# WOMEN SHELLFISHERS AND FOOD SECURITY PROJECT

## Year 1 Annual Report

## Milestone #8

October 15, 2021

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**Photo Credit**: Ernest Obeng Chuku, Centre for Coastal Management (Africa Centre of Excellence in Coastal Resilience), University of Cape Coast. In The Gambia, youth TRY Oyster Women's Association training participants practice the use of the refractometer during a field exercise.

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# TABLE OF CONTENTS

# LIST OF TABLES

Page



# LIST OF FIGURES

Page

# ACRONYMS

| | |
|---|---|
| CCM | Centre for Coastal Management |
| CRC | Coastal Resources Center |
| COVID-19 | Coronavirus Disease of 2019 |
| CSIR-FORIG | Council for Scientific and Industrial Research-Forestry Research Institute of Ghana |
| DAA | Development Action Association |
| DOPA | Densu Oyster Pickers Association |
| FANTA | Food and Nutrition Technical Assistance Project |
| FFQ | Food Frequency Questionnaire |
| FGD | Focus Group Discussions |
| FIL | USAID Feed the Future Innovation Lab for Fish |
| GIS | Geographic Information Systems |
| HFIAS | Household Food Insecurity Access Scale |
| HH | Household |
| ICRAF | World Agroforestry |
| NRM | Natural Resources Management |
| ODK | Open Data Kit |
| PPE | Personal Protective Equipment |
| RDA | Recommended Dietary Allowance |
| TRY | TRY Oyster Women's Association |
| UCC | University of Cape Coast |
| UG | University of Ghana |
| URI | University of Rhode Island |
| USAID | United States Agency for International Development |
| WHO | World Health Organization |

# 1. OBJECTIVE OF THIS DOCUMENT

This report documents progress on project implementation at the end of Year 1, September 15, 2020 – September 14, 2021, of this two-year project.

# 2. PROJECT SUMMARY

In September 2020, The United States Agency for International Development (USAID) awarded the University of Rhode Island (URI) the Women Shellfishers and Food Security Activity (project). With USAID, URI co-created the project in partnership with the University of Cape Coast (UCC) in Ghana, the University of Ghana (UG), TRY Oyster Women's Association in The Gambia, and World Agroforestry (ICRAF) based in Nairobi, Kenya.

This project addresses the need for greater attention to food security for women shellfishers and their families while improving biodiversity conservation of the ecosystems on which their livelihoods depend. More robust models, tools, approaches and processes are needed to enable and promote these sustainable food systems and natural resource management in coastal West Africa. The project will strengthen the evidence base, increase awareness, and equip stakeholders to adapt and apply successful approaches in areas of high potential 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 three key project components:

1) Conduct the first-ever participatory regional assessment of the situation, unmet needs, and promising approaches to shellfish co-management led by women across the eleven countries and the scope and scale 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. The project will conduct six technical studies covering the field research to document linkages in a Theory of Change and conceptual results chain between women's shellfish co-management and livelihoods, mangrove conservation, and nutrition. It will examine existing elements in the approach that are not well documented, and that could enhance the approach if they are better understood. It will document both sectoral and cross-sectoral findings.

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. This component consists of two activities; toolkit development and its' dissemination. The toolkit will integrate findings from the participatory regional assessment and site-based research. Building on those components, the toolkit development and dissemination will build a community of practice

and provide capacity development support for 37 stakeholder institutions in West Africa. It will provide the first practical guide for the design and implementation of women's shellfish co-management in West Africa, supported by a network of practice, among other elements such as policy briefs and case studies.

## 2.1 Goal

The project goal is to foster the adoption and scaling-up of an integrated approach to conservation of mangrove and estuarine ecosystems in West Africa that provides cross-sectoral benefits in terms of gender equality and women's empowerment, economic development, household food resiliency and nutritional benefits for women of reproductive age.

## 2.2 Theory of Change

The theory of change for this project, describes the interrelationship between women's empowerment, sustainable shellfisheries management, and cross-sectoral linkages to community-based mangrove conservation, local food system livelihoods, and nutrition of shellfishing households. The project will empirically examine these relationships and test hypotheses inherent in the following theory of change:

IF women's shellfish livelihoods in coastal mangrove and estuarine ecosystems in The Gambia and Ghana are improved through gender and nutrition sensitive co-management and linkages made to community based forest management in the land/seascape, THEN mangrove and estuarine biodiversity will be improved, AND IF approaches for sustainable food producing livelihoods within the coastal mangrove land/seascape contribute to a nutritionally balanced local food supply, THEN household resilience, sustainable food systems, and nutrition will improve.

The interrelationships and cross-sectoral linkages of the theory of change are depicted in Figure 6 in Annex 1. The model is based on practitioner experiences and qualitative evidence of these interrelationships and stitches together several sector-based models into a broader integrated theory. No in-depth empirical studies have provided a solid evidence base of this theory. While co-management of mangroves and small-scale fisheries have each been shown individually to be effective at improving sustainable management of these resource systems and are well documented in the existing knowledge base, our research activities will look more closely at the connections between fisheries management and resource tenure with mangrove conservation. The research will further broaden the basic community-based resource management aspects of the model and examine connections to coastal food systems and nutritional wellbeing of women shellfish harvesters and their families. This component of the model is less well proven and where the evidence base is weak or non-existent. Testing these cross-sectoral linkages empirically is a main focus of the site-based comparative research across six sites, three each in The Gambia and Ghana under project Activity 2.

The theory of change will be further broken down into several testable and interlinked hypotheses as illustrated below.

- Gender sensitive governance that promotes co-management and tenure rights and empowered women that manage shellfisheries sustainably improves conservation of mangroves.
- Improved and gender equitable management of shellfisheries and mangroves increases shellfish yields and availability of this nutrient rich food protein, which increases shellfish consumption and contributes to improved household nutrition and income of those engaged in shellfishing.
- High consumption of shellfish contributes to lower prevalence of anemia in women of reproductive age and controlling for other factors affecting anemia such as malaria or hookworms.
- Enriching landscapes around mangrove-shellfish estuaries systems with complementary food and nutrition sources reduces the extractive pressure on the mangroves thereby improving its health which subsequently boosts the productivity of the shellfishery having direct impact on household food security.

# 3. PROGRESS ON ACTIVITY 1: Conduct the first-ever participatory regional assessment

During the first year of project implementation, the Centre for Coastal Management, University of Cape Coast led the conduct of the participatory regional assessment of shellfisheries in West Africa covering 11 coastal countries: Senegal, The Gambia, Guinea Bissau, Guinea, Sierra Leone, Liberia, Cote d'Ivoire, Ghana, Togo, Benin, and Nigeria. The assessment covered the shellfisheries of coastal estuarine and mangrove ecosystems, with particular attention to women's involvement, to feed into the broader goal of the Women Shellfishers and Food Security Project.

The information in the literature review report finalized in February 2021 focused on mangrove and estuarine habitats that support shellfishing activities of women in the 11 West African countries. For each country, basic contextual information on population, percentage population living in/near the coast, gross domestic product (GDP), human development index (HDI) rank, length of coastline, fish consumption (as a percent of animal protein), anemia prevalence, estimated mangrove cover, estimated estuarine/freshwater area for shellfisheries, presence of women shellfishers, number of women shellfishers in mangrove zones, number of coastal systems with mangrove-based shellfishing, and shellfish and mangrove management plans/ regulations were considered (see Annex 2).

The review revealed seven main gap areas that the project's regional assessment should attempt to fill. These gap areas are:

1. The types of shellfisheries (by species, mode of fishing or gear type) within estuarine-mangrove ecosystems and the gender and age dynamics of harvesters – total approximated number of women/men by age categories.

2. The identity, description, location, and total area (ha) of the land- and seascapes of mangrove areas where shellfishing by women is of significance to the food and nutrition security of adjacent communities. Significance here is defined by the use of shellfish for food and the extent and composition of shellfish in diets (protein supply) of people in communities adjacent to these habitats.
3. The extent or percent composition of shellfish in diets (protein supply) of people in communities adjacent to these habitats.
4. The contribution of women-led shellfisheries in terms of their economic value and volume of landings relative to national fisheries production.
5. Stakeholder institutions and individuals who are directly and indirectly involved in the management and use of mangrove and shellfish resources – including ministries, fisher associations, NGOs, research and academic institutions, and individuals.
6. Legislative frameworks tailored towards the regulation and sustainable use of shellfish-mangrove interconnected resources.
7. Climate risks to the livelihoods and food security of women who depend on coastal mangroves and estuarine ecosystems. This includes specific climate impacts on mangrove habitat and whether this may exacerbate anthropomorphic drivers of mangrove deforestation and degradation in West Africa, as well as successful examples of mitigation efforts for shellfisheries and mangrove systems.

The regional assessment followed with the support of selected individuals stationed in each of the 11 countries, called In-Country Focal Persons (ICFPs). These individuals collected data in their respective countries on behalf of the University of Cape Coast. The data collection took the form of key informant interviews of individual shellfishers in different shellfishing communities identified in each country. The data was collected using a questionnaire with ethics approval from the Institutional Review Board (IRB) of URI and received by UCC digitally through an online submission portal for resource users and for other stakeholders (Government, Academia, NGOs). The responses from respondents were then pooled and analyzed to obtain a regional perspective of shellfisheries in the West Africa sub-Region. The results are presented in the report "The Estuarine and Mangrove Ecosystem-Based Shellfisheries of West Africa: Spotlighting Women-Led Fisheries Livelihoods". The report was submitted to USAID on October 13, 2021 (see Annex 2). Aside from this regional synthesis, each ICFP prepared and submitted a stand-alone country shellfisheries report to UCC, which are being completed for submission. The country report for Guinea is, however, not complete, so field data from Guinea is not included in the regional report. Information captured for Guinea is drawn from the literature.

Key areas of interest elaborated in the regional shellfisheries report include the following:

- The coast and geographical coverage of estuarine and mangrove ecosystem-based shellfisheries in the sub-Regio.n

- Shellfish exploitation (Estimated number of shellfishers; Insights on gender in shellfish exploitation; Shellfishing as primary occupation; Shellfishers' supplementary livelihoods; The shellfish value chain; Species harvested; Harvesting methods; Harvest volumes and value; Seasonality of harvests).
- Mangrove ecosystems as support for shellfisheries.
- Health and Safety of Shellfish Consumption.
- Shellfisheries and Mangrove Ecosystems Governance Regimes.
- Improving Shellfisheries Livelihoods of Women.

Important findings from the study are summarized in the figure and text box below:


*Figure 1: West Africa Shellfisheries.*

**Opportunities/Enabling Conditions**

- Strong vertical integration of the shellfish value chain with women harvesters themselves dominant at every node. This increases the potential for value chain improvements at any node to incentivize sustainable harvest and ecosystem stewardship by women harvesters.
- More than 600,000 hectares of coastal ecosystems already prioritized for conservation as Ramsar sites. This Convention on Wetlands is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
- More than 30 women shellfisher groups organized at community, ecosystem, and national levels.

# 4. PROGRESS ON ACTIVITY 2: Elaborate and test elements of models based on identified approaches through site-based research in The Gambia and Ghana

## 4.1 Quick View Summary of Progress to Date

Table 1 below provides a quick overview of progress to date on site selection and each of the six sub-activities for Activity 2 site-based research in The Gambia and Ghana. Site based research is in general on track for each of the specific technical analyses to be completed by March 2022 and feed into the final multivariate analysis report on the Theory of Change by mid-May 2022. These results will be integrated into the Toolkit.

**Community Entry and Coordination**

The TRY Oyster Women's Association has played a critical role in facilitating community entry in the Gambia and ensuring that project partners are cognizant of the need to align research schedules and coordination among partners with the needs of women harvesters, especially their time sensitive seasonal harvesting, processing, and marketing activities

**New Development**

The University of Rhode Island and the University of Ghana secured funding from the Feed the Future Innovation Lab for Fish to compliment research on anemia and heavy metals linked to shellfisheries in Ghana.

