fixed capital assets involved in oyster marketing are listed. The selling baskets are reserved purposely for placing the final processed oyster product for selling. On average, two baskets are used, one to contain the product and the other used as protective cover of the product during transport and selling. The mutton cloth and poplin cloth are used for covering and protecting the product in the basket during transport and in the display of the product for sale.

Table 10: Fixed assets in oyster marketing/selling per season

Input costs	Quantity	Unit cost	Total Cost
Selling basket	2	150	300
Two-metres mutton cloth	4	25	100
Two-metres poplin cloth	4	18	72
Total			**472**

In Table 11, the operating costs involved in the business of oyster harvesting, processing and marketing are presented for scenario 2 (without canoe). Scenario 1 is exactly the same, except there is no cost of canoe hire. Therefore, without canoe hire, the total operating cost is GMD1,880.

Table 11: Operating costs (without canoe)

Input costs	**Quantity**	**Unit Cost**	**Total Cost**
Hire of canoe/month	4 months	300	1,200
Firewood	48 lots	15	720
Matches	10 matches	1	10
Salt	1 bag	150	150
Transport cost (av)	36	25	900
Torchlight batteries	10	10	100
Total			**3,080**

5.1.3 Depreciation of Fixed Assets in Oyster Harvesting Processing and Marketing

To obtain the total depreciated costs of the fixed assets of oyster harvesting, the economic life span and cost of the different assets were used to calculate the depreciation. Table 12 and Table 13 show the economic lifespan and depreciation of the fixed assets of oyster harvesting, processing and marketing steps respectively. Depreciation of oyster harvesting fixed assets without canoe is arrived at by deducting the depreciated value of the canoe from the total depreciated value of fixed assets.

Table 12: Economic lifespan and depreciation of oyster harvesting fixed assets

Item	Lifespan	Qty	Unit cost	Total	Depreciation	y1	y2	y3	y4	y5
Canoe	5 years	1	4500	4500	900	3600	2700	1800	900	0
Big baskets	2 years	2	150	300	150	150	0	0	0	0
Empty rice bags	1 years	5	5	25	25	0	0	0	0	0
Paddle	2 years	1	100	100	50	50	0	0	0	0
Axe	2 years	2	100	200	100	100	0	0	0	0
Cutlass	2 years	1	100	100	50	50	0	0	0	0
Protective sweater	1 years	1	100	100	100	0	0	0	0	0
Masking hat	1 years	2	25	50	50	0	0	0	0	0
Life jacket	1 years	1	150	150	150	0	0	0	0	0
Pair of gloves	1 years	3	25	75	75	0	0	0	0	0
Touch light	1 years	2	25	50	50	0	0	0	0	0
Socks	1 year	3	25	75	75	0	0	0	0	0
Used clothes	1 year	1	100	100	100	0	0	0	0	0
					1875					

Table 13: Economic lifespan and depreciation of oyster harvesting fixed assets

Item	Lifespan	Qty	Unit cost	Total	Depreciation	y1	y2	y3	y4	y5
Empty 200L barrel	1 year	1	300	300	300	0	0	0	0	0
Empty rice bags	1 year	4	5	20	20	0	0	0	0	0
Used blankets	1 years	2	150	300	300	0	0	0	0	0
Pouring stick	1 year	1	75	75	75	0	0	0	0	0
Knives	1 year	5	25	125	125	0	0	0	0	0
Processing baskets	2 years	2	150	300	150	150	0	0	0	0
Empty rice bag	1 year	4	5	20	20	0	0	0	0	0
Cooking pot/pan	2 year	2	75	150	75	75	0	0	0	0
					1065	0	0	0	0	0

Table 14: Economic lifespan and depreciation of oyster marketing/selling fixed assets

production	Lifespan	Qty	Unit cost	Total	Depreciation	y1	y2	y3	y4	y5
Selling basket	2	1	150	300	300	0	0	0	0	0
Two-metre mutton cloth	1	4	25	100	100	0	0	0	0	0
Two-metre muslin cloth	1	4	18	72	72	0	0	0	0	0
					472					

The total depreciation of oyster harvesting, processing and marketing assets for the two scenarios (with and without canoe) is summarized in Tables 15 and 16.

Table 15: Total depreciation of fixed assets (with canoe)

Harvesting fixed assets	1875
Processing fixed assets	1065
Marketing/selling/distribution	472
Total	**3412**

Table 16: Total depreciation of fixed assets (without canoe)

Harvesting fixed assets	975
Processing fixed Assets	1065
Marketing/selling/distribution	472
Total	**2512**

5.1.4 Total Capital Projection

Having obtained the fixed assets at the different value chain steps and the operating costs with and without a canoe, the total capital projection of the business can be calculated as shown in Tables 17 and 18. A comparison of the two reveals that the investment with a canoe has higher demand on capital.

Table 17: Total capital projection with canoe

Harvesting fixed assets	5925
Processing fixed assets	1290
Marketing/selling/distribution fixed assets	472
Operating cost	1880
Total	**9567**

Table 18: Total capital projection without canoe

Harvesting fixed assets	1425
Processing fixed assets	1290
Marketing/selling/distribution fixed assets	472
Operating cost	3080
Total	**6267**

5.1.5 Average Revenues from Oyster Harvesting Business Enterprise

To obtain the revenue from sale of the product, average production per producer is estimated for the respective sample sites. This considers the average quantity of oyster meat produced per producer, per production cycle (3 days), characterized by an average of two days of harvesting and a day of processing and marketing. The production cycle calculation is the basis for calculation of the average revenue values from which average monthly and annual/seasonal revenue is estimated. The estimated average quantities of processed oysters from which estimated income (revenue) of oyster harvesters is estimated are both shown in Table 19.

