GENDER DIFFERENTIALS IN INCOME INEQUALITY, POVERTY AND FOOD INSECURITY AMONG ARTISANAL CRAYFISH HARVESTING HOUSEHOLDS IN THE NIGER DELTA AREA, NIGERIA

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ABSTRACTS

Globally, the major drawback to higher productivity, economic growth, development and general well-being of humanity in developing countries, such as Nigeria, is rise in gender differences on income inequality, poverty and food insecurity in such a society. Therefore, understanding the extent and sources of this gender differentials become imperative for the success of policy approach aimed at reducing the gender gap. This study examined empirically, gender differentials in income inequality, poverty and food insecurity among artisanal crayfish harvesting households in the Niger Delta Area, Nigeria. Multi-stage and stratified random sampling techniques were used to select a total of 409 (300 male and 109 female) respondents. A structured questionnaire and interview schedules were used to obtain information on socioeconomic characteristics and other quantitative variables of interest for this study. Descriptive statistics were used in describing the socioeconomic characteristics of the respondents. Income inequality, poverty and food security were determined using Gini coefficient/Lorenz curve, Foster Greer Thorbecke (FGT) model and Food security index, respectively. Decomposition of income inequality was achieved using Theil index while that of poverty and food insecurity were achieved using Oaxaca-Blinder technique. Coping strategy for poverty, food insecurity and income inequality were analysed using Coping Strategy Use Index (CSUI). Results revealed that income inequality was higher among male crayfish harvesters than females. Poverty incidence, poverty depth and poverty severity of 0.587, 0.333 and 0.179 for female respondents were higher than males with 0.383, 0.325 and 0.166, respectively. Conversely, males (57.33%) were more food secured than females (40.37%). Results of Theil decomposition by gender, socioeconomic and institutional factors revealed that more than 95% of income inequality was attributed to within group gender component. However, inequality by income source was ascribed to between group components (51.74%) and was higher than within group component (48.26%). The findings from Oaxaca-Blinder (O-B) decomposition revealed that 17.88% and 16.52% gender differentials gap in poverty and food security were accounted for by -53.86% and -70.22% of endowment effect, 149.67% and 107.51% of structural effect while 4.59% and 62.71% accounted for interaction effect, respectively. The major driving factors of endowment effect (explained) for poverty were marital status, household size, income of crayfish harvesting, age while education, marital status, labour, income of crayfish harvesting, access to harvesting net, household size was for structural effect (unexplained). In terms of food insecurity, it was only income of crayfish harvesting that drives the endowment effect (explained) while education, labour, extension visits, income of crayfish harvesting and access to safety kits drive the structural effect (unexplained component). The interaction effect was mainly attributable to income of crayfish harvesting in food security alone. Based on these, the study concluded that the existence gender differentials gap in the area is due to within group gender component for income inequality and structural disadvantage of female crayfish harvesters for poverty and food insecurity. Coping strategies widely used by the crayfish harvesters when faced with poverty, food insecurity and income inequality in the region were spending of saved income, children eating first, intensifying the amount of work done on the crayfish harvesting to increase output and purchasing items on credit among others. Therefore, it was recommended that the level of education should be enhanced in the area by the government in order to develop potentials and managerial skills of female crayfish folk in the profession, eliminate unnecessary restrictions and bias against them. Extension services should be strengthened to enhance skills acquisition and development in crayfish harvesting. The state governments should develop policies that will address distribution challenges and eliminate discrimination against female crayfish harvesters, while both the government and development partners should

initiate gender friendly programmes that will enhance equal access to harvesting tools and equipment and reduce gender gap.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

ACRONYMS

AAAE	African Association of Agricultural Economists
ADB	Asian Development Bank
ADP	Agricultural Development Project
ASN	Agricultural Society of Nigeria
BBC	British Broadcasting Corporation
CFS	Committee on World Food Security
CN	Corporate Nigeria
CSI	Coping Strategy Index
CSUI	Coping Strategies Use Index
DFID	Department for International Development
EIU	Economist Intelligence Unit
FAO	Food and Agriculture Organisation
FHHs	Female Headed Households
FICSUI	Food Insecurity Coping Strategies Use Index
FISON	Fisheries Society of Nigeria
GFSI	Global Food Security Index
GHI	Global Hunger index
GII	Gender inequality index
HDI	Human Development Index
HHS	Household size
HPCI	Household per Capita Income
ICN	International Conference on Nutrition

IDAF	Integrated Development of Artisanal Fisheries in West Africa
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IICSUI	Income Inequality Coping Strategies Use Index
ILO	International Labour Organisation
LDCs	Less Developed Countries
LGAs	Local Government Areas
MHHs	Male Headed Households
MT	Metric tons
MTHPCI	Mean Total Household per Capita Income
NBS	National Bureau of Statistics
NOUN	National Open University of Nigeria
NPC	National Population Commission
NSSP	Nigeria Strategy Support Programme
OECD	Organisation of Economic Cooperation and Development
PCSUI	Poverty Coping Strategies Use Index
PL	Poverty Line
SDGs	Sustainable Development Goals
SSA	Sub-Sahara Africa
UN/DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UN-HLCP	United Nations- High-level Committee on Programmes
US	United States

USDA	United States Department of Agriculture
WDR	World Development Report
WEF	World Economic Forum
WFP	World Food Programme
WHO	World Health Organisation.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Globally, income inequality, poverty and food insecurity have become issues of great concern in this 21st century. This is because high levels of income inequality, poverty and food insecurity produce an unfavourable environment for economic growth, development and general well-being of humanity. Income inequality is the unequal distribution of income among individuals in household, community and/or country. On the other hand, poverty is a situation where an individual is unable or lack the resources to meet the basic necessities of life or good standard of living while food insecurity exists when individuals do not have sustainable access to good and nutritive food for an active healthy life at all times (Attah, 2012; Grimaccia and Naccarato, 2020).

In Nigeria, income inequality, poverty and food insecurity incidences have increased substantially in the last 10 years (British Council, 2012; Akpan *et al*., 2016). For instance, income inequality has increased from 0.36 in 2012 to 0.39 Gini index in 2016 (Aigbokhan, 2017), poverty risen from 54.7% in 2004 to 62.6% in 2013 (British Broadcasting Corporation-BBC, 2012, United Nation Development Programme- UNDP, 2013) and about 7.1 million people are facing acute food insecurity (Food and Agriculture Organization- FAO, 2017a) with undernourished population increasing from 5.9% in 2008 to 7% in 2016 according to Global Hunger index (GHI) (International Food Policy Research Institute - IFPRI, 2017). These issues have resulted to complicated food crisis, political instability, conflict, communal rivalry, public unrest corruption and violence. Women seem to be worst affected by these issues as they are widely vulnerable to them (Etim *et al*., 2020a, b).

Gender inequality seem to spread across every sphere in the present-day Nigeria as it is seen in every sector, occupation, region and even families. Traditionally, women have limited access to production resources and restriction in decision making bodies. National Human Development Review for Nigeria as observed by UNDP (2016) reported 0.131 and 0.797 Gender Inequality Index (GII) for females and males respectively. Gender inequality index (GII) is the percentage of potential human development lost due to prevalence of gender disparities. Similarly, the World Economic Forum-WEF (2016) reported that there is wide variety of gender gap outcome in sub-Sahara Africa and ranked Nigeria 118th among middle low-income countries with global gender gap index of 0.643. This implies that there is high level of gender differentials across all parts of the country. Several empirical studies have concluded that high levels of gender inequality make poverty reduction more difficult (World Bank, 2018; Danaan, 2018; Busayo *et al*., 2021).

Notwithstanding, Nigeria is one of the nations in the world mostly endowed with resources, yet majority of its population live in poverty. National Bureau of Statistics (NBS, 2012) indicated that the official poverty rate in Nigeria is high, with 69% of the population living below the ₦200 National poverty line and 53.5% below the $1.90 International poverty line. As a result of this, Human Development Index (HDI) report observed by the UNDP (2015) ranked Nigeria 152nd out of 188 poorest countries in the world. Ajewole *et al*. (2016) also portrays the country as one of the world's poorest with estimated 80% of the population living on less than $2 a day. Critical observations of the poverty trend in Nigeria indicates that women and children are more vulnerable. Agwu and Otteh (2014) suggested that this may have been as a result of discrimination, customs, beliefs and attitudes that restrict women mostly to the domestic sphere and be less valued

economically. Oluwatayo (2014) reported 33.3% and 43.7% poverty level for male and female smallholder farmers in Eastern Nigeria. Consequently, this high percentage of poverty for women motivated by poor resource allocation, rise and volatility of food prices most times lead to food insecurity.

Food security challenge is currently of high importance to Nigeria *vis-à-vis* inadequate caloric and protein intake in the diet of large proportion of the country's increasing population with rising incidence of hunger and malnutrition. According, to Nwalie (2017), food insecurity have increased tremendously in Nigeria with the undernourished population multiplying daily. The Economist Intelligence Unit (2017) Global Food Security Index (GFSI) report for 2017 also ranked Nigeria as the 92nd out of 113 countries in terms of food affordability, availability, quality and safety. The majority opinion on this issue still viewed women as taking the lead. Available data from the NBS (2012), Agwu and Oteh (2014) indicated that, the Nigerian population especially women and children suffer from severe social desperation, with many households being food insecure, with limited access to resources to meet basic needs, resulting in nutritional deficiencies.

The greatest problem in this issue is the inadequate animal protein in the diet of large proportion of the population especially in rural area which constitutes more than 70% of its population. According to Oladimeji *et al*. (2014), Etim *et al*. (2020a), animal protein intake of Nigerians is continually declining from 14.90g/head/day to 4.5g/head/day against FAO recommended a minimum requirement of 35g/caput intake/day. Animal protein is essential in human nutrition because of its biological significance in nourishment of the human system (especially for pregnant women and nursing mothers). Nevertheless, crayfish (shrimp, crawfish) is one of the important alternative sources of animal protein which

could possibly help to bridge the gap between the daily per capita animal protein intake which is estimated to be less than 10g/caput intake/day. Crayfish is a very nutritious and delicious food ingredient found in virtually all Nigerian homes.

The artisanal crayfish harvesting is one of the major businesses in the fishery sub-sector of agriculture being practiced by both men and women households in the Niger Delta Area of Nigeria. It is an important profession which is capable of reducing poverty, ensuring human and livestock food security, creating employment, providing foreign exchange, enhancing earnings, health and improving nutrition by increasing protein intake and other dietary vitamins in our daily food consumption. It is highly priced and demanded in both local and international markets. Nigeria is among tropical countries endowed with shrimp resources (crayfish) with a production capacity of 12,000 metric tons (MT) per year (Achoja, 2019; Zabbey *et al*., 2019) and generating about 20 million US Dollars annually to the Nigerian economy (Etim *et al*., 2015; Etim *et al*., 2020b). Ele and Nkang (2014) reported crayfish as the second largest fishery in the marine/estuarine fisheries in the lower Cross River Basin.

In spite of the benefits derived from crayfish harvesting, large percentage of the harvesters of this product still live in poverty (Etim *et al*., 2020a). They are also confronted with income distribution problems resulting in very low per capita income and declining food consumption. The worrisome aspect is the fact that female crayfish harvesters are most vulnerable to these issues. Yet, within the riverine environment, women have been found playing vital roles in crayfish harvesting, processing and marketing. Some own boats and gears and hire men to fish or harvest crayfish for them, while others provide male harvesters with credit facilities. Therefore, reducing or even closing gender gaps in income inequality, poverty and food insecurity through appropriate resource allocation and policy support become necessary, not only because it improves the livelihood of women and tends to raise their relative status, but

also because gender equity in income, enhances human and economic development. In view of the above, it is pertinent to examine the gender differentials in income inequality, poverty and food security among crayfish harvesting households in Niger Delta Area of Nigeria.

1.2 Statement of the Research Problem

Gender differences in all socioeconomic attributes of income, wealth, poverty and food security seem to widened in Nigeria. This is because men most time tend to experienced higher income benefits in access to productive resources, occupation, employment and influence power in political arena than women. These scenarios have led to unemployment, low self-esteem, low living standard and poor nutrition among women fold, which in turn hindered productivity, induced inefficient allocation of resources, encouraged corruption and violence and ultimately slowed down the rate of economic growth in the country. The current economic recession seems to hit on women the hardest as greater number of them live in poverty and severe poverty. The continuous undermining of women potentials in the national economy may lead to high economic loss.

Despite these predicaments, women are still being engaged with more responsibilities and activities such as cooking and caring for the family, nurturing of children, nursing of elderly and carrying out of domestic work at home capable of worsening their deplorable condition. As a result of these, Organisation of Economic Cooperation and Development-OECD (2015) noted that there is no chance of making poverty history without significant and rapid improvements in the well-being of women and girls. Though, studies on gender differentials have been conducted at both the micro and macro levels on income inequality, poverty and food insecurity independently among some crop, livestock and fish farmers in Nigeria, but none based on available literatures have been conducted on artisanal crayfish harvesters

and none of it were carried out in three States of Niger Delta Area at a time. Moreso, there is knowledge gap in their studies as what gender factors stimulate the chances of individuals to experience these issues and how does these characteristics differ for males and females. Also, as to what extent the set of observed characteristics and institutional factors explained the overall gender differentials gap in income inequality, poverty and food insecurity and what underlining principle(s) propel these factors. Therefore, in order to bridge this gap the following questions are raised for this study:

i. what are the socioeconomic characteristics of the respondents in the study area?
ii. are there systematic gender differences in the distribution of income among the respondents?
iii. does poverty differ along gender line in the study area?
iv. how does food security differ between male and female headed crayfish harvesters?
v. to what extent do socioeconomic and institutional factors explain the gender differences in income inequality, poverty and food insecurity?
vi. which coping strategies are commonly adopted by the respondents to deal with poverty, food insecurity and income inequality in the study area?

1.3 Aim and Objectives of the Study

The aim of this study is to examine empirically the gender differentials in income inequality, poverty and food insecurity among artisanal crayfish harvesting households in selected States of Niger Delta Area, Nigeria. The specific objectives are to:

i. describe the socio-economic characteristics of the crayfish harvesters in the study area,
ii. compare the level of income inequality between male and female headed crayfish harvesting households,
iii. analyse the differences in poverty status of male and female respondents,

iv. evaluate the extent of gender-based differences in food security among the respondents,

v. decompose gender differences in income inequality, poverty and food insecurity based on socioeconomic, demographic and institutional factors of the respondents, and

vi. identify various poverty, food insecurity and income inequality coping strategies adopted by the respondents and the extent of their use.

1.4 Hypotheses of the Study

The following hypotheses were tested:

i. There is no significant difference in income inequality, poverty and food insecurity between male and female headed crayfish harvesting households in the study area.

ii. Socioeconomic, demographic and institutional factors such as age, education, household size, access to credit, extension contact have no significant influence on poverty and food insecurity of crayfish harvesters in the study area.

iii. Socioeconomic, demographic and institutional factors such as age, education, marital status, household size, access to harvesting tools, access to credit, access to extension contact, membership of cooperative does not significantly explain gender gap in poverty and food insecurity.

1.5 Justification for the Study

This study is expected to play important role in contributing information to the existing literatures on gender differentials in income inequality, poverty and food security in crayfish harvesting business in Niger Delta Area of Nigeria. This is because, there is dearth of information on gender differentials regarding these issues on crayfish harvesting in the Niger Delta Area as only few research works have been carried out in the area. Thus, the need to intensify research effort in the area becomes imperative and this is one of the aspects this research aims to address.

The findings of this study will also enable the government and policy makers to identify possible areas of policy intervention and develop gender friendly policies that will benefit the crayfish fishery sub-sector while ensuring equal and equitable distribution of income among the crayfish harvesting households. This is because, the harvesters of this product currently live in poverty especially female folks. They also suffered from income disparity problems leading to low per capita income and low food consumption among them. Moreso, it will provide insight to development partners and crayfish business stakeholders to know the kind of gender friendly intervention programme/project to be initiated in the area in order to combat income inequality, poverty and food insecurity among the respondents in the study area.

Furthermore, the study will be of benefit to development partners' and researchers in understanding the gender role and relation driving these differences on the issues in the study area in order to proffer adequate solution. It will enable researchers and students in this field of study to comprehend the underlining components and factors contributing to and explaining the gender gap on income inequality, poverty and food insecurity among the respondents in the study area. This will serve as useful tools in policy formulation.

It is expected that the findings from this study will contribute to reducing gender income inequality, mitigating gender poverty and food insecurity by enhancing income earning opportunities of women through equal access to harvesting resources, empowerment and education. Finally, the findings of this study would be used as a basis for future reference studies by researchers, higher institutions and crayfish business stakeholders.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Theory of gender income inequality

Over the years, attention to women's economic role and economic differences by gender have been a subject of discussion in many careers, professions, races, social classes and families. It started in 1960s through 1970s and 1980s until feminist critiques received economic theories (Busayo and Olufunmilayo, 2013). For instance, Feminist economic historians (Zinn and Dill, 2012; Anthias, 2013) carried out historical studies of the ways that race, class and ethnicity have situated women differently in relation to production. This started from microeconomics of the household and labour markets and spread to macroeconomics and international trade, leaving no field in economics untouched. They also pushed for and produced gender aware economic theory and analysis which broadened the focus of economics on gender nature of the labour force (Busayo and Olufunmilayo, 2013).

The pre-neoclassical theory of labour market states that women inferiority position in the labour market are based on wage differences and institutional constraints (Nweke, 2015). But neo-classical economic theory place premium on female equality in job sector and opined that inequality in labour force should decline with growth. However, it does not go further to look at the underlying mechanisms hindering women from making different choices (Anthias, 2013). The assumptions of orthodox economics are unrealistic and biased in favour of men's interest as they tend to legitimize a conventional gender division of work. For example, Kargbo *et al*. (2016) recognized that deteriorating terms of trade

affected accumulations of capital and consequently the rate of economic growth. Tandrayen-Ragoobur and Pydayya, (2016) pointed out that gender wage differential is one of the most durable findings in comparative labour economics.

Gender inequalities at work have a negative economic impact on the society as a whole. One prominent issue that feminist economists investigate is how the Gross Domestic Product (GDP) does not adequately measure unpaid labour predominantly performed by women, such as housework, childcare, and the care of the sick and elderly. Unpaid time spent in the reproduction and maintenance of human resources is a major constraint to women's labour force participation. Therefore, women are not in a favourable position in the labour market since patriarchal ideologies influence perceptions about women workers. Patriarchal culture and norms relegate women into a secondary, inferior status in the family and society (Jaiyeola and Isaac, 2020). This issue most often affected their level of income and purchasing power negatively.

In many parts of the globe, women play a major role as farmers, producers and managers of home. However, their access to resources and opportunities to enable them move from subsistence food production to higher value chains is much lower than men's. Women increasingly supply national and international markets with traditional and high-value produce, but compared to men, women farmers and entrepreneurs face a number of disadvantages, including lower mobility, less access to training, less access to market information, and less access to productive resources (Arjan De Haan International Development Research Centre – ADHIDRC, 2016). Evidence suggests that women tend to lose income and control as a product moves from the farm to the market (Dalborg *et al*., 2015). Women farmers can find it hard to maintain a profitable market niche.

According to Hillenbrand *et al*. (2014), the social relations framework is less prescriptive and at its core appreciates complexity, and is therefore not commonly adopted and used by development practitioners compared to more conventional gender analysis frameworks such as the Harvard Analytical Framework. The latter framework tends to guide analyses of differences between women and men as the goal is to identify gender gaps and subsequently fill them (Okali, 2012). It fails, however, to shed light on the complex relationships between women and men and the changes in relationships over time (Tandrayen-Ragoobur and Pydayya, 2016) and the diverse causes of gender inequalities at the varied institutional levels (Hillenbrand *et al*., 2014). It is argued that such an understanding enables the design of more holistic research and development programs and policies that help transform gendered power relations and assist poor and/or marginalised women and men to achieve their practical and strategic life goals (Rajaratnam *et al*., 2016). Gender differences in income inequality and poverty status could lead to inefficient allocation of resources and may reduce economic growth. If disparities between men's and women's status in access to resources, control of assets and decision-making powers persist, these will undermine sustainable and equitable development (Awotide *et al*., 2015).

2.1.2 Theory of gender in poverty

The term "feminization of poverty" originated in the United States in the late 1970s, when it was discovered that the fastest growing type of family structure was that of female-headed households. Moreover, because of the high rate of poverty among these households, their increase reflected in the growing numbers of women and children who were poor. By the mid-1980s, it was believed that almost half of all the poor in the U.S.

lived in families headed by women in various stages of the life-cycle (Oluwatayo, 2014; Deaton, 2016; Nwosa and Ehinomen, 2020).

The feminization of poverty is a phenomenon that is said to exist if poverty is more prevalent among females than men. The reasons for the existence of feminized poverty could be attributed to discrimination against women in the labour market or when women tend to have lower education than men and are therefore paid lower salaries, and also, when markets undergo changes, the issue of feminized poverty gets higher and increases gender inequalities (Oluwatayo, 2014; Altuzarra *et al*., 2021).

The feminist approach to poverty focuses on the gender implications and social costs of poverty. They include the growing involvement of women and children in the informal economy; differential treatment of girls and boys in households; pressure to get girls married off quickly; higher school drop-out rates for girls; less control over fertility; and recourse to prostitution (Anthias, 2013; Oluwatayo, 2014). Feminist approaches to women's poverty begin with the premise that pervasive gender inequalities and biases within households, labor markets, legal codes, and political systems throughout the world, render women more vulnerable than men to poverty (Anthias, 2013; Oluwatayo, 2014; Altuzarra *et al*., 2021).

Many poverty analyses describe the female condition of being poor, rather than considering how or why the condition exists. These descriptions typically focus on female individual attributes (e.g. a lack of assets, of education or of health, etc.). However, these attributes are the outcomes of social processes and need to be understood within the context of social institutions and systems. To understand, anticipate or attempt to alter these outcomes, it is necessary to understand the structures and processes that underlie these deprivations.

Poverty among women gender therefore needs to be understood as being strongly influenced by the resources that can be claimed, under particular conditions and with what level of choice. Social differentiation, distributional concerns and issues of power are central to poverty analyses. Government structures and other formal and informal processes and institutions govern social relations and power structures, which extend over various spatial, temporal and social scales (Suich, 2012). These in turn affect women's opportunities, their ability to make choices, their access to resources, etc., and therefore the distribution of benefits, costs and risks within and between individuals and groups.

In the fishery sub-sector of agriculture, norms and power relations that constrain women from accessing natural fisheries and participating in key profitable nodes of the value chain are often unexplored by research and development organisations working in such contexts (Lenthisco and Lee, 2015). Therefore, understanding the causes of vulnerability of women to poverty, and ways to protect against it, is relevant to the design of poverty alleviation policies. It will also play critical role in changing their poverty status over time.

The principle of equity is a necessary consideration in any poverty analysis. It is interpreted here to mean that individuals have equal opportunities, though this does not necessarily result in equal outcomes. Analyses of equity will highlight the distribution of power and resources underlying poverty, particularly with respect to how the views of the poor are incorporated into decision making that will affect them. The nature of how people are able to participate (in terms of access to services, information, education and institutions) and how they are affected by the outcomes of activities or policy changes. Goals relating to equity are rarely explicit in policies aim at alleviating or reducing poverty.

Thus, with particular attention to how the outcome will affect different groups, especially the poor and marginalised groups (female), and other different subgroups among them.

2.1.3 Theory of gender in food insecurity

Food security is a primary goal of sustainable agricultural development and a foundation for economic and social development. Adequate nutrition is essential for many human functions that include body growth, motivation, work output and educational attainment (Fawehinmi and Adeniyi, 2014). In order to enjoy a healthy life, there is need for access to a nutritionally balanced diet, comprising all essential ingredients for growth, energy and longevity. The recent emphasis on alleviating hunger, reducing malnutrition and the serious consequences of food insecurity on the poor, calls for investigation on food problems in African countries. As reported by Busayo *et al*. (2021), majority of the countries with the most extreme depth of hunger (less than 300 kilocalories per day) are in Africa with Nigeria inclusive in this estimate.

Food security exists, according to World Food Summit Plan of November 1996, when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for an active and healthy life (Fawehinmi and Adeniyi, 2014; FAO *et al*., 2019). Without food, a feeling of insecurity pervades the society, fueling tension and creating ground for anti-social behaviours. Within the framework of government goals of ensuring widespread improvements in the well-being of households and individual welfare, the issue of food insecurity is of high importance to Nigeria because average calorie intake is below the threshold of adequacy (Fawehinmi and Adeniyi, 2014).

The inability of Nigeria to sustainably feed its rapidly growing population was quantitatively revealed in the early 1970's and estimate shows that at least one percent of the population is food insecure with 16% being severely undernourished. Gender is a central factor in household decision-making, which affects productivity, time allocation, and investment in any countries. Gender-based inequalities all along the food production chain "from farm to plate" impede the attainment of food and nutritional security (ADHIDRC, 2016; FAO *et al*., 2021)). Maximizing the impact of agricultural development on food security entails enhancing women's roles as agricultural producers as well as the primary caretakers of their families.

Gender inequality induced poverty and any poverty alleviation programmes towards household welfare must thoroughly examine the link between gender relations and state of household's food security. Gender analysis is therefore an important factor in poverty and food security analysis. 'Gender analysis, once confined to the margins of development theory, and has over the last ten years penetrated both the thinking and the operations of international development institutions' (Karla *et al*., 2019). Subsequently, Sentsho (2020) referred to women as a group operating under the conditions in which their reproductive activities are traded at the margin against their economic ventures. This does not only limit the time at these women's disposal but also restrict them to activities that are compatible with their schedules. Consequently, most women work on small-scale farms for production with attendant low yields and income that can hardly meet their varying family obligations. This therefore places limitation on their purchasing power and invariably induce household food insecurity level.

2.2 Conceptual Framework

2.2.1 Concepts of income inequality

Inequality according to Girei and Dire (2014) could be conceptualized as the dispersion of a distribution in terms of income, consumption or some other welfare indicators like health facilities, education, good access road, food security and/or attribute of a population. However, income inequality is the existence of disproportionate distribution of total national income among families that is the share going to wealthy men and women in a country is far greater than that going to poorer individuals (Busayo and Olufunmilayo, 2013; Tandrayen-Ragoobur and Pydayya, 2016). This disparity is not just in income but in other issues such as education, health, employment and political participation (Aigbokhan, 2017). However, income inequality in this study is seen as unequal distribution of financial resources among individuals in a trade, household, community and/or country.

In Nigeria, the study of inequality is not new as many of the studies have discovered that income inequality is increasing and has led to a growing size of poverty, food insecurity and other social vices in the country (Girei and Dire, 2014; Akpan *et al*., 2016; Usman *et al*., 2016; Aigbokhan, 2017)). Several factors have also been identified by scholars to be responsible for income inequality in many developing countries. These include urban-rural disparity, household members education attainment level, age distribution, gender and ethnic (regional) differences among others (Busayo and Olufunmilayo, 2013; Aigbokhan, 2017; Etim *et al*., 2020b).

2.2.2 Concepts of poverty

Poverty is an argued concept, the particular meaning of which depends on the ideology and perspective within which it is used (whether as a social, economic or political, financial,

environmental, health, seasonal problem or a combination of any of them). The way it is defined and used is critical to any public policy on matters pertaining to the concept. The debate about poverty nexus dates back to Malthusian era who argued that poverty is mainly being enhanced by population explosion (Okwori *et al*., 2015). The scourge of poverty most often rendered an individual economically handicap thus making the poor to seldom think of the future. Mahatma Gandhi assertion concluded that "poverty is the greatest cause of environmental harm" (Etim *et al*., 2020a).

However, in the broadest sense, poverty can generally be understood as the lack of, or inability to attain a socially acceptable standard of living, or the possession of inadequate resources to meet basic needs (Suich, 2012; Baser and Kaynakci, 2019). The meaning of 'socially acceptable' or 'basic' is itself often require careful deliberation or specification. Poverty has been conceived to be the lack of command over commodities and resources that provide people with income and consumption (Burchi and De Muro, 2016).

Many poverty analyses describe the situation of being poor, rather than considering how or why the condition exists. These descriptions normally emphasis on individual attributes (e.g., a lack of assets, education or health). However, these attributes are the outcomes of social processes and need to be understood within the context of social organizations and systems. To understand or attempt to alter these outcomes, it is imperative to examine the structures and processes that underlie these deprivations.

Consequently, using the composite approach, people are considered poor if their levels of consumption fall below a given income (poverty) line, which is currently globally set at $1.90/person/day, though it varies these days. Nevertheless, Davis, and Sanchez-Martinez

(2014) argued that even this approach is a narrow perspective to the definition of poverty because it implicitly excludes the non-material elements included in the broader United Nations definitions. These non-material elements include lack of participation in decision making, violation of human dignity, powerlessness, susceptibility to violence and humiliation, among others.

According to a recent view from the World Bank (2015), "poverty is a multi-dimensional phenomenon, extending from low levels of health and inadequate education, to other 'non-material' issues of wellbeing, including gender gaps, social exclusion, powerlessness and insecurity". Oghiagbephan (2016) acknowledging this fact of poverty nature of multi-dimensionality, defined poverty as a situation of low income or low consumption. It can also be viewed as a circumstances in which individuals are unable to meet the basic needs of life such as food, clothing, shelter, education, security and health.

Subsequently, the UNDP (2013) defines human poverty to mean situations where "opportunities and choices of most basic amenities to human life are denied; to live a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-respect and the respect of others". Given the multi-dimensional nature of poverty, a difference also can be drawn among people in chronic (lengthy-time period) poverty and those affected by temporary vulnerability or transitory poverty. The latter may be as a result of natural or macro-economic shocks to human survival. Households in chronic poverty can also be disaggregated according to their specific characteristics and causal factors. It is from this point of view that Farsani and Nooripoor (2017) defined poverty as "a condition of lacking the necessary ingredients that make life worth living". These ingredients could be many and quite varied depending on one's need; it could also be material and/or non-material.

Going by these definitions and facts about poverty, Bakar *et al*. (2015) concluded that indicators of poverty include: literacy, health status, nutrition status, access to housing, water satisfaction, freedom of association and a host of others. Therefore, household poverty can be regarded as a circumstance, in which an individual is unable to provide himself and his family the barest fundamental needs of life because of either economic, social, political and psychological incapacitation or a combination of these factors. In the Niger Delta region, Akpakan *et al*. (2015), Etim *et al*. (2020a) stressed that while poverty may seem to cause deprivation and hamper individual development, it is also the consequence of a number of social and national factors, such as poor governance, corruption and the exclusion of particular societal groups, including minority ethnic groups, women and youths, from partaking in decision-making on matters relating to their wellbeing. Hence, poverty in the context of this study is the inability or lack of resources to provide the basic daily need of life for household in the face of societal challenges.

2.2.3 Concepts of food security and insecurity

Food security and insecurity are terms used to describe whether or not households have access to sufficient quality and quantity of food. Food security issues gained prominence in the 1970s and have since been given considerable attention (Aidoo *et al*., 2013; Oke, 2015). The Food security can be perceived at the global, national, household and individual levels. However, food security at higher (Global) level does not guarantee food security at lower (national) level or even at lowest (individual) level. The reason for this is complicated of which the United Nations (UN) and Food and Agriculture Organization (FAO) are still looking for way out. Food security may have various meanings for various people depending on their perception or ideology. According to Eme *et al*. (2014), food

security simply refers to the ability of individuals and households (especially the rural and urban poor) to meet essential food needs all year round. Chakrabarti *et al*. (2018) noted that food is more than just a basic requirement; it also serves as the physiological basis for which all other considerations and human activities are structured.

According to Raj (2013) and FAO/IFAD/WFP (2014), Food security exists when all people have physical, social, and economic access to enough, safe, and nutritious food to fulfill their nutritional needs and desires for an active and healthy life at all times. Household food security occurs when all members of the household have enough food to live an active and healthy life at all times (United States Department of Agriculture – USDA, 2019). The International Conference on Nutrition (ICN), held in Rome in 1992, defined food security as "access by all people at all times to the food needed for a healthy life" (Nwalie,2017; FAO, 2019).

In the household level, food security entails consistent access to adequate food over time (Aidoo *et al*., 2013; FAO *et al*., 2021). This is possible if the household has sufficient food available and has sufficient income to buy the food available food. Stability of food means that food supply is unaffected at all times by any shocks or threats affecting food production. Physical access to food, economic access to food, and long-term access to food are the three components of food access. Hence, the four basic ingredients of food security are availability, accessibility, stability, and utilization of food supplies. In addition, food security exists when all individuals in an area or community have sustainable and satisfactory access to good and nutritive food without prejudice for an active healthy life.

Aidoo *et al*., 2013) distinguished between national food security and household food security. This distinction is important because a country's total food supply, whether from

domestic sources or through importation, or both, is a necessary but not sufficient condition for food security situation in the country. In other words, adequate food availability in Nigeria on a per capita basis does not always imply sufficient and adequate food for every person. It is on this note that Ojo and Adebayo (2012) asserted that food insecurity is no longer seen simply as a failure of agriculture to produce enough food at the national level, but rather as a failure of livelihoods to ensure access to adequate food at the household level. According to FAO *et al*. (2019), household food security is considered to be influenced by a variety of factors, including wages, educational attainment, and household size, as these factors directly affect economic access and the maintenance of that access.

Food insecurity, on the other hand, is a condition in which there is a restricted or uncertain supply of nutritionally sufficient and safe foods, or when there is a limited or inability to obtain suitable foods in socially acceptable ways (Fawehinmi and Adeniyi, 2014). In a household or region, it is also known as a lack of access to a nutritionally adequate diet. For farm householders in rural areas, food availability means ensuring that enough food is available for them either by self- production or by purchase from markets. However, due to a lack of adequate storage facilities and pressing needs, they are sometimes compelled to sell excess produce during harvesting season and rely on market purchases during periods of scarcity, resulting in food insecurity for the majority of rural farm producers and households. Not only does food insecurity have a negative impact on families and individuals, but attempting to alleviate it has a negative impact as well if they must spend most of their income in obtaining food.

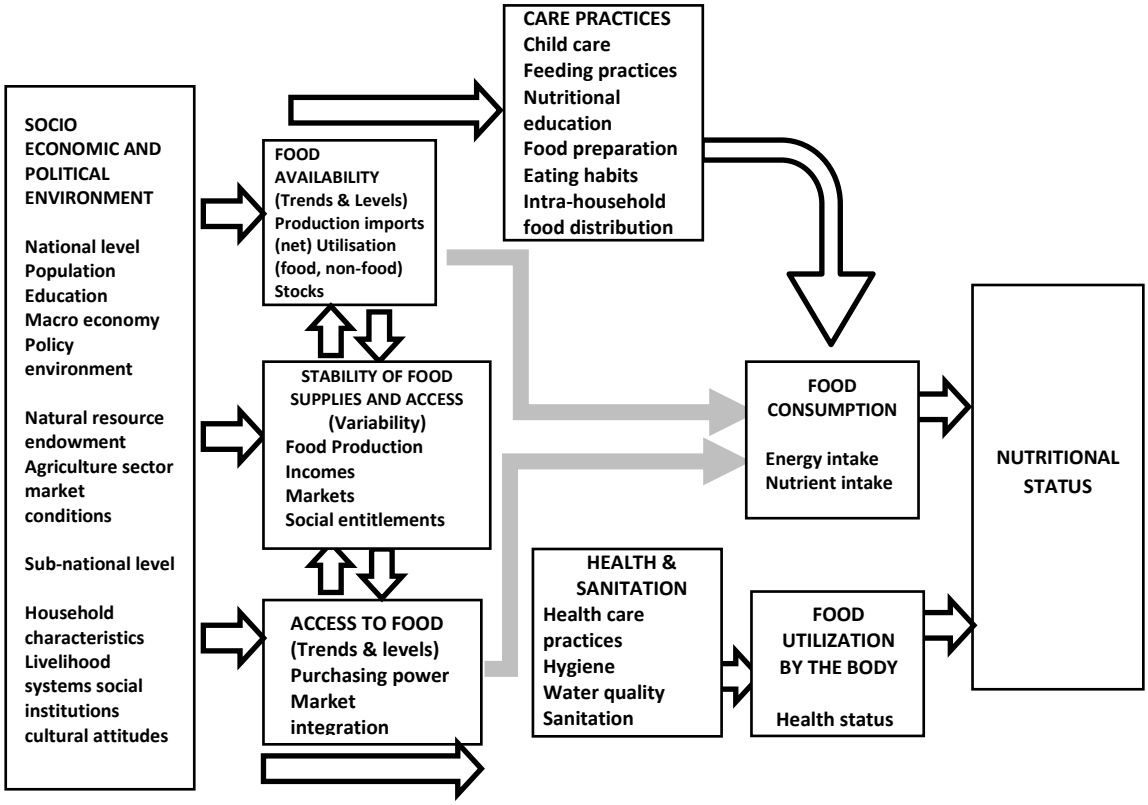
According to FAO (2017a) food insecurity refers to the consequences of inadequate consumption of nutritious food, considering the physiological use of food by the body as

being within the domain of nutrition and health. Food insecurity exists when people are undernourished as a result of the physical unavailability of food, their lack of social or economic access to adequate food (Otaha, 2013). Food insecure people are those whose food intake falls below their minimum energy requirements as well as those who exhibit physical symptoms caused by energy and nutrient deficiencies resulting from an inadequate or unbalanced diet or from the body inability to use food effectively because of infection or disease and biochemical imbalances in the body.

Nutrition security is achieved for a household when secure access to food is combine with a sanitary environment, adequate health services, and adequate care to ensure that all members of the household live a healthy life (Committee on World Food Security- CFS, 2012; United Nations Department of Economic and Social Affairs- UN/DESA, 2015). The key pillars of food security, according to the Aborisade and Bach (2014), FAO *et al*. (2021) are availability, access, utilization, and stability. Essentially, to achieve food security, a country must achieve three basic goals: ensure adequacy of food supplies in terms of quantity, quality, and variety of food; optimize supply chain stability; and ensure sustainable access to available supplies for those who require it. The conceptual framework of household food security shown in figure 2.1 illustrates the meaning and the pillars of food security.

As shown in Figure 2.1, the socioeconomic and political situation at the national and subnational levels are the most important determinants of food security since they affect food availability, stability of food supplies, and food access, all of which influence the amount of food consumed. When these factors interact with the health, sanitation environment and care practices, they determine the nutritious status of the individual concern. The basic determinants of food and nutrition security are resources: human

resources (e.g., people and their knowledge, abilities, and time); economic resources (assets, land, and income); and organizational resources (formal and non-formal institutions, extended families, and childcare organizations) as shown in figure 2.1.



Source: FAO (2017).

Figure 2.1: Conceptual framework of household food security.

Resources are available at different levels of society and are controlled in many different ways. At the household level, men usually control more of the resources, which often constrain the achievement of adequate food, care, and health (Grimaccia and Naccarato, 2020; FAO *et al*., 2021). The authors also noted that education plays an important role in determining how resources are utilized in securing food, health and care for children. The use of resources depends on the way a problem is understood as well as on the perception and priorities of those who control resources.

2.2.4 Concept of gender

The term ‘gender’ is often used interchangeably with the term ‘sex’. However, they are not the same; though whenever sex is assigned to a child, gender can be presumed. The naturalisation of gender to sex difference can be found in social constructionist arguments (such as socialisation or patriarchal models) found in radical or materialist feminism that see gender as a social manifestation whose limits are given by sex difference (Anthias, 2013). According to Genderspectrum (2017), gender refers to the set of characteristics that define and distinguish between masculinity and femininity. The gender of an individual is the product of a dynamic interrelationship between three dimensions or contexts; these characteristics include the body or biological sex (i.e., the state of being male, female, or an intersex variation or how others interrelate with us based on our body), expression or sex-based social structures (i.e., gender roles or how society uses those roles to try to impose conformity to contemporary gender norms), or gender identity (our genuinely held, internal sense of self as male, female, a blend of both) (Genderspectrum, 2017).

Anthias (2013), Etim *et al*. (2020b) described gender as a social and cultural construct that distinguishes females from males and, as a result, determines how females and males interact. These roles and expectations are learned, and they can change over time and differ across cultures. Richardson (2015) distinguishes between gender and sex, stating that gender refers to the socially constructed characteristics, roles, and obligations of women and men, boys and girls, while sex refers to biological distinctions between males and females defined in terms of the anatomy and physiology of the body. Gender is related to how we are perceived and expected to reason and behave as women and men because of

the way society is systematized, not because of our biological differences. It can also be seeing as personality differences between women and men in any society.

FAO (2017b) viewed gender as a source of power (or powerlessness) in any society or culture. This is because as societies and cultures change, the power associated with gender also changes. The power associated with gender can appear to increase or decrease as it interacts or intersects with other sources of power, such as class, race, religion, ethnicity, and sexuality. In terms of privileges and responsibilities, there is also a significant and complicated difference between men and women. Rich women most often do enjoy privileges that poor men do not. The same may be applied to women with different skin tones. For instance, woman belonging to a dominant ethnic group might enjoy certain liberties, privileges and benefits that a man from a small ethnic group within the same society might not. However, while gender manifests itself differently in myriad ways in diverse social contexts, such patterns in gender expression can also be observed in any stratum or layer of a society. Women traditionally have less freedoms, fewer rights, more household tasks, and less of a voice in socio-economic and political decision-making than their male counterparts, whether in fishing communities or small-scale fishing enterprises.

The homogeneousness of gender dynamics across social and cultural contexts indicates a system of social structures and practices which favours men over women (Anthias, 2013). This system allows gender discriminations and, in principle, commonly gives men more control over important aspects of women's lives, such as sexuality, reproduction, and labour and other resources (Anthias, 2013; FAO, 2017b). This power is legitimized by a wide range of social systems, institutions, traditions, and practices, including sometimes gender-neutral laws, policies, and customs, as well as various types of abuse (violence).

All these are determining factors in the distribution of responsibilities and resources between men and women known as gender roles. Gender division of labor is a significant means by which this power is exercised in fishing communities (Etim *et al*. 2020a, b) From the foregoing, it can be seen that biological distinction of individual is thus transformed into social identity to create what we called ‘gender’.

2.2.4.1 *Gender differences among households*

In the world today, there are systemic gender disparities in material well-being, income inequality, poverty and food security, regardless of socioeconomic class. Though, the degree varies across households or countries over time. Gender differences, according to Richardson (2015) are described as those socially defined differences that exist between men and women. Connell and Pearse (2014) defined it as a society's widely held perceptions and norms about acceptable male and female behaviour, characteristics, and roles. These differences are being demonstrated by both gender in their responsibilities performed in the household, community and the nation at large. However, these roles and responsibilities are not evenly distributed between the two genders. In some societies, it favours men while in some others, women have the advantages. Comparing the two genders, researchers always assumed and reported that men always have the leading advantage to the extent of calling the world “men’s world”.

2.2.4.2 *Gender differences in income inequality*

It is a characteristic in most societies that income inequality exists, with males on average holding higher positions in social, economic, and political hierarchies than females. Gender inequality is perpetuated not only by differences in access to and control over material resources such as income, but also by gender norms and stereotypes, which

reinforce gendered identities and constrain women and men's behaviour in ways that contribute to inequality (Anthias, 2013; Richardson, 2015).

According to World Bank (2016), universally, women's labour force participation has remained stagnated and indeed dropped from 57% in 1990 to 55% in 2013. This is attributed to gender inequality among other factors. National Bureau of Statistics (NBS, 2012) reported Labour Force Participation Rate of 40% for female of 15 years and above against 69% for male of the same age range. Inequality in resource allocation and asset ownership between men and women has both economic and social implications. According to Edet and Etim (2014a, b), Rajaratnam *et al*. (2016), Gender differences have an effect on the distribution of resources between men and women. Millions of girls and women around the world suffer from gender inequality, which has a negative impact on their health (Richardson, 2015) and frustrates their educational attainment (Kura, 2013). Ogundipe *et al*., 2019) added that it can also be detrimental to men's health, despite the many tangibles benefits it provides them in terms of resources, power, authority, and control. Subsequently, these benefits come at a cost to their emotional and psychological health, which often translates into risky unhealthy behaviours and shorter lifespans.

Therefore, gender differential in income inequality is the unequal distribution of income to the advantage or disadvantage of one gender in a country or household base on the gender characteristics, roles and perceptions in the society. This has resulted in the creation of income differential gap between one gender and another. The gap, which persists even in developed countries, has resulted in a plethora of patriarchal traditional and socio-cultural behaviours that place women at a disadvantage in a number of contexts as compared to men. In Nigeria, studies by British Council (2012), Busayo and Olufunmilayo (2013), Oxfam International

(2017) among others have affirmed to it. This scenario has made women to remain imprisoned in the cycle of poverty without means to have a higher standard of living. They are often duped into sex industries both within the country and in abroad due to their desperation.

Conversely, Gender income inequality is a measure of the disparities in wage earnings between men and women in the employment market. It compares the disparities between men and women's total earnings (Awotide *et al*., 2015; Tandrayen-Ragoobur and Pydayya, 2016). Differences in employment in the labour market by gender, according to Busayo and Olufunmilayo (2013), are significant reasons for the magnitude of the gender income inequality gap. For instance, nearly six million young Nigerian women and men join the labor market each year, but only 10% of them are able to get a job in the formal sector, with women accounting for one-third of these (British Council, 2012). Income inequality can be vertical (affecting individuals in any society) or horizontal (which affects groups of individuals e.g., culture, location, village, state, or environment). According to Nweke (2015), the pre-neoclassical theory of labour market asserts that women's inferiority in the labour market is based on wage disparities and institutional constraints.

To delineate the subject of gender differences in income, Nweke (2015), Tandrayen-Ragoobur and Pydayya, (2016) suggested that it will be more logical to compare the various attributes that different individuals bring to their career or workplace, which includes performances and other human capital characteristics, rather than differences in gender, race or ethnicity. Nweke (2015) related differences in education to the historical foundations of inequality in Nigeria, as women have less education than men. Husbands and wives have a strong correlation in terms of education, with husbands getting a higher

level of education than their wives. The author also discovers that development disadvantages are linked to gender inequality which significantly lower educational levels of females in many parts of Nigeria, especially among some ethnic groups. Oxfam International (2017) ascribed income inequality to labour market imperfection, social beliefs and prejudices, differences in skill and geographical differences in resource endowment and resource utilization. The tendencies of Nigerian women leaving the labour market are more often or to have a short time career leads to reduction of their average income earned compared to the men with more hours of work and long stay in the labour market (Olufunmilayo and Busayo, 2013; Fapohunda, 2013; Nweke, 2015) and these are some of the cardinal reasons for gender income inequality in Nigeria.

Gender relations (which are the hierarchical associations of power between men and women that tend to be detrimental to women) constitute the prime causes of gender inequality and are among the most influential social determinants of well-being (UNDP, 2013, 2015). It determines whether people's health, education, income and food needs are recognized, if they have a voice or a degree of control over their lives and well-being, and whether they are able to exercise their rights. Gender intersects with economic inequality, racial or ethnic hierarchy, class dominance, differences based on sexual orientation, and a variety of other social markers (Kura, 2013; WEF, 2014). These will require a multifaceted approach to tackle the problem if development and growth are to be achieved and sustained.

However, United Nations High-Level Committee on Programmes -UN-HLCP (2017) stated that unless action is taken on the contrary, inequality would widen further, causing social instability, undermining social progress, and jeopardizing political and economic stability. This might disrupt the United Nations' entire mission, from development to human

rights to peace and security. They also concluded that, development would only be sustainable if it is more equitable. Therefore, collective action is needed in order to mitigate the inequality effect. Moreso, if the 2030 Plan is to fulfilled the promise "leave no one behind" as enshrined in the Sustainable Development Goals (SDG) agenda, it must concentrate on eliminating discrimination and taming inequalities (UN-HLCP, 2017). The World Bank Group believes that no nation, society, or economy will reach its full potential or meet the challenges of the twenty-first century without full and equitable participation of women and men, girls and boys (World Bank, 2016, 2018).

2.2.4.3 *Gender differences in poverty*

Gender differences in poverty explain the effects of poverty on the society, culture and the economy based on the gender characteristics, roles and responsibilities set by that society or nation. There has not been a clear picture of how poverty and gender are related. Although some reports suggested that women are more likely to be affected by poverty than men, others claimed the opposite. According to Oluwatayo (2014), women account for more than half of the rural poor, and the number of poor women has risen by 50% in the last 20 years, compared to 30% for men. In today's world, the feminization of poverty is more pronounced. Evidence of widespread feminization of poverty has been established in South Africa (Sekhampu, 2013), rural Kenya (Owuor *et al*., 2017), and in Nigeria (Oluwatayo, 2014; Etim and Edet, 2014; Ogundipe *et al*., 2019).

