UNIVERSITY OF CAPE COAST

LIVELIHOOD ADAPTATION AND MIGRATION: A CASE OF

SELECTED ESTUARINE COMMUNITIES ALONG THE COAST OF

GHANA

CYNTHIA KUTIR

2023

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LIVELIHOOD ADAPTATION AND MIGRATION: A CASE OF

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GHANA

BY

CYNTHIA KUTIR

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Degree in Integrated Coastal Zone Management (ICZM)
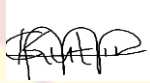
JANUARY 2023

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my original research and that no part of it has been presented for another degree at this University or elsewhere. Comprehensive references have recognized all sources utilized or quoted.

Candidate's Signature…… ~~signature~~   Date……29th /12/2023…

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Supervisors' Declaration

We hereby certify that the preparation and presentation of this thesis were overseen per the University of Cape Coast's criteria for thesis supervision.
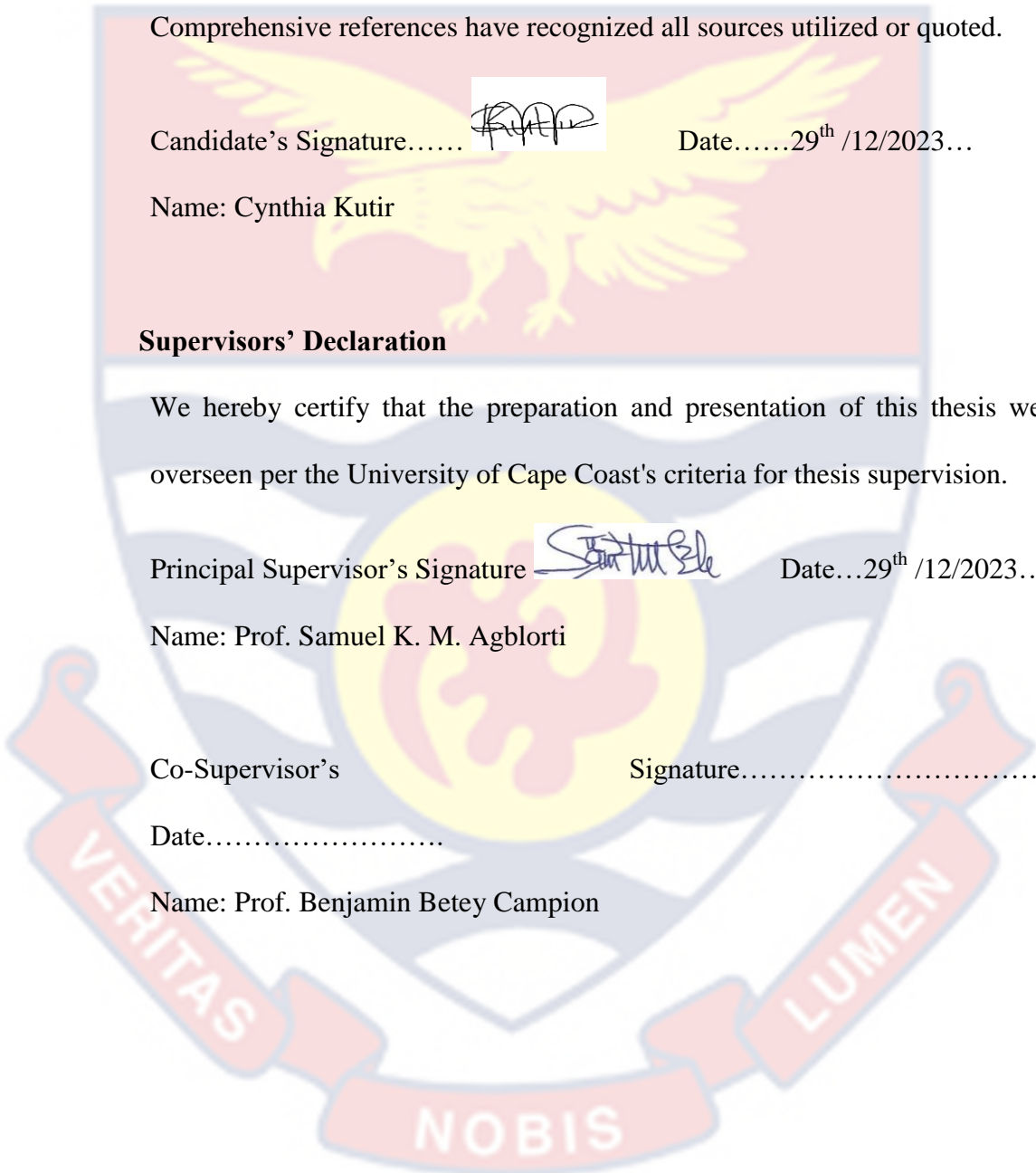
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ABSTRACT

Globally, migration has become an important livelihood strategy for many poor households, with estuaries and seashores playing a central role as points of human settlement and marine resource use. In Ghana, estuarine wetlands support and attract fisher migrants for livelihood adaptation. This study evaluates the impact of estuarine ecosystems on fishers' livelihood migration patterns and anthropogenic stresses on Ghanaian estuaries. Fisher household heads from five estuaries communities were selected using multistage sampling. Data for the study was collected using 652 structured interview schedule, seven focus groups discussions, and 10 in-depth interviews. The results revealed the selected estuaries along Ghana's coast were degraded based on a 34-year LULC change analysis. The type of fishing gear (P = 0.001), Sanctions (P=0.000), and Experience in fishing (P=0.001) were revealed to have a significant negative influence on the degradation of the estuaries along Ghana's Coast. There was a strong positive correlation between ethnicity and migration among migrant fishers (Cramer's V = 0.71). The results also revealed conflicts over the use of the estuarine ecosystem between migrant and native fishers found in Anlo Beach, Faana and Kewunor communities. Overall, fisher's household livelihood security index was 67%. Understanding fisher migration patterns is necessary for managing Ghana's coastal ecosystems, especially estuaries. Uncontrolled migration might lead to overexploitation and resource degradation, compromising SDG 14 and fishers' livelihoods.

KEYWORDS

Estuaries

Fishers'

Household Livelihood Security

Livelihoods

Migration

ACKNOWLEDGEMENTS

DEDICATION

To my late father, Mr Charles Kutir, and my children Charis Mwinkyogtaa

Aabeyir and Candice Mwinbangkumeh Aabeyir.

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CHAPTER ONE

INTRODUCTION

Introduction

This chapter provides background information on the study and the problem statement. This chapter also provides an overview of the study's specific objectives, its justification, and the limitations of the study.

Background to the Study

Livelihood activities are critical to sustainable development, and any threat to livelihoods, particularly among the poor, threatens sustainable development (Begum, 2018). Lee and Neves (2009) assert that the majority of the world's population comprises individuals residing in rural areas who are economically disadvantaged and rely on natural resources for their sustenance. Thus, uncertainty about sustainable livelihoods has become a critical issue of concern at all levels because it sometimes leads to migration and its associated problems and conflicts over natural resources that form the base of the livelihoods of rural populations. Increased population further aggravates livelihood insecurity, and climate change impacts dwindling natural resources. The situation has resulted in competition for livelihood capital (especially natural and physical), and adaptation to alternative livelihood sources has become necessary at the local, national and global levels.

Livelihood adaptation is a continuous process encompassing activities, attitudes and decisions connected to all facets of life. It can be driven by several factors, such as improving safety or protecting economic well-being (Adger et al., 2005). People adjust and change their livelihoods with internal and external challenges that affect livelihoods' availability, functions, and

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sustainability. Thus, these stressors range from weather/climate events to diverse environmental, social, economic, political, insecurity and cultural factors, and they negatively interrupt livelihoods by fortifying each other (Reid & Vogel, 2006). Multiple stressors, simultaneously and sequentially, shape livelihoods in diverse ways due to disparities and distinct vulnerabilities among and within households.

The results of livelihood adaptation are the goals people intend to achieve in their livelihood strategies, ranging from enhanced food security, augmented incomes, improved well-being, reduced vulnerability, and sustainable use of natural resources (Alinovi et al., 2010). Depending on the nature and effects of the stressors on livelihoods at a location coupled with consideration of human, natural, social, economic, physical, financial, and cultural capital. Livelihood adaptation may result in intensification, diversification, and migration to different locations (Ellis, Kutengule & Nyasulu, 2003; Gemenne et al., 2018; Scoones, 1999).

Most migration literature focused on rural-urban migration (Ajaero & Onokala, 2013; Ao, Jiang, & Zhao, 2016; Babi, Guogping & Ladu, 2017; Enu, 2015; Johnson & Taylor, 2018) and cross-border migration (Adepoju, 2006; International Labour Organizations, 2017; International Organization for Migration, 2017). Internal migration, which far exceeds international migration, particularly in coastal areas that transition to cross-border migration through the sea, has also received considerable attention in Ghana (Abobi & Alhassan, 2015; Asiedu et al., 2022; Cudjoe et al., 2017; Kraan, 2009; Marquette, Koranteng, Overa & Aryeetey, 2002). However, migration to estuarine destinations in Ghana is rarely being investigated.

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Coastal areas provide many vital ecosystem services, such as the storage of nutrients, high biodiversity, and climate regulation. They reduce pollution and serve as habitats for marine fish species (Martínez et al., 2007). Estuaries are among the most productive coastal ecosystems and provide more than 70% of global ecosystem services (Costanza et al., 2011). It is estimated that about half of the worldwide population lives within 150 kilometres of the coast, and nearly 114 to 192 million people will reside in urban areas on coastal flood plains in Africa and Asia by 2060 (Foresight, 2011). This suggests that their well-being and livelihoods largely depend on coastal ecosystems such as estuaries (Jayaweera, 2010). Thus, these productive environments are very attractive to prospective migrants. According to the National Geographic Society (2012), several cities have developed around estuaries, including Jakarta, Indonesia, New York City, and Tokyo, Japan. However, significant periodic variations in coastal ecosystems at fluctuating time-based and spatial scales are characterised by rare species variations. Numerous marine fish species move over large temporal and spatial scales (Crona, Wanyonyi, Ochiewo, Ndegwa & Rosendo, 2010) coupled with an increasing coastal population (Neumann et al., 2015) overexploitation (Sivaramanan, 2016), coastal erosion among others threatening the livelihoods of coastal people/fishers.

The livelihood of fishers is further worsened by the effects of climate change on fisheries characteristics. According to Phukan et al. (2011), the average temperature is projected to increase between 1.4 and 5.8°**C** between 1990 and 2100, with change most likely in the 2 - 4.5°**C** range**.** This rise is expected to affect other variables, including oxygen levels, harmful algal

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blooms, and the incidences of pests, diseases, and predators. In addition, the increasing temperature might change the migration/ mobility of fish. Global warming will likely increase the sea level due to ocean water's thermal expansion and glaciers' melting (Sivaramanan, 2015). Brander (2007) stated that climate change adversely influences individual fish species' existence, growth, and distribution. Therefore, an essential part of the fishing profession is migration which is seen as a livelihood adaptation to a dynamic situation rather than a response to degrading conditions (Crona et al., 2010). Reed, Andrzejewski and White (2010) and Srivastava and Sasilkumar (2003) added that migration in pursuit of better livelihoods is a vital component of human history. Empirically, migration functions as a well-being valve to over-population and reducing assets.

When the assets are no longer adequate to withstand the increasing population, individuals move to unexploited zones that are either uninhabited or more sparsely populated to create a niche (Cripps, 2009). These moves might be short- to long-distance and short- to long-duration (Kosiński & Prothero, 1975; Massey, 1990). Thus, migration is one of the most significant processes of demographic change and a strategy for diversifying fishermen's livelihoods. For instance, Kramer, Simanjuntak and Liese (2016) indicated that fisher migrants account for at least one-quarter of the population growth in coastal villages of North Sulawesi during the past decade in Indonesia. Sugimoto (2016) also added that 40% of Shiraho fisher communities in Okinawa, Japan, are internal migrants from other areas of Japan who migrated for economic and livelihood reasons. Myers (2002) also observed that in the mid-1990s, about 25 million people were forced to migrate due to their

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inability to secure a living as ecosystem services deteriorated. Similarly, Chen and Mueller (2018) found that salinity encroachment into coastal soil could be a powerful driver of migration within Bangladesh due to its effects on agriculture and associated loss of livelihood.

According to the International Organization for Migration (IOM)(2012), migration has become a significant livelihood adaptation strategy for many poor groups worldwide. However, sub-Saharan Africa (SSA) is the region most prone to internal migration due to its high dependence on the natural environment for livelihoods, low economic growth and low adaptive capacities (Kotir, 2011). De-Haan (2000) observed that West Africans have a long migration history and that one out of three people lives outside their place of birth. Migration is pronounced among fishers and has influenced fishing communities for centuries (Binet et al., 2012). It is projected that about 40% of the West African population lives in coastal cities, which is expected to increase by 2020 (Boko et al., 2007). This has profound implications for coastal resources and crosses-border migration through the sea.

It is further indicated that an increasing number of people will migrate due to worsening ecological conditions, loss of ecosystem services, population growth and loss of livelihoods (Milan et al., 2014). For instance, Duffy-Tumasz (2012) examined the fishing activities of migrant Ghanaian fisher folks on the coast of Ivory Coast. They supported the well-being of their host communities by augmenting local food security and sustaining livelihoods by providing processed and sold fish. In their study, Binet et al. (2012) also looked at the migration pattern and activities of Senegalese fishers along the

coast of West Africa at their popular destination sites in Mauritania, The Gambia, Guinea Bissau, Guinea, and Sierra Leone. Thus, the fishing sector plays a substantial role in livelihood security for countless fisher migrants in Africa, including those whose primary occupation was not initially fishing (Njock & Westlund, 2010).

