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WOMEN SHELLFISHERS AND FOOD SECURITY PROJECT

Selection of Locations for Site Based Research



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Photo credit: Development Action Association, Ghana

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ACRONYMS

CCM	Centre for Coastal Management
DAA	Development Action Association
DOPA	Densu Oyster Pickers Association
DPWM	Department of Parks and Wildlife Management, The Gambia
EEZ	Exclusive Economic Zone
IEZ	Inshore Exclusive Zone (of Ghana)
MOFAD	Ministry of Fisheries and Aquaculture Development, Ghana
MOFWR	Ministry of Fisheries, Water Resources and National Assembly Matters. The Gambia
NGOs	Non-Governmental Organizations
RAMSAR	The International Convention on Wetlands
TWNP	Tanbi Wetland National Park
UCC	University of Cape Coast
URI	The University of Rhode Island
USAID	United States Agency for International Development

1. INTRODUCTION

1.1 Purpose of this Report

This report provides documentation of the process used for selection of field research sites in The Gambia and Ghana for the Women Shellfishers and Food Security Project. Three sites were selected in each country based on a list of candidate sites generated. The report provides information on the criteria and process used for site selection, selected information on all the candidate sites, and a brief description of those sites selected for the in-depth field work. This report also is the milestone 2 deliverable required for submission to USAID. All the project implementing partners contributed to preparation of this report.

1.2 Project Background

In August 2020, USAID awarded the University of Rhode Island (URI) the Women Shellfishers and Food Security project. With USAID, URI co-created the project in partnership with the University of Cape Coast in Ghana, the University of Ghana, TRY Oyster Women's Association in The Gambia, and World Agroforestry. The Women Shellfishers and Food Security project will strengthen the evidence base, increase awareness, and equip stakeholders to adapt and apply successful approaches for replication and scale-up in the eleven coastal West African countries from Senegal to Nigeria. It will draw on successful cases of a rights-based, ecosystem-based, participatory co-management approach to shellfish management by women in mangrove ecosystems in The Gambia and Ghana developed with USAID assistance. Knowledge and experience generated through the project will open up opportunities for improvement and broader application of these promising approaches in West Africa through these key project activities:

- 1) Conduct the first-ever participatory regional assessment of the situation, needs, and promising approaches to shellfish co-management led by women across the eleven countries and the scope of the potential sectoral and cross-sectoral benefits.
- 2) Elaborate and test elements of models based on existing approaches through site-based research in The Gambia and Ghana to strengthen the evidence base for successful elements of the model.
- 3) Foster a community of practice around the development and dissemination of a toolkit on a rights-based, ecosystem-based, participatory co-management of shellfish by women in mangrove ecosystems in West Africa with and for community, national, and regional level stakeholders.

2. SITE SELECTION METHODOLOGY AND CRITERIA

Site selection involved the collection of secondary and qualitative field information on criteria for site selection as described in the program design. The criteria include:

1. Existing shellfish activity,

2. Significant involvement of women shellfishers,
3. Existing mangrove systems-based livelihoods,
4. A range of mangrove health conditions (level of degradation) and changes over time.

We used a purposive rather than random sampling approach for selection of sites. This approach was designed to produce sites that have significant variation in key outcome variables such as fisheries and mangrove health, nutrition, and anemia and treatment variables such as governance, gender dimensions, and women's empowerment. Purposive sampling is used since the characteristics of the entire population of estuaries regionally are not well known. This approach was also designed to be a rapid assessment utilizing secondary information available and expert opinion and local knowledge to identify candidate sites. Once candidate sites were identified, rapid field assessments were undertaken at candidate sites. World Agroforestry led the field assessment process in The Gambia while the University of Cape Coast led the process in Ghana, with other team members providing information and expert opinion. Once all the information was compiled, the research team held discussions for each country and made a consensus decision of the sites for the field research.

3. DESCRIPTION OF POTENTIAL SITES IN THE GAMBIA

3.1 A Brief Introduction to The Gambia Coastal Zone

The Gambia is one of the smallest countries in West Africa. It has a total land area of about 11,300 km², extending approximately 400 km eastwards with widths varying from about 80 km at the Atlantic coast to between 24 to 28 km in the east. It borders Senegal to the north, east and south and the Atlantic Ocean to west. The country is dissected by the meandering River Gambia which takes its source some 680 km upstream in the Fouta Djallon Highlands in Guinea Conakry, flowing 1,200 km through Senegal, The Gambia and then empties in the Atlantic Ocean (Satyanarayana et al., 2012).

The Gambia's coastal zone extends 80 km from Buniadu point and the Karenti Bolong in the North bank of the Gambia River to the mouth of Allahein River in the south (Jallow et al., 1999). It consists of both sheltered and open ocean coast, covering about 70 km and 200 km, respectively. Mangrove ecosystems and mudflats dominate the sheltered coast especially along the borders of the lower Gambia River. The coastal areas and their mangrove ecosystems have significant ecological importance. In The Gambia, the mangroves occupy nearly 581 km² (2.1% of the total mangrove cover in Africa) (Spalding et al., 2010). These mangrove ecosystems also play a pivotal role in sediment stabilization of the riverbanks. They also serve as feeding and nursery ground for various juvenile fish species as well as habitat for shellfish, primarily oysters and cockles. The four major mangrove species include *Avicennia africana*, *Rhizophora racemosa*, *Laguncularia racemosa*, and *Rhizophora mangle*.

The considerable pressure on mangrove ecosystems, due to natural and anthropogenic processes such as coastal erosion, urban development, overfishing, fuelwood collection, conversion to

agricultural fields and tourism/recreation (Simier et al., 2006) are key challenges facing mangrove ecosystem management. Anthropogenic activities are often a prime cause for mangrove degradation, leading to biodiversity losses (Kairo et al., 2002; Duke et al., 2000).

Communities use the mangroves as sources of wood and they also serve as a main habitat for oysters that they depend on for income generation and sometimes family consumption. Fish smoking and oyster steaming are the predominant fishery related wood consumption. This is in addition to the basic household energy needs. Mangrove wood commercialization is also a critical problem as wood needs for construction are increasing due to increasing population. That is how the entire rhun palm tree population around the wetland area was decimated as of late. Mangrove areas are also affected by land reclamation activities happening at the peripheries of the mangrove sites in areas close to urban areas (e.g. Tanbi) and settlements (e.g. Bulock). As a result of the land reclamation activities for settlement and hence construction of houses along the waterways, often sand inundation in the nontidal rice fields occurs. This results in diminishing livelihood returns pushing people to harvest mangroves for marketing as wood or charcoal. With the declining mangrove quality and area, oyster populations were reported to be declining further, putting the livelihood of the most vulnerable groups such as women and children at risk. In the past, rhun palm trees dominated the area surrounding the wetland but now all of those are gone and mangrove exploitation has intensified.

3.2 The Site Selection Process

A two-step process was followed for the site selection.

Step 1: There were six sites identified as potential research sites in The Gambia based on review of secondary published data and from expert opinion of individuals with local knowledge of The Gambia coastal areas (see Figure 1). These are discreet mangrove and estuarine systems separated from one another. All are adjacent to the Gambia River except one. Potential sites on the north bank of the Gambia River were not considered due to accessibility issues. The candidate sites selected for further inquiry included:

1. The Tanbi Wetland National Park and its surroundings.
2. The Allahein estuary near Kartong.
3. The Bafuloto mangrove system.
4. The Bulock mangrove area.
5. Bintang mangrove area.
6. Bwiam area.