*Table 1. Quick View Summary of Progress to Date*

| Activity | Progress to date | Remaining activities |
|---|---|---|
| Site Selection | Selection of 3 sites in The Gambia and 3 in Ghana completed November 2020 | |
| 2a: Participatory assessment of threats and drivers of mangrove ecosystem degradation and preferred restoration options. | Land use land cover dynamics analysis 2000-2020 for both Ghana and The Gambia completed.<br>▪ Ghana's net change in mangrove area is about -539 square km with average annual loss of about -27 square km<br>▪ The Gambia's net change in mangrove area is about 77.84 square km with an average annual gain of about 3.89 square km.<br>The main drivers and threats affecting mangrove forest dynamics in Ghana and The Gambia analyzed using drivers-Pressures-States-Impacts-Response (DPSIR) and Situation Modelling Tools. They include population dynamics, economic activities, natural factors, and sporadic seasonal drivers. Response strategies identified included policy, governance practices and behavioral changes. | Final country reports on the mangrove cover dynamics in the two countries.<br>Finalizing the report on drivers and threats of mangrove ecosystems changes.<br>See Annex 3 for draft reports. |
| 2b: Developing a sustainable land/seascape collaborative vision<br>2c: Integrated land/seascape food and nutrition complementarity profile using agricultural biodiversity and wild foods/feeds. | 20 focus group discussions (FGDs), 5 in Ghana and 15 in The Gambia conducted with community members between May and June 2021 to capture information on the use of agricultural and wild biodiversity, develop seasonal food harvest calendars, and allow communities to priorities their preferences for species to meet their food and livelihood needs.<br>355 households (211 in Ghana, 144 in The Gambia) interviewed during June and August 2021 to further assess on-farm food production diversity and food security.<br>Preliminary descriptive data presented below. | Feedback sessions with communities (postponed due to Covid19 restrictions).<br>Quantitative and qualitative data analysis on-going.<br>Development of the nutritious food portfolios.<br>Development of species priority and domestication report.<br>See Annex 3 for draft reports. |
| 2d: Analysis of shellfisheries and associated bio-physical parameters of the estuaries. | Research at 3 sites in The Gambia and 3 in Ghana initiated in March 2021. Seven months of water quality data and oyster samples collected as of October 2021.<br>Preliminary results from three months data: A generally better condition of oysters in The Gambia than in Ghana. Generally low concentrations of Lead and Mercury in water and oyster tissues from all stations in both countries in March 2021. Chromium and Cadmium concentrations for March were largely above WHO acceptable limits in water and oyster tissue samples.<br>Training in The Gambia of TRY members and youth on oyster ecology conducted. | On-going data collection and analysis.<br>Conduct shellfisheries socio-economic and stock assessments at the six sites.<br>Analysis of results and report.<br>See Annex 3 for draft report. |

| | | |
|---|---|---|
| 2e: Anemia research | Ethics approval for data collection in Ghana obtained from the Ghana Health Service Ethics Review Committee (GHS-ERC) on 18 February 2021.<br><br>Ethics approval for data collection in The Gambia obtained from The Gambia Government/Medical Research Council, The Gambia Joint Ethics Committee (GGMJEC) on 24 June 2021.<br><br>All field data collection in Ghana, including women's background characteristics, household food insecurity, blood hemoglobin concentration, two 24-hour dietary recall surveys, completed as of 16 July 2021.<br><br>A total of 915 oyster samples collected from the three study sites in Ghana (*n* = 305 per study site) stored (-86 °C) at the University of Ghana. Samples will be analyzed for iron, zinc, and trace/heavy metals supported by the USAID Feed the Future Innovation Lab for Fish.<br><br>All field data collection in The Gambia, as done for the 3 study sites in Ghana, completed as of 23 July 2021.<br><br>Much of the data cleaning for Ghana and The Gambia, as well as preliminary analysis of key background characteristics and anemia prevalence of the women shellfishers in both countries have been completed. | Compile a food composition database for The Gambia and calculate women's nutrient intakes at the 3 sites in The Gambia.<br><br>Analyze oyster samples collected in Ghana for iron, zinc, and trace/heavy metals.<br><br>Complete all data cleaning.<br><br>Complete analysis of dietary intakes for The Gambia.<br><br>Create final dataset and Codebook.<br><br>Complete data analysis for Ghana and The Gambia.<br><br>Prepare manuscripts for publication. |
| 2f: Coordinate TOC review, data gathering, and multivariate analysis. | Consultation with statistician to inform sampling and statistics conducted. | Refinement of statistical design. Analysis of results and report. |

## 4.2 Research Site Selection

In November 2020, selection of Activity 2 research sites in The Gambia and Ghana was documented in the report submitted to USAID in completion of Milestone #2 entitled, "Selection of Locations for Site Based Research." In summary from that report:

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

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 select 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 was 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.

The site selection report summarized the main features of the three sites selected in The Gambia and the three sites selected in Ghana respectively (Table 2 and 3 below). It is important to note that the estimated area of mangroves is tentative since a comprehensive spatial analysis has not been done.

*Table 2: 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 |
|---|---|---|---|---|---|---|---|
| Bullock area | Oyster<br>Crab<br>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<br>Crab<br>Cockle | 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) | Oyste,<br>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. |

*Table 3: Summary attributes of the sites selected for Ghana.*

| Site | Shellfishing activity | Number of women shellfishers for the site | Est. littoral mangrove & water body area | Livelihood connectivity with mangroves | Mangrove condition | Key factors affecting mangroves | Governance aspects | Nutrition Information |
|---|---|---|---|---|---|---|---|---|
| Densu Estuary | Oyster | ~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 | Coastwide increase in fishing dependent households of moderate and severe hunger during the artisanal and inshore fishing closure period.<br>Increase in low dietary diversity during artisanal and inshore fishing closure period.<br>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 |

| Site | Shellfishing activity | Number of women shellfishers for the site | Est. littoral mangrove & water body area | Livelihood connectivity with mangroves | Mangrove condition | Key factors affecting mangroves | Governance aspects | Nutrition Information |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | active – yet to be legislated* | products) in the period during the artisanal and inshore fishing closure low. |
| Narkwa Lagoon | Oyster Cockle Shrimp | Unknown [60% of 60 people interview-ed 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.<br>Dietary diversity among children 6-59 months of age is low.<br>Only about 11% of children consumed vitamin A rich foods and 47% of children met the minimum dietary requirements |
| Whin Estuary | Oyster Shrimp Periwinkle | ~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.<br>Increase in low dietary diversity during artisanal and inshore fishing closure period.<br>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. |

*Note: As of the writing of this progress report, the Ghana Co-Management Policy for the Fisheries Sector, and the Densu Delta Community-Based Fisheries Management Plan delegating exclusive use rights to the oyster fisheries resources to the Densu Oyster Pickers Association, were approved in December 2020.

## 4.3 Sub Activity 2a: Participatory assessment of threats and drivers of mangrove ecosystem degradation and preferred restoration options. (ICRAF Lead)

### Activity Description:

In the six selected study sites, we will identify the main mangrove conversion threats and drivers and other land use practices within the adjacent landscapes through analysis and interpretation of secondary data and with the engagement of local communities. Assessments will identify endogenous and exogenous factors (threats and drivers) to the community and the community-managed mangrove area that led to positive or negative outcomes. Then detailed typologies for the factors will be developed and presented to communities for prioritization depending on their relative impacts on the ecosystem. After prioritization is done, management interventions that correspond to the factors will be developed based on existing knowledge from previous projects and interventions. In each landscape, three cross-sectional transects across the land-seascapes will be laid out to document activity profiles that lead to mangrove exploitation. Sex-disaggregated participatory analysis of threats and drivers of mangrove and landscape degradation will be accomplished. In each land/seascape, four community consultation and participatory assessments will be conducted. For each of the meetings, male and female extension workers will lead the discussions in local languages for the male and female groups, respectively. For this purpose, we also have scientists from both genders specifically working on the field activities and consultation and validation meetings.

To understand the spatial-temporal changes in the state of the mangrove ecosystem, the project will collate local ecological knowledge and site-specific changes in land cover and land use types to contextualize the Geographic Information System (GIS) data trends. This will complement the temporal imagery data from Sentinel and Landsat 7 and 8 satellites. Using the results from these processes and data from literature in the region and other regional biomass models, carbon stock estimates for the landscapes will be made. Data on trends in mangrove health and existing conditions will also feed into the cross-sectoral multivariate analysis.

### Progress to Date:

Land use land cover dynamics analysis on how the mangrove areas have changed between 2000 and 2020 and what kinds of land use and land covers are replacing the mangroves is complete for The Gambia and Ghana. Citations for the detailed draft reports are in Annex 3.

The analysis of the main drivers, threats and restoration options is ongoing since it needs validation with the communities. The reports are currently undergoing revisions with some further reviews of the maps and the underlying classifications.

### Key Findings to Date:

The Gambia mangroves dynamics

- The net change in mangrove area is approximately **78 square km** with an average annual gain of about **3.9 square km.**

- Mangroves in The Gambia gained approximately **120 square km** in 20 years. This is the land cover that was not a mangrove in 2000 but was found to be mangrove in 2020. This gain is mainly the result of restoration investments through various projects by governments, partners and local communities.
- In the 20 years period, about **42 square km** of what was mangrove in 2000 was converted into other land cover and land uses. Noting that mangroves take time to mature, despite the gains in square km, the losses reported are also worrying and conservation and protection measures should be strengthened.
- Preliminary findings from literature show the mean carbon stock estimated at 54.98 t/ha.

Ghana mangroves dynamics

- The net change in mangrove area is approximately **-539 square km** with an average annual loss of about **-27 square km**.
- Mangroves in Ghana gained approximately **507 square km** in 20 years. This is the land cover that was not mangrove in 2000 but was found to be mangrove in 2020. This gain is mainly the result of restoration investments through various projects by governments, partners and local communities.
- In the 20 years period, approximately **1,047 square km** of what was mangrove in 2000 was converted into other land cover and land uses. The implication of this significant loss to biodiversity, ecosystem services provided by mangrove forests and the livelihood benefits is of concern. Hence, intensified measures to protect such critical ecosystems and restore the degraded ones are needed.
- Preliminary findings from literature show mean carbon stock estimated at 40.47 t/ha.

### Challenges:

The cloud cover on the imageries for time series analysis in The Gambia and Ghana was a key challenge for analysis of satellite imagery. Measures taken to address this problem included an increase in the number of field validation points and use of various satellite imagery sources to reduce the impact of clouds on the classification process. On September 23, 2021 ICRAF hosted a presentation of the methodologies used and the findings that mangrove extent may be greater than otherwise documented, especially in Ghana where cloud cover is always a challenge to estimate the realistic extent of mangrove vegetation.

### Next Steps:

Next steps include on-going analysis of the main drivers, threats, and restoration options, including validation with the communities, and revisions to the mangrove extent dynamics, drivers and threats for both Ghana and The Gambia;

## 4.4 Sub Activity 2b: Developing a sustainable land/seascape collaborative vision (ICRAF Lead)

### Activity Description:

Building on *Activity 2a*, we will identify where there are opportunities in the land/seascape for sustainable resources management. Using a cross-sectional transect (transects that cut across the landscape connecting it to the seascape) through each landscape, we will identify areas of weakness in the landscapes (unsustainable practices) and options for improvement (introduction of sustainable practices). This may, for example, involve identifying management interventions that could be adopted or scaled within the landscape based on biophysical, social, and cultural suitability. The visioning also identifies who should do what, when and how. The visioning incorporates issues of shellfishing, coastal resources uses and, in the agricultural areas, the food systems. There are specific areas where women are very prominent, such as in shellfishing, and there are areas where men are more active, such as in agricultural activities in the landscapes. The vision exercise pulls these different activities together to achieve and increase complementarity. Gender equality will be addressed by identifying socially and culturally acceptable roles and responsibilities and assigning them to the actors (i.e., men or women) who could best address them. To capture this effectively, selection of participants for the consultation and validation meetings will be done recognizing existing social, wealth and ethnic differences in the society to ensure inclusivity beyond gender issues.

The vision development will be based on the biophysical characteristics of the landscapes, the capacities of the key stakeholders in the land-seascape, how much return it could potentially generate from a livelihood perspective and ensuring reduction of pressure on the mangrove ecosystems. This can only be possible if the social capital among the communities and or stakeholders is strong. The vision development therefore will be based on the 4R's principle/ tool (Meyers 2005) capturing the rights, responsibilities, returns and relationships that exist. This also needs to be built to reduce externalities to the ecosystem and enhance complementarity and synergies among activities of various stakeholders. The inputs required to achieve the perceived 'better state' as described in the vision will be examined. At the end of the project each site will have a land-seascape vision that local partners or other government agencies can use to improve the state of the land/seascape.

Activity 2a, 2b and 2c essentially work together to expand the mangrove management model into a broader land and seascape approach to natural resource management, biodiversity conservation and food and nutrition security. It provides an opportunity to test tools and apply them in a combined and holistic manner.

### Progress to Date:

Landscape visioning field level data collection covering the three Ghana sites through FGD's (see section 3.5) took place from May 3-7, 2021. In The Gambia, the FGDs were conducted between 10th and 18th June 2021. The FDGs are summarized as follows and details provided in Annex 4.

- 5 Focus Group Discussions (FGD) with 115 shellfishers (93% female; 7% male) conducted

at the 3 Ghana project sites on (i) agricultural and wild biodiversity, and (ii) landscape visioning.

- 15 FGDs with 177 shellfishers, 143 female (81%) and 34 male (19%), conducted at the 3 Gambia sites including 10 female and 5 male groups conducted in 8 communities across the 3 sites.

Key Findings to Date:

Ghana

- The majority of shellfishers were female with mean age of 50 years with a standard deviation of about 14 years.
- The crops cultivated across sites included staples (maize, plantain, cassava), vegetables (tomatoes, onions, okro, pepper) and fruits (pineapple) while livestock included poultry (fowls and ducks), pigs and ruminants (goats and sheep).
- Landscape productivity and availability of resources over the past 5-10 years is perceived to be on a declining trend, largely due to increasing population and its resulting high demand for resource supplies, erratic/reduced rainfall, disease outbreaks, and continuous over-exploitation of resources.
- The main livelihood activities across the sites and communities were fishing and farming and were reported to be on the decline. Supplementary livelihoods which were mentioned in some communities include masonry, trading, and sand winning, but their scale of practice was low.
- Respondents identified some activities which they wish to stop/eliminate, expand, introduce and replace. The activities to be stopped or replaced are those with negative consequences on resources availability and, by extension, livelihoods including pollution of waters (sea and lagoon), light fishing and cutting of mangrove forests. Activities to expand or introduce are those that have positive impacts on communities and their livelihoods e.g. planting of mangrove forests, expansion of shellfishing, restoration of ecosystems, introduction of advanced fishing boats, and the provision of market linkages for local fisher folks.
- Stakeholders are actively present and have an influence on the communities in the execution of their daily livelihood activities.
- The indicators of healthy mangroves mentioned by respondents include physical appearance of mangrove plants, presence of indicator species like birds, presence of shellfish and crabs due to presence of mangroves; while unhealthy mangroves indicators include signs of harvesting, high sunshine in the area, and reduced yield of shellfish.