It is to be noted that in estimating the quantities of oysters produced, the marketing measure of one empty milk tin (cup) was used as the local unit of measurement of processed oysters. This was then converted to an average net weight derived from measurements from different producers. This unit weight (150 grams) is valued at the average selling price of GMD15. Assuming that there are approximately 12 possible production cycles in a month, the monthly production value is arrived at by multiplying average price of the product by the quantity produced per cycle.

Table 19: Estimated average quantity of processed oysters produced and income per harvester (all values in GMD)

Oyster Harvest Site	Average quantity per 3 days harvest cycle (cups)	Average quantity (grams)/ harvest cycle	Average income/ harvest cycle	Average monthly income	Average annual (seasonal) income
Jeswang	15	2,250	225	2,700	10,800
Kamalo	18	2,700	270	3,240	12,960
Abuko	10	1,500	150	1,800	7,200
Mandinary	15	2,250	225	2,700	10,800
Lamin	18	2,700	270	3,240	12,960
Fajikunda	15	2,250	225	2,700	10,800
Kubuneh	33	4,950	500	6,000	24,000
Kartong	20	3,000	300	3,600	14,400
Ibo Town	10	1,500	150	1,800	7,200

Oyster Harvest Site	Average quantity per 3 days harvest cycle (cups)	Average quantity (grams)/ harvest cycle	Average income/ harvest cycle	Average monthly income	Average annual (seasonal) income
Total	**154**	**23,100**	**2,325**	**27,780**	**111,320**
Average	**17.11**	**2,567**	**258**	**3,087**	**12,369**

Note: A cup (empty milk tin /150 grams) of oysters costs an average of GMD15. Harvest cycle is 3 days

5.1.6 Net Revenues from Oyster Harvesting

On the basis of the average costs and revenues obtained from the above analyses, the profitability of the business of oyster harvesting is estimated for each of the two scenarios (Tables 20 and 21, respectively).

The net profit of oyster harvesting per season with canoe (GMD7,077) is higher compared to without canoe (GMD6,077) as a consequence of the higher operational cost for canoe rental. Thus, oyster harvesting is more profitable when the operator invests in a self owned canoe than when the operator depends on renting a canoe. Recently, the TOWA Association established a savings and credit program, which may help members to save and purchase their own canoe with time.

Table 20: Profitability of the oyster harvesting business with canoe for one year

Income (proceeds from the sale of oyster meat)			**12,369**
Less cost:			
Depreciation of Havesting Fixed Assets	1,875		
Depreciation of Processing Fixed Assets	1,065		
Depreciation of Marketing/Selling Fixed Assets	472		
Total Depreciation		3,412	
Operating Cost		1,880	
Total Cost			**5,292**
Net Profit			**7,077**

Table 21: Profitability of the oyster harvesting business without canoe for one year

Income (proceeds from the sale of oyster meat)			**12,369**
Less cost:			
Depreciation of Harvesting Fixed Assets	975		
Depreciation of Processing Fixed Assets	1,065		
Depreciation of Marketing/Selling Fixed Assets	472		
Total Depreciation		2,512	
Operating Cost		3,080	

Total Cost				5,592
Net Profit				**6,777**

5.1.7 Net Worth of Investment in the Oyster Harvesting Enterprise at End of One Season

The net worth of the oyster harvesting business enterprise is estimated below. The net worth of the business is estimated at end of one year (one season) for the investments in both scenarios as shown in Tables 22 and 23 respectively. It is evident that the net worth of the oyster harvesting business enterprise in the first scenario, with investment in a canoe is higher (GMD16,644) after one season, as compared to the second business scenario based on canoe rental which has a net worth of GMD13,044.

Table 22: Net worth of the investment with canoe as at end of one year of operation

Capital				9,567
Net Profit				7,077
				16,644
Represented By:				
Fixed Assets:				
Harvestung	5,925			
Less Depreciation	1,875			
		4,050		
Processing	1,290			
Less depreciation	1,065			
		225		
Marketing/Selling/Distribution	472			
Depreciation	472			
Total Fixed Assets			4,275	
Current:				
Cash in Hand/at Bank	7,077			
Provision for the replacement of Depreciated Assets	3,412			
Provision for the replacement of operational inputs	1,880			
Total Current Assets			12,369	
Net worth				**16,644**

Table 23: Net worth of the investment without canoe as at end of one year of operation

Capital				6,267
Net Profit				6,777
				13,044
Represented By:				
Fixed Assets				
Harvestung	2,625			
Less Depreciation	975			
		1,650		
Processing	1,290			
Less depreciation	1,065			
		225		
Marketing/Selling/Distribution	472			
Depreciation	472			
Total Fixed Assets			1,875	
Current:				
Cash in Hand/at Bank	6,777			
Provision for the replacement of Depreciated Assets	2,512			
Provision for the replacement of operational imputs	3,080			
		12,369		
Less Current Liabilities				
			12,369	
Net worth				**13,044**

5.2 Cost and Sales Accounting on Production of White Lime from Oyster Shells

The production of white lime from oyster shells is an important commercial venture for producers and the product finds wide use in the local market. An attempt was therefore made to incorporate lime production in the study to provide an understanding of what is involved and identify opportunities and prospects within the utilization of this by-product of oyster harvesting as a horizontal step in the oyster industry value chain. The details involved in production of white lime from oyster shells were described in Section 4.6.1. Our task here is to present a cost and sales accounting to gauge investment costs and profitability in this commercial venture. Another objective is to attempt to analyze and identify opportunities for wealth creation prospects in the production of white lime.