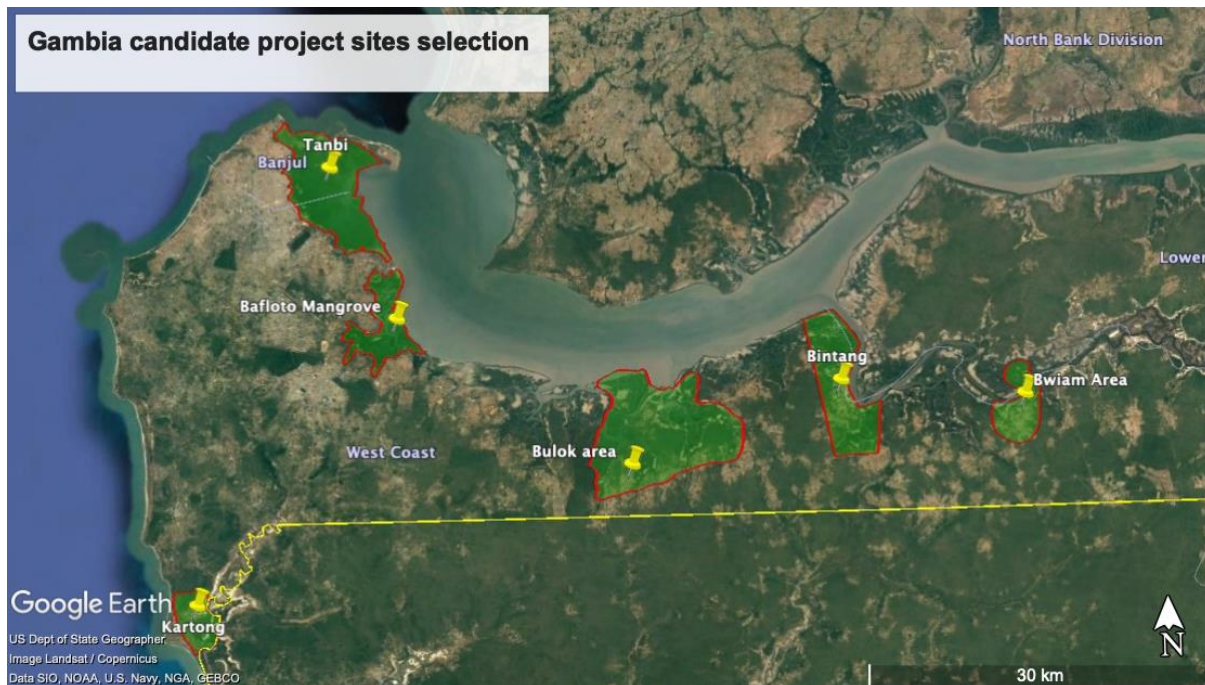


Figure 1: Location of the candidate sites in The Gambia.

Step 2. A rapid field assessment in the six candidate sites was conducted. For each site, we selected a number of village or communities where we conducted discussions with the community members. The assessment included:

- Talking to women and men shellfishers in the land-seascapes.
- Visits to the mangrove areas where the shellfishing activity happens.
- Visual overview of the mangrove health.
- Selective interviews on livelihoods, management of mangroves, threats, etc.

The rapid assessment was conducted over a one week period from 28th October to 03 November 2020. During this process, 28 villages (communities) around the six candidate sites were visited. Of the 28 villages, only 22 are engaged in shell fishing activity, which is one of the key criteria for site selection.

3.3 Results of the Field Assessments

Key informants at all candidate site locations indicated that shellfishing by women occurs, although the number of women engaged in shellfishing varies by site. In most cases, the individuals interviewed believe that there is significant overexploitation of the shellfishery resources except in Bintang estuary where a majority felt it is sustainable (see Table 1).

Table 1: Selected attributes of the candidate sites for The Gambia.

Candidate site	Number of villages assessed	No. of women shellfishers	Average no. of women shellfishers per village	Community perceptions of shellfishing intensity*
Tanbi	6	255	43	Overexploited (100%)
Bafuloto	3	47	16	Overexploited (100%)
Bulock	5	95	19	Overexploited (60%); Sustainable (40%)
Bintang	4	39	10	Overexploited (25%); Sustainable (75%)
Bwiam	2	26	13	Overexploited (100%)
Allahein	2	209	105	Overexploited (100%)
Total	22	671	~30	

* Percentages indicated are of the number of villages visited in each location.

Table 2 shows the dominant harvesting calendar for oysters taken from the estuary or mangrove ecosystems. The widely agreed period of harvesting is between December and June. Most of the interviewees highlighted that the harvesting calendar was guided by local regulations to safeguard the future of the livelihood activity by letting the small ones grow for the next season. In one community in the Bintang area, the harvesters are outsiders who come into the area during the harvesting season but do not permanently live in the area.

From mangrove-dependent livelihood perspectives, the most common is rice farming which occurs in wetland areas, followed by vegetable farming and fuelwood collection both for home use and sale. Of those communities that are shellfishing, two-thirds of them do rice farming, and almost one-half of the communities practice vegetable farming and also fuelwood collection.

Table 2: Harvest calendar of oyster as guided by local regulations.

Water body	Community/villages visited	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
		Tanbi estuary	Wencho				■	■	■	■			
Mandinari					■	■	■	■					
Jeshwang					■	■	■	■					
Daranka					■	■	■	■					
Lamin					■	■	■	■					
Abuko					■	■	■	■					
Bafuloto area	Bafuloto	■	■	■	■	■	■	■					
	Kunkujang	■	■	■	■	■	■	■					

Water body	Community/ villages visited	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	Kubuneh												
Bulock area	Bulock												
	Sutu Sinjang												
	Besse												
	Ndemban Chapechum												
	Berefet Bolong												
Bintang area	Bintang Group 1 (immigrants)												
	Bintang Group 2 (Locals)												
	Bulanjor												
	Bajilo												
Bwiam area	Kambong Madina												
	Dobong												
Allahein area	Kartong												
	Berending												

3.4 Sites Selected

Based on the assessments conducted, and after discussions among the project implementing partners, three sites were selected – the Tanbi, Bulock and Allahein estuaries (see Figure 2). The Bintang, Bwiam and Bafuloto sites were not selected for a number of reasons. Bintang is composed of resident and non-resident shellfishers who temporarily come to the area to do shellfishing. This would pose a challenge when developing a land-seascape vision based on which long term interventions will be planned. Bwiam was excluded because it has fewer women shellfishers who are the primary target groups of this project. Bafuloto was excluded as it had a relatively low number of women shellfishers. A more detailed description of each site selected is provided below.



Figure 2: Location of the research sites selected in The Gambia.

3.4.1 Tanbi Wetland National Park

Tanbi Wetland National Park (TWNP) consists of mangrove swamps that fronts the ocean to the north and the Gambia River to the east and stretches from Banjul to Mandinari. It covers an area of nearly 6,400 hectares (of which mangroves make up 4,800 hectares). It was declared a RAMSAR site (No. 1657) in February 2007, and then gazetted as a national park in 2008 (DPWM 2008). The impact of drought has caused several hydrological changes and ultimately changes in mangrove distribution in some areas (Diop et al., 2002).

It is an estuarine and intertidal forested wetland developed predominantly through the combination of deposition of fluvial and marine sediments. Its widest expanse is located to the west and south west of Banjul. It encompasses the fringes of the island of St. Mary at its Atlantic Ocean side and down south east towards Lamin and Mandinari Village.

The mangroves of Tanbi connect the Atlantic coast with the estuary of the River Gambia, and play crucial ecological functions including coastal stabilization, fish breeding, recreation, and crop production. A large portion of the Tanbi wetland complex is composed of several species of mangroves including the *Alder conocarpus*, *Avicennia africana*, *Laguncularia racemosa*, *Annona glabra* and the *Rhizophora*.

The key human activities in and around the park include shellfishing, vegetable gardening and rice production. During the dry season (December to June), women, who are mainly of the Jola ethnic group, engage in oyster harvesting from the mangroves. Firewood collection from the mangroves is also rampant in the area, making it possible for these women to cook and shuck the oysters, burn shells for lime production as well as to cook their meals. There is indiscriminate dumping of trash around the Jeshwang area, paving the way for pollution.

Women shellfishers in this area have been given exclusive use rights to the oyster and cockle fisheries by the Gambia government and authority to manage the shellfishery (MOFWR, 2012.) This is the first instance in sub-Saharan Africa for women shellfishers to be given these rights by a national government.

For this project, the specific part of the Tanbi that is selected as the research area covers the southern area from Abuko, Lamin, Kerewan, Mandinari and connections to the sea. The mangrove area (inclusive of the water bodies within the selected site) covers approximately 2550 ha. The northern parts of Tanbi are crowded by settlements (i.e. parts of Banjul city) and it is not possible to do extensive landscape level tree-based activities unless trees are only grown in homesteads which may not provide sufficient space. Households residing in the selected parts of Tanbi do have some agricultural activities which provide an opportunity for integrating trees for boosting nutrition and generating benefits.

3.4.2 Bullock Mangrove Area

The Bullock mangrove area is located in the West Coast Region of The Gambia, approximately 50 – 70 km from Banjul. The communities include Bullock, Sutu Sinjang, Ndemban Chapechum, Besse, Berefet. There are large areas of mangroves along the Bullock-Berefet stretch, with numerous creeks, which are locally called “*bolongs*”. The shallow water in these areas are important sources of fishing. Rice farming, vegetable gardening and firewood collection provide key livelihood activities in the area adjacent to the mangroves.