The Gambia

- Women shellfishers were about 57 years of age on average, with a standard deviation of about 15 years.

- Shellfishing and gardening (crop farming) are the main livelihood activities by women, while men are relatively engaged in sea fishing and other artisan activities in the 3 sites. Fishing, gardening/crop farming and shellfishing activities were the most dominant annual activities.
- There is a general feeling that productivity, biodiversity, vegetation, soil condition, and freshwater are in decline, while settlement is expanding over the last 10 years. The community envisions improvement in future through restoration and rehabilitation of degraded sites.
- Different drivers of changes such as roaming animals, deforestation, pests and diseases, and overharvesting of the natural resources were cited.
- Some of the main activities to stop across the sites included deforestation (especially of the mangroves), overharvesting of oysters, over extraction of fish through small mesh fishing nets, and continuous ploughing on the same piece of land in Old Jeshwang. The factors motivating this stoppage was to ensure continuous productivity of these sites and reduced environmental destruction. Activities suggested for expansion include reforestation, controlled oyster and fish harvesting, farming and wild fruits collection, since they all contribute to restoration and productivity. Shifting cultivation was cited as a common activity to replace while new activities to introduce included beekeeping, animal husbandry, and seasonal harvesting.
- Multiple stakeholders were identified including government agencies, private sector, community group and non-government organizations, which are ranked differently in their order of importance and years of presence in different areas.
- There is a general feeling that mangroves are expanding in most sites and communities. Only 2 out of 15 sites recorded mangroves to be unhealthy while the rest were healthy.

## 4.5 Sub-Activity 2c: Integrated land/seascape food and nutrition complementarity profile using agricultural biodiversity and wild foods and feeds. (ICRAF Lead)

### Activity Description:

A participatory screening of agricultural biodiversity and wild food and feed categories in each field site will be conducted. For each of the prioritized species, their contribution to food and nutrition security at the landscape level will be assessed based on existing production potential, including land availability for planting, and the respective nutrient content. Using production potential and seasonality, a food and nutrition portfolio for the land-seascapes in each country will be established. For wild tree species with high food and nutrition value, a domestication strategy will be developed for further piloting by other interested parties. Cross-sectional transects will be used to sample the current tree species abundance which contributes to the food and nutritional needs of local communities. Based on this, ICRAF will specifically develop; (1) A food and nutritional portfolio for selected landscapes in The Gambia and Ghana; and; (2) domestication strategies for high food and nutritional value wild tree species for each country. For the high value food and nutritional species,

appropriate agroforestry interventions will also be designed as a protocol for integrating the identified wild food and feed species into the landscapes. Depending on the preferences of the community, which could be influenced by numerous factors among which land availability, land suitability, etc. are key, this could be individual or communal interventions. The underlying premise is if such high value wild food and feed tree species become part of the food systems, the livelihoods and household resilience of local communities improve and pressure on mangrove ecosystems will decrease hence boosting sustainability of shell fishing and household resilience.

The food and nutrition portfolios (or Nutritious Food Portfolios) are context-specific recommendations for producing and consuming a greater diversity of nutrient-rich foods to address seasonal food harvest gaps, and micronutrient gaps in local diets. They consist of a variety of indigenous and exotic trees and crops including fruits, vegetables, pulses and staples. The portfolios are co-developed with communities taking into consideration socio-ecological dynamics of food production including seasonal availability, food security, and food consumption. They are further informed and validated with communities taking into consideration their needs and priorities for producing food for home consumption and income generation. The portfolios matter in our research because they are an approach to ensuring that agricultural and wild biodiversity are prioritized as part of a solution for promoting greater diversity of nutritious foods in local production systems and diets.

Progress to Date:

- Study plans have been implemented in Ghana covering sample households in Narkwa lagoon, Densu and Whin estuaries; and in The Gambia, covering household clusters recruited from Tanbi, Bullock and Allahein estuaries.
- Twenty focus group discussions (FGDs), five in Ghana and 15 in The Gambia, were conducted with community members between the months of May and June 2021 to capture information on the use of agricultural and wild biodiversity, develop seasonal food harvest calendars and allow communities to prioritize preferences for species to meet their food and livelihood needs.
- In Ghana, 107 women (93%) and eight (7%) men participated in the FGDs, this included 43 participants in Densu, 42 in Narkwa and 30 in Whin. In the Gambia, 143 women (81%); 34 men (19%) from Bullock, Tanbi and Allahein areas covering eight communities were interviewed.
- Further, a total of 355 households (211 in Ghana, 144 in The Gambia) were surveyed during the months of June and August 2021 to assess on-farm food production diversity and security status.
- Lists of the communities and groups were obtained through key informants and the local shellfisher cooperatives and groups such as the Densu Oyster Picker's Association (DOPA) in Ghana and TRY in The Gambia.
- Data cleaning and exploratory analysis has been conducted.
- A detailed project activity report and assembled data sets has been provided to the project

team for reference and review (see Annex3).

- Study findings validation meetings with communities, government, and other stakeholders planned for August/September 2021 have been postponed following tightened government restrictions on holding community gatherings due to increased Covid 19 cases. The plans will be re-assessed in Mid-October 2021.

## Key Findings to Date:

Some preliminary findings from combined study activities show the following:

### Ghana

- Mainly female respondents (94%) with a mean age of 50 years (± SD 14) were surveyed but there was significant difference between the Densu and Whin sites ($F(2,208) = 18.584$, $p < 0.0001$).
- There was an average of four adults and three children per household even though this differed significantly between Whin and Narkwa, Whin and Densu, and Densu and Narkwa.
- The average farm size was one acre and households reported an average of five years of farming experience. Farm sizes and farming experience also differed significantly between sites. There is a high variation in the quantity of oyster harvesting across peak (12.2; ± SD 16.5 Kgs) and off-peak seasons (6; ± SD 9.3 kgs).
- A good proportion of households grow staple crops and vegetables in Whin and Narkwa but not in Densu, while livestock keeping was major across the sites.
- Nearly similar proportions of surveyed households visit local markets either daily (29%) or once a week (32%) to source food. At least 50% of households spend earnings on starch and meat food groups. A small proportion spend on vegetables (20%) and fruits (13%).
- Vegetables and fish were the types of foods that respondents collected from the wild. Most sites with urban settlement did not mention this as an important source.
- Large groups of respondent households experienced food insufficiencies across sites Densu (90%), Whin (68%) and Narkwa (48%) in the previous 12 months. The months of April to June were identified as the main months of food insecurity. The months of insufficient food group availability correspond with the months identified as being most food insecure, starting in January and spanning across months until July as shown in Figure 2.

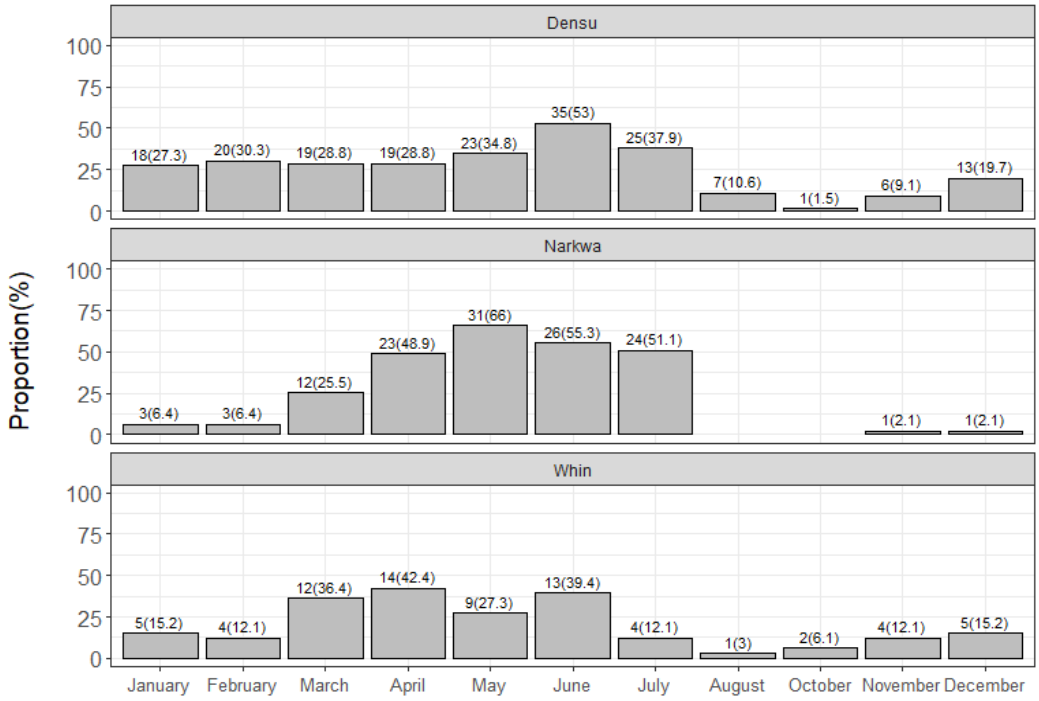


*Figure 2: Months of food insecurity identified by respondents across the three project sites in Ghana - Densu, Narkwa and Whin.*

The Gambia

- Mainly female respondents (92%) with a mean age of 57 years (± SD. 15) were surveyed.
- Households were on average large with six adults and six children.
- The average farm size was two acres, with respondents indicating an average of 11 years farming experience. Farm size differed significantly across the sites ($F(2,141) = 5.87$, $p = 0.00355$). The number of years farming experience also differed significantly ($F(2,141) = 8.9222$, $p = 0.0002$) between Bulock and Kartong, and Kartong and Tanbi, but not between Tanbi and Bulock.
- Over 50% of households grow staple crops and vegetables in all sites except Tanbi where fewer households grow vegetables. Bulock and Kartong also have high proportions of households producing fruits and keeping livestock compared to Tanbi.
- There is nonetheless a high rate of daily market visits (74%) to source foods by all interviewees, while 10% indicated three times a week and 6% twice a week. Similar to Ghana, weekly expenditure on food is highest on starch and meat diets.
- Wild food collection comprising fruits, nuts and seeds, and roots was undertaken by 40%, 37% and 10% of respondents in Bulock, Kartong and Tanbi, respectively. May, June, July and August are the main months when food is collected. Wild fodder is collected throughout the year, with the months of December through March being most common.
- A very high percentage of households in Tanbi (93%), Kartong (83%) and Bulock (81%) had experienced food scarcity in the previous 12 months. The main months of food insecurity were from June to September. The food group availability calendars corresponded with the

main months identified by respondents as being the most food insecure as shown in Figure 3.

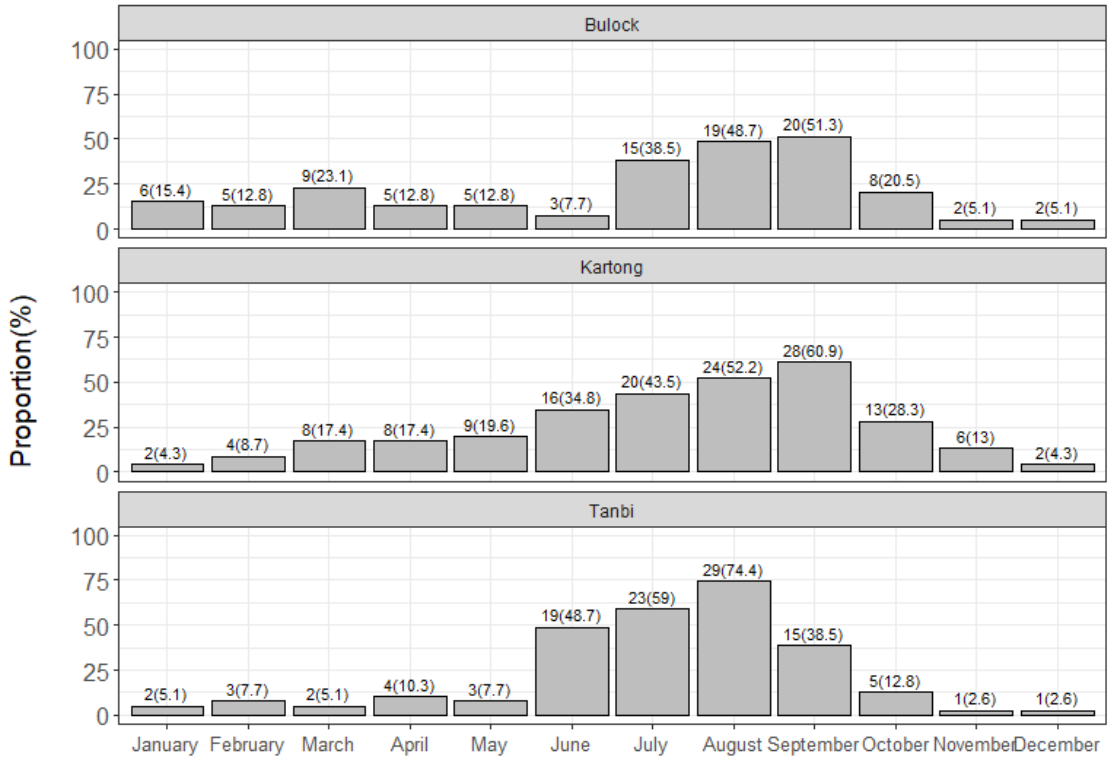


*Figure 3: Months of food insecurity identified by respondents across the three project sites in The Gambia- Bulock, Kartong, and Tanbi.*

## Challenges:

Household sampling: No comprehensive records exist across study sites to help draw study samples. Activity implementation timeliness was constrained given the need to assemble a representative sampling frame. Nonetheless, useful contacts involving local District Assemblies and key informants were obtained to help compile oyster household lists which serve as the sample frame (population of shellfishers).