In Nigeria, poverty, in all of its manifestations, has afflicted the entire country for centuries, and it has little or no regard for gender; it affects both men and women. Mbanasor *et al.* (2014) reported a poverty incidence of 0.567 in Southeastern Nigeria, as measured by the head count index. This means that 56.7% are unable to purchase a simple

basket of goods. As compared to the Zone's poverty incidence of 42.4% in 2019, as reported by NBS (2019). It can be deduced that the Southeastern Zone's poverty situation has declined by 14% between 2014 and 2019. However, the rate of reduction is still very low. Consequently, it is well documented that in Nigeria, the scourge of poverty affects women more than men (Oluwatayo, 2014; Edet and Etim, 2014a, b; Awotide *et al*., 2015; Ogundipe *et al*., 2019).

2.2.4.4 *Gender differences in food insecurity*

According to Fawehinmi and Adeniyi (2014), Nigerian women and households headed by women are often being regarded as the poorest in rural communities. Despite the fact that women play an important role in rural economic activities. They have a lower social status than men and thus have less access to education and training, particularly in childcare and health practices. Although the number of men migrating from rural areas in search of a better life has risen in recent decades. The number of female-headed households has also increased significantly. Women struggle to cope with the pressure of work at home and in the fields, fell on their shoulders. Malnutrition is a common occurrence in these households. Hence, in order to better incorporate women into Nigeria's socioeconomic life, education and job opportunities must be increased, and women should be encouraged to engage more actively into developmental activities.

Food and nutrition security are dependent on women (Ajewole *et al*., 2016). They play an important role as food producers, natural resource managers, income generators, and as care providers for their families. Yet, women in Nigeria often continue to have limitation on access to property (land), education, credit, information, technology, and decision making bodies. Land ownership gives the owner access to credit and inputs

including agricultural extension services, seeds, modern irrigation systems, fertilizers, pesticides, and cooperative society membership. Women without land have no security and must depend on landowners for livelihood. The break-up of communal land holdings in the eastern part of the country, where population density is high, has resulted in the transfer of exclusive land rights to male-headed households (Oluwatayo, 2014). This ignores the existence of female-headed households as well as married women's claims to a joint share. Women are either dependent on their husbands' goodwill and the availability of land to grow food, or they must lease farmland. Therefore, Understanding gender inequalities and their effect on economic performance should lead to improved program targeting on policy making in general. Enhancing gender equality could significantly lead to increasing food security, biodiversity conservation, child wellbeing and productivity (Grimaccia and Naccarato, 2020; FAO *et al*., 2021).

Inconsistent food security contributes to insufficient dietary consumption, which leads to malnutrition. Hence, the most serious consequence of food deficiency is malnutrition. Adult malnutrition has a negative impact on farm and labour capacity utilization. It also induces fetal malnutrition and low birth weights in women. Under nutrition of fetuses and infants causes slow cognitive development and poor academic performance. Food and nutritional insecurity are factors contributing to low school enrollment, absenteeism, early dropout, and poor classroom performance among school-aged children, as well as loss of productivity during adulthood.

The prevalence of high levels of infections among rural dwellers particularly women and children is as a result of inadequate food consumption which lead to nutritional imbalance in association with lack of access to good health care system, potable water, proper

sanitation as well as adequate information on caring practices. Hence, evaluating food and nutrition security through ensuring household food security, adequate caring practices, and a safe environment will save millions of lives of rural citizen in Nigeria.

2.2.5 Concept, effects and type of coping strategies

The impacts of vicious cycle of income inequality, poverty and food insecurity among households especially rural inhabitants have continue to aggravate to higher dimension of economic uncertainties, shock, hunger, malnutrition and associated diseases. Due to these, over 960 million people worldwide are hungry and undernourished with bulk of these people living in Asia and Africa (Dessalegn, 2018). In the midst of such uncertainties, shock and hunger, adoption of various coping strategies has always been a formidable mitigating force available to people. In Nigeria, rural households are vulnerable to shock due to their limited capacity to make informed decisions on stable coping strategies which is further aggravated by some households' specific socio-economic characteristics. Nevertheless, in Nigeria's current situation, many urban households are equally experiencing the same. This may be due mostly to the present-day insecurity problems (banditry, farmers-herdsmen crises, abduction and other related crises) being faced in the country, among other factors.

The concept of coping strategies is not new. As a result, many definitions of the concept have emerged over the years by researchers, scholars, authors and organizations. Each defining it in their own way, thus indicating that there is no broad-based definition. Coping strategy is defined as a response to traumatic events or shocks (Agrawal, 2020). Coping strategies are short-term, location-specific actions and adjustments against danger and events that take place within existing structures (Mitra *et al*., 2016; Dessalegn, 2018).

Broad definition of coping strategies according to Etim *et al*. (2020 a, b) refers to it as “all the strategically chosen actions that individuals and households in a poor socioeconomic situation use to limit their spending or raise some extra income in order to pay for basic necessities (food, clothes, and shelter) while not falling too far below their society's level of welfare”. In this context, coping strategies can be defined as ways or combination of ways where an individual in a household, community, region or country deals with circumstances (such as stress, shock, uncertainties, hunger, malnutrition and disease) associated with natural disaster, poverty, food insecurity and inequality inimical to his general well-being and survival. It is made up of the implicit ideologies that direct the poor in their quest for goods and services to help cope with their current life predicament (Agrawal, 2020). Although some of the processes are unconscious, others are learned, the author added. It is pertinent to also point out that not all coping strategies are beneficial, some can actually be harmful.

According to Amendah *et al*. (2014), there are two types of shocks or adverse events that can impact households: covariate shocks that affect the whole population and idiosyncratic shocks that affect a single household or person. While both covariate and idiosyncratic shocks have a significant effect on urban and rural households' vulnerability, idiosyncratic shocks have a higher impact on urban households' vulnerability or likelihood of falling into poverty (Amendah *et al*., 2014). The literature indicates that while households employ a variety of risk-coping techniques, they are not universally available to everyone. Poorer households, for example, may be unable to use mechanisms that rely on prior savings or collateralized assets. Shocks and their coping mechanisms may cause poverty to emerge

and/or continue by destroying or reducing a household's production resources or by causing a negative behavioral shift (Amendah *et al*., 2014).

In the literature on the subject, there are numerous classifications and typologies of coping strategies. Ex-ante and ex-post coping strategies are two types of coping strategies. Ex-ante strategies, as described by Amendah *et al*. (2014), Mitra *et al*. (2016), are defensive risk-management measures taken by households prior to an eventual shock. Self-insurance, such as pre-cautionary savings and wealth accumulation, or community-based formal or informal insurance, are common examples of these strategies. Ex-post strategies, on the other hand, are household behaviour taken to minimize the effects of an adverse event. Reducing spending, increasing home production, diversifying sources, and increasing income are examples of these strategies (Akeweta *et al*., 2014; Iyela and Ikwuakam, 2015). Such strategies can have both short and long-term consequences. Typically, households implement short-term coping mechanisms first, such as depleting savings or selling assets, and when those mechanisms fail, households turn to longer-term strategies, such as removing children from school (Amendah *et al*., 2014).

Consequently, Akeweta *et al*. (2014) make a rough distinction between coping strategies that focus on improving the usage of internal household resources and coping strategies that focus on mobilizing external resources offered by the state, the local community, relatives, friends, private organizations and development partners. Mitra *et al*. (2016) differentiated between monetary and non-monetary resources. Monetary resources comprise earnings from formal or informal labour or financial support offered by the local or national authorities. While Non-monetary resources comprise activities by household members to meet their own needs, informal mutual support by relations (or the exchange

of services), and goods or services supplied by official agencies. The author further stated that reducing house-hold expenditures is a non-monetary coping strategies which can be achieved by:

(1) Consuming less, cutting down on luxuries expenses (holidays, entertainment, transportation, the newspaper), or attempting to maintain the same consumer level of consumption with less money by procuring cheaper items.

(2) Intensive use of internal household resources, such as a self-supporting household that grows its own food, sews its own clothing, does its own repairs, and even builds its own home.

(3) Business-oriented activities, such as selling home-grown vegetables and other goods at the market

(4) Seeking funding from powerful external bodies such as the state, local governments, or non-governmental organizations (NGOs). This method of coping strategy is by far the most important; in many situations, there are additional provisions for the most disadvantaged groups with medical care and food, which are intended to provide medical health care and food to low-income groups (Akeweta *et al*., 2014; Mitra *et al*., 2016).

Mitra *et al*. (2016) classified poverty coping strategies in to two types, weak and active. According to the author, selling of assets, promoting labor force participation (including that of children), decreasing consumption patterns, restricting food intake of family members; taking children out of school to minimize education expenses, or deferring health care expenditures, relocating (migration), and/or reforming households are all examples of weak or passive strategies. Whereas, the active coping strategies consist of; increase in home production, changing place of residence, finding supplemental work or a

second job, formal borrowing, such as from banks, petty trading, and others (Akeweta *et al*., 2014). Similarly, Oluwatayo (2014); Iyela and Ikwuakam (2015) highlighted some of the poverty coping strategies adopted by both rural and urban dwellers to include buying food on credit, skip-ping meals, spending saved income, eating unconventional foods such as yam peals and long period of breast feeding. Others include withdrawing children from school in order to have them employed in the wage labour market or at home.

As coping strategies differ from place to place and from person to person (Iyela and Ikwuakam, 2015), the methods used by households also differ in many ways both within and between households. This means that the capability of a people to move out of poverty, food insecurity and inequality or adopt a coping mechanism for these issues is often associated with the peculiarities of circumstances inherent in their communities. These may include: degree of wealth among households, poverty, food insecurity and inequality level of the area and level of asset or liability owned by individual in the community. Hence, Dessalegn (2018) concluded that certain coping strategies are practiced by all households, but the degree to which these strategies help a household stay afloat is dependent on the assets available to them. As a result, investigating in Niger Delta Region to identify various coping strategies of poverty, food insecurity and income inequality among crayfish harvesting households become germane.

2.3 Analytical Framework

2.3.1 Measurement of income inequality indices

Income inequality refers to disparities in the distribution of economic assets and income (Sanusi *et al.*, 2016). Inequality is often studied as portion of broader analysis covering poverty and welfare, although these three concepts are distinctive. Inequality is a wider

concept than poverty in that it encompasses the whole distribution, not just a segment of individual or household income distribution. In the literature, a number of different measures of inequality have been suggested, but there seems to be no consensus on how best to measure inequality. Etim *et al*. (2020b) clearly pointed two ways in which inequality measures can be classified: they are normative measures and positive measures.

Normative measures are generated by imposing restrictions on the inequality mechanism based on specifically defined ethical beliefs underlying the societies' concern for inequality (Loury, 2021), while in positive measures, the indices summarise features of statistical dispersion in income distribution. Nevertheless, they all fail to meet the basic ethical criteria for use as inequality indices. Examples of normative measures include the generalised entropy class of inequality index and the Atkinson index whereas examples of positive measures include relative mean deviation, coefficient of variation, variance of logarithms and Gini coefficients among others. The questions had always been which one of these measures should be chosen for decomposition?

Adler and Fleurbaey (2016), Etim *et al*. (2020b) argued that good measures of inequality are only trustworthy if they are based on the following: (1) the distribution of real expenditures per adult, which includes all market goods and services. (2) Indicator of non-market access to resources for which no meaningful process cannot be allocated, such as non-market education and health care. (3) Measures of gender disparities and infant nutritional status, as well as indicators of household distribution. (4) Indicator of such personal attributes that impose uncommon limits on one's ability to escape poverty, such as physical disabilities or impairments caused by previous chronic malnutrition. According to Sanusi *et al*. (2016), the chosen measure should have five basic properties.

- The pigou- Dalton Transfer principles: - An income transfer from a poorer to a wealthier individual can result in an increase in inequality, not a decrease.
- Income scale independence: If there is a uniform proportional adjustment in households' sub-groups, inequality measures should be unaffected.
- Decomposability: This means that total discrimination must be applied to constituent sections of the population, such as population sub-groups, in a consistent manner.
- Principle of population inequality metrics should be invariant through population replications. Merging two similar data sets, for example, does not change the distribution.
- Anonymity or symmetry: Inequality measures should be independent of any person (or household) characteristics other than income (or the welfare indicator whose distribution is being measured).

Some of the basic inequality measures are the range, the relative mean deviation, the variance, and coefficient of variation, the standard deviation of logarithms, the Gini coefficient, generalized entropy (GE) measure (Theil index, mean log deviation and Atkinson's inequality measures). However, an inequality index like the Gini coefficient and Theil index remains a strong and valuable tool for calculating inequality (Liao, 2016; Trapeznikova, 2019).

The inequality measures that meet all these criteria are the general entropy class ($GE_{\alpha}(x)$) and the Atkinson measure (Anand and Segal, 2015; Adler and Fleurbaey, 2016). Though, the two measures are not significantly different as the Atkinson index is simply an

increasing transform of the GE_{α} measures. As a result, both GE_{α} and Atkinson rank income in the same order ((Liao, 2016; Sanusi *et al*., 2016). In addition to the above measures, the Gini index is also a widely used measure since it satisfies all the basic requirement for a good measure except the decomposability criteria.

It has been acknowledged in the literature that measures of inequality from the GE class are sensitive to changes at the lower end of the distribution for α close to zero. It is equally sensitive to changes across the distribution for α equal to one (which is the Theil index), and also sensitive to changes at the higher end of the distribution for higher values (Etim *et al*., 2020b). There are a number of definitional issues that arise when calculating inequality. The first is on the definition of income, which is used in conjunction with the data's reliability.

The reporting of income usually includes both earned and unearned income. There is also the issue of underreporting income in survey data, as many households refuse to reveal their true income. This is one of the reasons why, in recent research, expenditure data has been preferred against income data (Sanusi *et al*., 2016). However, household expenditure does not show the true level of household income because individual expenditure patterns do not always represent individual income flows, but instead are a function of individual lifestyle (Etim *et al*., 2020b).

2.3.1.1 *Generalized entropy (GE) measures*

There are a number of inequality measures that meet all the six requirements. Theil index and the mean log deviation measure are two of the most widely used. Both are members of the family of generalized entropy inequality measure. The values of GE measures range

from 0 to 1, with zero indicating a level of equality and a higher value indicating a higher level of inequality. The GE class parameter can take any real value and represents the weight given to distances between incomes at different parts of the income distribution. Lower values of GE are more sensitive to changes in the lower tail of the distribution, while higher values are more sensitive to changes in the upper tail of the distribution. The commonest values of α used are 0,1 and 2. GE (1) is Theil's T index while GE (0) is the mean log deviation or Theil's L. They are expressed as:

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right] \quad (2.1)$$

$$GE(1) = \frac{1}{N}\sum_{i=1}^{n}\left[\frac{y_i}{\bar{y}}\right]\ln\left[\frac{y_i}{\bar{y}}\right] \quad (2.2)$$

$$GE(0) = \frac{1}{N}\sum_{i=1}^{n} ln\left(\frac{\bar{y}}{y_l}\right) \quad (2.3)$$

The Theil index, despite its popularity (due largely to its decomposability), is still unable to capture record on variation and/ or dispersion differences in income distributions between social groups, which are often manifested as "glass-ceiling and glass-floor" effects (Liao, 2016).

2.3.1.2 *Atkinson's inequality measures*

Atkinson proposed another class of inequality measures that is used from time to time. This class has a weighting parameter *ε* (which measures inequality aversion) and some of its theoretical properties are similar to that of the extended Gini index (Smeeding *et al*., 2015). It is widely used measure for macro economic analysis.

It is express as: $A_{\varepsilon = 1-}\left[\frac{1}{N}\sum_{i=1}^{n} ln\left(\frac{y_i}{\bar{y}}\right)^{1-\varepsilon}\right]^{1}/_{1-\varepsilon}$ (2.4)

2.3.1.3 *Decile dispersion ratio*

The decile dispersion ratio is the ratio of the average consumption of income of the wealthiest 10% of the population divided by the average consumption income of the bottom 10%. It is simple and widely used measure for economic analysis. This ratio can also be calculated for other percentiles (for example, dividing the average consumption of the wealthiest 5% – the 95th percentile – by the poorest 5% – the 5th percentile). The decile ratio is easily understood by expressing the income of the top 10% (the "rich") as a multiple of that of the lowest decile (the "poor"). However, it ignores information about incomes in the centre of the income distribution, and does not even use information about the distribution of income between the top and bottom deciles (Trapeznikova, 2019).

2.3.1.4 *Gini coefficient*

The Gini coefficient is a statistical dispersion measure that is most commonly used to show the degree of income or wealth distribution inequality between different households in a population (Ayinde *et al*., 2012). According to the Trapeznikova (2019), Luptacik and Nezinsky (2020), Gini-coefficient is defined as a ratio with values between zero and one (0-1). A low Gini coefficient indicates a more even distribution of income or wealth, while a high Gini coefficient indicates an unequal distribution. Perfect equality is represented by zero (0), while perfect inequality is represented by one (1).

It is based on the Lorenz curve, which is a cumulative frequency curve that compares the distribution of a single variable (such as income) to the uniform distribution, which depicts equality. To get the Gini coefficient, graph the cumulative percentage of households (from poor to rich) on the horizontal axis and the cumulative percentage of expenditure (or income) on the vertical axis. The Gini-coefficient is a precise way of determining where

the Lorenz curve is positioned. It is calculated by dividing the area between the Lorenz curve and the 45 degree line by the total area under the 45 degree line. If the Lorenz curve is the 45 degree line, then the value of the Gini-coefficient would be zero. In general, the closer the Lorenz curve is to the line of perfect equality, the less the inequality and the smaller the Gini-coefficient (Ayinde *et al*., 2012; Trapeznikova, 2019).

According to Usman *et al.* (2016), the Gini index provides an appropriate standard for measuring inequality and is also one of the most widely used economic measures. Despite the fact that the Gini coefficient satisfies the transfer theory, it is not transfer responsive due to its reliance on ranks rather than income (Trapeznikova, 2019). It is not perfectly decomposable, as it has a non-zero residual K besides the within and between inequality (Trapeznikova, 2019; Luptacik and Nezinsky, 2020), implying that it is difficult to decompose to reveal the roots of inequality. It also fails to satisfy one property of being written as the sum of within-group and between-group inequality components (Etim *et al*., 2020b). Regardless of this flaw, the Gini index was used because it is adaptive to shifts in the middle income range. The equations Gini index are presented as follows:

$$\text{Igini(Y)} = \sum_{i=1}^{n} a_i(y)y \text{, where } Y_i = \frac{2}{n^2\mu}\left[\frac{\sum n+1}{2}\right]Y_i \qquad (2.5)$$

Where: Igini(Y) = Gini income, n = number of observations, μ = mean of the distribution, Yi = income of the i^{th} household.

Akpan *et al*. (2016) used Gini coefficient to determine the level of income inequality among youth farmers in Akwa Ibom State, Nigeria. The result revealed that male youths had income inequality index of 0.4009 while female youths had an income inequality index of 0.3797. Agwu and Otteh (2014) analysed income inequalities of farmers in Abia

State, South Easthern Nigeria using Gini coefficient. The findings reveals that the Gini coefficient value was 0.67 indicating high income inequalities in the study area.

Conversely, Adigun *et al.* (2015) in explaining poverty and inequality by income sources in rural Nigeria uses Gini coefficient and reported Gini index of 0.39 income inequality indicating low-income disparity among rural dwellers. Moreso, Igbalajobi *et al*. (2013) assessed income inequality among the rural farming households in Ondo State, Nigeria, using Gini coefficient. They reported Gini coefficient of 0.492 which implies that there is an average level of income inequality among the respondents in the study area.

2.3.2 Decomposing household income inequality

At the moment, development economists are very interested in the problem of economic inequality in developing countries known as less developed countries (LDCs). Studies of the determinants of inequality takes one of two general approaches. The more traditional approach is associated with names like Kuznets, Chenery, and Syrquin (Ayinde *et al*., 2012). These studies all use the same methodology, which consists essentially of looking at a cross-section of households or countries and (1) measuring the degree of inequality in each, (2) measuring other characteristics of each household or country (e.g. level of GNP, its growth rate, importance of agriculture in total product), (3) relating inequality level to the characteristics of the economy using correlation or regression analysis. In recent years, another type of approach has been taken, which looks at inequality within a household or country, and measures the contribution of the various components to total inequality.

2.3.2.1 *Types of decomposition methods*

There are three types of decomposition methods: functional decomposition by income source, functional decomposition by economic sector, and microeconomic decomposition by income-determining characteristics. However, the decomposition in this study will be based on household income-determining characteristics.

Decomposition by household Income Determinants: Studies nowadays has revealed that household total income and labour-force earnings are systematically related to a number of family characteristics: the number of labour used in production, the level of unemployment, individual characteristics (such as education, working experience, age, gender), the family's location (rural or. urban). The decomposition method of this nature can best be handled by 'within and between group' decomposition technique like coefficient of variation, Theil-T index, Atkinson index, Wolfoson index, Palma index and regression-based decomposition method (Trapeznikova, 2019; Etim *et al*., 2020b).

The rationale and scope for selecting income inequality decomposition measure depends on the measure that is used (Trapeznikova, 2019). In fact, from a conceptual standpoint, the differences highlighted by these estimates are dependent on the nature of the distribution and, more importantly, on the conceptual definition of the selected measures (Anand and Segal, 2015). The Atkinson family of inequality indexes, for example, is sensitive to changes in the lowest segment of the income distribution; the Gini coefficient is sensitive to changes in the midpoint of the distribution; and the Theil index is more sensitive to changes in the top segment of the distribution. (Trapeznikova, 2019). Indeed, the rationale for choosing among these indicators is, of course, determined by the shape of the empirical distribution of income. The Theil coefficient, for example, should be preferred for heavily tailed, highly

skewed distributions, while the Gini coefficient should be preferred for distributions clustered around the median and with much lower probability mass in the tails.

2.3.2.2 *The analysis of variance*

The analysis of variance is based on the decomposition of within and between elements. We have also learned that the variance itself can be used as an inequality index. Assume an income distribution with two groups, those in urban areas (U) and those in rural areas (R). Their incomes should be denoted as y_i^U and y_i^R , where the subscript refers to a generic individual, while the super-script identifies the area to which the individual belongs to. In a general form, the variance of total income can be decomposed as follows:

$$V(y) = \underbrace{[w_U V(y_U) + w_R V(y_R)]}_{\text{WITHIN}} + \underbrace{V[\bar{y}_U, \bar{y}_R]}_{\text{BETWEEN}} \quad (2.6)$$

Where: $V(y_U)$ = variance of urban incomes

w_U = share of urban residents on total population

$V(y_R)$ = variance of rural incomes

w_U = share of rural residents on total population

$\bar{y}_U$ = mean of urban income

$\bar{y}_R$ = mean of rural income

2.3.2.3 *Theil–T index decomposition*

Few decades ago, Theil in 1967 proposed a readily-decomposable inequality measure, which he later in 1972 illustrated with a number of empirical applications (Edward and Sumner, 2017). It is a member of generalised entropy indexes of measurement. Literarily, it depicts the measurement of disorderliness; it measures the deviations from perfect inequality. While the Gini index can compare between units and sizes of populations, it does not apply to grouped data and, when it does, it produces a residual. The Theil index can split data within and between groups; this is known as perfect decomposability. It is

defined as the 'between' and 'within' in the decomposability form. Unlike the Gini Index, the T index is completely decomposable without the use of a residual term. Their economic interpretation is thus straightforward; however, when viewed from another perspective, they conceal something that the Gini Index can reveal, namely the amount of inequality caused by the re-ranking effect. (Anand and Segal, 2015; Militarua and Stanila, 2015).

Decomposability is a key factor to measuring inequality. Indeed, Inequality measurement relies heavily on decomposability. It expresses how sub-groups contribute to overall inequality. The within inequality expresses the variability within each group, whereas the between inequality expresses the inequality across groups. Thus, theil decomposition measures of income inequality enables one to quantify the contributions of various sub-group characteristics to overall income inequality, yielding solid insights into inequality drivers as well as policy implications (Chongvilaivan and Kim 2015). A general decomposed inequality index is composed of within, between, and a residual and is denoted as:

I TOTAL = I WITHIN + I BETWEEN + K RESIDUAL (2.7)

The formula used for computation of Theil index (T) is as follow:

$$T = \frac{1}{n}\sum_{i=1}^{n} w_i \left[\frac{y_i}{\bar{x}}\right] \log\left[\frac{y_i}{\bar{x}}\right] \quad (2.8)$$

Where n is the total number of households in the sample, $\bar{x}$ is estimate of the population mean, w_i is the household weighted coefficient, and y_i is the income of given household i; for i= 1,2,3,…,n. This measure of inequality has a maximum value of one (perfect inequality) and a minimum value of zero (perfect equality).

It is common practice in income distribution to divide overall income inequality into within-group and between-groups in order to isolate the contribution of each component

(Edward and Sumner, 2017). This is primarily motivated by the following: while policies aimed at reducing intra-sectoral disparities may reduce intra-sectoral disparities, overall income inequality may persist due to large inter-sectoral income variance. Furthermore, the contribution to overall income inequality may differ from one sector or group to the next, and by decomposing it, it may be possible to design easily redistributive growth policies. The contribution of between-groups to overall income inequality is proportional to the number of distinct and non-homogeneous groups (Andrei *et al*., 2017), i.e., it rises as the number of groups' increases.

Within-group inequality, on the other hand, is inversely proportional and decreases as the between-group increases. Mostly because the within group variance decreases with group size, and as more and more disjoint sets are formed, the income dispersion within each set becomes smaller in relation to the overall population. (Militarua and Stanila, 2015; Edward and Sumner, 2017; Andrei *et al*., 2017). To decompose Theil's T index (i.e., GE (1)), Let Y represent the population's total income, Yi represents the income of a subgroup, n represent the total population, and n_i represent the population in the subgroup, and w_i the household weighted coefficient (which is the ratio of income on each source of income determine by socioeconomic factors and the total income). The equation (7) expression can then be rewritten as:

$$T = \sum_i w_i \frac{Y_i}{Y}\left[\sum_j \frac{y_{ij}}{Y_i} \log\left(\frac{y_{ij}/Y_i}{n_{ij}/n_i}\right)\right] + \sum_i w_i \frac{Y_i}{Y} \log\left(\frac{Y_i/Y}{n_i/n}\right) = T_W + T_B \qquad (2.9)$$

Where; the leftmost expression in the formula, is the within-group component (T_W) and the rightmost expression is the between-group component (T_B) (Andrei *et al*., 2017). Andrei *et al*. (2017) also stressed that the analysis of the degree of inequality in income distribution

across the entire population can be explained by two factors: inequality within each group of people and differences between two or more groups of people. The authors also added that the disjoint nature of two or more groups can be explained by the Theil index decomposition, which goes as follows:

$$T_{YIg}=\frac{1}{n}\sum_{i=1}^{2}\sum_{j=1}^{n_i}\frac{y_{ij}}{\mu}\log\frac{y_{ij}}{\mu} = \sum_{i=1}^{2}\frac{Y_i}{Y}T_i + \sum_{i=1}^{2}\frac{n_i}{n}\left[\frac{\mu_i}{\mu}\log\frac{\mu_i}{\mu}\right] = T_{WI} + T_{BI} \qquad (2.10)$$

Where:

the first expression in the formula = T_{WI}, which is the within-group component that measures income distribution inequality as a result of differences in income distribution between the two groups. Theil indices are used to calculate the inequality of income distribution for each group, and for all groups, we evaluate this part of $T_{(Y)}$ by multiplying the Theil indices calculated at the group level by the weighted arithmetic mean of all income; and the second expression = T_{BI}, which is the between-group component that quantifies the part of the inequality of distribution of population incomes due to differences between groups. This term refers to a Theil index calculated for the average income at the group level and using the population structure on the two groups from which the population is made up as a relative frequency.

T_Y = total income inequality or Theil index of total income

$Y_i = \sum_{j=1}^{n_i} y_{ij}$ = total income of for each group (e.g. male or female; rural or urban)

Y = total income of all the group

μ = total mean income of the population

$\mu_i = \frac{y_i}{n_i}$ = mean income of a group

n_i = number of persons in a group

n = total number of population

Thus, overall inequality is a simple sum of the within groups inequality, denoted by T_{WI}, and between groups inequality, T_{BI} such that

$$T_{YI} = T_{WI} + T_{BI} \quad (2.11)$$

Therefore, the breakdown of the Theil index for the total income of individuals of a population based on the Socio-economic and institutional factors that determine income is expressed as:

$$T_{YIg} = \left(\frac{\mu_{x1}}{\mu}T_{x1} + \frac{\mu_{x2}}{\mu}T_{x2} + \ldots + \frac{\mu_{xn}}{\mu}Tx_n\right) + \left(\frac{\mu_{x1}}{\mu}\log\frac{\mu_{x1}}{\mu} + \ldots + \frac{\mu_{xn}}{\mu}\log\frac{\mu_{xn}}{\mu}\right) + \left(-\left(\sum_{i=1}^{n}\frac{y_{x1}}{Y}\log\frac{y_{x1}}{Y} + \ldots + \frac{y_{xn}}{Y}\log\frac{y_{xn}}{Y}\right)\right) \quad (2.12)$$

Where:

X_1- X_n= explanatory variables

Y, y_i, n, and μ are as defined in equation (10)

the first term in this relationship is the weighted arithmetic mean of the Theil indices computed for the number of variables. The weights are the income ratios between each socioeconomic factor or source of income and total income. This term measures income inequalities caused by differences in income distribution based on socioeconomic factors or sources of income. In this case, the Theil index for each of the data series is calculated.

the second term measures income inequality due to income distribution by the socioeconomic variables or income sources. This term refers to a Theil index that is calculated using the income distribution by income sources. The third term represents the correlation between the number of observable characteristics or income sources that influence the inequality of income distribution among a population (Andrei *et al*., 2017).

2.3.3 Measurement and decomposition of poverty

According to Umoh *et al*. (2015) and Akpan *et al*. (2016), poverty can be measured using the head count ratio, which is based on the ratio or percentage of the number of people or

households whose income is less than the poverty line to the total number of people or households (Umoh *et al*., 2015). The "income-gap" ratio is another method of measuring the severity of poverty. Here, the poor's income deviation from the poverty line is averaged and divided by the poverty line, or expressed as a percentage (World Bank, 2018; Teka *et al*., 2019). However, considering the prevalent rate of poverty in the area, the possibility of increase in social vices and juvenile delinquencies among siblings of rural poor farmers could trigger social unrest and civil strife relative to the calm and peaceful atmosphere currently being experience in rural and peri-urban areas in Niger Delta States (Etim *et al*. 2020a).

Edoumiekumo *et al*. (2014) noted that for any poverty alleviation program to thrive, the following questions must be answered: (i) what proportion of the people are poor? (ii) How far away from the poverty line are the poor? (iii) What is the gap between the average poor and the core poor, and (iv) what are the causes of poverty in the given society? In order to answer the questions, they used the Foster, Greer, and Thorbecke (FGT) model and a logit regression to examine income poverty in Nigeria's South-South geopolitical zone. The consistency and additively decomposability nature of FGT model makes it to be widely used (Teka *et al*., 2019). The model can also accept any poverty approach use on it's (e.g. income, expenditure and energy calorie approach). The FGT index is specified as:

$$P_{\alpha}= \frac{1}{N}\sum_{i=1}^{q}\left[\frac{z-y_i}{z}\right]^{\alpha} \qquad (2.13)$$

Where:

Z = the poverty line defined as 2/3 of the Mean Per Capita Household Expenditure,

Yi = the value of poverty indicator/welfare index per capita for all households,

N = population size,

q = the number of poor people in the population of size N, and

α = the poverty aversion parameter that takes values of zero (0), one (1) or two (2). Lubrano (2016) uses FGT model to decomposed poverty between urban and rural area as

$$P_\alpha = P_\alpha^U + (1 - p)P_\alpha^R \quad (2.14)$$

Where: P_α^U is the index calculated for the urban population, while P_α^R is the index calculated for the rural population. Therefore, decomposition for a poverty index means that poverty for the entire population can be expressed as a weighted sum of the same poverty index applied to each group (Gradín, 2012 and Lubrano, 2016).

Nyamuhirwa (2019) analyzes gender, education and poverty in Democratic Republic of Congo (DRC) through a Blinder-Oaxaca decomposition approach. The latter was needed in this study to judge the difference in level of consumption expenditure per adult equivalent per day depending on whether the household is headed by a man or a woman. Preliminary results showed that educational attainment significantly influences the dependent variable at all levels of the education system considered in the female-headed household group. The decomposition showed that if female heads of household had the same endowments as men do then the consumption expenditure per adult equivalent per day would have been decreased in the area. Hence, in this study of poverty was decomposed based on gender differentials using Oaxaca-Blinder (O-B) decomposition method in order to properly diagnose which factor contributes most to increasing poverty gap between male and female headed crayfish harvesting household in Niger Delta area.

2.3.4 An overview of Oaxaca-Blinder (O-B) decomposition technique

Studies have shown that most income inequality decomposition approaches offered no details on the reason of their decomposition, what contribution each element of a group made to belong in that group and /or what made a person to actually belong to one of these

groups. Oaxaca and Blinder in 1973 were the first to try to give an explanation on the sources, and the causes of inequality, using linear regression model (Landmesser, 2016; Fairlie, 2017). The decomposition is often called the Oaxaca-Blinder (O-B) or Blinder-Oaxaca (B-O) decomposition. The two names will be used interchangeably in this work.

The above technique gained prominence and popularity as a result of the decomposition of wage-earning gaps and the estimation of discrimination in gender earnings differentials. The method was developed to evaluate wage differences between white males and white females, as well as white males and black males. The O-B decomposition method computes the difference in means of two groups' outcome variables and determines the contribution of each variable to the differences between the groups of interest. This decomposition method divides the gap or result of the mean differences between the two groups into the explained component, i.e., endowment or characteristic effect, and unexplained component, i.e., structural or coefficient effect. The explained component is the portion of the difference in group outcomes caused by group differences in explanatory variables, whereas the unexplained component is caused by discrimination or omitted predictors (Gutierrez *et al*., 2015; Ciaian *et al*., 2018; Rahimi and Hashemi-Nazari, 2021). According to Lubrano (2016), Blau and Kahn (2016), Oaxaca uses this wage equation

$$\log (W_i) = X_i\beta_i + u_i, \quad (2.15)$$

i = male (m), or female (f). To derived at this decomposition model

$$\log (\overline{W_m}) - \log(\overline{W_f}) = (\overline{X_m} - \overline{X_f})\hat{\beta}_m + \overline{X_f}(\hat{\beta}_m - \hat{\beta}_f). \quad (2.16)$$

In this decomposition, the difference in percentage between the average male and female wages is explained first by the difference in average characteristics and second by the difference in yield of female average characteristics expressed by $\hat{\beta}_m - \hat{\beta}_f$. This dual or two

folds decomposition can be combined in a single formulation with the difference in means expressed as:

$$\log(\overline{W_m}) - \log(\overline{W_f}) = (\overline{X_m} - \overline{X_f})\beta^* + [\overline{X_m}\,(\hat{\beta}_m - \beta^*) + \overline{X_f}\,(\hat{\beta}_m - \beta^*)]. = \hat{Q} + \hat{U} \qquad (2.17)$$

According to Lubrano (2016), the first part is the explained part, while the term in squared brackets is the unexplained part. Recovering the previous decomposition for $\beta^* = \hat{\beta}_m$ while the Blinder decomposition is found for $\beta^* = \hat{\beta}_f$. Other decomposition found in the literature chooses β^* as the average between the two regressions coefficients. For instance, Ciaian *et al*. (2018) provide an overview of the application of the following generalized linear decomposition:

$$\overline{Y}_A - \overline{Y}_B = (\overline{X}_A - \overline{X}_B)\,\beta^* + \overline{X}_A\,(\beta_A - \beta^*) + \overline{X}_B\,(\beta^* - \beta_B) \qquad (2.18)$$

Where: $\overline{Y}_A - \overline{Y}_B$ is the mean wage differences between male and female headed household.

$\overline{X}_A$ and $\overline{X}_B$is a vector of male and female individual characteristics (regressors) ;

β_A and β_B is the vector of corresponding coefficient for male and female to be estimated.

$\beta^*$is the weighted average of the coefficient vectors, β_A and β_B.

The authors however proposed the following extension of the Blinder–Oaxaca decomposition:

$$\overline{Y}_A - \overline{Y}_B = (\overline{X}_A - \overline{X}_B)\,\beta_B + \overline{X}_B(\beta_A - \beta_B) + (\overline{X}_A - \overline{X}_B)\,(\beta_A - \beta_B) = E + C + CE \qquad (2.19)$$

Where E is equivalent to the first part i.e. the part of the raw differential that is due to differences in observable characteristics or endowments, C is equivalent to the second part which reflects the part attributable to differences in coefficients, while CE represents the part that can be explained by the interaction between C and E. Of course, a natural question is to know if those differences are significant statistically. Croucher *et al*. (2018) proposed that the computation of standard errors for this decomposition is based on knowing if the

regressors are stochastic or not. However, the standard error is computed as follow; if the regressors are fixed, then the result becomes

$$\text{Var}(\overline{X}\hat{\beta}) = \overline{X}\text{Var}(\hat{\beta})\overline{X} \quad (2.20)$$

if the regressors are stochastic, but however uncorrelated, Croucher *et al*. (2018) showed that this variance becomes

$$\text{Var}(\overline{X}\hat{\beta}) = \overline{X}'\text{Var}(\hat{\beta})\,\overline{X} + \hat{\beta}'\text{Var}(\overline{X})\hat{\beta} + \text{tr}(\text{Var}(\overline{X})\text{Var}(\hat{\beta})). \quad (2.21)$$

The decomposition method of Blinder and Oaxaca which was generalized by Gradín, (2012), Ciaian *et al*. (2018), Rahimi and Hashemi-Nazari (2021) allows the decomposition of outcome variables between two groups into a part that is explained by differences in observed characteristics and a part attributable to differences in the estimated coefficients. The estimation of nonlinear models is often required because ordinary least squares (OLS) yields inconsistent parameter estimates and, in turn lead to misleading decomposition results. As a result of these challenges, Blinder–Oaxaca decompositions for binary dependent variables have been developed and applied in a number of studies (Bielby *et al*., 2014; Fairlie, 2017; Noroozi *et al*., 2018; Tharp *et al*., 2019; Cowling *et al*., 2020).

The Oaxaca –Blinder (OB) Decomposition Technique for poverty is expressed as:

$$E(P_m) - E(P_f) = [E(X_m) - E(X_f)]\beta_f + E(X_f)(\beta_m - \beta_f) + [E(X_m) - E(X_f)](\beta_m - \beta_f) = E+C+CE \quad (2.22)$$

Where: $E(P_m) - E(P_f)$= mean differences in poverty between male and female headed household; $E(X_m) - E(X_f)$= expected variable factors of male and female that contribute to differences in poverty; β_m and β_f = parameters of male and female to be estimated. The above equation can be written as:

$$E(P_m) - E(P_f) = E + C + CE \quad (2.23)$$

Where E is the part of the raw differential that is due to differences in endowments, C reflects the part attributable to differences in coefficients, and CE represents the part that is a is due to the interaction between C and E. This is called threefold decomposition.

Detailed decomposition**:** Not only is the total decomposition of the outcome differentials into an explained and unexplained part of interest, but so are the detailed contributions of single predictors or sets of predictors. For example, one might want to assess how much of the gender income gap is due to educational differences and how much is due to work experience differences. Similarly, it may be interesting and informative to determine how much of the unexplained gap is due to discrepancies in returns to education and how much is due to discrepancies in returns to work experience. Identifying the contributions of the individual predictors to the explained part of the differential will be done simply by summing up the individual contributions that make up the total component. For example, in decomposition of equation 2.16,

$$\hat{Q} = (\overline{X}_m - \overline{X}_f)\hat{\beta}_m = (\overline{X}_{1m} - \overline{X}_{1f})\hat{\beta}_{1m} + (\overline{X}_{2m} - \overline{X}_{2f})\hat{\beta}_{2m} + \ldots + (\overline{X}_{nm} - \overline{X}_{nf})\hat{\beta}_{nm} \quad (2.24)$$

Where $\overline{X}_1$, $\overline{X}_2$, . . .,$\overline{X}_n$ are the means of the single repressor and $\hat{\beta}_1$, $\hat{\beta}_2$, . . . $\hat{\beta}_n$ are the associated coefficients. The first summand represents the contribution of group differences in $\overline{X}_1$, the second of group differences in $\overline{X}_2$, and so on. It is also straightforward to estimate standard errors for individual contributions. Similarly, using decomposition of equation (2.16) as an example, the individual contributions to the unexplained part are the summands in

$$\hat{U} = \overline{X}_f (\hat{\beta}_m - \hat{\beta}_f) = \overline{X}_{1f} (\hat{\beta}_{1m} - \hat{\beta}_{1f}) + \overline{X}_{2f} (\hat{\beta}_{2m} - \hat{\beta}_{2f}) + \ldots + \overline{X}_{nf} (\hat{\beta}_{nm} - \hat{\beta}_{nf}) \quad (2.25)$$

Where $\hat{U}$ = unexplained part and

$\overline{X}_1$- $\overline{X}_n$ = mean of observable characteristics explanatory variables.

This method has been applied to fields other than labour economics, such as sociology for the analysis of social issues like education, health, and agriculture. Kumar and Kumari (2014) using data from multi-waves of the National Family Health Survey conducted in India between 1992 and 2006, applied the technique to examines the pattern of rural–urban differentials in childhood malnutrition in India over time. Adeyanju *et al*. (2017) used it to examines socioeconomic inequalities in maternal and child health care in Nigeria over an 18-year period using Nigerian demographic and heath survey (NDHS) data conducted in 1990 and 2008. Kia *et al*. (2017) used the technique to assess the socioeconomic inequality in malnutrition in under-5 children in Iran in order to help policymakers reduce such inequality. A similar decomposition method has also been applied to study rural-urban differences in children's dietary diversity in Ethiopia (Hirvonen 2016). Kilic *et al*. (2013) pioneered the use of O-B decomposition to measure gender disparities in agricultural productivity. Several studies have since followed suit, and utilising this technique to measure agricultural productivity in sub-Saharan Africa, including Ethiopia. (Aguilar *et al*., 2015); Nigeria (Oseni *et al*., 2015); Uganda (Ali *et al*., 2015); Niger (Backiny-Yetna and McGee, 2015); Ghana (Pionce, 2016). An important alternative decomposition approach applied in the literature is based on an approach which applies a nondiscriminatory coefficient vector to determine the contribution of the differences in the observed predictors to the outcome (diet diversity) differential (Croucher *et al*., 2018).

According to Wolff (2012), one reason for the success story of this decomposition technique is due to its widespread applications potential. As emphasized in Croucher *et al*. (2018), this technique can be used to examine group differences in any outcome variable. When the dependent variable is continuous, the decomposition is very simple to implement

because it only requires linear regression estimates for the outcome of interest and sample means for the covariates used in the regressions. However, Wolff (2012), Fairlie (2017) opined that the problem becomes slightly more complicated when the outcome variable is non-linear because OLS estimates cannot be used directly in the O-B decomposition equation. A few studies have recently attempted to generalize the O-B decomposition to non-linear models. They all provide a method for decomposing binary dependent variables that are explained by either logit or probit models. As a result, Fairlie (2017) and Ciaian *et al*. (2018) rewrite the usual decomposition equation in terms of conditional expectation to obtain a generalized version of O-B decomposition that can be applied to models with discrete or limited dependent variables.

2.3.5 Measurement and decomposition of food security

Food security is typically measured indirectly, using food balance sheets, national income distribution, and consumer expenditure data. Despite the fact that food security measurement has grown significantly in recent decades, there is still widespread dissatisfaction with existing measurement systems, particularly in the midst of the global food and financial crisis. Headey and Ecker (2012) outline criteria for which an ideal food security measurement system should satisfy and then go on to discuss four types of food security indicators that meet the criteria. The food indicators are calorie deprivation, monetary poverty, dietary diversity, and subjective/experiential indicators while validity and consistency of the indicator with respect to cross-sectional and inter-temporal dimensions, as well as the nutritional relevance of the indicator were the criteria used for the explanation. Most of the food security and insecurity empirical measurement is based on the above indicators. For instance, Zakari *et al*. (2014), Ogundari (2017) used

expenditure approach to measure food security in Nigeria, while Ahungwa *et al*. (2013), Mustapha *et al.* (2018) used calorie requirement approach to measure food security. Ike, (2015) identified how the three most widely used indicators of food security, the Household Food Insecurity Access Scale (HFIAS), Dietary Diversity Score (DDS) and the Coping Strategies Index (CSI), can complement one another in capturing the multiple dimensions of food security.

The food security measure using expenditure approach is expressed as;

$$F_i = \frac{per\ capita\ food\ expenditure\ for\ the\ ith\ household}{\frac{2}{3} mean\ per\ capita\ food\ expenditure\ of\ all\ households} \quad (2.26)$$

Where F_i = food security index.

$F_i \geq 1$= food secured household.

$F_i \leq 1$= food insecured household.

A food secure household is one whose per capita monthly food expenditure exceeds or equals two-thirds (2/3) of the average per capita food expenditure. On the other hand, insecured household is one whose per capita food expenditure falls below two-thirds of the mean monthly per capita food expenditure

2.3.6 Probit approach of Oaxaca-Blinder (O-B) decomposition

This approach can be used to examine the effect of household characteristics on the risk of food insecurity or security. As opined by Jayamohan and Kitesa (2014), an indicator that can be used as a reasonably close approximation to the individual's welfare should be chosen to address the association between gender and food security. There are several reasons why using an indicator based on expenditures is preferable in the context of measuring welfare in developing countries. According to the permanent income hypothesis, consumption is a better predictor of lifetime welfare than current income

(Carver and Grimes, 2019). In a probit model, the dependent variable has a value of one or zero depending on whether a household is food secured or food insecured (Jayamohan and Kitesa, 2014; Carver and Grimes, 2019). In this case, the dependent variable is defined as the binary outcome of an unobserved underlying latent variable, welfare. In the probit model, the dependent variable is expressed as a function of a set of explanatory variables in the following way:

$$F_h^g = x_h^g \beta^g + \varepsilon_h^g \quad (2.27)$$

Where g = (gender) male, female; h = 1, 2, …, H.

y_h^g isthe binary variable indicating whether or not household h is food secured:

F_h^g = { 1 if $y*_h^g$ > z or 0 if $y*_h^g \leq$ z; h = 1, 2, …, H.}

This equation can then be estimated across all observations of each group, establishing the concept that the likelihood of being poor is conditional on the characteristics of the household. As shown in equation 2.28, the probability can be linked to the dependent variable:

$$\text{P}\ (F_h^g = 1) = \text{P}\ (F_h^g < \text{z}) = \Phi\ (x_h^g \beta^g) \quad (2.28)$$

Bibi and Chatti (2009) decompose the difference in predicted poverty rates between female headed households (FHHs) and male headed households (MHHs) into differences in the conditional poverty function, which is the return of characteristics, and differences in the distribution of characteristics:

$$\text{P}(\text{F}^{\text{female}} < \text{z}) - \text{Pr}(\text{F}^{\text{male}}) = \Phi(\bar{\bar{x}}^{\text{female}}\hat{\beta}^{\text{female}}) - \Phi(\bar{\bar{x}}^{\text{male}}\hat{\beta}^{\text{male}})$$

$$= (\underbrace{\Phi(\bar{\bar{x}}^{\text{female}}\hat{\beta}^{\text{female}}) - \Phi(\bar{\bar{x}}^{\text{female}}\hat{\beta}^{\text{male}})}_{D_1(z)} + (\underbrace{\Phi(\bar{\bar{x}}^{\text{female}}\hat{\beta}^{\text{female}}) - \Phi(\bar{\bar{x}}^{\text{male}}\hat{\beta}^{\text{male}})}_{E_1(z)}$$

$$= (\underbrace{\Phi(\bar{\bar{x}}^{\text{male}}\hat{\beta}^{\text{female}}) - \Phi(\bar{\bar{x}}^{\text{male}}\hat{\beta}^{\text{male}})}_{D_2(z)} + (\underbrace{\Phi(\bar{\bar{x}}^{\text{female}}\hat{\beta}^{\text{female}}) - \Phi(\bar{\bar{x}}^{\text{male}}\hat{\beta}^{\text{female}})}_{E_2(z)}$$

$$= \underbrace{\frac{1}{2}(D_1(z) + D_2(z))}_{\text{Pure discrimination effect}} + \underbrace{\frac{1}{2}(E_1(z) + E_2(z))}_{\text{Endowment effect}}$$

$$= D(z) + E(z) \quad (2.29)$$

When the discrimination effect is positive and statistically significant, more effort should be made to promote gender equality, even if FHHs are less food secured than MHHs. (Jayamohan and Kitesa, 2014).