In Ghana, fishers' migration is further exacerbated because a projected sea-level rise of 1m by 2100 could lead to the loss of over 1000km^2 of land. This is likely to affect about 132,000 persons since the coast is vulnerable to flooding and shoreline recession owing to its gradient and sandy nature (EPA, 2000). According to sea-level change scenarios, the average rise in sea level by 2020, 2050, and 2080 will be 5.8 cm, 16.5 cm, and 34.5 cm, respectively, over the 1999 mean (EPA, 2020). The situation is further aggravated by other anthropogenic pressures such as population growth, overexploitation of fish, and soil salinity, among other stressors that influence migration as a livelihood adaptation strategy (Goldbach, 2017). According to Odetei (1995), Ghanaian fishers are divided into ethnic-technical groups, thus, the Ga, Fante and the Anlo Ewe. The Fantes are the most migratory fishing group and chiefly use the purse seine technique. The Fante fishers continue to migrate, even after settling permanently in other locations (Kraan, 2009). However, the beach seine technique is generally used by the Anlo-Ewe fishermen (Akyeampong, 2001). The technique makes the Ewe a much more settler fisher migrant group. Kraan (2009) argues that beach seine requires many men to operate due to the large net size, and this fishing technique is strongly connected to the land. However, land acquisition is more challenging than having access to the sea. Akyeampong (2001) added that the Anlo Ewe fishers move and settle

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permanently at other places along the coast, considering population pressures in their home areas and the erosion of beaches resulting in less fishing space. However, while the Fantes may settle permanently elsewhere, they continue to practice seasonal/circular migration. In Ghana fisher migrations is seen as a high professional accomplishment and, besides, affords a prospect for self-fulfilment through access to livelihood assets/capitals beyond one's local community, which can be used to improve situations back home (Overa, 2001). Thus, since migration is a livelihood adaptation strategy, are the livelihoods of fisher migrants sustainable?

Though migration could be a positive livelihood strategy among fisherfolks, the increasing movement of migrants can put extra pressure on resources in destination areas and threaten the livelihoods of sending and receiving area inhabitants. Njock and Westlund (2008) observed that destination communities do not easily accept fisher migrants. It can lead to misunderstandings that often result in conflicts, marginalisation, and exclusion of migrants. Hence, are migrants and natives using the estuary ecosystem having conflicts of interest?. Omondi, Odipo, and Agwanda (2015) and Owusu, Agyei-Mensah and Lund (2008) argued that migration adversely affects sending areas' socio-economic development due to low labour and low labour productivity and brain drain. In the same vein, destination areas are also presumed to experience many problems, including pressure on the ecology, leading to degradation of its natural resource base and hence, reduced livelihoods productivity, overpopulation, pressure on social amenities, the emergence of slums, increased unemployment, and declining standards of living (Omondi, Odipo & Agwanda, 2015). The consequence of this situation

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is that the well-being of natives with weak assets is affected first before that of the immigrants in the community (Omondi et al., 2015).

Consequently, migration can threaten the livelihoods of both sending and receiving areas. Thus, movement may substitute one set of stresses for another, e.g., economic, social, political, or environmental pressures. Migration can be associated with high vulnerability, gender inequality, unstable regimes, and breakdowns of social resilience. However, it is also a strategy to spread risk and increase assets, forming an integral part of household livelihood strategy.

In addition, migration threatens the earth's rich biodiversity, particularly wetlands, due to rapid unforeseen increases in population (Oglethorpe et al., 2007). Population growth results in increasing pressures on natural resources, thereby contributing to changes in land use and land cover of the environment (Islam et al., 2016). For instance, Muthusamy et al. (2010) found an alarming 47% decrease in the river area in their land use land cover analysis of the Manakudy Estuary from 1991 to 2001. Similarly, Ansa-Asare, Mensah and Biney (2008) indicated that nutrient inputs directly impact human activities in some designated lagoons in Ghana. Wuver and Attuquayefio (2006) observed that over the year, wetlands' biodiversity conservation was hampered by fuelwood harvesting, bushfire, hunting, and farming. Attuquayefio and Fobil (2005) added that rapid population growth and pressures, overexploitation and the need for more agricultural land are the major causes hampering biodiversity and ecosystem conservation. Similar results of human activities and population pressures threatening wetlands

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protection were also found in Attuquayefio and Gbogbo (2001) and Monney et al. (2013).

Nonetheless, none of these studies specifically focused on the estuary component of wetlands and its link with migration and related anthropogenic pressures affecting the state of the estuaries of Ghana. Therefore, what are the physical changes in the estuarine ecosystem along the coast of Ghana? This is because migration can result in swift and unforeseen increases in population size and density, adversely impacting the estuary through habitat destruction and fragmentation, unsustainable use of natural resources, and pollution (Bilsborrow, 2002). Wang et al. (2019) indicated that estuaries are among the world's essential ecosystems, which serve as a pull factor for migration.

Therefore, there is a need to ensure sustainable use and management of these valuable ecosystems. Thus, if the estuary is relevant in supporting the livelihoods of these migrants, they would continue to stay in the country and contribute to the fishery sector and the country's overall development. The rich biodiversity of estuaries attracts many migrants; thus, do the estuaries along with the coast influence the migration patterns of fishers? Internal migrants would embark on international migration if the estuary were degraded and could not support their livelihoods, resulting in loss of human resources and skills, increased poverty, and degradation of the estuary. Consequently, the need to explore how migrants/communities perceive the degradation status of the estuaries cannot be undermined. Bardsley and Hugo (2010) indicated that a threshold of tolerable environmental, socio-economic, and political stress exists, beyond which migration will be a crucial livelihood adaptation strategy.

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Migration can, therefore, represent both an adaptation of choice and the adaptation of last resort when all other avenues have failed.

Nevertheless, migration is not accessible to all (Chandrasekhar & Mitra, 2018; Suckall, Fraser & Forster, 2017). To migrate requires a combination of livelihood assets/capital and the desire to do so (De-Haan, 2000). Thus, poorer individuals with limited assets are unlikely to migrate as a livelihood adaptation strategy. Several studies have investigated the migration patterns of fisherfolks in Ghana. For instance, Overa (2001) looked at the international migration of Ghanaian fishers, particularly the Moree (Fante) fishers' migration patterns in and outside Ghana. According to Overa (2001), fishers habitually migrate according to the movements of the fish species they exploit. Kraan (2009) also looked at the artisanal fishing sector in West Africa, focusing on Ghanaian fishers who migrated from the Gambia and to Congo and those in Côte d'Ivoire to Benin. Atiglo and Codjoe (2015) also observed migration along the Volta delta. Towns near the Volta Lake were an excellent destination for migrants to settle because they offered opportunities for farming and fishing. However, these studies rarely look at internal migration. Much focus is on Ghanaian fishers' international migration patterns, representing a small fraction of fishers' migration since internal migration is comparably much higher. According to Oglethorpe, Ericson, Bilsborrow and Edmond (2007), internal rural-rural migration is generally overlooked in literature regardless of its significance, with the prevailing emphasis being on rural-urban migration. There is a need to understand the livelihood adaptation-migration-estuary relationship for government intervention and policy actions,

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especially along the coast, which could further be expanded to look at other forms of migration in the country.

Statement of the Problem

Along the coast of Ghana, estuaries are vital in sustaining fisher livelihoods by providing ecosystem services such as raw materials, food, and water. According to the NOAA (2019), estuaries are vital to the lives of many aquatic species. They serve as the "nurseries of the sea" because many fish species depend on estuaries for reproduction and breeding. In addition, estuaries purify water by removing debris and impurities from rivers and streams before they flow into the ocean. They also serve as recreational / tourist areas and sites for educational /training purposes. It is estimated that about 75% of coastal marine fish species spend at least a part of their lives in estuaries for reproduction, among others. This, therefore, indicates that the importance of estuaries in developing the fisheries sector cannot be undermined. The species richness of these estuarine areas often draws individuals seeking to move away from poverty, and environmental degradation, among others. This is mainly true for migrant fishers along the coast of Ghana who settle by estuaries.

However, as ecosystems, estuaries are at risk from anthropogenic activities such as pollution, overexploitation, habitat fragmentation and destruction, coastal settlement, land use, cover changes, etc. Despite estuaries serving as a livelihood adaptation destination site for migrants, their presence exacerbates the vulnerable state of the estuary as migration flows can cause a sudden and unforeseen rise in population size and density, which could harm the state of estuaries and, therefore, undermine its ability to perform its

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functions and the livelihoods of the migrants. There is fear that the rate of anthropogenic degradation of estuaries could surpass natural regeneration rates, which would affect their ability to provide the desired ecosystem services required for the livelihood adaptation of these migrants.

The migration trajectories of fishers are well-documented for international destinations. However, studies on fishers migration in Ghana (Aseidu et al. 2022; Kraan, 2009; Overa, 2001) focus on cross-border destinations and activities but rarely touch on internal migration. For instance, Overa (2001) looked at the Fante Moree fishers' migratory pattern in West Africa and how rights and access to resources is influenced by local institutions both at home and destination communities. Similarly, Kraan (2009) conducted a study on the livelihood and migration patterns of Anlo Ewe fishers. The research involved an analysis of the history and present state of Anlo-Ewe beach seine fishers in Ghana and West Africa. In order to safeguard the sustainability of fisheries resources and protect the livelihoods of fishers, Asiedu et al. (2022) conducted a study on the internal and international migration patterns within Ghana's small-scale fisheries sector. Hillmann, Okine and Borri (2019) conducted a study which revealed that the fishermen's migration is primarily driven by the need to adapt their livelihoods for food security, increased incomes, and resource accessibility. Interestingly, the study found that environmental and climate change impacts, such as coastal flooding, were not significant factors for outmigration in Keta. Instead, the fishermen's migration is deeply embedded in their cultural practices as a means of adapting to their changing circumstances. On the other hand, studies on anthropogenic impacts on coastal wetlands (Ansa-Asare et al., 2008;

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Attuquayefio and Fobil, 2005; Monney et al., 2013; Wuver and Attuquayefio, 2006) did not focus on the estuary component of wetlands and how the estuary ecosystem influences migration patterns of the fisher folks for livelihood adaptation, and in what way their activities influenced the state of the estuary and its potential to continue to support their livelihoods. For instance, Wuver and Attuquayefio (2006) carried out a research study on the influence of human activities on the preservation of biodiversity in the Muni-Pomadze Coastal Wetland in Ghana. Their findings revealed that the most significant impact on biodiversity conservation in the wetland was caused by human activities such as fuelwood harvesting, bushfire setting, hunting, and farming. Similarly, Ansa-Asare et al. (2008) also investigated the impact of human activities on nutrient and trophic status of some selected Lagoons in Ghana. This study, therefore, seeks to assess the contribution of estuarine ecosystems on livelihood adaptation and migration patterns of the migrant fishers' and the anthropogenic pressures on the estuaries along the coast of Ghana.

Main objective of the study

To assess the contribution of estuarine ecosystems to livelihood adaptation, migration patterns of the fishers and anthropogenic pressures on estuaries along the coast of Ghana.

Research objectives

i. To assess the influence of the estuarine ecosystem on fishers' migratory patterns along the coast

ii. To assess the trend of physical changes in estuaries in Ghana

iii. To explore community perception of the current state of the estuary.

iv. To examine competing interests between migrants and indigenes in the use of the estuarine resources

v. To examine the livelihoods of migrants in estuarine communities along the coast.

Research Hypotheses

According to the IOM (2012), migration has become an important livelihood strategy for many poor households globally. Fratzke and Salant (2018) indicated that 50-80% of rural households have at least one internal migrant member in Sub-Saharan Africa. Thus, migration has always been an essential component of livelihood adaptation. Estuaries and coastal seas have long been centres of human settlement and the use of marine resources in coastal areas, particularly in Ghana (Lotze et al., 2006). Oglethorpe et al. (2007) indicated that access to a particular natural resource/biodiversity could also be a pull factor for migration. Hartter et al. (2012) argue cultural/ethnic diversity influence preferences toward ecosystem goods and services. Thus, ethnicity or culture may determine a particular ecosystem's value and influence migration patterns towards the ecosystem that provides their preference for ecosystem goods and services. For instance, Cuni-Sanchez et al. (2016) showed that culture and ethnicity influence the value rural communities in northern Kenya place on their forest resources and their choice of plant species for ecosystem services. On the contrary, Kraan (2009) states that biological and socio-economic reasons, such as overpopulation, reduce fish stocks, lead to overexploitation and environmental degradation and compel fishers to migrate to other areas along the coast as a livelihood adaptation. It is, therefore, argued that:

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H$_o$: Fishers' migration patterns along the coast of Ghana are not determined by the estuarine ecosystems.