Field logistics: Budget overshoot occurred due to higher expenditure on travel costs, especially due to extra transport costs due to COVID-19 safety measures. This coupled with difficulties in obtaining a suitable sampling frame required more field visits. Due to seasonality considerations on the oyster fishing activity, time constraints on the part of respondents were experienced for conducting FGD interview sessions covering two major topics on landscape visioning and agriculture biodiversity assessments. ICRAF is minimizing international travel and hence using those savings for additional costs incurred for field activities. Training related costs also decreased due to online (virtual) sessions that resulted in savings which are being channeled to increased local field costs.

Data collection: FGD data was collected on manual data entry forms and later transferred onto the Kobotoolbox platform due to the nature of FGD discussions involving multiple respondents and

thereby posing challenges for note takers working directly on tablets. Given the fewer number of FGDs relative to individual and household interviews to be conducted, and the need to verify data with voice recording tools, this approach was preferred. This process, although time consuming, was valuable for completing data capture. The approach for the household interview phase was however to be conducted purely on the digital platform using tablets.

### Next Steps:

Analysis and write up of the results from:

- Land/seascape visioning FGDs data
- HH survey data – agricultural and wild biodiversity and food security
- FGD Data – community priorities and preferences
- Customize nutritious food portfolios for projects sites using data from the household surveys and focus group discussions.

Community feedback sessions: Study findings validation meeting with communities, government stakeholders planned for August/September has been postponed following tightened government restrictions on holding community gatherings due to increased Covid 19 cases. The plans will be re-assessed in Mid-October 2021.

## 4.6 Sub-Activity 2d: Analysis of shellfisheries and associated bio-physical parameters of the estuaries. (UCC Lead, UG and URI participation)

### Activity Description:

UCC will document the current status of the shellfisheries and number of shellfishers (disaggregated by sex). UCC will conduct participatory shellfish stock assessments looking at stock sizes and maturity levels (size at maturity) and determine trends of exploitation. UCC will assess water quality parameters, including physicochemical parameters, heavy metal content (mercury) and microbial levels, (i.e., *E. coli*). Sites will be ranked by high, medium, and low levels of exploitation, pressure, and fishery health. Participatory assessments will also document governance and other socio-economic variables to be used in the cross-sectoral multivariate analysis.

Analysis by the University of Ghana and URI will also quantify the benefits of oyster consumption. This will include an oyster consumption questionnaire that captures what percent of the Recommended Dietary Allowance (RDA) for iron and zinc is met by oyster consumption in these communities on a Food Frequency Questionnaire (FFQ) that captures all sources of zinc and iron in the women's diet to determine what percent of their total iron and zinc consumption is coming from oysters. Quantification or estimates of economic value will be conducted for the shellfish harvested, as well as percent sold for cash income versus household consumption. This will be factored into measures of household resilience.

Progress to Date:

Development of methods and protocols: Methodologies, protocols and survey instruments were designed and finalized for the research objectives:

- Water quality assessment (physicochemical properties, nutrients, microbial load, heavy metals).
- Oyster biology assessment [morphometrics, condition index, sex ratio (visual observation and histology)].
- Oyster fishery, governance, and socio-economics assessment [identify existing status of the shellfisheries and number of shellfishers (disaggregated by sex)].
- Ranking of sites into high, medium, and low levels of exploitation, pressure and fishery health.

Data collection and Analysis: UCC's Centre for Coastal Management (CCM) is conducting twelve (12) months data collection at the six sites selected in The Gambia and Ghana for in-depth studies on water quality and to sample oysters for analysis in the six research sites, three each in Ghana and the Gambia. Five stations were established at each site for sampling of water parameters and collection of oyster samples for analysis. Table 4 summarizes water quality parameters measured. Preliminary detail on these and parameters for the other objectives of this sub-activity are provided in the UCC Activity 2d progress report (see Annex 3).

*Table 4: Water quality parameters measured under Activity 2d.*

| Physicochemical parameters of the water (monthly for 12 months) | | Nutrients in the water (quarterly) | Microbial Load in water & fish/oyster tissue (quarterly) | Heavy Metals in water & fish/oyster tissue (quarterly) |
|---|---|---|---|---|
| Temperature ($^0$C) | TDS (mgl$^{-1}$) | $P0_4$ (mgl$^{-1}$) | *E. Coli* | Mercury |
| Salinity (ppt – 0/00) | pH | $NH_3$- (mgl$^{-1}$) | Faecal coliforms | Lead |
| DO (mgl$^{-1}$) | | | | Arsenic |
| Turbidity | | | | Cadmium |
| | | | | Chromium |

As of October 2021, UCC had collected 7 months of data on physicochemical parameters of water and morphometric measurements of oysters, three quarters of data on nutrients in the water, and water and oyster tissue samples for microbial load and heavy metal analyses for the six project sites. The data collected by UCC further includes data on reproductive studies on oysters by histological processes, oyster catch and effort, site-specific social surveys on the oyster fishery and socio-economics. The site-based activities of UCC are presented in Table 5.

*Table 5: In-depth studies by UCC in Ghana and The Gambia*

| Oyster biology and fisheries |
|---|
| Oyster Morphometrics |
| Reproductive studies [Histology] |
| Oyster catch and effort [in-season] |
| **Oyster ecology [environmental assessment]** |
| Physico-chemical assessment |
| Nutrient analysis [Phos/Nitr] |
| **Wholesomeness for Consumption [Health Implications – oyster & water]** |
| Heavy metal analysis |
| Microbial analysis |
| **Social Surveys** |
| Socio-economic survey |
| Site-specific Shellfishery KII |
| **Toolkit surveys** |
| Pre-toolkit survey |
| Post-toolkit survey |

UG data collection and analysis: As part of quantifying the benefits (and/or risk) of oyster consumption, UG collected oyster samples from each of the three study sites in Ghana for the purpose of determining the iron, zinc, and trace/heavy metal contents. These analyses are being supported by the USAID Feed the Future Innovation Lab for Fish.

The sample size for the oyster samples ($n$ = 305 per study site; total $n$ = 915) was calculated using procedures described by the Food and Agriculture Organization (1). At each study site, UG identified the main oyster harvesting locations and proportioned the 305 oysters per study site to the number of known harvesting locations at the site. At each oyster harvesting location, UG earmarked an estimated quadrat of 20 $m^2$ (2) from where a local guide randomly collected the quota number of oysters. The oyster samples collected are currently being stored (-86 °C) at the UG pending analysis.

For progress regarding level of oyster consumption and the percent of women's total iron and zinc consumption contributed by oysters, see Section 4.7 Sub-Activity 2e below.

Training of TRY Oyster Women's Association: UCC-CCM conducted a one-day long training workshop for TRY members and youth in the Gambia on the theme "Oyster Ecology for Improved Co-Management in The Gambia". The training was to build the capacity of women shellfishers on oyster ecology for better implementation of the community-based management of oyster stocks in

mangrove and estuarine systems in The Gambia and to encourage the youth to get involved in the oyster business as a source of economic empowerment and as a tool for natural resource conservation. A field trip to the Lamin area of the Tanbi system afforded participants the opportunity for practical use of the water quality equipment provided to TRY by the project, as well as take readings that were further explained and related to the ecology of oysters discussed in the previous class session. The citation of the draft technical report with more information on the preliminary data collected is included in Annex 3.

| Training Highlights |
| --- |
| A high level of interest was shown by women and youth participants, especially the youth, in wanting to understand the science of breeding/reproduction in the oysters and the factors responsible for the proliferation of the species.<br><br>Participants received clearer explanations to some inaccurate "facts" they had held on to over the years; an example being the male and female characterization of oysters.<br><br>After tutorials provided to a TRY representative on the water quality testing equipment including calibration, and after explanations of water quality parameters to participants, all demonstrations on the use of equipment to measure water quality were led by the representative from TRY. Participants appeared to pick up the demonstration very well as they took turns to practice using the refractometer (optical salinometer). |

UCC collaboration with the University of The Gambia: The UCC partners through their site-based activities in The Gambia have identified the potential for institutional partnership with the University of The Gambia (UTG), which is the only public University in the country. The team established linkages with the authorities of the University and initiated talks on collaboration for capacity building in the areas of fisheries, aquaculture, and coastal management. This is envisaged to be carried out through UCC's Department of Fisheries and Aquatic Sciences, which is an Africa Union Centre of Excellence in Fisheries and Coastal Management and UCC's Centre for Coastal Management, a World Bank Africa Centre of Excellence in Coastal Resilience (ACECoR). This initiative stems from the context that UTG currently has no fisheries programs offered at the University. The UCC team identifies this as an opportunity to start a longer-term partnership to support curriculum development and capacity building for students and staff of UTG and ultimately stimulate establishment of a fisheries department in the University. Initial discussions were well received by authorities of UTG leading to a follow-up meeting on site at the Faraba Campus (Figure 4) during UCC's September data collection trip to The Gambia. The Director of CCM-UCC led the UCC team in a meeting with authorities of UTG, mainly representatives from the School of Agriculture and Environmental Sciences. This partnership will also seek to involve the Ministry of Fisheries and TRY as strategic institutions of interest.


*Figure 4: The UCC team meets staff and students of UTG.*

## Key Findings to Date:

Preliminary results obtained from three months of water quality testing and oyster tissue samples are presented in graphs in the UCC Activity 2d progress report (see Annex 3).

The results include trends in water quality parameters, size variations of oysters from the different water bodies, shell height – shell length ratios of oysters, and morphometric relationships (shell height-shell length; shell height-whole weight). Condition index and sex ratios are also presented as graphs and charts. As very little time series data has been collected yet, few conclusions can be drawn at this time, and much of this data will feed into shellfish stock assessments and estuarine health assessments.

Preliminary data on heavy metal concentrations are also summarized in graphs with reference to World Health Organization (WHO) standards. There were generally low concentrations of Lead (Pb) and Mercury (Hg) in both water and oyster tissues sampled at all stations in Ghana and The Gambia in March 2021. Chromium (Cr) and Cadmium (Cd) concentrations recorded for March 2021 were largely above WHO acceptable limits in both water and oyster tissue samples.

UG's results of the iron, zinc, and trace/heavy metal analysis of the oyster samples are not yet available.

## Challenges:

One of the initial challenges was for the analysis of some water quality parameters (*E. coli* and Faecal coliforms) to be collected in The Gambia by a Gambian institution. Unfortunately, the only qualified laboratory is a government institution which cannot be funded under the Trafficking in Persons (TIP) restrictions for FY20 obligated funds. UCC has developed a work-around to this issue where samples can be preserved and brough back to Ghana for analysis.

During the initial stages of data collection in the Gambia, there was a challenge with the canoes available at Bullock as they were deemed unsafe for the research team. An old boast belonging to TRY was repaired for subsequent data collection. This has eased research activities at Bullock significantly. The team is shown in Figure 5 using the boat during data collection.


*Figure 5: Newly refurbished TRY Oyster boat being used for data collection at Bullock.*

For UG, because payments from the Fish Innovation Lab to UG are linked to milestones in that project, UG needs to complete several of the FIL milestones before there will be enough funds to complete the analysis of all the oyster samples. This means UG may experience delays in the analysis.

Next Steps:

- On-going data collection and analysis of water and oyster tissue.
- Conduct shellfisheries socio-economic and stock assessments at the six sites.
- Analysis of results and report.

## 4.7 Sub-Activity 2e: Anemia research. (UG/URI Lead)

Activity Description:

The URI Department of Nutrition and Food Science and University of Ghana will lead the assessment of food security and anemia prevalence across the six field sites. Food security will be measured using the Household Food Insecurity Access Scale (HFIAS), a questionnaire developed by the Food and Nutrition Technical Assistance (FANTA) II project that covers nine experiences of food insecurity over the past four weeks. Consumption of animal source foods (including oysters/shellfish) will be assessed by using a food frequency questionnaire. Anemia will be assessed using portable HemoCue devices to measure the hemoglobin concentration of women on site using one drop of blood obtained by finger prick. This technique is an inexpensive and excellent method for rapidly measuring hemoglobin in a small amount of blood in the field setting. It does not measure other blood indices that may be related to anemia (i.e., malaria). We will use questionnaire interview data to investigate what background factors might be related to anemia in our sample (i.e., exposure to indoor smoke and morbidity). At each of the six sites we will collect food insecurity and anemia data from 200 women (1200 total), giving an effect size of 0.3 (given 80 percent power and 0.05 level of significance) for cross site comparisons. The effect size indicates the magnitude of the difference between groups while taking into account the variability in the measurement. In statistics, it is generally accepted that effect sizes less than 0.2 are more likely to be trivial differences, while an effect size of 0.8 is viewed as a large magnitude of difference. Thus, with an effect size of

0.3, we do not require a large magnitude of difference between groups to obtain significance, but we also have ensured that we are not identifying very small differences, which are unlikely to have real world implications, as significant. Data from these parameters will also feed into the multivariate analysis.