The other probit model includes the gender of the household head as an independent variable in order to identify the effects of household head characteristics on the probability of a food insecure household:

$$F_i^* = \alpha + x_i \beta_i + u_i*, \quad (2.30)$$

where y_i^* refers to the underlying latent variable and is assumed to be unobserved; y_i is defined as the binary observed realization of the underlying latent variable F_i^* ,expressing the food security outcome of a household, 0 =food secured and 1 = food insecured; i = 1,…, n; x_i is a column vector of realizations on k explanatory variables for the i^{th} household; βi is a corresponding column vector of k unknown parameters for the i^{th} household to be estimated; u_i is an error term for the i^{th} household, and $u_i \sim N(0,\sigma^2)$, α is an intercept term. The probit model can be stated as follows:

$$P[F_i^* > 0] = P[F_i = 1] = \Phi(x_i\beta) \quad (2.31)$$

where F_i is the binary realization of the latent dependent variable and $\Phi(\cdot)$ denotes the cumulative distribution function for the standard normal.

2.4 Review of Empirical Studies

2.4.1 Gender dimension of income inequality

In sub-Saharan Africa, women make up about half of the working population. Despite their participation in a wide range of agricultural activities, women have limited access to

resources and decision-making power as opposed to their male counterparts (Odozi, 2012; Awotide *et al*., 2015). These limitations and restrictions probably would have a substantial negative impact on women's performance levels compared to men. Similarly, these limitations and restrictions also translate to vulnerability to income inequality, poverty and food insecurity among women.

Rajaratnam *et al*. (2016) employs a social relations perspective to investigate the role that institutions play in producing and reinforcing gender inequalities within the natural fishery value chain in Barotse Floodplain, Zambia. The findings revealed that there are contextual, structural and systemic gender-specific barriers, which limit women's abilities to properly engage in productive, economic and technical activities within the natural fishery value chain. The authors also elaborate how deep rooted certain norms, practices and power relations are and how their influence shaped women's (and men's) involvement in key nodes of the fishery value chain.

Valientes (2015) evaluated the wage structure and wage differences between men and women working in agricultural sector in the Philippines. According to the findings, average male wage workers in the agriculture sector earned remunerations that were 13% to 18% higher than average female wage workers. Using the three-fold Blinder-Oaxaca wage decomposition process, the author found that the endowment effect or human capital effect accounted for around 12% of the estimated gender wage gap, 74% for the coefficients effect, and 14% for the interaction effect.

Busayo and Olufunmilayo (2013) analysed the factors accountable for gender income inequality in seven selected sub-Saharan African countries. The result analysis showed that gender income inequality was significantly influenced by tertiary education (t=7.85,

$p<0.05$), population growth ($t=-3.98$, $p<0.05$), and government expenditure ($t=6.29$, $p<0.05$) in the selected sub-Saharan African countries. There has been slow reduction in gender gap in education and occupation while gender income inequality is stalled.

In northern Ghana, Pionce (2016) evaluated the gender differences in agricultural performance. The findings revealed that there is a gender gap in smallholder farmer financial performance. According to the difference, male farmers perform 46% better than female farmers. The endowment effect accounted for 35% of the gender performance differential after it was broken down into two parts, while the structural effect accounted for 65%. Since the structural impact is greater than the endowment effect, gender disparities between male and female smallholder farmers will continue despite program efforts to provide equal access to resources and production environments.

Tharp *et al*. (2019) examines whether male and female financial planners receive equal pay for equal work. Using detailed data on the backgrounds and practices of 710 financial planners, an unadjusted pay gap of 19% was observed between male and female financial planners. Blinder-Oaxaca decomposition analysis suggests that 91% of this pay gap can be explained by a model accounting for differences in important individual characteristics including job role, experience, team structure, hours worked, revenue produced, professional designation status, marital status, and psychological factors such as degree of motivation by income potential, performance pay, work-life balance, and stable pay; resulting in an unexplained gender pay gap of 1.8%, which is much smaller than the commonly cited pay gap among male and female financial planners. This unexplained pay gap may suggest unequal pay for equal work but could alternatively result from other unobservable differences.

However, Awotide *et al.* (2015) in his study of Gender Analysis of Income Inequality and Poverty among Rural Households in Nigeria: Evidence from Akinyele Local Government Area, Oyo State using Lorenz curve and Gini Coefficient reported differently that income was more equally distributed among the female headed households than the male counterparts. Nevertheless, the male headed households had better access to land for farming, higher income and spent more on food than the female headed households. In the study of gender dimensions to livelihoods in Nigeria, NBS/World Bank (2014) reported that men are more likely to farm than women, who are more likely to work in a household enterprise. In the north, male off-farm income participation is 14%, while female off-farm income participation is 8%, while in the south, it is 25% and 13%, respectively.

In the South South Region of Nigeria, Akpan *et al*. (2016) analysed Level of Income Inequality among Youth Farmers in Akwa Ibom State. They reported Income inequality index of 0.4009 for male youths and 0.3797 for female youths. Fapohunda (2013) reported gender pay disparity to be in favour of male Doctors, Journalists and Teachers. His findings from a multiple regression study of pay on gender and inequality established that discrimination plays a major role in the pay gap between men and women. According to the data, discrimination accounts for about 49% of the variance in respondents' pay differentials, while stereotypes account for about 51%. The findings also showed that discrimination against women accounts for 51% of the variation in wage differentials.

2.4.2 Gender dimension of poverty

Poverty is a global phenomenon that affects the socioeconomic and political well-being of its victims regardless of whether they live in a developed or developing country; however, available statistics indicate that poverty in poor countries is total and is more prevalent in

rural areas. From a gender perspective, Sallawu *et al*. (2016) investigated Poverty status of farm households in selected local government areas of Niger State, Nigeria. The distribution of respondents by poverty status revealed that there were more poor female-headed households than poor male-headed households in the study area, with over half of those surveyed living on less than one dollar a day.

Ajewole *et al*. (2016) used Foster Greer and Thorbecke poverty measures and Logitic regression decomposition to investigate gender analysis of poverty among rice farming households in Nigeria's rice hub. According to the report, 54.29% of women lacked formal education, compared to 25.89% of men. Male-headed households were 47.32 % poorer than female-headed households with 37.14%. Rice cultivated area, age, household size, credit usage, upland area, and education level were all determinants of poverty.

Igbalajobi *et al*. (2013) empirically analysed the poverty determinants among rural farmers in Ondo State, Nigeria using Foster-Greer-Thorbecke (FGT) poverty measure, and probit regression analysis. The findings showed that 81.8%, 81.1% and 34.1% of the respondents were male, married and with no formal education, respectively. The result of logit regression model pointed out that age, gender, marital status, household size, access to credit, farm income and educational standard of the respondents were the key determinants of poverty among rural farm households. It was also discovered that decreasing the number of meals consumed per day, engaging in non-farming activities, praying and fasting, and finding help from friends/relatives were all major strategies in the area used in coping poverty syndrome.

Adetayo (2014) conducted another study in the region to examine the poverty levels of farm households in Ogun State. Poverty incidence was found to be higher among male

headed (60%) and farming (63.9%) households as well as those with more than five members (66.1%). The Logit regression further indicates that large households, non-educated farm households head, households without access to credit and other non-farm income were variables with more likelihood of being poor.

However, Mukasa and Salami (2015) based on cross-country comparisons, investigated gender inequality in agricultural productivity differentials among smallholder farmers in Africa, and found that female-managed plots have strong endowment disadvantages in farm size, use and intensity of non-labour inputs. The result of the findings showed that female-managed agricultural lands on the average were 18.6%, 27.4%, and 30.6% less productive than that of their male counterparts in Nigeria, Tanzania, and Uganda respectively. The decomposition of the sources of gender productivity differences reveals that endowment and structural disadvantages of female managers in terms of land size, land quality, labour inputs, and household characteristics were the main drivers of gender gaps.

Using the FGT model and a logit regression model, Edoumiekumo *et al*. (2014) analysed income poverty in Nigeria's South-South geopolitical zone. Results of poverty incidence, gap, and severity were found to be 0.4924, 0.203, and 0.113, respectively. According to the report, males in the zone contributed more to poverty (91.56 %) than females (8.44 %). The study recommends that gender parity should be the goal of poverty reduction programmes.

There is a widely believed notion that income inequality and poverty differs among the female and male headed households in Africa. In order to substantiate this, Awotide *et al*. (2015) understudied gender analysis of poverty among rural households in Nigeria and taking Akinyele Local Government Area of Oyo State as a case study. The findings

revealed that poverty incidence, depth and severity were higher among the male headed households than the females. Number of dependents and households size were found to substantially increase the likelihood of respondents falling below the poverty line. Access to credit and contact with extension agents had positive impact on poverty reduction effort.

Conversely, in the study of Oluwatayo (2014) on gender dimensions of poverty and the coping options among smallholder farmers in Eastern Nigeria; the result showed that female respondents (43.7%) were poor more than their male counterparts (33.3%). Similarly, More women had their major occupation as farming (56%) than the men (42%), with more men (13.8%) having tertiary education than the women (10.2%). The results of the probit analysis showed that age, gender, education level, major occupation, household size, extension services and remittances amount received had momentous effect on the poverty status of the farmers.

Oluwatayo (2014) also reported that, majority of the respondents used one of the eleven coping strategies available in the study area, which was; depending on less costly clothes (11.2%), spending of savings (10.5%), reduction in dietary diversity (10.2%), reduction in the number of meals eaten every day (10.2%) and reduction in the quantity of food consumed (10.1%) were all close behind. As a result, the author recommends that improvements in human capacity building through education be prioritized, and that policies assisting smallholder farmers in the study area be gender-mainstreamed. Nmadu *et al*. (2015), on their determination of poverty reduction among small hold farmers in Kogi and Niger State reported approximately equal male and female non-poor farmers under dollar per day poverty line domain. They also revealed that farmers that went through adult education training were among the richest.

2.4.3 Gender dimension of food insecurity

In view of the recent food crises, Eme *et al*. (2014) under studied causes and consequences of food insecurity in Nigeria: a thematic exposition and highlighted income inequality as the major causes of food insecurity in Nigeria. However, this income inequality varies between genders and groups. Otaha (2013) opined that gender food insecurity exist due to gender inequality experienced in food and economic sector in Nigeria. Other gender factors of food insecurity in the country are unemployment, welfare crisis, policy inconsistencies, corruption, natural disaster, insufficient budget for food, poverty and hunger. Agarwal (2012) examines the relationship between gender inequality and food security, with a particular focus on women as food producers, consumers, and family food managers *vis-à-vis* the constraints women faced as farmers in terms of their access to land, credit, production inputs, technology, and markets. The findings revealed that women are at the disadvantage in all these. Hence, in bridging these productivity differentials between male and female farmers, he noted that helping women overcome production constraints would significantly increase agricultural output. Institutionally, the author recommended that a group approach to farming would, for instance, help women and other small holders enhance their access to land and inputs, benefit from economies of scale, and increase their bargaining power.

Fawehinmi and Adeniyi (2014) used stratified multi stage random sampling technique to examine the role of gender on household food security status in Oyo State. Information on socio-economic characteristics of the households were elicited, such as membership in cooperative societies, household consumption habits, and possession of durable goods. The

findings revealed that food security challenges occurs in both male and female-headed households, but it is more pronounced in the latter.

However, the existence and extent of gender food security remains uncertain. Tibesigwa and Visser (2016) extended existing knowledge by assessing gender inequality in food security among small-holder farm households in urban and rural areas of South Africa. They used the gender of the head of household in a treatment effects framework. The result of findings disclosed that male-headed farm households were more food secured than female-headed households, with the latter depending more on agriculture. The authors further observed that chronic food insecurity is greater and the gender gap in food security is wider amongst rural than urban households. Other studies on gender issues include: Headey and Ecker (2012); Edet and Etim (2014); Grimaccia and Naccarato (2020).

2.4.4 Crayfish fishery and species in Nigeria

Crayfish is a seafood that Niger Delta region has comparative advantage over non-riverine regions in the country. It is known by many names such as Crawfish, Shrimp, prawn, rock lobster, crawdad, mudbug, yabby and stone crab. Crayfish are freshwater crustacean's creatures. According to Etim *et al*. (2020a, b), Crayfish is a smoked dried commodity made up of shrimp, post larvae stages of pink shrimp, and other crustaceans that are harvested from estuaries and sediment-rich coastal waters. They breathe through feather-like gills and are found in water bodies that do not freeze to the bottom (Ojiako *et al*., 2012; Zabbey *et al*., 2019; Etim *et al*., 2020a), as well as rivers, estuary, creeks, streams and brooks where there is freshwater flowing and which have shelter against predators. Most species of crayfish cannot live in polluted water although some species are resilient (Ojiako *et al*., 2012). Crayfish are very sensitive to contaminated waters and have in the

past been used to test the purity of lakes before the invention of other methods to determine water purity (Trapper, 2016). Almeida (2013) and Flegel (2019) reported that crawfish have a physical robust broad geographic potential, simple life-cycle, and less complicated production technology that requires simple food and they are relatively cheap to produce.

The species exploited as crayfish in Niger Delta Region include *Palaeman hastatus*; *Hippolysmata hastatoirles,* and *Macrobrachium sp,* mixed with the larval, and juveniles of pink shrimp *Panaeus dourarum* (Almeida, 2013; Okayi *et al*., 2013; Ele and Nkang, 2014). Others are the estuarine prawn *Nematopaleamon hastus,Penaues notalis* (Okayi *et al*., 2013). In the tropical lagoon of Southwestern Nigeria, brackish fern (*Acrostichum aurem*) was observed to be used as a trap for the harvest of shrimp (*macrobrachium* spp). The species harvested were *Macrobrachium vollenhovenii*, *Macrobrachium macrobrachion*, *Penaeus notalis* and *Batanga lebritonis* (FAO, 2013c; Okayi *et al*., 2013).

In freshwater rivers and creeks, macrobrachium fishery predominates. *M. felicinum* (Niger river prawn), *M. vollenhovenii* (African river prawn) and *M. macrobrachion* (Brackish River prawn) dominates the catches of this sector. Okayi *et al*. (2013), affirmed that in Nigeria, what is normally referred to as crayfish are mainly the small shrimps composed of three families: Palaernonialee, Rippolytidae, and Sergestida, the species exploited include, *Palaernon hastatus, Hippolysmata hastatoides*, and Macrobrachium *spp*., all mixed with the larval: and juveniles of pink shrimp *Penaeus duorarurn* which usually move into the coastal and estuarine areas to mature. The size composition of crayfish varies from 2.5cm to 7cm, but the most common and easily exploitable ones average in sizes from 3cm to

4.5cm. The bigger sizes are caught at estuaries open to the sea, while the smaller sizes are prevalent in the littoral zones.

According to Flegel (2019), Zabbey *et al*. (2019), there are some other species that are important in the small-scale shrimp industry because they are harvested for sale, these include; *Desmocaris trispinosa* (Guinea swamp shrimp), *Palaemon maculates* (Zaire prawn) and *Palaemonetes africanus* (Creek shrimp). Crayfish are caught all year round along the Niger Delta, but particularly along the river estuaries and littoral waters of the Akwa Ibom, Cross River, Bayelsa and Rivers State with the highest production occurring in March to May. Crayfish are usually smoked, and sometimes sun-dried, and they form an essential food item in the diet of the people of the entire Southern States in particular and Nigeria in general.

2.4.5 Nutritional importance of crayfish to households and Nigerian economy

Crayfish as a source of animal protein have the potential to reduce protein deficiency in the diet because it is known to contain all food nutrients except carbohydrates (Venugopal and Gopakumar, 2017). It is high in lysine, sulphur and amino acids; therefore, it is suitable for complementing diet with high carbohydrate level. It is also rich in thiamine, riboflavin, vitamin D and A, phosphorus, calcium as well as iron (Ele and Nkang, 2014). It contains a lot of poly-saturated fatty acids, which help to lower cholesterol levels in the blood (Venugopal and Gopakumar, 2017). According to Trapper (2016), crayfish have a super healthy combination of nutrients, ranging from almost pure protein to a healthy amount of Omega-3 fatty acids which is one of the most beneficial fats needed by the body. The author also stated that crayfish protein contains a lot of tyrosine, an amino acid that

mentally energizes the brain. In addition, crayfish also contain a significant amount of vitamin D and A, as well as calcium, potassium, copper, zinc, and iodine.

Crayfish-based meals play an important role in human development around the world, especially in the lives of people in developing countries where other protein sources are grossly insufficient and ridiculously expensive. More than fifty percent of the world's population depends on crayfish as principal source of animal protein (Kainga and Kingdom, 2012) and a considerable source of minerals and vitamins (Venugopal and Gopakumar, 2017). Experimentally, Protein obtained from crayfish and fish-based diets is as good as that obtained from meat (Ele and Nkang, 2014). However, combining fish with plant-based items that are deficient in those amino acids, such as lysine and thiamine, not only allows for full utilization of plant protein, but also improves the content of the diet. Another favourable aspect of crayfish nutrition is that there are hardly any chemical residues or artificial hormones added into the flesh because crayfish are very sensitive to contaminated waters and normally come from lakes that are free of chemical or other pollutants (Trapper, 2016; Venugopal and Gopakumar, 2017; Zabbey *et al*., 2019).

Crayfish is highly medicinal because it reduces heart attacks, goiter, and other ailments, particularly when ingested in large amounts (Ele and Nkang, 2014; Venugopal and Gopakumar, 2017). This delicious creature lives in marine environment and reproduce naturally for food, income, ecological, and medicinal purposes. Crayfish fishing in the Niger Delta Region has created business and economic opportunities for fishermen in coastal areas where crayfish can be found, as well as for crayfish dealers and consumers. Many people in the country, including fishermen from the Niger Delta Region, now harvest and market crayfish as a popular source of income due to its high level

of profitability and as a common means of livelihood. It contributes significantly to the country's GDP. For instance, Etim *et al*. (2015) and Etim *et al*. (2020a), reported that in artisanal inshore fishery, crayfish landings in Cross River State contributed 11% to national marine fish landings from 1980 to 1984, and the quantity of crayfish alone accounted for 26% of the state's marine fish landings, estimated at ₦119 million.

Similarly, Artisanal shrimp catches of Akwa Ibom and Cross River States (which border the Cross River estuary) were estimated to be 20,000 metric tons (MT) net weight in late1970s to 1980s (Ogunsola, 2014; Zabbey *et al*., 2019). In the globe, shrimps constitute a significant portion of world-wide fisheries catch, which ranges from 2.1 to 2.5 million MT annually in 1993-1997 (FAO 1999). Moreso, in 2000, shrimps worth US$ 46, 495 (N5.58 billion) were exported from Nigeria and 43.35% of revenue generated from fish production in 2001 by the federal government, came from shrimp and shrimp licenses (Ogunsola, 2014; Zabbey *et al*., 2019). Generally, Seafood subsector contributes substantially to the Nigeria's gross domestic product- GDP (Ogunsola, 2014).

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Study Area

The study was conducted in Cross River, Akwa Ibom and Bayelsa States of Niger Delta Area, Nigeria. Niger Delta is the delta of the Niger River sitting directly on the Gulf of Guinea on the Atlantic Ocean in Nigeria. It is the largest wetland in Africa and the third largest in the world (Omuta, 2014). It consists of a low-lying terrain, dissected by a complex network of creeks, streams, rivers and seas with its tributaries emptying into Atlantic Ocean. It is a well-endowed ecosystem, consisting of one of the richest and highest concentrations of biodiversity on earth. It consists of nine coastal States (Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers) with a total of 185 local government areas (LGAs). It is situated between Latitudes 3°00'N and 9°00'N and Longitudes 4^{o}30'E and 7^{o}20'E with land area of 75,000km^2 (Omuta, 2014; Okinono *et al*., 2015; Etim *et al*., 2020b). The population of the Region stood at 31,244,587 distributed among the constituent States and projected to be 42,637,086 by 2016 (NBS, 2018) with Average monthly maximum and minimum temperatures vary from 28°C to 38°C and from 21°C to 23°C, respectively (Enaruvbe and Atafo, 2016; Etim *et al*., 2020b) and mean annual rainfall varies from 2000mm to 4500mm (Adejuwon, 2012; Etim *et al*., 2020b). The major economic activities of the area include: fishing, hunting, forestry, farming and animal husbandry (livestock/ microlivestock). Others are trading, crafting and artisanry work. The area also sustains the cultivation of wide variety of crops and economic trees such as cassava, maize, yam, cocoa yam, fluted pumpkin, water leaf, bitter leaf, okro and oil palm, rubber, coconut, among others.

The description of the study area by State is as shown in Table 3.1. The map of Nigeria showing Niger Delta area is as shown in Figure 3.1. Figure 3.2 is the map of Niger Delta showing the Constituent States while Figures 3.3, 3.4 and 3.5 are the maps of Cross River, Akwa Ibom and Bayelsa States respectively showing LGAs from which the sampling was carried out.

Table 3.1 Description of study area by State

Descriptive feature	Cross River	Akwa Ibom	Bayelsa
Geographical location	It lies between Latitudes 5°32' and 4°27' North and Longitudes 7°50' and 9°28' East.	It is located between Latitudes 4°32' and 5°33' North and Longitudes 7°25' and 8°25' East.	It is situated between Latitudes 4°15' and 5°23' North and Longitudes 5°22' and 6°45' East.
Landmass area	It has a landmass of 20.156 km^2 (2.6% of Nigeria).	It occupies a total land area of 7,246 km^2	It covers an area of 10,773 square kilometres.
Boundaries	It is bounded by Akwa Ibom on the East, Republic of Cameroun on the South, Ebonyi and Abia States on the West and Benue State on the North.	It is bounded by Abia on the North, Cross River on the East, Rivers and Abia State on the West and Atlantic Ocean on the South.	It is bounded with Rivers State on the West and Northwest, Delta State on the East and Southeast, Atlantic Ocean and Gulf of Guinea on the West and South.
Projected Population as at 2018	4,221852 (NBS, 2018).	5,482,177 (NBS, 2018).	2,277,961 (NBS, 2018).
Temperature	23^0C - 34^0C	22^0C - 35^0C	$22.^0$C – 32^0C
Rainfall	2,000mm – 3,800mm per annum.	2,000mm – 3300mm per annum.	It ranges from 2000 - 3500mm per annum.
Economic activities	Farming, fishing, hunting and forestry.	Farming, fishing, hunting and trading.	Fishing, hunting and farming.

3.2 Sampling Techniques and Sample Size

The study employed multi-stage and stratified random sampling techniques. Firstly, three States from the Niger Delta Area where crayfish harvesting business is widely practiced were purposively selected. The States are Akwa Ibom, Cross River and Bayelsa. Secondly,

three LGAs were randomly selected from each of the three States giving a total of nine (9) LGAs. Thirdly, four communities from each of the selected LGAs were randomly selected making a total of twelve (12) communities in each selected State. The fourth stage involved the use of proportional sampling to select 10% of the male and female respondents from the sample size of each community. Yamane formula (Chaokromthong and Sintao, 2021) was used to estimate the sample size from the sampling frame in each State to give a total sample size of 309 respondents for this study. The distribution of sampling frame and sample size of the respondents in the study area is as shown in Table 3.2. The Yamane formula is given as:

$$n = \frac{N}{1+N(e)^2} \quad (3.1)$$

Where: n= sample size, N= finite population, e = limit of tolerable error (0.08), 1= unity.

3.3 Methods of Data Collection

Data for this study were collected by the researcher and trained enumerators using structured questionnaire and interview schedules. Primary data used for this study were cross sectional data collected in 2018. Sampling frame were obtained from crayfish harvesting business associations in each selected States. Information was collected on age, occupation and gender of household head as well as other household characteristics such as marital status, education level of household head, household size, number of contacts with extension agents; accessibility to credit and amount accessed, harvesting input, membership of farmer associations among others. Data were also collected for monthly household expenditure on food and other items, household food production and consumption level. Furthermore, information on coping strategies used in the area to ameliorate poverty, food insecurity and income inequality were obtained.

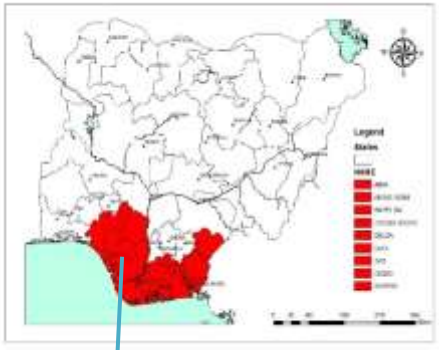


Fig. 3.1: Map of Nigeria showing Niger Delta Area

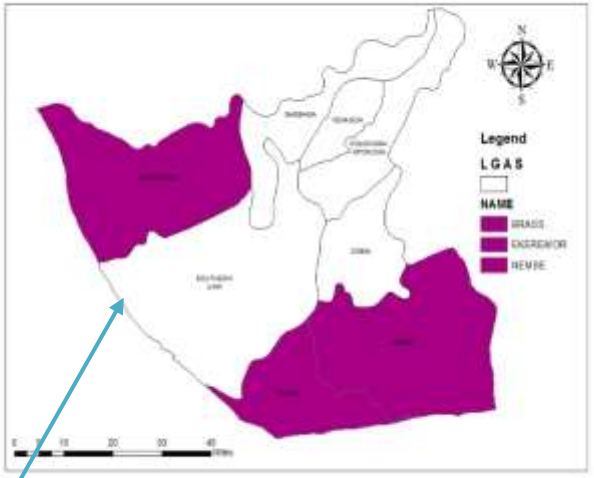
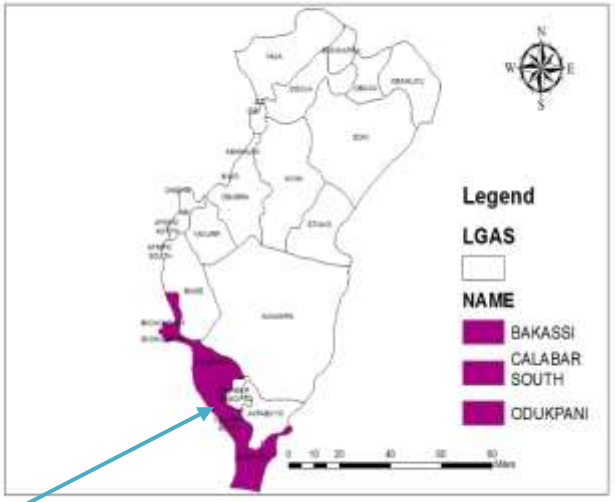


Fig. 3.5: Map of Bayelsa State showing study Area



Fig, 3. 3: Map of Cross River State showing study Area

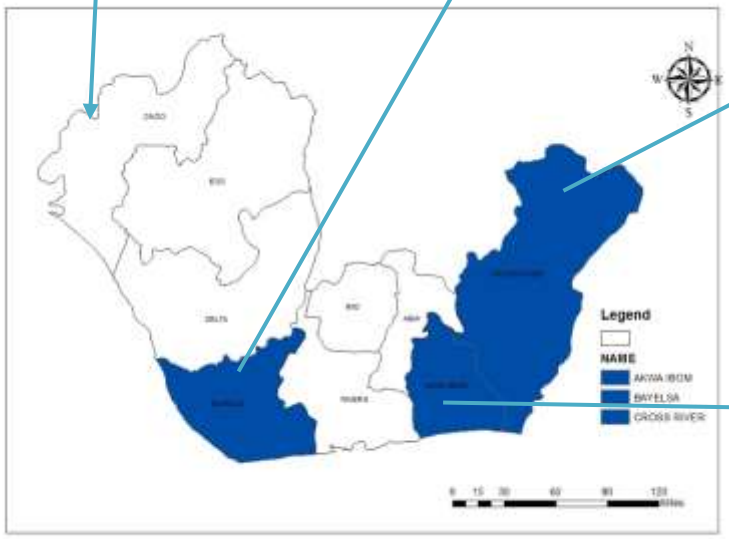


Figure 3.2: Map of Niger Delta showing study States

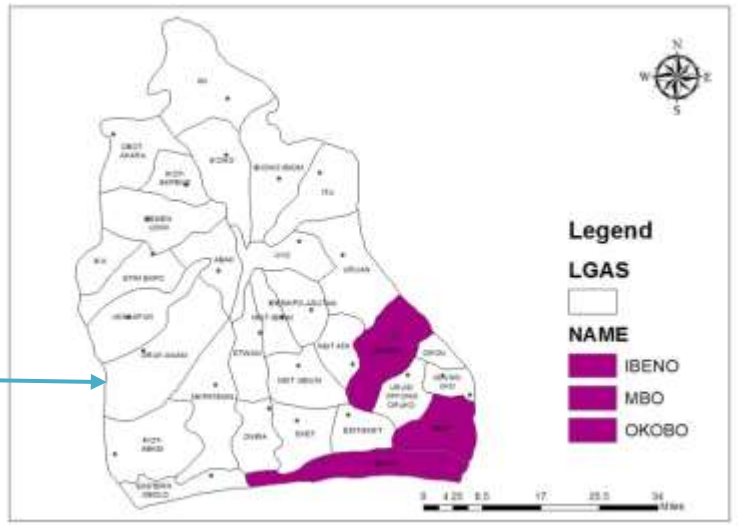


Fig. 3.4: Map of Akwa Ibom State showing study Area

Table 3.2: Distribution of sampling frame and sample size of the respondents in the study area

State	L. G. A.	Selected community	Sampling frame	Sample size	No. of male	No. of female
Cross River	Bakassi	Akpa Ikang	128	14	10	4
		Etak Edat	123	14	10	4
		Utang Mmong	113	13	10	3
		Ine Akpa Edok	93	10	8	2
	Calabar South	Esuk Atu	130	14	12	2
		Edibe – Edibe	118	13	10	3
		Esuk Anantigha	104	12	9	3
		James town	102	11	10	1
	Odukpani	Atan Onoyom	107	12	10	2
		Okoyong	85	9	7	2
		Ukwa Ibom	80	9	7	2
		Creek Town	69	8	7	1
Sub- total			**1252**	**139**	**110**	**29**
Akwa Ibom	Mbo	Efiat Inua Abasi	128	13	7	6
		Mbendoro	135	14	10	4
		Utan Brama	140	14	9	5
		Asiaha Obufa	153	15	8	7
	Ibeno	Mkpanak	127	13	9	4
		Opolam	90	9	7	2
		Iwuo – Okpom	122	12	8	4
		Atabrikang	90	9	6	3
	Okobo	Ine Atabong	100	10	8	2
		Ine Ama – Mmong	96	10	9	1
		Ine Atak Oro	102	10	9	1
		Ine Okopedi	110	11	10	1
Sub- total			**1393**	**140**	**100**	**40**
Bayelsa	Brass	Okpoma	71	12	9	3
		Akassa	70	12	8	4
		Odioma	59	10	7	3
		Eqivema	68	12	9	3
	Nembe	Basambiri	66	11	6	5
		Oluabiri	63	11	8	3
		Ogbolomabiri	54	9	6	3
		Okoroba	69	12	8	4
	Ekeremor	Letugbene	64	11	8	3
		Peretorugbene	60	10	7	3
		Agoro	59	10	7	3
		Agge	58	10	7	3
Sub- total			**761**	**130**	**90**	**40**
Grand total			**3406**	**409**	**300**	**109**

Source: Field Survey, 2018

3.4 Analytical Techniques

The data obtained were analysed using descriptive statistics, Gini coefficient, Lorenz curve, Foster Greer Thorbecke (FGT) model of poverty index, food security index, Theil index, Oaxaca- Blinder decomposition technique and Coping Strategies Use Index (CSUI).

3.4.1 Descriptive statistics

Descriptive statistics such as mean, frequencies distribution and percentages were used to describe the socioeconomic and demographic characteristics of the respondents as well as institutional factors (Objective i).

3.4.2 Income inequality of male and female headed households

The estimation and comparison of the degree of income inequality between male and female headed households of the respondents was achieved using Gini-coefficient and Lorenz curve.

Model specification:

The Gini-coefficient was computed following Rodrigue (2017):

$G_I = 1 - \sum_{k=0}^{n}(X_k - X_{k-1})(Y_k - Y_{k-1}) = 1 - \sum XY$ (3.2)

Where G_I = Gini coefficient,

X_k= the proportion of the population of crayfish harvesters,

for k= 0,...,n, with X_0= 0, Xn= 1.

Y_k = the cumulated proportion of the income of crayfish harvesters, for k = 0,..., n, with Y_0 = 0, Yn = 1.

The Gini coefficient was developed to measure the degree of concentration (inequality) of a variable in a distribution of its elements. It compares a ranked empirical distribution's Lorenz curve to the line of perfect equality (Rodrigue, 2017). This line assumes that each element contributes the same amount to the total sum of a variable's values. The Gini coefficient ranges from 0 when there is no concentration (perfect equality) to 1 when there

is total concentration (perfect inequality). This model was used by Igbalajobi *et al*. (2013), Akpan *et al*. (2016), Trapeznikova (2019) and Etim *et al*. (2020b).

3.4.3 Poverty status of male and female headed households

FGT model was used to analyse gender differences in poverty status of the respondents which is objective iii.

Model specification:

The FGT poverty index as proposed by Foster *et al*. (1984) is generally expressed as:

$$p_{\alpha} = \frac{1}{n} \sum_{i=1}^{q} \left(\frac{z-y_i}{z}\right)^{\alpha} \quad (3.3)$$

Where: n = total number of households in population,

q = the number of poor households,

z = the poverty line for the household,

y_i= per capita household income for i^{th} farmer,

α = poverty aversion parameter and takes on value 0, 1, 2,

$z-y_i$ = poverty gap of the i^{th} household and $\left(\frac{z-y_i}{z}\right)$ = poverty gap ratio.

Following FGT model, household poverty can be decomposed into the following sub-units

(a) When α = 0, then FGT index is expressed as:

$$p_o = \frac{1}{n} \sum_{i=1}^{q} \left(\frac{z-y_i}{z}\right)^{\alpha} = \frac{1}{n} \sum_{i=1}^{q} \left(\frac{z-y_i}{z}\right)^{o} = \frac{q}{n} \quad (3.4)$$

This is called incidence of poverty or headcount index.

(b) when α = 1, then FGT index is expressed as

$$p_1 = \frac{1}{n} \sum_{i=1}^{q} \left(\frac{z-y_i}{z}\right)^{\alpha} = \frac{1}{n} \sum_{i=1}^{q} \left(\frac{z-y_i}{z}\right)^{1} \quad (3.5)$$

This is called poverty depth or poverty gap index.

(c) when α = 2, then FGT index is expressed as

$$p_2 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^{\alpha} = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^{2} \quad (3.6)$$

This is called poverty severity index which measures the squares of the poverty gaps in relation to the poverty line. The index, which is the mean of the square proportion of the poverty gap, measures the severity of poverty. When multiplied by 100, it gives the percentage increase in per capita income required to lift a poor household out of poverty.

3.4.3.1 Measurement of poverty line

This is done to categorize crayfish harvesters into poor and non-poor groups. A threshold of two-thirds of the mean per capita income was used as a guideline. Households with mean per-capita incomes below the poverty line are considered poor, whereas those with mean per-capita incomes at or above the poverty line are considered non-poor.

Household per capita income (HPCI) = $\frac{\text{Household income}}{\text{Household size}}$ (3.7)

Total household per capita (THPCI) = Summation of HPCI (3.8)

Mean total household per capita income (MTHPCI) = $\frac{\text{THPCI}}{\text{n}}$ where n = sample size

Then poverty Line (PL) = $\left(\frac{2}{3}\right)$ (MTHPCI) (3.9)

This model has been used by many researchers in determining and analysing poverty, some of which include Onyemauwa *et al.* (2013), Adetayo (2014), Edoumiekumo *et al*. (2014) Umoh *et al*. (2015), and Akpan *et al*. (2016).

3.4.4 Food security of male and female headed households

The evaluation of the extent of gender differences in food security of the respondents was achieved using Food security index. The formula is expressed following Agwu and Oteh (2014) as;

$$F_i = \frac{\text{Per capita food expenditure for the ith household}}{\frac{2}{3}\text{mean per capita food expenditure of all households}} \quad (3.10)$$

Where F_i = food security index.

When $F_i \geq 1$= food secured household; and $F_i < 1$= food insecured household.

A food secure household is one whose per capita monthly food expenditure falls above or equals two-thirds of the mean per capita food expenditure. Insecure households, on the other hand, are those whose per capita food expenditure falls below two-thirds of the mean monthly per capita food expenditure. The formula has been used by Fawehinmi and Adeniyi, (2014), Ogundari (2017).

3.4.5 Computation and decomposition of gender differences in income inequality, poverty and food insecurity based on socio-economic and institutional factors of the crayfish harvesters

Computation and decomposition of the gender differences in income inequality, poverty and food security among the respondents based on socioeconomic, demographic and institutional factors (Objective v) was achieved using Theil-T index as adopted by Andrei *et al*. (2017), Oaxaca-Blinder decomposition technique (Logit approach) as adopted and modified by Ciaian *et al*. (2018) and Probit approach as used by Jayamohan and Kitesa (2014), respectively.

3.4.5.1 *Computation and decomposition of income inequality distribution by gender and income sources*

Theil index was used to measure and decompose the income inequality distribution of each group.

Model specification:

The Theil index for the measurement of income inequality distribution of each group is expressed as:

$$Ty_{ig} = \frac{1}{n_i}\sum_{j=1}^{n_i}\left[\frac{y_{ij}}{\mu}\right]\log\left[\frac{y_{ij}}{\bar{\mu}}\right] \quad (3.11)$$

Where:

Ty_{ig} = Theil index of gender income (g = male or female),

y_{ij}=incomes earned by crayfish harvesters in a group (male or female),

n_i= number of crayfish harvester in a group,

$Y_i = \sum_{j=1}^{n_i} y_{ij}$ = Total income of crayfish harvesters for each group, and

$\mu_i = \frac{y_i}{n_i}$ = mean income of a group.

The inequality of incomes explained by the Theil index was decomposed as follows:

$$T_{YIg}=\frac{1}{n}\sum_{i=1}^{2}\sum_{j=1}^{n_i}\frac{y_{ij}}{\mu}\log\frac{y_{ij}}{\mu} = \sum_{i=1}^{2}\frac{Y_i}{Y}T_i + \sum_{i=1}^{2}\frac{n_i}{n}\left[\frac{\mu_i}{\mu}\log\frac{\mu_i}{\mu}\right] = T_{WI} + T_{BI} \qquad (3.12)$$

T_{YIg} = total gender income inequality or Theil index of total gender income,

T_{WI}= within-group component,

T_{BI}= between-group component,

$Y_i = \sum_{j=1}^{n_i} y_{ij}$ = total income of crayfish harvesters for each group (male or female),

Y = total income of crayfish harvesters,

μ = total mean income of the population,

$\mu_i = \frac{y_i}{n_i}$ = mean income of a group,

n_i= number of crayfish harvester in a group, and

n = total number of crayfish harvesters.

Thus, overall inequality is a simple sum of the within groups inequality, denoted by T_{WI}, and between groups inequality, T_{BI} such that

$$T_{YI} = T_{WI} + T_{BI} \qquad (3.13)$$

Decomposition by income source is expressed as**:**

$$T_Y = \left(\frac{\mu_{x_{11}}}{\mu}Tx_{11} + \frac{\mu_{x_{12}}}{\mu}Tx_{12}\right) + \left(\frac{\mu_{x_{11}}}{\mu}\log\frac{\mu_{x_{11}}}{\mu} + \frac{\mu_{x_{12}}}{\mu}\log\frac{\mu_{x_{12}}}{\mu}\right) +$$

$$\left(-\left(\sum_{j=1}^{n}\left(\frac{x_{11}}{Y}log\frac{x_{11}}{Y} + \frac{x_{12}}{Y}log\frac{x_{12}}{Y}\right)\right)\right. \qquad (3.14)$$

Where:

Ty = Theil index of total income,

Y = total income of the crayfish harvesting,

$\mu_{x_{11}}$ = mean income of crayfish harvesting,

$\mu_{x_{12}}$ = mean income of other income sources,

x_{11} = total income of crayfish harvesting,

x_{12} = total income of other sources, and

μ = total mean income of the population.

The first term in this relationship is a weighted arithmetic mean of the Theil index calculated for the two income source variables. The second term measures income inequality due to distribution of income by the income sources. The third term represents the correlation between the two categories of income that influence the inequality of income distribution among the population (Andrei *et al*., 2017)

Therefore, the breakdown of the Theil index for the total income of individuals of the population based on the socio-economic and institutional factors that determine income are express as:

$$T_{YIg} = \left(\frac{\mu_{x_1}}{\mu}Tx_1 + \frac{\mu_{x_2}}{\mu}Tx_2 + \ldots + \frac{\mu_{x_{15}}}{\mu}Tx_{15}\right) + \left(\frac{\mu_{x_1}}{\mu}\log\frac{\mu_{x_1}}{\mu} + \ldots + \frac{\mu_{x_{15}}}{\mu}\log\frac{\mu_{x_{15}}}{\mu}\right) + \left(-\left(\sum_{i=1}^{n}\frac{y_{x_1}}{Y}\log\frac{y_{x_1}}{Y} + \ldots + \frac{y_{x_{15}}}{Y}\log\frac{y_{x_{15}}}{Y}\right)\right) \quad (3.15)$$

Where:

The first term in this relationship is a weighted arithmetic mean of the Theil indices calculated for the fifteen variables,

The second term measures income inequality due to distribution of income by the socioeconomic and demographic factors,

The third term represents the correlation between the fifteen observable characteristics that influence the inequality of income distribution among the population.

T_{YIg} = Total gender income inequality or Theil index of total gender income,

g = male or female,

n = Total number of crayfish harvesters,

T_{x1}– T_{x15}=Theil indices for the distribution of fifteen variables to be estimated,

μ_{x1}- μ_{x15}=The average income per harvester determined by X_1 – X_{15},

y_{x1} – y_{x15} =the income earned by a crayfish harvester by the influence of X_1 – X_{15},

Y = Total income of crayfish harvesters,

X_1 = Age of the crayfish harvester (in years),

X_2 = Gender (male =1; female = 0),

X_3 = Educational level of the crayfish harvester (in years),

X_4 = Marital status (married =1; otherwise = 0),

X_5 = Household size (number of people in the household),

X_6= Experience of the respondent (in years),

X_7 = Amount of credit accessed (in Naira),

X_8= Membership of co-operative (member = 1; otherwise = 0),

X_9 = Labour (in man days),

X_{10} = Extension visit (number of times/year),

X_{11}= Income of crayfish harvesting (in Naira),

X_{12} = income of other sources (in Naira),

X_{13} = Access to Outboard Engine (access = 1; otherwise = 0),

X_{14} = Access to net (access = 1; otherwise = 0), and

X_{15} = Access to safety kit (access =1; otherwise = 0).

All variables were subjected to correlation analysis before being used in the analysis. The formula is expressed as:

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{n\sum X^2 - (\sum X)^2}\sqrt{n\sum Y^2 - (\sum Y)^2}} \quad (3.16)$$

Where:

r = Pearson Product Moment correlation coefficient (it ranges between -1 to +1),

Y = Total income of crayfish harvesters,

X = Explanatory variable, and

n = Total number of crayfish harvesters.

The measurement of variables, definitions, and expected (*a priori*) sign for income inequality model is as shown in Table 3.3.

3.4.5.2 *Decomposition of poverty by gender*

The decomposition was done using poverty incidence estimated in equation (3.4). Oaxaca –Blinder (O-B) Decomposition Technique adopted and modified by Ciaian *et al*. (2018) was used for the decomposition.

Model specification:

The Oaxaca –Blinder (OB) Decomposition Technique for poverty is expressed as:

$$E(P_m) - E(P_f) = [E(X_m) - E(X_f)]\beta_f + E(X_f)(\beta_m - \beta_f) + [E(X_m) - E(X_f)](\beta_m - \beta_f) = E+C+CE \quad (3.17)$$

Where:

$E(P_m) - E(P_f)$= mean differences in poverty between male and female headed household,

$E(X_m) - E(X_f)$= expected variable factors of male and female that contribute to differences in poverty, and

β_m and β_f = parameters of male and female to be estimated.

The above equation can be written as:

$$E(P_m) - E(P_f) = E + C + CE \quad (3.18)$$

Where: E is the part that is due to differences in endowments,

C reflects the part attributable to differences in coefficients, and

CE represents the part that is due to the interaction between C and E.

This is otherwise called three-fold decomposition.

The two-fold decomposition is expressed as:

$$\log(\overline{P_m}) - \log(\overline{P_f}) = (\overline{X_m} - \overline{X_f})\beta^* + [\overline{X_m}\,(\hat{\beta}_m - \beta^*) + \overline{X_f}\,(\hat{\beta}_m - \beta^*)]. = \hat{Q} + \hat{U} \quad (3.19)$$

Where $\hat{Q}$ = explained component and $\hat{U}$ = unexplained component.

The explained part of the differential was decomposed simply by summing up the individual contributions that make up the total component. It is expressed as:

$$\hat{Q} = (\overline{X}_m - \overline{X}_f)\hat{\beta}_m = (\overline{X}_{1m} - \overline{X}_{1f})\hat{\beta}_{1m} + (\overline{X}_{2m} - \overline{X}_{2f})\hat{\beta}_{2m} + (\overline{X}_{3m} - \overline{X}_{3f})\hat{\beta}_{3m} + (\overline{X}_{4m} - \overline{X}_{4f})\hat{\beta}_{4m} + (\overline{X}_{5m} - \overline{X}_{5f})\hat{\beta}_{5m} + (\overline{X}_{6m} - \overline{X}_{6f})\hat{\beta}_{6m} + (\overline{X}_{7m} - \overline{X}_{7f})\hat{\beta}_{7m} + (\overline{X}_{8m} - \overline{X}_{8f})\hat{\beta}_{8m} + (\overline{X}_{9m} - \overline{X}_{9f})\hat{\beta}_{9m} + (\overline{X}_{10m} - \overline{X}_{10f})\hat{\beta}_{10m} + (\overline{X}_{11m} - \overline{X}_{11f})\hat{\beta}_{11m} + (\overline{X}_{12m} - \overline{X}_{12f})\hat{\beta}_{12m} + (\overline{X}_{13m} - \overline{X}_{13f})\hat{\beta}_{13m} + (\overline{X}_{14m} - \overline{X}_{14f})\hat{\beta}_{14m} + (\overline{X}_{15m} - \overline{X}_{15f})\hat{\beta}_{15m} \quad (3.20)$$

Where $\overline{X}_1, \overline{X}_2, \ldots, \overline{X}_{15}$ are the means of the single regressor or observable characteristics and $\hat{\beta}_1, \hat{\beta}_2, \ldots \hat{\beta}_{15}$ are the associated coefficients.

The first summand reflects the contribution of the group differences in $\overline{X}_1$, the second of differences in $\overline{X}_2$, and so on. Similarly, the individual contributions to the unexplained part are the summands in

$$\hat{U} = \overline{X}_f\,(\hat{\beta}_m - \hat{\beta}_f) = \overline{X}_{1f}\,(\hat{\beta}_{1m} - \hat{\beta}_{1f}) + \overline{X}_{2f}\,(\hat{\beta}_{2m} - \hat{\beta}_{2f}) + \overline{X}_{3f}\,(\hat{\beta}_{3m} - \hat{\beta}_{3f}) + \overline{X}_{4f}\,(\hat{\beta}_{4m} - \hat{\beta}_{4f}) + \overline{X}_{5f}\,(\hat{\beta}_{5m} - \hat{\beta}_{5f}) + \overline{X}_{6f}\,(\hat{\beta}_{6m} - \hat{\beta}_{6f}) + \overline{X}_{7f}\,(\hat{\beta}_{7m} - \hat{\beta}_{7f}) + \overline{X}_{8f}\,(\hat{\beta}_{8m} - \hat{\beta}_{8f}) + \overline{X}_{9f}\,(\hat{\beta}_{9m} - \hat{\beta}_{9f}) + \overline{X}_{10f}\,(\hat{\beta}_{10m} - \hat{\beta}_{10f}) + \overline{X}_{11f}\,(\hat{\beta}_{11m} - \hat{\beta}_{11f}) + \overline{X}_{12f}\,(\hat{\beta}_{12m} - \hat{\beta}_{12f}) + \overline{X}_{13f}\,(\hat{\beta}_{13m} - \hat{\beta}_{13f}) + \overline{X}_{14f}\,(\hat{\beta}_{14m} - \hat{\beta}_{14f}) + \overline{X}_{15f}\,(\hat{\beta}_{15m} - \hat{\beta}_{15f}) \quad (3.21)$$

Where:

$\overline{X}_1, \overline{X}_2, \ldots, \overline{X}_{15}$ are the means of the observable characteristics and $\hat{\beta}_1, \hat{\beta}_2, \ldots \hat{\beta}_{15}$ are the associated coefficients. These were computed using Stata software.