Estuaries are one of the world's vital ecosystems, performing a pivotal role as nurseries and breeding grounds for marine fish species and providing numerous ecosystem services to the well-being and livelihoods of humans (Wang et al., 2019). However, human activities have altered the land cover of estuaries, leading to the direct/ indirect adverse impacts through pollution, over exploitation and habitat fragmentation resulting in the destruction of these valued ecosystems and the services they provide (Samy et al., 2010; Wang et al., 2019). Population growth puts increasing pressure on the natural environment daily, resulting in changes in land use and land cover (Islam et al., 2016). For instance, Muthusamy et al. (2014) found an alarming 47% decrease in the river area in their land use land cover analysis of the Manakudy Estuary, India, from 1991 to 2001. In addition, they also found a 45% increase in cropland for the study period. According to Spruce et al. (2009), the land use a land cover change analysis of the Mobile Bay estuary indicates that during the 34-year study period, urban areas increased by 55.4%. Thus, the increasing migration of fishers to the estuary along the coast could cause significant degradation of this valuable ecosystem. However, Jack (2006) observed in his study of the urban estuary of Zandvlei that there was no substantial change in the semi-natural and permanently inundated land use/land cover types for the period 1944 to 1968. Similarly, to this, according to Hanslow et al. (2018) and Sweet and Park (2014), states that Sea Level Rise (SLR) may raise water levels in estuaries, potentially flooding nearby low-lying areas, eroding and receding shorelines, and affecting or destroying

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coastal settlements and infrastructures, causing LULC changes. In addition, Davis and Fitzgerald (2009) noted that although sea level rise is a significant factor impacting coastal erosion, other processes such as winds, waves, currents, bioerosion, and anthropogenic influences to play a role. Changes in land use land cover are not static. It is dynamic and continuous (Mondal et al., 2016). Frequent assessments are crucial in managing and conservating estuaries (Lal & Anouncia, 2015). Therefore, land use land cover change analysis could reflect the anthropogenic pressures on the estuaries along the coast of Ghana.

H_o: The trends of physical changes (LULC) of estuaries along the coast of Ghana are not due to anthropogenic causes.

Migration is a key livelihood adaptation strategy for many households (Alam & Streatfield, 2012; Collinson et al., 2009; Narayan, Chambers, Shah, & Petesch, 2000; UNDP, 2009). According to De-Haan (2000) and Young (2006), migration enhances the livelihoods and well-being of migrants through access to income, materials stuff and new practical skills, which help improve the household livelihood status. Odetei (1995) added that migration enhances the male fishers status back in their place of origin in Ghana. However, according to Cahn (2002), migration as a livelihood adaptation strategy could improve, unchanged, or deteriorate (maladaptation). Tanle (2013) indicated that the livelihood outcome of migration to a destination is context dependent. Thus, the outcome of a livelihood adaptation depends on the situation and condition of the destination communities. For instance, Gautam (2017), found migration could contribute significantly to economic growth and enable farming households in Nepal to escape poverty. Similarly, De-Brauw and

Harigaya (2007) also found that income from migration improved migrant families' living standards significantly and contributed to about one-fifth of the overall poverty reduction between 1993 and 1996 in rural Vietnam. Meekaew and Ayuwat (2018) observed that migrant fishers of Thailand contribute to improving the economic status of their place of origin by sending vast sums of remittances. However, although Tanle (2014) found no difference between natives and migration on assets ownership, the institutional structures and processes relatively favoured the natives. The desire and aim of every migrant is to achieve sustainable livelihood at the place of destination. It can, therefore, be hypothesised that:

    Ho: There is no difference between the livelihoods of the migrants and indigenes of the selected estuarine communities.

Research Questions

1. What are the effects of the estuarine ecosystem on fishers' migratory patterns along the coast?

   a) What is the relationship between ethnicity and preference for unique characteristics of the estuary?

   b) What factors are pulling (attracting) fisher folks into estuarine communities along the coast?

2. What are the trends of physical changes (LULCC) of estuaries along the coast of Ghana?

   ❖ What are the anthropogenic causes of estuaries' physical changes (LULCC) along the coast of Ghana?

3. What is the community's perception of the current state of the estuary?

   a) What are the causes of the degradation of the estuaries?

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b) What are the factors influencing the degradation of estuaries, and how can the estuaries be sustainably managed?

4. What competing interests exist between migrants and indigenes in using estuarine resources?

a) What is the competing interest in the use of the estuary?

b) What is the typology of conflict over the use of the estuary and the intensity of the conflict?

c) What are the conflict resolution mechanisms used in estuarine communities?

5. What level does migrant fisher's household livelihood security in estuarine communities along the coast?

a) What are the variations in fisher household livelihood security indices of migrant fishers in estuarine communities along the coast?

b) What are the sustainable household livelihood security index variations between estuarine communities along the coast?

Purpose and Significance of the Study

This research is centered on how fishers adapt their livelihoods and the contribution of estuary resources to their migration patterns. This includes dealing with competing interest between migrants and locals regarding access and utilization of estuaries, along with human-induced changes to these estuaries. The distinctiveness of this research lies in its inclusive exploration of the interplay between livelihoods, migration, and natural resources (estuaries). It also involves studying resource accessibility, collaboration, and social networks as catalysts for the migration of fishers along Ghana's

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coastline. Consequently, this study enriches the scholarly understanding and literature on internal fisher migration in Ghana.

This research also contributes to the existing literature on ecosystem-based migration in Ghana and its implication for coastal resource management. Similarly, property damage, casualties, and bloody altercations have security implications at both the local and national levels thus, violent disputes between migrants and natives over the usage of estuaries are worth bringing to light for policy action.

In addition, the results of this study would also highlight negative impacts of migration on estuarine degradation, changes in estuarine LULC and household livelihood securities of fishers and indicate sustainable management of Ghana's valuable estuarine. Thus, this study would contribute to the empirical literature on attaining some Sustainable Development Goals such as goal 1: No Poverty, Goal 2: Zero Hunger and Goal 14: life underwater.

The results of this research would also be relevant to the following national and international institutions in their development of interventions and policies for coastal protection and development.

   i.   Fisheries Commission of Ghana

   ii.   Ministry of Environment, Science and Technology

   iii.   Labour Commission

   iv.   Ministry of Tourism

   v.   Environmental Protection Agency of Ghana

   vi.   Ministry of Local Government

   vii.   NGOs in the fisheries sector

   viii.   International organization for Migration

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Delimitation

The study covered three coastal regions of Ghana (Central, Western and Greater Accra). Five communities in five districts (Shama, Ellembelle, Komenda/Edina/Eguafo/Abirem, Ada East, and Ga South Districts) were sampled for the study. There are a variety of livelihood activities in the area, but this study focused on fishers and their livelihood adaptations and security. Furthermore, this study only looked at the estuarine communities of Ghana's major rivers (the Pra, Ankobra, Kakum, Densu, and Volta). Similarly, the study focused solely on migratory fishers in these communities and the anthropogenic activities around these important ecosystems and interests in accessing the resources. Finally, variables from the household livelihood framework were utilised to evaluate fishers' livelihoods in the research areas.

Limitation

A limitation to this study was the year that the respondents, particularly the first-generation migrants, settled in the selected communities. Due to old age, illiteracy, and the long period of stay, it was difficulty for most respondent to recall the exact year they migrated or settled in the community. Most of them were unable to provide an accurate year; instead, they relied on estimates and other relevant events that occurred in the past. This could influence the reality of the temporal aspects of fisher migration into these communities in the results of the study.

The Organisation of the Study

Chapter One introduces the study with its objectives and delimitation. Chapters Two and Three are reviews of the literature in the field of livelihood and migration with reference to fisheries. The relevant migration theories and

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contextual definitions of the study were examined in Chapter Two. The review of the pertinent related empirical literature on thematic areas is the subject of Chapter Three. The thematic areas considered were natural resource-based migration, fishers' livelihood adaptations and migration in Africa, assessment of land use and land cover change of estuaries, competing interests/ conflict of interest in using natural resources, household livelihoods security (HLS) of migrant fisherfolks among other issues. Chapter Four describes the methodological approach: it covers the design, sampling, data collection methods and analysis and the collection of spatial data and analysis for the study. In Chapter Five, the research findings are presented, while Chapter Six discusses the results and compares them to related literature. Lastly, Chapter Seven summarises and draws conclusions and recommendations from the study.

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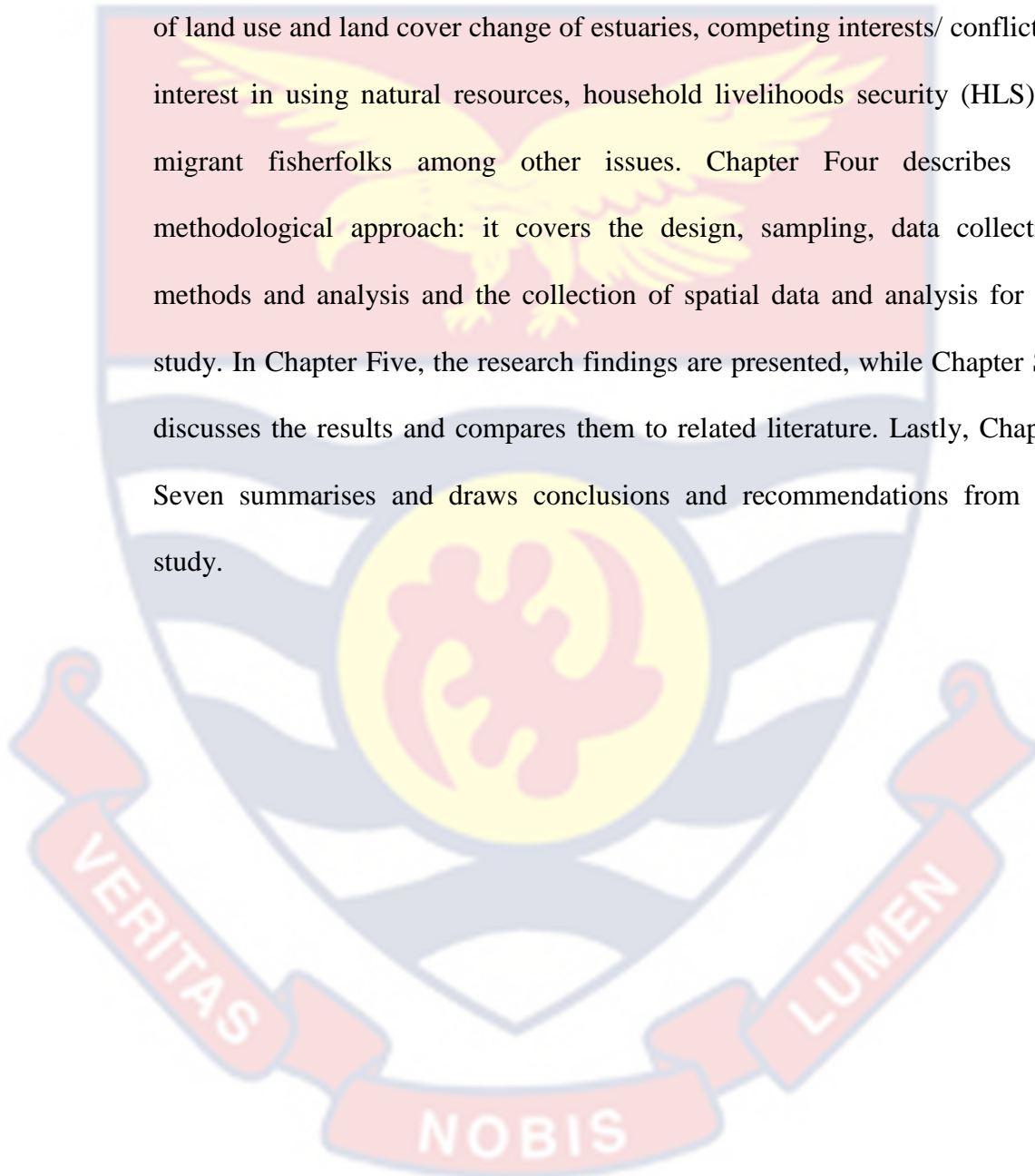
CHAPTER TWO

THEORETICAL LITERATURE REVIEW

This chapter examines relevant migration theories in relation to the study, such as the Push and Pulls theory and the theory of Social Networks. It also examines some contextual definitions of terms and frameworks for the study. These theories would direct the discussion of the results.

Contextual Definition of Key Terms

Livelihoods: There are several definitions of livelihoods by different authors. Niehof and Price (2004) refers to livelihood as a material means whereby one makes a living, and people engage in livelihood to meet their basic needs or exceed them. Unituslabs (2012) also viewed livelihood as the economic activities that provide support or subsistence for an individual and their family. Similarly, the World Bank (1999) defines a livelihood as mainly generating income. The International Centre for development-oriented Research in Agriculture (ICRA), 2012) defines livelihood as a means to an end, which includes aspects of food security, shelter, health, safety, reduced vulnerability to climatic, economic, or political shocks, and so forth), sustainability (the ability to continue to make a good living) and power (the ability to control one's destiny).

Niehof and Price (2001) and Unituslabs (2012) adequately define livelihoods, focusing on the activities but ignoring the importance of skills and assets. However, Chambers and Conway's (1992, p. 7-8) definition is the most popular and working definition of livelihood. It denotes:

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Livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future while not undermining the natural resource base (Chambers & Conway, 1992, p. 7-8).

Thus, this study adopts Chambers and Conway's (1992) definition of livelihoods as its contextual definition for the study. This is because the definition emphasises capabilities (skills) and assets which are essential components of the study.

Adaptation: According to the IPCC (2007, p. 1), "adaptation refers to an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities". Similarly, the UNDP (2004, p. 9) defines adaptation as a "process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented". The UKCIP (2003) also defines adaptation as a process or outcome that reduces harm or risk of harm or realises benefits associated with climate variability and climate change. The above definitions vary from each other. This implies that the word adaptation means different to different stakeholders and for various purposes. The three definitions used different words, such as outcome, adjustment, and strategies, to depict adaptation. For this study, the UNDP definition of adaptation would be used since fishers' livelihood adaptations are strategies to sustain and enhance their livelihoods.