The analysis is again approached through two scenarios: *a)* lime production at real investment cost, and *b)* lime production at minimum cost, with savings through performing of tasks by the producer, which are otherwise paid for. For example, transport of logs using own means, such as transport with donkey cart and to cut and supply one's own tree logs among others as depicted in the following accounting tables. Table 24 and Table 25 show the input items and costs involved in the two scenarios.

Table 24: Input items and costs in production of average batch of white lime from oyster shells at real cost

Input item	**Quantity**	**Unit cost**	**Total Cost**
1 Lot of oyster shells	1	1500	1500
1 Lot of firewood tree logs	1	2500	2500
Transportation of logs	1	500	500
Labour on loading shells /day	2	375	750
5L gasoil for lighting	5	32	160
Labour on mixing and churning	2	75	150
Empty bags	100	5	500
Bagging	100	2	200
Transportation of bags of lime	100	5	500
Transportation	2	25	50
Total input costs			**6,810**

Table 25: Input items and costs in production of average batch of white lime from oyster shells with labour savings

Input item	**Quantity**	**Unit cost**	**Total Cost**
1 Lot of oyster shells	1	1500	1500
1 Lot of firewood tree logs	1	1000	1000
Transportation of logs	1	0	0
Labour on loading shells /day	2	375	750
5L gasoil for lighting	5	32	160
Labour on mixing and churning	0	0	0
Empty bags	100	5	500
Bagging	0	0	0
Transportation of bags of lime	0	0	0

Transportation	2	25	50
Total input costs			**3,960**

5.2.1 Estimation of the Profitability of Production of White Lime from Oyster Shells

To estimate the profitability of white lime from oyster shells, an estimate of the revenue or income from the sale of white lime is made. The average production batch yields about 100 bags of white lime sold at an average price of GMD100. The total projected income from this average production batch is valued at about GMD10,000. With total input cost of GMD6,810.00, the net profit from production of an average batch of white lime at real cost is estimated to be about GMD3,190. (Table 26).

Table 26: Profitability of lime production at real cost per batch of lime produced

Income (proceeds from the sale of white lime)	10,000	
Less:		
Total input costs	6,810	
Net Profit		**3,190**

Profitability of the average batch of white lime at minimised cost of production by the lime producer is estimated at about GMD6,040 (Table 27). Assuming the lime maker's opportunity cost of his time is zero, the lime maker can almost double profit by performing the lime making labour himself.

Table 27: Profitability of production of white lime at minimized cost per batch of lime produced

Income (proceeds from the sale of white lime)	10,000	
Less:		
Total minimized input costs	3,960	
Net Profit		**6,040**

The average white lime producer produces about two batches of white lime per month and operates for about four months on average. This suggests that lime production can be very profitable and is even more profitable where the producer minimizes cost of production. The estimated total seasonal earnings (income) from production of white lime under our two scenarios is presented in Table 28 below, where seasonal profit with real cost is estimated at 25,520 and profit at minimum input cost is estimated at GMD48,320. This profit is with the assumption that all the white lime produced can be sold.

Table 28: Estimates of total earnings (profit) of lime producers per season at real and minimized (costs)

Scenario	Number of batches	Profit /batch	monthly profit	Profit per season Av. 4 months/season
At real cost	2	3,190	6,380	25,520
At minimized cost	2	6,040	12,080	48,320

In general, a producer does not assign a salary to herself but normally considers the whole earnings of the business to be his/her own earnings (a sole proprietorship or personal enterprise).

6.0 Profile of the Enabling Environment for Oyster Harvesting

6.1 National Policy relating to the Oyster Industry

National policies are in favour of development of the oyster industry (Anon 2010). Realising the nutritional and economic potential of the aquaculture sector, the Gambia Government's fisheries development policy now includes development of three areas of aquaculture: commercial, artisan and subsistence aquaculture. The strategy includes participation of communities in policy decisions and development activities, training farmers in pond construction methods and maintenance, tidal irrigation methods and access to loans. The policy also considers development and growth of commercial aquaculture to reduce dependence on capture fisheries. Shrimp and oyster culture are considered to have potential to be economically feasible in the River. Although some fresh water finfish culture was recently initiated in the Central River Region of the country, through donor assistance, to address food security and poverty reduction, little is being done about the culture of oysters apart from recent trials based on transfer of technology through project assistance.

As noted in Section 3.0, oyster culture in The Gambia became a stated development priority from the mid 1980's when the Department of Fisheries conducted research studies on the culture of the mangrove oyster of West Africa (*Crassostrea tulip)* through a research project funded by the Canadian International Development and Research Cooperation (IDRC).

The national environment policy, wildlife conservation, the fisheries and forestry sector policy and legislation all provide for measures in favour of the management and protection of mangrove ecology and sustainable harvesting methods of oyster resources among other resources. Fisheries policy objectives to effect meaningful contribution to food security and livelihoods' improvement for rural population have the strategy to promote commercial and small-scale aquaculture, including oyster culture development. The expected outcomes are increased revenue generation and foreign exchange earnings from export of aquaculture products, sustainable oyster production (using the rack-culture system), reduced destruction of mangroves, and increased local supply of oysters to meet demands both in the domestic and international market. Unfortunately little has been demonstrated in support of development of the oyster

industry. Recently however, greater attention is being drawn to the oyster harvesting sector thanks to the TOWA Association, support of the USAID Ba Nafaa project, and the introduction of oyster resource co-management.