Table 3.3: Measurement of variables, definitions, and expected (*a priori*) sign for income inequality model.

S/N	Explanatory variables	Definition	In literature	Expected sign
1	Age	Age of household head (years)	Awotide *et al*. (2015).	(±)
2	Gender	Gender of household head (dummy: male = 1, female = 0)	Usman *et al*, (2016).	(+)
3	Level of education	Educational level of household head (number of years spent in school).	Akpan *et al*. (2016); Su and Heshmati (2013)	(±)
4	Marital status	Status of household head in marriage. (married=1, not married=0)	Awotide *et al*. (2015).	(-)
5	Household size	Number of people in a household (number)	Oseni *et al*. (2015). Akpan *et al*. (2016)	(+)
6	Experience	Number of years spent in crayfish harvesting (years)	Akpan *et al*. (2016)	(-)
7	Amount of credit	Amount of credit accessed in a season per household head - HH (₦)	Awotide *et al*. (2015)	(-)
8	Membership of Coop. Soc.	Number of cooperative associations a respondent belongs	Igbalajobi *et al*. (2013)	(-)
9	Labour	Number of people employed for harvesting (Man/days).	Oseni *et al*. (2015); Awotide *et al*. (2015)	(±)
10	Extension visits	Number of visits by extension agents last season (number per year)	Awotide *et al*. (2015)	(-)
11	Income from crayfish	Income of HH generated per annum from crayfish harvesting (₦).	Awotide *et al*. (2015)	(+)
12	Income from other sources	Income of HH generated from other businesses or careers per annum(₦)	Awotide *et al*. (2015)	(-)
13	Access to outboard engine	Opportunity to use motorized outboard engine for harvesting by subsidy, gift or purchase.	Holzlohner, & Nwosu (2014)	(-)
14	Access to net	Opportunity to use modern crayfish net for harvesting.	Holzlohner, & Nwosu (2014)	(-)
15	Access to safety kit	Opportunity to use safety kit while harvesting crayfish.	Holzlohner, & Nwosu (2014)	(-)

The coefficient with the positive sign widens the gap while the coefficient with the negative sign reduces the gender gap.

For the estimation of the poverty logistic regressions, the study considered the following explanatory variables:

P = Poverty incidence of crayfish harvesters (poor = 1, non-poor = 0),

X_1 = Age of the crayfish harvester (in years),

X_2 = Gender (male =1; female = 0),

X_3 = Educational level of the crayfish harvester (in years),

X_4 = Marital status (married =1; otherwise = 0),

X_5 = Household size (number of people in the household),

X_6= Experience of the respondent (in years),

X_7 = Amount of Credit accessed (in Naira),

X_8 = Membership of co-operative (member = 1; otherwise = 0),

X_9 = Labour (in man days),

X_{10} = Extension visit (number of times/year),

X_{11}= Income from crayfish harvesting (in Naira),

X_{12} = income from other sources (in Naira),

X_{13} = Access to Outboard Engine (access = 1; otherwise = 0),

X_{14} = Access to net (access = 1; otherwise = 0), and

X_{15} = Access to safety kit (access =1; otherwise = 0).

All variables were subjected to correlation analysis before being used in the analysis. The formula is as expressed in equation (4.6). The measurement of variables, definitions, and expected (*a priori*) sign for model of poverty adopted is as shown in Table 3.4.

3.4.5.3 Decomposition of food insecurity by gender:

The food security index obtained in equation (39) was used for the decomposition.

The probit model expresses the dependent variable as a function of a set of explanatory variables in the following form:

$$F_h^g = x_h^g \beta^g + \varepsilon_h^g \qquad (3.22)$$

Where g = (gender) male, female; h = 1, 2, …, H.

F_h^g is the binary variable indicating whether or not household h is food secured:

F_h^g = {1 if $F*_h^g$> z or 0 if $F*_h^g \leq$ z; h = 1, 2, …, H.}

Table 3.4: Measurement of variables, definitions, and expected (*a priori*) sign for model of poverty adopted.

S/N	Explanatory variables	Definition	In literature	Expected sign
1	Age	Age of household head (years)	Awotide *et al*. (2015)	(-)
2	Gender	Gender of household head (dummy: male = 1, female = 0)	Usman *et al*, (2016)	(+)
3	Level of education	Educational level of household head (number of years spent in school).	Awotide *et al*. (2015); Akpan et al. (2016)	(-)
4	Marital status	Status of household head in marriage. (married=1, not married=0)	Awotide *et al*. (2015); Igbalajobi *et al*. (2013)	(-)
5	Household size	Number of people in a household (number)	Oseni *et al*. (2015); Akpan *et al*. (2016)	(+)
6	Experience	Number of years spent in crayfish harvesting (years)	Akpan *et al*. (2016)	(-)
7	Amount of credit	Amount of credit accessed in a season per household head – HH (₦)	Awotide *et al*. (2015)	(-)
8	Membership of Coop. Soc.	Number of cooperative associations a respondent belongs	Igbalajobi *et al*. (2013)	(-)
9	Labour	Number of people employed for harvesting (Man/days).	Oseni *et al*. (2015)	(+)
10	Extension visits	Number of visits by extension agents last season (number per year)	Awotide *et al*. (2015)	(-)
11	Income from crayfish	Income HH generated per annum from crayfish harvesting (₦).	Igbalajobi *et al*. (2013)	(-)
12	Income from other sources	Income of HH generated from other businesses or careers per annum(₦)	Akpan *et al*. (2016)	(-)
13	Access to outboard engine	Opportunity to use motorized outboard engine for harvesting by subsidy, gift or purchase.	Holzlohner, & Nwosu (2014)	(-)
14	Access to net	Opportunity to use modern crayfish net for harvesting.	Holzlohner, & Nwosu (2014)	(-)
15	Access to safety kit	Opportunity to use safety kit while harvesting crayfish.	Holzlohner, & Nwosu (2014)	(-)

The coefficient with the positive sign widens the gap while the coefficient with the negative sign reduces the gender gap.

The probability can be linked to the dependent variable as follows:

$$P\ (F_h^g = 1) = P\ (F_h^g < z) = \Phi\ (x_h^g \beta^g) \qquad (3.23)$$

The model for decomposition is expressed as:

$$P(F^{female} < z) - P(F^{male}) = \Phi(\bar{\bar{x}}^{female}\hat{\beta}^{female}) - \Phi(\bar{\bar{x}}^{male}\hat{\beta}^{male})$$

$$= \underbrace{(\Phi(\bar{\bar{x}}^{female}\hat{\beta}^{female}) - \Phi(\bar{\bar{x}}^{female}\hat{\beta}^{male})}_{D_1(z)} + \underbrace{(\Phi(\bar{\bar{x}}^{female}\hat{\beta}^{female}) - \Phi(\bar{\bar{x}}^{male}\hat{\beta}^{male})}_{E_1(z)}$$

$$= \underbrace{(\Phi(\bar{\bar{x}}^{male}\hat{\beta}^{female}) - \Phi(\bar{\bar{x}}^{male}\hat{\beta}^{male})}_{D_2(z)} + \underbrace{(\Phi(\bar{\bar{x}}^{female}\hat{\beta}^{female}) - \Phi(\bar{\bar{x}}^{male}\hat{\beta}^{female})}_{E_2(z)}$$

$$= \underbrace{\frac{1}{2}(D_1(z) + D_2(z))}_{\text{Pure discrimination effect}} + \underbrace{\frac{1}{2}(E_1(z) + E_2(z))}_{\text{Endowment effect}}$$

$$= D(z) + E(z) \quad (3.24)$$

Where;

z = food security line of the crayfish harvesters,

D = discriminative effect.

E = endowment effect

Φ = cumulative distribution function for the standard normal,

F_{gi} = Food security index of crayfish harvesters,

β_1 - β_{18} = associated coefficient to be estimated,

$x_{i=1}^{15}$ = explanatory variables of household characteristics,

X_1 = Age of the crayfish harvester (in years),

X_2 = Gender (male =1; female = 0),

X_3 = Educational level of the crayfish harvester (in years),

X_4 = Marital status (married =1; otherwise = 0),

X_5 = Household size (number of people in the household),

X_6= Experience of the respondent (in years),

X_7 = Amount of credit accessed (in Naira),

X_8 = Membership of co-operative (member = 1; otherwise = 0),

X_9 = Labour (in man days),

X_{10} = Extension visits (number of times/year),

X_{11}= Income from crayfish harvesting (in Naira),

X_{12} = income from other sources (in Naira),

X_{13} = Access to Outboard Engine (access = 1; otherwise = 0),

X_{14} = Access to net (access = 1; otherwise = 0), and

X_{15} = Access to safety kit (access =1; otherwise = 0).

All variables were subjected to correlation analysis before used as expressed in equation (4.6). The measurement of variables, definitions, and expected (*a priori*) sign for food insecurity model adopted is as shown in Table 3.5.

Table 3.5: Measurement of variables, definitions, and expected (*a priori*) sign for food insecurity model adopted.

S/N	Explanatory variables	Definition	In literature	Expected sign
1	Age	Age of household head (years)	Abu and Soom (2016)	(±)
2	Gender	Gender of household head (dummy: male = 1, female = 0)	Usman *et al*, (2016)	(+)
3	Level of education	Educational level of household head years spent in school).	Abu and Soom (2016)	(+)
4	Marital status	Status of household head in marriage. (married=1, not married=0)	Awotide *et al*. (2015)	(-)
5	Household size	Number of people in a household (number).	Abu and Soom (2016)	(-)
6	Experience	Number of years spent in crayfish harvesting (years).	Ahmed *et al*. (2015)	(+)
7	Amount of credit	Amount of credit accessed in a season per household head - HH (₦)	Abu and Soom (2016)	(+)
8	Membership of Coop. Soc.	Number of cooperative associations a respondent belongs	Ahmed *et al*. (2015)	(+)
9	Labour	Number of people employed for harvesting (Man/days).	Oseni *et al*. (2015)	(+)
10	Extension visits	Number of visits by extension agents last season (number per year)	Awotide *et al*. (2015); Ahmed *et al*. (2015)	(+)
11	Income from crayfish	Income of HH generated per annum from crayfish harvesting (₦).	Abu and Soom (2016); Ahmed *et al*. (2015).	(+)
12	Income from other sources	Income generated from other businesses or careers per annum(₦)	Abu and Soom (2016)	(+)
13	Access to outboard engine	Opportunity to use motorized outboard engine for harvesting by subsidy, gift or purchase.	Holzlohner, & Nwosu (2014)	(+)
14	Access to net	Opportunity to use modern crayfish net for harvesting.	Holzlohner, & Nwosu (2014)	(+)
15	Access to safety kit	Opportunity to use safety kit while harvesting crayfish.	Holzlohner, & Nwosu (2014)	(+)

The coefficient with the negative sign widens the gap while the coefficient with the positive sign reduces the gender gap.

3.4.6 Coping strategies for poverty, food insecurity and income inequality

The various forms of poverty, food insecurity and income inequality coping strategies identified in the study area (Objective vi) were analysed using Coping Strategies Use Index (CSUI) as adopted by Oluwatayo (2014). This was adopted to assess the extent of use of

coping strategies by the crayfish harvesting households. This knowledge allows for a clearer and better understanding of the possible strategies that respondents used to improve their living standards and reduce poverty. It also allows for a better understanding of the possible areas of intervention (formal or informal strategies) by the government or other stakeholders. In analysing the extent of usage of any of the coping strategies by the crayfish harvesting households, a coping strategy index (CSI) was developed by ranking. The extent of use of the CSI was expressed using a five-point Likert type scale with the scoring order 5, 4, 3, 2 and 1 for frequently used, occasionally used, undecided, rarely used and never used, respectively. The formula used to obtain the CSI is expressed as:

$$CSUI = N_1U_5 + N_2U_4 + N_3U_3 + N_4U_2 + N_5U_1 \quad (3.25)$$

Where: CSUI = Coping strategies use index,

N_1 = Number of households using a particular CSI frequently,

N_2 = Number of households using a particular CSI occasionally,

N_3 = Number of households using a particular CSI rarely,

N_4 = Number of households not using any of the Coping strategies, and

$U_5 – U_1$ = five-point scale with the scoring order 5, 4, 3, 2 and 1 for frequently used, occasionally used, undecided, rarely used and never used respectively.

The CSUI was used in ranked order to reflect the relative position of each of the CSI in terms of their use. The extent of use of the CSI was then obtained for all households in the study area by finding the mean of CSUI, each based on the number of households using it. This formula has been used by Igbalajobi *et al.* (2013), and Iyela and Ikwuakam (2015).

3.5 Test of Hypotheses

The z-values obtained from the Theil and Oaxaca-Blinder decomposition analyses were used to test hypothesis one. Similarly, the z-values obtained from the preliminary (logit and probit) regression and threefold/ twofold O-B decomposition models were used to test hypotheses two and three, respectively.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socioeconomic and Demographic Characteristics of Crayfish Harvesters

The socioeconomic characteristics of the crayfish harvesters deliberated in this study include gender, age, marital status, level of education, household size, and crayfish harvesting experience, among others.

4.1.1 Age

The results in Table 4.1 reveal that majority of female respondents (33.03%) were between the ages of 31– 40 years while male respondents (36.33%) and pooled (34.23%) were between 41– 50 years of age. Above 50 years recorded the lowest for male (11%), female (6.42%) and pooled (9.78%) respondents. The low level of harvesters in this age category denote that the artisanal crayfish harvesting is energy demanding which may be rather too unhealthy for elderly people. The results also reveal that females leave (retired from) the crayfish harvesting business early in life than the male colleagues. Conversely, the few respondents involved in the business may be due to either lucrativeness of the profession or interest. This observation agree with the findings of Ogunsola and Folakee (2018). Their mean ages were 37, 40 and 39 years for female, male and pooled respondents respectively. This is an indication that the respondents were in their active youthful age. These findings are in line with the study of Okayi *et al*. (2013), Kwen *et al*. (2013), Abah (2013) and Awotide (2015) who reported that majority of rural populace that generate their income from fishing, agriculture and its related activities are in their economically efficient and productive age. This may be attributed to the fact that younger people are more energetic and enthusiastic in adopting new practices in crayfish harvesting. They are also mentally alert and have greater flexibility in accepting new ideas in harvesting methods and gear development toward seafood related fishing operations. Hence, the age of an individual has

implication on the experience and decision making ability. However, the female harvesters were relatively younger than the males, and are therefore expected to be more active in crayfish harvesting activities which could enhance their income and reduce poverty.

Table 4.1: Distribution of crayfish harvesters according to socioeconomic and demographic characteristics.

Variable	Male (n= 300)	Female (n= 109)	Pooled (n= 409)
Age (years)			
≤ 30	60 (20.00)	35 (32.11)	95 (23.23)
31 – 40	98 (32.67)	36 (33.03)	134 (32.76)
41 – 50	109 (36.33)	31 (28.44)	140 (34.23)
>50	33 (11.00)	7 (6.42)	40 (9.78)
Mean	40 (9.39)*	37 (8.92)*	39 (9.33)*
Marital Status			
Married	237 (79.00)	37 (33.94)	274 (66.99)
Single	40 (13.33)	15 (13.76)	55 (13.45)
Widow/Widower	14 (4.67)	47 (43.12)	61 (14.91)
Divorced	9 (3.00)	10 (9.17)	19 (4.65)
Years spent on Formal Education			
1 – 6	157 (52.33)	60 (55.05)	217 (53.06)
7 – 12	74 (24.67)	35 (32.11)	109 (26.65)
>12	5 (1.67)	0 (0.00)	5 (1.22)
Mean	5.03 (3.62)*	5.56 (3.48)*	5.17 (3.59)*
Educational Attainment			
Non formal	50 (16.67)	11 (10.09)	61 (14.91)
Primary	166 (55.33)	65 (59.63)	231 (56.48)
Secondary	79 (26.33)	33 (30.28)	112 (27.38)
Tertiary	5 (1.67)	0 (0.00)	5 (1.23)
Primary Education Status			
Attempted	88 (29.33)	36 (33.03)	124 (30.32)
Completed	74 (24.67)	27 (24.77)	101 (24.69)
Ongoing	4 (1.33)	2 (0.92)	6 (1.43)
Secondary Education Status			
Attempted	64 (21.33)	20 (18.35)	84 (20.54)
Completed	15 (5.00)	13 (11.93)	27 (6.60)
Ongoing	0 (0.00)	0 (0.00)	0 (0.00)
Tertiary Education Status			
Attempted	0 (0.00)	0 (0.00)	0 (0.00)
Completed	5 (1.67)	0 (0.00)	5 (1.22)
Ongoing	0 (0.00)	0 (0.00)	0 (0.00)
Household size (numbers)			
1 – 5	61 (20.33)	24 (22.02)	85 (20.78)
6 – 10	171 (57.00)	65 (59.63)	236 (57.70)
11 – 15	67 (22.33)	20 (18.25)	87 (21.27)
>15	1 (0.33)	0 (0.00)	1 (0.24)
Mean	8.00 (3.15)*	8.00 (2.92)*	8.00 (3.10)*
Primary Occupation			
Crayfish Harvesting	299 (99.67)	109 (100.00)	408 (99.76)
Fishing	1 (0.33)	0 (0.00)	1 (0.24)

Source: Computed from field survey data, 2018.
Figures in parentheses ( ) are percentages and ( )* are standard deviation.

4.1.2 Marital status

Table 4.1 also indicates that the currently married respondents (66.99%) were the dominant group, followed by widow/widower (14.91%), single (13.45%) and divorced (4.65%) respectively according to pooled result. More of the male respondents (79%) were married than the females (33.94%). There were more widows (43.12%) than widowers (4.67%). The divorced contributed 3.00%, 9.17%, and 4.65% for male, female and pooled data, respectively. The findings indicate that most of the respondents in the study area were married which implies high level of responsibility. These findings are in consonance with Shettima *et al*. (2014) who reported that married and responsible men dominated fishing careers in the study area and Akingba *et al*. (2016) who reported that majority of the fisher folks (59%) aged between 21 and 40 years in Ondo State were married and operated the nuclear family. Furthermore, the observed high number of married harvesters in the area is consistent with the findings of Olaoye *et al*. (2012), who reported that the artisanal sector is dominated by married people. The possible explanation to this is that married people have more pressing demands and problems to deal with than singles and divorcees. Moreso, married household tend to have upper hands in terms of family right of access to productive tools and labour availability for harvesting, processing and marketing operation of crayfish and other seafood products (Etim *et al*. 2020b).

4.1.3 Education level

Results on educational attainment in Table 4.1 reveal that majority (85.09%) of the respondents from pooled result had formal education. Also larger proportion of females (89.91%) had formal education than males (83.33%), even though males had tertiary education than females. Education is an important factor in determining the level of technological adoption (Okeowo *et al*., 2015) and in making strategic changes in any given career. The relatively high level of education of respondents could give them the capability

to successfully implement income diversification strategies so as to cope with income fluctuations, poverty and food insecurity. The findings are in agreement with Kwen *et al*. (2013), Bassey *et al*. (2014), Okeowo *et al*. (2015), Ogunsola and Folakee (2018) who reported high level of literacy in marine and lagoon artisanal fisheries in their study areas and observed that career fishers do not have enough practical knowledge to access resources and to understand official documents in the sector.

4.1.4 Household size

The results in Table 4.1 further show that most of the male (57.00%), female (59.63%) and pooled (57.70%) respondents had household sizes of about 6 – 10 persons with equal mean of 8 persons. Considering the small scale nature of their harvesting business, this household size is relatively large. Although having a large household size may imply that they have enough free labour for their crayfish harvesting business, it could have a negative impact on household well-being. According to Akpan *et al*. (2016), an increase in household size indicates an increase in non-farm budgetary allocation and perhaps a decrease in farm investment. The authors also added that, an increase in household size is also concomitant with an increase in family responsibility and a decrease in per capita household income. This invariably means that crayfish harvesters with large household sizes will have income below the poverty line thus increasing the number of poor people in the community *vis-à-vis* income inequality. These results confirm previous findings by Olatunji and Olah (2012) who reported household size of 6 –10 for artisanal fishers in Cross River State. Tasie and Wilcox (2018) stressed that large household size offers timely, free and cheap labour for the fishing households in the area. The result also agrees with Adetayo (2014), Awotide *et al.* (2015) and Akpan *et al*. (2016).

4.1.5 Primary occupation

The number of respondents (both male and female) engaged in crayfish harvesting as their primary occupation in the study area is as shown in Table 4.2. The results reveal that more than 98% of the harvester's used crayfish as the main source of livelihood. The findings are in line with the findings of Nandi *et al*. (2014). However, the high percentage of women in the profession agreed with the studies of Olaoye *et al*. (2012), Kwen *et al*. (2013) that 45 to 65% of women actively participated in fishing activities in most parts of Nigeria. This high number of female involvements could be attributed to factors such as the recent emerging trend of women participating more in both farming and fishing activities apart from making ends meet; the (females) are the key to food and nutrition security (FAO *et al*., 2021). They play significant roles as producers of food, as managers of natural resources, as income generating drivers and as providers of care for their families.

4.1.6 Experience

In terms of experience, Table 4.2 indicate that more male (40.67%), female (37.61%) and pooled (39.85%) respondents had crayfish harvesting experience ranging between 11 and 20 years. The average years of experience stood at 21, 19, and 20 years for male, female and pooled data respectively which correspond to the range of years (11 – 20) having large percentage of harvesters with exception of the males who had mean experience a little above 20 years. This findings imply that the respondents from both gender have sound knowledge and skills on crayfish harvesting business. However, male headed households (87.01%) with experience of 11 – 50 years was higher than female headed households (73.39%) with the same years of experience. This depicts that the male respondents in the study area were more rooted in crayfish harvesting earlier in lives than female counterparts. Years of experience in artisanal crayfish harvesting can enhance harvester's

knowledge in understanding the feeding habit and movement of crayfish in line with sea or river weather, depth and direction of water flow *vis-à-vis* water current, thus increasing their efficiency, output and income. These results support the earlier findings by Kwen *et al*. (2013), Tasie and Wilcox (2018) who all reported that majority of fishers in Niger Delta creek have fishing experience of 11 years and above.

4.1.7 Level of involvement

Results in Table 4.2 also reveal that most of the respondents (males 98%, females 100%, pooled 98.53%) take crayfish harvesting as a full time business. Only 2% of male harvester take it as part time business. This indicates that females involvement in crayfish harvesting were of a full time bases than their male counterparts. This however affirmed the earlier findings reported by Olaoye *et al*. (2012); Kwen *et al*. (2013) and Lenthisco and Lee (2015).

4.1.8 Labour usage

In addition, the results in Table 4.2 also show that males (82.67%), females (88.07%) and pooled (84.31%) respondents used 1 to 4 labourers in the crayfish harvesting business. However, the mean number of labourers used by male, female and pooled respondents was 4, 4 and 3 and standard deviation was 1.25, 1.32 and 1.68 respectively. This suggests that the number of labourer used by individual harvester was approximately the same for both genders. These findings agree with Nweke (2015); Mukasa and Salami (2015); World Bank (2018). The number of labourers used in any agricultural business by the farm entrepreneur determine the level of production outcome and income. It also enhances division of labour and improves efficiency. Fapohunda (2013) and Nweke (2015) stressed that the tendency of Nigerian women to leave the labour market more frequently or to have a short-term career lowers their average income earns when compared to men who work more hours and stay in the labour market for a longer period of time. Further analysis

revealed that male respondents use more of male permanent (86.15%) and family (56.49%) labours than females who use 84.42% and 50.27% of same labours, respectively. Conversely, female respondents use more of female permanent (15.58%) and family (49.73%) labours than males who use 13.85% and 43.51% of same, respectively. These findings is in consonance with Mukasa and Salami (2015) and Okeowo *et al*. (2015).

4.1.9 Annual income of crayfish harvesting

Table 4.2 reveal that majority of the male respondents (53.33%), females (55.05%) and the pooled result (53.79%) had annual income of ₦2, 000,001 and above. However, the mean annual income of crayfish harvesting stood at ₦2, 549,403 for male, ₦2, 030,244 for female and ₦2, 370,019 for pooled with the females having the lowest. This implies that crayfish command high market price and high return on investment, which also means that crayfish harvesting business is very profitable. The findings agree with Okeowo *et al* (2015), Ibok *et al*. (2017), Oladimeji (2018) and Zabbey (2019). According to Olaoye and Ojebiyi (2018), Seafood subsector contributes substantially to the gross domestic product (GDP) of Nigeria. Nevertheless, income generated by male respondents was higher than that of the females despite having the same mean labour usage in the business.

4.1.10 Annual income of other sources

Annual income of other sources is the income crayfish harvesters derived from other forms of livelihood. These may include farming, animal husbandry, petty trading, menial jobs and transportation work among others. Table 4.2 shows that a few numbers of male (15.33%), female (25.69%) and pooled (18.09%) respondents had annual income from other sources ranging from ₦500, 001 – 1,000,000. The mean annual income from other sources was ₦ 54,865.34 for males, ₦ 55,644.04 for females and ₦ 108,000.47 for pooled with that of females being higher than males. Nevertheless, 61.33% of males, 49.54% of

females and 58.19% of pooled respondents did not engage in other form of income generating venture. This means that more females engage in other forms of livelihoods than male counterparts. These findings support Awotide *et al*. (2015), Etim *et al*. (2020b).

Table 4.2: Distribution of crayfish harvesters according to socioeconomic and demographic characteristics (continued).

Variable	Male (n= 300)	Female (n= 109)	Pooled (n= 409)
Experience (years)			
≤10	39 (13.00)	29 (26.61)	68 (16.33)
11 – 20	122 (40.67)	41 (37.61)	163 (39.85)
21 – 30	105 (35.00)	26 (23.85)	131 (32.03)
31 – 40	32 (10.67)	12 (11.01)	44 (10.76)
41 – 50	2 (0.67)	1 (0.92)	6 (0.73)
Mean	21 (8.16) *	19 (9.15) *	20 (8.49) *
Level of involvement (dummy)			
Full time	294 (98.00)	109 (100.00)	403 (98.53)
Part time	6 (2.00)	0 (0.00)	6 (1.47)
Number of labour used			
1 – 4	248 (82.67)	96 (88.07)	344 (84.31)
5 – 8	51 (17.00)	13 (11.93)	64 (15.69)
>8	1 (0.33)	0 (0.00)	0 (0.00)
Mean	4.00 (1.25)*	4.00 (1.32)*	3.00 (1.68)*
No of male Permanent labour used	199 (86.15)	65 (84.42)	264 (85.71)
No of female Permanent labour used	32 (13.85)	12 (15.58)	44 (14.29)
No of male Family labour used	274 (56.49)	92 (50.27)	366 (54.79)
No of female Family labour used	211 (43.51)	91 (49.73)	302 (45.21)
Annual income of crayfish harvesting (₦)			
1 – 500000	24 (8.00)	12 (11.01)	36 (8.80)
500001 – 1000000	35 (11.67)	13 (11.93)	48 (11.74)
1000001 – 1500000	45 (15.00)	11 (10.09)	56 (13.69)
1500001 – 2000000	36 (12.00)	13 (11.93)	49 (11.98)
2000001 and above	160 (53.33)	60 (55.05)	220 (53.79)
Mean	2549403 (1977885)*	2030244 (1063807)*	2370019 (1796835)*
Annual income of other sources (₦)			
1 – 50000	4 (1.33)	7 (6.42)	11 (2.69)
50001 – 100000	46 (15.33)	28 (25.69)	74 (18.09)
100001 - 150000	45 (15.00)	16 (14.68)	61 (14.91)
150001 – 200000	13 (4.33)	1 (0.92)	14 (3.42)
200001 and above	8 (2.67)	3 (2.75)	11 (2.69)
None	184 (61.33)	54 (49.54)	238 (58.19)
Mean	54865.34	55644.04	108000.47
Standard deviation	(66856.48)*	(56900.54)*	(64286.89)*
Gender			
Male	-	-	300 (73.35)
Female	-	-	109 (26.65)

Source: Computed from field survey data, 2018.

Figures in parentheses ( ) are percentages and ( )* are standard deviation.

4.1.11 Gender

The socioeconomic and demographic characteristics of the respondents are shown in Table 4.2. The results of gender for the pooled data show that 73.35% of the respondents were males while 26.65% were females. This finding discloses that crayfish harvesting in the study area was dominated by men. The dominance of males in the profession may be due to the fact that society made women to be involved more in household domestic work (cooking, nurturing of children and washing of cloths, general compound cleaning, fetching of fire wood and water) and performance of other task (crop farming, micro-livestock production, mat making, brewing of local gin and casual labour work). It might also be due to women being involved more in menial jobs within the natural fishery value chain environment such as food vending, fish/crayfish processing and marketing.

Furthermore, it may be as a result of energy demanding nature of activities in artisanal crayfish harvesting. This corroborated the observation by Ogunsola and Folakee (2018) that fishing trips at water bodies (sea, river, lake, and lagoon) and landing at the shore involve a lot of physical energy which is considered to be beyond the female capabilities. These results confirm the findings of Abah (2013) in Coastal Niger Delta Region, Okayi *et al*. (2013) in Benue State, Shettima *et al*. (2014) in Borno State, Okeowo *et al*. (2015) in Badagry, Rajaratnam *et al*. (2016) in Zambia, Ogunsola and Folakee (2018) in Lagos, Etim *et al*. (2020b) in Niger Delta Region who reported that fishing and related fish creatures (seafood) harvesting are dominated by men. Although the results showed the dominance of the crayfish harvesting business by men, the contribution of the women folk effort in the business cannot be undermined.

4.2 Institutional Factors Influencing Crayfish Harvesters in the Study Area

4.2.1 Extension visits

The analysis for extension visits in Table 4.3 show that 76.33%, 70.64% and 74.82% of male, female and pooled respondents respectively had no extension visit. Furthermore, 23.67% and 32.36% of the male and female crayfish harvesters had 1 – 2 number of extension visits in a year. This predicts that crayfish harvesters in the study area have limited or no information on awareness for the adoption of new technologies that can enhance their efficiency and effectiveness in crayfish harvesting business as they have little or no extension contact with extension agents. Extension contact is a potent viable factor that can enhance the adoption of new harvesting strategies among small scale fisher folk. This finding is in support of the previous empirical study of Kwen *et al*. (2013), Awotide *et al*. (2015), Akpan *et al*. (2016), Tasie and Wilcox (2018).

4.2.2 Membership of association

The frequency on membership of association in Table 4.3 reveal that 18.00%, 32.36% and 21.08% of male, female and pooled respondents belong to association while 82.00%, 77.64% and 78.02% of same did not belong. This implies that the number of harvesters belonging to association in the area are generally low and it could affect production negatively. Though that of female group was higher than males. Membership of association increase farmers' access to timely, speedy and genuine access to market information and innovation that would augment income and enhance general livelihood. It can also grant farmers access to soft loan to increase production. This finding is similar to that of Kwen *et al*. (2013). According to Lein and Setiawina (2018), fishers' ability to purchase improved fishing gear and fish processing equipment is heavily influenced by their income.

4.2.3 Distance to market

Distance to market refers to the distance between farmers' farm or production site and market (place) where sales of the product(s) take place. Results in Table 4.3 indicate that the mean distance to market for male, female and pooled stood at 60.54km, 60.27km and 60.47km respectively. However, 56.67%, 61.47% and 50.94% of male, female and pooled respondents had distance of 61km and above. The lowest kilometres (≤ 20km) was recorded by 18.67%, 16.51% and 18.09% of male, female and pooled respondents respectively. This implies that majority of respondents from both genders have to embark on long journey to transport harvested produce to the market in order to sell at reasonable price. Embarking on long journey between crayfish harvesting area (production site) and market can result to losses which can negatively affect profit margin (income) and livelihood apart from exposing them to high environmental hazards and risk. The findings disagreed with Agwu *et al*. (2013) who opined that majority of the smallholder farmers in Nigeria do not embark on long journey to market to sell their produce. This may be attributed to environmental differences in the area of operation.

4.2.4 Access to credit

The distribution of the respondents on the basis of access to credit facilities (Table 4.3) reveal that 91.67%, 91.74% and 91.69% of male, female and pooled respondents had no access to credit facility, with female being the most disfavoured in credit accessibility. This implies that agricultural loans were not easily accessible to farmers in the study area among other factors. This may be due to low level of education, lack of credit institution in the area and lack of collateral especially among smallholder farming households. It is expected that limited access to agricultural loans will have a detrimental impact on domestic food production and other agro-processing enterprises, thus resulting in food scarcity, lower incomes, and a lack of sustainable rural household food security, as well as

a lower quality of life. Access to credit is another important factor that can influence the likelihood of adopting new technologies and expanding the crayfish harvesting business. Farm credit is widely acknowledged as one of the intermediary factors between farm technology adoption and increased farm income among Nigerian rural farmers (Akpan *et. al*., 2013); hence crayfish harvesters in the study area may lack the ability to enlarge their production business due to financial drawback. This finding is in agreement with Ahmed *et al*. (2015), Awotide *et al*. (2015) and Haddabi *et al*. (2019).

4.2.5 Sources of credit

Agricultural credit is an effective instrument for improving agricultural productivity and encourage the expansion of agricultural business. Table 4.3 shows that 3%, 3.67%, 3.18 male, female and pooled respondents obtained credit from microfinance bank to finance crayfish harvesting business. This appear to be the one with high patronage. It was closely followed by cooperative, commercial bank, money lenders, government, personal saving and agricultural lending agency. However, majority 91.67%, 92.66% and 91.69% of the male, female and pooled respondents did not used any of the above credit sources to access any loan. This may be due to high interest rate charged by money lenders and credit institutions, poor access to agricultural credit facilities and lack of awareness of such institutions. According to Ajagbe (2012), poor access to agricultural credit is characteristics feature of peasant agriculture. This result support earlier findings of Haddabi *et al*. (2019).

Table 4.3 Distribution of crayfish harvesters based on institutional factors

Variable	Male (n= 300)	Female (n= 109)	Pooled (n= 409)
Extension visits (dummy)			
Yes	71 (23.67)	32 (29.36)	103 (25.18)
No	229 (76.33)	77 (70.64)	306 (74.82)
Number of visits per year			
2 and above	6 (2.00)	4 (3.67)	10 (2.44)
1	65 (21.67)	28 (28.69)	93 (22.74)
0	229 (76.33)	77 (70.64)	306 (74.82)
Distance to market (km)			
< 21	56 (18.67)	18 (16.51)	74 (18.09)
21 – 40	18 (6.00)	7 (6.42)	25 (6.11)
41 – 60	56 (18.67)	17 (15.60)	73 (17.85)
61 – 80	86 (28.67)	39 (35.78)	125 (30.56)
81 – 100	60 (20.00)	23 (21.10)	83 (20.29)
>100	24 (8.00)	5 (4.49)	29 (7.09)
Mean	60.54 (32.65) *	60.27(29.82) *	60.47 31.88) *
Membership of Association (dummy)			
Yes	54 (18.00)	32 (29.36)	86 (21.08)
No	246 (82.00)	77 (70.64)	322 (78.02)
Access to Credit (dummy)			
Yes	25 (8.33)	9 (8.26)	34 (8.31)
No	275 (91.67)	100 (91.74)	375 (91.69)
Sources of credit			
Commercial bank	5 (1.67)	0 (0.00)	5 (1.22)
Microfinance bank	9 (3.00)	4 (3.67)	13 (3.18)
Cooperative	4 (1.33)	3 (2.75)	7 (1.71)
Personal saving	2 (0.67)	0 (0.00)	2 (0.49)
Friends	0 (0.00)	0 (0.00)	0 (0.00)
Relatives	0 (0.00)	0 (0.00)	0 (0.00)
Agricultural lending agency	1 (0.33)	0 (0.00)	1 (0.24)
Money Lenders	3 (1.00)	1 (0.92)	3 (0.73)
Government	2 (0.67)	0 (0.00)	3 (0.73)
None	295 (91.67)	101 (92.66)	375 (91.69)
Amount of credit accessed (₦)			
1 – 300000	11 (55.00)	4 (44.44)	15 (51.72)
300001 – 600000	3 (15.00)	2 (22.22)	5 (17.24)
600001 – 900000	2 (10.00)	1 (11.11)	3 (10.34)
> 900000	4 (20.00)	2 (22.22)	6 (20.69)
Mean	30700 (143248.90) *	41284.40 (16447.50) *	33520.78 (149047.10) *

Source: Computed from field survey data, 2018. Figures in parentheses ( ) are percentages and ( )* are standard deviation.

4.3 Level of Income Inequality of Crayfish Harvesters by Gender in Niger Delta Area of Nigeria

4.3.1 Level of income inequality of crayfish harvesters based on earned income from crayfish by gender

Table 4.4 present Gini coefficient results of income inequality of crayfish harvesters based on earned income from crayfish by gender. The results indicate income inequality of 0.6414, 0.5984, and 0.6388 Gini coefficient for male, female and pooled respondents respectively. These results imply that there is existence of high level of income inequality in the Niger Delta Area among the crayfish harvesters. These results support the findings of Agwu and Oteh (2014) who report similar Gini index in the analysis of income inequalities among farmers in Abia State, South Eastern Nigeria. The results also reveal that male respondent's level of income inequality was higher than that of their female counterparts. However, the income was a little evenly distributed among the female respondents than the males. This finding agrees with National Human Development Review for Nigeria (UNDP, 2016) who reported higher gender inequality index for males to be higher than females but disagree with Awotide *et al*. (2015) who reported otherwise.

World Economic Forum-WEF (2016) also stated that there is a wide variety of gender gap outcome in sub-Sahara Africa and reported Nigeria to have global gender gap index of 0.643. The reasons for these may be attributed to market commission and restriction imposed against women before and after marketing of crayfish produce, patriarchal dominance, low labour force and poor resources allocation. These issues have led to the creation and expansion of gender inequality gap in the crayfish harvesting business. Oxfam International (2017) ascribed income inequality to labour markets (or employment markets) imperfection, social values and prejudices, skill and regional differences in

resource endowment and resource utilization. The results also agree with NBS (2011), British Council (2012), Busayo and Olufunmilayo (2013), Edet and Etim (2014a), Nweke (2015), World Bank (2016), Akpan *et al*. (2016)

Furthermore, the results also depict that the bottom (lowest) income group of respondents (10%) had income share of 0.82% total earned income from crayfish and that of the top (highest) income group (12.67%) was 31.92% of the total earned income from crayfish by the male category. While in the female category, the bottom (lowest) income group of respondents (11.93%) had income share of 1.58% total earned income from crayfish and the top (highest) income group (7.34%) share of the income stood at 18.22% of the total earned income from crayfish. In the pooled category, the bottom (lowest) income group of respondents (10.51%) had income share of 0.99% of the total earned income from crayfish while the top (highest) income group (9.29%) was 24.69% of the total earned income from crayfish in the study area. The implication of this scenario is that few numbers of crayfish harvesters in the top income group control large percentage of the total earned income from crayfish compared to other income groups at the middle and the bottom in all the three categories of the respondents. The result also signifies that the poor are more limited by individual and/or income group characteristics. These results are in tandem with the findings of Su and Heshmati (2013), Etim *et al*. (2020b)

The “Lorenz curve” is a common graphical method of depicting the degree of income inequality in a community, region, state, or country. It plots the cumulative share of income y earned by the poorest x of the population for all possible x values. The 45-degree line represents the line of equality, which occurs when income is distributed equally among all individuals. Lorenz curves usually lie below the 45-degree line.

Table 4.4: Income inequality of crayfish harvesters in Niger Delta Area based on earned income from crayfish by gender

Income range	NCH	PCH	CPCH (X)	TVCEI	PTECI	CPTECI (Y)	XY
Male							
1 to 500000	30	0.1	0.1	6087783	0.0082	0.0082	0.0008
500001 to 1000000	32	0.1067	0.2067	25168335	0.0340	0.0422	0.0045
1000001 to 1500000	47	0.1567	0.3633	58690125	0.0793	0.1215	0.0190
1500001 to 2000000	33	0.11	0.4733	60445490	0.0817	0.2032	0.0223
2000001 to 2500000	38	0.1267	0.6	78645705	0.1062	0.3094	0.0392
2500001 to 3000000	33	0.11	0.71	95947360	0.1296	0.4390	0.0483
3000001 to 3500000	31	0.1033	0.8133	99835910	0.1349	0.5739	0.0593
3500001 to 4000000	9	0.03	0.8433	41083605	0.0555	0.6294	0.0189
4000001 to 4500000	9	0.03	0.8733	38037300	0.0514	0.6608	0.0204
Above 4500000	32	0.1267	1	236319655	0.3192	1	0.1267
Total	300	1		740261268	1		0.3586
Gini coefficient (1-∑XY)							**0.6414**
Female							
1 to 500000	13	0.1193	0.1193	3417750	0.0158	0.0158	0.0019
500001 to 1000000	14	0.1284	0.2477	10110350	0.0466	0.0624	0.0080
1000001 to 1500000	10	0.0917	0.3394	12599650	0.0581	0.1205	0.0111
1500001 to 2000000	13	0.1193	0.4587	22761725	0.1049	0.2254	0.0269
2000001 to 2500000	24	0.2202	0.6789	46527900	0.2145	0.4399	0.0969
2500001 to 3000000	10	0.0917	0.7706	36404800	0.1678	0.6078	0.0558
3000001 to 3500000	17	0.1560	0.9266	45565050	0.2101	0.8178	0.1276
3500001 to 4000000	8	0.0734	1	39513400	0.1822	1	0.0734
Total	109	1		216900625	1		0.4016
Gini coefficient (1-∑XY)							**0.5984**
Pooled							
1 to 500000	43	0.1051	0.1051	9505533	0.0099	0.0099	0.0010
500001 to 1000000	46	0.1125	0.2176	35278685	0.0369	0.0468	0.0053
1000001 to 1500000	57	0.1394	0.3570	71289775	0.0745	0.1213	0.0169
1500001 to 2000000	46	0.1125	0.4694	83207215	0.0869	0.2082	0.0234
2000001 to 2500000	62	0.1516	0.6210	125173605	0.1308	0.3390	0.0514
2500001 to 3000000	43	0.1051	0.7262	132352160	0.1383	0.4773	0.0502
3000001 to 3500000	48	0.1174	0.8435	145400960	0.1519	0.6292	0.0738
3500001 to 4000000	17	0.0416	0.8851	80597005	0.0842	0.7134	0.0297
4000001 to 4500000	9	0.0220	0.9071	38037300	0.0397	0.7531	0.0166
Above 4500000	38	0.0929	1	236319655	0.2469	1	0.0929
Total	409	1		957161893	1		0.3612
Gini coefficient (1-∑XY)							**0.6388**

Source: Computed from field survey data, 2018.

Note: NCH= Number of Crayfish Harvesters, PCH= Proportion of Crayfish Harvesters, CPCH= Cumulative Proportion of Crayfish Harvesters, TVCEI= Total Value of Crayfish Earned Income, PTECI= Proportion of Total Earned Crayfish Income, CPTECI= Cumulative Proportion of Total Earned Crayfish Income.

Moreover, the farther the distance between the Lorenz curve and the equality line, the more unequal the income distribution. Figures 4.1, 4.2, and 4.3 show the Lorenz curves of income inequality level for male, female and pooled data of crayfish harvesters in Niger Delta States of Nigeria based on earned income from crayfish.

Comparing the three figures (Lorenz Curves), it can be deduced that female harvesters' level of inequality (59.84%) was closer to the 45° arbitrary line. It was followed by the pooled (63.88%), while that of the males (64.14%) was far from the arbitrary line. Therefore, high inequality among the male harvesters contributed to the high level of inequality among the respondents in the area as earlier pointed out. Looking at the pooled result, the level of income inequality among the crayfish harvesters in the area was generally high (0.6388). Figure 4.4 shows the generalized gender-based Lorenz curve of crayfish harvesters in the study area based on earned income from crayfish. Economies with Gini values above 0.5 are considered very unequal (Ayinde, 2012, and Rodrigue, 2017). These findings reveal that there is high level of income inequality existing among the crayfish harvesters in the area and is higher among the male than the female. This scenario may be due to the possible impact of rural areas multifunctional activities on income distribution, allocation and lack of equality assessment and evaluation among the two genders.

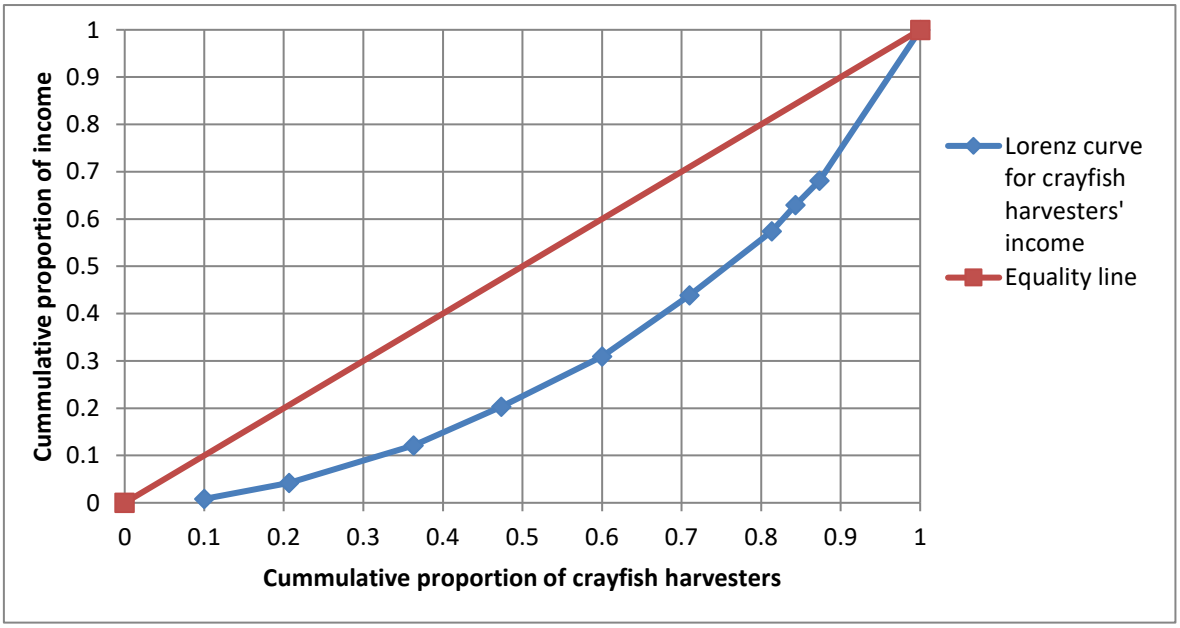


Figure 4.1: Lorenz curve of male headed households of crayfish harvesters based on earned income from crayfish

Source: Computed from field survey data, 2018.

