Characterization of consumption patterns of small indigenous fish species among children aged 18-59 months in coastal fishing communities in Ghana

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This thesis is submitted in partial fulfilment of the requirements for the degree of Master of Philosophy in International Health at the University of Bergen

Abstract

Even though there is some progress towards Sustainable Development Goals (SDGs) during the past decades in Ghana, malnutrition due to poor diets remains an unresolved challenge with significant inequalities, especially among children under five years of age. This master's project is affiliated to the SmallFishFood project, which focuses on various aspects of fisheries and aquaculture in Ghana. The study involved a remotely supervised, descriptive, cross-sectional study to assess the nutritional status and dietary patterns among 385 children aged 18-59 months and caregiver perception on fish-food security. Different variables were generated from the quantitative data collected using a structured questionnaire. The MUAC screening identified a very low prevalence of malnutrition of 0.5 percent with MUAC less than 12.5 cm, and 78 percent of the children had an adequately diversified diet based on the Dietary Diversity Score (DDS). More than 40 different marine fish species were consumed across the four coastal regions and the majority of the children preferred the fish fried or smoked. The Likert scale analysis revealed that the majority of the caregivers have a positive perception on small fish of good quality being readily available throughout the year. The study also provided some insights into how the Covid-19 pandemic has affected the community, where about 70 percent of the caregivers stated that their household fish consumption was not affected by the pandemic. Finally, the study shows that the studied communities are frequent consumers of small fish with a positive attitude towards adding small fish into the diets of children. Therefore, we suggest that interventions should be focused on establishing sustainable harvesting, processing and distribution methods to facilitate a stable supply of small fish throughout the year as they are preferred mainly by the children in these communities. If a similar relationship between low prevalence of malnutrition and frequent small fish consumption is confirmed by future studies, the dietary pattern of these fishing communities could be adapted to combat malnutrition in other communities with a high prevalence of malnutrition. This would be a step towards achieving food security in Ghana in particular and other parts of sub-Sharan Africa facing similar nutritional challenges in general.

Acknowledgement

I take great pleasure in thanking you all, who helped me in completing this work.

I owe much to my supervisors:

- Anne Hatløy**,** Associate Professor, Centre for International Health
- Marian Kjellevold, Senior Research Scientist, Institute of Marine Research (IMR)
- Peter Andersen**,** Head of Department, Department of Geography

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I find it to be a privilege to have been a part of SmallFishFood project and I take this opportunity to thank the funding agencies. All the support I received during filed work from Amy Atter and Matilda Steiner-Asiedu in supervising the field work and Frank Peget, Obiri Kojo Odei, Theophilus Annan and Richard Ansong by collecting data is greatly appreciated.

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Last but not least, all the little children and the caregivers who took part in this study deserved to be thanked for their valuable time and information provided.

Finally, I must express my gratitude to my loving parents, my family and friends for their unfailing support and encouragement.

My partner Naveen, and my two sons, Mevan and Arun, "It is to you, that I dedicate this thesis".

Bhagya Janananda

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Abbreviations

COVID	Coronavirus Disease 2019
CSIR	Council for Scientific and Industrial Research
DDS	Dietary Diversity Score
DHS	Demographic and Health Surveys
FAO	Food and Agriculture Organization
FFQ	Food frequency questionnaire
GHS	Ghana Health Service
GSS	Ghana Statistical Service
IYCF	Infant and Young Child Feeding
MUAC	Mid-Upper Arm Circumference
UNHCR	United Nations High Commissioner for Refugees
USAID	United States Agency for International Development
WFP	World Food Program
WHO	World Health Organization

Chapter I: Introduction

Malnutrition, various forms of poor nutrition and poor-quality diets are leading causes of disease globally. New forms of malnutrition, particularly obesity and overweight have started to affect nearly two billion people across all regions of the world (FAO, 2014). Sustainable Development Goals (SDGs) set forth by the United Nations, explicitly aim to address malnutrition in all its forms through SDG 2, "*end hunger, achieve food security and improved nutrition*" [1]. With regards to SDGs, Ghana has performed well compared to other developing countries during the past years but the current prevalence rates of malnutrition among children stands above internationally accepted levels [2]. There has been a steady decrement in stunting at the national level since 2003 [3]. However, according to GSS, GHS & ICF International data, nearly 19 percent of under-five children were stunted with highest prevalence of 33 percent reported in northern regions [3]. Ghana demographic and health survey 2014 and 2015 shows a 4.7 percent of wasting and 5.9 percent of underweight among under five children [4]. Prevalence of obesity and overweight among 40 percent of women is evidence for the double burden of malnutrition in Ghana [5]. Data related to micronutrient deficiencies is scarce and geographically limited, yet shows some high prevalence of iron, vitamin A, zinc and riboflavin deficiencies, especially among preschool children [6].

Researchers around the world are carrying out studies to address challenges related to child malnutrition and household food insecurity to come up with timely interventions to overcome this crisis. Among many such nutrition related interventions, fisheries and aquaculture is of pivotal importance. The SmallFishFood[1]consortium which is funded by LEAP-Agri[2], is one such multidisciplinary research team that focuses on fish stock assessment, processing, marketing, nutrition, risk assessment and governance, mainly in Ghana, Kenya and Uganda. Aims of this master's project falls within the scope of SmallFishFood project, with special emphasis on characterizing fish consumption patterns of the children living in coastal fishing communities of Ghana **Figure 1**.

[1] SmallFishFood has a partnership between University of Bergen and Institute of Marine Research in Norway and universities in the Netherlands, Germany, Uganda, Kenya and Ghana.
[2] LEAP-Agri is a joint Europe Africa Research and Innovation (R&I) initiative related to Food and Nutrition Security and Sustainable Agriculture (FNSSA). The project has two pillars, (i) funding R&I projects on FNSSA, and (ii) Feeding the long-term EU- AU partnership on FNSSA.

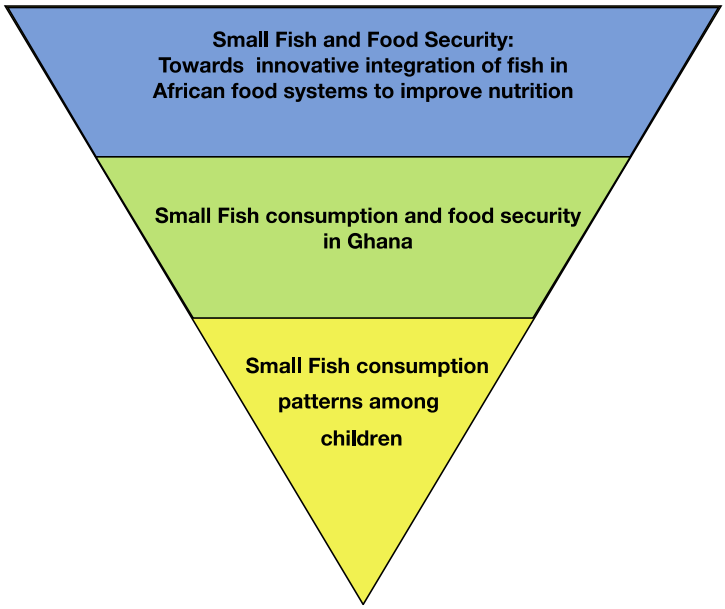

Figure 1: Focal areas of the SmallFishFood project in Ghana

Ghana is a West African country with a population of 29 million and over 2.6 million Ghanaians depend on fisheries for their livelihood [7]. According to FAO Fishery and aquaculture country profiles for Ghana [8], the per capita fish consumption stands at 28 kg/year, which is higher than that of Sub-Saharan Africa. Also, 50 - 80 percent of the animal protein requirement in Ghana is fulfilled by fish [9].

Given the significant role played by the fisheries sector in Ghana, there is great potential for involving the fisheries sector in food related interventions to combat malnutrition. However, a detailed characterization of fish consumption patterns in these communities is an essential first step towards achieving this goal. Therefore, to investigate the possibility of involving the fisheries sector in food related interventions in Ghana, we decided to conduct our study in Ghanaian fishing communities. Having a long tradition of consuming fish, there is great potential for involving the fisheries sector in food related interventions to combat malnutrition and food insecurity, especially among children in these communities. The specific contribution of small fish across different domains of food security (availability, accessibility, utilization and stability) in these communities and how these domains interact to influence nutrition and health outcomes remains a significant knowledge gap. Without such knowledge, the ability of the fisheries sector to contribute meaningfully to reduce malnutrition is significantly impaired. Therefore, characterization of small

fish consumption patterns in these communities would help to identify how fish consumption can be improved to optimize its integration into interventions towards achieving food security.

1.1 Fisheries Sector of Ghana

Ghana's fisheries sector can be divided into marine, inland (rivers, lakes and lagoons) and aquaculture [10]. Eighty percent of the total fish consumption in Ghana is comprised of marine fish and marine fisheries, which provides employment for most coastal communities [11]. The estimated mean per capita fish consumption is about 28 kg [8] and 75 percent of annual fisheries production is being consumed locally [12]. Twenty two percent of the household food expenditure is spent on fish products, which accounts for as much as 60 percent of animal protein in the average Ghanaian diet [13]. Around 2.6 million people rely on marine capture fisheries, including family members, input suppliers and office workers for fishing fleets [14]. Coastal communities rely on artisanal fisheries, which provides them with income, employment and fish as a cheap source of protein [15]. Though Ghana produces around 400 000 tons of fish products, it imports up to 600 000 tons of fish, spending roughly around USD 200 million per year, in order to fulfill the fish requirement of the country [13]. Low value small pelagic fish such as mackerel, comprise a bigger proportion of African fish imports [16]. This scenario of exporting higher value fish products to earn income and importing lower-value fish products to achieve food security is now becoming an emerging pattern in many African countries [17]. In such a situation, it is of crucial importance to emphasize the importance of small fish, which is high in nutritional value but considered a low-value commodity.

1.2 Fish consumption patterns in Ghana and factors affecting fish consumption

Fish and fishery products have been consumed across the demographic spectrum by young children to elderly and rural poor to urban rich in all regions of Ghana [13]. Small pelagic fish species such as anchovies, round sardinella, flat sardinella and mackerel (horse mackerel, chub mackerel) are comparatively more affordable to the local community and constitute a higher proportion of the artisanal catch, which contributes to 60-70 percent of the total annual marine fish output [13]. Premium fish species such as red snapper, sea bream, croaker and cassava fish have a demand from hotels and restaurants thus they have become unaffordable for average Ghanaians

[13]. Smoked-dried fish can be considered as the main export-oriented traditional fish product that contribute to incomes of artisanal fishermen and women processors [18].

Fisheries is one of the most cost-effective and sustainable ways to improve food security in rural communities. The provision of financial, technical and institutional support, especially for women who engage in fisheries in low-income households is an effective way to achieve household food security [19]. With such valuable attributes, Ghana has the potential to use the fisheries industry effectively to achieve food security, poverty reduction and sustainable livelihoods [14].

Research done on fish consumption around the world reveal various factors that can potentially affect fish consumption patterns. Consumers' social, geographical, and cultural characteristics affect fish consumption, frequency and preference [20]. For example, a study comparing the UK and Singapore, focusing on socio-demographic characteristics such as age, sex, educational level and religion has shown disparities in fish consumption patterns [21].

1.3 Small indigenous fish consumption in Ghana

Small fish in Ghana constitute of marine pelagic species and inland freshwater species. Ghana's marine fishery resource is associated with the western Gulf of Guinea that harbors small pelagic species with higher commercial value such as sardines, anchovy and mackerel. These species account for about 70 percent of the total marine catch [22]. According to data from the government of Ghana, the quantity of small pelagic species fluctuates considerably and has been in decline mainly due to overfishing [22]. Inland (rivers, lakes and lagoons) small fish are higher in diversity, consisting of wild species such as the Nigerian fangtooth pellonuline, West African pygmy herring, *Alestes* and *Brycinus* species [14, 23]. These wild small fish species are not well recorded in catch statistics because they are consumed locally and also due to their small size. However, to make better informed interventions targeting improved access, availability and consumption, further studies are needed to determine the exact contribution of different small fish species in different communities representing Ghana. The information on different species of small fish consumed in coastal communities is sparse.

1.4 Malnutrition in fishing communities

The four coastal regions of Ghana are comprised of fishing communities that rely on fisheries for livelihood [24]. In general, the presence of fish and higher levels of fish consumption are considered to be the major characteristics of a fishing community [25]. As a recent survey carried out in a peri-urban fishing community in Ghana points out, in spite of the abundance of nutrients gained by consuming fish and other staples in fishing communities, they still suffer from the burden of undernutrition. Also, the findings show a high prevalence of undernutrition among under-five children in this fishing community [25]. Apart from the health-related issues, findings of a recent household survey show higher prevalence of poverty among fishing communities [24]. Therefore, research aimed at identifying the underlying causes of malnutrition in fishing communities, despite the high levels of fish consumption is of critical importance. Data collected through such research projects will eventually be beneficial for the wellbeing of the community, thereby contributing significantly to the development of the nation [25]. Nutritional status of under five children is considered as a sensitive indicator to assess the overall health of a population [26].