The coastal zone of some of this area is under threat due to anthropogenic human activities, mainly from mangrove cutting, resulting in physical loss of the ecosystem. Local grassroots efforts in Bullock and nearby communities are replanting mangrove saplings to help restore degraded areas.

For this project, the specific part of the Bullock site that is selected covers Bullock, Sutu Sinjang, Bessi, Ndemban Chapechum, Somita, Kandonk, and Brefet Bolon villages. The landscape selected is approximately 7427 ha with mangroves covering about 3539 ha.

3.4.3 Allahein Estuary

The Allahein River estuary is an area of high ecological importance. It supports communities from The Gambia and southern Senegal, who are separated by the water body, which has crossing points either by boat or on foot during low tide (Anonymous, 2014). The communities of Kartong and Berending

in The Gambia and others from Southern Senegal utilize the oyster and cockle resources for their livelihoods.

Shell fishing in such communities creates employment, income and revenue and provides food and nutrition security as well. Overexploitation of the oyster and cockle resources is a major challenge due to involvement of a large number of people harvesting these resources, in addition to the uncontrolled misuse of the mangroves. For this project, the specific part of the Allahein that is selected covers the Gambian side of the estuary with an estimated mangrove area of 424 ha (including the water body) within a landscape covering 1133 ha.

3.5 Synthesis of Data Comparing Across the Selected Research Sites

Table 3 summarizes the main features of the three sites selected. It is important to note that the estimated area of mangroves is tentative since a comprehensive spatial analysis has not been done.

Table 3: Summary attributes of the sites selected for The Gambia.

Site	Shellfishing activity	Average number of women shellfishers per village	Estimated mangrove area in the site	Livelihood connectivity with mangroves	Mangrove condition	Key factors affecting mangroves	Governance aspects
Bulock area	Oyster, crab, Cockles,	19	3539 ha	Rice farming, vegetable gardening, Firewood collection	Less degraded	Harvesting, settlements expansion (Land reclamation), die back, pollution	Local regulations of harvesting shellfish are present.
Tanbi Wetland complex	Oyster, crab, Cockles,	43	2550 ha	Rice farming, vegetable gardening, Firewood collection	Moderate (location specific)	Harvesting, settlements expansion (Land reclamation), die back, pollution	National park and Ramsar site, hence, enjoys some degree of management though weak. Women are given exclusive use rights.
Allahein Estuary (Kartong)	Oyster, crab	~100	424 ha	Vegetable gardening, Firewood collection	Highly degraded	Harvesting, settlements expansion (Land reclamation), die back	Shellfishing groups exist but no properly functioning governance structure is in place.

4. DESCRIPTION OF POTENTIAL SITES IN GHANA

4.1 A Brief Introduction to Ghana's Coastal Zone

The Republic of Ghana is a coastal West African nation with very high commercial activity along its coastal zone. The land mass of the country covers an area approximated to be 238,535 km², of which about 6.5%, i.e. 25,505 km² represents the coastal zone. The coastal zone of Ghana is defined in the country's Coastal Zone Indicative Plan as the "line joining the landward limits of lagoons, lagoonal depressions, marshes and estuarine swamps together with the intervening interfluvial areas." The seaward limit of the coastal zone is suggested variously as the edge of the continental shelf, the sublittoral fringe, the 200nm Exclusive Economic Zone (EEZ) or the extent of the artisanal fishing zone otherwise the Inshore Exclusive Zone (IEZ) (Wiafe et al., 2013).

Ghana's coast is bordered by Côte d'Ivoire and Togo to the West and East respectively and Burkina Faso to the North. To the south of Ghana lies the Atlantic Ocean, which washes along the 550 km stretch coastline of the country and borders four of the sixteen administrative regions of the country. These four coastal regions are the Western, Central, Greater Accra and Volta Regions. Major coastal cities include Cape Coast, Sekondi-Takoradi, Kasoa, Tema and the capital Accra. Cape Three Points and Cape St. Paul on the west and east, respectively, are two iconic features of the coastal topography of Ghana.

Based on different geomorphological characteristics, the coast of Ghana has been divided into Eastern, Central and Western coasts. The high-energy-waves Eastern sandy coast stretches about 140km, the Central coast spans 310km of shoreline (representing a medium energy environment with embayed coasts, rocky headlands and sand bars intermittently enclosing coastal lagoons) and the low energy beach Western coast covers 90km of shoreline (Boateng et al., 2017). All of these sections are interspersed with coastal aquatic ecosystems, that is, lagoons, estuaries, mangrove vegetation, mud and tidal flats, and marshlands, among others. The estuaries of Ghana's coast are mainly formed by rivers and streams flowing into the Gulf of Guinea. The largest man-made lake in the world, formed by the damming of the Volta River for hydroelectric power generation, empties into the Gulf of Guinea at the Volta Estuary in Ada Foah. The rivers Pra, Ankobra, Amisa, Narkwa, Ayesu, Butre, Kakum and Densu all flow into the sea through lagoons and estuaries of Ghana's coast while the Tano River enters the sea through a lagoon at the Ghana/Côte d'Ivoire border.

Although Ghana's coastal zone, which extends from the shore to the 30 m contour landward, occupies only about 6.5% of the land area, it houses over 75% of industrial establishments and serves as residence to about 25% of the nation's total population, many of whom depend directly or indirectly on the natural resources therein for their livelihoods and income. The coastal cities receive most rural migrants due to the numerous job opportunities and relatively higher standards of living although there are some poor areas along the coast. Economic activities of the coast include fishing

and crop production, coconut plantations, livestock rearing, aquaculture, quarrying, solar salt production, oil and gas exploration, and tourism. Many seafood and coastal resources including mangroves are extracted for subsistence and also at commercial scales. Artisanal fishing takes the central stage of coastal livelihoods providing jobs to approximately 10% of the close to 30 M people in Ghana, directly and indirectly.

Mangroves are a conspicuous vegetative cover occupying 14,000 ha of the coastal zone of Ghana and fringing the lagoons, estuaries and coastal marshlands (see, Ajonina et al., 2014). Their distribution is sparse with a range of conditions. For instance, they are generally healthy in the Western region with evident degradation in some areas emanating from cutting for fuelwood. In other places they are highly degraded such as in the Densu estuary due to cutting for fuelwood, brush parks¹ and conversion to salt pans, among other anthropogenic pressures. They are more prevalent along the eastern coastal areas of Ghana especially at the Volta delta whereas smaller covers occur along the western coastline in areas such as the Amansuri River estuary and Kakum River estuary at Iture.

The species of mangrove found along the Ghana coast are the red mangroves, *Rhizophora racemosa*, *Rhizophora mangle* and *Rhizophora harrisonii*; the white mangroves *Avicennia germinans* and *Laguncularia racemosa* as well as the closely associated mangrove fern *Acrostichum aurerum*; and mangrove shrub *Conocarpus erectus* (Ajonina et al., 2014). The mangrove areas of Ghana form highly productive coastal ecosystems that provide ecological services to marine and brackishwater fauna and flora; bivalves, gastropods, crustaceans, invertebrates, birds and fish. These species are often harvested as food and traded for income for coastal households.

4.2 The Site Selection Process

A purposive site selection exercise was conducted to identify a number of potential research sites and, among the lot, further select three sites along the coast of Ghana for the in-depth study. This was done in line with the criteria outlined in the scope of work for this activity, which includes (1) Existing shellfish activity, (2) Significant involvement of women shellfishers, (3) Existing mangrove systems-based livelihoods, and (4) Healthy, moderately, and unhealthy biophysical status of the mangroves. As an initial step, secondary data on coastal ecosystems were elicited through desktop review of available literature using these criteria as search terms. The search was also guided by expert knowledge on the state of shellfishing and mangrove resource affairs from the Centre for Coastal Management (CCM), University of Cape Coast (UCC) as well as consultations with related local non-governmental organizations (NGOs).