The creation of practical and enforceable legal rules of engagement in the oyster sector is essential to future sustainability. For effectiveness, rules and regulations and any policy development to guide development and management of the oyster resources need to be participatory and inclusive. Incorporation of local knowledge, and traditional and cultural values should be part of policy and regulatory frameworks and processes. Any regulations developed must take account of community by-laws to enhance integration of social and cultural values.

6.2 Increasing Visibility of the Oyster Harvesting Sector

The oyster industry now receives increased visibility due to greater attention drawn toward the demanding work of oyster harvesters and heightened awareness of the contribution of the oyster industry to the national economy and livelihoods of harvesters.

With the objectives of preserving mangroves and increasing the supply of oysters, trial culture techniques were introduced to women groups following lessons of a study tour to Senegal. It is envisaged that eventually with increased supply and sustainability of oyster culture and harvesting, that there will be opportunities to develop and expand to untapped markets.

Fig. 31: Transfer of oyster farming techniques to complement harvesting of wild oysters (courtesy of Ba Nafaa Project)

However, the importance of improved hygiene and sanitary practice in oyster production cannot be overemphasized if the products are to be promoted in the domestic market and new external markets are to be found. International sanitary standards will remain to be barriers until appropriate sanitary measures are implemented.

Knowledge of the state of the resources (oyster stocks) is vital to any management and development efforts in the oyster industry. That is why the TOWA Association, Department of Fisheries, Water Resources Board and the USAID Ba Nafaa project are partnering to research and test culture and growing techniques, water quality sampling, seasonal spat production, and engaging a process of co-management, as well as supporting this value chain analysis.

7.0 Synthesis of Constraints on Oyster Harvesting, Processing, and Marketing

Constraints of oyster harvesters are diverse but could be grouped to fall under their different livelihoods assets: those related to the natural assets (resources based), physical assets (infrastructure related), financial assets, human (personal well being and technical) and social assets related constraints and include the following that were identified by the study (Table 29)

Table 29: Constraints in the oyster harvesting industry classified according to livelihoods assets

Constraint Area	**Nature of constraints**
Natural assets related constraints	- Depletion of the oyster resources due to increased entry and destructive methods of harvesting - Limited oyster resources and short production period
Physical assets related constraints	- Inadequate number of harvesting canoes and accessories (paddles, poles, ropes etc.) - Lack of supportive infrastructure and facilities including processing rooms with proper equipment, handling and processing equipment, and sanitary facilities including water and hygiene facilities - Lack of appropriate handling equipment and facilities such as plastic containers, cooling and cold storage facilities - Lack of proper retail sales space in local markets - Difficulty in transportation of harvested oysters to the processing site and in finding transport to markets and back home from some processing sites after the day's work - Lack of appropriate protective clothing for the various operations (harvesting, processing and marketing of products) including appropriate protective shoes, gloves, life jacket, overalls etc).
Financial assets related constraints	- Inadequate off-season livelihood opportunities - Lack of access to micro-finance
Human (technical) assets related constraints	- Lack of hygiene training - Need for increased awareness and basic training in food handling and safety control - Lack of supportive research including in oyster growth and culture techniques

	- Inadequate training on oyster culture methods and practices
Social assets related constraints	- Theft of oysters and processing materials at landing and processing sites due to lack security and an absence of storage facilities - Sexual harassment of oyster harvesters and processors by men - Weak organization of oyster harvesters - Inadequate institutional support and services

8.0 Opportunities and Recommended Priority Actions

8.1 Natural Resources Management and Co-management Options for Oyster Resources

From a management and sustainability perspective, the oyster resources must be appropriately managed for a successful oyster industry. There are various treats to the industry that must be addressed if net value and benefits are to be increased. These include over-exploitation due to poor harvesting techniques that are destructive to the mangroves.

There has been growing pressure on the oyster stocks due to increasing number of harvesters and demand for oysters. This has led to a decrease in oyster stocks evident from the low density of populations in some areas, smaller sizes and reduced quantity of oysters harvested, as compared to the past. Based on the findings of the value chain analysis, it is recommended that the **co-management strategy**, that is a partnership between the state and the oyster harvesting communities continue to be strengthened and improved.

It is also important to support the development of **oyster culture** for the purpose of protecting wild mature oysters as a source of spat, to protect the mangrove from damage during the harvest of the wild stocks and to improve the food security of communities. For the culture of oysters in the Tanbi wetlands to be successful many different disciplines must be involved. These include biological and technical aspects, organisational and management, and processing and marketing disciplines.

8.2 Strengthening Oyster Associations

Increasing pressure on oyster stocks raised concern among producers and supporters regarding actions for sustainability of the resources and livelihoods of dependent communities. This concern attracted support from concerned individuals, organizations and development project partners. A number of community based local associations of small informal groups of harvesters were formed and were later amalgamated into the Association of Women Oyster Sellers (commonly known as TRY Association), now called The

Oyster Women's Association (TOWA). This association constitutes the umbrella organization of oyster and cockles harvesters of the Tanbi Wetland Complex. It provides the opportunity for partnership toward greater management and utilisation of the resources. The objectives of the association is in line with good governance of the resources by improving the harvesting, processing, and selling of oysters, adding value to the product and improving sustainability of the industry.

The TOWA Association has raised funds to buy three canoes to reduce dependency on hired canoes for oyster harvesting. They have established a micro-credit union scheme with a bank account and savings passbooks for members. Members selling oysters along the roadside have also started to wear clean aprons and gloves during selling of the oysters and are regularly cleaning at the processing and selling points for improved hygiene. Training is also being offered on alternative livelihoods activities during the closed season. A study tour was organized to Senegal for selected oyster harvesters to learn from their Senegalese counterparts and this has enabled members to engage in localized trials on oyster culture techniques.