1.5 Significance of small fish in human diet

Small Indigenous fish species (small fish); fish that usually grow to a maximum of 25 cm or 9 inches in their mature stages [27] or fish that are small enough to consume whole with head and bones, living in the waters of Ghana, was the main focus of this project. However, specific data on the habitat, availability and utilization of small indigenous fish species of Ghana is scarce. Therefore, information discussed here is applicable to small fish species in general, without any specific reference to indigenous species. One aim of the SmallFishFood project will be to address this information deficit on indigenous small fish of Ghana.

Fish, which are rich in amino acids, vitamins, unsaturated fatty acids and trace elements are considered as an easy to digest animal source of food for a healthy diet [20]. Small fish species eaten whole with head, bones and viscera are proven to be rich in bioavailable calcium, vitamin A, iron and zinc [28] and oily fish rich in omega-3 fatty acids are important for a child's brain development [7]. Compared to other animal proteins, fish is considered to be an easily digestible, affordable and yet, nutrient-rich source of protein, mainly for people who consume a carbohydrate based diet in developing countries [29]. Studies have shown that the intake of animal proteins such as meat, fish (oily and lean) and poultry can facilitate the non-heme iron absorption (uptake) from

the diet. This effect, which is known as the “meat factor” [30] would be an added advantage of incorporating fish and other animal sourced proteins into a plant-based diet, even in small quantities. A study on the contribution of fish consumption to the maternal and child nutrition in Zambia shows fish as the most consumed animal-source food by a high proportion of children and women [31]. In spite of the nutritional value, small fish are called "trash fish" and considered as a low value commodity [32].

1.6 Small fish for food and nutrition security

It has been found that the nutrients provided by small fish can be used to effectively fight micronutrient deficiencies that cause a considerable number of premature deaths that are attributed to malnutrition or “hidden hunger” in sub-Saharan Africa [15]. Also, small-scale fisheries can contribute to food security in two ways: by direct consumption and by increasing the purchasing power through income and employment [19]. Despite the declining overall fisheries income due to environmental degradation, the income received by small-scale fisheries in Ghana generally remains above the poverty line [19]. However, the link between consuming small fish and its health benefits is largely overlooked in national food polices, in global food security discourse and in current strategies to combat nutrient deficiency in low-income populations [15].

1.7 Assessing nutritional status and the dietary diversity

There are four approaches to evaluate the nutritional status of an individual/individuals: i.e. dietary assessment, anthropometrics, biochemical parameters and clinical examination [33]. Two of these methods, namely, dietary assessment and anthropometric measurements were chosen to assess the nutritional status of the selected children due to their easy administration in a field study involving more than one location. Evaluation of food and nutrient intake and dietary pattern of an individual is referred to as a “dietary assessment” [33]. Dietary diversity, which is defined as the number of different food groups being consumed over a certain period of time, is considered as a potentially useful indicator in dietary assessment [34]. This method is ideally suited for collecting data on the dietary pattern with regards to aim 2 of the study. The Food Frequency Questionnaire (FFQ) based on a 24-hour recall, which is a method of collecting data for the dietary assessment [33, 35] was chosen for this study, again due its ease of use with regards to this study.

Measurements of the variation of physical dimensions of an individual are known as "anthropometric measurements". Mid-upper arm circumference (MUAC) cutoffs for screening undernutrition are well established for children < 5 years and the measurement requires minimal equipment and training [36]. Therefore, it is well suited to screen the children in this cross-sectional study and was selected as the method for collecting anthropometric measurements.

Chapter II: Objective and Aims

We designed our study within a frame work to collect data relevant to improve the nutritional status of children by incorporating "small fish", which is the main focus of the SmallFishFood project. Even though our main focus is small fish, we designed the project in such a way to assess all the food groups the children consume, to get a better understanding of their dietary patterns. Since knowing the nutritional status and their dietary patterns is an effective way to choose community-based nutrition interventions, assessment of the nutritional status was included as the first step of the study.

2.1 Research question, objective and aims and the significance of the research

The main purpose of this master's project is to fill the knowledge gap in small fish consumption patterns in coastal fishing communities in Ghana by asking the question "**what are the characteristics of small fish consumption patterns among children aged 18-59 months in coastal fishing communities in Ghana?".**

Based on this question, the main objective of this project was "**to characterize small fish consumption patterns among children aged 18-59 months in coastal regions of Ghana".**

This main objective was addressed through three specific research aims.

1. To assess the nutritional status of children aged 18-59 months in coastal fishing communities in Ghana.
2. To assess food and fish consumption patterns among children aged 18-59 months in the fishing communities.
3. To assess consumption behavior and caregiver perception on small fish-food security in coastal fishing communities.

Based on the aims we addressed, the rationale of the study was "**to assess the nutritional status and dietary patterns of children aged 18-59 months to better understand how small fish can be incorporated to their diet to combat child-malnutrition and achieve household food security in nutrition deficient communities in Ghana**".

2.2 Conceptualized Framework

The conceptual framework of how the successful completion of this master's project on small fish consumption would contribute to integrating fisheries into strategies and polices aimed at addressing nutrition and food security in Ghana through the SmallFishFood project is shown in ***Figure 2***.

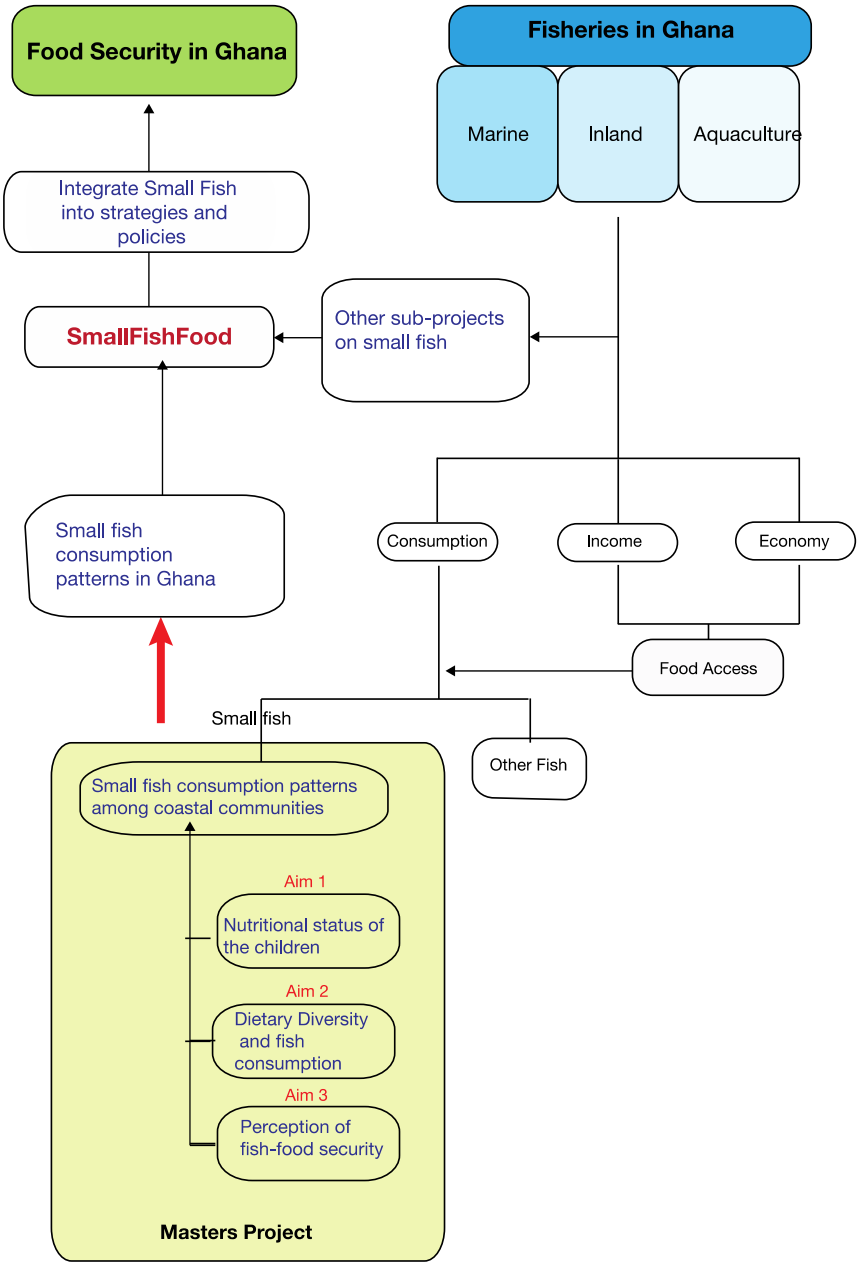

Figure 2: Conceptualized Framework of the master's project

Chapter III: Methodology

3.1 Study design

A total of 385 children between the ages of 18-59 months and their caregivers in four coastal fishing communities in Ghana were assessed. Due to the COVID situation, we made special arrangements so that the field work could be carried out remotely. The survey collected quantitative data on several components, namely demographics, nutritional status of the children, dietary diversity, small fish consumption and perceptions of fish-food security. The survey instrument comprised both open and closed ended questions addressing each of the three aims stated in the research protocol (**Table 1**). The frequencies, percentages and mean values of the demographic variables were calculated separately for each coastal region. After that, the findings were compared to identify any significant differences, associations or trends between variables.

Table 1: Measures, methods and variables used to address specific aims of the project

Aim	Measure	Method	Generated variables to use in the analysis
Aim-1	Demographics, Anthropometric parameters	Questionnaire to the caregiver & Measuring MUAC	Age categories, sex, education level, work situation, marital status, occupation, monthly household income MUAC measurement
Aim-2	Food groups Small fish species Frequency of small fish consumption	Questionnaire to the caregiver	Consumption of food groups, Dietary Diversity score, Dietary adequacy, Frequency of fish consumption (daily, weekly) Most preferred and most purchased fish species, cooking method, purchasing site
Aim-3	Perceptions on small fish- food security	Questionnaire to the caregiver	Responses to each dimension of food security

(i) Ethical approval

We sought ethical approval from REK (Regional Committees for Medical and Health Research Ethics, Reference number: 160065), Norway and NMIMR (Noguchi Memorial Institute for Medical Research, Study Number: 009/20-21), Ghana. Implications of collecting MUAC as the anthropometric parameter and recording other personal information were discussed during the process of ethical approval and the research was performed in accordance with the Helsinki Declaration. In addition, we asked for and were granted permission to enter and interview the residents of the communities by chief fishermen/ assembly men responsible for each community. The field assistant along with a project supervisor contacted the assembly men upon arrival or beforehand, depending on their availability in the communities. The field assistants explained the nature of the study, presenting the obtained ethical approval as official documentation to interview the community. Talking to chief fishermen in such a way facilitated easy access and acceptance in the community. Every participant enrolled in the study was given a bottle of hand sanitizer and a face mask as a non-monetary incentive.

(ii) Remote setting of field work during the aftermath of COVID-19 outbreak in Ghana

With the onset of the COVID-19 outbreak, master's students' travel to Ghana for the current study was cancelled. Therefore, special arrangements were made to carry out field work remotely. The expected starting date of field work in September, 2020 was pushed back to March, 2021 due to the situation arisen with the pandemic. This lagging period was mainly used to obtain ethical clearance and to revise the questionnaire. The REK requested details on the special arrangements added to the project to carry out data collection remotely without the presence of the master's student. These included the training of field assistants on building rapport and measuring MUAC of children under five years old, directing children identified as malnourished to a health facility and the transferring of data between Norway and Ghana in an efficient and secure manner. A detailed protocol with the plan to address each of their concerns was provided to REK.

After the gradual easing of the COVID-19 restrictions, the opinion leaders of the respective regions were contacted beforehand, asking for permission to enter the communities. The selected communities were visited by the field assistants according to COVID-19 restrictions and the guidelines were followed accordingly, as they were advised during the training session. All the necessary

communications between myself and the field team in Ghana were carried out via Zoom and WhatsApp during the entire duration of field work.

(iii) Selection of field assistants

Two personnel who are familiar with local culture and community, speak local dialects and with prior experience on conducting surveys related to nutrition, were appointed on behalf myself to carry out the field work. The team in Ghana included two field assistants (Frank Peget and Obiri Kojo Odei) who were guided by two doctoral students (Theophilus Annan and Richard Ansong). The two doctoral students were under the supervision of Professor Matilda Steiner-Asiedu (University of Ghana) and senior scientist Amy Atter of (CSIR - Food Research Institute).