A total of sixteen sites were listed and field visits were carried out from October 22- 27, 2020 to establish the current status in locations unfamiliar to UCC. A selection matrix was then developed out of both secondary data and field assessment reports. During the field visits, some observations

¹ A brush park is a collection of cut tree branches or cut brush assembled in an area of an estuary to attract fish as a form of temporary artificial habitat. After several months, a net is placed around the area, the brush removed and fish harvested.

were made to confirm variables of interest such as the extent of shellfisheries and mangrove health, food systems of adjacent landscapes, accessibility of the sites, governance and gender dimensions of shellfishing activities. Brief semi-formal interviews were also conducted to further understand the nature of shellfish and mangrove livelihoods in the communities. Heaps of shells in the villages adjacent to the estuaries were in many instances first signs of existence of shellfishing activity in the various communities visited.

The following are the listed candidate sites from the literature review and expert opinions. The geographical locations of all sixteen candidate sites are shown in Figure 3.

- | | |
|---------------------------------------|------------------------|
| 1. Anyanui (Volta Delta) | 9. Amissano Estuary |
| 2. Tunu/Gblife (Volta Delta) | 10. Benya Lagoon |
| 3. Keta Lagoon | 11. Pra Estuary |
| 4. Ada Foah (Volta Estuary) | 12. Whin Estuary |
| 5. Big Ada (Agogpkor) (Volta Estuary) | 13. Ankobra Estuary |
| 6. Jange Lagoon | 14. Azuleloanu Estuary |
| 7. Densu Estuary | 15. Anyinzili Wetland |
| 8. Narkwa Lagoon | 16. Domunli Lagoon |

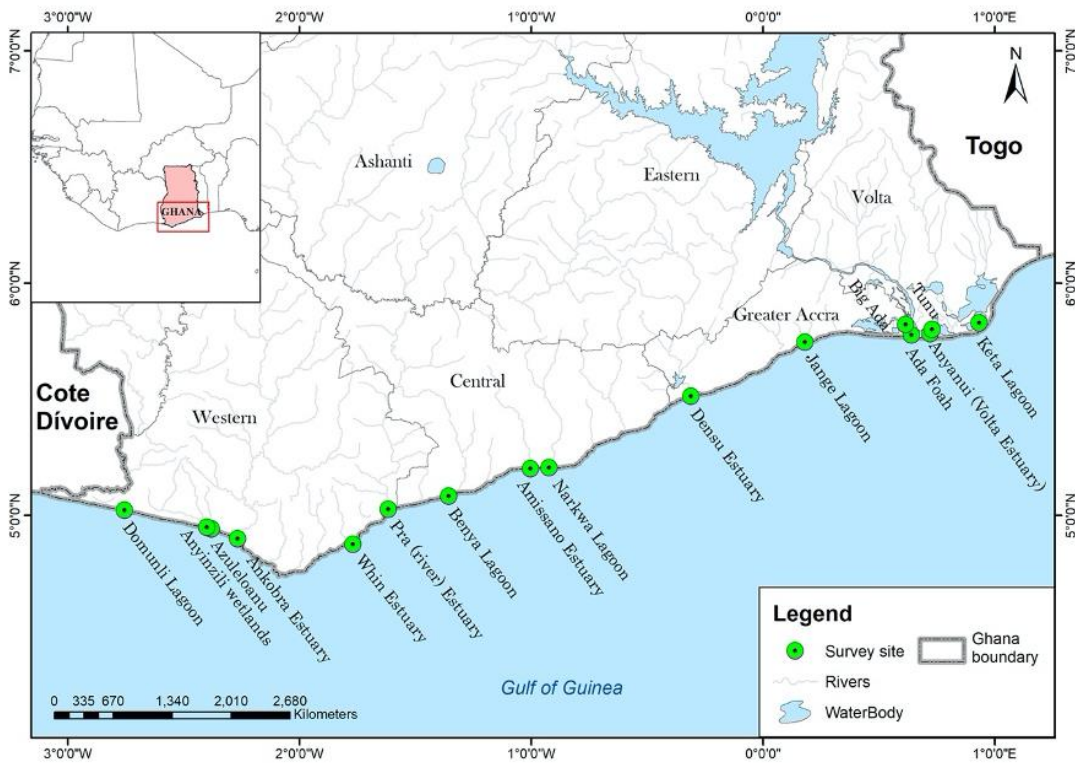


Figure 3: Geographic locations of the candidate sites in Ghana.

4.3 Results of the Field Assessments

Buttressing the secondary data gathered remotely, the field visits revealed appreciable levels of shellfishing activity in some of the visited sites, and where there was not, there were accounts of historically existing populations of some shellfish, especially bivalves, that have been decimated. The reasons are not fully known by the community. Sites where onsite field assessments were conducted but not selected as field sites are described below.

4.3.1 Anyanui (Volta Estuary)

Anyanui is one of the communities fringing the deltaic sections of the River Volta Estuary. Mangrove wood trade is a notable livelihood activity in this community (see Figure 4). In the estuary, dense oyster colonies were observed on the stilt roots of the large expanse of mangrove vegetation in this community. There were also reports of bottom colonies of oysters by interviewees. However, there is very minimal regular harvesting of the oysters. The oysters are usually harvested by the community during lean fishing seasons. Periwinkles are the more preferred shellfish frequently harvested from this section of the Volta Estuary. The meat of the periwinkles is either consumed as food or used as bait for fishing.



Figure 4: Mangroves are harvested and traded for various purposes at the Anyanui community.

4.3.2 Gblife/Tunu (Volta Estuary)

Gblife and Tunu are small villages next to Anyanui. Here also, there are oysters on the bed of the estuary and attached to the roots of mangroves. Both men and women harvest oysters. The abundance of oysters is seasonal, determined by the rains. According to a community informant, oysters are more abundant during the rainy season. The women harvest and sell them at the nearby Anloga market. Those harvested from the mangroves are brought to the bank and shucked immediately whereas those harvested from the bottom are sometimes kept in the water overnight and processed later. Larger sized oysters are harvested from the bottom. Similar to the Anyanui area, periwinkles are harvested from the estuary for food and as bait for other fish. There were accounts of an individual (a foreigner) who previously bought oysters from the women for export, but no longer. Some men engage in harvesting and sell the oysters to women. Other species harvested include shrimps, prawns and crabs. The shells of the oysters are mixed with mud as concrete and also converted to lime and used for whitewash.

4.3.3 Keta Lagoon

The site visit zoned in on the Adzido-Kedzi stretch of the Keta Lagoon based on prior information of shellfishing activity in this area. This section has very little mangrove cover. Cockles (*Anadara senilis*) and whelks are the main shellfish of commercial importance in the lagoon and they are most heavily exploited in the lean fishing season as a supplementary livelihood. Harvested shellfish are processed (by steaming/boiling and shucking the meat) for food and/or sold at the nearby Keta or Anloga markets. Harvesting is done by both men and women, the latter forming the majority, and processing is done primarily by women.



Figure 5: A heap of crushed whelk shells (right) and a pile of empty cockle shells (left) in the Kedzi community.

4.3.4 Ada Foah (Volta Estuary)

There was no shellfishing activity in this community.

4.3.5 Big Ada (Agogpor) (Volta Estuary)

The Agokpor community in Big Ada was characterized by heaps of clam shells, indicating the importance of the Volta clam to the community. This section is located at the upper reaches of the Volta River Estuary, thus, very low in salinity, mostly freshwater. Women are seldom involved in the harvesting of clams but are solely involved in their processing and marketing.



Figure 6: Heaps of clam shells in the Agogpor community, Big Ada.

4.3.6 Jange Lagoon

The observation at the Jange Lagoon at Old Ningo in the Greater Accra Region was quite contrary to previous reports that indicated thriving populations of shellfish, especially oysters, in the lagoon. There were only a few tiny live oysters amidst old shells in the lagoon at the time of the visit. The mangroves are almost completely depleted and there was no active shellfishing in the lagoon.

4.3.7 Amissano Estuary

The Amissano community near Mankessim in the Central Region of Ghana derives its name from the River Amissa which discharges into the sea at the southernmost end of the community. This community has mangroves swamps with portions converted into salt pans for solar salt mining. The mangroves serve as habitat for quite a significant population of oysters. The estuary has other shellfish including shrimps and crabs. Oysters are also found on the rocky bottom portions of the estuary. Harvesting of shellfish is done by both men and women.

4.3.8 Pra Estuary

The Pra Estuary is currently in a degraded state with a very turbid riverine feed. The estuary provides direct livelihood and support to about 10,000 people through fishery-related activities (MOFAD, 2018). However, there is limited evidence of a recent shellfishery in the Pra estuary. Historic data indicates an abundance of the oyster *Crassostrea tulipa* about seventeen years ago but the species is

rarely encountered in the estuary at the moment, attributable to the siltation of the estuary due to upstream gold mining activities. At the time of field visit to the site, there was no evidence of shellfishing within the estuary. There is, however, some mangrove cover along the banks and tributaries showing some degradation, and with some restoration attempts by local non-governmental organizations.