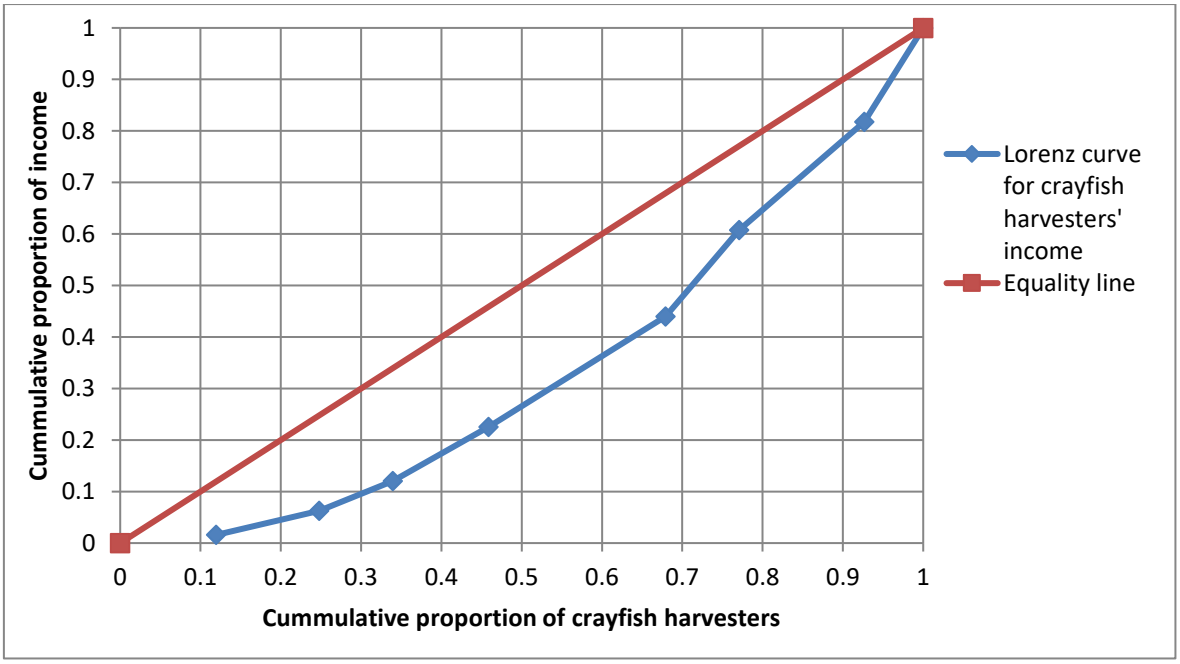


Figure 4.2: Lorenz curve of female headed households of crayfish harvesters based on earned income from crayfish

Source: Computed from field survey data, 2018.

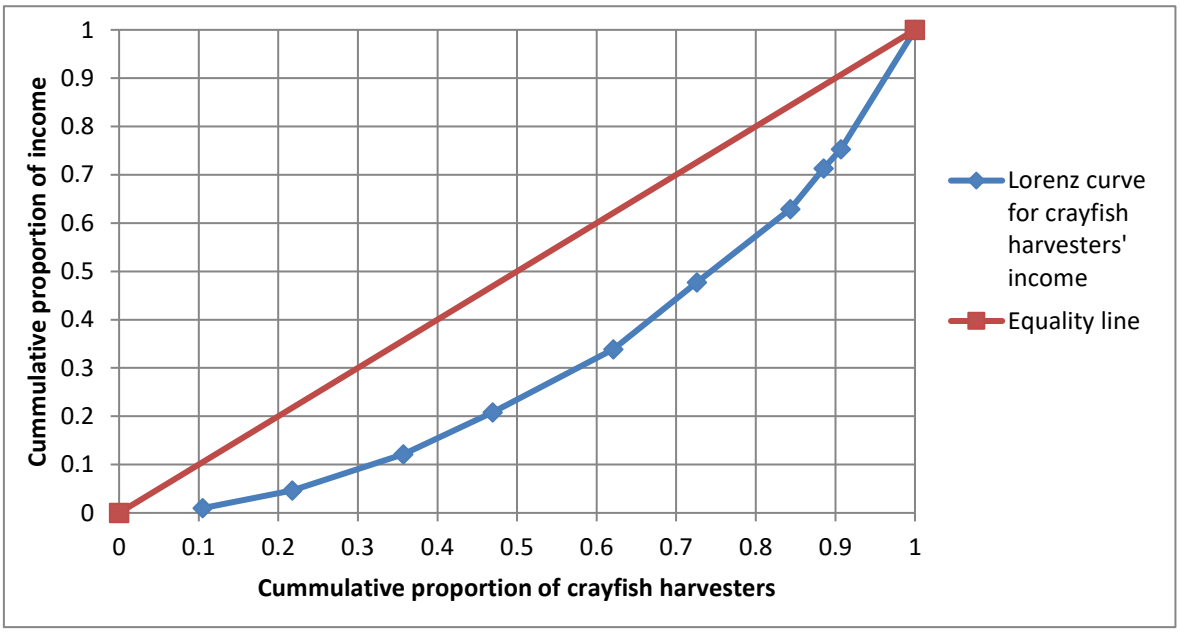


Figure 4.3: Lorenz curve of pooled crayfish harvesters in Niger Delta Area based on earned income from crayfish

Source: Computed from field survey data, 2018.

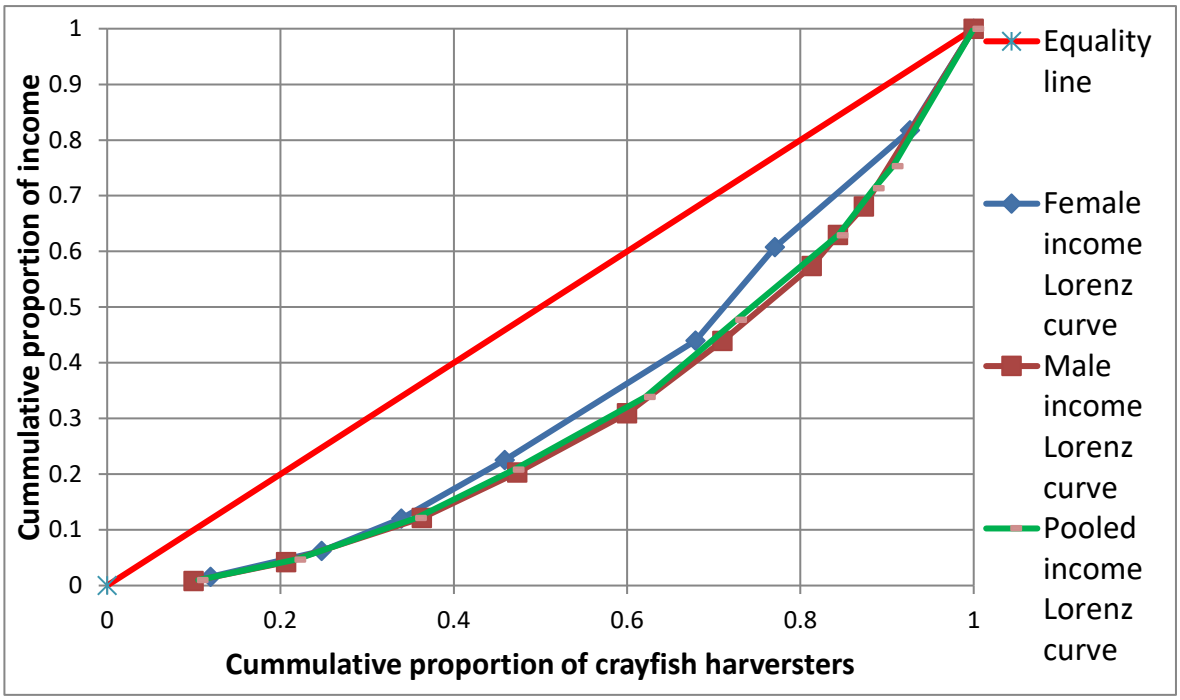


Figure 4.4: Generalized gender-based Lorenz curve of crayfish harvesters in Niger Delta Area based on earned income from crayfish.
Source: Computed from field survey data, 2018.

4.3.2 Level of income inequality of crayfish harvesters based on total earned income by gender in Niger Delta Area.

Results of analysis using Gini coefficient in Table 4.4 show that income inequality of 0.64 for the male respondents was higher than 0.58 of the female counterparts. The pooled Gini coefficient of 0.63 shows that income inequality among crayfish harvesters was high in the area. However, it was a bit evenly distributed among the female respondents than among the males. Results further depict that males' respondent have higher level of income inequality than females in the sampled population, thus making women to be vulnerable to inequality effect. This may be due to women having limited access to resources, restricted in decision-making and power, low labour force and putting in few hours of time for crayfish harvesting compared to their male counterparts. This have resulted to the creation of gender differentials gap in income among the crayfish harvesters. Oxfam International (2017) ascribed income inequality to labour markets (or employment markets)

imperfection, social values and prejudices, skill and regional differences in resource endowment and resource utilization.

On the other hand, the result of male category also reveals that the bottom income group of harvesters (8%) controlled 0.84% share of their total income and the top income group (13%) controlled 31.98% share of the male total income. while in the female category, the bottom income group of harvesters (11.01%) controlled 1.58% share of the female total income and the top income group (10.09%) controlled 18.32% share of their total income. Similarly, in the pooled category the bottom income group of harvesters (8.80%) controlled 1.01% share of the total income and the top income group of harvesters (9.53) controlled 24.61% share of the total income in the area.

This apparent existence of income inequality in the area predict existence of poverty, food insecurity and negative social vices inimical to national security of the country. This findings is in agreement with Obayelu and Awoyemi (2012) who assessed the level of spatial income inequality in rural Nigeria, Akpan *et al*. (2016) who examined the level of income inequality and determinants of poverty incidence among youth farmers in Akwa Ibom State, Awotide *et al*. (2015) who understudied gender analysis of income inequality and poverty among rural households in Nigeria with particular reference to Akinyele Local Government Area of Oyo State and Rajaratnam *et al*. (2016) in South Africa. Notwithstanding, the result disagrees with Usman *et al*. (2016) who reported that the female household heads contributed more to maximum income inequality than the male in his study of 'the dynamics of income inequality in rural areas of Nigeria'.

The "Lorenz curve" is a common graphical method of depicting the degree of income inequality in a community, region, state, or country. Its plots the cumulative share of income y earned by the poorest x of the population for all possible x values. The 45-degree

line represents the line of equality, which occurs when income is distributed equally among all individuals. Lorenz curves usually lie below the 45-degree line. Moreover, the farther the distance between the Lorenz curve and the equality line, the more unequal the income distribution.

Table 4.5: Income inequality of crayfish harvesters in Niger Delta Area based on total earned income by gender.

Income range	NCH	PCH	CPCH (X)	TVEI	PTEI	CPTEI (Y)	XY
Male							
1 to 500000	24	0.08	0.08	6227760	0.0084	0.0084	0.0007
500001 to 1000000	35	0.1167	0.1967	25100000	0.0339	0.0423	0.0049
1000001 to 1500000	45	0.15	0.3467	58400000	0.0789	0.1212	0.0182
1500001 to 2000000	36	0.12	0.4667	61700000	0.0833	0.2045	0.0245
2000001 to 2500000	35	0.1167	0.5833	78700000	0.1063	0.3108	0.0363
2500001 to 3000000	35	0.1167	0.7	95300000	0.1287	0.4395	0.0513
3000001 to 3500000	31	0.1033	0.8033	99700000	0.1347	0.5742	0.0593
3500001 to 4000000	11	0.0367	0.84	40400000	0.0546	0.6287	0.0231
4000001 to 4500000	9	0.03	0.87	38100000	0.0515	0.6802	0.0204
Above 4500000	39	0.1300	1	236800000	0.3198	1	0.1236
Total	300	1		740427760	1		0.3622
Gini coefficient (1-∑XY)							**0.6378**
Female							
1 to 500000	12	0.1101	0.1101	3501050	0.0158	0.0158	0.0017
500001 to 1000000	13	0.1193	0.2294	10200000	0.0460	0.0618	0.0074
1000001 to 1500000	11	0.1009	0.3303	13400000	0.0605	0.1223	0.0123
1500001 to 2000000	13	0.1193	0.4495	22800000	0.1029	0.2252	0.0269
2000001 to 2500000	21	0.1927	0.6422	47500000	0.2143	0.4395	0.0847
2500001 to 3000000	14	0.1284	0.7706	37400000	0.1688	0.6083	0.0781
3000001 to 3500000	14	0.1284	0.8991	46200000	0.2085	0.8168	0.1049
3500001 to 4000000	11	0.1009	1	40600000	0.1832	1	0.1009
Total	109	1		221601050	1		0.4170
Gini coefficient (1-∑XY)							**0.5830**
Pooled							
1 to 500000	36	0.0880	0.0880	9728810	0.0101	0.0101	0.0009
500001 to 1000000	48	0.1174	0.2054	35300000	0.0367	0.0468	0.0055
1000001 to 1500000	56	0.1369	0.3423	71800000	0.0746	0.1214	0.0166
1500001 to 2000000	49	0.1198	0.4621	84400000	0.0877	0.2091	0.0251
2000001 to 2500000	56	0.1369	0.5990	126000000	0.1310	0.3401	0.0466
2500001 to 3000000	49	0.1198	0.7188	133000000	0.1382	0.4783	0.0573
3000001 to 3500000	45	0.1100	0.8289	146000000	0.1517	0.6301	0.0693
3500001 to 4000000	22	0.0538	0.8826	81000000	0.0841	0.7143	0.0384
4000001 to 4500000	9	0.0220	0.9046	38100000	0.0396	0.7539	0.0166
Above 4500000	39	0.0953	1	236800000	0.2461	1	0.0917
Total	409	1		962128810	1		0.3680
Gini coefficient (1-∑XY)							**0.6320**

Source: Computed from field survey data, 2018.

Note: NCH=Number of Crayfish Harvesters, PCH= Proportion of Crayfish Harvesters, CPCH =Cumulative Proportion of Crayfish Harvesters, TVEI=Total Value of Earned Income, PTEI = Proportion of Total Earned Income, CPTEI= Cumulative Proportion of Total Earned Income.

Figures 4.5, 4.6 and 4.7 show the Lorenz curves of income inequality for male, female, pooled data of crayfish harvesting households based on total earned income in Niger Delta Area of Nigeria. Comparing the three Lorenz Curves, it depicts that female harvesters with the lowest inequality index (58.30%) was closer to the arbitrary 45°line. It was followed by that of the pooled (63.20%), while that of the males was the highest (63.78). Therefore, the male harvesters were the major cause of inequality in the area as earlier pointed out. Looking at the pooled result, the level of income inequality among the crayfish harvesters in the area was generally high (0.6320). Figure 4.8 shows the generalized gender Lorenz curves of crayfish harvesters based on total income. Economies with Gini values above 0.5 are considered very unequal (Ayinde, 2012, and Rodrigue, 2017). These findings depict the possible impact of rural areas multifunctional activities on income distribution and equality assessment among the crayfish harvesters.

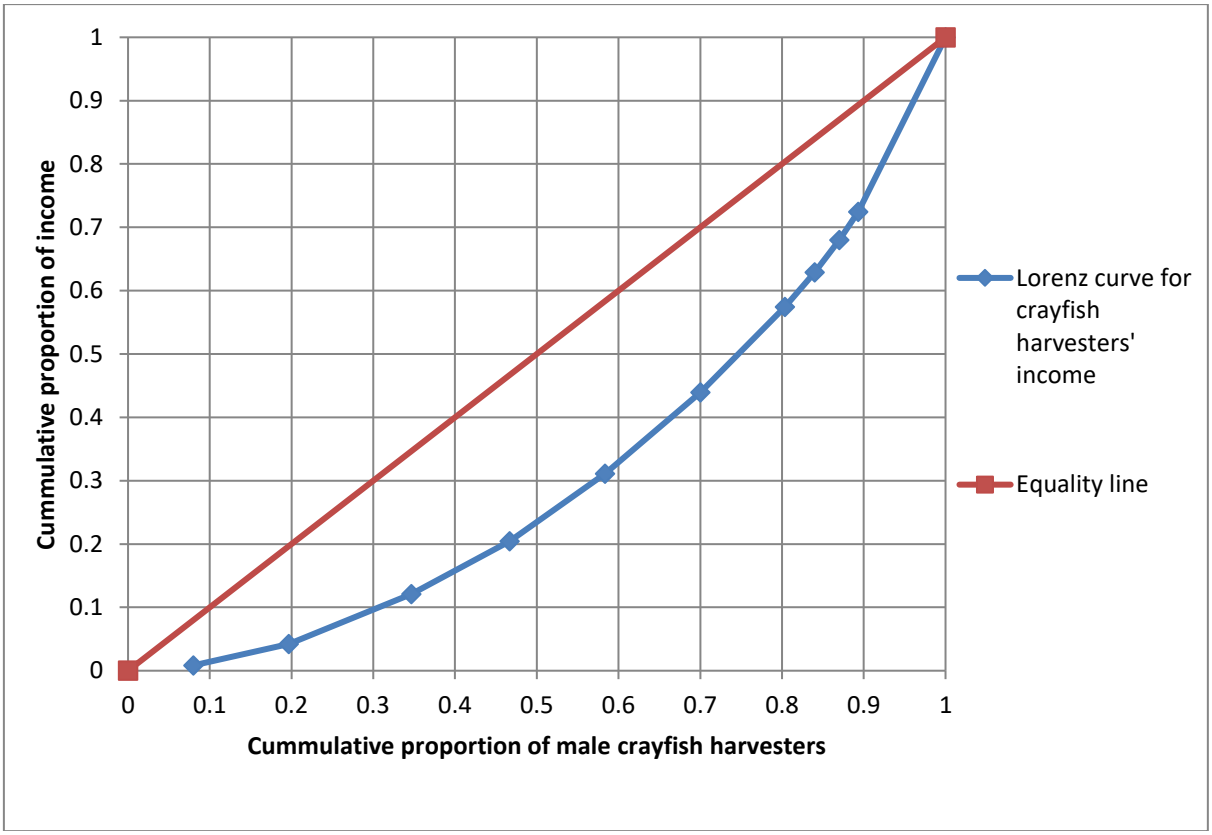


Figure 4.5: Lorenz curve of male headed households of crayfish harvesters based on total earned income

Source: Computed from field survey data, 2018.

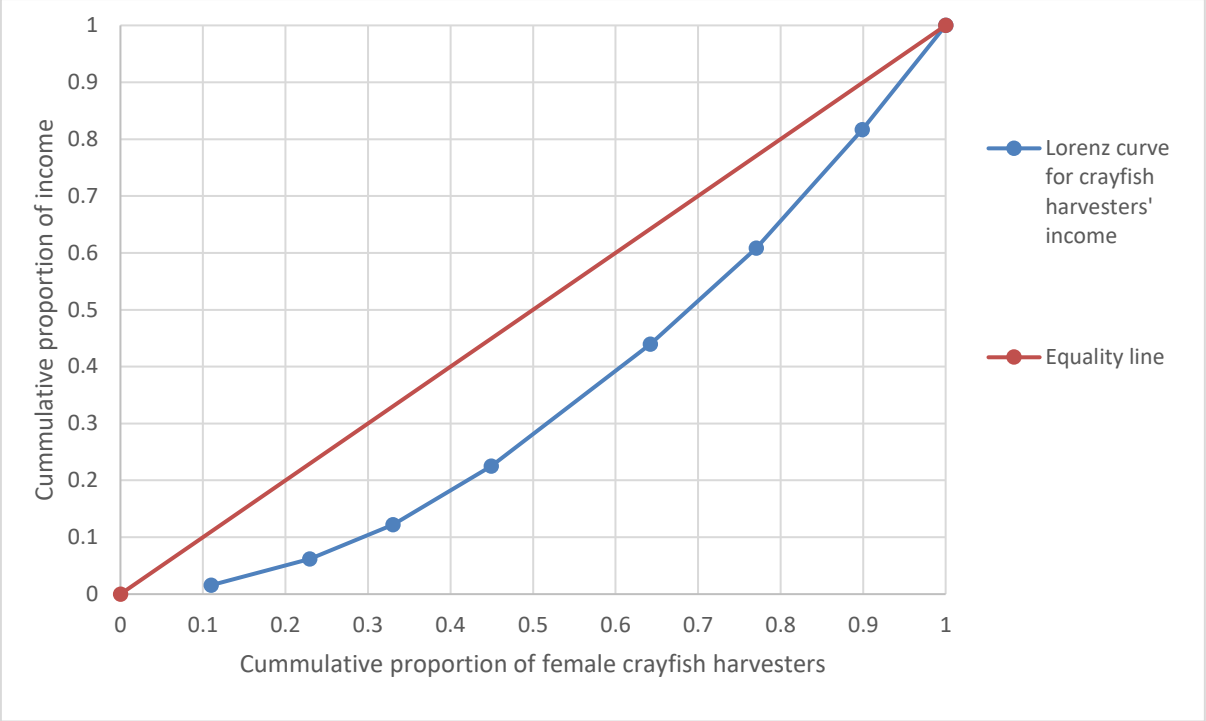


Figure 4.6: Lorenz curve of female headed households of crayfish harvesters based on total earned income

Source: Computed from field survey data, 2018.

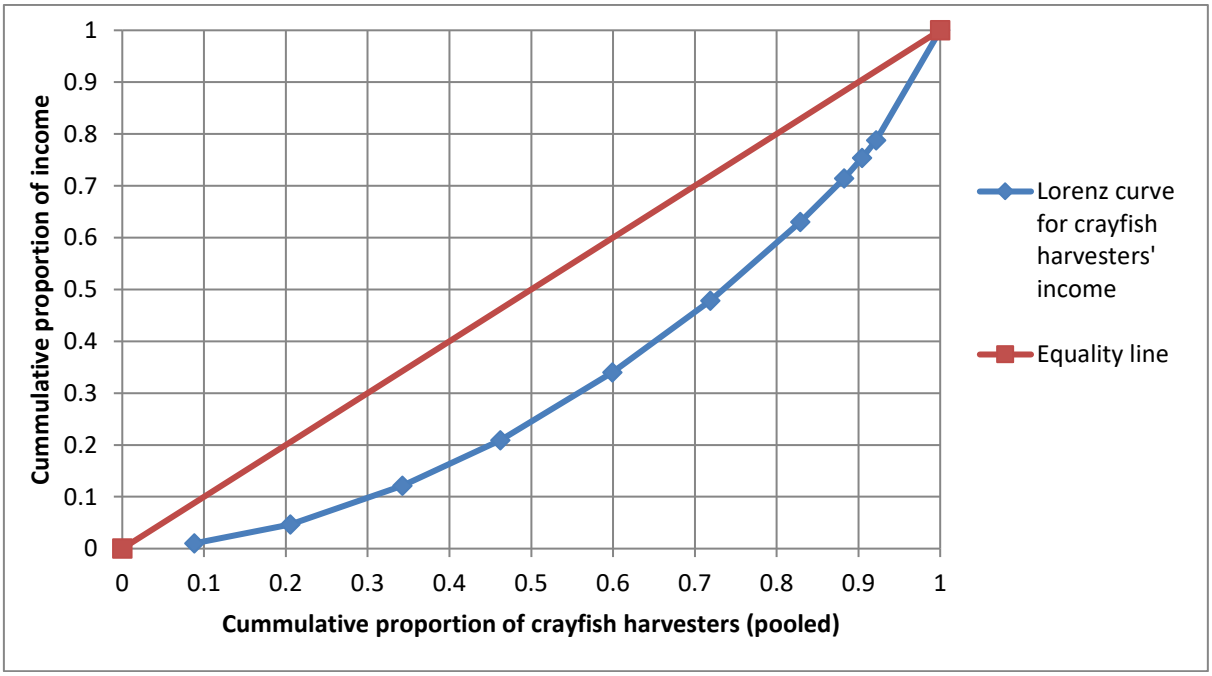


Figure 4.7: Lorenz curve of pooled crayfish harvesters in Niger Delta Area based on total earned income

Source: Computed from field survey data, 2018.

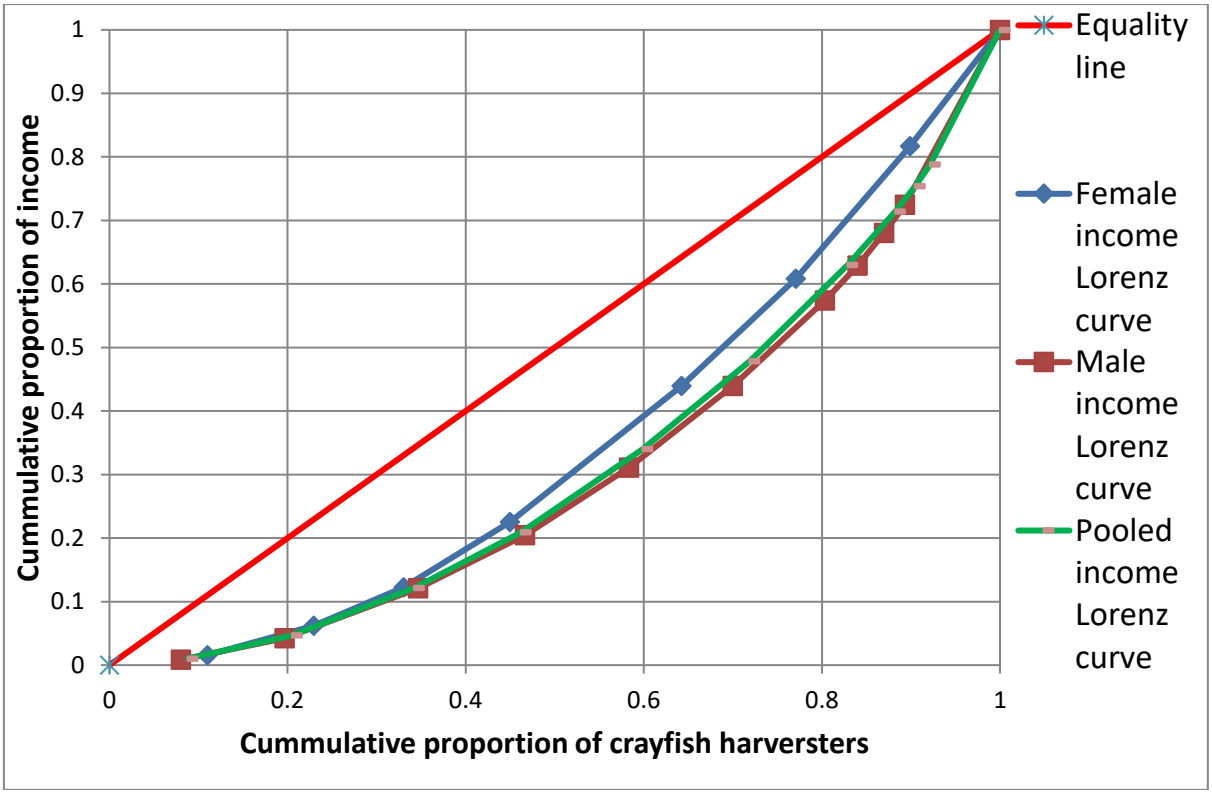


Figure 4.8: Generalized gender-based Lorenz curve of crayfish harvesters in Niger Delta Area based on total earned income.

Source: Computed from field survey data, 2018.

4.4 Poverty Status of Male and Female Crayfish Harvesters in Niger Delta Area

Poverty status among respondents in the area was analysed based on the three indicators of poverty presented in Table 4.6 of Foster, Greer, and Thorbecke (FGT) model. The indicators are as follows: the incidence of poverty, the poverty gap, and the severity of poverty. The poverty line was calculated as 2/3rd of the mean per capita income of crayfish harvesters in the study area. According to the findings in Table 4.6, the headcount index or incidence of poverty for male and female respondents was 0.383 and 0.587, respectively. This means that approximately 38% of males and 59% of females' respondents in the area were poor or had per capita income lower than the poverty line. The results show that, female respondents were poorer than their male counterparts in the area. These results correspond with the findings of Oluwatayo (2014), Sallawu *et al*. (2016), Adeyemi *et al.* (2019) on poverty and gender as well as Teka *et al*. (2019).

Table 4.6: Poverty status of male and female crayfish harvesters in Niger Delta Area

Poverty status	Male	Female	Pooled
Poverty incidence (Head count index)	0.383	0.587	0.396
Poverty depth (poverty gap index)	0.325	0.333	0.378
Poverty severity index	0.166	0.179	0.200
Poverty line (₦)	225850.52	181196.80	213950.14

Source: Computed from field survey data, 2018.

However, it is on record that the scourge of poverty is more noticeable on the female gender than the male in Nigeria (Oluwatayo, 2014; Edet and Etim, 2014a, b, Etim *et al*. 2020a). This may be ascribed to the effects of societal norms and power relations prohibiting women from equally accessing productive resources like the men. The women are not given free access to areas where crayfish seem relatively abundance in harvesting water zone of the creeks, estuaries, rivers and seas. According to Rajaratnam *et al*. (2016) norms and power relations that become institutionalised promote and legitimise the livelihood activities undertaken by resident women and men in the society. Other reasons could be large household sizes, high rate of sea pirate activities (raping, robbing, kidnaping and assault). Moreso, differences in harvesting experience, time of working hours and high level engagement of women in many other fishing activities such as processing, marketing and fetching of fire wood also contribute to the reasons why female crayfish harvesters are poorer than their male counterparts. However, the results disagree with Edoumiekumo *et al*. (2014), Ajewole *et al*. (2016) and Ogundipe *et al*. (2019) who reported that male headed households in the area and the country respectively are likely to be poor than the female headed households. The head count index for the pooled data was 0.396. This means that about 40% of the crayfish harvesters in the study area are poor or have per capita income below the poverty line income. The implication here is that the existence of poverty in the area is at the increasing rate. This scenario is a threat to livelihood and

general well-being of people in the area considering the poor environmental condition and skyrocketing high cost of living in the area. The findings are in consonance with the study of Nandi *et al*. (2014) and Etim *et al*. (2020a) who reported high poverty incidence for fish farmers and crayfish harvesters, respectively in the area.

The results of the findings in Table 4.6 also reveals that male respondents has a poverty depth of 0.325 while that of females was 0.333 in the study area. The findings imply that about 32.50% and 33.30% increase in per capita income are required to raise poor male and female respondents from poverty to the poverty line in the study area. The pooled population poverty depth index was 0.378, implying that about 37.80% of per capita income is required to lift poor crayfish harvesters from poverty to the poverty line.

The poverty severity index in the study area was 0.166 for male respondents and 0.179 for females, as shown in Table 4.6. This result indicates that about 16.60% increase in per capita income is required to lift male crayfish harvesters out of severe (extreme) poverty. Similarly, female crayfish harvesters required about 17.90% increase in per capita income to escape extreme poverty. The population had a severe poverty index of 0.200 on the average. This predicts that approximately 20.00% of per capita income is required to push away crayfish harvesters trapped by severe poverty. These results support the findings of Oluwatayo (2014) on poverty among smallholders' farmers in South Easthern Nigeria and Akpan *et al*. (2016) on level of income inequality and poverty among youth farmers in Akwa Ibom State. Conversely, the findings disagree with Adetayo (2014), Awotide *et al*. (2015) and Ajewole *et al*. (2016) who reported that male farmers and rural household males are poorer than their female counterparts in Ogun State, Oyo State and Nasarawa/Benue rice hub of Nigeria respectively. This may be due to regional, environmental, job and /or type of farm differences operational in the area.

4.5 Food Security Status of Crayfish Harvesters by Gender in Niger Delta Area

Results in Table 4.7 show the distribution of food security status of crayfish harvesters by gender in Niger Delta Area. The results indicate that 57.33% of the males, 40.37% of females and 52.57% of the pooled respondents were food secured while 42.67%, 59.63%, and 47.43% of males, females and the pooled sample of the crayfish harvesters were food insecured. This depicts that male's crayfish harvester in the area are more food secured than their female counterparts. This may be attributed to insecurity, social restrictions and gender violence against women in crayfish harvesting communities, thus making them loss interest in the harvesting activity that would have improve their income and make them more food secured. These results are in consonance with the findings of Agarwal (2012), Agwu and Oteh (2014) in Abia State, Fawehinmi and Adeniyi (2014) in Oyo State, Tibesigwa and Visser (2016) in South Africa, Grimaccia and Naccarato (2020). According to NBS (2012), Agwu and Oteh (2014), The Nigerian population, particularly women and children, lives in severe social desperation with many households becoming food in-secured and with limited access to resources that meet basic needs, resulting in nutritional deficiencies.

The findings in the pooled sample reveal that more than half the respondents (52.57%) were food secured though marginal. According to Tasie and Wilcox (2018), the efforts of men and women fisher involved in artisanal fishing enterprises contribute immensely to food and nutrition security and curbing hidden hunger in Nigeria. These findings are in line with Ajayi (2016) who study food security status of artisanal fishers and concerns of bycatch in Nigeria and USDA (2019). The mean per capita expenditure for males (₦10,724) was also higher than that of the females (₦8,241). Reasons may be due to the fact that women have limited access to harvesting resources (credit, board, outboard engine, and safety kit), information, technology and decision making bodies among others.

This scenario most times pushes females into prostitution, human trafficking and early marriage.

Table 4.7: Food security status of crayfish harvesters by gender in Niger Delta Area

Food security status	Male	Female	Pooled
Food secured	172 (57.33)	44 (40.37)	215 (52.57)
Food insecured	128 (42.670	65 (59.63)	194 (47.43)
Mean per capita expenditure (₦)	10724.25	8240.63	10062.36
2/3mean per capita expenditure (₦)	7149.50	5493.75	6708.24

Source: Computed from field survey data, 2018. Figure in parenthesis ( ) are percentages.

4.6 Decomposition of Gender Differences in Income Inequality, Poverty and Food Insecurity among Crayfish Harvesters in Niger Delta Area

This section discusses decomposition of gender differences in income inequality, poverty and food insecurity based on socioeconomic, demographic and institutional factors of crayfish harvesters in Niger Delta Area, Nigeria. However, inequality as used in this study is described as the dispersion of the distribution of attributes of the population's welfare indicators, such as income, expenditure, and consumption. Our welfare indicator is household income, as revealed in the previous chapter. Using the Theil decomposition, total inequality is decomposed into within and between group components based on gender, income sources, and other socioeconomic, demographic and institutional variables taken one at a time.

The variables comprise the age, marital status, household size, experience, education level of the head of the household, access to credit, extension visit, access to crayfish harvesting net among others. Based on the above sub groups, the property of decomposability is that the overall inequality can be expressed as a summation of two terms named ‘within’ and ‘between’ group inequalities. The within group indicates the degree (extent) of inequality as a result of the variations in individual income in each of these groups. The between

group quantifies the level of inequality examined due to the differences in the average incomes of each group. This can be valuable in identifying correlates of inequality. The first part of this section presents the results of the inequality status and decomposition analysis while the second and third part presents the Oaxaca- Blinder decomposition analysis for poverty and food insecurity.

4.6.1 Decomposition of income inequality by gender of household head of crayfish harvesters

Results in Table 4.8 show the decomposition of income inequality by gender of household head of crayfish harvesters. It indicates that 73.35% of crayfish harvesting households are headed by male while 26.65% are headed by the female in the study area. The males were also richer as their mean income of ₦2,550,000 and income share of 77.54% was higher than that of the females with mean income of ₦2,030,000 and income share of 22.46%. The results of the decomposition also indicate that the Theil index for male headed crayfish harvesters (0.2681) was higher than that of the females (0.1642). The implication is that the high level of income inequality by male crayfish harvesters will translate to high level of income inequality in the area. It will also imply that the effect of income inequality in the area will be felt mostly by female crayfish harvesters. will suffer from. However, the female crayfish harvesters tend to be more vulnerable to income inequality effects due to their low level of income and social restriction in the attainment of set goals. Some of the reasons behind this is the fact that men have more advantages and opportunities in resource allocation, rights and privileges than women. This finding is in line with the findings of Awotide *et al*. (2015) as well as Etim *et al*. (2020b)

However, the within group inequality accounts for 98.16% while the between group inequality accounts for 1.84%. This means that apart from inequality being mostly

contributed by the within group element (male or female), it is also being contributed by the between groups. Hence, effort should be made more toward reducing inequality within group while redistributive policy should also be developed to take care of between gender groups income inequality. This result support the earlier findings of Busayo and Olufunmilayo (2013), Adeosun and Owolabi (2021) in Nigeria; Chongvilaivan and Kim (2015) in Indonesia; Tobden (2017) in Bhutan. Nevertheless, the result disagrees with Tobden (2017) who opined that gender is not an important factor behind explaining total inequality. This disagreement is on the fact that the between group component contribution is more than 1%. Hence, there is need to redressed distributive criteria in some of the resources allocated to the crayfish harvesters of both genders. Etim *et al*. (2020) noted that when a between group component contributions is less than one percent, it means that it is not a prominent factor in overall expenditure or income inequality.

Table 4.8: Decomposition of income inequality by gender of crayfish harvesters

Gender	Income share	Population share	Mean income(₦)	Theil index
Female	0.2246	0.2665	2030000	0.1642
Male	0.7754	0.7335	2550000	0.2681
Within group				0.2448 (98.16)
Between group				0.0047 (1.84)

Source: Computed from field survey data, 2018. Figures in ( ) are percentages.

4.6.2 Decomposition of income inequality by income source of household head of crayfish harvesters

It should be of interest to ascertain the extent to which sources of income from a particular occupation contribute to overall income inequality and the role it played in widening of income disparity gap. Table 4.9 shows that crayfish harvesting was the main stay of employment (primary source of income) among the people in the study area. About 71% of the harvesters earned their living from crayfish harvesting with income share of 98% and

mean income being ₦2,370,000, while about 29% derive their income from non-crayfish sources with income share of about 2% and mean income being ₦108,000. Table 4.8 also reveals that the Theil index of income inequality from crayfish harvesting (0.2569) was higher than that of other source of income (0.1243). This connotes that income from crayfish harvesting which is the main economic activity of the harvesters contribute more to the income inequality. Conversely, the within gender group component of the inequality accounts for 48.26% slightly lower than the between gender group component (51.74%). This means that the income inequality gap among the crayfish harvesters is being widen more from the income of non-crayfish harvesting business (i.e., other income sources). That is, crayfish harvesters who's income are also derived from other source(s) of occupation contribute more to income inequality in the area than those deriving their income mainly from crayfish harvesting business alone. The result support the findings of Etim *et al*. (2020b), Adeosun and Owolabi (2021).

Table 4.9: Decomposition of income inequality by income source of crayfish harvesters

Income source	Income share	Population share	Mean income (₦)	Theil index
Crayfish harvesting	0.9813	0.7052	2370000	0.2569
Other sources	0.0187	0.2948	108000	0.1243
Within group				0.2544 (48.26)
Between group				0.2727 (51.74)

Source: Computed from field survey data, 2018. Figures in ( ) are percentages.

4.6.3 Decomposition of income inequality by socioeconomic and demographic factors of household head of crayfish harvesters

The general wellbeing of an individual is most times being driven and sustained by socioeconomic, demographic and institutional factors. These factors include: education,

age, experience, household size, access to credit, access to extension services and access to productive tools. These factors in most cases also determined the level of income inequality and other unfavourable issues operating among individuals in the community or country. Hence, proper understanding of the analysis of these factors will play vital role in the development and implementation of policies needed to reverse such unpleasant issues.

Table 4.10 shows the decomposition of income inequality by socioeconomic and demographic factors of household head of crayfish harvesters in the study area. The results show that the mean income of crayfish harvesters increased and then decreased with age. These findings is in line with the analogy that household income usually increases gradually with the age of the household head until it reaches a certain age after which it begins to decline. However, income inequality of 0.3197 was recorded as the highest by the crayfish harvesters with age range of 20 to 30 years. The mean income, population share and income share were ₦2, 240,000, 0.2323 and 0.2156 respectively. Though, this inequality was not from the age group with highest mean income (31 – 40) as expected. This means that crayfish harvesters with younger age contributed more to the total inequality than the older one.

The within group component of the inequality stood at 0.2481 accounting for 99.32% of the total inequality in the area. While the between group component of 0.0014 accounted for 0.68% of the total inequality in the study area. This implies that the disparity 'between' in the age group is not prominent in the overall inequality. It also suggests that the age is not important determinant factor capable of explaining inequality among the crayfish harvesting households, as the bulk of the inequality still occurs between individuals of the same age group. That is, it is the inequality within the age bracket that largely explains

total inequality and not the differences in age of household heads. The findings are in tandem with the findings of Seriño (2014), Tobden (2017), Adeosun and Owolabi (2021).

The decomposition of income inequality by marital status as shown in Table 4.10 reflects that singles with population share of 0.1345, income share of 0.1370 and mean income of ₦2,460,000 recorded the highest inequality index of 0.3004 to the total income inequality among the harvesters. This is contrary to *a priori* expectation while the divorced with 0.0465 population share, 0.0506 income share and ₦2,630,000 mean income recorded the lowest inequality index of 0.0376. This means that differential gap of income inequality was mostly widened by income of single (unmarried) crayfish harvesters. While the divorced tend to be most vulnerable to income inequality. The result also reflected that the within group component contributed 99.20% to the total inequality depicting that the widening of the gap were from differences in individual income of the same marital group. These findings are in line with the findings of Adeosun and Owolabi (2021) who reported that unmarried men and women contributed the highest to inequality in expenditure and within group component contributed the highest percentage to total inequality in their study. Thus, when considering policies to reduce inequality, allowances must be made for the more vulnerable groups especially women such as widowed, divorced or abandoned.

Subsequently, results in Table 4.10 also indicate that there is a positive relationship between the educational attainment of the household head and the mean income. That is, the higher the educational attainment of the household's head, the higher the household's mean income. Tertiary education had the highest mean income of ₦3,430,000 with the lowest population share of 0.1222. The results also show that the inequality index is higher in households with primary education (0.3082), implying that income variability is more pronounced in this group. The income shares for primary education stood at 0.5074, with the population share of 0.5306 and mean income of ₦2,310,000 which is the lowest mean

income compared to non-formal education. This may be due to lack of proper funding of primary education in the area when considering high population share of the group to total population. It was also observed from the result that 99.28% of the total inequality which is the highest was attributed to within education group inequality component, while 0.72% was attributed to between education inequality components. The implication is that, though household heads may have the same educational level, their incomes are highly influenced by their employment activities, which also determine the structure of earnings, resulting in differences in earnings and thus mean income. Therefore, policies aimed at reducing within education group component of inequality becomes pertinent. The findings are in agreement with Militarua and Stanila (2015) in Romania, Tobden (2017) in Bhutan, as well as Adeosun and Owolabi (2021) in Nigeria.

In terms of household size, the results in Table 4.10 further show that crayfish harvesters with household size 1 – 5 had a population share of 0.2078, income share of 0.1992, mean income of N2,300,000 and recorded the highest inequality index (0.3238). While the respondents with household size 11 and above recorded the lowest (0.1874) inequality index. This implies that crayfish harvesters with household size 1 – 5 contributed more to total inequality in the region than others while household size 11 and above are the most vulnerable to income inequality than others. The scenario may have been as a result of income poverty on the latter. However, the within group component accounts for more than 99% of total inequality. In other words, equalizing household size will have very little effect on the overall inequality in the region. This result is in consonance with a priori expectation and support the findings of Tobden (2017), Adeosun and Owolabi (2021). Accordingly, Precupetu (2013) opines that the most vulnerable in terms of poverty risk are children, youths, women, families with dependent children (especially those with three or more children), single people with and without dependent children, the unemployed, aged people, self-employed in small scale agriculture, and low-skilled workers. In addition, a greater proportion of the poorest among these groups of people live in rural area.

Table 4.10: Decomposition of income inequality by socioeconomic and demographic factors of crayfish harvesting household heads.

Socioeconomic factors	Income share	Population share	Mean income (₦)	Theil index
Age				
20 – 30	0.2156	0.2323	2240000	0.3197
31 – 40	0.3492	0.3276	2570000	0.2356
41 – 50	0.3371	0.3423	2370000	0.2319
>50	0.0982	0.0978	2420000	0.1910
Within group				0.2481 (99.32)
Between group				0.0014 (0.68)
Marital status				
Married	0.6676	0.6699	2400000	0.2686
Single	0.1370	0.1345	2460000	0.3004
Widow/Widower	0.1448	0.1491	2340000	0.1850
Divorced	0.0506	0.0465	2630000	0.0376
Within group				0.2492 (99.20)
Between group				0.0003 (0.80)
Education				
Non formal	0.1948	0.1907	2460000	0.1948
Primary	0.5074	0.5306	2310000	0.3082
Secondary	0.2804	0.2665	2540000	0.1880
Tertiary	0.0174	0.0122	3430000	0.0312
Within group				0.2476 (99.28)
Between group				0.0019 (0.72)
Household size				
1 – 5	0.1992	0.2078	2310000	0.3238
6 – 10	0.5997	0.5770	2510000	0.2440
11 – 15	0.1996	0.2127	2260000	0.1874
>15	0.0016	0.0024	1570000	0.0000
Within group				0.2482 (99.52)
Between group				0.0012 (0.48)
Experience				
1 – 10	0.1570	0.1663	2280000	0.3463
11 – 20	0.4316	0.3985	2610000	0.2412
21 – 30	0.2993	0.3203	2250000	0.2320
31 – 40	0.1084	0.1076	2430000	0.1610
41 – 50	0.0037	0.0073	1220000	0.1791
Within group				0.2460 (98.64)
Between group				0.0034 (1.36)
Access to outboard engine				
Yes	0.2480	0.1932	3010000	0.2161
No	0.7520	0.8068	2250000	0.2484
Within group				0.2404 (96.39)
Between group				0.0091 (3.61)
Access to harvesting net				
Yes	0.2320	0.2176	2570000	0.2213
No	0.7680	0.7824	2370000	0.2572
Within group				0.2488 (99.76)
Between group				0.0006 (0.24)
Access to safety kit				
Yes	0.1665	0.1809	2220000	0.2341
No	0.8335	0.8191	2450000	0.2516
Within group				0.2487 (99.72)
Between group				0.0007 (0.28)

Source: Computed from field survey data, 2018. Figures in ( ) are percentages.

The decomposition of income inequality based on experience is also shown in Table 4.10. The results portray that respondents with experience 1 – 10 years recorded the highest

inequality index of 0.3463 against those with experience 31–40 which recorded the lowest inequality index of 0.1610. The within group component of inequality accounted for 98.64% while the between group component accounted for 1.36% of total inequality in the region. This portends that the inequality gap is mostly widen in the within group (i.e. respective years of experience group) than between groups. Therefore, distribution and redistribution policy should be repeal and effectively implemented. Subsequently, there is need for policies that will also reduce between group component inequalities effects apart from that of within group component effect. The induction of more women into the crayfish harvesting business and removing all form of barriers to enhance their operations will not be out of place. Busayo and Olufunmilayo (2013), Seriño (2014), Etim *et al*. (2020) enumerated prior work experience, occupational segregation and discrimination among others as causes of income inequality in Nigeria.

Table 4.10 also presents decomposition of income inequality by access to outboard engine, crayfish harvesting net and safety kit. The result indicates that lack of access to outboard engine, crayfish harvesting net and safety kit also contributed highly to total inequality in the region. Their inequality index was 0.2484, 0.2472 and 0.2516, respectively. Consequently, the within group component of inequality for access to outboard engine, crayfish harvesting net and safety kit were 0.2404, 0.2488 and 0.2487, accounted for 96.39%, 99.76% and 99.72% of the total inequality in the area; while the between group component accounted for 3.61%, 0.24% and 0.28%, respectively. This depicts that the within group component of inequality contributed the highest to the total inequality than the between group component of inequality (i.e., the widening of inequality gap in the region is a function of harvesters' non-accessibility to harvesting inputs and safety tools). However, the between group component of inequality for access to outboard engine contributed 3.61% to total inequality which is the highest in the between group components across all the socioeconomic and institutional factors of inequality so decomposed.

This demonstrates that apart from within gender group inequality, inequality between gender group for access to outboard engine by the household head also account reasonably for inequality among the crayfish harvesting households in the region though not outstanding. Therefore, enactment of policy that will reduce class-access to productive tools will also reduce the total inequality in the region. According to Awotide *et al*. (2015) and Tobden (2017) women have limited access to resources even though they may be involved in variety of agricultural activities. Busayo and Olufunmilayo (2013) stressed that women in many developing countries face income inequality and poverty on a continuous basis due to the patriarchal nature of their societies. When it comes to income inequality, poor women and less privileged men are often marginalized and disenfranchised.

4.6.4 Decomposition of income inequality by institutional factors of crayfish harvesting household heads

Table 4.11 show the decomposition of income inequality by institutional factors of crayfish harvesting household heads. It portrays the decomposition of income inequality by access to credit, extension visit and membership of association. The result revealed that crayfish harvesters with access to credit (0.3259), extension visit (0.2563) and membership of association (0.3079) inequalities contributed more to total income inequality in the study area. Though they all have low income share, population share and mean income as reflected in Table 4.11. This may be due to few numbers of crayfish harvesters having access to aforementioned institutional factors in the area. In the similar way, the within group component of inequality for access to credit, access to extension visit and membership of association accounted for approximately the total inequality compared to the between group component of the same factors. This depicts that the disparity between access and non-access group inequality is not significant in overall inequality. Hence, reduction in inequality should be based on within group policies. These results support the findings of Tandrayen-Ragoobur and Pydayya (2016), Tobden (2017).