The field assistants were advised to follow the guidelines outlined by the WHO and Ghana Health Service to prevent the spread of COVID-19 during field work. These included but were not limited to social distancing, wearing face masks, hand washing and using hand sanitizers. During the first few weeks, I held frequent online meetings to explain the research protocol and to assist the field assistants remotely. After that, weekly zoom meetings and additional meetings were held as necessary to solve any concerns regarding the questionnaire and/or data collection.

(iv) Designing the questionnaire

The survey collected quantitative data on several components, namely demographics, nutritional status of the children, dietary diversity, small fish consumption and perceptions on fish-food security using a structured questionnaire. The survey instrument comprised both open and closed ended questions addressing each of the three aims stated in the research protocol. The structure of the questionnaire, with three section allocated to each aim is shown in **Figure 3**. A separate set of questions to assess the asset-based wealth index were also included at the end of the third section of the questionnaire with the hope of calculating the wealth index. That section was developed based on DHS standards [4] relevant to Ghana. However, the data analysis required further clarifications, and was not addressed here due to time constraints.

The questionnaire was pre-tested for a randomly selected sample of six people from a fishing community in Accra. After that, the questionnaire was revised and certain questions were rephrased to address the difficulties identified during pre-testing.

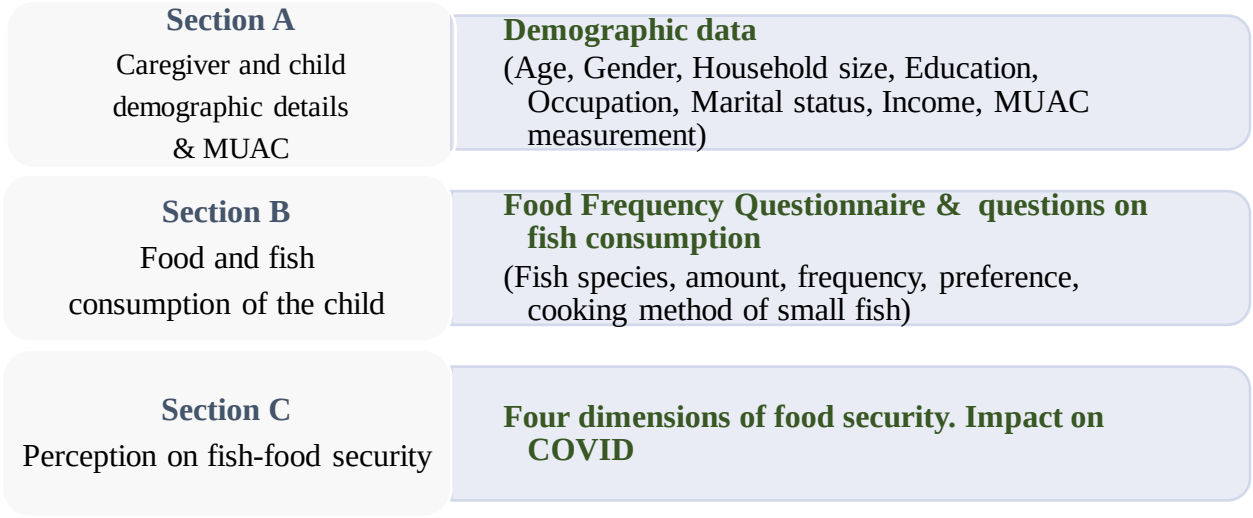

Figure 3: Three sections of the questionnaire corresponds to project aims

(v) Data management

During pre-testing, field assistants encountered difficulties with internet connectivity while collecting data using google forms. To mitigate this challenge, a free, open source platform called KoBoToolbox[3] was used to collect, store and transfer data for the duration of field work.

This platform was used to build questionnaire forms, interview guides, collect data, visualize results and export data. Access to KoBoToolbox is password protected from both data entry and data retrieving ends. Authorized personnel of the project had to use his/her personal credentials to login and access the data, ensuring the security of collected data. Through every step from the beginning to the end of the study, we ensured the security of personal data collected for the study. After administering the questionnaire, the field assistants stored the collected data on the tablet that they were provided with. Later in the day, the collected data were revised to make relevant changes such as replacing the local names of the fish by their common names for clarity during data analyses. Data were retrieved in Norway after the stored data were uploaded to the KoBoToolbox platform.

[3] KoBoToolbox is a free, open-source toolkit for collecting and managing data in challenging environments and is the most widely-used tool in humanitarian emergencies. It allows field data collection using mobile devices such as mobile phones or tablets and facilitates convenient data sharing https://www.kobotoolbox.org/

3.2 Sampling locations and communities

(i) Selection of coastal fishing communities

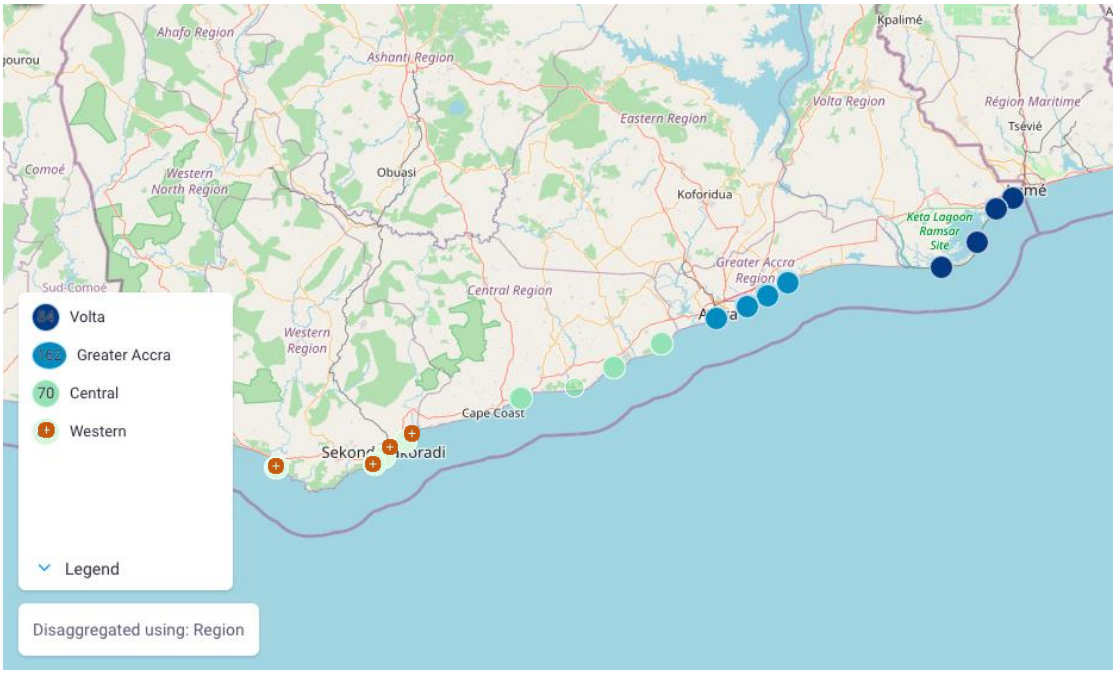

Figure 4: Sampling sites of the four marine coastal regions included in the study (color-coded according to the region). Source: Kobo toolbox

This study included all the four coastal regions of Ghana (Greater Accra, Volta, Central and Western), which are subdivided into a total of 26 districts. We purposefully selected 16 fishing communities representing 16 different districts (**Figure 4**) to obtain a thorough understanding of the fish consumption pattern in coastal fishing communities and for subsequent comparisons between regions. We defined a fishing village/community as a location where fisherfolks reside and have an "Assembly man/ Chief fisherman" as the head of the community [9]. The coastal communities of the above mentioned regions have a higher percentage of fisher folks involved in fisheries activities [37]. However, the communities can be further categorized as smaller and larger communities based on the number of fisherfolks and the number of canoes occupied by each fishing community. Every chief fishermen of the community knew to which category (small or large) their community belonged. Based on their categorization, 8 small fishing communities and 8 large fishing communities representing the 16 regions were chosen to be included in the study. After that, the field assistants visited the selected communities to carry out random sampling to recruit participants.

Table 2: Sampling framework showing the four districts selected from each region with obtained number of caregiver-child pairs with number of days allocated for field work

Region: Selected Districts	**Number of caregiver-child pairs (included in data analysis)**	**No. of days allocated to sample each region**
Greater Accra: Nungua Faashie, Tema New Town, Prampram, Otrokpe	152	9 days
Central: Moree, Anomabo, Mankwadze, Gomoa Fetteh	69	5 days
Western: Apewosika, Funko, New Takoradi, Aboadze	81	6 days
Volta: Ketu,Dzelukope, Adina, Atorkor	83	4 days
Total	**385**	**24 days**

(ii) Calculating the sample size

Ghanaian household composition reflects the social structure of the population [38]. The *Ghana living standards survey* defines a household as "a person or group of related or unrelated persons who live together in the same housing unit, sharing the same housekeeping and cooking arrangements and are considered as one unit, who acknowledge an adult male or female as the head of the household" [38].

Smith's [39] formula for determining sample size was employed to calculate the sample size of this cross-sectional study. We used a Z-score of 1.96 which corresponds with a 95percent confidence level, standard deviation of 0.5, and a 5percent margin of error in the following formula.

Sample Size = $(\text{Z value})^2$ X standard deviation (1-standard deviation)/$(\text{margin of error})^2$

$= (1.96)^2 \text{ X } 0.05 \text{ X } (1 - 0.05)/ (5\%)^2$

$= 384.16$

Based on this formula, we calculated a sample size of 384.16. To achieve the desired precision or confidence interval after removing missing data or non-responders from the data set, we decided to oversample 10 percent of the calculated sample size. This resulted in a total sample size of 423.5 participants. However, only a total of 407 households were visited during the random sampling process to recruit participants, out of which, a total of 385 caregiver-child pairs were included in the final cleaned data set used in the analysis. According to the criteria used in the sample size calculation, the sample size of 385 participants included in our data analysis has fulfilled the desired statistical requirements. Number of caregiver-child pairs obtained from each coastal region and the number of days allocated for sampling in each region is shown in **Table 2**. Selected districts to be included in the study are mentioned beneath each region.

(iii) Random sampling of the households

After obtaining permission to enter the community from the chief fisherman, field assistants located an important landmark, such a school, hospital or church as the random starting point. Then, a random direction was chosen by spinning a pen as the direction of their movement to select eligible households. The first house they encountered was numbered as 01. The field assistants kept moving in the pre-determined direction while continuing to sample and interview the community until they reached the allocated time for field work for the day. If there were more than one eligible caregiver-child pairs living in a selected household, the child who has had the most recent birthday was selected to be included in the sample.

(iv) Recruiting Participants

After selecting an eligible household, the field assistant carried out a quick assessment to determine the eligibility of the caregiver and the child. To be eligible for the study, the household had had a child of the age 18- 59 months, living with a person who was willing to give full consent as the main caregiver of the child who could either be the biological mother or other main caregiver. The field assistant explained the nature of the study once he decided to include the caregiver-child pair as participants. After that, they guided the caregivers through the consent procedure to obtain written consent. After that, the field assistant measured the MUAC of the child and administered the questionnaire to the caregiver. In cases where the mother was less than 18

years old, consent was obtained from the guardian. Participation in the study was voluntary and the participants were free to discontinue participation at any time as explained in the Helsinki-declaration. Such participants were removed from the sample during data cleaning.