The association has now grown from seven affiliated groups a total of 15 main communities in the Tanbi Wetlands complex, involving over 500 oyster harvesters. It is recommended that the TOWA model be transferred to other oyster areas and communities on the estuaries of the river Gambia.

It is recommended that TOWA and future oyster women's associations be further assisted in their organisational development, in building capacities in various aspects of the industry, and in resource management planning. This should include establishment of a cooperative savings and credit union through which micro loans can be made to finance oyster operations, materials, and improvements in processing and packaging of oyster products.

8.3 Improving Product Quality and Safety along the Value Chain

Improved handling and storage facilities during harvest and storage are required for improvement of oyster products. Durable containers that can be cleaned and secured during transport of harvested oysters are required in the handling and transport of harvested produce (oysters as well as cockles). Landed oysters should be easy to unload from vessels and transported to the processing sites.

Storage of landed oysters must be hygienic. At present harvested oysters are heaped on the ground or left in bags and pans under shaded areas at processing sites while kept moist by sprinkling water. The use of appropriate containers (heavy duty plastic tubs and vats) in which live oysters can be dipped will maintain oysters alive in hygienic conditions until processing, usually after two to three days.

Quality of the products including food safety issues can only be assured under appropriate hygiene and sanitation controlled conditions during handling, storage and processing. This calls for appropriate

infrastructure such as buildings with appropriate handling, processing and storage facilities. To reduce product spoilage during storage and marketing, it is important to introduce a cold chain.

Lacking appropriate processing and storage facilities, efforts should be undertaken at the current landing and processing sites to correct obvious sanitation problems, such as moving animal husbandry from close to the shoreline and assuring that pit latrines are located at least 200 meters from the intertidal zone.

Improvement of product quality also requires that quality control is introduced under an appropriate quality management system (such as a HACCP based food safety and quality management system). This requires that training is provided in food hygiene and in the operation and monitoring of such a food safety and quality system.

Monitoring of water quality in oyster harvesting and potential growing areas is necessary for food safety and quality. It is particularly important and urgent that fecal coliforms and pathogenic bacteria including the vibrios, are continuously monitored. Since June 2010, the USAID Ba Nafaa project, in partnership with the Water Resources Board has been monitoring water quality on a monthly basis at 9 landing sites in the Tanbi Wetlands Complex. It is encouraging that both total coliform and fecal coliform counts are very low in all sample sites, even during the rainy season. Slightly elevated coliform counts were found at two locations in the estuary system at Old Jeswang (where pigs are being raised within the tidal zone), and at Lamin Lodge, the site of a hotel, boat marina and fishing boat landing.

8.4 Upgrading Oyster Processing

The processing of oysters (and cockles) generally takes place at the landing sites. Processing sites are generally unhygienic and without potable water. Processing operations always take place in the open under shades of trees and shrubs. As noted above, from a food safety and quality perspective, there is a need to improve and upgrade oyster processing practices. The successful introduction of processing buildings and equipment would also require the introduction of transport services to facilitate collection of oyster produce from landing sites to improved processing sites where all oyster processing would take place.

Considering that oyster harvesters are the same people involved in the whole chain of activities from harvest to marketing, the labour demand on individual harvesters is considerably high and operating times lengthy. Proposals were made to operators involving three options, during focus group discussions.

i) The first option is the re-organization of harvesters such that while some are involved in primary production or harvesting, others will be involved in processing and in marketing of the final product. This option involves setting up a company owned by the harvesters with processing and marketing facilities.

ii) The second option involves inviting a third party private investor (local or foreign) to invest in a private company that buys and collects the oyster produce at landing sites and delivers to a processing facility for processing, storage and marketing.

iii) The third option is to invite an existing local fish processing company to invest in equipment and facilities to receive the oyster produce for further processing for local and export marketing and distribution.

All three options were welcomed by oyster harvesters in different communities who indicated that they will be willing to only harvest and sell the produce for further processing.

8.5 Enhancing Local and Export Markets and Wealth Creation

There is no doubt that the local market for oysters could be further tapped and expanded. As noted earlier, the sale of oysters and cockles is localized at processing sites and in the peripheries of local public markets. Other means of distribution include the door to door sale of oysters and cockles by harvesters. There are many opportunities for widening and acceleration of the marketing and distribution of oyster and cockles products. The exploitation of these opportunities requires that improvements are made on processing and packaging of products.

Packaging could involve simple hot sealed plastic packs with appropriate labels. The opportunity also exists for diversification of products with options for production of special packs of convenience, adequately heat treated or preserved in jars and packs for retail.

Promotional campaigns relating to greater awareness of the general public about the important nutritional role of oysters (and cockles) in the diet and health of consumers is relevant for market expansion and value added in oyster products. The existence of the National Nutrition Agency and the media provides opportunities for collaboration in this matter.

8.6 Enhanced Inter-Firm Cooperation and Opportunities for Tapping Export Markets

Although current export quantities of oysters is limited and restricted by a lack of health risk assessment and sanitation control, there are opportunities and prospects for improved access to more lucrative export markets.

Local fishery products processing establishments provide the opportunity for cooperation with oyster producers toward development of the industry. Interviews with management of three processing establishments gave indications that it is possible to build linkages through which oysters and cockles could be processed both for local distribution and for export, if the health and sanitation control systems were in place.

This type of arrangement would require additional supplies of oysters to feed both the local market as well as the export market. This would be possible through improved management of wild stocks and additional supply from oyster farming systems. Processing and packing of oysters in modern processing establishments would result in added product lines and employment creation resulting in improved contribution of the industry to the national economy through increased revenue generating capacity and foreign exchange earnings.