4.3.9 Ankobra Estuary

Shellfish of the Ankobra Estuary include some oysters, periwinkles and shrimps. The oysters are usually not harvested. It's mainly the periwinkles that are harvested. Also, shrimp are harvested from the estuary by men and processed by women. The thick mangrove cover fringing the estuary extends upstream and merges with upland forest areas.

4.3.10 Azuleloanu Estuary

Shellfishes in the Azuleloanu Estuary are comprised of oysters, periwinkle and cockles and are harvested mainly by women. The cockles are sold in the community and sometimes at the nearby Eziam market, likewise the oysters. Oysters are seasonal whereas the periwinkles are more readily available year round. Flood waters during heavy rainfall events usually hamper the harvesting of oysters as women are unable to access deep areas of the estuary. There is a ready market for harvests.

4.3.11 Anyinzili Wetland

This wetland area in the Bakanta community in the Western Region is formed by the discharge of a tributary of the Ebi River. The river joins the Azuleloanu before entering the sea. Together, they form the Greater Amanzule Wetlands. The main shellfishes in the wetland are oysters and periwinkles. There is very minimal harvesting of oysters. Mainly harvesting of periwinkles by young women.

4.3.12 Domunli Lagoon

The Domunli lagoon is located in the Domunli Wetlands Complex. It has about 120 ha of mangroves, mainly *Rhizophora*, *Avicennia* and the *Laguncularia*. Adjoining the mangroves are freshwater swamp forests covering 161 ha of land (Hen Mpoano, 2017). Periwinkles are available in abundance in the Domunli Lagoon and its harvesting and trade is the main shellfishing business on the lagoon. There was not a significant population of oysters at the lagoon during the field assessment. Accounts of an interviewee indicated that historically thriving populations, which community members used to access and harvest with ease, had disappeared with only a few small-sized oysters observed on mangrove roots now. Many empty oyster shells were seen on the bottom of shallow areas of the lagoon. This is indicative of mass mortalities of oysters, probably caused by long periods of freshwater influx, or to hyper-salinity of the lagoon, as a salinity reading of 50 ppt was taken at the time of visit. The mangrove vegetation is near pristine as there is no active harvesting for any form of domestic or commercial use. There has also been some community sensitization on the conservation of mangroves, through which the community appear to have gained some level of awareness on not harvesting mangroves.

4.4 Sites Selected

Considering the criteria mentioned in section 4.2, the project team selected the Densu Estuary (Greater Accra Region), Narkwa Lagoon (Central Region) and Whin Estuary (Western Region) as the preferred sites for the in-depth research in Ghana. Key parameters for the selection were the extent of shellfishing activity at the sites, the scale of women's involvement in the fishing and the existence of mangrove vegetation directly or closely related to the shellfishery of the site. Expert knowledge project partners at the CCM-UCC and research activities at the Department of Fisheries and Aquatic Sciences-UCC over the last five years as well as the available literature favored these sites as the most significant regarding women-led shellfishing activity. A cursory assessment of the mangrove health in these three sites provides a spectrum of low, moderate, and high health relative to each other. It is worth mentioning, however, that sites located within the deltaic sections to the east of the Volta Estuary, i.e. Anyanui, Tunu and Gblife, are promising sites with the largest expanse of mangrove cover and impressive availability of shellfish but where shellfishing activity is very low.

4.4.1 Densu Estuary

The greater Densu Delta is a RAMSAR site designated in August 1992 and located west of Accra in the Greater Accra Region. The Delta covers an area close to 6,000 ha. It is located west of Dansoman, south of Mallam, McCarthy Hill and Aplaku, and east of Bortianor. The wetland receives water mainly from the Densu River, which supplies water to approximately half of the Accra metropolitan area. The southern section of the Delta is estuarine (Fig. 7) where it empties into the sea at different locations depending on the season. Sparse mangroves stands are found in some areas around the estuary, while the freshwater parts of the wetland support stands of Typha, Imperatagrasses, and Cyperus sedges. The area has been estimated to provide feeding and nesting grounds for over 57 water bird species; comprising the little egret *Egretta garzetta*, common ringed plover *Charadrius hiaticula*, Curlew sandpiper *Calidris ferruginea*, and the rare roseate tern *Sterna dougallii*.

The immediate surrounding communities are predominantly fishing communities. Its location is in a cosmopolitan area with fast urbanization leading to encroachment in the northern parts of the wetland. Inhabitants of Bortianor, Tsokome, Tetegu, and Faana communities use the water areas of the Delta for navigation and tourism purposes. These communities depend heavily on the estuary for commercial fishing, fuelwood harvesting and salt mining. The Densu Delta provides suitable habitat for a significant population of oysters found on bottom habitat. Oyster harvesting is a major livelihood for the women, supported by their children (see Fig. 8). The oyster beds are sometimes exposed at low tide.



Figure 7: Satellite image of the Densu Delta with shellfishing area and mangrove interface demarcated. (Image Source: Google Earth)



Figure 8: Various scenes from the Densu Estuary where (A) the oyster bed is exposed at low tide. (B) An oyster picker harvests oysters by hand into a canoe at high tide. (C) Women and their children harvesting oysters from an oyster bed and being placed into buckets and pans at low tide. (Source: Chuku, 2019)

There is an increasing number of oyster shellfishers in the estuary and the time spent to collect the same amount of shellfish year-on-year is increasing (Janha et al., 2017). Men fish with seine and small gills nets and use brush parks, usually landing very small sized fish and juveniles. There are about 150

women and 10 men oyster harvesters/divers. The men are responsible for harvesting oysters from depths ranging from one to two meters, whereas the women and their children harvest from shallow areas at low tide. The oyster fishery is currently regulated by a community-based management plan by the Fisheries Commission of the Ministry of Fisheries and Aquaculture Development of Ghana, developed with the assistance from the Development Action Association (DAA), a community NGO. A Densu Oyster Pickers Association (DOPA) has been formed and officially registered and the management plan grants them use rights to the oyster fishery. A closed oyster fishing season is observed for a total of six months every year from November to April and July-August. The plan, although yet to be signed by the Minister of Fisheries, is being implemented by the Association and respected by formal and traditional local authorities. There have been oyster aquaculture experimental trials conducted in the estuary by UCC. Hunger and dietary diversity are low for the communities around the Delta. Preliminary results of a study by URI and Univ. of Ghana shows high levels of anemia among shellfishers.

4.4.2 Narkwa Lagoon

The Narkwa Lagoon is located south of the Ekumfi Narkwa community in the Ekumfi District of the Central Region of Ghana. Narkwa lagoon is formed by the flow of one of the two main tributaries of the Okye River which discharges into the sea through the lagoon. Conservatively, the lagoon covers about 110 ha of estuarine and littoral vegetation (mainly mangroves) in the north-eastern section of the lagoon. The mangrove cover fringing the north-eastern bank of the lagoon is not dense but with little exploitation; thus, it could be described as being moderately healthy. The lagoon serves as an important food source for the local people whose primary occupation is artisanal marine fishing. A salt factory situated north of the community draws water from the lagoon for salt production.

Fish species of the lagoon are often used for subsistence, unlike the catches from the sea that are commercially sold and some kept for home consumption. Important food fish of the lagoon include finfish such as black chin tilapia *Sarotherodon melanotheron* and shellfish such as the bloody cockle *Anadara senilis* and mangrove oyster *Crassostrea tulipa*. The finfish are mostly harvested by men whereas women dominate the shellfish harvesting. Women consisted of about 89% of shellfishers in a survey conducted in 2016 (Asare et al., 2019) whereas the cockle harvesting involves some substantial participation by men. The estimated number of people involved in these fisheries is yet to be assessed. There is a section of the Narkwa community, the south-eastern area, where the people's livelihood is primarily based on oyster trade; harvesting, processing, and marketing. These species are harvested from the bottom of the lagoon; oysters from sandy-mud areas and cockles from relatively muddy areas.