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Migration: According to the IOM

*Migration is the movement of a person/people across an international border or within a state. It encompasses any movement of people, whatever its length, composition, and causes; it includes the migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification (*IOM, 2011, p. 137*).*

The United Nations defines a "migrant as an individual who has resided in a foreign country for more than one year irrespective of the causes, voluntary or involuntary". Under such a definition, tourists and business people travelling for shorter durations would not be considered migrants. However, the term is also commonly used to describe seasonal farmworkers who travel for brief periods to plant or harvest agricultural products.

Similarly, Shaw (1975, p. 6) denotes migration "as a relatively permanent movement of persons over a significant distance". What constitutes a "significant distance" is relative and would vary from person to person. The International Organization of Migration definition is adopted for this study. The definition encompassed the various reasons for migrating and the types of migration relevant to the study.

Estuaries are highly dynamic environments characterised by spatial and temporal variability in their physical, chemical, and biological structure. These systems' temporal fluctuations and spatial gradients result in a great deal of variation in water and sediment's chemical and biological properties. According to Mateus, Mateus and Baretta (2008), estuaries are subject to continuous changes in wind, irradiance, rainfall, water level, and freshwater

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runoff. Additionally, estuaries are frequently heavily utilised and impacted by humanity, serving as (natural) harbours, fish farms, recreational areas, and wastewater recipients. As transition zones between very different environments, Estuaries share several significant physical, chemical, and biological characteristics. Thus, an estuary can be defined as a transition system governed by complex interacting elements that vary spatially and temporally. According to Valle-Levinson (2011), estuaries are classified into three types. Tectonic estuaries, like coastal plain estuaries, operate dynamically in various ways. For example, the processes and dynamics described above apply to coastal plain estuaries. Fjord estuaries are the deepest and most stratified during the season of greatest buoyancy input. Bar-Built estuaries are typically shallow (a few meters deep), with low river discharge and rapid tidal energy dissipation as the tidal wave enters the estuary. They are primarily found in low-lying subtropical and temperate areas with scarce land for a well-developed river basin.

Theoretical Framework

Several theories have been used to explain migration of people in Ghana: The Neoclassical Economic Theory, the Push-Pull Theory, the New Economics of Labour Migration Theory, and the Social Network Theory.

According to the Neoclassical Theory, there is a link between global labour supply and demand and migration. Countries with a shortage of workers and high demand will have high wages that entice immigrants from countries with a labour surplus. Thus, access to jobs and disparities in pay are the main drivers of migration. Although other elements may have contributed to the migration, the individual higher pay benefit element occupies the central

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position. According to Sulaiman (2020), the neo-classical perspective holds a positive outlook on the effects of migration on countries that send labor. This is because it anticipates a decrease in poverty, unemployment, and overpopulation. Early migration studies in Ghana used the neoclassical equilibrium theory to examine labour migration to ports, cocoa-growing regions, and mining regions (Awumbila et al., 2008). Some regions of Ghana experienced an increase in migration from other underdeveloped or resource-poor areas due to increased employment opportunities (on farms), industrial development, and higher wages (Anarfi et al. 2000; Arthur, 1991; Beals & Menezes 1970). This neoclassical viewpoint explains some of Ghana's internal migration in general and rural-urban migration. According to Alexandrovna and Galimovna (2018), the neoclassical theory provides an explanation for migration at both micro and macro levels. At the micro level, migrants are seen as individuals who aim to maximize their benefits and minimize their costs. On the other hand, at the macro level, migration is influenced by the dynamics of supply and demand in the labor market. However, Sulaiman (2020) indicated the Neoclassical theory has faced criticism for its tendency to overlook factors that drive migration, disregard market flaws, oversimplify the diversity of migrants and their societies, and neglect the dynamic nature of migration throughout history.

Similarly, some migration research in Ghana has been done using the "Push-Pull" theoretical framework. The theory indicates that unfavourable conditions in one place "push" people out and favourable conditions in a different location "pull" them in and that economics is the primary driver of migration. The theory of intervening obstacles by Lee (1966) also features in

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many Ghanaian migration research and findings that suggest that distance as a determinant of migration could be overcome by factors such as a person's education, knowledge of the potential receiving population, or family ties. According to Lee's (1966) Push-Pull theory of migration, the decision to migrate is not easy. There are four major factors to consider: (1) factors related to the origin area, (2) factors related to the destination area, (3) intervening impediments, and (4) personal factors. He argues that lack of employment and overpopulation drive people away from their homes; and that job opportunities, natural resources, and social amenities would draw people to a destination. As a result, they migrate once the push and pull factors are appropriately considered. Perceptions of origin and destination differ significantly, according to the theory. Intervening impediments include funds, transportation, and distance. As such, before moving, people must overcome these obstacles. According to Jones (2016), migration is influenced by a combination of push and pull factors, which can be attributed to economic, safety, environmental, social, and political reasons. Niu (2022) therefore, indicated that the "push-pull" theory suggests that every region possesses its unique set of "push factors" and "pull factors" due to variations in influencing factors. These factors determine the relative attraction or repulsion of each region within the entire study area. However, Sridhar, Reddy and Srinath (2010) argue that Lee's model is limited by its assumption of complete knowledge of available jobs. Still, considering risk neutrality, potential migrants may be indifferent between their actual rural and uncertain expected destination income. Amaral (2020), therefore, believes it is unclear how

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migration affects initial structural conditions and its inclinations for macro-level variables as causal migration factors.

Equally, the social network theory has also been used in Ghanaian migration studies (Awumbila et al. 2008). For instance, Meier (2005) used the network theory to examine social peace among northern migrants in Accra and Tema. According to Andoh-Kumi (2000), Ghanaian urban migration depends on information networks among migrants. Durkheim (1893) and Tönnies (1887) provide early findings on social networks and migration. Migrant social networks are webs of interpersonal links that bind migrants, former migrants, and none-migrants in origin and destination places via kinship, friendship, and shared community roots (Massey et al., 1993). Fundamental to network theory is that individual actors are interdependent (Blumenstock & Tan, 2017). According to the proponents of the social network theory, a connection to someone who has moved before can be a valuable resource. Social networks increase migration potential by lowering costs and risks while increasing expected net gains (Muanamoha, Maharaj & Preston-Whyte, 2010). People can use social networks for jobs and other socio-economic, cultural, and religious support. This network is self-reinforcing, such that increased migration leads to increased social network expansion, which leads to increased migration, and so on (Sha, 2021). According to the theory, migrants who leave without social ties pay a high price and the costs of migrating for friends and family drop significantly. The social network theory has been criticised for ignoring migration's effects on sending and receiving areas. According to Light, Parinder and Stavros (1989), social network theory enhances new immigrant arrivals while decreasing the job supply. The social

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network theory has also been criticised by Kurekova (2009) for being a conceptual framework rather than a theory.

In assessing all these theories to understand the causes of migration fully, Teye et al. (2019) concluded that no single theory could explain all migrations in Ghana because the drivers are complex and multifaceted. People often migrate due to environmental, economic, and social factors. Thus, a combination of migration theories would, to some extent, explain the different migrations in Ghana. Sarfo (2019) combined the new economics of labour migration (NELM) theory and the push and pull theory of migration to explain the effects of out-migration on fishing households in the Ningo-Prampram District, Ghana. The limitation of the NELM theory is that it assumes people migrate temporarily to accomplish their objectives in the host communities, which serve as the foundation for their eventual return (Abreu, 2012; Sarfo, 2019). However, this is not the case for the migrant fishers in estuarine communities along Ghana's coast, as they have become permanent migrants, and most have no intentions of moving permanently back home.

Despite the unique criticisms of the theories, their contributions to explaining and understanding migration, especially in Ghana, have been enormous. For this research, we propose a new individual/household complementary migration framework by combining the two theories and emphasising how remittances, migrant success stories and advice improve local conditions at the individual and household levels (Figure 1).

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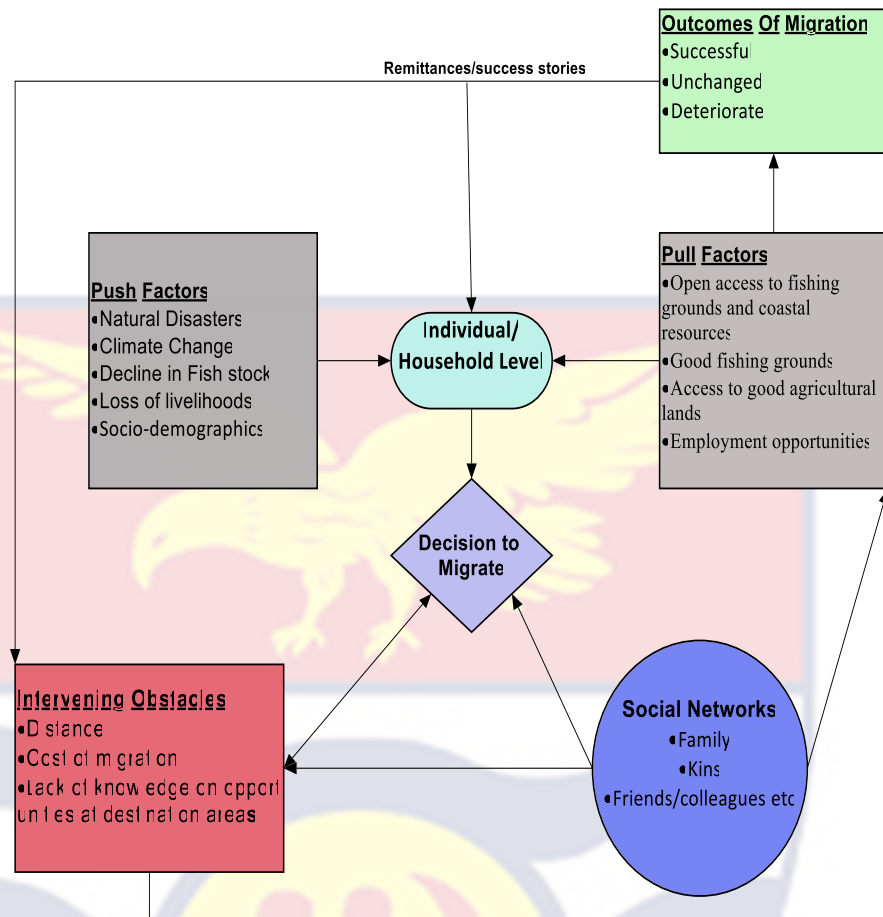
Figure 1: Individual/ Household Complementary Framework of Migration.
Source: Author's Construct (2021)

Coastal erosion, natural disasters, loss of ecosystem services, declining fish stocks, and climate change have contributed to the loss of fishers' livelihood (Kraan, 2009; Kutir, Agblorti & Campion, 2022),), pushing them to migrate. Due to their rich biodiversity, natural beauty, and source of livelihood, estuaries have also been areas of major human settlements and attract (pull) migrants' fishers (Kutir et al., 2022). Livelihood resources comprise natural, financial, human, social, cultural, traditional, and physical resources that individuals require to achieve their well-being objectives. Interventions aimed at sustaining livelihoods are usually structured to influence one or multiple distinct components of the sustainable livelihood's

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framework, such as physical, financial, or human capital, among others (Fratzke & Salant, 2018).

After assessing push and pull factors (while still at home), migrants must be certain and overcome issues/questions concerning distance, cost, and destination area knowledge. The social networks help fishers overcome these obstacles. Thus, having friends, family, and kin in destination communities could reinforce the site-specific pull factors for fisher migration. A migrant's livelihood outcomes can be positive, negative, or neutral. Successful migration implies improved food security, income, and assets (Tanle, 2015) and increase connectivity and relationships with their home communities. Remittances improve conditions at the origin of individual/household level. Thus, from Figure 1, successful migrant fishers may send remittances home through the same social networks to improve conditions at home by building better houses and improving education and health care. These migration outcomes manifesting through remittances and migrant success stories could help resolve some intervening obstacles for future migrants. Migrant fishers may travel home for weddings, funerals, and festivals. Their success stories and improved personalities (which may be perceived or real) help shape potential migrants' perceptions and aspirations about migrating. On the other hand, adverse outcomes may increase the migrant's vulnerability and livelihood and decrease the connectivity with home. This individual/household complementary framework of migration therefore does not only combine the push-pull and social network theories but explains the critical role the outcomes of migration and intervening factors play on a person or household's decision to migrate.

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Theoretical Underpinning on Factors influencing Degradation of estuaries

Estuaries provide fish and other resources for human consumption. Thus, they are valuable resources for people's livelihood in the study area. This research seeks to uncover factors affecting the estuary's degradation related to access and use. Understanding the relationship between fisher's livelihood activities and estuary deterioration is critical in this assessment. Many theories have been proposed to explain the use and degradation of natural common-pool resources. (Social cost, access, community goods, tragedy of the commons). This study uses the theory of Access by Ribot and Peluso (2003) and the tragedy of the common's theory by Hardin (1968) to explain the factors that influence the degradation of estuaries in Ghana.

Ribot & Peluso's (2003) **access theory** examines the interaction between people, resources, and access. Access refers to the capacity to profit from things (resources), physical goods, people, institutions, or symbols. Access is a concept that develops from power hierarchies and concerns actors' capacities to gain from resources.

Differential relationships between actors and the things they desire to gain from, and control were at the heart of Ribot and Peluso's (2003) theory. According to the theory, some persons and institutions control resource access (Myers & Hansen, 2020). On the other hand, others want to keep access to the resource through those who control it. According to Ribot and Peluso (2003), resources elicit some socially recognized rights or claims, whether through the law, conventions, or rights. The hypothesis showed that oral, written, formal, or informal laws could not outline all the channels and intricate access to

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resources on the common property (Ribot & Peluso, 2003). Actors can gain and control access to a resource through rules, procedures, and relationships. Sanctions are incorporated in unauthorized access to resources. According to the theory a relationship that allows those seeking to benefit from a resource is sometimes called a resource maintenance relationship.