8.7 Other Opportunities and Priorities for Increasing Wealth from the Oyster Industry

- The current capacity to produce white lime can be increased (although the impact on tree cutting for wood fuel needs to be evaluated), and in addition to white lime, there are other ways that **oyster shells** can be put to use with examples of these other uses in Senegal.
- It is important that there is a census on the numbers of oyster harvesters and white lime producers and to estimate total oyster production nationwide, determine densities, populations and characterize habitat. **Research activities** could involve university students in The Gambia and from elsewhere. The National Agricultural Research Institute (NARI) and government institutions such as Departments of Fisheries, Forestry and Parks and wildlife conservation and the National Environment Agency could as well participate directly in these studies or provide supervision. Research results and findings can help improve oyster management and culture techniques.

- **Cockle gathering** is a the second most important economic activity of oyster harvesters and this is usually operated in conjunction with oyster harvesting and becomes the main activity during closure of the oyster harvesting season. It is considered by operators to be as important as oyster harvesting and earns producers valuable incomes. It is therefore important that cockle gathering is also better understood and developed. This requires an understanding of the biology and habitats of cockles including their abundance and distribution, growth and maturity among other factors, so that exploitation can be monitored and managed for sustainability and for improved wealth creation.

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Appendix 1: Questionnaires for The Gambia Oyster Fisheries Value Chain Assessment

A. For Each Value Chain Actor

Site: ---------- Date:-----/------/----- Respondent Number (.....)

Part 1: Information on the Respondent

1. Sex: Male ( ), Female ( ),

2. Age: ( ),

3. Marital Status:

Married----------

Single ----------

Divorced--------

Widowed--------

4. Number of household members: ----------

   Number of dependent members: ----------

5. Ethnic group:

   Mandika ----

Serrel-------

Jola ---------
Fula ---------

Wolof -------

Other --------

6. Nationality:

Gambian --------

Senegalese ------

Other ----------

7. Education:

Grade 1 – 6 ---------

Grade 7 – 9 ----------

Grade 10 – 12 ---------

Koranic school (Darah/Karanta) --------
Non formal education----------(explain)

None ------

8. Do you live in this village/town as full time resident?

a) Yes ( ),
No ( ),

b) If yes in "a" above, how long?---------- Total years full time residence in the Gambia……..

B. <u>Boat and Gear Owner:</u>…… Respondent Number (.....) Date:-----/------/-----

Harvest/collection Site:……. Location of vessel and gear …….

Part 2: Harvesting Equipment Information

Type of Canoe	----------
Length of Canoe	----------
Total cost	----------
Date & place of construction	----------
Type(s) of oyster harvesting tools used	----------
Cost and source of funds	----------
Other equipment (if any) describe	----------
Number of Assistants	Harvesting Unit----- Assistants------ Canoe Owner-------
Share system (%)	

C. <u>Harvester</u>:…….. Are you also owner of boat and gear?.....

Site: ---------- Date:-----/------/----- Respondent Number (.....)

Part 3: Daily Production of Oyster

Area (if available) ----------	Time out: ----------
Weather condition -----	Time in: ----------
Expenses : daily/monthly?	
Food :----------	Cost ----------
Water:……litres	Cost ----------
Other expenses	Costs .....
Means of transport to production site	
……	Cost ----------
Repairs and Maintenance:	
Spare parts/repairs ----------	Cost ……
Other :----------.	Cost:……
	Total costs----------

Daily production of Oysters (Changes in daily harvest with annual seasonality)	Weight(kg)
How much oysters do you harvest/collect daily:	----------
During peak periods?	
During lean periods?	----------
What are your other sources of livelihood when not in the season or harvests too low?	..... ----------
Additional earnings	
Sources	Amount
----------	----------
----------	----------

How long have you been harvesting oysters?

Do you harvest alone, or in a group with other harvesters and their boats?

If you harvest in a group, why?

How has oyster size and abundance changed over the time?

What do you think or belief is responsible for the change

At what times of the year do you engage in oyster collection/harvesting?

Are there periods during the season when oysters are more abundant?

If Yes, What periods are these?

Do you have any idea why they are most abundant during that time?

Do you harvest other shellfish, crabs or any other things in the mangroves area?

Are there different types (species) of oyster?
If yes, which ones are they? (please indicate knowledge on differences)

Do you have preference for a type (species) of oyster?
If yes why do you prefer this type of oyster?

Do you always harvest in the same location?
If in different locations why do you change locations?
Which locations are these?

What is the biggest problem facing the oyster fishery?
What would you like to see changed?

How do you sell your oysters?

What is the current price of oysters?

Are you a member of an oyster harvester's group/association? (Yes) (No)

If Yes, which association?

What is the purpose of the association (please explain)

What benefits do you get from the association?

If not a member of an association why not? (please explain)

What are the periods of time during the year that you do not harvest?

Why do you not harvest in this period?

During that time how do you provide for yourself and family?

What other livelihood activities are you engaged in?
Is oyster harvesting your main source of livelihood?

Which other livelihood activities (in order of importance) are your main activities after oyster harvesting?

Are there conflicts in oyster harvesting?

What is the nature of conflicts?

a) With other oyster fishers?
b) With fishers of other species?
c) With other users of the wetlands? Explain

How are conflicts resolved?

Do you think oyster harvesting is sustainable?

Why or why not?

What needs to be done to make it more sustainable and equitable?

How is the condition of the estuary, river, riverbanks, mangroves and forests?

a) Are they getting worse or better?
b) What are the main threats?
c) Has water quality changed noticeably over the period you have been oyster harvesting?