The University of Rhode Island and the University of Ghana received a $114,588 award from the USAID Feed the Future Innovation Lab for Fish (FIL) to strengthen the nutritional research component of the Women Shellfishers and Food Security project. The award will fund the following objectives:

- Determine the contribution of oyster consumption to iron and zinc intakes of women shellfishers.
- Determine whether there is any variation in iron and zinc content of oysters across the three study sites in Ghana.
- Investigate whether heavy metal contamination is a concern in the three study sites in Ghana.
- Provide guidance for public health authorities, women's shellfish associations, and other stakeholders.

To achieve those objectives, the award will add two 24-hour dietary recall surveys to the three study sites in Ghana to provide a robust analysis of the total iron and zinc dietary intakes, which will enable us to determine what portion is coming from oysters. Conducting two dietary recall surveys is more expensive than the previously planned food frequency questionnaire, but it is the most accurate method in a community setting to measure total micronutrient intake. Additionally, the award will fund collection and analysis of 305 oysters from each study site in Ghana for analysis of heavy metal contamination. While there is some preliminary data on heavy metal contamination in oyster tissue from a small sample of oysters collected in the study sties by UCC, this research will fund a well-powered analysis and deliver a strong dataset on the status of heavy metal contamination in oysters. The FIL data collection will run parallel with that of the Women Shellfishers and Food Security Activity. We will collect the oyster samples during the time of data collection, which will be kept in a -86 degree Celsius freezer at the Department of Nutrition and Food Science until laboratory analysis at the University of Ghana ECO Lab.

### Progress to Date:

In Ghana, UG obtained the study's ethics approval from the Ghana Health Service Ethics Review Committee (GHS-ERC) on 18 February 2021 and completed all field data collection by 16 July 2021. In total, UG enrolled 502 women shellfishers, including 198 from the Densu estuary (Bortianor, Tsokomey, and Tetegu communities), 138 from the Whin estuary (New Amanful, Apremdo, and Beaho communities), and 166 from the Narkwa Lagoon (Ekumfi Narkwa). These women comprised nearly all the women shellfishers in the target age group (women of reproductive age, 15-49 years of age) available for enrolment at the 3 study sites.

In The Gambia, UG obtained ethics approval from The Gambia Government/Medical Research Council, The Gambia Joint Ethics Committee (GGMJEC) on 24 June 2021 and completed the field

data collection by 23 July 2021 (see Annex 5 for the report submitted by Zakari Ali). The number of women shellfishers in the target age group (15-49 years) available for recruitment at each of the study sites was much smaller than in Ghana. In all, 214 women shellfishers were enrolled, including 109 from the Tanbi Wetland (including Oyster Creek), 70 from the Bulock mangrove area (including Bintang Bolong), and 35 from the Allahein River estuary.

In both countries, UG collected women's information including background socioeconomic characteristics, household food insecurity, and blood hemoglobin (Hb) concentration. In addition, UG conducted two non-consecutive 24-hour dietary recalls, the first on the day of enrolment and the second, within 7 days after enrolment, by which UG collected data on the type, ingredients, and quantities of foods the women shellfishers consumed.

UG has completed much of the data cleaning and performed preliminary analysis of key variables. For the analysis of women's nutrient intakes in the Ghana sample, UG compiled a food composition table (FCT) based on a previous version, which UG supplemented with data from the Food and Agriculture Organization and the United States Department of Agriculture. UG has not yet begun the analysis of dietary intakes for The Gambia.

### Key Findings to Date:

In Ghana, the average ± SD age of women in the overall sample was 32 ± 9 years. In preliminary analysis, mean Hb concentration differed significantly among women from the 3 sites ($P < 0.001$), with the mean for Whin estuary being significantly greater than either of the other 2 sites, whereas the means for Densu estuary and Narkwa lagoon did not differ from each other. There was a tendency towards significant differences in the prevalence of anemia ($P = 0.08$) defined at Hb concentration <12 g/dl, and the Whin estuary women appeared to have a lower prevalence of anemia than women at the other sites. UG found significant differences among the 3 sites in daily intakes of oyster ($P = 0.002$), total iron ($P = 0.001$) from all foods consumed, and iron ($P = 0.029$) and zinc (0.030) from oysters alone. The 3 sites also differed in the percent contribution of oyster to the total iron ($P = 0.001$) and zinc ($P < 0.001$) intakes.

In The Gambia, the average ± SD age of women in the overall sample was 31 ± 9 years. Mean Hb concentration did not differ significantly among women from the 3 sites (P 0.24) and likewise for the prevalence of anemia ($P = 0.55$). The anemia prevalence among the women in The Gambia (40% overall) was twice that of women in Ghana (20% overall).

See Annex 6 for Preliminary results tables.

### Challenges:

Except for the Densu estuarly where UG enrolled 198 women, the number of women in the target age group (15 - 49 years of age) available for enrolment at each of the remaining study sites was much smaller than the target sample size of ~ 200, particularly in The Gambia. It is possible this will reduce the statistical power to detect significant differences between sites in each country.

Finding a reliable food composition table (FCT) for Ghana and The Gambia to determine the women's nutrient intakes and the contribution of oyster consumption to iron and zinc intakes has been a major challenge, but UG is compiling them from various sources.

### Next Steps:

- Compile a food composition database for The Gambia and calculate women's nutrient intakes.
- Analyze oyster samples for iron, zinc, and trace/heavy metals.
- Complete all data cleaning.
- Complete analysis of dietary intakes for The Gambia.
- Create final dataset and Codebook.
- Complete data analysis for Ghana and The Gambia.
- Prepare manuscripts for publication.

## 4.8 Sub -Activity 2f: Coordinate TOC review, data gathering, and multivariate analysis. (UCC/URI Lead: ICRAF, TRY, UG participation)

### Activity Description:

URI, ICRAF, University of Ghana and UCC will coordinate a multivariate and qualitative analysis of the dataset from the six sites to test the hypotheses stated in the award document. Data collection on all variables will use Kobotoolbox or the ODK platform which is a free cloud-based platform that allows field data collection from smart phones and tablets with uploads via cellular networks. The database and survey forms can be accessed from any location and use multiple language forms as necessary. Data will be analyzed using statistical packages such as SPSS and using a variety of tests depending on data type. Survey data will be supplemented with qualitative information based on local knowledge and secondary information. The write up of the findings will include discussion of potential confounding variables behind statistical correlations and qualitative relationships, or acknowledge if no confounding variables are found. As part of documentation of the evidence base, we will summarize knowledge and cross-sectoral connections relative to the various parts of the Theory of Change as to whether that evidence is weak, moderate or strong, and extent to which our research findings have improved it or not, or if findings are counter to hypothesized assertions. The analysis will be summarized in a report and a journal manuscript drafted and submitted for peer review and publication. Results of the study will be disseminated to the network of stakeholders involved in the regional assessment and the in-depth field work. For results related to nutrition and health, results will be shared with local health authorities who will be engaged from the beginning of the process, throughout, and when findings are known, for guidance on the best method for sharing information with the community members. This would include potential benefits of shellfish consumption for a healthy diet and any identified risk due to heavy metal contamination or high levels of E. coli as an indicator of potential human pathogens.

### Progress to Date:

The University of Rhode Island met with the University of California Davis Statistician to discuss the sampling design and indicators to be used for the multivariate analysis.

### Challenges:

The multivariate analysis was originally conceived as mainly a qualitative analysis. Some quantitative analysis is possible but will have some challenges based on the mix of individual, household and site level data, all with different sample sizes and varying data types (binary, ordinal, continuous). The approach will be to break down the statistical analysis into the various hypotheses contained in the overall theory of change statement and use appropriate methods for each based on the type of data collected. Path analysis is also being considered.

### Next Steps:

The Statistician provided feedback which is under review to assess any changes needed in statistical design for the various hypotheses to be tested.

## 4.9 COVID-19 Mitigation and Adaptation Measures.

The project partners and their field teams have been applying the mitigation measures for implementation of Activity 2 and sub-activities 2a to 2f in accordance with safety standards to prevent the spread of COVID-19 described in the project's COVID-19 Implementation Plan (Appendix 1 of the Program Description) and have been using and distributing personal protective supplies as included in the project budget. Anecdotal information from field visits in The Gambia and reported by TRY are that project visits have helped to raise the awareness of the women harvesters that COVID-19 is real, that they are at risk, and to educate them about and model the risk reduction measures they should be taking. A recent series of photo essays by the Associated Press on Covid-19 and The Gambia's women oyster harvesters highlights their attitudes about vaccines and the gender gap on vaccines in Africa.

The first international travel on the project was in March 2021 when the University of Cape Coast went to The Gambia. ICRAF also travelled from Kenya to The Gambia and Ghana, a technician from The Gambia traveled to Ghana for training in data collection by UG, and UCC made a second trip to The Gambia in September 2021. While in June 2021 the U.S. State Department had classified both The Gambia and Ghana as level 1 (low levels) for COVID-19, as of the writing of this report, both countries are classified as Level 3.

Anecdotal information from TRY Oyster Women's Association in The Gambia and Development Action Association in Ghana that supports the Densu Oyster Picker's Association indicate that there were significant impacts of the COVID-19 pandemic directly on women's shellfish livelihoods as markets closed cutting off revenue and as alternative sources of revenue upon which women shellfishers traditionally depend also dried up, in The Gambia due to COVID-19 and in Ghana due to the longstanding decline and recent collapse of the small pelagic fishery due to overfishing. TRY reports that in The Gambia there is even more extreme pressure on shellfish resources this year. Due to the widespread economic hardship caused by COVID-19, many additional people, most of

whom are not trained in best practices, are harvesting oysters this year as the season opened in 2021. As a result of the influx, the usual practice of rotating harvesting days in order to extend the harvest over a four-month period is not being applied this year and the harvest ended after less than 3 months. These types of impacts will need to be considered in the analysis of research findings.

# 5. PROGRESS ON ACTIVITY 3: Foster a community of practice around the development of a toolkit

The UCC, as part of its regional assessment of shellfisheries, collected preliminary data using the pre/post-toolkit survey instrument to identify potential stakeholders to engage in development of and benefit from the toolkit in the second year of project implementation. This data is yet to be analyzed. Also, the ICFPs identified for the regional assessment have been mobilized into a group platform on WhatsApp mainly for the coordination of activities on the regional assessment. This community of experts will be engaged to facilitate stakeholder engagement in toolkit development in their countries. Dissemination and discussion of the regional assessment report will also serve as a platform for stakeholder engagement in toolkit development.

Throughout the participatory regional assessment process and based on preliminary findings emerging from site-based research, themes, findings, and elements for consideration in the draft toolkit to be produced in December 2021 are being compiled.

# 6. PROGRESS ON ACTIVITY 4: Toolkit and Participatory Regional Assessment Dissemination

These activities will be initiated in year two, but the engagement of stakeholders to champion dissemination has already begun as described above. The ICFPs identified by UCC in each country will also be facilitated to evolve into a regional shellfisheries platform that will promote and disseminate the toolkit and outcomes of the participatory regional shellfisheries assessment. Finally, UCC submitted an abstract on the regional assessment findings that has been accepted for development of a manuscript to be submitted to Frontiers in Marine Science in February 2022.

# 7. LEARNING QUESTIONS

In the Program Description and the Monitoring, Evaluation and Learning Plan, the project identifies some key questions and challenges to be addressed by the Theory of Change that will be tested in the site-based research. These constitute the project's focus for Learning Questions as follows:

The project addresses the challenge identified in the AFR BAA under **Area of Interest #2: Regional dimensions of the nexus of sustainable Natural Resources Management (NRM) and food systems** concerning the need for tools, approaches, and processes to enable and promote regional

sustainable food systems and NRM. The project will also address **Area of Interest #1: Sustainable NRM and Food Systems** concerning cross-sectoral integration and synergies between food production systems and the environment.

Key Question 1: What is the extent of socio-ecological benefits provided by empowering women shellfish harvesters to co-manage estuarine shellfisheries as a means to conserve mangrove ecosystems in coastal West Africa? By co-management, we mean the sharing of decision making between resource users and government authorities over the goals of management, choice of management actions as to how resources will be managed sustainably, who can harvest and defining the resources and areas where user rights are provided.

Key Question 2: Can the basic and well proven model linking shellfish management and mangrove conservation be expanded into a more integrated approach that provides cross sectoral benefits within the coastal mangrove seascape and adjacent landscape for sustainable food production and a nutritionally balanced food supply that contributes to improved nutritional wellbeing of this marginalized group?

Key Question 3: What is the potential for women's shellfish co-management to provide an entry point for integration with community-based forestry management approaches demonstrated in the region in order to better address some of the key threats of mangrove degradation and the gender dynamics of those threats.

The project's comprehensive approach to addressing these questions integrates concerns over the differential levels of access to, and utilization of natural resources (shellfisheries and mangroves) by vulnerable groups (marginalized women shellfish harvesters) and will articulate the implications of these dynamics for promoting cross-sectoral programming towards USAID goals of sustainable NRM and broad-based economic growth in coastal communities. Learning question results will be shared and disseminated as part of the Activity 3: Community of Practice and Toolkit Development and Activity 4: Dissemination activities.

To enrich reflection on the learning questions and analysis of results, project partners submitted an abstract that was accepted to organize a scientific session panel to present and discuss preliminary results of site-based research at the Cultivating Equality: Advancing Gender Research in Agriculture and Food Systems conference held virtually on October 12–15, 2021. The one hour and a half session held on October 13th with presentations by each project partner, attracted approximately 25 participants from around the globe. A recording of the presentations and discussion will be available in the coming weeks.