Table 4.11: D**ecomposition of income inequality by institutional factors of crayfish harvesting household heads.**

Institutional factors	Income share	Population share	Mean income (₦)	Theil index
Access to credit				
Yes	0.0798	0.0831	2320000	0.3259
No	0.9202	0.9169	2420000	0.2427
Within group				0.2494 (100)
Between group				0.0001 (0.00)
Extension visits				
Yes	0.2562	0.2518	2450000	0.2563
No	0.7438	0.7482	2400000	0.2293
Within group				0.2494 (100)
Between group				0.0000 (0.00)
Membership of Association				
Yes	0.2114	0.2103	2420000	0.3079
No	0.7886	0.7897	2410000	0.2337
Within group				0.2494 (100)
Between group				0.0000 (0.00)

Source: Computed from field survey data, 2018. Figures in ( ) are percentages.

4.6.5 Decomposition of gender differences in poverty among crayfish harvesters in Niger Delta Area

4.6.5.1 *Determinants of gender poverty differentials among crayfish harvesters in Niger Delta Area.*

Table 4.12 presents Determinants of gender poverty differentials among crayfish harvesters in Niger Delta Area under Oaxaca- blinder decomposition model. It is the preliminary results of decomposition in order to fully understand the impact of gender differences in poverty among the crayfish harvesting household in the study area. The log likelihood ratio statistics as indicated by χ^2 statistics of 86.89, 90.81 and 170.15 for female, male and pooled data are highly significant at ($P < 0.0000$), suggesting the model has a strong explanatory power.

Results in Table 4.12 reveal that for the pooled sample, age, gender, marital status, household size, income of crayfish harvesting, and income of other sources are the major determining factors of poverty in the study area. The coefficients of age, and marital status

(both significant at 10%) and household size (significant at 1%) were positive with the regressand. This implies that increase in the value of any of these variables will lead to increase in the probability of being poor. This also means that a unit increase in age, marital status and household size will result in 49.28%, 54.61% and 21.14% increases in poverty among the crayfish harvesters in the study area, respectively. For instance, as the respondent increases in age, the likelihood of being poor rises. This can be justified by the fact that as respondents age increases, strength and productivity declines, and they become more prone to health problems. Older people also tend to have more responsibilities than the average aged people. Hence, more responsibilities go with age which translates into more expenditures. Household size also increases the likelihood of being poor because increment in household size may directly or indirectly reduce income per head (per capita income), increases household expenses and as well impair standard of living of the households.

On the other hand, education (significant at 10%), gender, income from crayfish harvesting and income from other sources (significant at 1%) had negative relationship with poverty in the study area. Thus, an increase in a unit value of any of these variables, rises the probability of crayfish harvesters not being poor in the study area. This implies that a female respondent with increased level of income in crayfish harvesting and other income sources may likely be non-poor in the area. These findings support the studies of Igbalajobi *et al*. (2013) in Ondo State, Oluwatayo (2014) in South Eastern Nigeria, Oladimeji *et al*. (2014) in Kwara State, Edoumiekumo *et al*. (2014) in South South Nigeria, Owuor *et al*. (2017) as well as Baser and Kaynakci (2019).

However, amount of credit obtained, membership of cooperative, access to outboard engine and access to crayfish harvesting net with exception of extension contact, were negatives and conformed to a *priori* expectation but were not significant. This implies that

they are negatively related to poverty meaning they have affinity of increasing the probability of crayfish harvesters being non- poor in the study area. These results disagree with the findings of Etuk *et al*. (2015) but consistent with the findings of Sekhampu (2013) who reported that no significant effect on the poverty status is made by the cooperative member of the head of the household.

Table 4.12 also reveal that in the case of males, age, marital status and household size were positive and significant at 10%, 5% and 1% levels, respectively. While income of crayfish harvesting, income of other sources and constant term were negative and significant at 1%, 5% and 1% level of significance, respectively. This implies that a unit increase in age, marital status and house-hold size will increase the likelihood of male crayfish harvesters being poor while a unit in-crease in income from crayfish harvesting and income from other sources will tend to increase the likelihood of crayfish harvesters being non-poor. Similar to the result of pooled data, education level, amount of credit obtained, membership of cooperative and access to outboard engine with exception of access to crayfish harvesting net were negative and conformed to a *priori* expectation.

In addition, the female data of Table 4.12 shows that household size and labour have positive relationship with poverty status of the respondents and was significant at 1% and 10% probability level. This indicates that as the unit of household size and labour increase among the crayfish headed harvesters, the probability of being poor increases. On the other hand, income from crayfish as well as other sources and access to harvesting net were negatives and significant at 1%, 10%, and 5% level of probability respectively. This also implies that they have negative relationship with poverty and as they increase, the probability of female headed crayfish harvesters being poor reduces.

Comparing the results of male and female respondents, it shows that household size was positive and significant at 1% in both genders. But age and marital status were positive and significant at 10% and 5% level of probability for male crayfish harvesters while labour was positive and significant at 5% level of probability for female harvesters. This means that they were the major determinants of poverty inducement for their respected group in the study area. For instance, in term of males, as the respondents get older, the possibility of being poor rises. This can be justified by the fact that elderly male persons decline in strength, vigour and productivity. They also have health problems faster than their female counterparts as they get older. Hence, they always demand for more and better care than the females who will still be doing some menial job to take care of themselves. The males were also more involved in polygamous marriages than females. This act of marrying more wives lead to more children, more dependent, and more financial responsibilities. This also leads to a reduction in per capita income of the male headed households.

In terms of the females, most of the female headed households are made up of singles, divorcees and widows. They make use of more labourers in order to complement the absence of husbands in their lives thus increasing the burden of family care, maintenance and training of children. The constant term of the male respondents was positive and significant at 1% level of probability. This means that female harvesters were more vulnerable to poverty in the area than the males. These findings support the studies of Edoumiekumo *et al*. (2014), Shettima *et al*. (2014), Owuor *et al*. (2017), Ogundipe *et al*. (2019) and Etim *et al*. (2020a).

Conversely, income of crayfish harvesting and income from other sources were negative and significant in both gender but the later was significant at 10% for females while that of males was at 5 probability level. Access to crayfish harvesting net was negative and significant at 5%. These imply that these variables are the major determinants of making

the crayfish harvesters' non-poor in the study area. These findings are in agreement with Igbalajobi *et al*. (2013), Shettima *et al*. (2014), Oladimeji *et al*. (2014), Ajayi (2016) and Altuzarra *et al*. (2021) who reported that accesses to both fishing and non-fishing income are also important determinants of wellbeing in the study area. Other sources of income activities complement crayfish harvesting income by providing the household with additional resources for both consumption and investment. The Investment, in return, increases asset accumulation and opens up additional escape routes out of poverty.

Results in Table 4.12 also reveal that the coefficient for gender in the pooled sample has negative relationship with poverty and was significant at 1% probability level. This implies that the more female headed crayfish harvesting households are empowered and increased in the profession, the more the probability of reducing gender differences in poverty among the crayfish harvesters in the study area. The results support the findings of Oluwatayo (2014), Baser and Kaynakci (2019), Altuzarra *et al*. (2021) but disagree with Awotide *et al*. (2015), Tharp *et al*. (2019) and Teka *et al*. (2019). However. OECD (2015) noted that there is no chance of making poverty history without significant and rapid improvements in the well-being of women and girls.

Table 4.12: Determinants of gender differentials in poverty among crayfish harvesters in Niger Delta Area.

	Female harvesters			Male harvesters			Pooled data		
Variables	Coefficient	Std. error	Z- value	Coefficient	Std. error	Z- value	Coefficient	Std. error	Z- value
Age (years)	-0.0651	0.1075	-0.61	0.0466	0.0394	1.51*	0.4928	0.0281	1.75*
Education level (years)	0.0181	0.1041	0.17	-0.0643	0.0601	-2.74**	-0.2692	0.1573	-1.71*
Marital status	-0.5671	0.7301	-0.78	0.8482	0.4090	2.07**	0.5461	0.3257	1.68*
Household size	0.3639	0.1162	3.13***	0.1988	0.0519	3.83***	0.2114	0.0430	4.92***
Experience (years)	0.0747	0.1029	0.73	0.0131	0.0330	0.40	0.0070	0.0295	0.24
Amount of credit obtained (₦)	-7.89e07	2.22e-06	-0.36	-3.04e-07	1.15e-06	-0.26	-6.07e-07	9.41e-07	-0.65
Mem. of cooperative (dummy)	-0.0545	0.8859	-0.06	-0.0959	0.3857	-0.25	-0.2129	0.3360	-0.63
Labour (man-days)	0.0615	0.0306	2.01**	-0.0033	0.0082	-0.40	-0.0009	0.0077	-0.11
Extension visits (days/ year)	-0.3072	0.6755	-0.45	0.3192	0.3136	1.02	0.2351	0.2686	0.88
Income of crayfish harvesting (₦)	-2.14e-06	4.88e-07	-4.38***	-1.02e-06	2.01e-07	-5.05***	-1.22e-06	1.77e-07	-6.91***
Income of other sources (₦)	-0.0001	7.57e-06	-1.58*	-5.58e-06	2.53e-06	-2.21**	-7.11e-06	2.33e-06	-3.05***
Access to outboard engine	0.9895	1.0096	0.98	-0.3514	0.4238	-0.83	-0.1412	0.3664	-0.39
Access to crayfish harvesting net	-2.4044	1.0144	-2.37**	0.0130	0.4196	0.03	-0.2748	0.3614	-0.76
Access to safety kit	1.3306	0.8809	1.51	0.0084	0.4070	0.02	0.1712	0.3455	0.50
Gender (male = 1, female = 0)	-	-	-	-	-	-	-2.0393	0.3809	-5.35***
Constant term	1.5273	2.2752	0.67	-2.7452	0.8787	-3.12***	-0.3708	0.7971	-0.47
Log likelihood	31.88			149.44			190.35		
LR chi2 (14) and (15) for pooled	86.89***			90.81***			170.15***		
Prob > chi2	0.0000			0.0000			0.0000		
Pseudo R^2	0.5767			0.2330			0.3089		
No. of observation	109			300			409		

Source: Computed from field survey data, 2018. Note: ***, ** and * are significant levels at 1%, 5% and 10% respectively.

4.6.5.2 *Oaxaca Blinder (OB) threefold decomposition of the gender differences in poverty among crayfish harvesters in Niger Delta Area*

The logistic regression-based Oaxaca-Blinder decomposition method was used to analyse the sources of gender differentials gap in poverty between the male and female headed crayfish harvesters in the study area. From the preceding sections of logistic regression estimates of gender poverty determinants among crayfish harvesters, the empirical analysis has identified the existence of gender differentials gap in the study area investigated. However, what is more important, especially for policy makers, is to understand the reasons for these gaps in order to propose interventions measures that will likely reduce the gap.

Table 4.13 show the results of the threefold Oaxaca-Blinder decomposition of the gender differentials in poverty among the crayfish male and female headed households in Niger Delta Area. It summarizes the main findings by group of covariates in Table 4.12. The first panel of the logistic regression-based O-B decomposition results as presented in Table 4.13 shows the mean gender poverty level predictions by groups and their differences. It shows that the mean poverty level for female and male crayfish harvesters was 0.5321 and 0.3533 resulting to a poverty gap of 0.1788. They were all significant at 1% level of probability. These findings are in line with Mukasa and Salami (2015) in Nigeria, Morgado and Salvucci (2016) in central and northern part of Mozambique as well as Tobden (2017) in Bhutan.

Furthermore, the second panel of the decomposition results is divided into three parts. The first part which is the respondent's 'endowment' reflects the mean increase in poverty level of the female respondents if they had the same endowment as the males. The second part quantifies the change in the females' poverty when applying the males' 'coefficients' to the current level of females' characteristics. The third part is the 'interaction' term which measures the simultaneous effect of differences in the endowments and coefficients.

The threefold decomposition analysis reports gender differentials gap of -0.0963 (-53.86%) due to endowment, 0.2669 (149.27%) due to coefficients and 0.0082 (4.59%) due to interaction. Accordingly, the differences due to endowment or composition effect (i.e. the part of the gender poverty differential gap due to differences in the levels of observables characteristic or poverty determinants between male and female headed crayfish harvesting households) was negative and significant at 5% probability while the differences due to coefficients or structural effect (i.e. the portion of the gender differential attributable to the returns of the same observables characteristic or effect of poverty determinants) was positive and significant at 1% probability level. Consequently, the coefficients for interaction was positive but not significant.

These mean that female respondents would benefit more from better endowments than their male counterparts, whereas males have a clear structural advantage in terms of the returns of observable characteristics. This further implies that the gender differentials gap among the crayfish harvesters in the area is majorly caused by female structural disadvantage (coefficients effect) otherwise known as discriminations effect. The outcome of the results may be due partly to the intrinsic behavioural characteristics of the two genders such as their managerial ability, status of their education level, number of hours spent in the crayfish harvesting business, level of commitment, level of strength and partly due to bias and discrimination against one gender (female) which is embedded in the family stereotypes, societal norms and customs

As opined by Oseni *et al*. (2014) a positive coefficient widens the gender gap whereas a negative coefficient reduces the gender gap. These results agree with Lubrano (2016) findings in the study of extending the approach of Oaxaca to explain the difference that there exist a baseline gap of being poor between Serbs and Albanian households in Kosovo.

The results are also in line with Mukasa and Salami (2015) in the study of Gender productivity differentials among smallholder farmers in Africa: A cross-country comparison and Oseni *et al*. (2015) on the explanation of gender differentials in agricultural production in Northern Nigeria but disagreed with the author in that of Southern Nigeria excluding the West whose report was otherwise. In addition, these results are consistent with the study of Cowling *et al*. (2019) on gender and bank lending after the global financial crisis: are women entrepreneurs safer bets?

The third panel which inferably is the last part of Table 4.13 shows the detailed decomposition of the three (3) sources of gender differentials gap in poverty. Determining whether the poverty gap between the male and female respondents is more dependent on differences in the level of the determinants (covariates effects) or on differences in the effects of the determinants (coefficients effects) is critical for designing the appropriate intervention measures and policies aimed at reducing the gender differences. If the gender differentials gap is due to differences in the effect of the determinants (structural effect), then the redistribution of endowments factors would not be sufficient to improve poverty level of the females, since the impact of the endowment factors are weaker among the female respondents. Gender mainstreaming, training and awareness programmes would be necessary interventions to bridge the gap between the two genders. However, if the gender differential gap in poverty is due to differences in the level of the determinants (covariate effect), then redistribution of endowments factors and improvement in the female's poverty determinants would be an effective policy to reduce gender poverty differences.

In this study as shown in Table 4.13, the endowments effect is mostly explained by differences in household size, income of crayfish harvesting and marital status of the respondents. Household size is positive and significant at 1% while income of crayfish

harvesting and marital status are negative and significant at 1% and 5% probability level respectively. This implies that improvement in the magnitude of household size would tend to be more effective in enhancing the poverty status of the male respondents while improvement in the magnitude of income of crayfish harvesting and marital status would be more effectives in enhancing the poverty status of the female counterparts in the study area. The negative endowment effect therefore suggests that policies targeted at improving women's endowments in both income of crayfish harvesting and marital status, and improvement on female respondents' poverty determinants might be more effective in addressing the observed gender differences in poverty.

The sources of the structural effect, like the endowment effect, differ across genders. Education, and use of labour appear to be more effective on male headed crayfish harvesters in the area. They were positive and significant at 10% and 5% level of probability. Whereas, income of crayfish harvesting, access to crayfish harvesting net and marital status all have a strong influence on the magnitude of the structural effect on female headed crayfish harvesters in the study area. They carry negative signs and were significant at 5%, 5% and 10% level of probability, respectively. The constant term of the structural effect was positive and significant at 10% probability. This implies that male respondents will benefit more from returned to observable characteristics than the female counterparts. This may be due to lack of proper education, female restrictions in access to higher education and harvesting resources. Others are traditional practice of norms and custom, cultural barriers, belief and local laws operating against females in the area, under value of women potentials and contributions to crayfish harvesting business, general marginalization and bias against women ideology.

In the interaction effect, none of the variables were significant. However, the magnitude of most number of the variables carried negative sign which signifies that effective redistribution and use of the variables would have been beneficial to women in reducing poverty incidence among them in the area. Finally, looking at the detailed decomposition, it is clear that the coefficients effect of the constant term is the main reason why females have a higher poverty incidence. Though females have better characteristics that can lower poverty incidence and make them benefit from these characteristics more than males, there is a large baseline gap in poverty incidence between the two gender groups, as captured by the coefficients effect of the constant term. Hence, for poverty incidence to be mitigated in the area and gender poverty gaps reduced among the crayfish harvesters, policy formulation and intervention programmes should be geared towards gender integration. Women should be given free access to resources and opportunities as well as inclusion in policy formulation, implementation and effective monitoring of programmes meant for their welfare. These findings are in support of Aguilar *et al*. (2014), Mukasa and Salami (2015), Lubrano (2016), Tobden (2017) and Nyamuhirwa (2019).

4.6.5.3 *Oaxaca-Blinder (O-B) twofold decomposition of the gender differences in poverty among crayfish harvesters in Niger Delta Area*

This section decomposed gender differences in poverty (based on Oaxaca-Blinder twofold technique) into explained component (part due to group gender differences in the magnitude of poverty the determinants) otherwise known as endowment or composition effect; and unexplained component (part due to group gender differences in the effect of such poverty determinants) or structural effect. The analysis of the decomposition as shown in Table 4.14 (panel 1) reveal similar results like that of threefold decomposition earlier discussed in Table 4.

Table 4.13: Oaxaca Blinder three-fold decomposition of gender differentials in poverty among crayfish harvesters in Niger Delta Area

1	**Gender differentials**								
Category	Coefficient	Std. error	Z value						
Female	0.5321	0.0438	12.15***						
Male	0.3533	0.0281	12.57***						
Differentials gap	0.1788	0.0521	3.43***						
2	**Aggregate decomposition**								
	Endowments effect (E)			**Coefficients effect (C)**			**Interaction effect (CE)**		
	Coefficient	Std. error	Z value	Coefficient	Std. error	Z value	Coefficient	Std. error	Z value
Total	-0.0963	0.0390	-2.47**	0.2669	0.0613	4.35***	0.0082	0.0569	0.14
% share of differentials gap	-53.86%			149.27%			4.59%		
3	**Detailed decomposition**								
Variables	Coefficient	Std. error	Z value	Coefficient	Std. error	Z value	Coefficient	Std. error	Z value
Age (years)	-0.0143	0.0112	-1.28	-0.6351	0.6070	-1.05	0.0092	0.0516	0.18
Education level (years)	-0.0054	0.0058	-0.92	0.1433	0.0840	1.71*	0.0020	0.0118	0.17
Marital status	-0.0455	0.0222	-2.05**	-0.1601	0.0988	-1.62*	0.0203	0.1126	0.18
Household size	0.0333	0.0134	2.48***	0.1278	0.0913	1.40	0.0074	0.0420	0.18
Experience (years)	-0.0035	0.0091	-0.39	0.1850	0.3160	0.59	-0.0044	0.0258	-0.17
Amount of credit obtained (₦)	-0.0004	0.0016	-0.24	-0.0021	0.0109	-0.19	-0.0002	0.0012	-0.14
Membership of cooperative (dummy)	-0.0013	0.0052	-0.25	0.0011	0.0249	0.04	0.0015	0.0038	0.04
Labour (man-days)	0.0011	0.0027	0.39	0.3911	0.1719	2.28**	-0.0055	0.0301	-0.18
Extension visits (days per year)	0.0028	0.0035	0.79	-0.0230	0.0269	-0.86	-0.0015	0.0080	-0.18
Income of crayfish harvesting (₦)	-0.0623	0.0204	-3.06***	-0.2289	0.1069	-2.14**	-0.0183	0.0945	-0.19
Income of other sources (₦)	-0.0005	0.0044	-0.12	-0.0410	0.0520	-0.80	-0.0002	0.0016	-0.10
Access to outboard engine	-0.0005	0.0020	-0.25	0.0365	0.0292	1.25	0.0005	0.0034	0.15
Access to crayfish harvesting net	0.0001	0.0033	0.03	-0.0692	0.0300	-2.30**	-0.0050	0.0263	-0.19
Access to safety kit	0.0001	0.0044	0.02	0.2966	0.0215	1.38	0.0038	0.0209	0.18
Constant				0.6118	0.3406	1.80*			

Source: Computed from field survey data, 2018. Note: ***, **, * are significant levels at 1%, 5% and 10% respectively.

The aggregate decomposition results depict that out of 17.88% gender poverty differentials gap, -82.72% is ascribed to explained component or endowment effect while 182.72% is ascribed to unexplained component or structural effect. The negative sign of the explained part implies that female respondents would benefit more from better endowments than their male counterparts, while the males have a clear structural advantage in terms of the returns of observable characteristics. This may be attributed to gender stereotype, anti-female attitude, lack of awareness of rights and privileges by females, non-availability of proper guidance, lack of self-confidence, family discouragement, more involvement in household responsibilities by females and economic dependence on male counterparts.

Therefore, the major contributing factor to widening of the gender poverty gap in the study area is the unexplained component or discrimination effect. Hence, to reduce this gender poverty gap and improve women living conditions, policies and intervention programmes that will benefit women on such factors that explained and contribute in reducing the gap should be designed and implemented. It should be made to include redistribution, improvement, empowerment and creation of awareness about females' rights and privileges. Others are social norms, customs, beliefs and negative traditional practices. These results are similar to the findings of Mukasa and Salami (2015), Valientes (2015), Lubrano (2016) and Nyamuhirwa (2019).

The detailed decomposition in Table 4.14 (panel 3) shows the contributions of various factors to the gender poverty differential. when the endowment effect is negative, any positive variables under it reduces the gender gap in favour of men, while any negative variables do the opposite. The main factors contributing to the endowment effect are age, marital status, household size and income of crayfish harvesting. The age (-0.0245), marital status (-0.0473) and income of crayfish harvesting (-0.1211) are negative and significant at

10%, 10% and 1% level respectively. This negative endowment effect suggests that interventions aimed at improving women's endowments in age, marital status, and crayfish harvesting income, as well as improving female respondents' poverty determinants, may be more effective in addressing observed gender differences in poverty.

In the unexplained portion, the major variables contributing to the gap are educational level with a magnitude of 0.1548 and significant at 10%, marital status with a magnitude of -0.0968 and significant at 10%, household size with a magnitude of 0.1739 and significant at 10%, labour with a magnitude of 0.4025 and significant at 5%, income of crayfish harvesting with a magnitude of 0.3247 and significant at 5% and access to harvesting net having a magnitude of 0.0890 and being significant at 5% level of probability.

Variables with negative sign signifies that if the differences in return of such observables are improved, it would be of female benefit in reducing the gap and alleviating poverty among them. While the variables with positive sign signifies that if the differences in the effect of such determinants are improved, it would be to the structural advantage of male respondents, thus increasing the gender poverty gap in the area.

Generally, the overall return of the characteristics' generating poverty was low in female respondents, meaning it was in favour of males. This in turn led to the widening of the gender poverty gap in the area. The constant term is positive and significant at 5% probability level. This suggests that females will continue to experience high incidence of poverty if the coefficient of the constant term is not reduced. Even though females have better characteristics that can lower poverty incidence and benefit from these characteristics more than males, there is a large baseline gap in poverty incidence between the two gender groups, as captured by the coefficients effect of the constant term. The cause of this circumstances may be attributed to hidden gender bias and discrimination operating on resource accessibility, role, power and

authority virtually in all sector of the society against women. Hence, formulation of gender mainstreaming policies, empowerment of women in training, provision of productive tools and resources, creation of free, conducive and equitable environment, giving unrestrictive access to power, authority and control over women career's among others becomes imperative for consideration. The results of this study are in support of Aguilar *et al*. (2014), Oseni *et al*. (2015), Mukasa and Salami (2015), Lubrano (2016), Tobden (2017).

4.6.6 Decomposition of gender differences in food insecurity among crayfish harvesters in Niger Delta Area

The decomposition was achieved using Oaxaca-Blinder decomposition technique. However, the probit model of the Oaxaca-Blinder decomposition technique was applied in the analysis. This was done because the food security status used in the analysis was in the binary form. The decomposition technique apart from identifying the gender food insecurity gap in the area and determining factors generating this gap will also help to identify, explain and determine the level of impact of each factor in widening the gap. Therefore, the knowledge of these will aid policy makers to develop appropriate and effective policies that will mitigate the gender food security gap, ensure food availability, affordability and safety as well as improve the general livelihood of the crayfish harvesters in the area. The findings of the decomposition analysis are presented in Table 4.15 – 4.17.

4.6.6.1 *Determinants of gender food insecurity differentials among crayfish harvesters in Niger Delta Area.*

Table 4.15 show the determinants of gender food insecurity differentials among household head of crayfish harvesters in Niger Delta Area under Oaxaca- blinder decomposition technique. It shows the preliminary results of decomposition in order to fully understand the impact of gender differences in food insecurity among the respondents in the study area.

Table 4.14: Oaxaca Blinder two-fold decomposition of gender differentials in poverty among crayfish harvesters in Niger Delta Area

1	**Gender differentials**					
Category	Coefficient	Std. error	Z value			
Female	0.5321	0.0433	12.30***			
Male	0.3533	0.0277	12.76***			
Differentials gap	0.1788	0.0514	3.48***			
2	**Aggregate decomposition**					
	Explained			**Unexplained**		
	Coefficient	Robust Std. error	Z value	Coefficient	Robust Std. error	Z value
Total	-0.1479	0.0430	-3.44***	0.3267	0.5142	6.35***
% share of differentials gap	-82.72%			182.72%		
3	**Detailed decomposition**					
Variables	Coefficient	Robust Std. error	Z value	Coefficient	Robust Std. error	Z value
Age (years)	-0.0245	0.0138	-1.78*	-0.6497	0.6773	-0.96
Education level (years)	-0.0053	0.0073	-0.73	0.1548	0.0985	1.57*
Marital status	-0.0473	0.0249	-1.90*	-0.0968	0.0564	-1.72*
Household size	0.0573	0.0266	2.15**	0.1739	0.0923	1.88*
Experience (years)	-0.0031	0.0130	-0.24	0.1787	0.3133	0.57
Amount of credit obtained (₦)	-0.0012	0.0027	-0.46	-0.0026	0.0101	-0.26
Membership of cooperative (dummy)	-0.0046	0.0070	-0.67	0.0040	0.0395	0.10
Labour (man-days)	0.0004	0.0039	0.11	0.4025	0.1863	2.16**
Extension visits (days per year)	0.0033	0.0045	0.74	-0.0315	0.0305	-1.03
Income of crayfish harvesting (₦)	-0.1211	0.0304	-3.98***	-0.3247	0.1942	-1.67*
Income of other sources (₦)	-0.0011	0.0091	-0.12	-0.0455	0.0599	-0.76
Access to outboard engine	-0.0003	0.0014	-0.22	0.0421	0.0318	1.32
Access to crayfish harvesting net	-0.0035	0.0051	-0.69	-0.0980	0.0483	-2.03**
Access to safety kit	0.0030	0.0060	0.50	0.0491	0.0353	1.39
Constant term				0.6705	0.3153	2.13**

Source: Computed from field survey data (2018). Note: ***, ** and * are significant levels at 1%, 5% and 10% respectively.

The results of the male respondents indicate that education, household size, amount of credit obtained, labour, income of crayfish harvesting and access to harvesting net are significant at different levels of probability and therefore predicts food insecurity status in the study area. While for the female respondents, household size, extension visit, income of crayfish harvesting, income of other sources and access to safety kit are the significant variables predicting food insecurity at different probability level. On the other hand, the results of the pooled sample show that education level, household size, amount of credit obtained, labour, extension visits, income of crayfish harvesting, income of other sources and access to crayfish harvesting net are the major factors predicting food insecurity in the study area. They were all significant at various level of probability.

The coefficient for education level was positive as expected and it conform with *a priori* expectation and significant at 5% and 10% probability levels for male respondents and pooled sample respectively. This implies that the higher the education level of the household head, the more food secured that household will be and vice versa. Education, in a manner, has the tendency to expose people and place them in advantageous positions over those who are less educated. This includes the knowledge of adoption of new productive ideas or techniques, management of fund and investment, and food combination among others. These findings agree with Agwu and Oteh (2014) in Abia State, Shettima *et al*. (2014), Ahmed *et al*. (2015) in Borno State and Tobden (2017) in Bhutan. The coefficient of education for female respondents was negative and not significant. This may be due to lack of proper education (education drop-out) among them, discrimination and lack of freedom for women in the riverine community to express themselves and show their educational potentials in the crayfish harvesting business. The finding contrasts with Tibesigwa and Visser (2016) who found that education was significant in females.

The coefficient for household size was negative as expected and significant at 1%, 5% and 10% probability levels for male, female and pooled sample. This implies that as the household size of crayfish headed harvester's increases, food insecurity increases. That is, as household size increases, there is the probability of household being food insecured. This is because increase in household size indirectly reduces income per head (per capita income), which affect households' expenditure on food thus increasing the likelihood of the household being food insecured. Increased family size necessitates an increase in household food expenditure, especially if many of the other household members do not generate any income and rely solely on the household head, the likelihood that food insecurity would rise as household size increases. The findings are consistent with Abur (2014) and Ahmed *et al*. (2015), Tibesigwa and Visser (2016), Tobden (2017) and Sentsho (2020).

As expected, the coefficient for the amount of credit obtained for the male respondents was positive and significant at the 5% probability level, while the coefficient for the pooled was also positive and significant at the 10% level, indicating that access to credit tended to positively influence household food security levels. However, the amount of credit obtained by female respondents was positive but not statistically significant. Credit is an important means of investment, and households that have accessed a considerable amount of credit can invest in preferred businesses and earn more income. This will increase the financial capacity and purchasing power of households while lowering the risk of food insecurity. These results are in tandem with the findings of Ahmed *et al*. (2015). However, the results disagree with the findings of Grimaccia and Naccarato (2020) who reported that there is no gender pay gap between male and female group understudied.

Coefficient of labour was positive and significant at 5% and 10% for male respondents and the pooled. This means that the more the labour, the more the quantity of harvest of the products and the more the income level of the harvesters, which will in turn lead to the

respondents being more food secured. Therefore, the number of labourers used determine the outcome and income level of production in small-scale agricultural business as it enhance division of labour which in turn induce professionalism and improve efficiency. However, the coefficient for female respondent was negative and not significant. The reason is that majority of the females are poor and cannot afford the payment of extra labour to enhance the crayfish harvesting business, thus depending mainly on family labour. These findings are in line with the views of Mukasa and Salami (2015), Sentsho (2020).

As expected, the coefficient of extension contact was positive and significant at the 10% level among female headed households. The findings suggest that contact with extension agents is important in the adoption of modern farm practices, which ultimately influences farm output and household income earning capacity, and thus food security in the study area. These results are consistent with Ahmed *et al*. (2015) and Tibesigwa and Visser (2016) who found that extension contact is significant among female headed households of crop farmers. Nevertheless, the result of the male respondents and the pooled were not significant but that of the males was negative. This may be due partly to non-visitation of the respondents regularly by the extension agents and partly to non-acceptability of few ones that comes around the fishing community occasionally by the male respondents as only female's respondents usually associate and listen to them.

The coefficient of income of the crayfish harvesting was found to exert high significant influence at 1% level each, for male, female and pooled. It also revealed a positive relationship for all three groups in terms of household food security status. This means that as the household head's monthly income rises, there is a 99% probability that the household will be food secured. Increasing household income also implies that households should be able to afford food. This means that the higher the household income, the more likely the household will be food secured. It is therefore critical that, all things being equal, an

increase in household income implies increased access to food and is a sure way of combating food insecurity. These findings support the views of Ahungwa *et al*. (2013) and Grimaccia and Naccarato (2020) that household income has a direct impact on food security status, with higher-income households striving more than lower-income households. The results agree with the findings of Okwoche *et al*. (2012), Ahmed *et al*. (2015), Valientes (2015), ADHIDRC (2016) and Haddabi *et al*. (2019) who asserted that an increase in income enhances the chance of households being food secured and vice versa.

In terms of income of other sources, the coefficient for females and the pooled data was positive and significant at 5% and 1%, respectively. This implies that men engaged in other form of business within their immediate community than women. They do these just to improve their income, enhance their livelihood and ensure food security. These findings are consistent with ADHIDRC (2016) and Tibesigwa and Visser (2016), who revealed that off-farm income significantly predicts food security in general, but contrasts with ADHIDRC (2016) who noted this to be more significant in male-headed households. According to USDA (2019), there are also a large number of women (both rural and urban) who rely on wage employment and non-farm self-employment for food security.

Access to safety kit was positive and significant at 10% level for the female respondents only. This suggests that female headed households of crayfish harvesters in the study area are more likely to use safety kit whenever they went out for harvesting than their male counterparts. The reason behind this may be due to the fact that women like to accept change, innovation and training on safety issues in the river or sea than men. While often than not men like to depend on their braveness and swimming potentials wherever and whenever they are faced with water mishap or boat wreck. These findings are in consistent with Shettima *et al*. (2014), USDA (2019), Grimaccia and Naccarato (2020).

Results in Table 4.15 also depict that the coefficient for gender in pooled sample has positive relationship with food insecurity and was highly significant at 1% level of probability. This implies that female-headed households were more likely to be food insecured in the study area than male-headed households. It could be because female household heads have traditionally been saddled with the responsibility of home-keeping and infant care, which limits their participation in crayfish harvesting and other income-generating activities when compared to their male counterparts. It may also be due to economic dependence on male harvesters, lack of self-confidence and low level of education among others. These findings disagree with Ahmed *et al*. (2015) who reported otherwise and agree with *a priori* expectation, Fawehinmi and Adeniyi (2014), Tibesigwa and Visser (2016), Grimaccia and Naccarato (2020). The likelihood ratio statistics was -162.88.14, 50.42, and -227.43 for male, female and pooled, respectively. The χ^2 statistics (83.65, 46.20 and 110.84) for male, female and pooled, respectively are highly significant statistically ($P < 0.0000$), suggesting the model has a strong explanatory power.

4.6.6.2 *Oaxaca Blinder (O-B) threefold decomposition of the gender differences in food insecurity among crayfish harvesters in Niger Delta Area*

From the preceding sections of probit-based regression of O-B decomposition technique (Table 4.15), the empirical analyses have identified the existence of food insecurity gap between male and female crayfish harvesters in the study area. However, what is more important, is for policy makers to understand the underlying causes behind these gaps so as to propose appropriate measures and interventions likely to narrow or even close the gap. On this note, further decomposition summarized their differences and distinguished what percentage of gender differential gap in food insecurity is attributed to differences in average characteristics of food insecurity generating factors (endowment or composition effect), what is due to gender differences in returns of such factors (coefficient or structural effect) and interactive relationship between the two (interaction effect) as shown in Table 4.16.

Table 4.15: Determinants of gender food insecurity differentials among household head of crayfish harvesters in Niger Delta Area

	Male household			Female household			Pooled data		
Variables	**Coefficient**	**Std. error**	**Z- value**	**Coefficient**	**Std. error**	**Z- value**	**Coefficient**	**Std. error**	**Z- value**
Age (years)	-0.0030	0.0176	-0.17	0.0617	0.0444	1.39	0.0086	0.0153	0.57
Education level (years)	0.0668	0.0266	2.51**	-0.0200	0.0477	-0.42	0.0340	0.0196	1.73*
Marital status	0.3190	0.2151	1.48	0.0398	0.3587	0.11	0.1842	0.1698	1.08
Household size	-0.2672	0.0393	-6.79***	-0.2213	0.0880	-2.51**	-0.2284	0.0330	-6.93***
Experience (years)	0.0220	0.0195	1.13	-0.0225	0.0419	-0.54	0.0188	0.0161	1.17
Amount of credit obtained (₦)	1.05e-06	5.15e-07	2.04**	4.40e-07	1.01e-06	0.44	7.15e-07	4.19e-07	1.79*
Mem. of association (dummy)	-0.0763	0.2235	-0.34	-0.5879	0.4312	-0.44	-0.1596	0.1841	-0.87
Labour (man-days)	0.0140	0.0057	2.45**	-0.0125	0.0137	-0.91	0.0087	0.0049	1.79*
Extension visits (days per year)	-0.1116	0.1871	-0.60	0.5559	0.2987	1.86*	0.1418	0.1446	0.98
Income of crayfish harvesting (₦)	2.00e-07	7.25e-08	2.76***	7.47e-07	1.76e-07	4.25***	3.13e-07	6.46e-08	4.84***
Income of other sources (₦)	1.40e-06	1.33e-06	1.05	6.03e-06	2.95e-06	2.04**	2.79e-06	1.16e-06	2.40**
Access to outboard engine	-0.0083	0.2336	-0.04	0.1356	0.4148	0.33	0.0989	0.1921	0.51
Access to crayfish harvesting net	0.5361	0.3046	1.76*	-0.0165	0.4826	-0.03	0.1601	0.2332	0.69
Access to safety kit	-0.1423	0.2381	-0.60	0.6950	0.3646	1.91*	0.1645	0.1879	0.88
Gender (male = 1, female = 0)	-	-	-	-	-	-	-0.6505	0.1785	3.64***
Constant term	0.5110	0.4259	1.20	-1.9355	0.9521	-2.03**	0.0026	0.3657	0.01
Log likelihood	-162.88			50.42			-227.43		
LR chi2 (14) and (15) for pooled	83.65			46.20			110.84		
Prob > chi2	0.0000			0.0000			0.0000		
Pseudo R^2	0.2043			0.3142			0.1959		
No. of observation	300			109			409		

Source: Computed from field survey data, 2018. Note: ***, ** and * are significant levels at 1%, 5% and 10% respectively.

The results in panel A of Table 4.16 shows the mean food security level of 0.5697 for male and 0.4045 for female respondents. It identifies the gender food insecurity gap to be 0.1652 (16.52%). They were all significant at 1% level of probability. These results are in consonance with the findings of Aguilar *et al*. (2014) in Ethiopia, Mukasa and Salami (2015) in Nigeria, Backiny-Yetna *et al*. (2015), Grimaccia and Naccarato (2020).

As earlier noted, this differential is decomposed into three components: the endowment effect, which is the portion of the gender food insecurity gap caused by the level of observable attributes; the structural effect, which is the portion of the gap caused by the difference in return of factors involved in generating food insecurity; and the interaction effect, which is the combination of the two (endowment and structural). The aggregate decomposition in panel B of Table 4.16 shows a varied picture, with females having a significant ($p \leq 0.05$) advantage in endowments and males having a significant ($p \leq 0.01$) advantage in structural factors. Nevertheless, the interaction effect was insignificant. The magnitudes of the estimates indicate that the endowment effect accounts for -70.22% of the gender food insecurity gap while the structural effect represents 107.51% of this gap. The interaction effect, on the other hand, accounts for 62.71% of the gap. The negative sign of the endowment effect implies that female respondents benefit more from better characteristics, whereas the positive sign of the structural effect implies that male respondents have an advantage in the returns to determinants generating food insecurity.

The detailed decomposition in Panel C of Table 4.16 show how different factors contributed to the gender gap in food insecurity. The endowment effect is negative, therefore any positive coefficient widens the gender gap in favour of males, while any negative coefficient narrows it. (Backiny-Yetna *et al*., 2015). The main factor contributing to the endowment effect is income of crayfish harvesting with a negative magnitude of -0.1014 and was significant at 1%

probability level. It accounts for over 87% of the endowment effect meaning slide increment in female income of crayfish harvesting will go a long way in decreasing the gap.

The negative endowment effect suggests that policies aimed at improving women's endowments in crayfish harvesting income and improving female respondents' food security determinants may be more effective in closing the observed gender gap in food security. With reference to socioeconomic and demographic characteristics, female respondents have less mean income than their male counterparts and on the other hand they generate more percentage of higher income than males. Therefore, the smaller endowment of income on crayfish harvesting for female headed households will translates into advantage of females being food secured if they are enhanced. This aspect appears to drive a large part of the endowment effect. The results are in consistent with the findings of Oseni *et al*. (2014), Valientes (2015) Backiny-Yetna *et al*. (2015), Lubrano (2016), Sentsho (2020) and FAO *et al*. (2021).

Other factors that will contribute in reducing the food insecurity gap if improved are household size (0.0226) accounting for 19.48%, membership of association (0.0176) accounting for 15.17%, and access to safety kit (0.167) accounting for 14.40% among others. They are negative and not significant. The absence of these factors in explaining gender differences in food insecurity could be explained by the fact that they are used in very small quantities, not enough to make a significant difference. Those factors that are positive depicts that male respondent were better off than females. Therefore, to reduce this gender food insecurity gap, policies and intervention programmes that will benefit female respondents on such factors that explained and or contributed in reducing the gap should be designed and implemented. It should be made to include redistribution, improvement and empowerment.

In the structural effect, (the component that captures the differences that is due to the return of factors generating food security or effect of determinants of food insecurity) several variables such as education level, labour, extension visit, income of crayfish harvesting and access to

safety kits significantly contributed at various level to explaining gender gap in food insecurity. Generally, the overall of return of characteristics generating food insecurity was low in female respondents meaning it was in favour of male counterparts.

Income of crayfish harvesting, extension visits and access to safety kit are negative and significant at 1%, 10%, and 10% probability levels respectively, while education level and labour used are positive and significant at 10% probability level. The constant term of the structural effect was positive and significant at 5% probability level. This implies that male respondents benefit more from return to observable characteristics than the female counterparts. The source of this disadvantage on female is not visible. However, it may be attributed to factors that undermine female potentials in economic growth and development. These factors include: restrictions in resource use, negative traditional practice of norms and custom, cultural barriers, local laws imposed on female gender, under-value of women potentials and contributions in crayfish harvesting business, general marginalization and bias against education and ideology. The results support the findings of Aguilar *et al*. (2014), Oseni *et al*. (2014) and Backiny-Yetna *et al*. (2015), FAO *et al*. (2019)

In the interaction effect, only one variable (income of crayfish harvesting) was significant and at 0.05 probability level. Though, the magnitude of most variables carries negative sign which signifies that effective redistribution and use of the variables would have been beneficial to female respondents in checking food insecurity situation among them while reducing the gender differentials gap. Generally, it can be deduced that the reason for females' structural disadvantage in being food secured despite having better characteristics that would have place them in the same level like males is due to huge baseline gap captured by coefficients effect of the constant term. These findings agree with Lubrano (2016) and FAO *et al*. (2021) who reported that high poverty gap generated by coefficients effect of the constant term enhances poverty incidence between one country and another.

Table 4.16: Oaxaca Blinder three-fold decomposition of gender differences in food insecurity among crayfish harvesters in Niger Delta Area

A.			**Gender differentials**						
Category	**Coefficient**	**Std. error**	**Z value**						
Male	0.5697	0.0286	19.96***						
Female	0.4045	0.0465	8.70***						
Differentials gap	0.1652	0.0571	3.03***						
B.			**Aggregate decomposition**						
	Endowments effect (E)			**Coefficients effect (C)**			**Interaction effect (CE)**		
	Coefficient	Std. error	Z value	Coefficient	Std. error	Z value	Coefficient	Std. error	Z value
Total	-0.1160	0.0571	-2.03**	0.1776	0.0601	2.95***	0.1036	0.0633	1.64
% share of differentials gap	-70.22%			107.51%			62.71%		
C.			**Detailed decomposition**						
Variables	Coefficient	Std. error	Z value	Coefficient	Std. error	Z value	Coefficient	Std. error	Z value
Age (years)	0.0421	0.0330	1.28	-0.6724	0.4836	-1.39	-0.0418	0.0333	-1.26
Education level (years)	0.0038	0.0094	0.40	0.1349	0.0810	1.67*	-0.0156	0.0134	-1.16
Marital status	0.0047	0.0429	0.11	0.0265	0.0398	0.67	0.0315	0.0475	0.66
Household size	-0.0226	0.0211	-1.07	-0.1007	0.2159	-0.47	-0.0044	0.0103	-0.43
Experience (years)	-0.0135	0.0253	-0.53	0.2330	0.2384	0.98	0.0253	0.0277	0.91
Amount of credit obtained (₦)	0.0004	0.0024	0.18	0.0070	0.0135	0.52	0.0006	0.0031	0.19
Member of association (dummy)	0.0176	0.0148	1.19	0.0420	0.0393	1.07	-0.0145	0.0148	-0.98
Labour (man-days)	-0.0089	0.0107	-0.82	0.2930	0.1640	1.79*	0.0178	0.0144	1.23
Extension visits (days per year)	-0.0108	0.0101	-1.07	-0.0616	0.0326	-1.89*	0.0123	0.0117	1.05
Income of crayfish harvesting (₦)	-0.1014	0.0347	-2.93***	-0.2973	0.0884	-3.36***	0.0703	0.0310	2.27**
Income of other sources (₦)	-0.0107	0.0117	-0.91	-0.0689	0.0476	-1.45	0.0078	0.0093	0.84
Access to outboard engine	-0.0004	0.0021	-0.20	-0.0081	0.0269	-0.30	0.0004	0.0022	0.20
Access to crayfish harvesting net	0.0002	0.0046	0.03	0.0241	0.0252	0.96	-0.0050	0.0078	-0.64
Access to safety kit	-0.0167	0.0124	-1.35	-0.0580	0.0309	-1.87*	0.0191	0.0143	1.33
Constant	-	-	-	0.6841	0.2847	2.40**	-	-	-

Source: Computed from field survey data, 2018. Note: ***, ** and * are significant levels at 1%, 5% and 10% respectively.

4.6.6.3 *Oaxaca-Blinder (O-B) two-fold decomposition of the gender differences in food insecurity among crayfish harvesters in Niger Delta Area*

In this section, Oaxaca-Blinder decomposition of gender differentials in food insecurity is based on two-fold: the explained component (gender differences in food insecurity determining characteristics or factors) otherwise known as endowment or composition effect; and unexplained component (gender differences in net effect of the determining factors or return of such characteristics) or structural effect. The analysis of the decomposition results is as presented in Table 4.17. The gender differentials (panel A) presents similar result like that of threefold decomposition earlier discussed in Table 4.16.

The aggregate decomposition results (panel B) indicated that out of 16.52% gender differentials gap reported in panel A, -30.51% (statistically insignificant) is attributed to explained component (composition effect or endowment) while 130.51% (significant at $p<0.001$) is attributed to unexplained component (structural effect). This portrays that female have advantage in explained component than the male while the male have significant advantage in unexplained component than the female. It further portrays that Gender disparities (differentials gap) in food insecurity among crayfish harvesters are driven more by the unexplained factors than by the observed characteristics. The reasons for this may be due to bias and discrimination against female gender in resources allocation, roles, traditional norms, values, belief, laws and family wealth sharing; non-involvement of women in policy development and implementation; undervalue of female potentials in food production, processing and marketing; marginalization in position of authority to lead in the society and association; and giving of women restricted access to freedom of speech among others. These findings are in consonance with Mukasa and Salami (2015), Tibesigwa and Visser (2016) and Backiny-Yetna *et al*. (2015), FAO (2019), and Sentsho (2020).

Table 4.17 panel C shows a detailed decomposition of the endowment and structural effect, as well as the variables that contribute the most to the various components of the gender food insecurity gap. In the explained portion (endowment effect), only one variable which is income of the crayfish harvesting that contributed the most to the gap. It contributed 121.63% to the endowment effect with a coefficient of -0.0613 and significant at $p \leq 0.001$ level. It contributions is to the advantage of the female group in reducing the gap. Hence, policies gear toward enhancing the females' income in crayfish harvesting and other variables with negative sign will go a long way in closing the gender food insecurity gap and making female harvesters to be more food secured.

On the other hand, the unexplained portion (structural effect) that is return of factors determining food insecurity are lower for females than males. The variables mostly responsible are education (0.1333), labour (0.3084), extension visits (-0.0586), income of crayfish harvesting (0.2918) and access to safety kits (-0.0521). They are all significant at 10%, 5%, 10%, 1% and 10% level of probability respectively. The significant variables with negative sign suggest that if policies are made to abolish hidden bias and discriminatory gender roles, laws, norms, belief and values in the allocation, distribution, redistribution, provision and development of such variables that check food insecurity; however, women would be better off in food security and nutrition, and the gap would be reduce to the barest minimum if not totally close. Moreso, the introduction of gender mainstreaming in the allocation, distribution and accessibility of food productive resources (such as inputs, tools, technology, information and right) will be of great benefit in combating food insecurity thus reducing its differentials gap. The results support the findings of Jayamohan and Kitesa (2014) Mukasa and Salami (2015); Tibesigwa and Visser (2016), Sentsho (2020) and FAO *et al*. (2021).