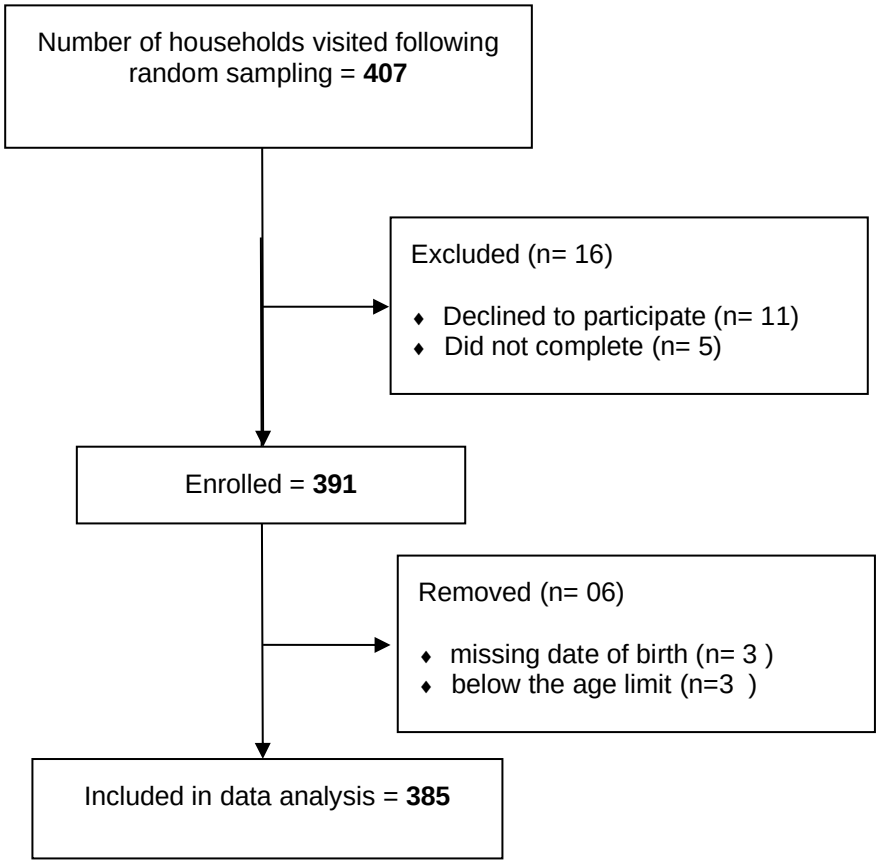

Figure 5: Flow diagram showing the selection of participants

The field assistants visited a total of 407 households according to the random sampling procedure. Sixteen participants were excluded from the data set as 11 of them did not consent after explaining the sampling procedure and 5 participants withdrew participating due to interruptions. Data from a total of 391 caregiver-child pairs were collected and recorded into KoBoToolbox, out of which, six caregiver-child pairs were removed due to missing date of birth and the recorded age of the child being below 18 months. This resulted 385 complete entries to be included in data analysis (**Figure 5**).

(v) Data collection procedures

The field assistants conducted face-to-face interviews with the caregivers using the pre-tested, structured questionnaire to collect data. Data collection using the questionnaire was started by measuring and recording the MUAC along with the date of birth of the eligible child. Then the field assistants administered the questionnaire accordingly, recording the answers to the questions from section A to C. Demographic data, food and fish consumption data and information regarding perceptions on fish-food security were collected using the questionnaire. Field assistants used a tablet-based (paperless) method to collect, store and upload all collected data using the KoBoToolbox platform.

(vi) Measuring MUAC measurement

All the selected children were screened for acute malnutrition upon receiving the consent of the caregiver. Trained field assistants measured the MUAC of every eligible child while following COVID-guidelines by sanitizing the upper arm with hand sanitizer. This measurement was taken with a standard MUAC tape recommended by WHO, at the mid-point of the left upper arm while the arm is fully stretched. Every child was measured twice by the same field assistant to the nearest 0.1cm. The presence of acute malnutrition, defined as a MUAC measurement less than 12.5 cm (UNHCR & WFP, 2011) was used as the cutoff to identify malnourished children. The data set included a total of 385 MUAC measurements of children of different ages within the selected age of 18-59 months. The field assistants tried to build a good rapport with the child and worked at the child's level to secure a successful measurement. The caregivers of the children who were identified as malnourished were informed about the circumstances and were advised to direct the child to a health facility for assistance. The REK has reviewed and approved measuring MUAC on the selected age group in this study.

3.3 Data Analysis

Data were uploaded in several sessions with intervals into KoBoToolbo due to the nature of the field work. All data were downloaded in Excel format from the KoBoToolbox platform. The final data set with 385 participants was created by removing participants with missing dates of birth, and children below the age of 18 months.

After that, the data were exported to IBM® SPSS® Statistics version 26 for data management and statistical analyses. Specific analysis methods are discussed under each section relevant to addressing each aim. The frequencies, percentages and mean values of the demographic variables were calculated separately for each coastal region.

(a) Anthropometric measurements and Demographic characteristics

Section A of the questionnaire contained questions to collect demographic information of the child and the caregiver. Child's date of birth and sex were recorded as the child's demographic data. Caregiver's demographic data included age, sex, status in the household, education level, number of children per caregiver, work situation and occupation. Some other demographics related to the household, such as the size of the household and the monthly income were also recorded. Categorical variables were described as frequencies, whereas continuous variables were descried as means ± SD. Mean MUAC measurements were compared between two age categories and between sexes using crosstabs in SPSS.

(b) Food frequency, fish consumption and dietary patterns

As a means for understanding food consumption patterns, we calculated the DDS using a simple scoring system[4] based on the food groups consumed by the child during the previous 24 hours. Section B of the questionnaire comprised of an FFQ, which was created based on WHO's IYCF guidelines [35]. Commonly eaten local foods were also incorporated to the standardized seven food groups to optimize the food frequency questionnaire to the local community. We decided to use a Food Frequency Questionnaire (FFQ) as the data collecting instrument due to its

[4] If a child was given any food belong to a certain food group, it was recorded as "yes". For example, if a child was given a fish for lunch, this is recorded as ‘yes’ for the food group "Flesh foods". In the DDS calculation, every "yes" was replaced by "1". Every "No" was replaced by "0". Number of “1"s were summed to calculate the DDS for each child.

simplicity and because it can be administered in a shorter period of time. The food groups were: 1) Grains, roots, tubers, plantains and bread, 2) Legumes, nuts and seeds, 3) Milk and milk products, 4) Flesh foods, 5) Eggs, 6) Vitamin A-rich plant foods and 7) Other fruits and vegetables. Completed FFQ can be found in Appendix. Field assistants asked the caregiver to recall whether the child had consumed food from each of the seven food groups during the past 24 hours. If the answer was "yes" it was converted to a score of "1" and if the answer is no, it was converted to a score of "0". Therefore, the dietary diversity score ranged from 0 to 7 with a maximum of 7 if all the food groups were consumed and 0 if none of them were consumed. In order to order compare our data with available data from previous surveys, we categorized children into two age categories as 18-35-month-old and 36-59-month-old children. Chi-Square and ANOVA tests were performed to test the statistical significance of the comparisons, using a significance level of 0.05.

(c) Perception of Fish-Food Security

Caregiver perception on the four dimensions of food security in terms of small fish consumption were identified based on the responses received from the third section (Section C) of the questionnaire. Four Likert scale questions linked to the four dimensions of food security were included as shown below.

Availability - "I can find the small fish species that we eat when I want them"

Accessibility - "I believe the small fish prices are generally affordable"

Utilization - "Good quality small fish is available for me to purchase"

Stability - "I get the small fish species I want throughout the year"

Caregivers were asked as to what extent they agree, disagree or hold a neutral opinion on the above-mentioned statements. The percentage of each response on the Likert scale were calculated by dividing the number of responses by the total number of respondents using Microsoft Excel.

At the end the following question was asked, to gain insights into how the Covid-19 pandemic has affected the household fish consumption. And the answers were collected as in a Likert scale question.

"Has your household fish consumption changed due to COVID -19?"

Chapter IV: Results

Background characteristics of the caregivers and children are presented in **Table 3** and **Table 4** respectively. Majority of the caregivers, 98 percent (376/385) were females. The mean age of the caregivers was 31 ± 7.7 years and 71 percent of the caregivers were married. The modal level of education among the caregivers was Junior High School (JHS), and over 12 percent had a secondary or higher education. Of the 78 percent who were employed, 31 percent were involved in fisheries as a livelihood. Most of those fisher folks were fish mongers (smoke fish and sell) fish processors (smokers) and vendors (sells fish). A comparatively higher percentage (47 percent) of the caregivers were involved in other occupations such as food vendors, hairdressers, tailors, traders, etc.

The monthly household income of nearly 43 percent of the caregivers was less than US$ 100 while 20 percent stated that they were receiving more than US$200 per month. Average size of a household is 5.5 ± 2.3 and the mean number of children per caregiver was 2.8 ±1.6. The percentage of households using iodized salt for cooking was 37 percent. Only 14 participants have taken part in a community nutrition program in the past and 73 percent of the caregivers stated that they have received information on the importance of including small fish in their diets through a health facility.

Table 3: Socio-demographic characteristics of caregivers of the children aged 18-59-months.[5]

Demographic Variable	Greater Accra	Central	Volta	Western	All
Sex (n =385)					
Female	149 (98)	67 (97)	79 (95)	81(100)	376 (98)
Male	3 (2)	2 (3)	4 (5)	0 (0)	9 (2)
Total number of caregivers	152 (39)	69 (18)	83 (22)	81 (21)	385 (100)
Mean Age (years±SD)	32 ± 0.6	31 ±1	29 ± 6.7	31 ± 0.8	31 ± 7.7
Educational level (n = 385)					
Non-formal	46 (30)	17 (25)	13 (16)	25 (31)	101 (26)
Primary	28 (18)	18 (26)	30 (36)	18 (22)	94 (24)
JHS	59 (39)	24 (35)	30 (36)	30 (37)	143 (37)
Secondary	14 (2)	8 (12)	7 (8)	7 (9)	36 (9)
Tertiary	2 (1)	0 (0)	3 (4)	1 (1)	6 (2)
Vocational Training	3 (5)	2 (3)	0 (0)	0 (0)	5 (1)
Work Situation (n = 385)					
Employed	122 (80)	45 (65)	69 (83)	65 (80)	301(78)
Unemployed	30 (20)	24 (35)	14 (17)	16 (20)	84 (22)
Occupation (n=301)					
Fisher folk	45 (30)	10 (15)	26 (31)	39 (48)	120 (31)
Other	77 (51)	35 (51)	43 (52)	26 (32)	181 (47)
Missing	30 (20)	24 (35)	14 (17)	16 (20)	84 (22)
Monthly household income in US$ (n = 306)					
Income 0 to ≤ 100	41 (27)	33 (48)	43 (52)	48 (59)	165 (43)
Income 101 to ≤ 200	61 (40)	27 (39)	30 (36)	23 (28)	141 (37)
Income > 200	50 (33)	9 (13)	10 (12)	10 (12)	79 (21)
Other Information (n=385)					
Household size (mean ± SD)	5.5 ± 2.2	5.3 ± 2.4	5.8 ± 2.5	5.7 ± 2.1	6 ± 2.3
Children per caregiver (mean ± SD)	2.9 ± 1.4	2.7 ± 1.9	2.8 ± 1.5	3.1 ± 1.6	2.8 ± 1.6
Add Iodized salt to food	75 (49)	14 (20)	11 (13)	44 (54)	144 (37)
Received information about small fish	103 (67)	54 (78)	59 (7)	65 (80)	281 (73)
Taken part in Nutritional Programs	8 (5)	3 (4)	2 (2)	1 (1)	14 (3)

[5] Total number of entries included to calculate each variable is denoted as "n". The data on continuous variables are presented as mean ± Standard Deviation (SD), while the findings on categorical variables are presented as frequency (n (percentage)).

Table 4: Demographic characteristics of the children aged 18-59-months in four coastal regions.[6]

Demographic Variable	Greater Accra	Central	Volta	Western	Total
Sex					
Female	77 (51)	33 (48)	35 (42)	38 (47)	183 (48)
Male	75 (49)	36 (52)	48 (58)	43 (53)	202 (52)
Total	152 (40)	69 (18)	83 (22)	81 (22)	385 (100)
Age group					
18 – 35 months	72 (47.)	38 (55)	54 (65)	42 (52)	206 (54)
36 – 59 months	80 (53)	31 (45)	29 (35)	39 (48)	179 (46)
Mean MUAC (cm) (±SD)	15.2 ± 0.1	15.4 ± 0.1	15.2 ± 0.1	15.1 ± 0.1	15.23 ± 1.2
Currently breastfeeding	11 (7)	12 (17)	23 (28)	7 (9)	53 (14)
Completely weaned	142 (93)	57 (83)	60 (7)	74 (91)	332 (86)
Child consume small fish	148 (97)	67 (97)	82 (99)	81(100)	378 (98)
Child takes vitamin supplements	69 (45)	30 (43)	52 (63)	48 (59)	199 (52)

Calculated Demographic characteristics are tabulated in **Table 4**. Out of a total of 385 children surveyed, 183 (48 percent) were girls and 202 (52 percent) were boys. They belonged to the age category of 18 - 59 months, which was further divided into two groups as 18-35 months and 35-59 months during data analysis. Most (82 percent) of the children were completely weaned and only 14 percent were supplemented with breastmilk. Almost half (52 percent) of the children have been taking vitamin supplements and 98 percent of the children ate small fish.

[6] The data on continuous variables are presented as mean ± Standard Deviation (SD), while the findings on categorical variables are presented as frequency (percentage). Total of 385 entries were included in the calculation of each variable

4.1 Assessment of the nutritional status of the children aged 18-59-months

We screened the participated children using the MUAC measurement to identify their nutritional status. **Table 5**, summarizes the calculated mean MUAC measurements by age and sex of the 385 children included in the study.