Similarly, the relationship between livelihood adaptations, migration and estuarine ecosystems is like the tragedy of the common's theory. Garret Hardin popularized the theory in his 1968 article. The Tragedy of the Commons denotes a scenario in which a commonly owned resource such as grazing land is inevitably degraded because everyone in the community grazes their livestock there (Anukwonke, 2015). According to Hardin (1968), self-interest influences how individuals think and act contrary to the best interest of a whole group by depleting some common resource. "Commons" refers to open-access resources such as the atmosphere, oceans, lagoons, estuaries, rivers, and fish stock (Anukwonke, 2015). Hardin explained his theory using the scenario below:

"Picture a pasture, open to all. Each herder is responsible for keeping as many cattle on the commons as possible. Such an arrangement may work reasonably satisfactorily because tribal wars and diseases, among others, keep human and animal populations well below the land's carrying capacity. But the day that stability becomes a reality, the tragedy becomes clear. As a rational being, each herder seeks to augment its gain. The rational herdsman concludes that adding another animal to his herd is the only sensible course of action.

Nevertheless, this is the conclusion that every rational herder shares in the commons. That's the tragedy. Everyone is trapped in a system that forces

them to keep expanding their herds. Men rush to ruin in a society where the commons believe in their independence. "All is destroyed by common freedom" (Hardin, 1968: 1244).

Conceptual Framework

This research adapts the Sustainable Livelihood Framework developed by Tanle (2015), which slightly modified the sustainable livelihood framework for the Pacific Island by Cahn (2002). Tanle's (2015) framework is more appropriate as it emphasises the role of migration in livelihood adaptations, which is the focus of this study. The framework encompasses six main components: background characteristics, livelihood resources and capitals, vulnerability context, institutional structures and processes, livelihood strategies, and livelihood outcomes or well-being, as explained below.

According to Tanle (2015), the background characteristics refer to the economic, social, cultural, political, and environmental context within which migration (either internal or international) occurs (see Figure 1). Thus, the variation in background characteristics between places of origin and destination account for the push or pull factors promoting out-migration from one area to another or within a country in case of internal migration or emigration from one country to another. These factors could be differences in climatic factors, social infrastructure/amenities, and social relationships, among others.

Livelihood resources comprise natural, financial, human, social, cultural, traditional, and physical resources that individuals require to achieve their well-being objectives. Natural capital refers to common environmental resources such as land, water, trees, and wildlife. These resources can impact

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migration decisions at the place of origin and the type of livelihood activity that a person engages in at their destination. Therefore, the kind of livelihood activity a migrant engages in, to a large extent, will be influenced by the natural capital available to them at the place of destination.

From the framework, financial capital encompasses money, access to loans, and savings. The availability and accessibility of affordable credit to migrants are significant for supporting their livelihood activities and outcomes (Meikle et al. 2001). Whiles human capital denotes the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives. The amount and quality of human capital available at the household level differ regarding skills, size, and health status, among others. According to Sabates-Wheeler et al. (2005) and IOM (2008), a migrant's ability to get a good job in a competitive labour market at their destination depends on the quality of their human capital.

Similarly, social capital represents the various social networks and resources that aid people in achieving their livelihood objectives. Social networks provide financial information and serve as a safety net on which migrants can rely during crises or shocks such as illness or death (Tanle 2015). People's perceptions and experiences are influenced by culture and traditions.

Thus, traditional/cultural capital deals with the beliefs, norms, values, language, and aspirations of individuals or social groups. These can influence people's opinions and approaches towards migration and how migrants perceive their livelihood status or outcome. From the framework, physical capital encompasses the basic social infrastructure and producer goods needed

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to support livelihoods. The infrastructure includes access to good roads, communication, information, health care services, and affordable transport. The lack of some basic infrastructure could affect livelihood outcomes. For example, human health deteriorates without water and energy, and time is spent on non-productive activities like water and fuelwood collecting.

As indicated in the framework, livelihood strategies are activities people engage in to earn a living and better their well-being (Tanle 2015). These livelihood strategies could be diversification of livelihoods or temporary and permanent seasonal migration. People usually choose livelihood strategies that offer the best or optimum livelihood outcomes. Several variables affect this, including the assets available to migrants, the type of migration, and personal characteristics (McDowell & De Hana, 1997).

From Figure 1, institutional structures and processes are the laws, policies, and incentives that can positively or negatively impact livelihood strategies or their outcomes. These structures and processes could determine access to some livelihood strategies capitals and the terms of exchange between the various capitals and returns to livelihood strategies. In addition, they directly impact whether people can achieve a feeling of inclusion and well-being in times of migration. According to Tanle (2015), some government policies can trigger migration. In the case of Ghana, the colonial government policy of forced recruitment of labour from the then northern territory to the mines encouraged north-south migration in the country, which has since become an established culture among people in the five Regions in northern Ghana (Northern Region, Upper East Region, Upper West Region, Northeast Region, and Savannah Region)

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According to Tanle (2015), three main elements of vulnerability are identified: shocks, seasonality, and household dynamics. For instance, ill health, accidents, job dismissal, floods, drought, conflicts, pests, and diseases could affect livelihood outcomes (Tanle 2010). Thus, seasonality influences different migration patterns. For example, e.g., people from northern Ghana people migrate during the dry season to work in cocoa farms in the south, and fishers also migrate during the bumper harvest to the destination they think would have enough fish. Also, variations in the seasons can affect prices, production levels, employment opportunities, and health status, all of which can have an impact on migration and livelihood outcomes.

Livelihood outcomes are the accomplishments or outputs of livelihood strategies, such as more income, increased well-being, reduced vulnerability, improved food security and more environmentally friendly usage of natural resources. When considering livelihood outcomes, knowing a group's goals and how far they've previously been reached is essential.

Tanle (2015) indicated that livelihood outcomes could be positive, negative, or neutral. Positive outcomes suggest improved food security, income, and increased assets. In contrast, adverse outcomes denote worsening or a decrease in all these factors, increased vulnerability, and deterioration in a person's livelihood status. Neutral outcomes signify neither positive nor negative changes in these outcomes or livelihood status. It is crucial to note that all livelihood outcomes, whether positive, negative, or neutral, are subjective.
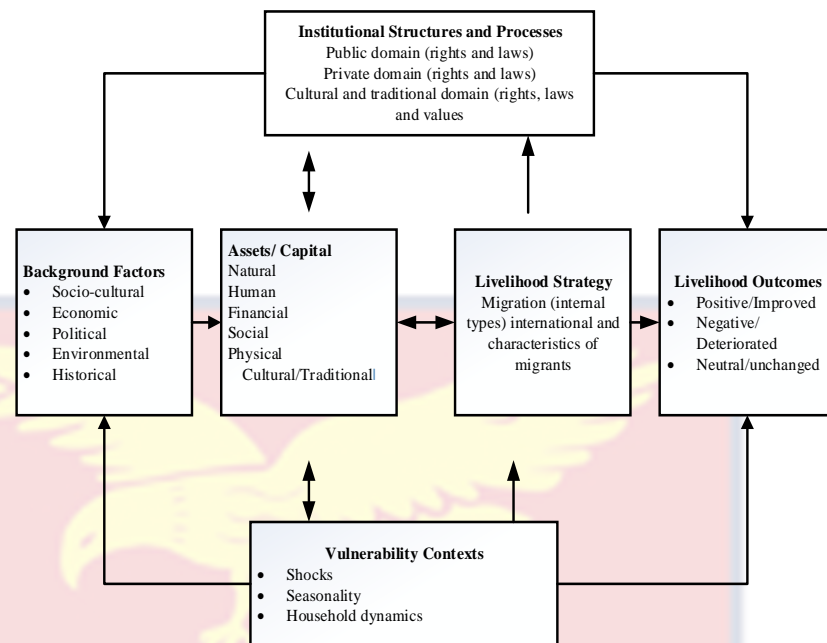
Figure 2: Conceptual Framework for Migration and Livelihood.
Source: Adopted from Tanle (2015)

According to McDowell, and De Haan (1997) the concept of Sustainable Livelihoods examines three key components: intensification of livelihoods, diversification of livelihoods, and migration. As such, migration plays a crucial role in achieving sustainable livelihoods, serving as one of the primary strategies for impoverished rural households. Zaami (2022) indicated that the connection between migration and livelihoods is complex and dynamic. De Haas (2007) indicated that migration can be both a cause and a consequence of livelihood adaptation. As a cause, migration as a livelihood adaptation compels people to move to other places in search of livelihoods. Here livelihood becomes the cause of migration. This form of migration is seen in fisher migration, seasonal migration of farmers, rural urban migration among others. This interplay between livelihood adaptation and migration can be viewed as a mutual relationship, with livelihood adaptation being the driving force behind migration.

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Livelihood adaptation as a consequence of migration is seen as not being the cause of migration. Other factors such as environmental, conflict, natural disasters among others could be the cause or push factors of migration, but the migrant will have to engage in livelihood activities in the destination communities in other to survive. In addition, the phenomenon of livelihood adaptation due to migration could also be observed in destination areas where the arrival of migrants can lead to competition for livelihoods, thereby rendering certain livelihood activities unprofitable. Besides the influx of migrants could also result in loss of livelihoods of natives. This stance is supported by Asfaw et al. (2010) who highlighted that migration leads to a rise in local unemployment within the destination communities. As a result, individuals may be compelled to switch to alternative livelihood activities as a means of adaptation. However, in the context of this study migration is seen as livelihood adaptation strategy adopted by fishers. Thus, livelihood adaptation causing fishers to migrate to the study communities.
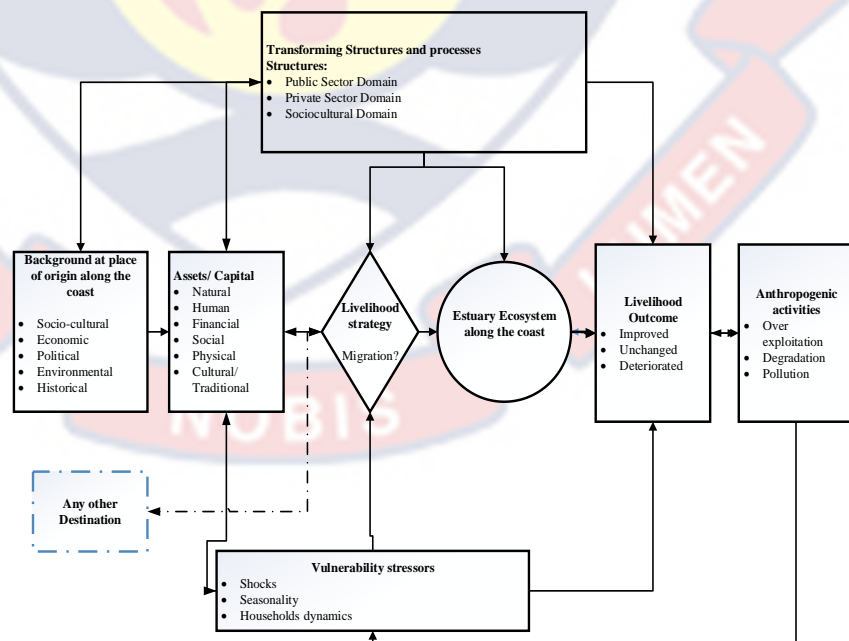
Figure 3: Conceptual Framework for the Study Adapted from Tanle (2015).
Source: Author's Construct (2021)

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From the framework (Figure 3), the prevailing background situation in coastal communities is overpopulation, resource depletion, coastal erosions, and loss of biodiversity resulting in inadequate livelihood outcomes and increasing poverty levels and low living standards. These prevailing situations compel fishers to migrate as a livelihood adaptation strategy.

The results of livelihood adaptation are the goals people intend to achieve in their livelihood strategies, ranging from enhanced food security, augmented incomes, improved wellbeing, reduced vulnerability, and sustainable use of natural resources. Migration is a difficult choice to make causes it has financial, social and socioeconomic implications or costs. Thus, Cahn (2002) and Tanle (2015) indicated that for one to migrate, one needs a combination of two or more capital assets. Thus, natural, financial, human, social, traditional, and physical (Cahn 2002). Like the DFID (1989), the natural capital/assets in Cahn's (2002) and Tanle's (2015) frameworks include land, water, trees, and wildlife. In this study, migrant fishers required access to the sea or natural water bodies such as the estuary, lagoon, and land to fish at their destinations. Money, lending access, and savings are all examples of financial capital and the income derived from the sale of labour, among others. Human capital covers skills in fishing, education, and health. While the sale of labour is crucial in fishing, health care is also important in defining the quality of labour with access to formal education. People can improve the worth of their human capital by participating in skills training (Meikle et al. 2001).

Furthermore, social capital consists of networks and associations such as friends, being part of fishers' associations, relationships, etc. These social networks facilitate access to information about economic opportunities and

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serve as a safety net for migrants during times of crisis. Traditional capital comprises individuals' or social groups' beliefs, norms, values, language, and aspirations. These can influence migrants' perceptions, attitudes, and behaviours in the type of livelihood strategies they adopt and how they view their livelihood situation. For fisher folks, migration is embedded in their culture as a way of life.