Table 4.17: Oaxaca Blinder twofold decomposition of gender differences in food insecurity among crayfish harvesters in Niger Delta

A	**Gender differential**					
Category	**Coefficient**	**Std. error**	**Z value**			
Male	0.5697	0.2828	20.15***			
Female	0.4045	0.0462	8.75***			
Differentials gap	0.1652	0.0542	3.05***			
B	**Aggregate decomposition**					
	Explained			**Unexplained**		
	Coefficient	Robust Std. error	Z value	Coefficient	Robust Std. error	Z value
Total	-0.0504	0.0360	-1.40	0.2156	0.0543	3.97***
% share of differentials gap	-30.51%			130.51%		
C	**Detailed decomposition**					
Variables	Coefficient	Robust Std. error	Z value	Coefficient	Robust Std. error	Z value
Age (years)	0.0085	0.0156	0.55	-0.7070	0.4606	-1.53
Education level (years)	-0.0093	0.0073	-1.27	0.1333	0.0804	1.66*
Marital status	0.0317	0.0334	0.95	0.0452	0.0538	0.84
Household size	-0.0336	0.0281	-1.20	-0.1089	0.2089	-0.52
Experience (years)	0.0163	0.0159	1.03	0.2441	0.2265	1.08
Amount of credit obtained (₦)	0.0011	0.0055	0.20	0.0076	0.0127	0.60
Membership of cooperative (dummy)	0.0069	0.0090	0.77	0.0409	0.0345	1.18
Labour (man-days)	0.0089	0.0072	1.24	0,3084	0.1491	2.07**
Extension visits (days per year)	-0.0040	0.0053	-0.75	-0.0586	0.0310	-1.89*
Income of crayfish harvesting (₦)	-0.0613	0.0223	-2.75***	-0.2918	0.0830	-3.51***
Income of other sources (₦)	-0.0071	0.0075	-0.95	-0.0688	0.0450	-1.53
Access to outboard engine	-0.0004	0.0019	-0.23	-0.0081	0.0253	-0.32
Access to crayfish harvesting net	-0.0022	0.0039	-0.56	0.0211	0.0221	0.96
Access to safety kit	-0.0057	0.0072	-0.80	-0.0521	0.0272	-1.92*
Constant term				0.7104	0.2731	2.60***

Source: Computed from field survey data (2018). Note: ***, ** and * are significant levels at 1%, 5% and 10% respectively.

4.7 Coping Strategies for Poverty, Food Insecurity and Income Inequality Among Crayfish Harvesters in Niger Delta Area

The coping strategies, adopted by respondents on poverty, food security and income inequality are discussed in this section.

4.7.1 Poverty coping strategies based on frequency of use among crayfish harvesting households

The ranking of poverty coping strategies was accomplished by using a five-point Likert type scale to score the responses of the respondents. The scores 5, 4, 3, 2, and 1 indicate that they were frequently used, occasionally used, undecided, rarely used, and never used respectively. The results in Table 4.18 depict that intensifying the amount of work done on the crayfish fishing to increase output, spending saved income, children eating first, purchasing items on credit, reduction in food consumption, diversify off-fishing activities to boost income, borrowing money for the household upkeep, eating less preferred food, reduction in the number of meals taken per day i.e. skipping of meals, rely less on expensive cloths, reduction in food diversification and reliance on help from relatives and friends with ranking 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th and 12th respectively were the top twelve (12) poverty coping strategies widely adopted by the majority of male headed respondents.. Their weighted mean were 4.55, 4.54, 4.50, 4.46, 4.03, 4.00, 3.98, 3.81, 3.75, 3.74, 3.63, and 3.00 However, any coping strategy with weighted mean ≥ 3 indicates high extent of use while the one with weighted mean < 3 indicates low extent of use in the study area.

Results of Table 4.18 also show that female respondents lead with children eating first (1st), followed by diversify off-fishing activities to boost income (2nd), spending of saved income (3rd), purchasing items on credit (4th), intensify the amount of work done on the crayfish

fishing to increase output (5th), borrowing money for household upkeep (6th), reduction in food consumption (7th), reduction in food diversification (8th), eating less preferred food (9th), reduction in the number of meals taken per day i.e. Skipping of meals (10th), rely less on expensive cloths (11th) and reliance on help from relatives and friends (12th) as the most widely used poverty coping strategies. The weighted mean of each coping strategy which indicates the extent of their use were 4.69, 4.57, 4.47, 4.41, 4.31, 4.00, 3.88, 3.83, 3.75, 3.62, 3.56, and 3.15 respectively. Similar to that of the male respondents, coping strategy with weighted mean ≥ 3 indicates high extent of use while < 3 implies low extent of use.

Table 4.18 also reveals that intensifying the amount of work done on the crayfish fishing to increase output (1st), children eating first (2nd), spending of saved income (3rd), purchasing items on credit (4th), diversify off-fishing activities to boost income (5th), borrowing money for household upkeep (6th), reduction in food consumption (7th), eating less preferred food (8th), rely less on expensive cloths (9th), reduction in the number of meals taken per day i.e. skipping of meals (10th), reduction in food diversification (11th), and reliance on help from relatives and friends were the poverty coping strategies used by the majority of crayfish harvesters in the area.

Looking at the results generally, it could be observed that majority of the respondents in the study area used twelve (12) poverty coping strategies continuously out of the fifteen (15) adopted. Though there is slide variation in position ranking of the strategies between the three sample categories (male, female and pooled). However, intensifying the amount of work done on the crayfish harvesting to increase output came first in male and in pooled results while in female, it was 'children eating first'. This may be deduced from the fact that men are the breadwinners of the family which implies that in the midst of uncertainties or shock triggered by poverty, they have to intensify the amount of work done on the crayfish harvesting business in order to increase output. With more output, there would be more

income to use and spend for the family so as to maintain their integrity. On the other hand, females are very close to their children and they have more affection to them than their male counterparts. Hence, in the midst of poverty and hunger, they prefer their children to eat to satisfaction first before themselves as they regard children as their pride. These results are in line with the findings of Igbalajobi *et al*. (2013), Akeweta *et al*. (2014), Oluwatayo (2014) and Agrawal (2020). The least poverty coping strategy adopted in the region is relocating to other places which has a percentage of 3.48, 3.23 and 3.41 for male, female and pooled, respectively.

The results also show the extent of use of each coping strategies across samples and across households. From the three samples results, it was found that intensify the amount of work done on the crayfish fishing to increase output, children eating first, spending of saved income, purchasing items on credit, diversify off-fishing activities to boost income, and reduction in food consumption among others were coping strategies with high extent of use (with weighted mean ≥ 3) while selling of assets to increase income, allocating children to friends and relatives and relocating to other places (with weighted < 3) were the coping strategies with low extent of use in the study area.

This implies that the extent of use of any of these coping strategies depend largely on the level of solution it proffers them. It also depends on the ease of usage, perception and knowledge about a particular strategy as well as peculiarity of situation inherent in their households or communities. Akewata *et al.* (2014), Iyela and Ikwuakam (2015) noted that poverty coping strategies differ from place to place and from person to person based on each strategy's ability to solving problem. In the same vein, Dessalegn (2018) concluded that certain coping strategies are practiced by all households, but the degree to which these strategies help a household stay on top of the situation is a function of the asset available to them, nature and level of the problem perceived to be solved by it.

Table 4.18 Coping strategies for poverty among crayfish harvesting households in Niger Delta Area, Nigeria

Coping strategies	Male			Female			Pooled		
	PCSUI (Wt. sum)	Mean	Rank	PCSUI (Wt. sum)	Mean	Rank	PCSUI (Wt. sum)	Mean	Rank
Intensify the amount of work done on the crayfish fishing to increase output	1365	4.55	1st	470	4.31	5th	1835	4.49	1st
Children eating first	1350	4.50	3rd	511	4.69	1st	1861	4.55	2nd
Spending of saved income	1363	4.54	2nd	487	4.47	3rd	1850	4.52	3rd
Purchasing items on credit	1339	4.46	4th	481	4.41	4th	1820	4.45	4th
Diversify off-fishing activities to boost income	1194	3.98	7th	498	4.57	2nd	1692	4.14	5th
Borrowing money for the household upkeep	1201	4.00	6th	436	4.00	6th	1637	4.00	6th
Reduction in food consumption	1208	4.03	5th	423	3.88	7th	1631	3.99	7th
Eating less preferred food	1142	3.81	8th	409	3.75	9th	1551	3.79	8th
Rely less on expensive cloths	1123	3.74	10th	388	3.56	11th	1511	3.69	9th
Reduction in the number of meals taken per day i.e. Skipping of meals	1124	3.75	9th	395	3.62	10th	1519	3.71	10th
Reduce food diversification	1088	3.63	11th	418	3.83	8th	1506	3.68	11th
Reliance on help from relatives and friends.	899	3.00	12th	343	3.15	12th	1242	3.04	12th
Selling of assets to increase income	874	2.91	13th	320	2.94	13th	1194	2.92	13th
Allocating children to friends and relatives	648	2.16	14th	239	2.19	14th	887	2.17	14th
Relocating to other places	488	1.63	15th	167	1.53	15th	655	1.60	15th

Source: Computed from field survey data, 2018. Decision: Mean ≥ 3 = High extent of used and mean < 3 = low extent used.

4.7.2 Food insecurity coping strategies based on frequency of use among crayfish harvesting households

Results of Table 4.19 present the ranking of food insecurity coping strategies based on frequency of usage among crayfish harvesting households. The results indicate that majority of the male respondents adopted children eating first as their strategy, followed by intensifying the amount of work done on the crayfish fishing to increase output, purchasing items on credit, spending of saved income, diversify off-fishing activities to boost income. In addition, borrowing money for household upkeep, reduction in food consumption, reduction in food diversification, rely less on expensive cloths, eating less preferred food, reduction in the number of meals taken per day i.e., Skipping of meals, and reliance on help from relatives and friends based on their ranking. Their weighted mean which determine the extent of use of each of these strategies are 4.55, 4.48, 4.44, 4.30, 4.05, 3.97, 3.89, 3.71, 3.65, 3.56, 3.25, and 3.01 respectively. However, weighted mean ≥ 3 implies high extent of use while mean with < 3 denotes low extent of use. These results are in agreement with the findings of Abur (2014) who reported eating once a day, letting children to eat first and buying food on credit as among the food insecurity coping strategies adopted in Guma Local Government of Benue State.

The results of Table 4.19 also show the strategies of intensify the amount of work done on the crayfish fishing to increase output (1^{st}), children eating first (2^{nd}), spending saved income (3^{rd}), purchasing items on credit (4^{th}), diversify off-fishing activities to boost income (5^{th}), borrowing money for household upkeep (6^{th}), reduction in food consumption (7^{th}), rely less on expensive cloths (8^{th}), eating less preferred food (9^{th}), reduction in food diversification (10^{th}), reliance on help from relatives and friends (11^{th}), and reduction in the number of meals taken per day i.e. skipping of meals (12^{th}) as the widely used coping

strategies by the female respondents in the study area. They were also the strategies with high extent of use since their weighted mean were ≥ 3.

In terms of the pooled, Table 4.19 reveal that children eating first (1^{st}), intensify the amount of work done on the crayfish fishing to increase output (2^{nd}), purchasing items on credit (3^{rd}), spending saved income (4^{th}), diversify off-fishing activities to boost income (5^{th}), borrowing money for household upkeep (6^{th}), reduction in food consumption (7^{th}), reduction in food diversification (8^{th}), rely less on expensive cloths (9^{th}), eating less preferred food (10^{th}), reduction in the number of meals taken per day i.e. skipping of meals (11^{th}) and reliance on help from relatives and friends (12^{th}) were the coping strategies widely used in the area. The respective weighted mean are 4.53, 4.49, 4.43, 4.34, 4.07, 3.99, 3.92, 3.67, 3.64, 3.58, 3.22, and 3.04. This suggests that they were strategies with high extent of use in the area to fight food insecurity any time it occur.

A critical observation of the three sample results shows that 12 food insecurity coping strategies are mainly used in the area by respondents when faced with food crises. It can also be observed that about three (3) strategies: selling of assets to increase income, allocating children to friends and relatives and relocating to other places were the strategies with low extent of use by the respondents. This is because their weighted mean fell below 3. The overall study indicates that the respondents adopt various coping strategies in the area to reduce the impact of food insecurity, enhance their livelihood and live a better life. These findings support the study of Akeweta *et al*. (2014), Abur (2014), Iyela and Ikwuakam (2015) and Mitra *et al*. 2016).

Table 4.19 Coping strategies for food insecurity among crayfish harvesting households in Niger Delta Area, Nigeria

Coping strategies	Male			Female			Pooled		
	FICSUI (Wt. sum)	Mean	Rank	**FICSUI** (Wt. sum)	Mean	Rank	**FICSUI** (Wt.sum)	Mean	Rank
Children eating first	1366	4.55	1st	487	4.47	2nd	1853	4.53	1st
Intensify the amount of work done on the crayfish fishing to increase output	1343	4.48	2nd	494	4.53	1st	1837	4.49	2nd
Purchasing items on credit	1331	4.44	3rd	480	4.40	4th	1811	4.43	3th
Spending of saved income	1291	4.30	4th	483	4.43	3rd	1774	4.34	4th
Diversify off-fishing activities to boost income	1214	4.05	5th	452	4.15	5th	1666	4.07	5th
Borrowing money for the household upkeep	1191	3.97	6th	440	4.04	6th	1631	3.99	6th
Reduction in food consumption	1167	3.89	7th	438	4.02	7th	1605	3.92	7th
Rely less on expensive cloths	1095	3.65	9th	408	3.74	8th	1503	3.67	8th
Reduce food diversification	1114	3.71	8th	374	3.43	10th	1488	3.64	9th
Eating less preferred food	1069	3.56	10th	395	3.62	9th	1464	3.58	10th
Reduction in the number of meals taken per day i.e., Skipping of meals	975	3.25	11th	340	3.12	12th	1315	3.22	11th
Reliance on help from relatives and friends	903	3.01	12th	341	3.13	11th	1244	3.04	12th
Selling of assets to increase income	844	2.81	13th	315	2.89	13th	1159	2.83	13th
Allocating children to friends and relatives	625	2.08	14th	228	2.09	14th	853	2.09	14th
Relocating to other places	480	1.60	15th	199	1.83	15th	679	1.66	15th

Source: Computed from field survey data, 2018. Decision: Mean ≥ 3 = High extent of use and mean < 3 = low extent of use

4.7.3 Income inequality coping strategies based on frequency of use among crayfish harvesting households

Income inequality coping strategies based on frequency of usage among crayfish harvesting households is as shown in Table 4.20. The results indicate that spending of saved income (1^{st}), purchasing items on credit (2^{nd}), intensify the amount of work done on the crayfish fishing to increase output (3^{rd}), children eating first (4^{th}), rely less on expensive cloths (5^{th}), borrowing money for the household upkeep (6^{th}), diversify off-fishing activities to boost income (7^{th}), reduction in food consumption (8^{th}), reduce food diversification (9^{th}), eating less preferred food (10^{th}), reduction in the number of meals taken per day i.e. skipping of meals (11^{th}) and reliance on help from relatives and friends (12^{th}) were the coping strategies used mostly by the male respondents in the area to curb income inequality in the area. Their respective weighted mean showing extent of use by households are 4.61, 4.52, 4.39, 4.36, 3.98, 3.84, 3.60, 3.54, 3.53, 3.23, 3.09, and 3.02.

The results of Table 4.20 also show the ranking of coping strategies adopted by female respondents to be spending saved income (1^{st}), children eating first, intensify the amount of work done on the crayfish fishing to increase output (2^{nd}), purchasing items on credit (3^{rd}), diversify off-fishing activities to boost income (4^{th}), borrowing money for the household upkeep (5^{th}), rely less on expensive cloths (6^{th}), reduction in food consumption (7^{th}), reduction in food diversification (8^{th}), eating less preferred food (9^{th}), reliance on help from relatives and friends (10^{th}), reliance on help from relatives and friends (11^{th}) and reduction in the number of meals taken per day i.e. skipping of meals (12^{th}). The extent of household using these strategies are as shown by their weighted mean; 4.63, 4.56, 4.46, 4.43, 3.77, 3.76, 3.75, 3.68, 3.38, 3.33,3.19, and 3.06 respectively. The weighted mean ≥ 3 depicts high extent of use while < 3 depicts low extent of use.

On the other hand, the pooled results in Table 4.15 also indicate spending of saved income (1^{st}), purchasing items on credit (2^{nd}), children eating first (3^{rd}), intensify the amount of work done on the crayfish fishing to increase output (4^{th}), borrowing money for the household upkeep (5^{th}), rely less on expensive cloths (6^{th}), diversify off-fishing activities to boost income (7^{th}), reduction in food consumption (8^{th}), reduce food diversification (9^{th}), eating less preferred food (10^{th}), reduction in the number of meals taken per day i.e. skipping of meals (11^{th}), and reliance on help from relatives and friends (12^{th}). as the coping strategies used by majority of the respondents in the area together with their ranking.

Generally, from the results in Table 4.20, it can be observed that majority of the crayfish harvesters in the area used various forms of coping strategies in order to combat income inequality existing in the area and meet the current economic reality. The strategies varies from household to household, place to place, profession to profession and class level to class level. These findings are in conformity with Mitra *et al*. 2016) who asserted that most rural household heads cope with shocks and economic uncertainties through a variety of coping strategies such as borrowing, distress sales of assets, remittances, adjustment in food intake, withdrawing from savings, and so on. The result is also in congruent with the study of Amendah *et al*. (2014), Akeweta *et al*. (2014) and Agrawal (2020).

Table 4.20 Coping strategies for income inequality among crayfish harvesting households in Niger Delta Area, Nigeria

Coping strategies	Male			Female			Pooled		
	IICSUI (Wt. sum)	Mean	Rank	**IICSUI** (Wt. sum)	Mean	Rank	**IICSUI** (Wt. sum)	Mean	Rank
Spending of saved income	1382	4.61	1st	505	4.63	1st	1887	4.61	1st
Purchasing items on credit	1356	4.52	2nd	486	4.46	3rd	1842	4.50	2nd
Children eating first	1307	4.36	4th	497	4.56	2nd	1804	4.41	3rd
Intensify the amount of work done on the crayfish fishing to increase output	1318	4.39	3rd	483	4.43	4th	1801	4.40	4th
Rely less on expensive cloths	1195	3.98	5th	410	3.76	6th	1605	3.92	5th
Borrowing money for the household upkeep	1153	3.84	6th	409	3.75	7th	1562	3.82	6th
Diversify off-fishing activities to boost income	1059	3.53	9th	411	3.77	5th	1470	3.59	7th
Reduction in food consumption	1062	3.54	8th	401	3.68	8th	1463	3.58	8th
Reduce food diversification	1079	3.60	7th	368	3.38	9th	1447	3.54	9th
Eating less preferred food	970	3.23	10th	363	3.33	10th	1333	3.26	10th
Reduction in the number of meals taken per day i.e., Skipping of meals	928	3.09	11th	333	3.06	12th	1261	3.08	11th
Reliance on help from relatives and friends	906	3.02	12th	348	3.19	11th	1254	3.07	12th
Selling of assets to increase income	816	2.72	13th	302	2.77	13th	1118	2.73	13th
Allocating children to friends and relatives	633	2.11	14th	224	2.06	14th	857	2.10	14th
Relocating to other places	550	1.83	15th	192	1.76	15th	742	1.81	15th

Source: Computed from field survey data, 2018. Decision: Mean ≥ 3 = High extent of use and mean < 3 = low extent of use

4.8 Test of Hypotheses

4.8.1 Hypothesis one

The result of hypothesis one is presented in Table 4.21 The null hypothesis stated that there is no significant difference in income inequality, poverty and food insecurity between male and female headed crayfish harvesting households in the study area. For income inequality, the results show that there is a Theil index difference of 0.1039 which was statistically significant at 1% level of probability. This implies that there is a significant difference in income inequality between male and female headed crayfish harvesting households in the study area. Therefore, the null hypothesis for income inequality is hereby rejected.

Furthermore, the results reveal that the difference in poverty incidence between male and female headed crayfish harvesting households was 0.1788 with at z-value of which was significant at 1% level of probability. This implies that there is a significant difference in poverty incidence between male and female headed crayfish harvesting households in the study area. Hence, the null hypothesis for income inequality is hereby rejected.

Results of Table 4.21 also show that food insecurity index difference of 0.1652 was statistically significant at 1% level of probability. This implies that there is a significant difference in food insecurity between the male and female headed crayfish harvesting households. Therefore, the null hypothesis for food insecurity is hereby rejected.

Table 4.21 Hypothesis one

Variable	Difference	z-value	Decision
Income inequality (Theil index)	0.1039	2.59***	Reject H_{o1}
Poverty incidence	0.1788	3.43***	Reject H_{o1}
Food security index	0.1652	3.03***	Reject H_{o1}

Source: Computed from field survey data, 2018. Note: *** are significant levels at $p \leq 0.01$.

4.8.2 Hypothesis two

The result of hypothesis two is presented in Table 4.22 The null hypothesis stated that socioeconomic, demographic and institutional factors such as age, education, household size, access to credit, extension contact have no significant influence on poverty and food insecurity of crayfish harvesters in the study area. The results show that age at $p \leq 0.10$, education at $p \leq 0.10$ and household size at $p \leq 0.01$ probability levels respectively were significant. This implies that age and household size significantly influenced the poverty status of the households. Therefore, the null hypothesis for these factors is hereby rejected. Conversely, access to credit and extension contact were not significant. This implies that these factors have no significant influence on poverty status of the households. Therefore, the null hypothesis for these factors is hereby accepted.

Furthermore, results on food insecurity, reveal that education at $p \leq 0.10$, household size at $p \leq 0.01$ and access to credit at $p \leq 0.10$ probability levels respectively were significant. This implies that education, household size and access to credit significantly influenced the food security status of the households. Therefore, the null hypothesis for these factors is hereby rejected. On the other hand, results show that age and extension contact were not significant. This implies that age and extension contact have no significant influence on food security status of the households. Therefore, the null hypothesis for these factors is hereby accepted.

Table 4.22 Hypothesis two

Variables	Poverty		Food security	
	z- value	Decision	z- value	Decision
Age	1.75*	Reject H_{o2}	0.57	Accept H_{o2}
Education	-1.71*	Reject H_{o2}	1.73*	Reject H_{o2}
Household size	4.92***	Reject H_{o2}	-6.93***	Reject H_{o2}
Access to credit	-0.65	Accept H_{o2}	1.79*	Reject H_{o2}
Extension contacts	0.88	Accept H_{o2}	0.98	Accept H_{o2}

Source: Computed from field survey data, 2018. Note: *** and * are significant levels at $p \leq 0.01$ and $p \leq 0.10$

4.8.3 Hypothesis three

The results of hypothesis three is presented in Table 4.23 The null hypothesis stated that age, education, marital status, household size, access to harvesting tools, access to credit, access to extension contact, membership of cooperative does not significantly explain gender gap in poverty and food insecurity. The results show that education level at $p \leq 0.10$, marital status at $p \leq 0.05$, household size at $p \leq 0.01$ and access to harvesting tools at $p \leq 0.05$ probability levels respectively were the factors that significantly explain gender gap in poverty among the households. Therefore, the null hypothesis for these factors is hereby rejected. On the other hand, results also show that age, access to credit, access to extension contact and membership of cooperative were not significant. This implies that these variables do not significantly explain gender gap in poverty among the households. Hence, the null hypothesis for these factors is hereby accepted.

In terms of food insecurity, the results show that education at $p \leq 0.10$, access to credit at $p \leq 0.10$ and access to extension at $p \leq 0.10$ probability levels respectively were the factors that significantly explain gender gap among the households. Hence, the null hypothesis for these factors is hereby rejected. Contrarily, results further show that age, marital status, household size, access to harvesting tools and membership of cooperative were not

significant. This implies that the factors do not significantly explain gender gap in food insecurity among the households. Therefore, the null hypothesis for these factors is hereby accepted.

Table 4.23 Hypothesis three

Variables	Poverty		Food security	
	z- value	Decision	z- value	Decision
Age	-1.78*	Reject H_{o3}	-1.39	Accept H_{o3}
Education	-1.71*	Reject H_{o3}	1.67*	Reject H_{o3}
Marital status	-2.05**	Reject H_{o3}	0.67	Accept H_{o3}
Household size	2.48***	Reject H_{o3}	-1.07	Reject H_{o3}
Access to harvesting tools	-2.30**	Reject H_{o3}	0.96	Accept H_{o3}
Access to credit	-0.24	Accept H_{o3}	0.52	Accept H_{o3}
Access to extension	0.79	Accept H_{o3}	-1.89*	Reject H_{o3}
Mem. of cooperative (dummy)	-0.25	Accept H_{o3}	1.19	Accept H_{o3}

Source: Computed from field survey data, 2018. Note: ***, **, and * are statistical significance at 0.01, 0.05 and0.10 level of probability.

4.9 Summary of Findings

Gender differentials in income inequality, poverty and food insecurity have become issues of global consideration as a result of their effects in productivity, economic growth, community development and general wellbeing of humanity. Hence, a deep understanding of the extent and sources of the gender differentials gap on the issues has become crucial for the success of policy interventions aimed at empowering women and narrowing or closing the gap. This study examined empirically gender differentials in income inequality, poverty and food insecurity among crayfish harvesting household in selected States of Niger Delta Area, Nigeria. The study also attempted to identify various poverty, food insecurity and income inequality coping strategies adopted by the respondents and the extent of their use in the area.

The results revealed that female headed household of crayfish harvesters did not have a clear disadvantage in most of the socioeconomic and institutional factors involved in crayfish harvesting business. However, it was discovered that fewer women than men completed tertiary education, with the majority of women dropping out after secondary level. Furthermore, the analysis on the level of income inequality, poverty and food security indicated that male crayfish harvesters contributed more to higher level of income inequality in the area than females as depicted by high Gini index (0.64 against 0.58); while majority of the female crayfish harvesters were poor and less food secured compared to their male counterparts.

In term of decomposition results, Theil decomposition of income inequality by gender, income sources, socioeconomics and by institutional variables portrays the inequality in the area as being mostly accounted for by within gender group component apart from that of income source which was mostly accounted for by between gender group components. The Oaxaca-Blinder preliminary decomposition estimation of gender poverty showed household size (0.3639), labour (0.0615), income of crayfish harvesting (-2.14e-06), income of other sources (-0.0001) and access to crayfish harvesting net (-2.4044) as the major determinant for female harvesters; while age (0.0466), marital status (0.8482), household size (0.1988), income of crayfish harvesting (-1.02e-06) and income of other sources (-5.58e-06) were the major determinant factors for male harvesters. On the other hand, decomposition for gender food insecurity predicted that education level (0.0668), household size (-0.2672), amount of credit obtained (1.05e-06), labour (0.0140), income of crayfish harvesting (2.00e-07) and access to harvesting net (0.5361) were the major determinants for male, while household size (-0.2213), extension visit (0.5559), income of crayfish harvesting

(7.47e-07), income of other sources (6.03e-06) and access to safety kit (0.6950) were the major determinants for female harvesters.

The aggregate decomposition of gender differential gap in poverty and food insecurity in the study area was mostly being accounted for by coefficient component (structural or discrimination effect) that is differences due to return of the observable characteristics or differences in effect of the determinant (149.27% and 107.51%) rather than endowment component (characteristics or composition effect) which is differences due to observable characteristics or determinant (-53.86% and -70.22%) and interaction effect (4.59% and 62.71%) which is the combination of both endowment and structural effect. This may be due to bias and discriminatory laws and norms against women; giving women restrictive access to productive resources, undermining their views in decision making, limiting their powers and authority among others.

Subsequently, the detailed decomposition revealed that marital status, household size, income of crayfish harvesting and age were the major contributing factors that explained the gender differential gap in poverty due to endowment or composition effect (explained factor) while marital status, education level, household size, labour, income of crayfish harvesting and access to crayfish harvesting net explained the poverty gap due to coefficient or structural effect (unexplained factors). Similarly, gender differential gap in food insecurity due to endowment or composition effect (explained factor) was mainly being explained only by income of crayfish harvesting, while that due to structural effect (unexplained factors) was mainly being contributed and explained by education, labour, extension visit, income of crayfish harvesting and access to safety kit. Nonetheless,

interaction effect similar to composition effect was mainly being explained by income of crayfish harvesting.

Additionally, the results of the analysis of various coping strategies use index (CSUI) revealed that intensifying the amount of work done on crayfish harvesting to increase output (1st), children eating first (2nd), spending of saved income (3rd) and purchasing items on credit (4th) among others are the major coping strategies adopted in the area to reduce poverty. In the same way, children eating first (1st), intensifying the amount of work done on the crayfish fishing to increase output (2nd), purchasing items on credit (3rd) and spending of saved income (4th) among others are the major coping strategies used to combat food insecurity. However, spending of saved income (1st), purchasing items on credit (2nd), children eating first (3rd) and intensifying the amount of work done on crayfish harvesting to increase output (4th) among others are the major coping strategies used to check income inequality in the study area.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

There is existence of high level of income inequality among the crayfish harvesters in the area and men's contribution to it was more than that of the women. Poverty status was higher among female headed harvesters than males and male headed households were also more food secured. The gender differential gap in income inequality was mostly accounted for by "within gender group" components of socio-demographic and institutional factors with exception of income source which was mostly accounted for by "between gender group" factors.

However, gender differential gap in poverty and food insecurity was mostly being attributable to coefficient of structural or discrimination effect (unexplained factors) rather than explained factors. It was mainly being explained by marital status, education level, household size, labour, income of crayfish harvesting, and access to crayfish harvesting net for poverty while that of food insecurity, the gap was explained by education, labour, extension visit, income of crayfish harvesting and access to safety kit. The major coping strategies adopted in the area to ameliorate poverty are intensifying the amount of work done on crayfish harvesting to increase output, children eating first, and spending of saved income among others. That of food insecurity include children eating first, intensifying the amount of work done on crayfish harvesting to increase output and purchasing items on credit; while spending of saved income, purchasing items on credit, and children eating first among others were coping strategies for income inequality in the study area.

5.2 Recommendations

Based on the findings of this study, policy measures aimed at reducing income inequality, mitigating poverty and reducing household food insecurity along gender lines among crayfish harvesters in the study area become imperative. In view of this, the followings are hereby recommended:

1. Results from the study have shown that income inequality is high in the area and was attributable to within gender group inequality. Therefore, State and Local governments should intensify effort towards ensuring equitable distribution of income and access to good and sustainable education in the area especially at secondary and tertiary levels by introducing compulsory primary and secondary education in the area. This will help them to increase their income earning opportunities and make strategic changes in the profession where necessary.
2. Female group was found to be more vulnerable to income inequality effect while the male group was found to have highest level of income inequality in the area. Therefore, to ensure adequate return of investment in crayfish harvesting business, vocational training and skills development programmes should be integrated into the Universal Basic Education (UBE) programme being implemented by the Federal Government of Nigeria through various unit, division, area and department of the Federal Ministry of Education. This will help female crayfish harvesters to develop and improve their managerial potentials and skills in the business, which could lead to increase in their incomes. Also, Stakeholders in crayfish harvesting business should give women equal opportunities, rights and privileges in the profession like

their men counterparts as well as paying equal wages to female labourers to enhanced their continuous participation in the crayfish harvesting business.

3. Policy makers in collaboration with agriculture-based non-governmental organisations (NGOs) such as the SOFER Initiative and other relevant government agencies (Federal Department of Fishery) should develop gender friendly policies to address the distribution and redistribution of resources challenges in the area. This will help to reduce income inequality gap between gender groups and eliminate discriminatory attributes against female harvesters as highlighted in the study.
4. The Federal Department of Fisheries, State Division of Fisheries and development partners (e. g. Sustainable Development Goals (SDG)) office should sponsor public enlightenment campaigns and trainings for crayfish harvesters through regular town hall meetings, social work groups, and workshops on gender related issues in crayfish harvesting business. These will help to check negative traditional taboos (e.g., restriction of females from accessing water ways for crayfish harvesting in some days chosen by the community to appease their deity and sea goddess) against females. This will help to enhance females' potentials and managerial skills in the profession, as well as create awareness on gender analysis issues among the males, thereby bridging the gender gap in income inequality and poverty.
5. Extension services in the area should be strengthened through the deployment of more extension agents knowledgeable in crayfish harvesting by the state government because extension education was found to be a significant determinant accounting for gender differentials. This would be of great benefit to women in learning new techniques of harvesting and managing crayfish business. It will also

facilitate capacity building, skills improvement, and income generation thereby reducing food insecurity.

6. Relevant government agencies and development partners (e. g. WorldFish Nigeria Strategy 2018 – 2022, and Sustainable Development Goals (SDGs) of the United Nations) through gender mainstreaming should initiate gender friendly intervention programmes/projects that will enhance equal access to harvesting tools such as crayfish harvesting nets, and safety kits among others. This will help to boost harvest, increase income and reduce gender gap in poverty and food insecurity among the harvesters.
7. Female crayfish harvesters should form groups such as clubs and associations in the area so as to enable them access credit facilities provided by WorldFish Nigeria Strategy 2018 – 2022 of the United Nation in partnership with federal and state government.
8. Women should also be encouraged by the local government councils, Bank of Agriculture and Micro finance banks through the provision of micro-credit loans at low interest rate. Accessibility to these loans will enable them diversify their sources of income.

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APENDICES

Apendix A: QUESTIONNAIRE

FERDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE, NIGERIA. SCHOOL OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY, DEPARTMENT OF AGRICULTURAL ECONOMICS AND FARM MANAGEMENT.

GENDER DIFFERENTIALS IN INCOME INEQUALITY, POVERTY AND FOOD SECURITY AMONG CRAYFISH HARVESTING HOUSEHOLDS IN SELECTED STATE OF NIGER DELTA REGION, NIGERIA.

Dear Sir/ Madam,

I am a Ph.D. student of the above named Institution and Department carrying out a research work on the title stated above.

I shall be grateful if you can help answer the following questions below. All the information provided will be treated with strict confidentiality and will be used only for academic purposes.

Thank you.

ETIM, Ebenezer Joseph
PhD/SAAT/2016/946

SECTION A: STUDY IDENTIFICATION

Questionnaire Number: ……

Interview Date: …….. Time interview started ……..

State:…… Local Government Area :…… Community ……..

SECTION B: SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENT

1. Age: ……2. Gender: …… (Male = 1 and Female = 2)
3. Marital status: …….
   (1=Married, 2=Single, 3=Widow/Widower, 4=Divorced. Others (specify) ……..)
4. No. of years spent on formal education: ……
5. Please indicate the level of educational attainment by supplying the requested information below.

*Educational level	Attainment (1=yes or 0 = no)	Degree Obtained	**Status
Primary			
Secondary			
College			
University			
Adult Education			
Others (specify)…….			
……			
Not at all			

*****Educational level: 1= Primary, 2= Secondary, 3= College, 4= University, 5= others, 6= Not at all

****** Status: 1=attempted, 2= completed, 3= on going, 4= not attempted.

6. Household size ……..

7. Please complete the information in the table below.

Household member ID	*Relationship with household head	Gender (1=male; & 2= female)	Age	level of Education	**Major economic activity perform
	.				

* Relationship with household head: 1= Spouse, 2= Children, 3= Parent, 4= Relative, 5= Servant, Others specify….....

** Major economic activity performs: 1 = crayfish harvesting; 2 = fishing; 3 = farming; 4 = artisan; 5 = civil servant; 6 = trading; others (specify)……..

8. Primary occupation… (1= crayfish harvesting, 2= fishing, 3= farming, others (specify) ……)
9. Crayfish harvesting experience (in years) …….
10. Level of involvement in crayfish harvesting: …… (Full-time = 1 and part-time = 0).
11. Do you have access to credit facilities? (YES= 1/ NO=0) ……
12. If yes please complete the information in the table below.

Sources of credit (e.g. Agency, institution, organization,	Year obtained	Amount applied for	Amount obtained	Amount repaid	Amount outstanding

*****Sources of credit: Commercial bank=1, Micro-finance bank=2, Cooperative=3, Personal saving=3, Friends=4, Relatives=5, Agricultural lending agency=6, Money lenders=7 others (specify) …….....

13. Do you belong to any Association? (1 = YES/ 0 =NO) ……
14. If yes, please complete this table.

Name of association	Level of participation (Member = 1; Exco. member=2)	Frequency of attendance at meeting days per year		Benefit derived
		No called	Number attended	

15. Have you been visited by an extension agent in the past one year?
……. (1=YES/0 =NO)

16. If yes, how many times were you visited by an extension agent in the year? …….

17. What type of training did you receive?.....
(Method of harvesting=1, Water safetymeasures=2, Fire prevention measures=3, others (specify) ……..)

18. Did you find the training very useful in your crayfish harvesting business?
…..... (1=YES/0 =NO)

19. Have you ever adopted the innovation (information) given to you at the training? ……. (1=YES/0 =NO)

SECTION C: INFORMATION ON INCOME DISTRIBUTION AND CRAYFISH HARVESTING

20. How many days in a week do you harvest crayfish?
Peak season ……. Lean season ……..

21. How many hours do you spent in a day to harvest crayfish?
Peak season ……. Lean season ……..

22. Number of labour used in crayfish harvesting enterprise……..

Farm labour	Gender	Number of labour used		Wages/salaries	
		Peak season	Lean season	Peak season	Lean season
Permanent	Male				
	Female				
Hired	Male				
	Female				
Family	Male				
	Female				

23. What is the weight of a standard bag of crayfish? ---------- (in kg)

24. Please complete the information in the table below about crayfish harvesting in the peak and lean season.

Crayfish information	Peak season	Lean season
Number of week(s) involved.		
Price of crayfish per bag.		
Quantity of crayfish harvested per day (in bag)		
Quantity of crayfish harvested per week (in bag).		

Income from crayfish harvested per day		
Income from crayfish harvested per week (in ₦).		

25. Please complete the information in the table below about operating expenses of crayfish harvesting in the peak and lean season.

operating expenses	Cost for Peak season (₦)	Cost for Lean season (₦)
Fueling of outboard engine/day		
Mending of net		
Repairs of other crayfish fishing gears e. g. trap, basket		
Servicing of the engine		
Firewood for smoking of crayfish		
Miscellaneous		
Total		

26. To whom do you sell your produce? ……
(1= Local purchasing agents, 2= Commision agents, 3= Cooperative society, 4 = Consumers, Others (specify) ……..).

27. Where do you sell your crayfish produce? ……..
(1= farm gate, 2= village market,3= urban market, others (specify) ……..).

28. Distance to the market ……. (in km)

29. Have you received some form of assistance from Government?.....(1 =Yes; 0 =No)

30. If yes, in which form? ……(1= direct supply, 2= subsidy, 3= loan, others ……).

31. List the type of input you benefited from (i).....
(ii) …… (iii)…….
(iv) …… (v) ……

32. Do you have access to harvesting tools?……. (Yes=1, No=0)

33. If no. why? …….

34. Please provide the following information about your fix capital input in crayfish harvesting.

S/N	Input	Yes/ No	*Source	Quantity	Cost of acquiring (₦)	Lifespan (in years)
1	Boat/ Canoe					
2	Outboard Engine					
3	Crayfish smoking house					

4	Paddle					
5	Crayfish net					
6	Crayfish harvesting basket/pot					
7	Rubber basin/container					
8	Pyramid wooden lath trap					
9	Conical cone trap					
10	Bully net					
11	Scoop net					
12	Anchor					
13	Floaters (corks)					
14	Safety kit					
15	Others (specify)……					

Note: 1 = Yes and 0 = No

*source: 1= purchase, 2= government, 3= cooperate organization/NGOs, 4= rented, 5= inheritance

35. Which of the following size of boat/canoe do you use in crayfish harvesting?

Boat /Canoe size	Yes / No (1=Yes and 0= No)	Carrying capacity (maximum number of person / boat)	Number possess
Big			
Medium			
Small			

Note: Carrying capacity: big boat = 11 people and above, medium boat = 6 to 10 people, small boat = 1 to 5 people

36. Which of this post-harvest technology do you use in preserving your crayfish? ..... (1= smoking, 2=salting, 3= sun drying, 4= refrigeration, 5= frying, others (specify)…….).

37. Other sources of income

S/N	Source of income	Working hours	Income acquired/month	Total Income / annum (~~₦~~)
1	Forestry work			
2	Fishing			
3	Petty Trading			
4	Crop farming			
5	Animal farming			

6	Government employee			
7	Private sector employee			
8	Artisan/craft work e.g. Carpentry Painting Tailoring Mason Mechanic			
9	Remittance from abroad			
10	Remittance from relative in Nigerian towns/cities			
11	Pension			
12	Contract			
13	Social benefits			
14	Transport services			
15	Housewife			
16	Others (specify)……..			
17	Non			

38. Expenses incurred in other sources of income

S/N	Source of income	Operating expenses (₦)	Miscellaneous expenses (₦)	Expenses incurred/month (₦)	Total expenses/ annum (₦)
1	Forestry work				
2	Fishing				
3	Petty Trading				
4	Crop farming				
5	Animal farming				
6	Government employee				
7	Private sector employee				
8	Artisan/craft work e.g. Carpentry Painting				

	Tailoring Mason Mechanic				
9	Remittance from abroad				
10	Remittance from relative in Nigerian towns/cities				
11	Pension				
12	Contract				
13	Social benefits				
14	Transport services				
15	Housewife				
16	Others (specify)……				
17	Non				

SECTION D: INFORMATION ON POVERTY LEVEL

39. Asset ownership

S/N	Asset	Yes=1; No=0	*Type	**Size	No.	Cost of possession (~~N~~)	Current value	Life span (years)
1	Land							
House								
1	Duplex							
2	Bungalow							
3	Thatch							
4	Non							
5	Others (specify)							
Farm Asset								
1	Cutlasses							
2	Hoes							
3	Tractors							
4	Ploughs							
5	Harrows							

6	Cattle							
7	Sheep and Goats							
8	Chicken							
9	Farms							
10	Planters							
11	Sprayers							
12	Harvesters							
13	Threshers							
14	Mills							
15	Water pumps							
16	Others (specify)							
Non- Farm Asset								
1	Grinding Machines							
2	Sewing Machines							
3	Goods in store							
4	Motorcycles							
5	Vehicles							
6	Factory Machines							
7	Others (specify),,,,,,							

*** Type**: 1= mud, 2= wood, 3= concrete, 4 = thatch, 5= not applicable

****Size** (in m^2): 1=10m^2 - 25m^2, 2=26m^2- 40m^2, 3=41m^2- 55m^2, 4=56m^2 and above, 5= not applicable.

40. Do you have access to institutions (Yes=1; No=0) ……

41. Indicate the institutions located in your locality and your accessibility to them.

S/N	Institution	Availability		Accessibility	
		Yes	No	Yes	No
1	General hospital				
2	Cottage hospital				

3	Clinic				
4	Primary health care centre				
5	Nursery school				
6	Primary school				
7	Secondary school				
8	College				
9	University				
10	Extension service				
11	Other educational training centre (specify)				
12	Electricity				
	Pipe born water				
13	Commercial bank				
14	Microfinance bank				
15	Agricultural bank				
16	Others (specify)				
17	Recreational centre				
18	Church				
19	Mosque				
20	Others (specify)……..				

42. Who is responsible for providing income for household needs?..... (1= myself, 2= my spouse, 3= male children, 4= female children, 5=male relative, 6= female relative, 7= male friend, 8= female friend, others (specify).

43. Other Material Cost: Please provide information requested in the following table on expenditure on other items apart from labour, capital and other harvesting inputs used for crayfish harvesting last year

Item	Expenditure in the last production season
Asset maintenance Transport Power rate (Electricity) Telephone Others (specify) ……..	
Total cost	

44. How many people actively participate in crayfish harvesting activities in your household and how much do you normally paid them in a week?

Peak period

S/N	Category	No. of Male	Amount/week	No. of Female	Amount/week
1	Adult (18- 64yrs)				
2	Children (5- 17yrs				
3	Aged (65 yrs and above)				

Lean period

S/N	Category	No. of Male	Amount/week	No. of Female	Amount/week
1	Adult (18- 64yrs)				
2	Children (5- 17yrs				
3	Aged (65 yrs and above)				

SECTION E: INFORMATION ON FOOD SECURITY

45. Indicate which of the following food items is available and accessible in your area and how much do you spent daily to consume them in your household?

Food Item	*Availability	**Ease of access	Amount spent daily (~~₦~~)
Yam			
Beans			
Rice			
Cassava			
Maize			
Vegetable			
Guinea Corn			
Millet			
Sweet potatoes			
Wheat			
Indomie			
Macroni			
Bread			

Fruits /juice			
Meat, poultry, offal			
Eggs			
Fish and seafood e.g. crayfish, oyster			
Pulses/legumes/nuts			
Milk and milk products			
Oil/fats			
Sugar/honey			
Others(Specify) …… …… ……			

*Availability: 1 = available, 0 = not available

**ease of access: 1= easily accessible, 2= not easily accessible

46. What is the average amount of money spent on household food consumption monthly? .....

47. Sources of food supply in the locality:

Sources	Number of male	Number of female
Farmers		
Marketers		
Importers		
Government agencies		
Non-governmental organizations (NGOs)		
International food donor organization		
Others (specify)…….		

*Sources: 1 = Farmers, 2 = Marketers, 3 = Importers, 4 = Government agencies, 5 = Non-governmental organizations (NGOs), 6 = International food donor organization

48. Is there any food processing industry found in your area? ……(1=Yes/0= No).

49. If yes, which type? ……

50. Do you always have access to your preferred food product(s) at all time?..... (1=Yes/0= No).

51. If no, for how long does the scarcity persist?..... (1= one day, 2= one week, 3= two weeks, 4= one month, 5= three months, 6= six months, 7= seven months and above)

52. Who is responsible for providing income for household food?..... (1= myself, 2= my spouse, 3= male children, 4= female children, 5=male relative, 6= female relative, 7= male friend, 8= female friend, others (specify)

SECTION F: COPING STRATEGIES FOR INCOME INEQUALITY, POVERTY AND FOOD SECURITY

53. COPING STRATEGIES FOR INCOME INEQUALITY

Coping strategies	Frequently used (3)	Occasionally used (2)	Rarely used (1)	Never used (0)
Reduction in food consumption				
Eating less preferred food				
Reduce food diversification				
Children eating first				
Reduction in the number of meals taken per day i.e. Skipping of meals				
Selling of assets to increase income				
Spending of saved income				
Rely less on expensive cloths				
Purchasing items on credit				
Borrowing money for the household upkeep				
Diversify off-farms activities to increase income				
Intensify the amount of work done on the farm to increase output				
Reliance on help from relatives and friends.				
Allocating children to friends and relatives				
Relocating to other places				
Others (specify)				

54. COPING STRATEGIES FOR POVERTY

Coping strategies	Frequently used (3)	Occasionally used (2)	Rarely used (1)	Never used (0)
Reduction in food consumption				
Eating less preferred food				
Reduce food diversification				
Children eating first				

Reduction in the number of meals taken per day i.e. Skipping of meals				
Selling of assets to increase income				
Spending of saved income				
Rely less on expensive cloths				
Purchasing items on credit				
Borrowing money for the household upkeep				
Diversify off-farms activities to increase income				
Intensify the amount of work done on the farm to increase output				
Reliance on help from relatives and friends.				
Allocating children to friends and relatives				
Relocating to other places				
Others (specify)				

55. COPING STRATEGIES FOR FOOD INSECURITY

Coping strategies	Frequently used (3)	Occasionally used (2)	Rarely used (1)	Never used (0)
Reduction in food consumption				
Eating less preferred food				
Reduce food diversification				
Children eating first				
Reduction in the number of meals taken per day i.e. Skipping of meals				
Selling of assets to increase income				
Spending of saved income				
Rely less on expensive cloths				
Purchasing items on credit				
Borrowing money for the household upkeep				
Diversify off-farms activities to increase income				

Intensify the amount of work done on the farm to increase output				
Reliance on help from relatives and friends.				
Allocating children to friends and relatives				
Relocating to other places				
Others (specify)				

Time interview ended ……

Apendix B. Results on distribution of crayfish harvesters according to socioeconomic characteristics and institutional factors by State and Pooled

Table 1. Distribution of crayfish harvesters according to socioeconomic characteristics and institutional variables by State and Pooled

Variables	Cross River (n=139)	Akwa Ibom (n=140)	Bayelsa (n=130)	Pooled (n=409)
Age				
20- 30	27 (19.42)	58 (41.43)	10 (7.69)	95 (23.23)
31- 40	49 (35.25)	34 (24.29)	51 (39.23)	134 (32.76)
41- 50	45 (32.37)	38 (27.14)	57 (43.85)	140 (34.23)
>50	18 (12.95)	10 (7.14)	12 (9.23)	40 (9.78)
Mean	40.17 (8.86)*	35.48 (10.22)*	41.65 (7.52)*	39.03 (9.33)*
Gender				
Male	112 (80.58)	97 (69.29)	91 (70.00)	300 (73.35)
Female	27 (19.42)	43 (30.71)	39 (30.00)	109 (26.65)
Marital status				
Married	106 (76.26)	68 (48.57)	100 (76.92)	274 (66.99)
Single	7 (5.04)	42 (30.00)	6 (4.62)	55 (13.45)
Widow/Widower	17 (12.23)	28 (20.00)	16 (12.31)	61 (14.91)
Divorced	9 (6.47)	2 (1.43)	8 (6.15)	19 (4.65)
Years spent on Formal Education				
0	28 (20.14)	39 (27.86)	11 (8.46)	78 (19.07)
1-6	51 (36.69)	89 (63.57)	77 (59.23)	217 (53.06)
7-12	55 (39.57)	12 (8.57)	42 (32.31)	109 (26.65)
>12	5 (3.60)	0 (0.00)	0 (0.00)	5 (1.22)
Mean	6.24 (4.20)*	3.46 (3.5)*	5.86 (2.63)*	5.17 (3.59)*
Educational attainment				
No formal	23 (16.54)	32 (22.86)	6 (4.61)	61 (14.91)
Primary	54 (38.85)	94 (67.14)	83 (63.85)	231 (56.48)
Secondary	58 (41.73)	13 (9.29)	41 (31.54)	112 (27.38)
Tertiary	4 (2.88)	1 (0.71)	0 (0.00)	5 (1.22)
Primary Education Status				
Attempted	23 (16.55)	67 (47.86)	34 (26.15)	124 (30.32)
Completed	31 (22.30)	22 (15.71)	48 (36.92)	101 (24.69)
Ongoing	0 (0.00)	5 (3.57)	1 (0.72)	6 (1.43)
Secondary Education Status				
Attempted	38 (27.34)	6 (4.29)	40 (30.77)	84 (20.54)
Completed	20 (14.39)	6 (4.29)	1 (0.77)	27 (6.60)
Ongoing	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Tertiary Education Status				
Attempted	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Completed	4 (2.88)	1 (0.71)	0 (0.00)	5 (1.22)
Ongoing	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)

Source: Computed from field survey data, 2018.