Table 5: Mean MUAC measurement of children 18- 59 months (n=385)

Age Category	Sex	Mean MUAC (cm) ±SD	Identified as acutely malnourished (MUAC< 12.5cm) N (%)
18-35 months	Girl	14.8 ± 1.1	1(0.5%), 12.4cm
(n=206)	Boy	14.9 ± 1.2	1(0.5%), 12.2cm
36-59 months	Girl	15.6 ± 1.6	0
(n=179)	Boy	15.5 ± 1.1	0

Mean MUAC of the sampled population of 385 children is 15.2 ± 1.2. Only two children (0.5%) were identified as acutely malnourished, having MUAC measurements of 12.4 cm and 12.2 cm. None of the children of the age category 36-59 months were acutely malnourished[7]. Therefore 99.5% of the children took part in the survey were not malnourished based on their MUAC measurement.

[7] The term "wasted" and "acutely malnourished used interchangeably in this document.

4.2 Assessment of food and fish consumption patterns among children aged 18-59 months in coastal fishing communities

(a) Consumption of food groups

Analyzed data on the consumption of different food types during the past 24-hours is tabulated as below.

Table 6: Summary of Food Group Diversity

Number of Food Groups Consumed	Frequency	Percent
1	4	1
2	25	6.5
3	57	14.8
4	118	30.6
5	112	29.1
6	52	13.5
7	17	4.4
Total	**385**	**100**

The frequency of the number of different food groups consumed across the sampled population in the 24-hour dietary recall is shown in **Table 6**. Of the study population, 30.6 percent of the children consumed four food groups during the past 24hrs. Only 1 percent of the sampled population consumed one out of seven food groups.

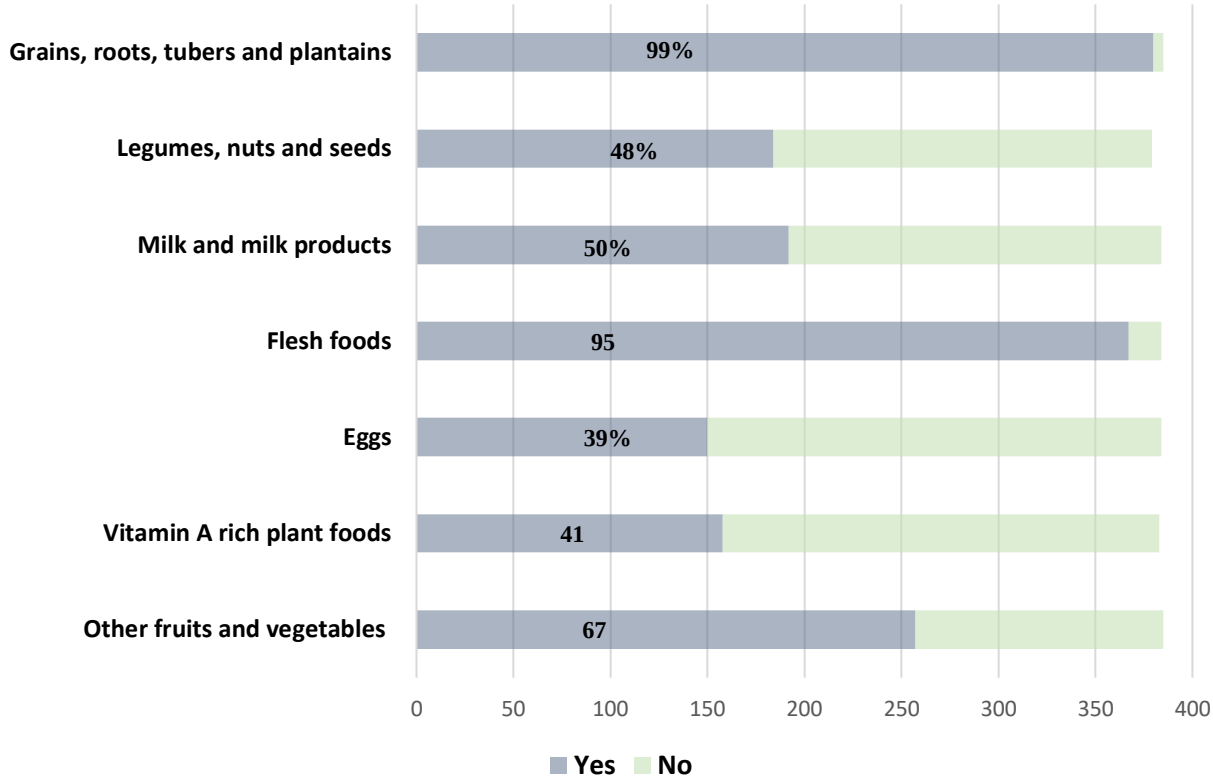

Figure 6:Frequency of consumption of seven food groups by children 18-59 months

According to **Figure 6**, the diets of the children were mainly composed of grains, roots, tubers and plantains as 99 percent of the children had consumed food belonging to that group. Flesh foods, which includes fish, poultry, red meat and organ meat showed the second highest percentage (95 percent) of consumption. The food groups consisting of eggs and vitamin A rich plant foods were consumed less compared to the other food groups.

(b) Dietary Diversity

The dietary diversity of 385 children aged 18-59 months in the four coastal regions were assessed. Dietary diversity data were analyzed and presented across two age categories and two sexes for further comparison (**Table 7** and **Table 8**).

Table 7: Mean Dietary Diversity of children by sex and age group

Variable	DDS mean	p-value
Sex		
Boys (n=202)	4.4 ± 1.1	0.9
Girls (n=183)	4.3 ± 1.3	
Age		
18-35 months (n=206)	4.3 ± 1.2	0.6
36-59 months (n=179)	4.4 ± 1.2	
Total=385	4.3 ± 1.2	

The mean dietary diversity score of the participated children was 4.3 ± 1.2. Mean dietary diversity among girls (4.4 ± 1.3) and the boys (4.4 ± 1.1) show no significant difference based on the statistical analyses performed using chi-squared test.

Table 8: Frequency distribution of adequate and inadequate dietary diversity scores across coastal regions. [8]

Age Category	Greater Accra	Central	Volta	Western	All
18-35 months					
DDS-Inadequate	12 (26)	5 (11)	19 (41)	10 (22)	46 (22)
Adequate	60 (37)	33 (21)	35 (22)	32 (20)	160 (78)
36-59 months					
DDS-Inadequate	8 (20)	7 (17)	12 (30)	13 (32)	40 (22)
Adequate	72(52)	24 (17)	17 (12)	26 (19)	139 (78)
Total					
DDS-Inadequate	20 (13)	12 (17)	31 (37)	23 (28)	86 (22)
Adequate	132 (87)	57 (83)	52 (63)	58 (72)	299 (78)

[8] (DDS = Dietary diversity score, Inadequate classified as DDS ≤ 3, Adequate DDS classified as DDS ≥ 4)

Categorization of children as having an "Adequate" or "Inadequate" dietary diversity based on the number of food groups consumed during the previous 24hrs is shown in Table 8. The percentage of children with adequate (78 percent) and inadequate DDSs (22 percent) were the same across age groups in the total sampled children. However, the percentages differ across the four coastal regions. Greater Accra has the highest percentage (86.8 percent) of children with an adequate DDS while Volta region has the lowest (63 percent). The minimum dietary diversity score (children who consumed four or more food groups / total number of children surveyed) was 78 percent. Based on the p value of Pearson Chi-Square test (0.001), the differences between regions were significant.

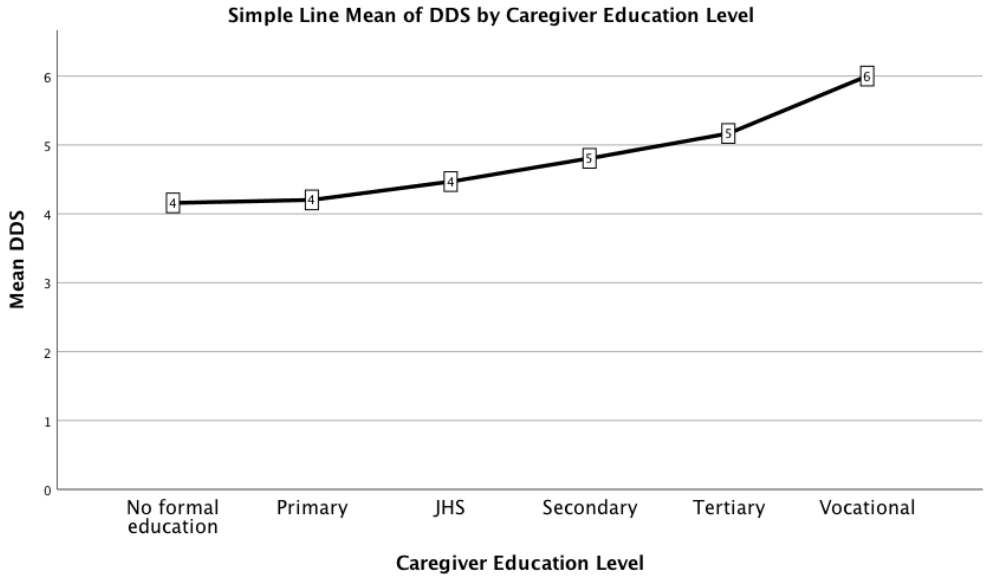

Figure 7: Relationship between caregiver's education level and mean DDS

(DDS - Dietary Diversity Score, JHS- Junior High School. The number indicated inside the boxes are mean DDS)

Figure 7 shows a positive relationship between the mean DDS and the caregiver's education level. The mean dietary diversity increases as education level increases.

(c) Fish consumption

The survey identified over 40 different fish species that are being consumed by the participants. The most consumed small fish species by children aged 18-59 months were Chub mackerel, round sardinella and anchovy. When considering all types of fish species consumed in the communities, Chub mackerel, round sardinella, anchovy and frigate tuna were among the most purchased and preferred species (**Table 9**).

Table 9: Most preferred and purchased fish species among children and the household

Most preferred fish species of the child	Most preferred fish species of the household	Most purchased fish species of the household
Chub mackerel	Chub mackerel	Chub mackerel
Round sardinella	Round sardinella	Round sardinella
Anchovy	Frigate tuna	Frigate tuna
Frigate tuna	Anchovy	Anchovy
Skip jack tuna	Barracuda	Barracuda
Barracuda	Skip jack tuna	Lesser African Threadfin
Spanish mackerel	Lesser African Threadfin	Spanish mackerel
Lesser African Threadfin	Spanish mackerel	Skip jack tuna
Atlantic bumper	Cassava croaker	False scad
Red pandora	Angola dentex	Red pandora

Table 10 : Weekly mean small fish consumption by children aged 18-59 months in different coastal regions

Mean small fish consumption	Greater Accra	Central	Volta	Western	Total	One-way ANOVA P value
Per week	3.3(1.6)	2.7(1.2)	3.5(2.0)	2.4(0.7)	3.1(1.6)	0.000

The means of the frequency (number of times the child is fed small fish) of small fish consumption per week across the four coastal regions are shown in **Table 10**. The mean weekly small fish consumption of the total sampled population is 3.1 servings. The data shows that children in the Volta region consume small fish more frequently when compared to other regions. A P-value of less than 0.05, obtained from One-way ANOVA shows that the differences seen across different regions are statistically significant.

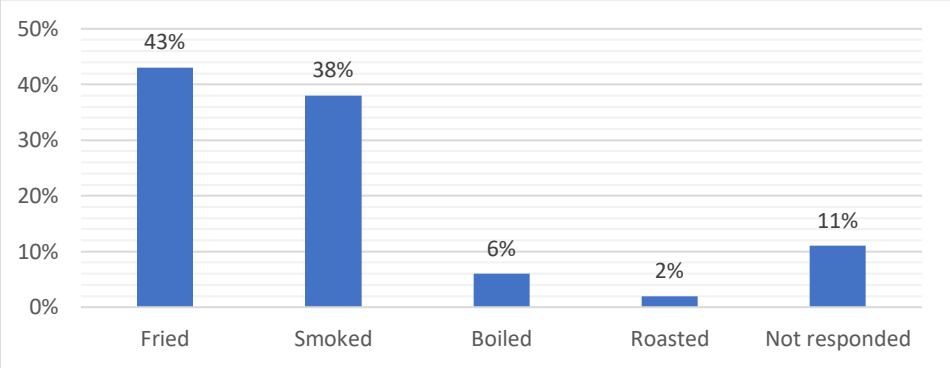

Figure 8: The most preferred cooking/processing method of small fish by children

Figure 8 shows the frequency in y axis and the preferred cooking method in the x axis. As shown in **Figure 8**, the most preferred processing or cooking method of small fish consumed by children was assessed using the questionnaire and the data showed that the majority of children preferred small fish that were fried (43 percent) or smoked (38 percent). Boiled and roasted were also mentioned as other common cooking methods. The age category was not considered for this assessment.