# 8. EXPECTED OUTCOMES AND INDICATORS OF ACHIEVEMENT

Activities are on track to achieve the expected outcomes and indicators as stated in Tables 6 below excerpted from the project Monitoring Evaluation and Learning Plan. All except the Participatory Regional Assessment recently submitted to USAID and currently under review, are expected to be achieved in Year 2 by the end of the project.

*Table 6: Performance Indicator Tracking Table.*

| Indicator | Base-line | Year 1 | | | Year 2 | | | LOP | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Target | Actual | % target v. actual | Target | Actual | % target v. actual | Target | Actual | % target v. actual | |
| Number of research results documented and available (AFR/SD Custom Indicator STIR-1-UAF: Special Studies (Resources for Missions) | 0 | 1 | 0 | 0% | 6 | | | 7 | | | 1 Participatory Regional Assessment (submitted to USAID in October 2021 (Year 2)<br>5 Technical Reports<br>1 Consolidated Multivariate TOC Report |
| Research hypotheses or alternative findings are validated by research results. | 0 | 0 | | | Tracked | | | Tracked | | | Will be tracked but no target |
| Number of shellfish and mangrove stakeholders that:<br>● Have increased awareness of the basic concepts embodied in the theory of change,<br>● Have tools to design interventions to achieve TOC intended outcomes,<br>● Are networked regionally, and | 0 | 0 | | | 74 | | | 74 | | | 6 per country x 11 countries + 4 regional institutions with 2 pax each = 8 (i.e., 2 people per organization from the 37 institutions) |

| Indicator | Base -line | Year 1 | | | Year 2 | | | LOP | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Target | Actual | % target v. actual | Target | Actual | % target v. actual | Target | Actual | % target v. actual | |
| • Some identify plans or resources to pursue opportunities for scale up. | | | | | | | | | | | |
| Number of people trained in sustainable natural resources management and/or biodiversity conservation as a result of USG assistance (USAID Standard Indicator EG.10.2-4) | 0 | 0 | | | 74 | | | 74 | | | 6 per country x 11 countries + 4 regional institutions with 2 pax each = 8 (i.e., 2 people per organization from the 37 institutions) |
| Number of Toolkits produced | 0 | | | | 1 | | | 1 | | | |
| Number of Dissemination Activities | 0 | 0 | | | 17+ | | | 17+ | | | 11 country level key stakeholder meetings (1 in each country) to disseminate at the country level the final participatory regional assessment.<br>1 Region-wide stakeholder meetings to disseminate the final regional assessment.<br>1 Region-wide Theory of Change Research findings stakeholder workshop.<br>1 Training of Trainers workshop on the Toolkit.<br>Number of on-line platforms where the toolkit, participatory regional assessment and research findings are posted and/or discussed.<br>2 peer reviewed journal articles submitted for |

| Indicator | Base -line | Year 1 | | | Year 2 | | | LOP | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Target | Actual | % target v. actual | Target | Actual | % target v. actual | Target | Actual | % target v. actual | |
| | | | | | | | | | | | publication in peer reviewed journals |
| Number of institutions receiving capacity development support (AFR/SD Custom Indicator CBLD-9-UAF). | 0 | 0 | | | 37 | | | 37 | | | 3 institutions per country X 11 countries + 4 regional institutions |
| Number of host country higher education institutions receiving capacity development support with USG assistance (AFR/SD Custom Indicator ES.2-1) | 0 | 0 | | | 11 | | | 11 | | | 1 institution per country X 11 countries |

# ANNEX 1 – Theory of Change and Results Chain Framework

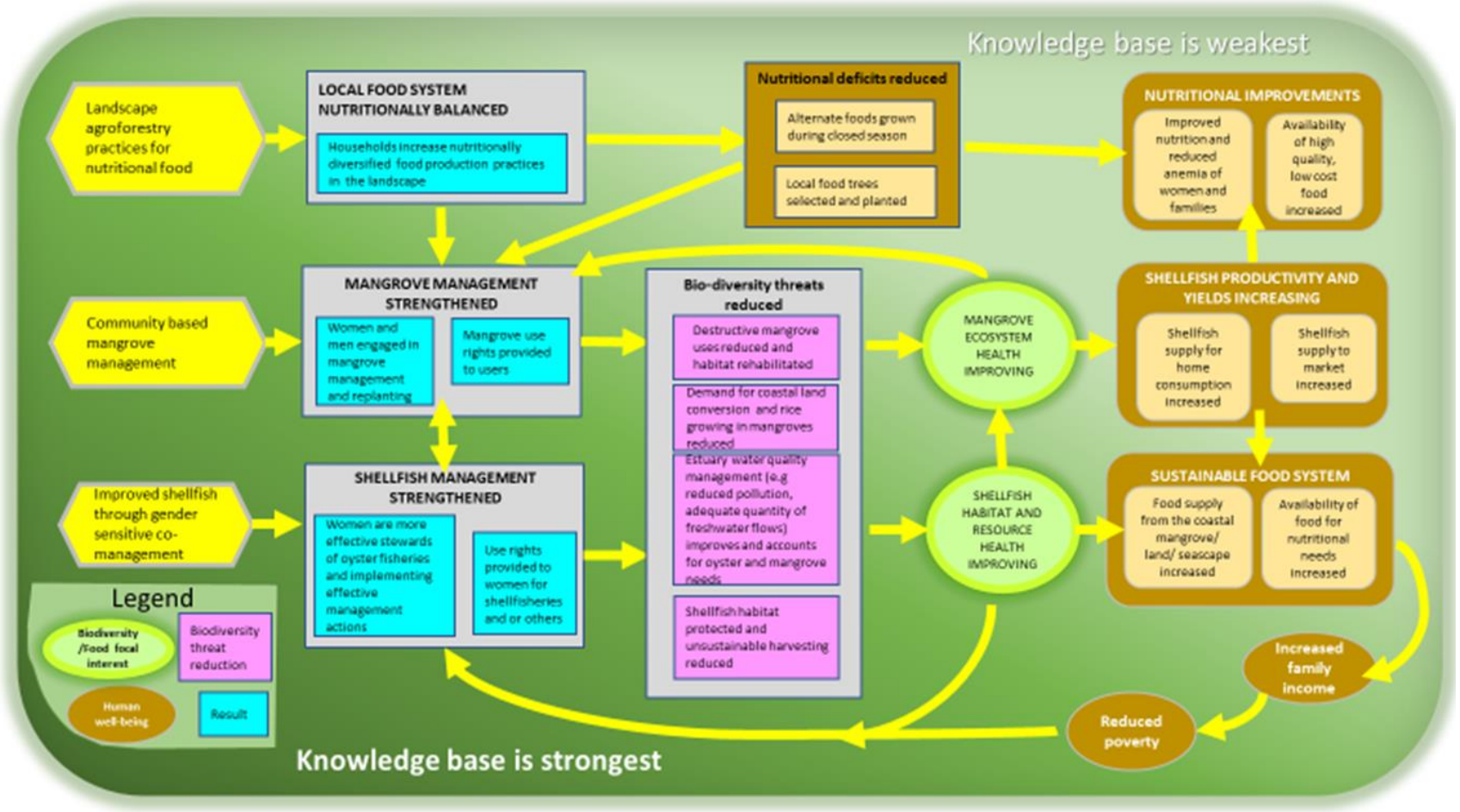


*Figure 6: Visualization of the Theory of Change and Results Chain Framework.*

# ANNEX 2 – ACTIVITY 1: REPORTS

Chuku, E. O., Abrokwah, S., Adotey, J., Effah, E., Okyere, I., Aheto D. W., Duguma, L., Oaks, B., Adu-Afarwuah, S. (2020). Literature Review for the Participatory Regional Assessment of the Shellfisheries in 11 Countries from Senegal to Nigeria. USAID Women Shellfishers and Food Security Project. Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island. Narragansett, RI, USA. WSFS2020_05_CRC. 102 pp. https://www.crc.uri.edu/download/WSFS2020_05_CRC_FIN508.pdf

Chuku, E. O., Adotey, J., Effah, E., Abrokwah, S., Adade, R., Okyere, I., Aheto D. W., Kent, K., Crawford, B. 2021. The Estuarine and Mangrove Ecosystem-Based Shellfisheries of West Africa: Spotlighting Women-Led Fisheries Livelihoods. USAID Women Shellfishers and Food Security Project. Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island. Narragansett, RI, USA. 67 p.

# ANNEX 3 – ACTIVITY 2 A, B, C AND D: TECHNICAL REPORTS:

The following three Draft Reports are incorporated as separate documents sent with this report due to their length.

### Activity 2a:

World Agroforestry (ICRAF). 2021. Land Use Land Cover Dynamics in Ghana with an Emphasis on Mangrove Forests: A Spatial-Temporal Analysis From 2000 To 2020. Draft Report. 30 p.

World Agroforestry (ICRAF). 2021. Mangrove Extent Dynamics in The Gambia: A Spatial-Temporal Analysis From 2000 To 2020. Draft Report. 22 p.

World Agroforestry (ICRAF). 2021. Drivers and Threats Affecting Mangrove Forest Dynamics in Ghana and The Gambia. Draft Report. 35 p.

### Activities 2b and 2c:

World Agroforestry (ICRAF). 2021. Participatory Land-Seascape Visioning in Densu Estuary, Narkwa Lagoon and Whin Estuary, Ghana. Draft Report. 37 p.

World Agroforestry (ICRAF). 2021. Participatory Land-Seascape Visioning in Tanbi, Bulock and Allahein sites, The Gambia. Draft Report. 33 p.

World Agroforestry (ICRAF). 2021. Land-seascape food and nutrition profiles in Ghana and The Gambia. Draft Report. 69 p.

### Activity 2d:

Chuku, E. O., Okyere, I., Abrokwah, S., Adotey, J., Effah, E., Aheto D. W. 2021. DRAFT UCC Report on Site-Based Research in Ghana and The Gambia. Centre for Coastal Management (Africa Centre of Excellence in Coastal Resilience), University of Cape Coast and Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island. Narragansett, RI, USA. 64p

# ANNEX 4 – ACTIVITIES 2B AND 2C: TRAINING REPORT AND DATA COLLECTION SUMMARY

### Trainings for data collectors:

Four individual online training sessions were planned, of which three have taken place to date. Between 6-12 participants were present from ICRAF and the respective country field teams during each of the sessions (see Table 7). Additional training materials such as an ODK Guide, and the training presentation were made available to teams for further guidance.

Ghana: Two online training sessions were held with the field co-ordination and enumeration team, one on the FGDs (20 April 2021) and one on the HH survey (27 May 2021). The data collection team was comprised of 2 senior researchers and 2 technicians from CSIR-FORIG; and one field worker affiliated with Development Action Association (DAA) and Densu Oyster Pickers Association (DOPA). Five ICRAF staff were involved as technical training support. Each of the training sessions provided an overview of the project objective, principles of good data collection processes, use of the data tools collection using the open data kit (ODK) and the Kobotoolbox platform.

The Gambia: One online training session on the FGD tool was held with the field coordination and enumeration team (20 May 2021). All enumerators selected have either attained a bachelor's degree or are about to finish their BSc. Most have experience working with communities. The same training session agenda as described above was covered. The second training session on the HH survey tool was undertaken from

### Field Data Collection - Ghana

A trip was undertaken from 3rd - 7th May 2021 to project sites at Densu estuary, Narkwa lagoon and Whin estuary in Greater Accra, Central and Western regions of Ghana. The purpose was to collect data through Focus Group Discussions (FGDs) on (i) agricultural and wild biodiversity, and (ii) landscape visioning. Participants of the FGDs included largely female shellfishers and few male shellfishers.

Community contacts identified and enumerated shellfishers and invited them to voluntarily participate in FGDs. A total of 115 shellfishers comprising 107 (93%) females and 8 (7%) males participated in the FGDs. Male shellfishers are very rare to find in the areas, hence fewer male respondents. In total, 5 FGDs were undertaken (2 in Densu, 2 in Narkwa and 1 in Whin).