Table 2. Distribution of crayfish harvesters according to socioeconomic characteristics and institutional variables by State and Pooled cont'd

Variables	Cross River (n=139)	Akwa Ibom (n=140)	Bayelsa (n=130)	Pooled (n=409)
Household size				
< 5	9 (6.47)	74 (52.86)	2 (1.54)	85 (20.78)
6- 10	96 (69.06)	63 (45.00)	77 (59.23)	236 (57.70)
11- 15	34 (24.46)	3 (2.14)	50 (38.46)	87 (21.27)
>16	0 (0.00)	0 (0.00)	1 (0.77)	1 (0.24)
Mean	8.79 (2.59)*	5.69 (1.98)*	10.20 (2.77)*	8.18 (3.10)*
Primary Occupation				
Crayfish Harvesting	139 (100.00)	140 (100.00)	129 (99.23)	408 (99.76)
Fishing	0 (0.00)	0 (0.00)	1 (0.77)	1 (0.24)
Farming	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Others	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Experience				
>10	21 (15.11)	34 (24.29)	13 (10.00)	68 (16.33)
11-20	62 (44.60)	49 (35.00)	52 (40.00)	163 (39.85)
21-30	47 (33.81)	43 (30.71)	41 (31.54)	131 (32.03)
31-40	8 (5.76)	13 (9.29)	23 (17.69)	44 (10.76)
41-50	1 (0.72)	1 (0.71)	1 (0.77)	6 (0.73)
Mean	19.75 (7.67)*	19.20 (9.03)*	22.27 (8.45)*	20.36 (8.49)*
Level of involvement				
Full time	136 (97.84)	140 (100.00)	127 (97.69)	403 (98.58)
Part time	3 (2.16)	0 (0.00)	3 (2.31)	6 (1.47)
Access to credit				
Yes	1 (0.72)	19 (13.57)	14 (10.77)	34 (8.31)
No	138 (99.28)	121 (86.43)	116 (89.23)	375 (91.69)
Sources of credit				
Commercial bank	0 (0.00)	0 (0.00)	5 (3.85)	5 (1.22)
Microfinance bank	0 (0.00)	10 (7.14)	3 (2.31)	13 (3.18)
Cooperative	0 (0.00)	3 (2.14)	4 (3.08)	7 (1.71)
Personal saving	1 (0.72)	1 (0.71)	0 (0.00)	2 (0.49)
Friends	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Relatives	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Agricultural lending agency	0 (0.00)	0 (0.00)	1 (0.77)	1 (0.24)
Money Lenders	0 (0.00)	3 (2.14)	1 (0.77)	3 (0.73)
Government	0 (0.00)	2 (1.43)	1 (0.77)	3 (0.73)
None	138 (99.28)	121 (86.43)	116 (89.23)	375 (91.69)
Member of Association				
Yes	13 (9.35)	66 (47.14)	7 (5.38)	86 (21.08)
No	126 (90.65)	74 (52.86)	123 (94.62)	322 (78.02)
Extension visit				
Yes	0 (0.00)	35 (25.00)	68 (52,31)	103 (25.18)
No	139 (100.00)	105 (75.00)	62 (47.69)	306 (74.82)
Number of visit/year				
2	0 (0.00)	4 (2.86)	6 (4.62)	0 (0.00)
1	0 (0.00)	31 (22.14)	62 (47.69)	10 (2.44)
0	139 (100.00)	105 (75.00)	62 (47.69)	93 (74.82)

Source: Computed from field survey data, 2018.

Apendix C. Results on Level of gender income inequality, poverty and food security of crayfish harvesters in Cross River.

Table 3. Level of gender income inequality of crayfish harvesters in Cross River based on total income.

Income range	NCH	PCH	CPCH (X)	TVI	PTI	CPTI (Y)	XY
Male							
1 to 500000	13	0.1111	0.1111	3958033	0.0142	0.0142	0.0016
500001 to 1000000	11	0.0940	0.2051	8197725	0.0294	0.0437	0.0041
1000001 to 1500000	18	0.1538	0.3590	23350550	0.0839	0.1275	0.0196
1500001 to 2000000	15	0.1282	0.4872	25028880	0.0899	0.2174	0.0279
2000001 to 2500000	18	0.1538	0.6410	40158975	0.1442	0.3616	0.0556
2500001 to 3000000	15	0.1282	0.7692	41270290	0.1482	0.5098	0.0653
3000001 to 3500000	9	0.0769	0.8462	29527120	0.1060	0.6158	0.0474
3500001 to 4000000	3	0.0256	0.8718	11385320	0.0409	0.6567	0.0168
4000001 to 4500000	3	0.0256	0.8974	12726190	0.0457	0.7024	0.0180
Above 4500000	12	0.1026	1	82860205	0.2976	1	0.1026
Total	117	1		278463288	1		0.3590
Gini coefficient (1-∑XY)							**0.6410**
Female							
1 to 500000	1	0.0455	0.0455	343400	0.0071	0.0071	0.0003
500001 to 1000000	1	0.0455	0.0909	895800	0.0185	0.0256	0.0012
1000001 to 1500000	5	0.2273	0.3182	6475650	0.1337	0.1593	0.0362
1500001 to 2000000	2	0.0909	0.4091	3396575	0.0702	0.2294	0.0209
2000001 to 2500000	5	0.2273	0.6364	11065400	0.2285	0.4580	0.1041
2500001 to 3000000	1	0.0455	0.6818	2586500	0.0534	0.5115	0.0232
3000001 to 3500000	5	0.2273	0.9091	15966750	0.3298	0.8412	0.1912
3500001 to 4000000	2	0.0909	1	7687800	0.1588	1	0.0909
Total	22	1		48417875	1		0.4680
Gini coefficient (1-∑XY)							**0.5320**
Pooled							
1 to 500000	14	0.1007	0.1007	4301433	0.0132	0.0131	0.0013
500001 to 1000000	12	0.0863	0.1871	9093525	0.0278	0.0410	0.0035
1000001 to 1500000	23	0.1655	0.3525	29826200	0.0912	0.1322	0.0219
1500001 to 2000000	17	0.1223	0.4748	28425455	0.0870	0.2192	0.0268
2000001 to 2500000	23	0.1655	0.6403	51224375	0.1567	0.3759	0.0622
2500001 to 3000000	16	0.1151	0.7554	43856790	0.1342	0.5101	0.0587
3000001 to 3500000	14	0.1007	0.8561	45493870	0.1392	0.6492	0.0654
3500001 to 4000000	5	0.0360	0.8921	19073120	0.0583	0.7076	0.0254
4000001 to 4500000	3	0.2158	0.9137	12726190	0.0389	0.7465	0.0161
Above 4500000	12	0.0863	1	82860205	0.2535	1	0.0863
Total	139	1		326881163	1		0.3677
Gini coefficient (1-∑XY)							**0.6325**

Source: Computed from field survey data, 2018.

NCH = Number of crayfish harvesters, PCH = Proportion of crayfish harvesters, CPCH = Cumulative proportion of crayfish harvesters, TVI = Total value of income, PTI = Proportion of total income, CPTI = Cumulative proportion of total income.

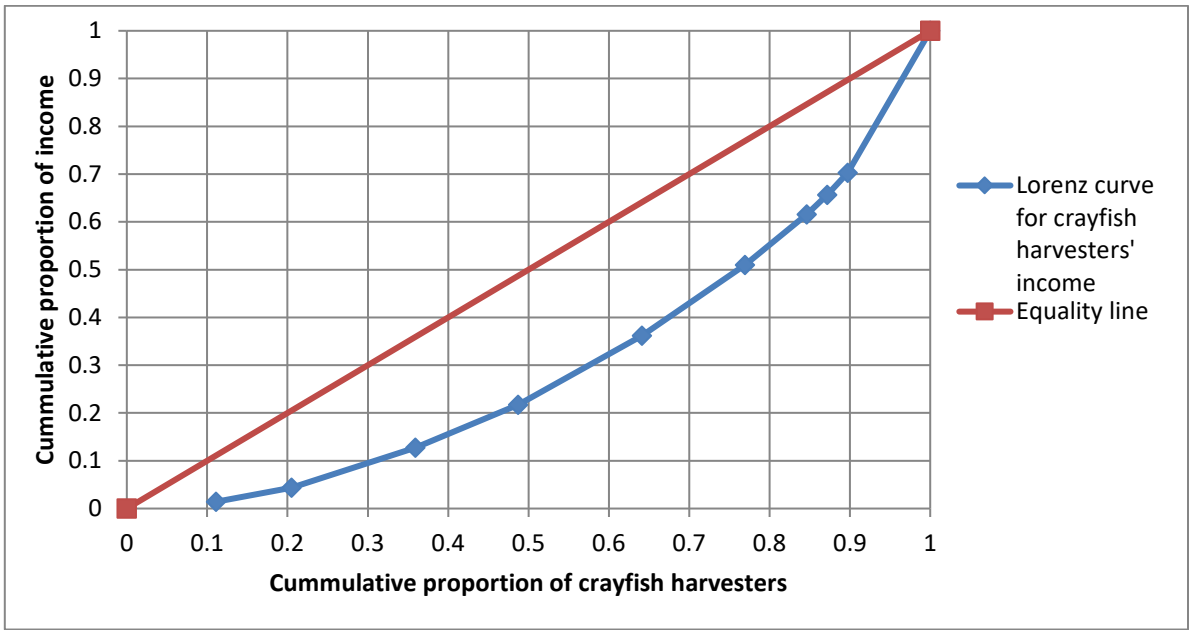

Figure 1 : Lorenz curve of male headed household of crayfish harvesters in Cross River State based on total income.

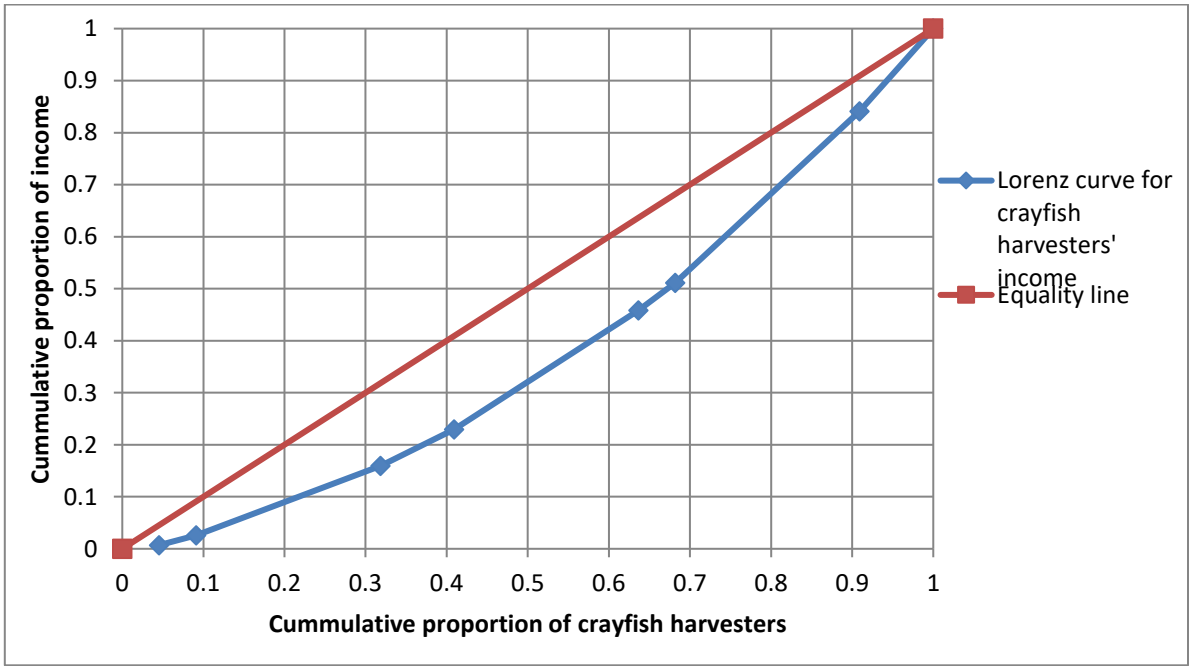

Figure 2: Lorenz curve of female headed household of crayfish harvesters in Cross River State based on total income.

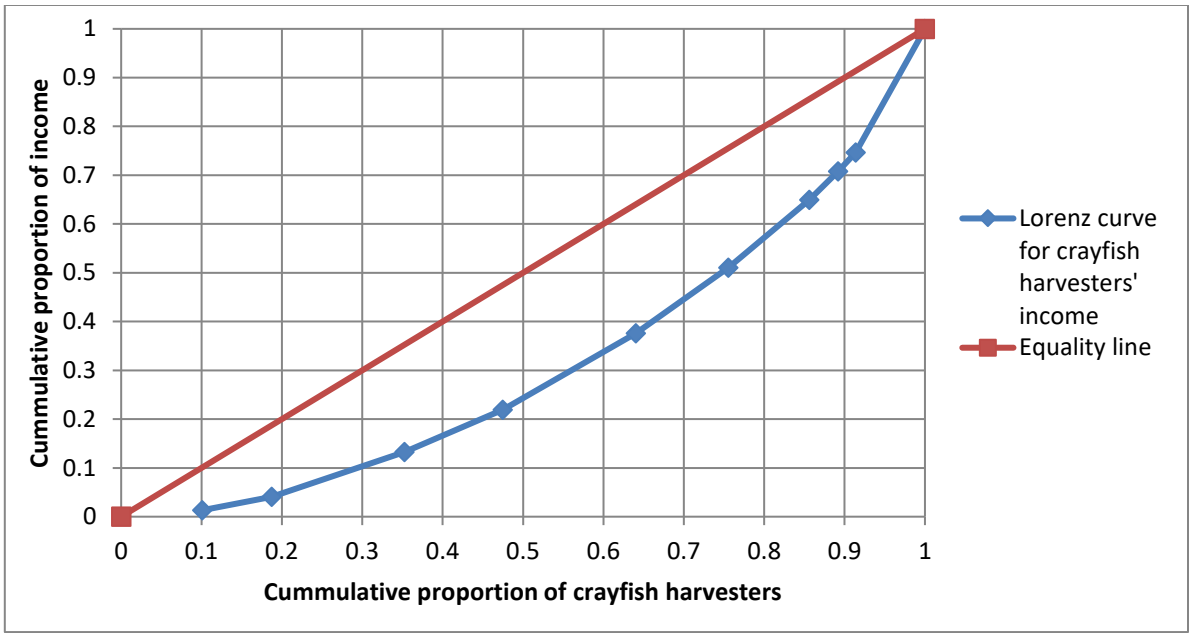

Figure 3. Lorenz curve of pooled household of crayfish harvesters in Cross River State based on total income.

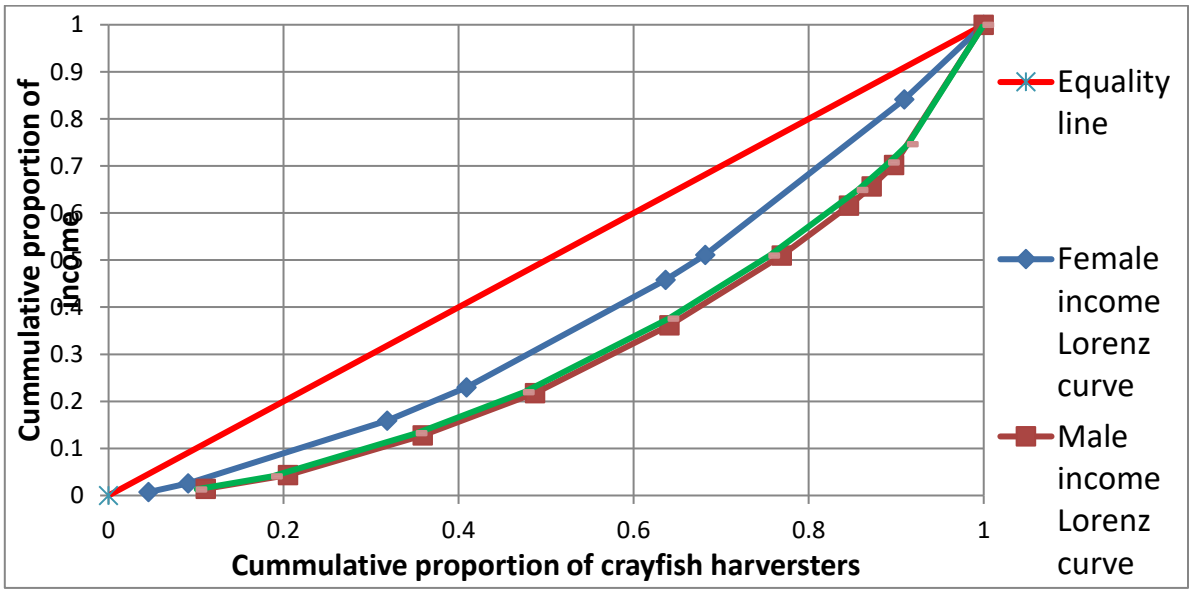

Figure 4. Generalized gender Lorenz curve of crayfish harvesters in Cross River State based on total income.

Table 4. Poverty status of male and female crayfish harvesters in Cross River State

Poverty status	Male	Female	Pooled
Poverty incidence (Head count index)	0.309	0.586	0.367
Poverty depth (poverty gap index)	0.388	0.239	0.361
Poverty severity index	0.213	0.085	0.180
Poverty line (₦)	206,717.31	172,938.64	199,669.96

Source: Computed from field survey data, 2018.

Table 5. Food security status of crayfish harvesters by gender in Cross River State

Food security status	Male	Female	Pooled
Food secured	60 (53.57)	12 (44.44)	74 (53.24)
Food insecured	52 (46.43)	15 (55.56)	65 (46.76)
Mean per capita expenditure (₦)	8052.06	6759.97	10062.36
2/3mean per capita expenditure (₦)	5368.04	4506.65	6708.24

Source: Computed from field survey data, 2018.

Appendix D. Results on the level of gender income inequality, poverty and food security of crayfish harvesters in Akwa Ibom State

Table 6. Level of gender income inequality of crayfish harvesters in Akwa Ibom State based on total income.

Income range	NCH	PCH	CPCH (X)	TVI	PTI	CPTI (Y)	XY
Male							
1 to 500000	7	0.07	0.07	1605110	0.0065	0.0065	0.0005
500001 to 1000000	17	0.17	0.24	13514250	0.0548	0.0614	0.0104
1000001 to 1500000	24	0.24	0.48	30197545	0.1226	0.1839	0.0441
1500001 to 2000000	9	0.09	0.57	15523850	0.0630	0.2469	0.0222
2000001 to 2500000	7	0.07	0.64	16074170	0.0652	0.3122	0.0219
2500001 to 3000000	9	0.09	0.73	24011420	0.0974	0.4096	0.0369
3000001 to 3500000	11	0.11	0.84	34862560	0.1415	0.5511	0.0606
3500001 to 4000000	1	0.01	0.85	3622955	0.0147	0.5658	0.0057
Above 4000000	15	0.15	1	106986400	0.4342	1	0.15
Total	100	1		246398260	1		0.3522
Gini coefficient (1-∑XY)							**0.6478**
Female							
1 to 500000	7	0.175	0.175	1470650	0.0200	0.0200	0.0035
500001 to 1000000	6	0.15	0.325	4446800	0.0605	0.0806	0.0121
1000001 to 1500000	1	0.025	0.35	1101000	0.0150	0.0956	0.0024
1500001 to 2000000	4	0.1	0.45	7250650	0.0987	0.1943	0.0194
2000001 to 2500000	11	0.275	0.725	25133400	0.3422	0.5365	0.1475
2500001 to 3000000	4	0.1	0.825	10938300	0.1489	0.6854	0.0685
3000001 to 3500000	7	0.175	1	23106800	0.3146	1	0.175
Total	40	1		73447600	1		0.4285
Gini coefficient (1-∑XY)							**0.5715**
Pooled							
1 to 500000	14	0.1	0.1	3075760	0.0096	0.0096	0.0010
500001 to 1000000	23	0.1643	0.2643	17961050	0.0562	0.0658	0.0108
1000001 to 1500000	25	0.1786	0.4429	31298545	0.0979	0.1636	0.0292
1500001 to 2000000	13	0.0929	0.5357	22774500	0.0712	0.2348	0.0218
2000001 to 2500000	18	0.1286	0.6643	41207570	0.1288	0.3637	0.0468
2500001 to 3000000	13	0.0929	0.7571	34949720	0.1093	0.4729	0.0439
3000001 to 3500000	18	0.1286	0.8857	57969360	0.1812	0.6542	0.0841
3500001 to 4000000	1	0.0071	0.8929	3622955	0.0113	0.6655	0.0048
Above 4000000	15	0.1071	1	106986400	0.3345	1	0.1071
Total	140	1		319845860	1		0.3495
Gini coefficient (1-∑XY)							**0.6505**

Source: Computed from field survey data, 2018.

NCH = Number of crayfish harvesters, PCH = Proportion of crayfish harvesters, CPCH = Cumulative proportion of crayfish harvesters, TVI = Total value of income, PTI = Proportion of total income, CPTI = Cumulative proportion of total income.

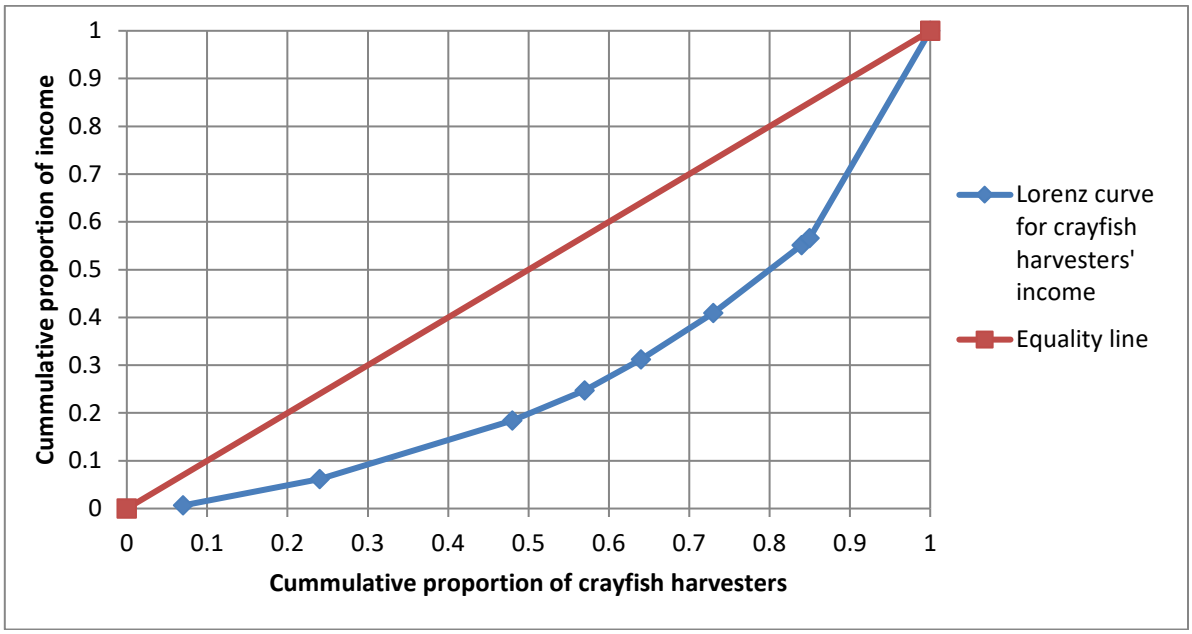

Figure 5: Lorenz curve of male headed household of crayfish harvesters in Akwa Ibom State based on total income.

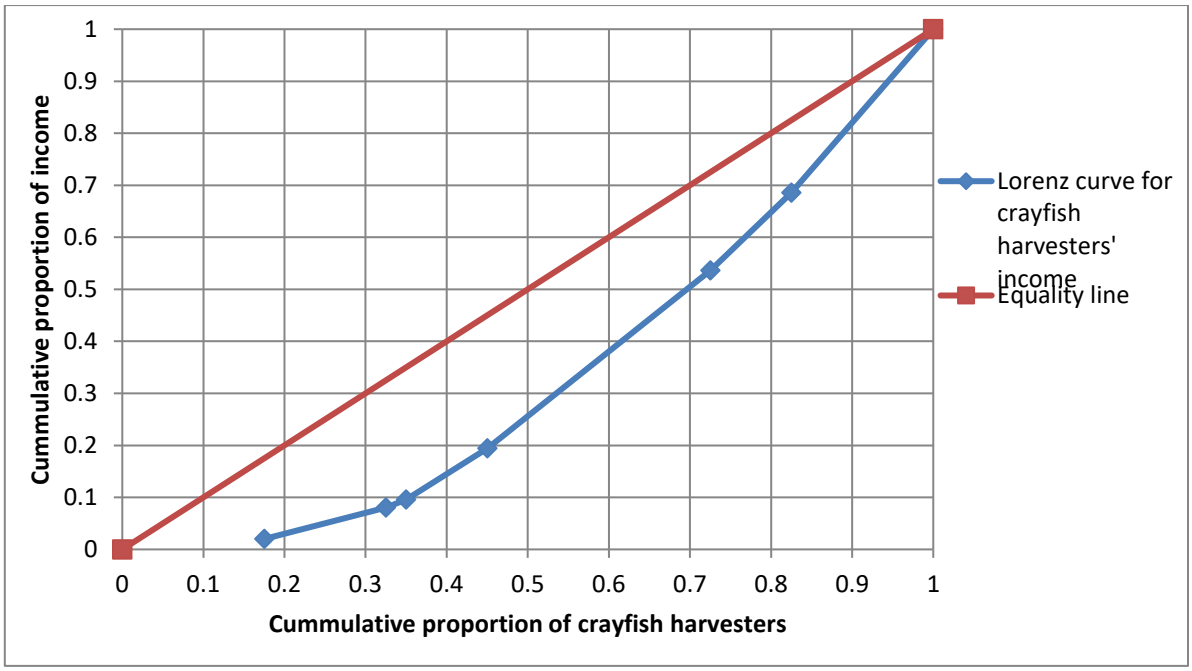

Figure 6. Lorenz curve of female headed household of crayfish harvesters in Akwa Ibom State based on total income.

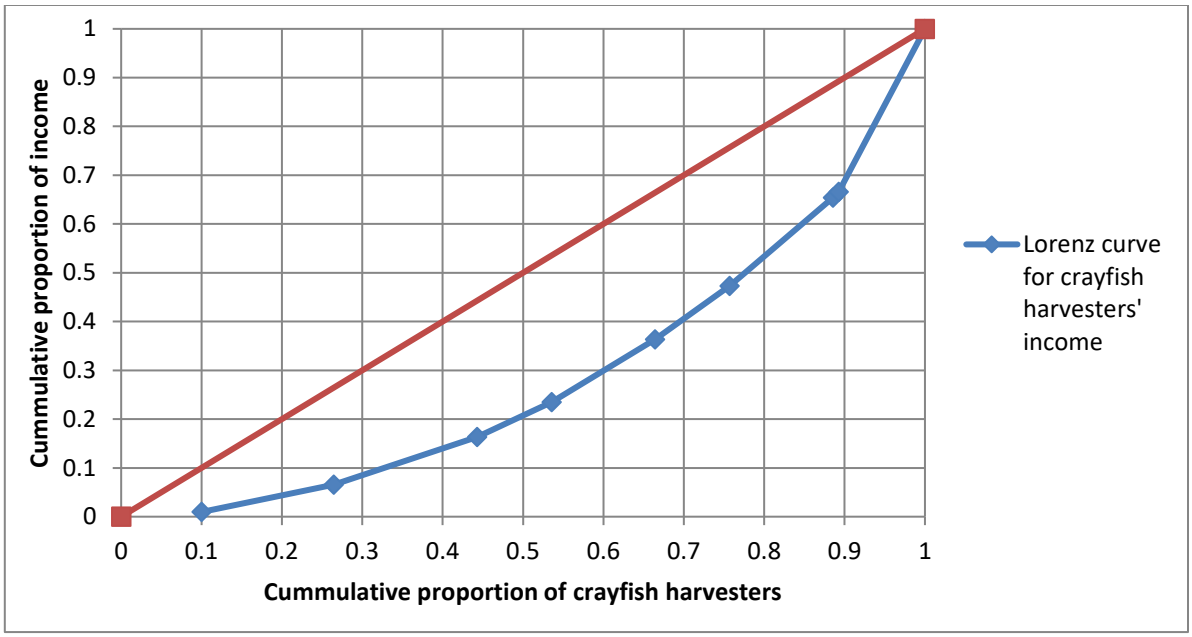

Figure 7. Lorenz curve of pooled household of crayfish harvesters in Akwa Ibom State based on total income.

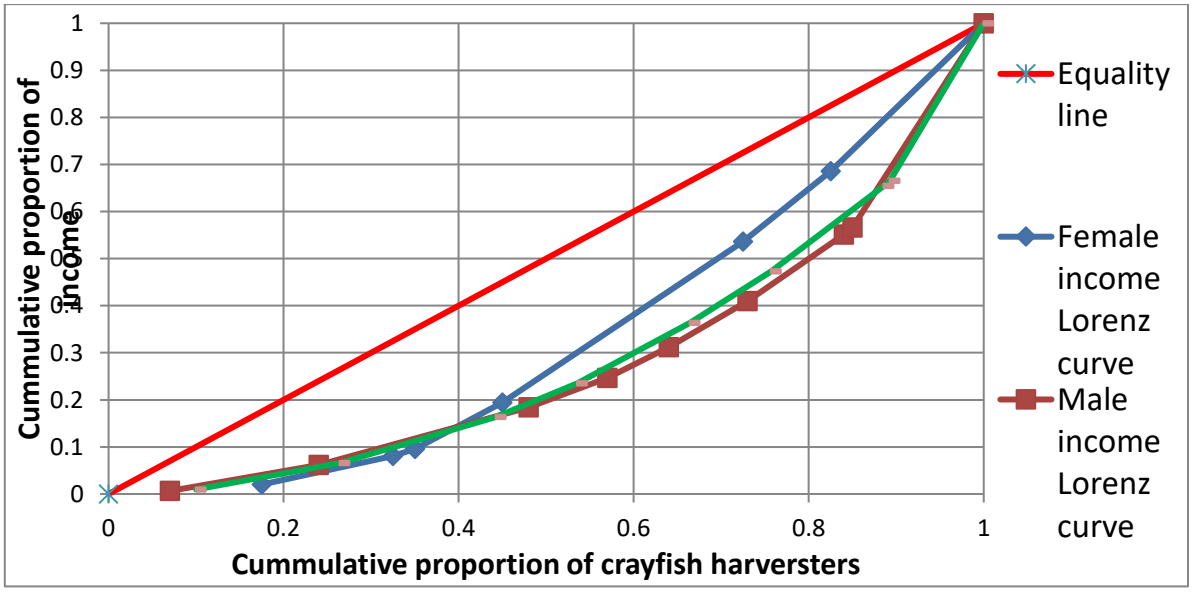

Figure 8. Generalized gender Lorenz curve of crayfish harvesters in Akwa Ibom State based on total income.

Table 7. Poverty status of male and female crayfish harvesters in Akwa Ibom State

Poverty status	Male	Female	Pooled
Poverty incidence (Head count index)	0.410	0.475	0.401
Poverty depth (poverty gap index)	0.368	0.557	0.447
Poverty severity index	0.192	0.368	0.266
Poverty line (₦)	278,769.98	229,971.36	264,827.52

Source: Computed from field survey data, 2018.

Table 8. Food security status of crayfish harvesters by gender in Akwa Ibom State

Food security status	Male	Female	Pooled
Food secured	64 (65.98)	18 (41.86)	82 (58.57)
Food insecured	33 (34.02)	25 (58.14)	58 (41.43)
Mean per capita expenditure (₦)	16,467.62	11,289.52	14,877.20
2/3mean per capita expenditure (₦)	10,978.41	7,526.35	9,918.14

Source: Computed from field survey data, 2018.

Apendix E. Results on level of gender income inequality, poverty and food security of crayfish harvesters in Bayelsa State.

Table 9. Level of gender income inequality of crayfish harvesters in Bayelsa State based on total income.

Income range	NCH	PCH	CPCH (X)	TVI	PTI	CPTI (Y)	XY
Male							
1 to 500000	10	0.1111	0.1111	2824640	0.0117	0.0117	0.0013
500001 to 1000000	4	0.0444	0.1556	2256360	0.0093	0.0210	0.0009
1000001 to 1500000	7	0.0778	0.2333	9557930	0.0395	0.0605	0.0047
1500001 to 2000000	11	0.1222	0.3556	19314960	0.0798	0.1403	0.0172
2000001 to 2500000	13	0.1444	0.5	29412560	0.1216	0.2619	0.0378
2500001 to 3000000	10	0.1111	0.6111	27273450	0.1127	0.3746	0.0416
3000001 to 3500000	12	0.1333	0.7444	38729930	0.1601	0.5346	0.0713
3500001 to 4000000	6	0.0667	0.8111	21817330	0.0902	0.6248	0.0417
4000001 to 4500000	6	0.0667	0.8778	25311110	0.1046	0.7294	0.0486
Above 4500000	11	0.1222	1	65473050	0.2706	1	0.1222
Total	90	1		241971320	1		0.3873
Gini coefficient (1-∑XY)							**0.6127**
Female							
1 to 500000	5	0.125	0.125	2003700	0.0253	0.0253	0.0032
500001 to 1000000	7	0.175	0.3	5967750	0.0754	0.1007	0.0176
1000001 to 1500000	2	0.05	0.35	2607100	0.0329	0.1336	0.0067
1500001 to 2000000	5	0.125	0.475	8692300	0.1098	0.2434	0.0304
2000001 to 2500000	8	0.2	0.675	18329100	0.2315	0.4750	0.0950
2500001 to 3000000	4	0.1	0.775	10272200	0.1298	0.6047	0.0605
3000001 to 3500000	4	0.1	0.875	13207800	0.1668	0.7716	0.0772
3500001 to 4000000	5	0.125	1	18083600	0.2284	1	0.125
Total	40	1		79163550	1		0.4155
Gini coefficient (1-∑XY)							**0.5845**
Pooled							
1 to 500000	15	0.1154	0.1154	4828340	0.0150	0.0150	0.0017
500001 to 1000000	11	0.0846	0.2	8224110	0.0256	0.0406	0.0034
1000001 to 1500000	9	0.0692	0.2692	12165030	0.0379	0.0785	0.0054
1500001 to 2000000	16	0.1231	0.3923	28007260	0.0872	0.1657	0.0204
2000001 to 2500000	21	0.1615	0.5538	47741660	0.1487	0.3144	0.0508
2500001 to 3000000	14	0.1077	0.6615	37545650	0.1169	0.4313	0.0465
3000001 to 3500000	16	0.1231	0.7846	51937730	0.1617	0.5931	0.0730
3500001 to 4000000	11	0.0846	0.8692	39900930	0.1242	0.7173	0.0607
4000001 to 4500000	6	0.0462	0.9154	25311110	0.0788	0.7961	0.0367
Above 4500000	11	0.0846	1	65473050	0.2039	1	0.0846
Total	130	1		321134870	1		0.3833
Gini coefficient (1-∑XY)							**0.6167**

Source: Computed from field survey data, 2018.

NCH = Number of crayfish harvesters, PCH = Proportion of crayfish harvesters, CPCH = Cumulative proportion of crayfish harvesters, TVI = Total value of income, PTI = Proportion of total income, CPTI = Cumulative proportion of total income.

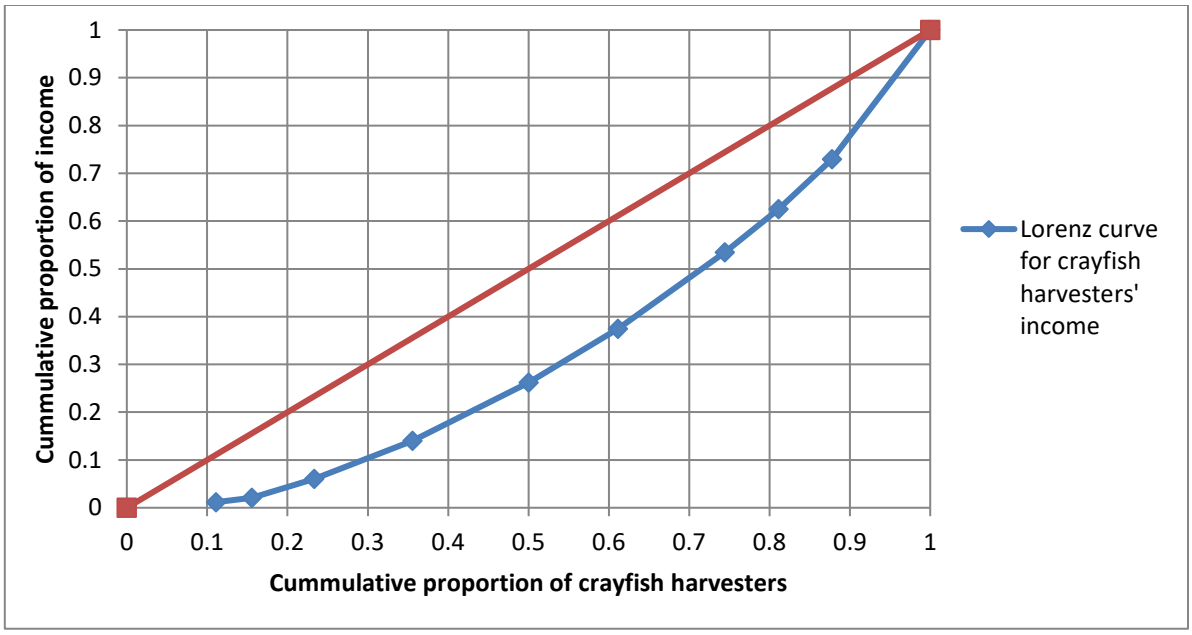

Figure 9. Lorenz curve of male headed household of crayfish harvesters in Bayelsa State based on total income.

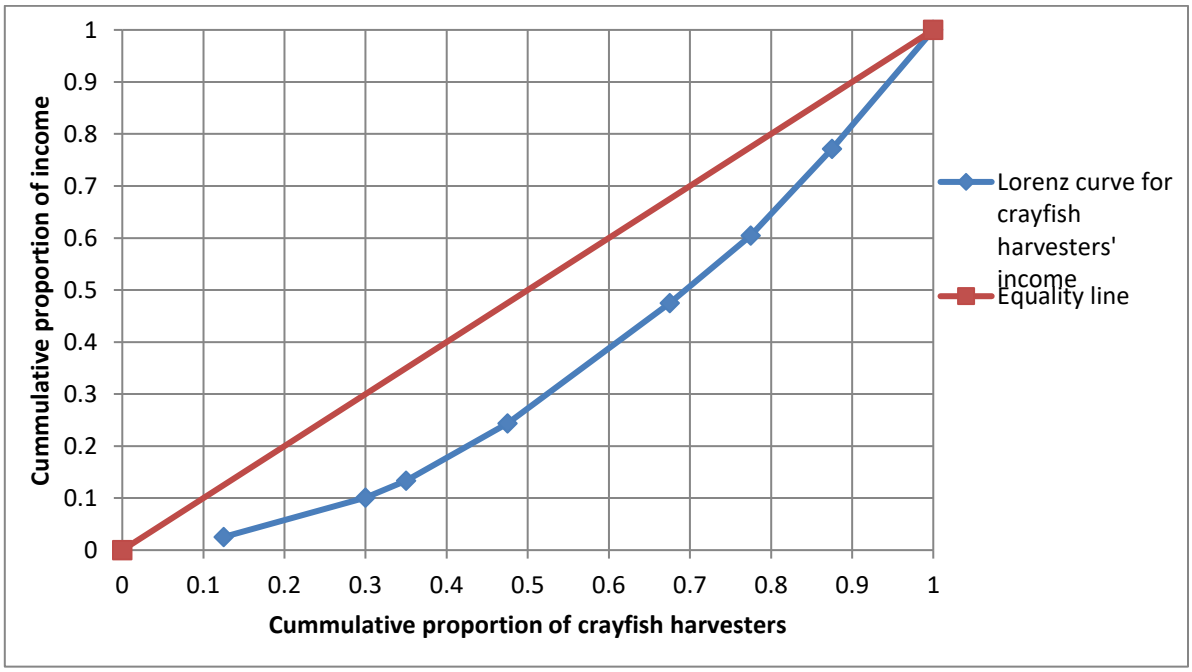

Figure 10. Lorenz curve of female headed household of crayfish harvesters in Bayelsa State based on total income.

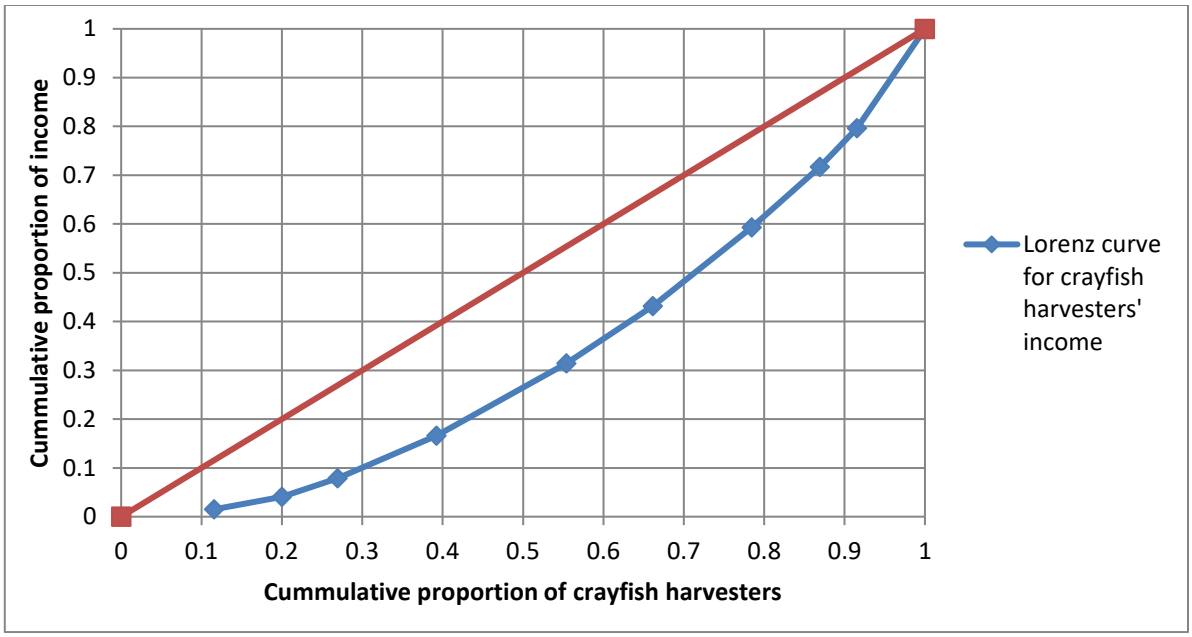

Figure 11. Lorenz curve of pooled household of crayfish harvesters in Bayelsa State based on total income.

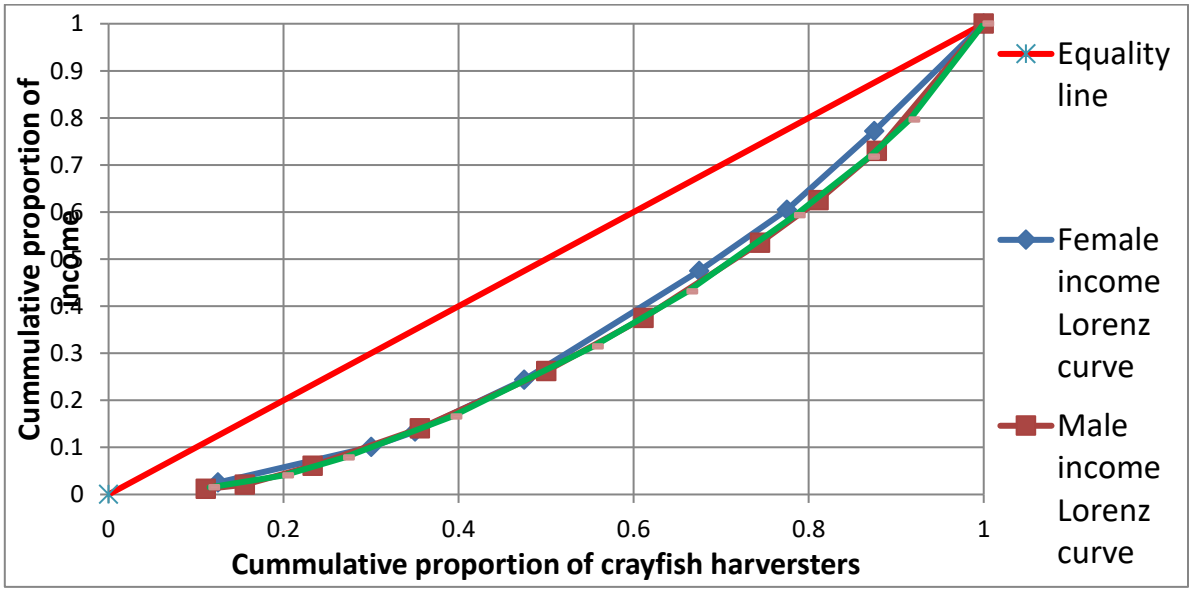

Figure 12. Generalized gender Lorenz curve of crayfish harvesters in Bayelsa State based on total income.

Table 10. Poverty status of male and female crayfish harvesters in Bayelsa State

Poverty status	Male	Female	Pooled
Poverty incidence (Head count index)	0.311	0.400	0.362
Poverty depth (poverty gap index)	0.278	0.238	0.295
Poverty severity index	0.131	0.097	0.150
Poverty line (₦)	190,436.15	138,409.41	174,427.92

Source: Computed from field survey data, 2018.

Table 11. Food security status of crayfish harvesters by gender in Bayelsa State

Food security status	Male	Female	Pooled
Food secured	51 (56.04)	14 (35.90)	65 (50.00)
Food insecured	40 (43.96)	25 (64.10)	65 (50.00)
Mean per capita expenditure (₦)	7,891.04	5,904.10	7,294.96
2/3mean per capita expenditure (₦)	5,260.69	3,936.07	4,863.30

Source: Computed from field survey data, 2018.