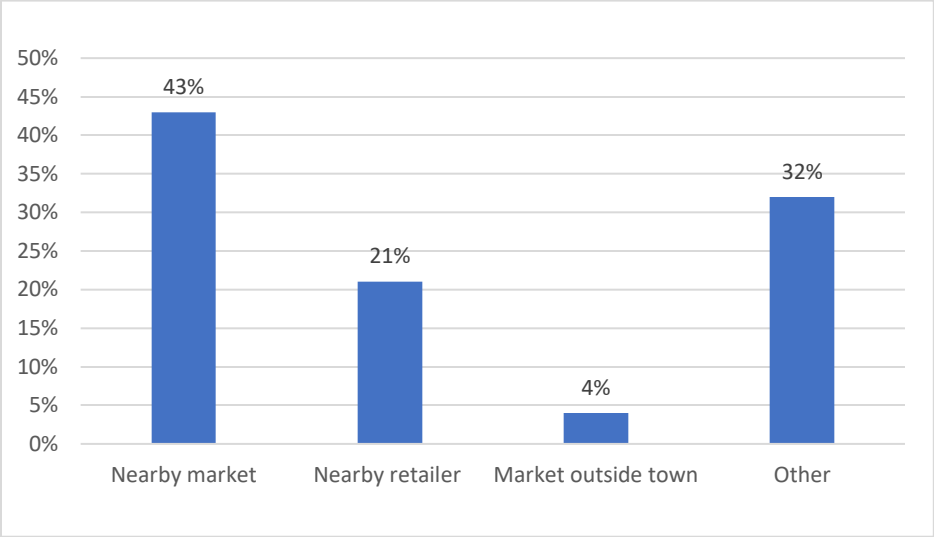

Figure 9: Common small fish purchasing sites in the communities

The respondents of each region were asked to mention the places they regularly buy small fish from in order to characterize purchasing preferences of the communities. according to **Figure 9**, majority of the respondents bought small fish from the nearby market while other responses included from a fisherman, fishing harbor, cold store and at the beach.

4.3 Assessment of consumption behavior and caregiver perception on small fish-food security in coastal fishing communities.

(a) Perception of Fish-Food Security

The responses received on the four dimensions of food security using a Likert scale is shown in **Figure 10**.

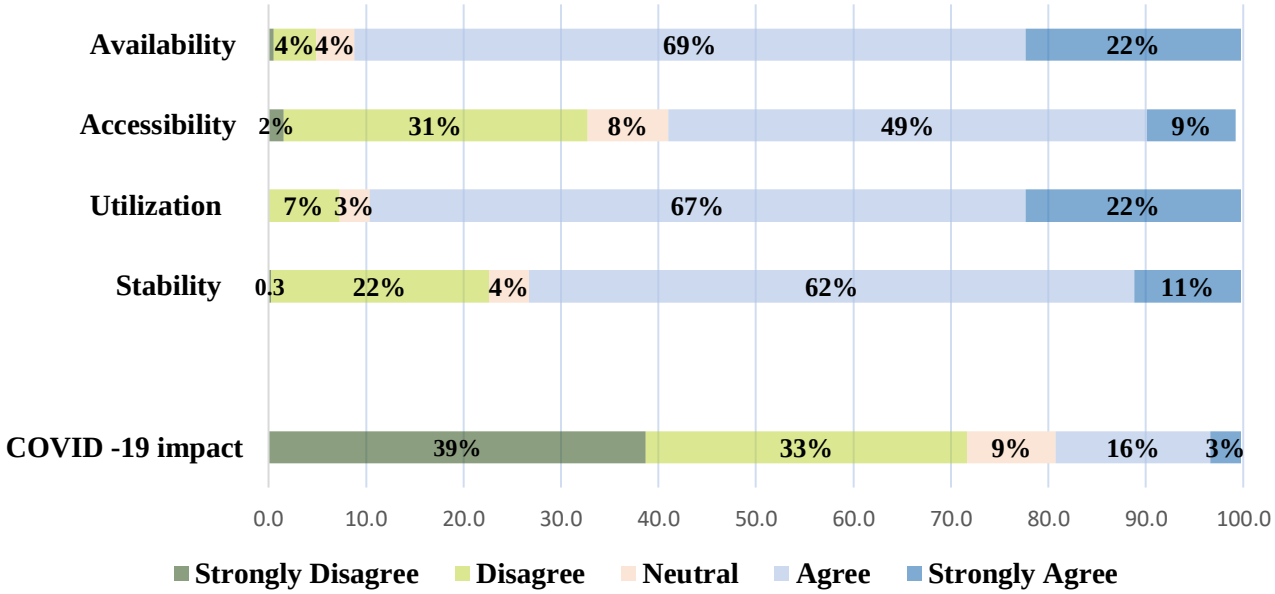

Figure 10: Caregivers' perceptions of small fish consumption and fish-food security

Nearly 90 percent of the of caregivers either strongly agreed (22 percent) or agreed (69 percent) that they can find small fish species when they want them. As shown in **Figure 10**, varied opinions were given by the caregivers on the accessibility of small fish. About 60 percent of the respondents either agreed (49 percent) or strongly agreed (9 percent) that small fish prices are generally affordable while about 33 percent either disagreed (31 percent) or strongly disagreed (2 percent) with the statement. A considerably high percentage of participants (89 percent) responded positively by agreeing (67 percent) or strongly agreeing (22 percent) with the dimension of utilization. Even though a majority of the sampled population agreed and strongly agreed that they can get small fish year around, a fraction of the caregivers (22 percent) disagreed with the statement. Lastly, less than 20 percent of the respondents agreed or strongly agreed that the

situation arisen due to COVID-19 has negatively affected their usual household fish consumption. About 9 percent of the respondents were neutral in their response.

(b) Consumption behavior

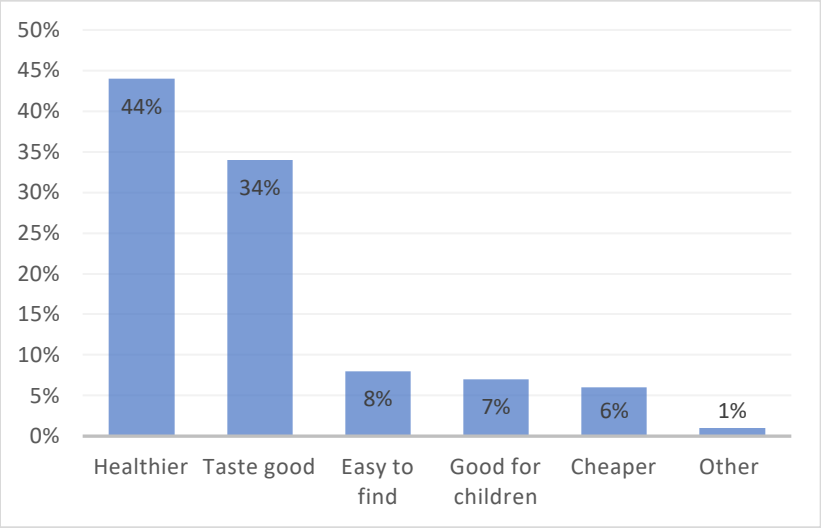

Figure 11: Caregivers' opinions about small fish consumption

According to the survey data, a majority (44 percent) of the caregivers believe that small fish is a healthier choice of animal protein and 7 percent believe it is specifically good for children. Thirty four percent chose small fish due to its taste and only 6 percent found them to be affordable **Figure 11**.

Chapter V: Discussion

The main objective of this master's project was to study 18-59-month-old children and their caregivers living in coastal fishing communities to characterize their small fish consumption patterns. In order to gain insights into this objective we assessed the current nutritional status of children, patterns of food and fish consumption and lastly, their consumption behavior and perceptions towards small fish. Through the descriptive, cross-sectional setting of the study, we were able to compare socio-economic factors, nutritional status and food and fish consumption patterns across four coastal regions of Ghana. The assessment of nutritional status of the children together with dietary data on food and small fish consumption provided valuable insights into food consumption patterns of 18-59-month-old children in coastal fishing communities.

Nutritional status of children aged 18-59 months in coastal fishing communities in Ghana

Measuring the MUAC was used as a proxy measure to screen under five-year-old children for the presence of malnutrition in the studied coastal fishing communities. From this assessment, only 0.5 percent of the children from the Volta region was found to be acutely malnourished or wasted. Apart from that, our MUAC data did not indicate to the prevalence of any other forms of malnutrition. The USAID 2018, Ghana Nutritional Profile [40] has shown that the national wasting percentages have decreased from 9 percent in 2008 to 5 percent in 2014. Therefore, it is likely that the low prevalence of wasting of 0.5 percent observed in the Volta region reflects these national trends. However, the same nutritional profile [40] shows varied levels of wasting across different regions of the country ranging from 9 percent in the upper east to 3 percent in the Volta region. Therefore, one needs to be cautious when using this data for nationwide comparisons as other factors affecting different communities might influence the prevalence of wasting differently in a community dependent manner. This highlights the need for more data from various communities for generating a more complete description of the nutritional status of the country.

In an attempt to identify the underlying causes resulting in the observed low prevalence of wasting and higher dietary diversity among children in the study sample, we looked at the level of nutritional knowledge of the caregivers in the study sample. A majority of the caregivers (44

percent) included small fish in the diet as they believed that it was a healthier option and 7 percent of the caregivers believed that small fish is a healthier option for children in particular. Also, 73 percent of the caregivers stated that they have been informed about the importance of incorporating small fish into the diet by a health facility. These findings suggest that the caregivers in these communities are well aware of the importance of including small fish in their diet, especially in the diets of children. Therefore, it is likely that the low prevalence of malnutrition in the sampled communities might be linked to the increased level of awareness of the caregivers on the importance of including small fish in the child's diet and the relatively high level of education of the caregivers. Also, based on the collected data, we calculated a mean of 2.8 ± 1.6 children per caregiver, which is less than the national average of 3.8 children [41] per woman in Ghana. Having a fewer number of children per caregiver might also have an impact on the improvement of child nutrition and health in these communities. These findings indicate to complex relationships between multiple factors contributing to child nutrition and health that needs to be investigated further.

Food and fish consumption patterns among children aged 18-59 months

Conducting a dietary assessment to understand existing food consumption patterns in a given community is considered to be a necessary requirement when planning nutritional interventions [33]. Therefore, we carried out a dietary assessment using a simplified FFQ to identify the commonly consumed foods by the children in the studied communities. At the same time, we collected information on their fish consumption patterns with special emphasis on small fish.

Food Groups and Dietary Diversity

Grains, roots, tubers and plantains was the most consumed food group in the studied sample. However, this finding does not agree with the findings of Bandoh and Kenu (2017), where flesh food was found to be the most consumed food group (79.8 percent) in another fishing community in the central region of Ghana [25]. According to our data, flesh food was the food group with the second highest level of consumption, followed by fruit and vegetables. The findings of the current study together with the findings of Bandoh and Kenu (2017) suggests that children

in coastal communities are more likely to consume foods on the "flesh food" group [25]. However, not including questions to identify the types of flesh food was one drawback of the questionnaire we designed. Despite this limitation, we identified that 98 percent of the children in our study sample consumed small fish according to the responses of the caregivers. Due to the higher frequency of small fish consumption along with the higher diversity of small fish identified, it is likely that the majority of the flesh food consumed in these communities would comprise of fish. This assumption is in line with FAO statistics (2016), which identifies fish as the most important animal protein consumed in all regions of Ghana, regardless of the socio-economic situation. However, we noted that studies on food group consumption, including small fish in Ghana is scarce, limiting the possibility of conducting comparative analyses. Therefore, this study provides much needed information for future studies, especially with regards to coastal fishing communities.

With regards to the "meat factor" discussed in the literature survey, we calculated the proportion of plant-based food groups eaten together with flesh food in the sampled population and found that the consumption of vitamin A-rich plant food and other fruits and vegetables in the study sample were 42 percent and 67 percent respectively. Therefore, by consuming flesh food along with other plant-based foods rich in vitamins, it is likely that a majority of the population must be receiving an added advantage of absorbing more micronutrients from their diets. Furthermore, according to Hicks et al (2019) incorporation of fish-based food strategies in communities have the potential to substantially increase global food and nutrition security [42]. Thus, by incorporating small fish to their diet more frequently, it is likely that these fishing communities are benefiting in many ways towards improving their nutritional status, especially under five children.

The DDS was calculated by summing up the number of food groups consumed by each child and was used as a proxy indicator of nutrient adequacy. The mean dietary diversity score for study population was 4.3 ± 1.2, which is higher than the minimum acceptable recommended DDS of "four or more" out of the seven food group category [35]. Our results for the DDS are also different from that of Bandoh and Kenu, (2017) where they found a mean DDS of 2.29 ± 1.33, which indicates to comparatively low dietary diversity among under five children in their sample [25]. Furthermore, our DDSs show no significant differences between age categories or sexes,

suggesting the children in the studied fishing communities have an acceptable DDS in general, regardless of their age or sex.