*Table 7: Training topics and list of participants on the focus group discussion (FGD) and household survey activities.*

| Training Title & dates | Details about the training (what is the training about and what was addressed) | No of participants |
|---|---|---|
| Ghana USAID-WSFS Tool Training<br><br>**Dates:** 16/4/2021 | **Learning Topic 1: Introduction to digital data collection tools for field surveys (FGDs & HH interview)**<br>I. Field preparations & requirements<br>II. Instructions on downloading data collection App & tools on android devices<br>III. Demo: Actual data collection, accuracy, completeness<br>IV. How to upload filled survey forms on the platform<br>V. Tips to ensure uninterrupted field data collection, pitfalls on using android devices<br>VI. Piloting data collection; timeliness, corrections, roles of field teams; supervisor<br>VII. Data cleaning, standardization<br><br>**Learning Topic 2: Orientation to WSFS survey objectives**<br>I. Visioning exercise: what to ask and record<br>II. How to collect complete seasonal food calendar information<br>III. Assessing tree food and fodder resources, species name, translations<br><br>**Other requirements**: COVID health forms, consent from respondents. | **8 Participants:**<br>Beatrice Darko Obiri (FORIG)<br>Sammy Carsan (ICRAF)<br>Reginald Tang Guuroh (FORIG)<br>Kennedy Muthee (ICRAF)<br>Parmutia Makui (ICRAF)<br>Lalisa Duguma (ICRAF)<br>McMullin, Stepha (ICRAF)<br>Kwame Antwi Oduro (FORIG) |
| Enumerator Trainings: HH survey data collection & management via ODK & Kobotoolbox<br><br>**Dates:**<br>27/05/2021 | **Objective:** Training on household survey data collection & management<br>1. Discussion on survey plans and tools<br>2. Installing ODK collect and linking to Kobotoolbox on android phones/tablets<br>3. Data collection demo trial<br>4. Data checks and submission<br>5. Q &A<br>6. Discussion on Logistics<br><br>**Other requirements**: COVID health forms, consent from respondents | **10 Participants:**<br>Beatrice Darko Obiri (FORIG)<br>Kwame Antwi Oduro (FORIG)<br>Abraham Asare (DAA)<br>Isaac Osei (FORIG)<br>Sammy Carsan (ICRAF)<br>Reginald Tang Guuroh (FORIG)<br>Kennedy Muthee (ICRAF)<br>Parmutia Makui (ICRAF)<br>Lalisa Duguma (ICRAF)<br>Stepha McMullin (ICRAF) |
| Training on Field Data Collection - FGDs and HH surveys - Gambia<br><br>**Date:**20/05/2021 | **Objectives:**<br>● equip the data collectors with basic principles of dealing with communities during field data collection;<br>● orient the team through the details of each question or discussion points<br>● provide an overview on use of the tools and the field guides tailored to the FGDs.<br><br>Programme:<br>● Welcoming and introducing the team<br>● Introducing the project<br>● The dos and don'ts during FGDs<br>● How to use the tools accessing, saving, etc. | **14 Participants**:<br>Rose Fatou Manga<br>Sheikh Sadibou Sanyang<br>Fatoumatta Manjang<br>Modou K Bah<br>Nyimasatou Y. Touray<br>Bintou Jarjou<br>Fatou Janha (Try oyster)<br>Adama Touray<br>Alagie Bah (ICRAF)<br>Lalisa Duguma (ICRAF)<br>Kennedy Muthee (ICRAF)<br>Sammy Carsan (ICRAF) |

| | | |
|---|---|---|
| | • FGD on the Visioning tool<br>• FGD on wild plants<br>• HH Surveys<br>• General logistics<br>• Implementation plan<br>• Travel arrangements | Parmutia Makui (ICRAF)<br>McMullin, Stepha (ICRAF) |

*Table 8: Breakdown of participants taking part in Ghana FGD at Densu, Narkwa and Whin.*

| Site | District | Village | Female | Male | Total No. of Participants |
|---|---|---|---|---|---|
| Densu | Ga South | Bortianor | 10 | 3 | 13 |
| | | Tsokomey & Tetegu | 23 | 5 | 28 |
| Narkwa | Ekumfi | Narkwa | 39 | 3 | 42 |
| Whin | Effia-kwesimintsim | Amanful kuma | 13 | 0 | 13 |
| | | Apremdo | 19 | 0 | 19 |
| All sites (participants) | | | 104 | 11 | 115 |

*Table 9: Breakdown of participants taking part in The Gambia FGD at Tanbi, Bullock and Allahein.*

| **Site** | **Community** | **District** | **FGD gender group** | **Female** | **Male** | **Total participants** |
|---|---|---|---|---|---|---|
| Tanbi | Karmalo | Jeshwang | 1 Female | 0 | 11 | 11 |
| | Old Jeshwang | Jeshwang | 1 Female | 0 | 15 | 15 |
| | Faji Kunda | Serekunda East | 1 Female + 1 male | 13 | 12 | 25 |
| | Lamin | Busumbala | 1 Female | 0 | 12 | 12 |
| Bulock | Bulock | Foni Berefet | 3 female + 1 male | 11 | 36 | 47 |
| | Bintang | Foni Bintang Karanai | 1 female | 0 | 10 | 10 |
| Allahein | Kartong | Kombo South | 3 female + 1 male | 10 | 38 | 48 |
| | Berending | Kombo South | 1 female | 0 | 9 | 9 |
| **TOTAL** | | | **15 FGDs** | **34** | **143** | **177** |


*Figure 7: Introductory sessions for FGDs at Tsokomey-Densu and Apremdo - Whin estuaries, Ghana. (Photo: Beatrice Obiri).*

Participants were enthusiastic in providing responses to questions discussed. Further, contacts were made to facilitate pending individual questionnaire interviews the team is scheduling for early June. Participants signed consent forms provided by the University of Ghana Team for information provision. They voluntarily participated after invitation and provided responses at will. Covid-19 protocols were adhered to as much as possible. Some preliminary observations include:

- Generally, coastal livelihood is increasingly being threatened as products from the marine ecosystems and adjacent landscapes seem to be declining due to over-exploitation, infrastructure expansion and climate change. Apart from land scarcity issues at Densu, irregular climatic patterns leading to high temperatures and unexpected drought during the main growing season is negatively affecting farming particularly at Narkwa and Whin. At Narkwa, the coping strategy for some people has been digging wells for watering especially for pineapple production.
- Crops of commercial value and short duration including cassava, pineapple, tomato, pepper, okra, garden eggs (a type of eggplant), cabbage, and other green leafy vegetables, most of which are currently cultivated in these areas, were of interest to participants across the three sites. Tree products of cash value from avocado, pawpaw, oil palm, guava, orange, and lemon were also preferred.
- Rearing of goats, sheep, chicken and ducks are common across the three sites. They are usually penned and also left to free range. Goats and sheep used to graze on grass along the shores of the Densu estuary. Cassava leaves, cassava and plantain peels are fed to goats as supplemental feed as grazing strips are shrinking over time due to increasing demand for land for other developments e.g., settlements. Fodder from Ficus trees and other species are harvested for sheep. Poultry including chicken and duck free range and may be fed with processed feed and food left over.
- The diversity of medicinal plants harvested from the wild mainly for subsistence use to treat malaria, fevers, pains, etc. seemed higher at Narkwa and Whin compared to that at Densu where few species including moringa planted in fences and home compounds are harvested. Collection from the wild for commercial purposes seemed highest at Narkwa where some people engage in herbal medicines production for sale in cities such as Accra and other places in the West African sub Region.

- Participants were willing to undertake any future land improvement activity but are concerned with the following:
    a. Land unavailability at Densu
    b. Moisture (rainfall) and financial limitations at Narkwa
    c. Livestock browsing, moisture constraints from drought on farms as maize crops in the major rainy season (March-September) seem to be failing.
- In general, participants are of the view that innovative production systems less dependent on land and rain-fed production need to be devised to overcome current production constraints and seemingly food and cash insecurity.

## ACKNOWLEDGEMENT

ICRAF highly appreciates the support of different partners which made our activities possible in this quarter. We are grateful to USAID for funding the project. We also appreciate the effective coordination by the University of Rhode Island in the execution of the project activities. We are also grateful to TRY Oyster Women's Association for facilitating field activities in The Gambia, as well as University of Cape Coast (UCC) and University of Ghana for site specific inputs in Ghana. Finally, the communities have been instrumental in providing key information and inputs to the project, and we are grateful to their collaboration and support, especially those in Densu, Narkwa and Whin estuaries where we conducted the focus group discussions in Ghana, as well as communities in Allahein, Bulock and Tanbi in the Gambia.

# ANNEX 5 – ACTIVITY 2E: BRIEF REPORT OF FIELD DATA COLLECTION

## BRIEF REPORT OF FIELD DATA COLLECTION: USAID WOMEN SHELLFISHERS AND FOOD SECURITY PROJECT THE GAMBIA

**By: Zakari Ali**

**Nutrition and Planetary Health Theme,**

**MRC Unit The Gambia at the London School of Hygiene & Tropical Medicine,**

**Banjul, The Gambia.**

**August, 2021**

## Table of Contents

## Pre survey activities

Prior to the commencement of field activities, all field workers attended a 2-day training. This included an overview of the study protocol, study procedures on the consenting process and eligibility assessment of potential participants, electronic data capture using the data collection tool installed on tablets (Kobo data collection platform), synchronization of collected data to the server, allocation of study numbers, the study questionnaire, and anthropometric measurements (height, weight). Field workers were also trained on point of care assessment of haemoglobin level including the required safety precaution and dispensing of iron-folic acid tablets to eligible participants. In addition to the training given to all field workers on haemoglobin assessments, we hired a trained laboratory technologist to accompany the teams to measure haemoglobin. The first day of training covered all areas of field activities and the second day was dedicated mainly to reviewing topics covered on day 1 with particular emphasis on the household food security, food frequency, and 24 hour recall questionnaires. Field workers also did a pre-test with invited women from nearby communities. The pre-test involved consenting, questionnaire administration, anthropometric measurements and blood sampling for haemoglobin assessment using the haemocue 301 device.

The training sessions were facilitated by the study coordinators (Mr Zakari Ali and Dr Modou Jobe), the Data Manager (Mr Simon Donkor) and a representative from the National Nutrition Agency (Mrs. Fatou Drammeh).

The training aimed to make all field workers comfortable with all aspects of the data collection and also give hands-on practice before field work began.

## Community mobilization, consenting and participation

Before community visits, the women shellfishers were contacted through their leaders or a local mobiliser at least a day prior to the visit. The potential participants gathered at a pre-identified location (usually at the site of oyster processing). A group sensitization was conducted in the local language understood by the participants prior to individual consenting and recruitment. As per the study protocol, each participant was visited twice, the first and second visits separated by 1 week. During the first visit, field workers administered the baseline socio-demographic questionnaire, and the household food security questionnaire. Capillary haemoglobin concentration was assessed using a Haemocue device (HemoCue 301) which was calibrated daily. This was after the procedure was explained to the participant and followed sterile procedures and measurement standard procedures. Participants who had a capillary haemoglobin level of <12g/dL were supplied with a 2-month supplementation of pills containing Ferrous Sulphate and Folic Acid. Height was measured to the nearest centimeter using a stadiometer (Leicester height measure) with the participant standing erect against the stadiometer, with no foot or head wear. Weight was assessed to the nearest 0.1kg using a daily calibrated Seca scale with the participant standing erect and wearing only light clothing.

On the second visit, only the 24-hour questionnaire and the food frequency (food group consumption) were assessed. Data on food items recorded in the 24hr recall were used to score the food group consumption questionnaire (called “food frequency questionnaire” on the Kobo

platform). While the 24 hour recall was not entirely quantitative (not required per protocol), field workers were trained to provide some approximate quantities to help with the food group scoring and further checks where necessary.

## On-site activities and data quality checks

During the data collection, field staff were divided into 3 groups with each group comprising of a supervisor/team lead and 2 field workers and a mobile laboratory personnel who visited the teams for Hb measurements. All staff were expected to perform similar tasks, while the Supervisor/Team lead in the respective groups had the extra responsibility of managing study resources (participant incentive (cash and soap), equipment, study documents). The teams met each morning with the coordinators and the local Data Manager for briefing and discussions of difficulties (faced or anticipated), as well as ensuring that all data was synchronized. Field workers also regularly communicated with coordinators to give updates or in cases where they required clarification. The teams were also provided with Standard Operating Procedures (SoPs) to carry along to the field for reference whenever required. We provided SoPs for Haemoglobin measurement using the haemocue machine; blood sampling for Haemocue use; COVID-19 protocol; measurement of height and weight; and participant consent. Field teams were transported daily to field sites using vehicles specially hired for the study.

## Sampling and sample size

The data collection for The Gambia project took place between 2nd July 2021 and 23rd July 2021. Non-pregnant women aged 15-49 involved in oyster harvesting were approached for consent prior to recruitment. We identified potential participants residing in the estuaries of the Tanbi Wetland National Park, Bulock mangrove area, and the Allahein river. We obtained information on the number of women involved in oyster harvesting following consultation with personnel of TRY Oyster Women's Association, the Ministry of Fisheries, and ICRAF. Using this information, we ensured sampling included participants from each of the respective sites. Women were selected by approximate proportion to the total number of women engaged in oyster processing in those areas. 214 women from 11 communities in the three estuaries were selected (Table1 and Figure 1).

*Table 10: Distribution of sample by study areas.*

| No. | Estuary/area | Selected community | Numbers | |
|---|---|---|---|---|
| | | | Visit 1 | Visit 2 |
| 1 | Tanbi | Jeshwang | 20 | 20 |
| 2 | Tanbi | Abuko | 15 | 15 |
| 3 | Tanbi | Fajikunda | 25 | 25 |
| 4 | Tanbi | Kamalo | 18 | 18 |
| 5 | Tanbi | Lamin | 11 | 11 |
| 6 | Tanbi | Wencho | 12 | 12 |
| 7 | Tanbi | Kubuneh | 8 | 8 |
| 8 | Bulock | Bulock1 | 36 | 36 |
| 9 | Bulock | Bulock2 | 13 | 13 |

| | | | | |
|---|---|---|---|---|
| 10 | Allahein | Kartong | 25 | 22* |
| 11 | Allahein | Berending | 10 | 9* |
| 12 | Bintang | Bintang | 21 | 20* |
| **Total** | **3** | **11** | **214** | **209** |

*missed at least 1 second visit.