In this study, fishers decide whether they can migrate or not. Without the pressure to migrate, one would be forced to remain in the community if one cannot access financial and social capital. However, one can migrate if one can access financial and other capital. Fishers' migration along the coast is in different directions. Whiles some migrate internally to other coastal communities, some also migrate to estuaries for their livelihood adaptations. From the framework, the outcomes of their livelihood adaptations are in three forms: improved, unchanged and deteriorated livelihoods. These have implications for the place of origin and standards of living. For instance, if livelihoods are improved, migrants would send remittance homes that could improve the prevailing conditions at home and acquire more capital assets for a sustainable livelihood.

On the other hand, if livelihoods deteriorate, migrants cannot positively influence lives back home. The situation may further push migrants to further migrate to other places or be forced to stay if they cannot afford any assets to enable them to further migrate. Thus, migration as a strategy for livelihood adaptation is not a strategy for the poor of the poor.

According to DFID (2000), Cahn (2002), and Tanle (2015), vulnerability stressors are critical trends such as shocks and seasonality, which people can't control, and affect people's livelihoods and asset availability. Trends and seasonality aren't always bad. For instance, a season of drought can affect the availability of fish. Moser and Meikle (1998) define vulnerability as the insecurity of individuals or groups' well-being in changing settings (ecological, social, economic, and political). Also, a sudden loss of an important family member may affect the livelihoods of the rest of the family members.

There is evidence that estuaries are at risk from anthropogenic activities such as pollution, overexploitation, habitat fragmentation and destruction, coastal settlement, land clearance and much more. Although the services of estuaries serve as pull factors in times of livelihood adaptation, the presence of migrants in the estuaries exacerbates the vulnerable state of the estuaries as migration flows can cause a rapid and unforeseen rise in population size and density, which could have a negative impact on the state estuary and the livelihoods of the migrants. There is fear that the estuary's anthropogenic degradation rate could surpass natural regeneration rates. Unsustainable exploitation of the estuary will threaten its state and affects its ability to provide the needed ecosystem services required for the livelihood adaptation of these migrants. Consequently, the initial purpose for migrating will be sustained. The transforming structures and processes are essentially Internal or external laws, rules, conventions, beliefs, and incentives that can affect livelihood methods, outcomes, and well-being. Thus, policies,

institutions, and processes have a direct impact on whether people can achieve a feeling of inclusion and well-being.

This framework could be expanded to look at any other natural resources-based ecosystem/environment linked with migration and livelihood adaptation strategies. This further goes to address one of the limitations of the Sustainable Livelihood Framework, thus, its lack of detailed attention to issues of the environment (Carney, 2002; Small, 2011).

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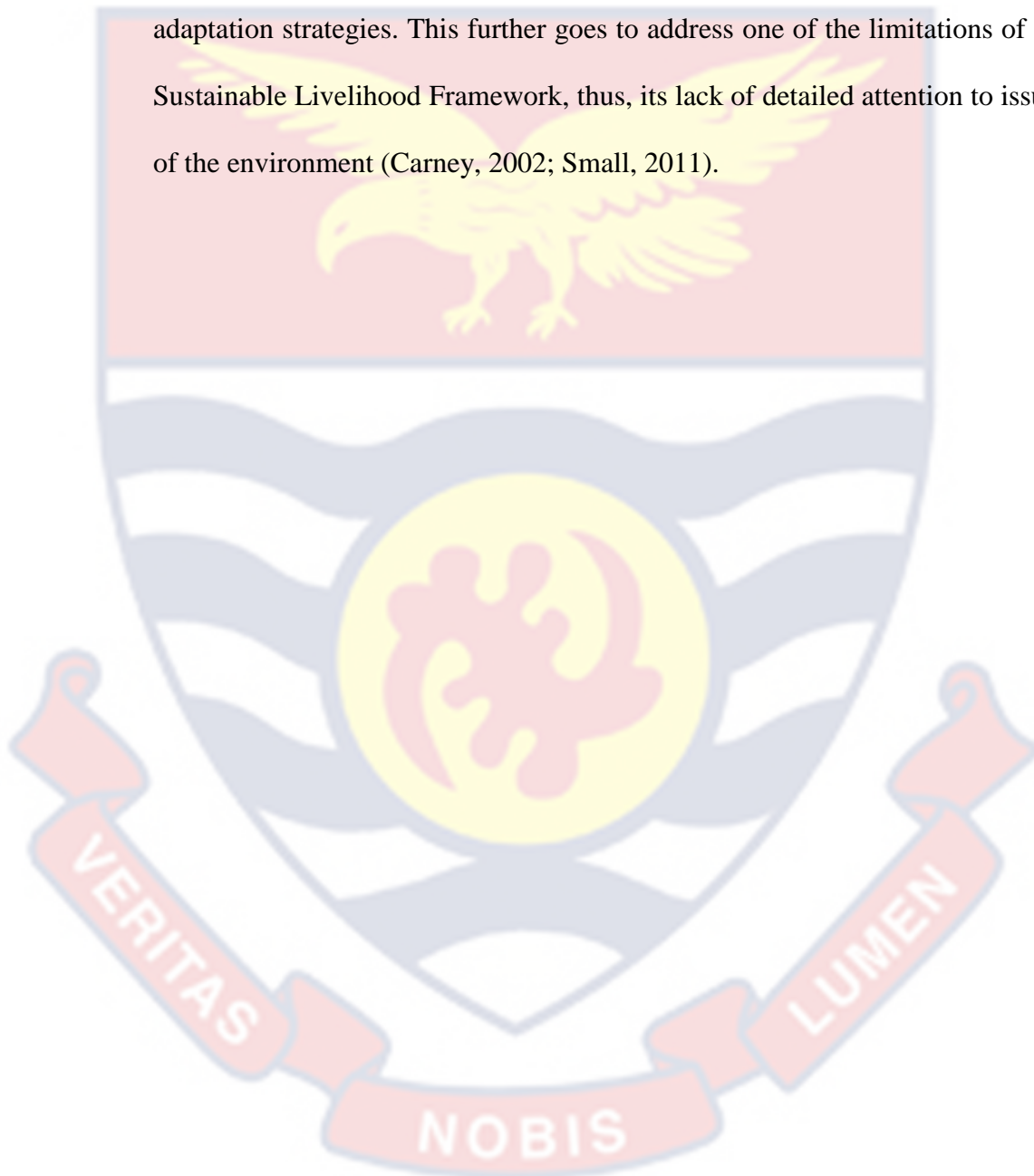
CHAPTER THREE

EMPIRICAL LITERATURE REVIEW

Introduction

This chapter reviewed a more comprehensive range of empirical literature to explain the migration patterns of fishers, natural resource-based migrations, estuarine degradation, land use and land cover assessments of estuaries, and conflicts involving natural resources. The empirical literature on household livelihood security and how it pertains to fishermen's livelihood adaptation was also reviewed.

Natural Resource-Based Migration

Historically, migration and water were broadly related to nomads and pastoralists looking for water and food for their animals (Jägerskog, & Swain, 2016) Population pressure on natural resources may influence these migrations (Van der Geest, 2011). Human life depends on the continuing capacity of biological processes to provide many benefits. Besides migrating for good farmland (Le Meur, 2006), many West Africans travel to utilise marine and inland fisheries resources (Njock & Westlund, 2010). Kallio (2016) indicated that ecosystems with rich biodiversity and natural beauty attract migrants to such areas. Thus, humans are inextricably linked to freshwater ecosystems such as rivers and estuaries (UNEP, 2017). Therefore, these ecosystems influence their migration patterns by acting as pull factors. According to Gemenne et al. (2018), people respond to changes in ecosystem services. There is a livelihood mobility dimension to any trade-offs between social-ecological systems as people migrate to other places with rich ecosystem services for livelihood adaptation. Hartter et al. (2012) argue that

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cultural/ethnic preferences toward ecosystem services serve as pull factors for migration.

Thus, ethnicity or culture influences a particular ecosystem's value and uses, which might affect migration patterns of that specific group towards a particular ecosystem that provides their preferred ecosystem goods or services. Martín-lópez et al. (2012) opined that those perceptions and choices about ecosystem services depend on social and cultural context. For example, throughout a study conducted in the Iberian Peninsula, Martn-lópez et al. (2012) discovered considerable disparities in social/cultural perceptions of the relative relevance of several ecosystem service categories. While this is the case, Goldbach et al. (2018) have indicated that people's occupational status determines the value placed on a resource. These ecosystems turn to control the migration patterns of these people. This is evident in García-Llorente et al. (2012). They specified that the preference of wetlands by diverse interest groups such as fishers, farmers, and conservationists is because of its ability to maintain the abundance of fish species and water supply for agricultural irrigation and its capacity to serve as a habitat for endangered wildlife species and recreational and aesthetic features. Hamann et al. (2016) also stressed the gender dimension of ecosystem services valuation in their study in rural Mozambique. Kraan (2009) states that low fish catch at home shores, lagoons, and estuaries pushes fishers to migrate. These migrant fishers would look for similar wetland/ coastal ecosystems to continue their livelihood activities. Kraan (2011) also indicate that biological and socioeconomic reasons such as overpopulation, reduced fish stocks, overexploitation, and environmental degradation compel fishers to migrate to other areas along the coast for

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livelihood adaptation. In the last 30 years, the migration of fishers along the West African coast has increased (Overa, 2001). According to Issifu and Darko (2021) and   Oglethorpe et al. (2007) access to a particular natural resource/biodiversity could also be a pull factor for migration. Thus, natural resources' role in migration patterns and livelihood adaptation processes cannot be undermined.

Fishers' Livelihood Adaptations and Migration in Africa

Randall (2005) opined that mobility and migration as livelihood adaptation strategies have always been essential for inland, coastal, or maritime fishing fishers. "Initially, most populations migrated in response to fish, but motives and patterns have become more diverse in recent decades (Randall, 2005). Atuobi (2016) added that open access to the sea without any regulations or restrictions contributes to fishers' migratory habits, especially in Africa. Fisher migrations are seen as a high professional accomplishment. There are several livelihood migration patterns of fishers, such as short term, long term, short distances, and long distances, internal and international migration. For this study, only the internal migration patterns of fishers were reviewed.

Internal migration of fishers along the coast of the same country far exceeds those that engage in international migration for livelihood adaptation. For instance, Ngo Likeng (2006) indicated that circular internal migration was practised by the Mousgoums fishers from Lake Chad, who migrated to the coast of Cameroon for fishing. Rao and Sophia (2023) look at internal fisher migration along India's east coast. Similarly, fishers from Saloum Island also move to the inland fishing ports of Senegal for livelihood adaptation (Samba

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& Faye, 2006). Likewise, the Hilsha fishers of Bangladesh also embark on seasonal migration along the coast for livelihood adaptation purposes.

The migration of fishers was initially perceived to follow the movement of the fish they harvested. However, the reasons for migrating have become diverse recently, although fish is still an important component (Njock & Westlund, 2010). Kramer, Simanjuntak, and Liese (2016) point out that fisher migrants account for at least one-quarter of the population growth in coastal villages of North Sulawesi during the past decade in Indonesia. Sugimoto (2016) also added that 40% of the Shiraho fisher community in Okinawa, Japan, are internal migrants from other areas of Japan who migrated for economic and livelihood reasons. Chen and Mueller (2018) found that salinity encroachment into coastal soil could be a powerful driver of migration within Bangladesh due to its effects on agriculture and associated loss of livelihood. Kraan (2009) added that the reasons for fisher migration range from biological (following fish species) to socioeconomic (migrant networks, access to cheap inputs, markets, and adventure, among others). Overa (2001) implied that these socioeconomic factors are often ethnically defined. According to Abobi and Alhassan (2015), migration is deep-rooted in the history of fishers from Moree as they have been fishing in rivers and lagoons along the coast of Ghana before Europeans began to document it in the 15th century.

The primary goal of fisher migrants is to attain livelihood security and improve their standard of living. For example, Meekaew and Ayuwat (2018) observed that migrant fishers of Thailand contribute to improving the economic status of their place of origin by sending vast sums of remittances.

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Marquette et al. (2002) also observed that Ghanaian fishers migrants always send their proceeds to their hometowns to build houses, pay school fees and perform other family responsibilities. Deb et al. (2002) added that remittance improves the living conditions back home by purchasing livelihood assets for poverty alleviation. Finally, it is said that migrating elsewhere for fishing strongly enhances your male status in Ghana (Odetei, 1995). Similarly, according to the research conducted by Asiedu et al. (2023), migrant fishers have contributed significantly to the advancement of fishing technology, improvement of food security, and growth of small-scale businesses in the fishing communities where they reside in Ghana.

Land Use Land Cover Changes Around Estuaries Areas

Globally, estuaries are vital to the lives of many aquatic species (NOAA, 2019). They serve as "nurseries of the sea" because many fish species depend on estuaries for reproduction and breeding. Estuaries also purify water by removing debris and impurities from rivers and streams before they flow into the ocean. They also serve as recreational / tourist areas and sites for educational and entertainment purposes. According to Merrifield et al. (2011), estuaries are among the most biologically productive ecosystems on earth and are essential to maintaining biological diversity and the viability of coastal ecosystems. Lotze et al. (2006) indicated that historically estuaries and coastal seas had been significant areas of human settlements and marine resources, particularly those that depend on marine livelihoods. Estuaries and coastal seas attract migrants because of their rich biodiversity and beautiful natural ecosystem (Kallio, 2016). Thus, estuaries have become destination grounds for migrants seeking to enhance their livelihoods.