Figure 9: Satellite image of the Narkwa Lagoon with shellfishing area and mangrove interface demarcated. (Image Source: Google Earth)



Figure 10: Women harvesting oysters from the Narkwa Lagoon by (A) bending to reach the bottom of the water and collecting them by hand into pans; (B) their children help carry oyster-filled pans back home. (Source: Chuku, 2019)

Although there is no legal regulation of access and use rights of the fishery in the lagoon, there is the blanket no-fishing Tuesday traditional regulation. The effectiveness of this customary law, is at the moment, based on voluntary compliance. The oyster population at Narkwa are heavily exploited every year during the dry season by the oyster pickers who conventionally, by no formal regulation, cease oyster fishing during the rainy season. The oyster harvest season spans from November/December to May/June. Harvesting intensifies at the onset of the rains in May-June for fear of mass mortality of the oysters from freshwater influx from the riverine source. During this oyster fishing holiday period in the rainy season (June/July-October/November), the oyster stock of the lagoon rebuilds naturally and the cycle continues. Oyster aquaculture experimental trials in the lagoon showed the oysters at Narkwa to exhibit faster growth compared to those cultured at Densu and Whin estuaries.

The farming of staple food crops, i.e. maize, cassava, cocoyam and plantain is a secondary occupation for the people of Narkwa. Nonetheless, the community falls within the region (Central) reported to have about 19% of people in phase 2 category (under pressure) of food insecurity, the highest in the country. Children under five in Ekumfi Narkwa are reported to depend on abundant food groups (more of fleshy foods) as diet, with consumption of fruits and vegetables being low.

4.4.3 Whin Estuary

The Whin Estuary is accessed through the New Amanful community near Takoradi in the Ahanta West District of the Western Region of Ghana (see Figure 11). The estuary orients itself oblique to the sea, relative to the shoreline at its narrow mouth. It is a shallow system with a few deep areas. The Takoradi Airport is located about 1.5 km north-east of the estuary. The surrounding communities depend on the Whin Estuary for their livelihoods, mainly finfish and shellfish harvesting. Fishers from Adakope, Kokompe, New Amanful and sometimes the residential estate area, also known as Beach Road, obtain their livelihood and income from the estuary.

The Whin estuary supports a diverse fish community. Fish species of marine origin dominate the fish biota in the estuary. These include *Liza falcipinnis*, *Liza dumerilii*, *Mugil bananensis*, *Mugil cephalus*, *Mugil curema*, and *Sardinella maderensis*. Oyster harvesting is the main shellfish-targeted fishery in the estuary. Other shellfish include mussels, shrimps, and some estuarine gastropods. Women are the main harvesters of the oysters whereas shrimp form part of the species fished by men in the estuary. There are about 80 women oyster harvesters in the surrounding communities (Atindana et al., 2019). Access and use rights of the fishery in the Whin estuary is also customary (no-fishing Tuesday) with compliance deteriorating over the years because there are no punitive measures for flouting this law. There have been some oyster aquaculture experimental trials in the estuary.



Figure 11: Satellite image of the Whin Estuary with shellfishing area and mangrove interface demarcated. (Image Source: Google Earth)

There is dense mangrove vegetation surrounding the estuary, which is considered healthy relative to those of Densu and Narkwa. Active cutting of the mangroves is evident at a few sections for various purposes including trimming under electricity lines and for fuelwood. In 2014, the Western Region reported 8% of people in phase 2 category (under pressure) of food insecurity, thus communities around the Estuary could be within similar category.

4.5 Synthesis of Data Comparing Across the Selected Research Sites

Figure 12 shows the locations of the sites selected, and Tables 4 and 5 below show a comparison of information concerning the three sites selected in Ghana. All have a substantial number of women oyster harvesters and they report a range of mangrove health conditions. The Narkwa and Whin estuaries have similar seasonal harvesting periods whereas the Densu estuary shows a different pattern that includes a formal closed season from November to May, and a short closure in July-August declared and controlled by the river priest.

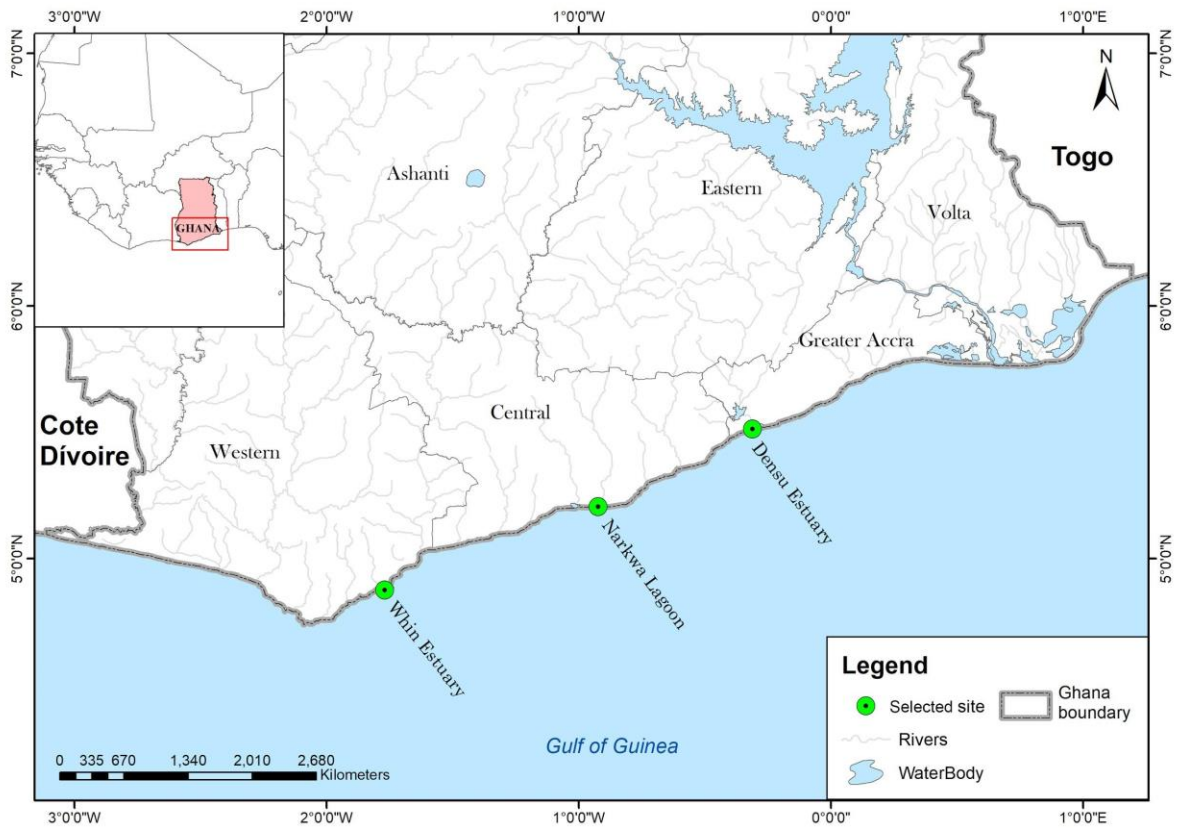


Figure 12: Geographic locations of the selected sites in Ghana.

Table 4: Conventional harvest calendar for oyster fishing in selected sites for Ghana.

Water body	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Densu Estuary					■	■	■	■	■	■		
Narkwa Lagoon	■	■	■	■	■	■					■	■
Whin Estuary	■	■	■	■							■	■

Table 5: Summary attributes of the sites selected for Ghana.