D. Processor:……

Processing Site: ---------- Date:-----/------/----- Respondent Number (.....)

Part 4: Processing Technique

1. No. of Assistants

Gambians:----------

Non-Gambians:……..

2. Do you process your own products? Yes

(Confirm if also the harvester or processor ☐ only

No ☐

3. If yes? What kind of On-shore facilities do you have?

…….

4. If No? Your source of supply

…….

☐

5. Processing method used ☐ Smoking Boiling

Also Drying??? ☐

If both, what is the proportion (%) of each relative to total harvest?

6. What type of processing equipment do you use……

7. How much oysters do you process daily?

During the peak period? ..... (container -pan/bag/Kg) please give estimate weight of container.

During the lean period? ..... (container -pan/bag/Kg) please give estimate weight of container.

7. Processing Cost specify per unit/or per day

	Quantity	Value (GMD)
Fuel wood	……..	……..
Water (liters)	……..	……..
	……..	……..
Other		

8. Constraints

……

……

Are you both processor and seller of ready to eat oysters?

If process only, who buys the oysters from you and sells the oysters?

How long have you been processing and/ selling oysters?

How do you get your oysters?

How do you sell your oysters?

Are you able to sell all of your processed product?

If you have leftovers, what do you do with it?

Who are your customers?

Do you have many returning customers? Yes / No

If yes, why do you think they come back?

What is the price of oysters?

How is price determined for individual buyers and larger buyers (e.g. buying for school food program, or for other public/private institutions as part of meals provided to staff or for sale?

Do you process alone, or together with other processers?

If with others, what is the advantage or disadvantage of working together with other processers?

What type of fuel do you use for boiling or smoking your oysters?

Where do you get your fuel for boiling or smoking your oysters?

Do you fetch the fuel yourself, or do you buy from someone else?

Describe changes in the abundance of fuel and costs of fuel over time.

Do you feel that fuel harvesting is sustainable? If not, what do you see as other options?

Are you aware of any problems associated with illness from eating oysters?

Do prices for oysters vary over the years? Explain.

What are the reasons for this variation in price if any?

How do you think the value of the oysters you sell could be increased?

What is done with the oyster shells after sucking/shelling?

Is there a market for the shells? Describe?

Have you ever sold the oyster shells you produce?

Why or why not are you able to take advantage of use and sale of shells?

What in your work would you like to see different in order to make you better off?

What is the biggest challenge facing you in your work?

E. Trader:……

Site: ---------- Date:-----/------/----- Respondent Number (.....)

Part 5: Marketing and Distribution

1.. Market Outlets
Av. Quantity (kgs)

Domestic :----------

Export destination:……..

2 Do you market your own product? Yes ☐ No ☐

2.1 If No? How often do you get your supplies?----------

2.1.1 Where do you get your supplies from?----------

2.1.2 How much quantity of processed oyster do you buy in a day for marketing?
(Specify whether smoked or cooked)

Quantity (kg) **Value**

…… …….

3 Who do you sell\supply your oyster?:……

4. What type of transport do you use for distribution?:……..

5. Cost of transportation for marketing? D----------

6. How much is the lowest price you sell your oyster per kg? D----------

7. How much is the highest price you sell your oyster per kg ?D----------

8 Any problem with marketing:……

……

Questionnaire on White Lime Producers

Oyster shell lime producer:……

Site: ---------- Date:-----/------/----- Respondent Number (.....)

Part 1: Information on the Respondent Respondent Number (.....)

1. Sex: Male ( ), Female ( ),

2. Age: ( ),

3. Marital Status:

Married----------

Single ----------
Divorced--------

Widowed--------

4. Number of household members: ----------
Number of dependent members: ----------

5. Ethnic group:
Mandika ----

Serrel-------

Jola ---------

Fula ---------

Wolof -------

Other --------

6. Nationality:

Gambian --------

Senegalese ------

Other ----------

7. Education:

Grade 1 – 6 ---------

Grade 7 – 9 ----------

Grade 10 – 12 ---------

Koranic school (Darah/Karanta) --------

Non formal education----------(explain)

None ------

8. Do you live in this village/town as a full time resident?

a) Yes ( ),

No ( ),

b) If yes in “a” above, how long?---------- Total years full time residence in the Gambia……..

How long have you been engaged in the production of lime from oyster shell?

Do you use only oyster shells to produce lime? (Please.explain)

Is this a difficult work?

Where do you get the oyster shells to make lime?

Do you buy them? Yes / No. How much do you buy them for?

Is it easy to get oyster shells?

Do you make the lime at the place the shell are produced or transport it to another place?

I f you transport it, how do you do that?

How much transportation cost do you incur?

If you make the lime on the site of the oyster shells how much do you incur to transport the lime to where you sell it?

What other materials do you need to burn shells and produce the lime?

How much do you spend in the production of the lime?

How much oyster shells do you use to produce a bag of lime?

What is the weight of a bag of lime?

For how much is a bag of lime sold for?

Do you think that this amount is a fair price?

Do you produce the lime alone or do others join in the work

If others join you, who are these people

Are these people paid or given a share

If paid or given a share, how much is this amount

How much do you sell a bag or quantity of lime?

Do you think this is fair price of not, and why?

Who are the buyers of the lime you produce?

Do you know if they buy them for direct use for re-selling?

If for reselling, how much do you know they sell it for?

What do you do with the money you get from producing lime from oyster shells?

Is lime production profitable?

If the raw materials are currently obtained freely, would you buy the shell for your lime production?