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According to the National Geographic Society (2012), cities such as Jakarta, Indonesia, New York City, and Tokyo, Japan, grew around estuaries. García-Llorente et al. (2012) indicated that the preference for wetlands by fishers, farmers and conservationists is because of their ability to maintain the abundance of fish species, water supply for irrigation and capacity to serve habitat for endangered wildlife species, recreational and aesthetic features. This is true for fishers, as their livelihoods primarily depend on coastal ecosystem goods and services. However, as the population of these areas increases, excess dependence on these valuable ecosystems lead to overexploitation, habitat fragmentation and degradation, among others (Tian et al., 2016). This has the likelihood of undermining the ability of these ecosystems to continue to provide essential ecosystem services in terms of quantity and quality. It is noted that increasing coastal populations have resulted in both direct and indirect anthropogenic degradation of many coastal ecosystems, particularly estuaries. Estuarine degradation and biodiversity loss have increased due to centuries of overexploitation, habitat destruction, and pollution, which has hindered their ecological resilience (Adger et al., 2005; Kennish, 2023).

Thus, to lessen these problems and sustainably manage these ecosystems, especially coastal estuaries, long-term monitoring of land use and land cover (LULC) dynamics is essential for understanding the history, current and future LULC changes and degradation status of estuaries (Chakraborty et al., 2016). Yang and Liu (2005) added that the degradation of estuarine ecosystems worldwide due to increasing population growth with its fishing, agricultural and urban development validates the need for continued land use

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and land cover assessment. Population growth puts increasing pressure daily on the natural environment resulting in land use and land cover changes (Islam et al., 2016).

Several authors have researched land use land cover assessments around different world estuaries (Esmail et al., 2016; Jack, 2006; Muthusamy et al., 2014; Putra et al., 2017; Yang & Liu, 2005). For instance, Muthusamy et al. (2014) found an alarming 47% decrease in the river area in their land use land cover analysis of the Manakudy Estuary from 1991 to 2001. Similarly, Yang and Liu (2005), in their LULC assessment of estuaries of Pensacola Bay, observed that the woody wetlands area has declined by 6.1% due to anthropogenic activities through intensification and urban development. However, Jack (2006) observed in a study of the urban estuary of Zandvlei, South Africa, that there were no significant changes in the semi-natural and permanently inundated land use/land cover types for the period 1944 to 1968. Nevertheless, he observed a 3.7% increase in the urban area from 1944 to 1968. Similarly, Putra et al. (2017) observed that the major land cover types changed around the Kampar River estuary from 1990 to 2016 were agriculture/plantations (11.57 ha/year), building/settlement (48.11 ha/year) and scrubland (30.88 ha/year). Thus, anthropogenic activities in and around estuaries and other coastal ecosystems have caused irreversible changes in the ecosystem and ecology (Ellis, 2007).

Roy and Roy (2010) emphasised that land use is context specific as it deals with the resource's social and economic benefit and management. Lambin et al. (2001) indicated there might be different land-use activities happening in other parts of the same landscape even though the land cover is

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the same. Consequently, the results of any land use land cover change of any estuary cannot be generalised to cover other estuaries without considering the land use and intensity of anthropogenic activities happening at those estuaries.

Assessment of Land Use Land Cover Change of Estuaries

Land use land cover change assessments have been done in many estuarine and coastal regions using remote sensing images over various spatiotemporal scales Klemas (2015). Nevertheless, these remotely sensed images compromise temporal frequency and spatial resolution (Li & Gong, 2016). According to Ai et al. (2020), high-spatial-resolution imagery, such as the Chinese satellite Gaofen-6 imagery, which provides detailed information, is relatively costly for regular monitoring of estuaries and other coastal resources. Vogelmann et al. (2016) added that high temporal frequency with comprehensive coverage but with low spatial resolutions is unclear to identify detailed land-use cover changes. Therefore Landsat TM and Landsat ETM were developed to remotely sense images at a temporal scale of 16 days at 30m spatial resolution and offers the oldest and most systematic historical data. Wulder et al. (2008) recommend that it is more appropriate for monitoring dense LULC dynamics in large estuarine regions. According to Braimoh (2006), in LULC analysis, random or systematic changes are the two primary dynamics of land cover changes. Random change is depicted as "a change influenced by coincidental or unique process", and systematic change, on the other hand, is "a consistent and progressive change in land cover due to population growth, industrial or commercial expansion, or changes in land management policies" (Braimoh, 2006; Lambin et al., 2003). Thus, the need to

focus on systematic land cover changes for better understanding and policy formulation (Braimoh, 2006).

According to Ai et al. (2020), Muthusamy et al. (2014), and Szabó et al. (2016), there are diverse change detection methods for landcover/use classification. They include object-based classification, pixel-based classification, comparison of land cover classifications, maximum likelihood classification and image differencing. However, each of these methods has its advantages and disadvantages. For instance, Gómez et al. (2016) indicated that pixel-based methods use texture and context information, resulting in low mapping accuracies in heterogeneous regions, especially estuary areas. Xie et al. (2015) also added that the object-based method requires high spatial resolution remotely sensed images which are limited and very expensive.

Maximum likelihood classification is a pixel-based statistical classification method that helps classify overlapping signatures; pixels are assigned to the class of highest probability. When conducting a maximum likelihood classification, one must know quite a bit about the land-cover in the study area (Jensen et al., 2009). The maximum likelihood classifier produces more accurate results than any other classification method; however, it takes longer to generate results due to extra computations (Shodimu, 2016). ISO-based unsupervised classification and supervised classification using the Maximum Likelihood algorithm are commonly used methods. ISO data algorithm requires a minimum of two classes and an unlimited maximum number of classes, several alterations, and convergence.

The Maximum Likelihood algorithm, in contrast, presupposes that the input bands have normal distributions and that each class has an equal

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probability. Per Tewabe and Fentahun's (2020) methodology, ground truth data points were gathered to act as training samples. For example, Zheng et al. (2019) used maximum likelihood classification to assess the impact of land cover land use of Area in Minjiang River Estuary in China. Likewise, Shodimu (2016) also used the same methodology to evaluate the spatial analysis of land cover changes in the grand lake meadows, New Brunswick. Similarly, Obubaa and Ozigis (2020) also used the maximum likelihood classification (unsupervised and supervised) to assess the spatio-temporal land-cover changes of the Imo River Estuarine in Nigeria.

Impact of Migration on Land Use Land Cover

According to the IOM (2011, p. 137), migration is "the movement of a person or a group of persons, either across an international border or within a state. It is a population movement, encompassing any movement of people, whatever its length, composition, and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification". According to Kutir et al., 2022 and Oglethorpe et al., 2007 the movement of people can affect biodiversity through habitat fragmentations, clearing of land for settlements, and other land uses, among others. Migration is a multifaceted demographic with time-based and spatial dimensions (Avis, 2017).

Rural-rural migration tends to have the most significant impact on biodiversity, and LULC changes as areas of rich biodiversity are isolated in rural areas (Oglethorpe et al., 2007). For instance, migration linked to the extension of the agricultural frontier directly contributes to the ongoing deforestation on the agricultural frontier resulting in LULC changes

(Bilsborrow et al., 1997). In-migration was a significant driver of negative net LULCC in Burkina Faso (Ouedraogo et al., 2010). Nébié and West (2019) also added that migration is attributed to the expansion of agriculture which results in the conversion of various land covers into agricultural uses and its accompanied LULC changes. Braimoh (2004) found that in the Volta Basin of Ghana, most LULC changes occurred between 1984 and 1992, when the study area recorded the most migrants. Bhawana (2015) found that the internal migration of people was one of the significant drivers of LULC change due to the expansion of human settlement in Nepal. Similarly, Angelsen et al. (2020) observed a 0.73% loss of forest cover due to increased migration and the accompanying demand for agricultural land in Mexico.

The adverse impacts of migration on land cover changes are not different in coastal areas. For instance, Alemayehu (2016) observed that the growing number of migrants in Watamu Mida Creek, Kenya's coastal area, has impacted the land-use change observed on the 2010 land-use map, where coastal vegetation declined for settlements, urbanisation and establishment of tourist sites. Chen and Mueller (2018) also found that human-environment interactions are shaping the LULC dynamics of the coastal region. Thus, they observed that out-migration in Bangladesh resulted in the conversion of the built-up area into other land uses, such as agricultural land use in the coastal region of Bangladesh. This, therefore, indicates that fishers' migration along the coast of Ghana for livelihood adaptation purposes would have adverse impacts on biodiversity, and land use land cover changes, if unchecked and unmanaged, would result in unprecedented degradation of valuable land covers and ecosystems along the coast of Ghana.

Fishers Competing Interests in the use of the Natural Resources

The livelihoods of many people globally depend on natural resources. These resources generally include land, water (estuaries, lagoons, and sea), and forests, among others, that can improve and sustain livelihoods (Ayling & Kelly, 1997; United States Institute of Peace, 2007). However, using these natural resources has varied and conflicting uses to different stakeholders and tends to result in user conflicts. Tensions or conflicts over resource use can be caused by ethnic tensions, distrust, socioeconomic crises, resource scarcity, and political instability (Benjamisen, Maganga & Abdallah, 2009; Reuveny, 2007). These tensions affect livelihoods and development in West Africa and across the continent (Lewins, 2014). Food and Agriculture Organization (2000) defines natural resource conflicts as disagreements and disputes over access to, control and use of natural resources. These conflicts often occur because individuals have various services for natural resources such as forests, water, pastures, and land that are managed differently, which in most cases are incompatible (FAO, 2000). Hammill and Besançon (2003) indicated that natural resources signify other things to different groups of people. According to Atta-Asamoah (2010), natural resource use has often led to conflicts because it plays a pivotal role in wealth creation in society and, by extension, the rise and fall of nations. Engel and Korf (2005) and Nang et al. (2011) indicated varied causes of natural resource-based conflicts ranging from scarcity of the resources, multiple uses, extended dependence on the resource, poor stakeholder management, and overlapping roles. Globally, conflicts of interest over coastal and marine resources have emanated from access and use issues (Muhfuzuddin et al., 2006).

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Fisheries resource-related conflicts result from competing interest over marine and aquatic resources usage (Suryanarayan, 2005). For instance, Mohammed (1990) observed conflicts of interest between fishers and plantation owners as increasing fish mortality in the Mwanakombo and Zingwezingwe rivers, both of which receive waste from the Mahonda sugar factory and sugarcane plantation in Tanzanian. Similarly, fishers from Mapopwe Creek in Chwaka Bay found that the disappearance of shrimps in the creek after the rains resulted from pesticides being washed off into the Bay from Cheju-irrigated and rain-fed rice farms (Masalu, 2000). In addition, Tunje et al. (2016) also observed in their study of fisher conflict along the Kenyan Coast revealed most causes of conflict among fishers were fish theft from gears, destructive activities of aquarium fishers and the use of unapproved gears. Cutts and Hemingway (2013) indicated numerous disputes between different users of estuaries such as the Weser estuary, Elbe estuary, Scheldt estuary among others. Song and Tønnesson (2013) reported a competing interest over parts of the South China Sea by China, Vietnam, Philippines, Taiwan, Malaysia, and Brunei. This stresses that natural resource-related conflicts could be beyond internal boundaries, such as a community, to involve several countries and institutions or bodies depending on their interest. Were (2016) indicated the conflict of interest between Uganda and Kenya in exploiting Lake Victoria's resources. According to the United States Institute of Peace (2006), disputes about overfishing led to the 1950s and 1970s "cod wars" between Britain and Iceland and therefore no conflicts in the use of fishing resources. Hence, there are no conflicts in the use of the resource. For example, according to Hen Mpoano (2016), there is no conflict of interest

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among users of the Ankobra Estuary in Ghana. This is attributed to the high obedience to the traditional regulations governing the use of resources.

According to Tunje et al. (2016), a resource related to conflict, particularly fisheries resource conflicts, has adverse impacts on the community and economy, especially on the livelihoods of the parties involved. Therefore, it should be managed to resolve this sustainably. FAO (2000) indicated several ways of resolving natural resource conflicts: avoidance, mediation, arbitration, negotiation, adjudication, and coercion. Tuda et al. (2014); Schultz-Zehden et al. (2008) used marine spatial planning to control conflicts in a multi-use Kenyan coastal area. Cicin-Sain and Knecht (1998) indicated that Integrated Coastal Zone Management (ICZM) had been adopted to address disputes among varied coastal resource users. Similarly, McLeod et al. (2005) added ecosystem-based management (EBM) as yet another coastal resource conflict management approach. Thus, to ensure sustainable marine and aquatic resource use among multiple users, fishers' conflicts of interest should be amicably resolved with all stakeholders' mutual respect and cooperation.

Household Livelihoods Security of Migrant Fisherfolks

In the economic development of low-income communities, household livelihood security remains a critical issue (Bhandari & Grant, 2007). Household livelihood security (HLS) is defined as having sufficient and long-term access to the income and resources needed to meet basic needs (Mishara & Debata, 2021). Chambers and Conway (1992) indicates that a livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base. According to Frankenberger

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and McCaston, (1998), food, health care, educational opportunities, housing, community participation, and social integration are essential for a sustained and secured livelihood. However, due to the difficulty of securing livelihoods, poverty is a concerning phenomenon in today's world, particularly in Asia and Africa (World Bank, 2012). Thus, inhibiting people's ability to meet their household needs and survival.