Based on the cutoff used in the minimum acceptable DDS, the children were categorized as having either an adequate or an inadequate dietary diversity. According to this classification, we identified that 78 percent of the children in the studied fishing communities had an adequate dietary diversity. According Frempong et al, 2017, approximately 47 percent of the under five-year-old Ghanaian children were consuming a diet with adequate diversity [2], which is significantly lower than percentage in our sample. Therefore, it is important to consider the reasons for the high dietary diversity observed in the studied fishing communities as this would provide valuable insights into ways in which we could improve the dietary diversity of a given community. At the same time, it is also important to further investigate the underlying reasons for 22 percent of the children in the current study having a diet with inadequate dietary diversity. In addition to this, we identified significant differences among the dietary adequacy between different regions included in the study. Greater Accra has the highest percentage (89 percent) of children with an adequate DDS while the Volta region has the lowest (62 percent). These findings comparing different regions and the country average would provide critical information to help identify and develop ways to improve the health and nutritional status of communities with an inadequate dietary diversity. However, as mentioned earlier, our study does not capture seasonal variations in the diet that can potentially change the diversity of the diet depending on the time of the year. Abizari et al. (2017) have shown that seasonality has an effect on the DDS of school-children in northern Ghana [43]. Hence, further investigations aimed at collecting more data on seasonal variations in the diet in these fishing communities will enable the determination of a more accurate DDS that reflect seasonal variations in their diet.

Finally, we used a bivariate analysis to evaluate the effect of the mothers' education level on the dietary diversity of the child and found that there is a general trend towards children having a higher dietary diversity as the caregivers' education level increases. This emphasizes education as one important tool that policy makers should consider when developing nutrition-related programs. We observed 26 percent of the caregivers in the study population had no formal education. Therefore, we recommend two ways in which, nutritional knowledge can be provided for these communities. One, by including nutrition and health education in the school curriculum and two, by educating communities through media and nutrition related community programs.

Fish Consumption

We allocated more room in the questionnaire to identify the available fish species in the fishing communities, commonly consumed small fish species, children's preferred small fish species and the frequency of small fish consumption. This was done with the intention of addressing the scarcity of information regarding these aspects in the available literature. Consistent with other findings on Ghanaian fish species [7], this study identified chub mackerel, round sardinella and anchovy as the most preferred and consumed small fish species among children. Chub mackerel, round sardinella, anchovy and frigate tuna were among the most purchased and preferred species among most households. Spanish mackerel, lesser African threadfin and cassava croaker are some of the other commonly consumed and purchased fish species in these communities.

The study identified over forty different marine fish species consumed in the coastal communities. During this study, we came cross difficulties in categorizing fish as "small-fish" and "other-fish" based on the size. Most of the species identified by the respondents as small-fish has the potential to grow to a bigger size exceeding the cutoff of 25 cm as discussed earlier. Therefore, we decided to follow the classification of the community by expanding the common definition of small fish. With regards to this, the fish species that can be eaten whole with head and bones and are processed and cooked as other well-known small fish were categorized as small fish. Juvenile stages of some tuna species and barracuda are some of the fish species the respondents considered as small fish but have the potential to grow into much larger sizes.

Fried or smoked were found to be the most preferred method of cooking/processing by children. This finding provides the basis for further studies aimed at characterizing nutrient loss associated with these preparation methods, which in turn would provide insights into the actual nutrient uptake by consuming these small fish species. Even tough small fish is considered to be a nutrient rich protein source, frequent intake of fish might contribute to certain health issues. One such factor that needs attention is the level of Polynuclear Aromatic Hydrocarbons (PAHs) in processed fish. PAHs are contaminants produced during the smoking process due to incomplete combustion [44]. Since smoked fish can contribute significantly to the intake of PHAs, the high level of consumption of smoked fish in these communities could result in other adverse health conditions. Therefore, these findings highlight the pressing need for investigating the specific

method of smoking fish in these communities and the levels of PAHs in the smoked fish consumed by these communities.

The mean weekly small fish consumption of the total sampled population of 3.1 servings is greater than the recommended 1-2 servings per week for children [44]. While indicating to a nutrient rich diet, this high level of fish consumption raises other health concerns such as the ingestion of heavy metals. Even though the toxicity of methylmercury ingested by large marine fish is a concern that is being addressed widely there is insufficient information regarding the level of these toxins in smaller fish species [45]. Therefore, research investigating the accumulation of these toxins in fish needs to be further expanded to include small pelagic fish species that are being consumed frequently in fishing communities as indicated by the findings of this study.

Consumption behavior and caregiver perception on small fish-food security in coastal fishing communities

Food security, the state of having reliable access to a sufficient quantity of affordable, good quality food, was assessed with regards to small fish consumption in the study population. In order to address the third aim of this study, we assessed the caregivers' perception of the four dimensions of food security, i.e. availability, accessibility, utilization and stability of small fish. With regards to the availability of good quality small fish species of their preference, our results showed that nearly 90 percent of the caregivers strongly agreed or agreed that small fish was available when needed. This is consistent with the findings of Onumah et al. (2020), where 87 percent of the respondents strongly agreed or agreed that small fish was available when needed [7]. The same study also stated that the availability of a wide variety of fish, different processing methods and efficient transportation of fish within and between regions as factors contributing to the increased availability of fish. Our results further support this statement as we identified over 40 different fish species that can be processed using different methods such as smoking to increase their shelf life. Caregivers mentioned several options as places for purchasing fish, suggesting that there are efficient ways of distributing fish in the community. Even though our study did not collect information on storage methods, Gordon et al. (2011) mentions that fish traders store fish during the season and release them to the market in the lean period, which contributes to the increased availability of fish in the community throughout the year [46].

The physical accessibility and the economic capability to purchase necessary amounts of small fish accounts for the accessibility of small fish. About two thirds of the respondents stated that the prices of available small fish species are affordable. Respondents mentioned several options as available locations for purchasing small fish, which suggests that they have easy physical access to purchase small fish. However, one third of the respondents found it difficulties to afford the prices, suggesting that there is still a need for improving accessibility of small fish in these communities. It is likely that the prices vary due to the seasonality of different fish species and Altenburg (2006), states that some trading activities and competition in the small pelagic fish chain can also affect small fish prices [47]. The response to this dimension can be further investigated by comparing the responses with the different socio-economic quintiles the respondents represent. This would allow us to identify whether there is a positive correlation between accessibility and the socio-economic status of the caregiver, which would be useful when developing programs for improving accessibility.

Our questionnaire only covered one aspect of the dimension of utilization where the caregivers' responses indicated to whether they could find fresh or processed fish of good quality (whether they are satisfied with the quality of fish they can find). A majority of the respondents (89 percent) agreed that good quality small fish was readily available, which is not surprising given the close proximity of these communities to the ocean. As described by Onumah et al. (2020), certain practices such as unhygienic handling of fish, substandard processing technologies, chemical adulteration and inadequate marketing mechanisms could compromise the quality of fish and fishery products [7]. However, it is unlikely that the quality of fish in coastal fishing communities would be significantly affected by these factors as good quality fish is readily available locally. It will be interesting to investigate the effects of these factors on fish utilization in inland communities, especially the northern region where effective methods of distribution might be of critical importance for the quality of small fish available in the communities. These studies can be expanded into investigating the proper utilization of fish within households by observing whether fish is prepared and consumed in such a way that it retains the nutrient content of the fish and enhances the uptake of available micronutrients.

Stability refers to having access to adequate amounts of small fish throughout the year and this is also of great importance as a continuous supply of the food sources that provide essential nutrients is especially important for the proper growth of under five children. Majority of the

respondents (63 percent) stated that they have access to small fish year around with multiple options when it comes to small fish purchasing sites within close proximity. According to Onumah et al. (2020), the availability of adequate processing and storage facilities in Ghana is one of the main reasons for the availability of fish and stable fish prices year around, even in the fish deficit seasons [7]. However, approximately 23 percent of our respondents disagreed with the dimension of stability, despite living in a community with an abundance of fish, which requires further investigation. Additionally, comparing these data across different socio-economic quintiles of a community will enable us to understand how the financial capabilities of the respondents affect fish intake and dietary diversity. Information on socio-economic status, location and seasonality factors with reference to fish consumption is of greater importance for planning necessary interventions to enhance food security in Ghana.

Chapter VI: Conclusion

This study revealed that there was very low prevalence of wasting among children aged 18-59 months in the study communities, a finding that contradicts with previous studies done in Ghanaian fishing communities. About three fourths of the surveyed children consumed a diet with adequate dietary diversity. We identified over forty different fish species being consumed in the studied communities out of which, the majority can be categorized as small fish. Overall, the participants of the study were found to be frequent consumers of small fish with a positive attitude towards incorporating small fish into the diet of their children. A higher frequency of consuming flesh foods along with frequent weekly small fish consumption suggests that small fish forms a significant part of the diet of the children in these coastal fishing communities. Pertaining to the significance of small fish in these communities, we highlight the need for further research focusing on the utilization of small fish to establish it as a safe, nutrient rich food source for the community, especially for children under five years. The fact that one third of the respondents being fisherfolk, coupled with the availability of a great diversity of small fish in the communities, suggests that there is great potential to incorporate small fish into strategies towards improving nutrition, food security and a sustainable economy in these communities. The findings of this study provide the basis for further studies aimed at realizing this potential through increased public awareness and community development programs centered on the effective utilization of small fish.

Declarations

Funding

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Ethical approval

Regional Committees for Medical and Health Research Ethics ((REK), Reference number: 160065), Norway and Noguchi Memorial Institute for Medical Research ((NMIMR), Study Number: 009/20-21), Ghana. A thorough project description, including the project proposal and the proposed interview guide were all submitted as part of the requirements to meet the ethical approvals.

Conflicts of interest/Competing interests

The researches have no competing interests to declare that are relevant to the content of this article.

Availability of data and material

The raw data are not publicly available due to containing information that could compromise the privacy of research participant.

Consent to participate

Permission was sought from the assembly man, district chief executive, or the chief fisherman, and from the head of the household if applicable. Before the start of each interview, the nature of the research to its full extent was explained to the respondents including the fact that they could withdraw at any time without giving reasons. Verbal consent was sought from the interviewees.

Consent for publication

Not applicable

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Appendix

Consent Form

PARTICIPANT INFORMATION SHEET TEMPLATE FOR ADULTS

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT

Title: **Characterization of SIS (Small Indigenous fish Species) consumption pattern of 2-5-year-old children in coastal regions of Ghana**

WHAT IS THE PROJECT ABOUT?

We, a team from CSIR- Food Research Institute- Accra (also on behalf of Institute of Marine Research and University of Bergen Norway), is undertaking a study on the preparation method, storage and consumption pattern of small fish by households within the coastal regions of Ghana. This work is under the auspices of the EAF-Nansen Program and it's executed by Food and Agricultural Organization (FAO) in close collaboration with the Institute of Marine Research (IMR) and University of Bergen, Norway and funded by the Norwegian Agency for Development Cooperation (Norad).

What information we need from you

We would like to gather some information about you and your child's dietary pattern using a questionnaire. First, you will be asked some general information about you, such as preferred name, age to the nearest month and year, gender, education level, and occupation. After that we would like to ask some questions regarding your household possessions and assets to make a rough estimation of your socio-economic status. Then we would like to ask you to recall what your child consumed during the last 24-hours. It would be great you can recall the fish and fishery products that your child consumed within the past week. In addition to the questionnaire we kindly ask your permission to take the MUAC measurement of your child as described in the participation information sheet for children. MUAC is the only measurement we take and we would like to copy the most recently measured height and weight of your child from the growth chart maintains by a health facility, if available. This survey can take about 30-40 minutes of your time. We assure you that all the information we collect would be kept confidential and will be used only for the purpose of this study.

MUAC Measurement for children

MUAC measurement is a quick and easy way to check if your child is healthy. First we would like to record the month and date of your child's birth and first name. Then we will explain to you and your child with the help of a picture, how the MUAC measurement is taken. This measurement will be taken by a trained field assistant using a tape. We will ask you to stay with your child and help him/her to go through this quick measurement. You will be notified if the child is malnourished or not, based to the MUAC measurement, so that you can seek medical help if needed.

Observational study and information about fish preparation and storage

The field assistants will collect information related to the production method, the raw materials, utensils and equipment used, as well as observing the preparation process itself. Information on specific methods and processes that you are following is protected and you are not waiving any legal claims or rights because of your participation.

Significance of the information you provide us

The information that you provide will help us to better understanding how people in coastal regions of Ghana consume different types of fish and fishery products. That information will then be used to find out how we can incorporate small-fish and fishery products into your diet in order to prevent malnutrition among children and establish food security in Ghanaian households. Therefore, we kindly ask you to take part in this survey and provide us with necessary information.