Site	Shellfishing activity	Number of women shellfishers for the site	Estimated littoral mangrove and water body area	Livelihood connectivity with mangroves	Mangrove condition	Key factors affecting mangroves	Governance aspects	Nutrition Information
Densu Estuary	Oysters	~150	~206 ha	Brush parks - culture-based fishing; Firewood collection; Salt mining	Highly degraded	Harvesting, settlements expansion (Land reclamation)	Ramsar protected site with weak enforcement; Co-management policy for oyster harvesting active – yet to be legislated	Coastwide increase in fishing dependent households of moderate and severe hunger during the artisanal and inshore fishing closure period. Increase in low dietary diversity during artisanal and inshore fishing closure period. The consumption of six food groups (“other vitamin A rich fruits and vegetables”, “other fruits and vegetables”, organ meat, meat and fish, legumes and nuts, and milk and milk products) in the period during the artisanal and inshore fishing closure low.
Narkwa Lagoon	Oysters Cockles Shrimps	Unknown [60 % of 60 people interviewed were involved in oyster harvesting and trading (Asare et al., 2019)]	~110 ha	Crop farming (maize, cassava, plantain); Salt mining	Moderate (low density of naturally occurring mangrove)	Harvesting, settlements expansion (Land reclamation), die back, pollution	Open access fishing; Customary law – no-fishing Tuesday (low compliance)	Central region was ranked as a food insecure region in the country. Dietary diversity among children 6-59 months of age is low. Only about 11% of children consumed vitamin A rich foods and 47% of children met the minimum dietary requirements

Site	Shellfishing activity	Number of women shellfishers for the site	Estimated littoral mangrove and water body area	Livelihood connectivity with mangroves	Mangrove condition	Key factors affecting mangroves	Governance aspects	Nutrition Information
Whin Estuary	Oysters Shrimps Periwinkles	~80	~178 ha	Firewood collection; Bivalve shell trade	Less degraded	Harvesting, settlements expansion and tourism, pollution from sewage	Open access fishing; Customary law – no-fishing Tuesday (low compliance)	Coastwide increase in fishing dependent households of moderate and severe hunger during the artisanal and inshore fishing closure period. Increase in low dietary diversity during artisanal and inshore fishing closure period. The consumption of six food groups (“other vitamin A rich fruits and vegetables”, “other fruits and vegetables”, organ meat, meat and fish, legumes and nuts, and milk and milk products) in the period during the artisanal and inshore fishing closure low.

5. SYNTHESIS OF INFORMATION AND SITES SELECTED

The following table shows information on all of the candidate sites in both the Gambia and Ghana, including those selected and not selected for the site based research.

Table 6: Matrix of Criteria per Candidate sites in The Gambia and Ghana.

Site	Existing shellfish activity	Significant involvement of women shellfishers	Existing mangrove systems-based livelihoods	Mangrove health
<i>Selected sites</i>				
Tanbi, The Gambia	Yes cockles and oysters	Yes	Yes Firewood collection	Moderately healthy with degradation on the fringes and some internal areas
Bulock, The Gambia	Yes cockles and oysters	Yes	Yes Firewood collection	Healthy compared to other sites from The Gambia
Allahein, The Gambia	Yes cockles	Yes	Yes Firewood collection	Moderately healthy with significant degradation over time due to human exploitation
Densu Estuary, Ghana	Yes oysters	Yes	Yes	Unhealthy (relative to other selected sites for Ghana) Mangroves almost completely degraded; restoration attempts underway by DOPA
Narkwa Lagoon, Ghana	Yes oysters	Yes	Yes	Moderately healthy (relative to other selected sites for Ghana) Cutting of mangroves for salt mining operations
Whin Estuary, Ghana	Yes oysters	Yes	Yes	Healthy (relative to other selected sites for Ghana) Mangrove harvesting for fuelwood and under electricity cable lines

Site	Existing shellfish activity	Significant involvement of women shellfishers	Existing mangrove systems-based livelihoods	Mangrove health
<i>Rejected Sites</i>				
Bafuloto, The Gambia	Yes oysters, cockles	Yes	Yes	Unhealthy and degraded
Bwiam, The Gambia	Yes, but few harvesters	Yes (a few)	Yes	Healthy
Bintang, The Gambia	Yes, oysters largely	Yes, both by local women and those come from other areas	Yes	Moderately healthy
Anyanui-Tunu-Gblife Enclave (Volta Delta), Ghana	Yes Periwinkles, shrimps, oysters	Yes (very few)	Yes	Healthy
Keta Lagoon, Ghana	Yes Cockles, whelks	Yes (very few)	No	Unhealthy
Ada Foah, Ghana	No	No	No	Moderately healthy
Big Ada, Ghana	Yes Clams	No Mainly men harvest and women process and sell	No	Moderately healthy
Jange Lagoon, Ghana	No	No	No	Unhealthy
Amissano Estuary, Ghana	Yes Oysters, shrimps	Yes (very few)	Yes Salt mining	Moderately healthy
Benya Lagoon Ghana	Yes Oysters, cockles	No	Yes Salt mining	Healthy
Pra Estuary, Ghana	No	No	Yes Harvesting for fuelwood	Unhealthy

Site	Existing shellfish activity	Significant involvement of women shellfishers	Existing mangrove systems-based livelihoods	Mangrove health
Ankobra Estuary, Ghana	Yes (very low) Periwinkles, oysters	Yes (very few)	Yes Harvesting for fuelwood	Moderately healthy
Azuleloanu Estuary, Ghana	Yes (very low) Periwinkles, oysters	Yes (very few)	Yes Harvesting for fuelwood	Moderately healthy
Anyinzili Wetland, Ghana	Yes (very low) Periwinkles	Yes (very few)	Yes Harvesting for fuelwood	Moderately healthy
Domunli, Ghana	Yes Periwinkles	Yes	No	Healthy