For how much are you willing to buy the shells?
What do you think about the oyster industry?

Do you think that the oyster resources are increasing or decreasing?

Do you think oyster harvesting is sustainable?

What are your concerns about the oyster industry (Probe to get more information)

Appendix 2: Generalised Chain of Activities in Oyster Harvesting, Processing and Marketing

ACTIVITY	DESCRIPTION OF PROCESS IN ACTIVITY	PLACE DONE	AVERAGE TIME TAKEN	RESOURCES USED	OBSERVATION
Preparation for the oyster harvesting trip	Assembling of harvesting paraphernalia and tools, wearing protective gear, loading tools onboard canoe and travel on canoe to harvest sites	Landing Site and onboard canoe to harvest sites	Between 3 and 20 minutes to prepare and 3 to 5 hours travel (depending on harvest ground)	protective clothing (layers of clothes, head gear, canoe, paddle, axe, baskets, gloves, live jackets, socks)	
Oyster harvesting	Scraping of whole oysters and clusters of oyster from attachments on mangrove root system (using axe and cutlass) placed into baskets in canoe while moving around the mangroves	Harvesting site (among mangrove roots system) while in or off the canoe in water	2 to 5 hours (depending on harvest site and density and accessibility of oysters)	Canoe, axe, cutlass, baskets, protective clothes (gloves, layer of clothes, lifejacket, socks)	
Cleaning of oysters	Dipping of whole oysters contained in basket into clean part of the river water to remove attached mud and other debris and placed into bags or large baskets	Harvesting area	10-20 minutes depending on quantity (some done while harvesting)	Basket, bag s, clean river water	
Transport and landing of oysters	Canoe is paddled back to landing site with harvested oysters in baskets/bags onboard	On canoe along river/streams	30 minutes to 5 hours depending on distance from harvest site, tide and prevailing wind and current direction	Canoe, paddle	
Unloading/discharge of	Oysters are unloaded from canoe at landing site on to sheets of joint empty bags if contained in baskets	Landing site	10 – 20 minutes	Basket/plastic pan, bags, sheets of opened	

ACTIVITY	DESCRIPTION OF PROCESS IN ACTIVITY	PLACE DONE	AVERAGE TIME TAKEN	RESOURCES USED	OBSERVATION
oysters from canoe	or bottom of canoe; or bags unloaded from canoe and transported to processing site			and joint together empty bags	
Preparation for boiling of oysters	"Clean seawater" is collected and filled into cooking drums, oysters are placed in cooking drum over the lighted fire	Processing site	10 -20 minutes	Pans or buckets, seawater, cooking drum, firewood, matches, raw whole oysters and cloth	
Boiling of oysters	Whole oysters are cooked/ steamed in sea water while covered in the cooking drum (to coagulate meat and soften muscles for shelling/ extraction process	Landing /processing site	30 to 45 minutes per batch	Cooking drum, burning firewood, raw whole oysters, old blanket	
Pouring out of oysters from boiling pan	With aid of a special pouring stick placed beneath the cooking drum with one hand and the other hand holding the rim, the cooking drum is tipped over spread-out empty bags used to sieve out the oysters ready for shelling	Processing site	3 to seven minutes	A pouring stick, piece of cloth or heavy gloves, sheet of joined pieces open empty bags	
Shelling/extracting and grading of oyster meat	Whole oysters are opened with knives to extract and separate the meat from the shell. Oyster meat is then collected in processing/ selling baskets and shells in pans or sheets of empty bags. In some processing sites large and small oysters are sorted into grades by separation into small, medium or large size oysters in the process	Processing site	5-8hours depending on quantity and may as well involve selling on site	Knife, gloves, baskets, pan or sheet of empty bags, cups	
Cleaning the processed oyster meat	Although not by all processors, oyster meat is washed by dipping and shaking in "clean sea water" from the streams, to remove debris and broken shells	Processing site	5-10 minutes	Baskets, seawater	

ACTIVITY	DESCRIPTION OF PROCESS IN ACTIVITY	PLACE DONE	AVERAGE TIME TAKEN	RESOURCES USED	OBSERVATION
Pasteurization of oyster meat	Although not a general practice , oyster meat is soaked in boiling fresh water with added salt to pasteurize and preserve the oyster meat.	Home	30 minutes to one hour	Cooking pot/ empty 20 litre pans	
Dripping and cooling of oysters	The hot oysters are placed in perforated local baskets and covered with light clean cloth (mosquito netting) and placed above ground to drip and cool down.	Home	30 minutes to 1hour or overnight.	Basket, clean mutton/netting cloth,	
Storage	The processed oysters (heat treated or not) is ready for marketing immediately or in most sites is often stored covered in baskets overnight for transport and marketing the following day	Home	Few minutes to overnight storage	Product in basket, covering cloth, cool ventilated place	
Transport to markets	Travel with product to urban markets and along roadsides to sell product. Product in selling basket covered with netting cloth is tied around with stronger cloth during transport	Private commercial vehicles and taxis	20 minutes to 1 hour time depending on market place of choice and location	Product in covered basket with measuring cup tied in, transport cost	Some sites are distant from markets, roads in poor conditions with transport vehicles irregular and scarce, thus journeys can take considerable time
Marketing of oyster meat	Selling of oyster meat to customers by measuring **(**milk cup equivalent of about 150 grams) from basket on to brown paper and wrapping at D15 (US$0.60) per cup.	At marketing point	1 to 10 hours depending on market and location. Could even take a day or two away from home	Marketing space, measuring cup, stool /sitting object to place basket with product and a seat for sitting down	Sometimes excessive time is spent selling the product