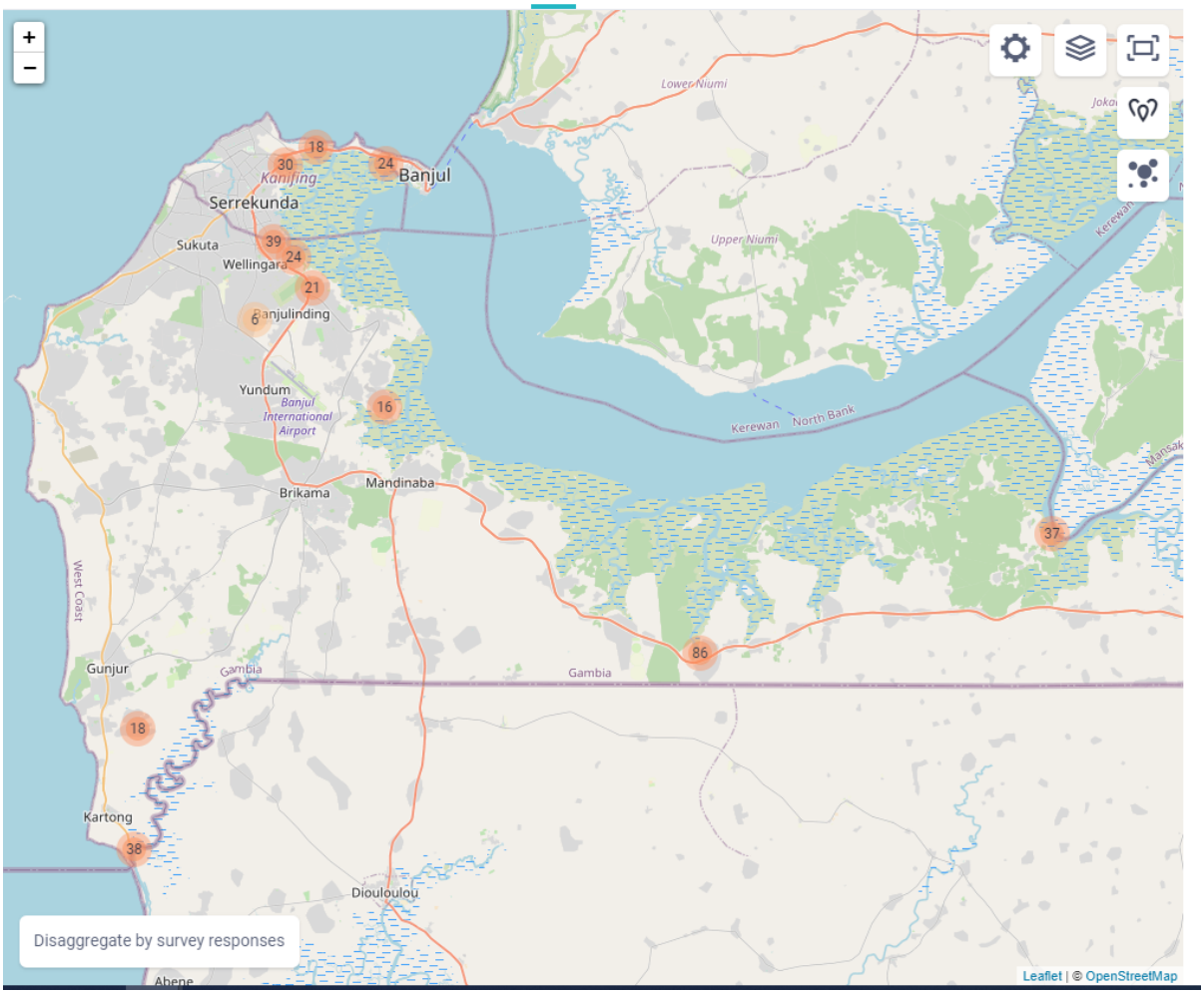


*Figure 8: Spread of data collection points.*

## Participant incentive

Upon discussion with TRY Oyster Women's Association and the ICRAF team, we agreed to compensate participants for loss of earnings during participation in cash and in kind (provision of *Madar* sets containing powdered soap, liquid soap and bleach– a popular local household washing and disinfectant set). On the first visit, participants received GMD 250 cash compensation and received *Madar* sets for the second participation on second visit.

## Some field challenges

On the whole, the field work went as expected and minor challenges were resolved by team leaders and project coordinators as the survey progressed. A few challenges concerned the age range required for inclusion in the study as many older women (above 49 years) also engage in oyster business. This delayed the first few days of start, but subsequent community mobilizations included the age range but meant that our initial estimates of expected numbers changed and we added nearby communities.

## End of survey and data cleaning

We have held update meetings with Mrs Fatou Janha Mboob of TRY Oysters and The Ministry of Fisheries representative to debrief them on the field work. We (data manger and project coordinators) have also completed two days of formal data cleaning with field workers who attended with their field notebooks for cross-checking any inconsistencies. Other minor data cleaning was also done by the local data manager and the University of Ghana data team before data export.

## Next steps/deliverables

1) Data export to University of Ghana team for collaborative data management and reporting. This will be done in the form of an exported and linked database (Microsoft Excel or Access) and online through direct access to the Kobo cloud data storage platform (*completed*).
2) We plan to present preliminary results of the survey at the National Nutrition Agency (NaNA) in the presence of community representatives, the Ministry of Fisheries, women shellfishers, and other relevant stakeholders for potential uptake and also as feedback from the project.
3) We also plan to lead in co-authoring scientific publication(s) with the University of Ghana team and wider project team members.
4) Signed participant consent forms to be archived. University of Ghana team to decide whether to deliver these to Ghana or archive in The Gambia.

*Table 11: Survey deliverables.*

| | **Deliverable** | **Status** |
|---|---|---|
| a | Assist with obtaining ethics for The Gambia study | Completed |
| b | Hire personnel (interviewers and phlebotomist) for the field work | Completed |
| c | Oversee the recruitment of study participants | Completed |
| d | Arrange logistics required for data collection | Completed |
| e | Train project staff | Completed |
| f | Supervise data collection | Completed |
| g | Ensure project stuff and participants adhere to COVID-19 protocols | Completed |
| h | Transmit data to the University of Ghana | Completed |

## Annexes: Some picture stories of The Gambian team

*Figure 9: The Gambian data collection team*


*Figure 10: Data collection activities in The Gambia, including distribution of Madar sets (top right) containing powdered soap, liquid soap and bleach– a popular local household washing and disinfectant set.*

# ANNEX 6 – ACTIVITY 2E: PRELIMINARY ANALYSIS OF KEY VARIABLES IN GHANA AND THE GAMBIA

We have completed much of the data cleaning and performed preliminary analysis of key variables by using SAS for Windows version 9.4 (SAS Institute, Cary, NC).

Among the 3 sites in each country, we compared continuous variables by using ANOVA and categorical variables by using logistic regression. For the analysis of all variables, we set the level of significance (alpha) at 0.05 and considered $0.05 < p \leq 0.08$ to show a tendency towards significance (68, 69). Where there was a statistically significant treatment effect at $\alpha = 0.05$, we identified the differing means or percentages by using Tukey-Kramer pairwise comparisons at an alpha level of 0.05. The tables below present the background characteristic of the women shellfishers, by study site, in Ghana (Table 12) and The Gambia (Table 13) as well as the mean hemoglobin concentration, anemia prevalence and mean iron and zinc intakes of women in Ghana (Table 14) and The Gambia (Table 15).

*Table 12: Background characteristics of participants, by study site, in Ghana.*[1]

| Variables | Densu estuary (n = 200)[2] | Narkwa Lagoon (n = 166)[2] | Whin estuary (n = 138)[2] | P-value |
|---|---|---|---|---|
| Age, years | 32.2 ± 8.5 (200) | 30.7 ± 9.6 (166) | 31.9 ± 9.5 (138) | 0.30 |
| Ever attended school | 162/200 (81.0)[a] | 93/166 (56.0)[b] | 107/138 (77.5)[a] | < 0.001 |
| Can read sentence[3] | 333/162 (206) | 187/93 (201) | 226/98 (231) | < 0.001 |
| Currently breastfeeding | 26/200 (13.0)[a] | 41/166 (24.7)[b] | 25/138 (18.1)[ab] | 0.017 |
| Body Mass Index, kg/m$^2$ | 26.6 ± 5.1 (200)[a] | 22.9 ± 4.8 (166)[c] | 25.0 ± 5.2 (138)[b] | < 0.001 |
| Overweight/obese (BMI >25) | 117/200 (58.5)[a] | 42/166 (25.3)[c] | 62/138 (44.9)[b] | < 0.001 |
| Obese (BMI >30) | 46/200 (23.0)[a] | 21/166 (12.7)[b] | 20/138 (14.5)[ba] | 0.022 |

[1]Total *n* = 504. Values are means ± SDs (n) unless otherwise indicated. *n*/total *n* indicates the number of participants whose response was "yes" for the variable in question/total number of participants analyzed for the variable in question.
[2]Labeled means in a row without a common letter differ significantly, P<0.05 by ANOVA and Tukey-Kramer tests; labeled percentages in a row without a common letter differ significantly, P<0.05 by logistic regression and Tukey-Kramer tests.
[3]Can read the sentence "The child is reading a book".

*Table 13: Background characteristics of participants, by study site, in The Gambia.*[1]

| Variables | Allahein estuary (n = 35)[2] | Bulock Area (n = 70)[2] | Tanbi Wetland (n = 109)[2] | P-value |
|---|---|---|---|---|
| Age, years | 34.4 ± 8.2 (35) | 29.8 ± 8.6 (70) | 31.5 ± 10.1 (105) | 0.06 |
| Ever attended school | 17/35 (48.6) | 47/70 (67.1) | 64/109 (58.7) | 0.18 |
| Can read sentence[3] | 9/35 (25.7) | 34/70 (48.6) | 45/109 (41.3) | 0.09 |
| Currently breastfeeding | 5/35 (14.3) | 16/70 (22.9) | 13/109 (11.9) | 0.15 |
| Body Mass Index, kg/m$^2$ | 27.5 ± 6.0 (35)[a] | 25.1 ± 5.2 (70)[ba] | 24.7 ± 5.0 (109)[b] | 0.022 |
| Overweight/obese (BMI >25) | 20/35 (57.1) | 29/70 (41.4) | 50/109 (45.9) | 0.32 |
| Obese (BMI >30) | 12/35 (34.3)[a] | 13/70 (18.6)[ba] | 16/109 (14.7)[b] | 0.044 |

[1]Total *n* = 214. Values are means ± SDs (n) unless otherwise indicated. *n*/total *n* indicates the number of participants whose response was "yes" for the variable in question/total number of participants analyzed for the variable in question.
[2]Labeled means in a row without a common letter differ significantly, P<0.05 by ANOVA and Tukey-Kramer tests; labeled percentages in a row without a common letter differ significantly, P<0.05 by logistic regression and Tukey-Kramer tests.
[3]Can read the sentence "The child is reading a book".

*Table 14: Hemoglobin, anemia prevalence and iron and zinc take of women shellfishers at 3 estuary sites in Ghana.*[1]

| variables | Densu estuary (n = 200)[2] | Narkwa Lagoon (n = 166)[2] | Whin estuary (n = 138)[2] | P-value |
|---|---|---|---|---|
| Hemoglobin concentration, g/dl | 12.7 ± 1.7 (200)[b] | 12.9 ± 1.4 (166)[b] | 13.4 ± 1.5 (138)[a] | < 0.001 |
| Any anemia, Hb < 12 g/dl | 50/200 (25.0) | 32/166 (19.3) | 21/138 (15.2) | 0.08 |
| Total oyster consumed, g | 11.6 ± 38.0 (200)[a] | 6.7 ± 25.7 (166)[ba] | 0.3 ± 2.2 (138)[b] | 0.002 |
| Total Fe intake, mg | 16.7 ± 10.4 (200)[a] | 13.7 ± 6.9 (166)[b] | 17.4 ± 10.4 (138)[a] | 0.001 |
| Total Zn intake, mg | 9.3 ± 12.0 (200) | 7.5 ± 6.5 (166) | 8.9 ± 6.1 (138) | 0.14 |
| Oyster Fe intake, mg | 0.6 ± 2.9 (200)[a] | 0.3 ± 1.7 (166)[ba] | 0.02 ± 0.20 (138)[b] | 0.029 |
| Oyster Zn intake, mg | 2.2 ± 10.3 (200)[a] | 1.2 ± 5.9 (166)[ba] | 0.09 ± 0.72 (138)[b] | 0.030 |
| % oyster Fe contribution | 2.9 ± 7.8 (200)[a] | 2.2 ± 7.8 (166)[a] | 0.2 ± 1.5 (138)[b] | 0.001 |
| % oyster Zn contribution | 7.2 ± 16.8 (200)[a] | 5.3 ± 14.6 (166)[a] | 0.7 ± 5.7 (138)[b] | < 0.001 |

[1]Total *n* = 504. Values are means ± SDs (n) unless otherwise indicated. *n*/total *n* indicates the number of participants whose response was "yes" for the variable in question/total number of participants analyzed for the variable in question.
[2]Labeled means in a row without a common letter differ significantly, P<0.05 by ANOVA and Tukey-Kramer tests; labeled percentages in a row without a common letter differ significantly, P<0.05 by logistic regression and Tukey-Kramer tests.

*Table 15: Hemoglobin and anemia prevalence of women shellfishers at 3 estuary sites in The Gambia.*[1]

| variables | Allahein estuary (n = 35)[2] | Bulock Area (n = 70)[2] | Tanbi Wetland (n = 109)[2] | P-value |
|---|---|---|---|---|
| Hemoglobin concentration, g/dl | 12.2 ± 1.3 (35) | 12.1 ± 1.1 (70) | 12.4 ± 1.2 (109) | 0.24 |
| Any anemia, Hb < 12 g/dl | 15/35 (42.9) | 32/70 (45.7) | 41/109 (37.6) | 0.55 |

[1]Total *n* = 214. Values are means ± SDs (n) unless otherwise indicated. *n*/total *n* indicates the number of participants whose response was "yes" for the variable in question/total number of participants analyzed for the variable in question.