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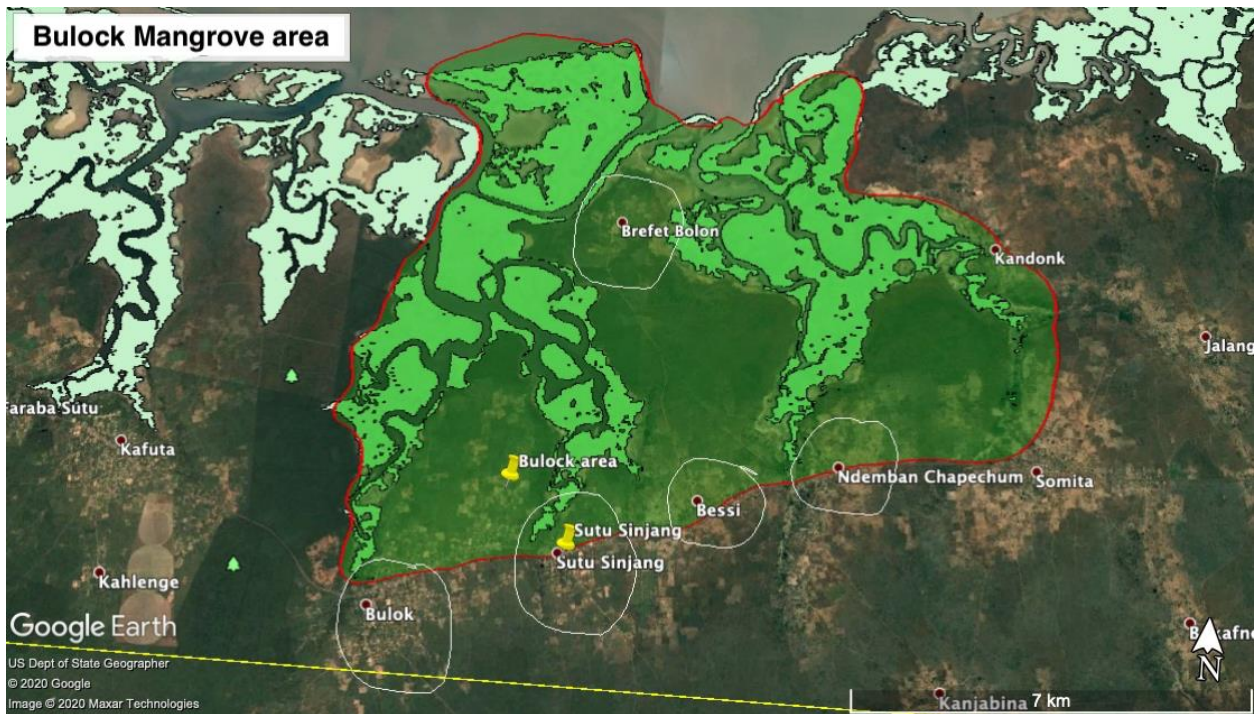
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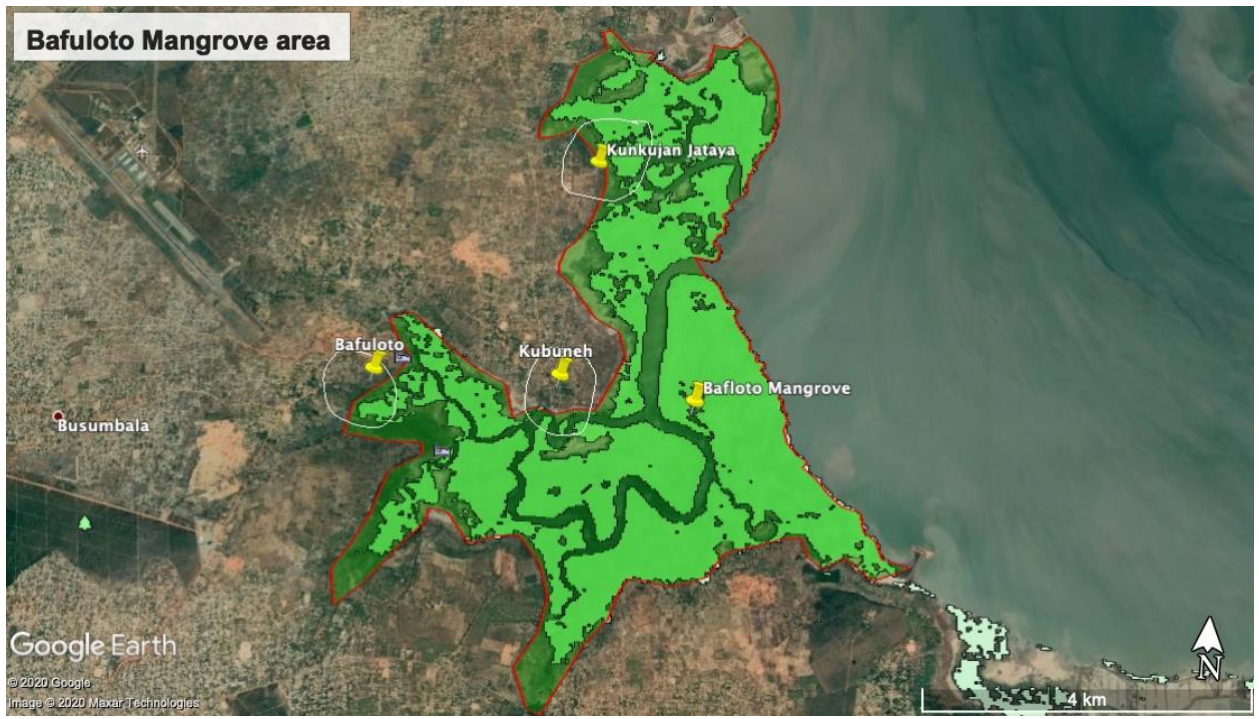
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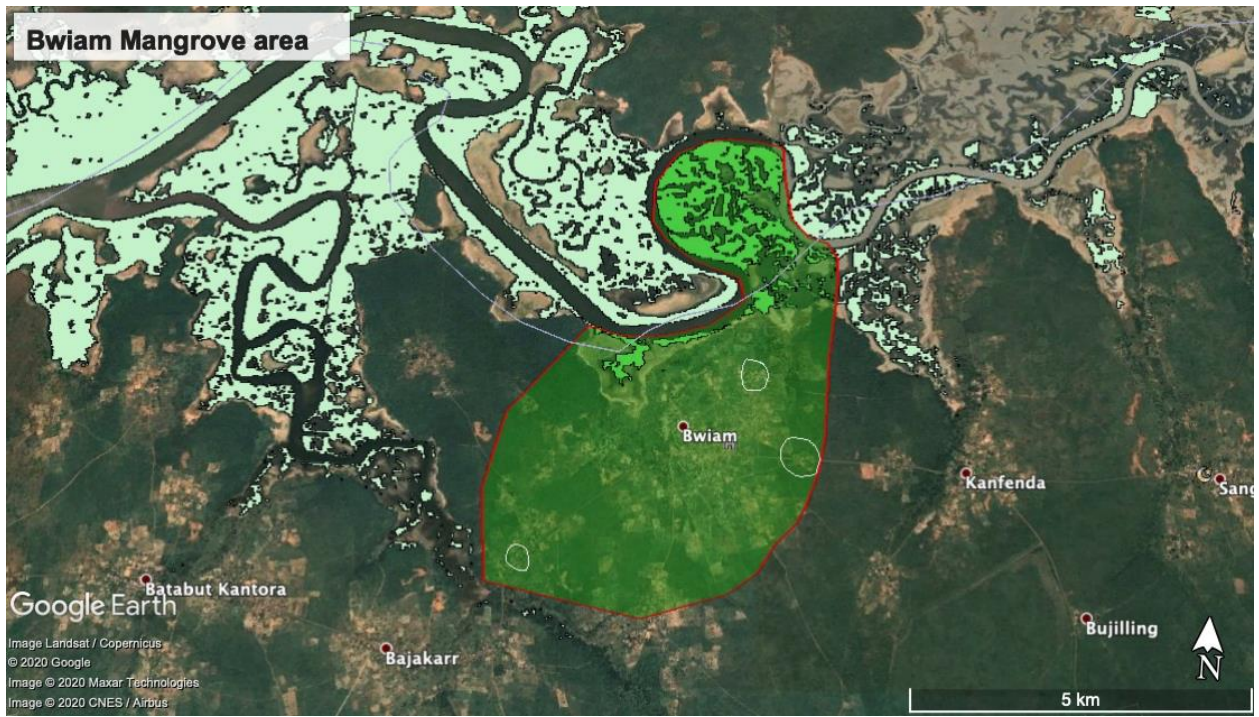
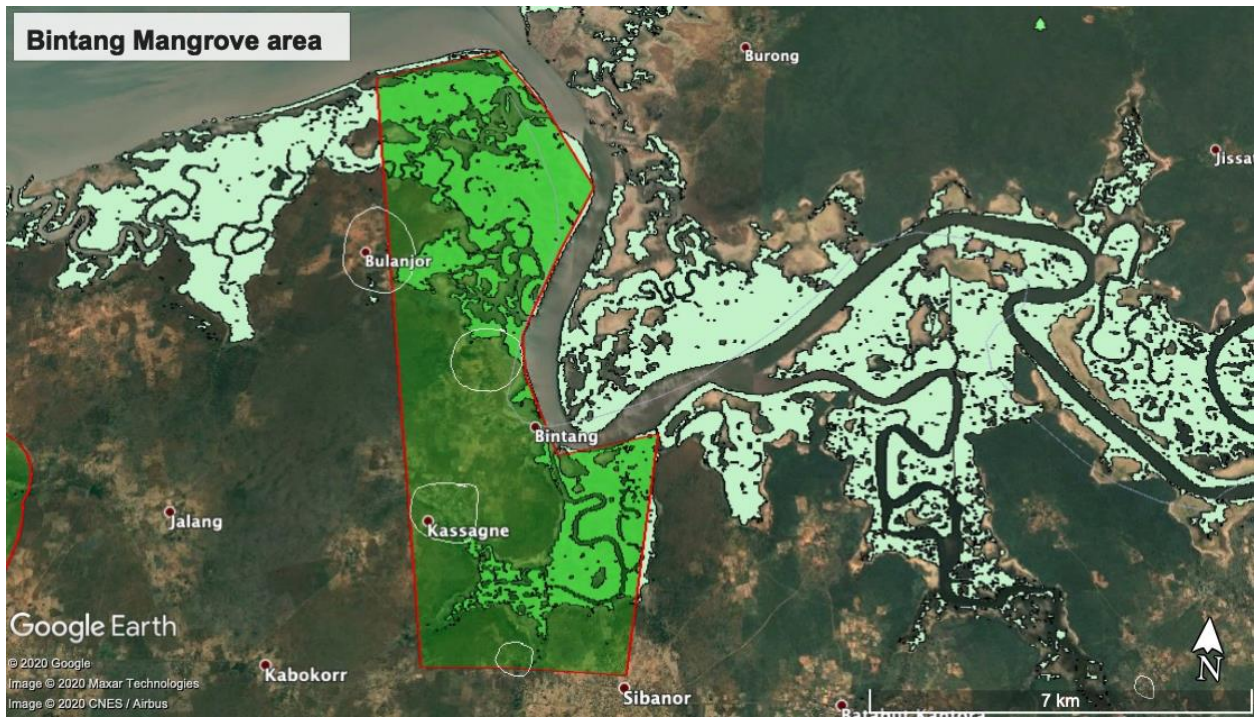
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APPENDIX 1: Map of Each Site Location with Villages Identified

The Gambia Sites







Ghana Sites

Ada-Anyanui-Tunu-Gblife Enclave (Volta Estuary)



Keta Lagoon (Adzido-Kedzi section)



Jange Lagoon



Densu Estuary



Narkwa Lagoon



Amissano



Benya Lagoon



Pra Estuary



Whin Estuary



Ankobra



Amanzule enclave



Domuli Lagoon