PREDICTABLE RISKS AND BURDENS OF TAKING PART

MUAC measurement is a non-invasive, painless procedure with no side effects. You and your child's personal data will be protected and not be released. Data collection will be a face to face interview using a questionnaire. This whole process will take about 30 minutes. Participant and the child can withdraw from participating at any time. Withdrawal will not lead to any negative circumstances.

Possible Benefits

The data we collect from you, will be used to set forth interventions that will improve the nutrition status and food security in the coastal communities of Ghana. This will also help us to do a rough estimation of the nutritional status of the children in your community. Any identified malnourished children will be directed to a health facility for assistance.

VOLUNTARY PARTICIPATION AND THE POSSIBLITY TO WITHDRAW CONSENT

Your participation is voluntary and there is no penalty or loss of benefits that you may otherwise be entitled to if you do not wish to participate. You may refuse to answer any particular question and move to the next one, and you have the right to address any queries about the study now or at any point during your participation to the field assistant or the principle investigator identified in the Consent Form. If you do choose to participate, you are free to withdraw at any time and do not need to give a reason.

Your Child's Rights as a Participant

This research has been reviewed and approved by the Noguchi Memorial Institute for Medical Research Institutional Review Board (NMIMR-IRB). If you have any questions about your child's rights as a research participant you can contact the IRB Office between the hours of 8am-5pm through the landline 0302916438 or email addresses: nirb@noguchi.ug.edu.gh

The caregiver is the person who will be giving the consent on behalf of the child. However, no child will be exposed for coercive procedures and the child can refuse participation at any time. If the child refuses or is hesitant to take part, your participation will be withdrawn by the field assistant with no further consequences. If you wish to join the study, you will be asked to complete and sign the attached Consent Form agreeing on your participation.

Contacts for Additional Information and Inquires

Kindly take enough time to decide. All your questions about the study are always welcome. For further information concerning your participation in this study you can contact the Principal Investigator, Prof. **Matilda Steiner- Asiedu** on **0541260704**

Confidentiality

The information you provide, will be used solely for scientific purposes and will be treated as strictly confidential. Your anonymity will be guaranteed. You will not be identified in any publication or dissemination of the study findings. Your rights of the indigenous knowledge and methods will be protected.

WHAT WILL HAPPEN TO YOUR PERSONAL DATA CONCERNING HEALTH?

The MUAC (Mid-Upper Arm Circumference) measurement of your child will be recorded and will only be used to assess the nutritional status.

SHARING OF PERSONAL DATA AND TRANSFER OF PERSONAL DATA ABROAD

By agreeing to participate in the study, you are also consenting to your information (your preferred name, age in years, gender, education level, occupation and marital status, your child's first name and age in months, MUAC measurement) being transferred to another country as part of research collaboration and publication. Data will only be shared with the people who worked on this project in Norway and Ghana. The code that connects you and your personal data will not be released.

OTHER INFORMATION

There will be no genetic testing or follow-up in this study.

FINANCE

You will be given a bottle of sanitizer and a face mask at the end of the interview.

APPROVAL

Ethical approval regarding performing MUAC and collecting personal data will be sought and obtained from REC and Noguchi Memorial Institute for Medical Research Institutional Review Board (NMIMR-IRB)

CONTACT INFORMATION

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VOLUNTEER AGREEMENT

The above document describing the benefits, risks and procedures for the research title (Characterization of SIS (Small Indigenous fish Species) consumption pattern of 2-5-year-old children in coastal regions of Ghana) has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction.

Consent on behalf of the child

I agree that my child can participate as a volunteer but with no ..... I hereby consent on behalf my child to take part in this survey.

_____ _____

Date Name and signature or mark of parent or guardian

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the child's parent or caregiver. All questions were answered and the child's parent has agreed that his or her child should take part in the research.

_____ _____

Date Name and signature of witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____ _____

Date Name Signature of the person who obtained consent

Questionnaire

household/ questionnaire identifier number. (Sequential number)	

Characterization of small fish consumption patterns among children aged 18-59 months in Ghana

General Information

Region (REG)	
District (DIST)	
Community (COM)	
Name of the interviewer (NAME)	
Date of interview (dd/mm/yyyy) (DATE)	
Interviewer ID (ID):	
Contact details (TEL):	

SECTION A: Caregiver and child demographic details & MUAC

A1. Caregiver ID (Care ID): Age (in completed years) (Age):
A2. Caregiver gender (SEX):
A3. Child's DOB:
A4. Gender: (1) Male Female (2)
A5. What is your level of education?

☐ Primary (1) ☐ JHS (2) ☐ Secondary (3) ☐ Tertiary (4) ☐ Non formal (5) (6) Other (specify): …..…..
A6. Marital Status

☐ Single ☐ Married ☐ Divorced ☐ Widowed
A7. What is your occupation?

☐ Working ☐ Not working
Please specify your profession: ……

A8. Who is the head of Household?
☐ Self ☐ husband ☐ Other, specify
A9. Is your respondent the female head of the household?
☐ Yes ☐ No, Give reasons for your answer……...
A10. Does this household eat small fish: ☐ Yes / No?
A11. How many people are there in your household? ……

A12. Can you provide a rough estimate of the total household income per month?(GHC)
……

Fill this table for every child born between September 2015 and October 2018 in the household.

Name	Gender	Age
	Girl ☐ Boy ☐	Month Year
	Girl ☐ Boy ☐	Month Year
	Girl ☐ Boy ☐	Month Year

(Please select the child who has the most recent birthday)

A13. Name of the selected child .....
A14. MUAC of the selected child .....

A11. Is your child completely weaned? ☐ Yes ☐ No

A12. Has the child currently been admitted to a feeding program? ☐ Yes ☐ No
where:
☐ Pre-school: ☐ health center: ☐ other:
A13. Is the child suffering/has suffered from common childhood diseases recently? Yes ☐ No
A14. Does your child take vitamin supplements/ herbal? Yes ☐ No ☐ ☐
A15. Have you taken part in a Community-based food and nutrition programs before?
Yes No

SECTION B: Food and fish consumption of the child

Recall Period: Information on household food consumption should be collected using the previous 24-hours as a reference period (24-hour recall).
The field assistant should first find out whether the previous 24-hours was "usual" or "normal" for the household. If it was a special occasion, such as a funeral or feast, or if most household members were absent, another day should be selected for the interview.

How to collect the data: Data for the (Individual dietary diversity score) IDDS indicator is collected by asking the caregiver a series of yes or no questions. These questions should be asked from the person who is responsible for food preparation and feeding the child, or if that person is unavailable, of another adult who was present in the household the previous day.

The respondent should be instructed to include the food groups consumed by the child at the home, or prepared to eat outside the home (e.g., at lunchtime in the childcare center, etc). As a general rule**, foods consumed outside the home** that were not prepared in the home **should not be included**.

Food Group	**Coding Categories** **YES=1** **NO=0**
Now I would like to ask you about the types of foods that your child ate yesterday during the day and at night. READ THE LIST OF FOODS. PLACE A ONE IN THE BOX IF ANYONE IN THE HOUSEHOLD ATE THE FOOD IN QUESTION, PLACE A ZERO IN THE BOX IF NO ONE IN THE HOUSEHOLD ATE THE FOOD. **Please tell whether your child had any of the following food items?**	**(please write "1" if the child consumed at leat one food item from the list) if not write "0".**
A. Grains, roots and tubers and plantain Bread (brown, sugar, tea, butter), Rice, Fried rice, Waakye, Banku, kenkey, Plantain, Yam, Cocoyam, Orange flesh sweet potatoes, Cassava (Fufu/Kokonte), Tuo-zafi	**A. .....**
B. Legumes, nuts and seeds, Cowpeas (black, red, brown, white) , Koose, Groundnut, Almonds , Tiger nuts, Cashew nuts, Baked beans,	**B. .....**
C. Milk and milk products Milk drinks (countre milk, milk drink, cocoa drink), Cheese, Yoghurt/fan ice, ice cream, Wagashie, Milk (evaporated)	**C .....**
D. Flesh foods fish, other seafood, beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds , Gizzard, sausage, Offal (liver, kidney, heart)	**D.....**
E. Eggs chicken, duck, guinea hen or any other egg	**E.....**
F. Vitamin A-rich plant foods pumpkin, yellow yam, green vegetables [kontomire] mangoes and pawpaw, squash, or sweet potatoes that are orange inside other locally available vitamin-A rich vegetables	**F.....**
G. Other fruits and vegetables other vegetables (e.g. tomato, onion, eggplant) , including wild vegetables	**G.....**
H. Sweets Foods consumed from the sugary food group (sweets, pastries and drinks)	**H.....**
Did the child eat anything (meal or snack) OUTSIDE of the home yesterday?	

Additional questions

B1. Do you add iodized-salt to the food that your child consume?

Yes No

B2. Do you or your household buy and eat fish and other fishery products? Yes No

B3. Do you or your household buy and eat SMALL fish and other fishery products? Yes No

B4. If "No", reason for not consuming small fish?

Do not like small fish	
We sell small-fish	
Do not like the taste	
Too expensive	
Too many bones	
Do not like the smell	
Got sick last time	
Religious beliefs	
Allergic to fish	
Other	

Other reasons: .....

B5: If you consume SMALL-fish, why you prefer to consume small fish?

they are easy to find	
cheaper	
taste good	
more healthier	
good for children	
other	

FISH CONSUMPTION OF THE CHILD

(Please write down the answers to the following questions on Table 2. Record all the different names that they use to call each type of fish, If you can categorize the fish according size, write the names accordingly. IF you are not certain of the size please mention them under "Size, do not know section".)

C1. Can you recall the types of fish and shellfish that your child normally eats?

C2. How is it consume? With

- ☐ Head,
- ☐ Bones,
- ☐ Gut or fillet?
- ☐ Remove some parts of the fish

C3. What is the preferred method of cooking? _____

C4. What is the serving size (please use the key to estimate the portion size)? (portion size estimation/ local food models?) _____

C5. How often does your child consume fish? _____

Table 2

	C1	C2	C3	C4	C5	
Fish Group	**Common name**	**How does it consumed, (with head, bones, gut or fillet ?) (Please write if some parts are removed)**	**Preferred Cooking method**	**Serving size (can use the size chart)**	**How many times**	
					per day	**per week**
Small (less than 15cm)						
Medium(15 - 24cm)						
Big (>25cm)						

Size - Do not know						

C6. Where do you get the fish from?

- ☐ Nearby local market
- ☐ Nearby retailer
- ☐ Market outside own city
- ☐ Other (specify)……

C7. Child's preferred fish types ……

C8. Most Preferred cooking method (boiled, fried, whole fish, filleted, etc) …….

C9. Most preferred types of fish in the household? .....

Reason for preference ?

C10. Most purchased fish? .....

Reason for purchasing? (price?, taste?, availability? nutritious values? etc)

C11 What, in your opinion, can be done to promote the consumption of small-fish and other fishery products in Ghana?.....

C12. Which of the following activities do you find most effective in informing you about the benefits and use of fish/small-fish and other fishery products? Please circle ONLY ONE option.

A. Radio B. Newspaper C. TV shows Other ……

C16. Has your child's local health center explained to you regarding the benefits of giving your child small-fish? Yes No

SECTION C :Caregiver perception of fish-food security

Following questions are for the caregiver about his/her opinion

B6. I can find the small fish species that we eat when I want them

Strongly agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

B7. I believe the small fish prices are generally affordable

Strongly agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

B8. Good quality small fish is available for me to purchase

Strongly agree		
Agree		
Neutral		
Disagree		
Strongly Disagree		

B9. I get the small fish species I want throughout the year

Strongly agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

B10. "Has your household fish consumption changed due to COVID -19?"

Strongly agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

ADITIONAL SECTION : SURVEY QUESTIONS TO ASSESS THE WEALTH INDEX

		Option 1	**Option 2**	**Option 3**
Q1	Does this household have: a radio?	Yes	No	
Q2	a television?	Yes	No	
Q3	a computer/tablet computer?	Yes	No	
Q4	a refrigerator?	Yes	No	
Q5	a cabinet/cupboard?	Yes	No	
Q6	Does any member of this household own a mobile phone ?	Yes	No	
Q7	Does any member of this household have a bank account?	Yes	No	
Q8	What is the main source of drinking water for members of your household?	Sachet Water	Other source of drinking water	
Q9	What kind of toilet facility do members of your household usually use?	Flush to manhole/septic tank (not shared)	Other toilet facility	
Q10	What type of fuel does your household mainly use for cooking?	Wood	LPG	
Q11	What is the main material of the floor of your dwelling?	Cement	Other material	

Survey questions of Equity tool, Ghana https://www.equitytool.org/ghana/ which was prepared based on the Ghana MHS 2017 source data were directly used to create this questionnaire.