Globally, migration is seen as a critical livelihood adaptation strategy for households (Alam & Streatfield, 2012; Collinson et al., 2009; Narayan, Chambers, Shah, & Petesch, 2000; UNDP, 2009). According to De-Haan (2000) and Young (2006), migration enhances the livelihoods and well-being of migrants through access to income, materials stuff, and new practical skills, which help improve the household livelihood status. According to Foresight (2011), migration is a common household strategy for meeting basic needs and sustaining livelihoods. Gautam (2017), for example, indicated that migration could contribute significantly to economic growth and enable farming households in Nepal to escape poverty. De-Brauw and Harigaya (2007) also found that income from migration improved migrant families' living standards significantly and contributed to about one-fifth of the overall poverty reduction between 1993 and 1996 in rural Vietnam. Meekaew and Ayuwat (2018) observed that migrant fishers of Thailand contribute to improving the economic status of their place of origin by sending vast sums of remittances. In their study of the livelihood conditions of migrant fisherfolks of Kanniyakumari district in south India, Rajan and Pillai (2020) discovered that most remittances were used for the higher education of children, maintenance and construction of houses, and marriage of daughters.

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The situation of migration to improve livelihoods is even more severe in Africa due to extreme poverty, high population growth, and low economic growth (Kotir, 2011). According to Van Der Geest (2011), seasonal migration in West Africa allows returned migrants to contribute to domestic food production. According to Njock and Westlund (2010), Senegalese fishers migrate to Mauritania for better livelihood opportunities and more fish catch. Fishers migrate domestically and globally. Seasonal, long-term, regular, or irregular domestic and international migration can occur (Crona & Rosendo, 2011; Njock & Westlund, 2010). According to Crona et al. (2020), many fishers migrate along the Kenyan coast for livelihood adaptation. Odetei (1995) added that migration enhances the male status back in their place of origin in Ghana. Duffy-Tumasz (2012) examined the fishing activities of migrant Ghanaian fisher folks on the coast of Ivory Coast. They supported the well-being of their host communities by augmenting local food security and sustaining livelihoods by providing the fish that is processed and sold. In their study, Binet et al. (2012) also looked at the migration pattern and activities of Senegalese fishers along the coast of West Africa at their popular destination sites in Mauritania, The Gambia, Guinea Bissau, Guinea and Sierra Leone. Thus, the fishing sector plays a substantial role in livelihood security for countless fisher migrants in Africa, including those whose primary occupation was not initially fishing (Njock & Westlund, 2010).

However, according to Cahn (2002), migration as a livelihood adaptation strategy could improve, unchanged, and deteriorate livelihoods (maladaptation). Tanle (2013) indicated that the livelihood outcome of migration to a destination is context-dependent. Thus, the result of a livelihood

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adaptation depends on the situation and condition of the destination communities. A study conducted in Ethiopia in 2006 by Mberu (2006) found no statistically significant difference in asset and durable goods ownership among permanent migrants compared to non-migrators. Tanle (2014) also revealed no significant variations between migrants and natives in ownership of assets, consumer durable goods, and housing quality. Nonetheless, the institutional structures and processes relatively favoured the natives.

Degradation of Estuaries

According to Lotze et al. (2006), estuaries and coastal seas have been significant areas of human settlement and marine resources. Estuaries are transitional environments, the meeting place of land, freshwater and marine ecosystems (Thrush et al., 2013). Centuries of overexploitation, habitat transformation, and pollution have obscured the total magnitude of estuarine degradation and biodiversity loss and undermined ecological resilience (Adger et al., 2005). Estuaries are affected directly by actions and processes occurring within them and close to them (Breen &Mckenzie, 2001). Without human intervention, damages to estuarine systems due to escalating population growth and development will likely increase and become irreparable. For instance, according to Sukdeo et al. (2016), the Mvoti Estuary is one of the most severely degraded systems on the North Coast of KwaZulu-Natal due to excessive agricultural and industrial production pollution and effluent disposal into the estuary. McAuliffe et al. (2014) argue that the economic situation that uses an estuary as a primary livelihood source influences the degradation in the region. Cyrus (2020) indicated that 133 estuaries out of the 280 estuaries in southern Africa are degraded, with anthropogenic use and alteration of

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catchment areas being the dominant causes of degradation. Dolbeth et al. (2007) indicated that the Mondego estuary had been degraded over the past decay mainly through eutrophication.

Similarly, Vu (2018) found anthropogenic activities contribute to the Dong Ho Estuary degradation in Vietnam. Land conversion for agriculture, forestry, or residential and industrial development causes habitat loss or fragmentation (Kennish, 2002). These land use changes can raise sediment, debris, nutrient, and pollutant levels in estuaries, smothering or entangling species and causing eutrophication, hypoxia, and anoxia (Leschine et al., 2003). Coastal development and land-use changes have led to many estuarine environments and habitat loss and alteration, affecting biotic groups and biological communities (Díaz et al., 2006).

In Africa, things are considerably worse; according to Okyere (2019), the past two decades have significantly degraded Ghana's coastal ecosystems, such as wetlands, lagoons, and estuaries. The dominant forms of degradation are pollution from effluents, solid waste disposal, siltation (Biney, 1982; Karikari et al., 2006), encroachments, and reclamation (Aheto et al., 2011) and land use land cover changes. Okyere (2019) found that the Pra estuary was degraded due to siltation from illegal mining resulting in high turbidity and poor water quality. Similarly, Ansa-Asare, Mensah and Biney (2008) indicated nutrient inputs directly impact human activities in some designated lagoons in Ghana. In addition, according to Wiafe et al. (2008), the sea-level surface temperature rise is already detrimental to the productivity of Ghana's marine waters; thus, anthropogenic degradation of coastal ecosystems, particularly estuaries, will negatively affect the fishery through the decline in

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recruitment, food supply and overall productivity if not given management priority (Okyere, 2019).

Thus, there is a need for sustainable use and management of coastal resources, particularly estuaries, to ensure long-term benefits and access to the valuable ecosystem goods and services they provide and the sustainability of the fishing industry. This is because about 70% of fish species spend some time in estuaries for reproduction and breeding purposes.

Measuring Household Livelihoods Security

The Brundtland Commission on Environment and Development introduced the sustainable livelihood approach in 1987 and later expanded it at United Nations Conference on Environment and Development in 1992 (IISD, 2013). There are five diverse forms of assets owned by individuals to build their livelihoods which entails natural, social, human, physical and financial assets. A person's livelihood is sustainable if he owns these assets. CARE (1994) indicated that sustainable household livelihood is dependent on five showed thus, economic security, food security, education security, health security, and empowerment security. Frankenberger (1996) defines household livelihood security as "a family's or community's ability to maintain and improve its income, assets and social well-being from year to year the relief to rehabilitation to development continuum". The household livelihood security (HLS) index was first developed by CARE to assess household assets and constraints to wellbeing. Household livelihood security comprises five key domains: economic security, food security, health security, education security, and empowerment (Akter & Rahman, 2017; Lindenberg, 2002). The desire and aim of every migrant are to achieve sustainable livelihood at the place of

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destination. Migration is well-studied, especially on the economic well-being of migrant households back home (Geest 2005; Heering et al. 2004; Kothari 2002; Yaro 2006; Young 2006). For example, a study on migration and livelihoods found that migrants brought home material goods and skills that improved household livelihoods (De Haan et al., 2000). Like Young (2006), remittances and migration were the second most important source of food and income for poorer households after agriculture.

According to Akter and Rahman (2017), each HLS index uses a balanced weighted average approach with many indicators contributing equally to the overall index. The indicators are grouped into different domains. Because each indicator is measured on a different scale, indicators are standardised following the approach adopted in measuring "life expectancy". First computation of household livelihood security indices (HLSI) Household Livelihood Security Index" for each indicator of the entire household was calculated using the formula given below:

$$Zindj = \frac{Xij - min(Xi)}{Max(Xi) - min(Xi)}$$

Where minimum and maximum values of the indicators are from the same Community within which the household belongs.

$$HLS_j = \frac{\sum_{j=1}^{j} Zindj}{j}$$

Where HLS_j = Household livelihood security

Zindj= sum of standardised indicators of j

J= number of Indicators

Where J is the index's indicator count, these HLS indices are bounded between 0 and 1 by construction. A household livelihood security index of

below 0.5 indicates the households are poor; therefore, their livelihoods are not secured and sustainable and vice versa. Akter and Rahman (2017) and Barela et al. (2018) used the same methodology to compute household livelihood security in their various studies.

Determinants of Household Livelihood Security

According to Babulo et al. (2008), rural households adopt diverse livelihood strategies to help achieve their livelihood objectives of augmenting incomes and food security. Recent development in the literature has indicated that several socioeconomic characteristics such as age, gender, educational status, and household size influence the livelihood securities of rural households. Akter and Rahman (2017) used regression to see the relationship between the socioeconomic characteristic and livelihoods of fishers. For instance, Adili and Antonia (2017) used regression to ascertain the most relevant factors for determining fishing income on the Tanzania coastline. George and Mallery (2019) indicated that for accurate results from regression modelling, a principal component analysis should be done on the factors to examine the correlation among the variables and reduce the Multicollinearity effects in the regression analysis (Nishantha, 2011). Using a multinomial logit model, Hatlebakk (2012) determined Malawi's occupational choice and livelihood strategies, which provided a more intelligent and balanced assessment of the factors influencing livelihood choices. Amevenku et al. (2019) also used multinomial logit regression to determine socioeconomic factors that influence the livelihood strategies of fishing households in the Volta Basin.

Nevertheless, Olawumi (2012), Kamaruddin and Baharuddin (2015) and Akter (2017) used structural equation modelling to determine household livelihood securities in their various studies. For instance, Akter (2017) found low domains of HLS in his Study Investigating Multiple Domains of Household Livelihood Security: Insights from Urban Slums in Bangladesh. Kumar et al. (2018) found health security as the highest domain in their Study of HLSI of livestock farmers in rural Tamil Nadu. Similarly, Ibrahim et al. (2018) also used the same methodology. They found that support from the government affects the livelihood outcomes of households and individuals, which ultimately enhances food security.

The partial least-squares (PLS) path modelling with SmatPLS 2 is a two-step analysis approach to analysing the data. Kamaruddin and Baharuddin (2015) also stressed that income increase supports household livelihoods which further helps reduce poverty. According to Ibrahim et al. (2018), PLS makes minimal demands on the data distributions, sample size and measurement scales. Gliolariri et al. (2013) used bootstrapping to determine the importance of loadings, weights, and path coefficients. This study would adopt the structural equation path analysis modelling to model the livelihood security indices on overall household livelihood security of fisherfolk households in several estuarine communities along Ghana's coast.

Livelihood Challenges of Fisher Migrants

Small-scale (artisanal) fishing is vital to the rural poor and accounts for most African fish catches. It is critical to exploit marine resources and provide food for domestic use, assisting nutrition and meeting demand for local and domestic markets. Fisher migration is possible in various circumstances due to

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the open-access nature of fishing grounds coupled with inadequate or absence of regulations governing access and use (Njock & Westlund, 2010; Wanyonyi, Wamukota, Mesaki et al., 2016).

Small-scale (artisanal) fishing employs millions in West Africa, particularly Ghana, and serves as a conduit for other economic activities such as trading. However, artisanal, and small-scale fishers face numerous challenges that jeopardise their output. According to Megahed and EL Sayed (2020), the primary constraints on Lake Bardawil, Egypt's fishers, are high fuel prices, limited availability, and closure periods resulting in hardships caused by a lack of revenue. In addition, Megahed and EL Sayed (2020) noted that from a biological standpoint there are illegal fishing, fish stock loss, and climate change are some challenges inhibiting the livelihood activities of fisherfolks. This has socioeconomic ramifications, resulting in friction and clashes between fishers to access and share natural resources. Similarly, Gideon (2020) identified challenges associated with diminishing fishing resources, poor market access, and limited prospects in value-chain activities as restricting fishers on Kenya's Southern coast. Evans (2013) discovered that migrant fishers in James Town had difficulties due to a lack of outboard motors, premix fuel, and fishing nets.

Mensah (2019) also discovered that a shortage of credit available to fishers to purchase fishing inputs (fishing boats and nets) combined with an erratic supply of premix fuel might reduce fish catch volume and output in Yeji. Similarly, in Kenya and Tanzania, fishing-related challenges noted were a lack of credit available to fishers. In addition, unproductive fishing gear and vessels were also recognised as obstacles. Migration in the marine fishing

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sector may be a necessary adaptation mechanism for fisherfolk to live in an environment of shifting fish catch and disguised unemployment. Salim et al. (2021) emphasised that significant hurdles confronting migrant's fishers include language difficulties, a lack of education, competition among migrants and locals, a lack of experience, cultural lag, prejudice in revenue sharing, and insufficient skills than fishing. Wanyonyi et al. (2021) added that a significant challenge confronting Kenyan fishers was a lack of basic infrastructure at landing sites, including insufficient fish storage facilities and piped water in Gazi and a lack of ready market and cold storage facilities in Kipini.

Despite the multiple difficulties faced by migrant fishermen, Rajan and Pillai (2020) found that migration enhanced the living level of migrant fishers in South India. Crona, and Rosendo (2011) reported that the opportunity to earn more, save money, and improve one's life were among the most frequently cited reasons for migration by Kenyan fishers. In their research in Zanzibar, Wanyonyi, Wamukota, Tuda (2016) discovered that migration was associated with increased income and savings, benefiting wider communities and households. According to Nunan (2021), financial benefits related to fisherfolk migration can be realised in both the originating and destination communities. According to Binet, Failler, and Thorpe (2012), fisher migration ensures food security and provides a sustainable livelihood for Senegalese coastal communities.

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CHAPTER FOUR

METHODOLOGY

Introduction

This chapter describes the study's methodology. These include the research design, study area, population, sampling procedure, data collection instruments and procedures, data processing, ethical considerations, data management, and data analysis.

Study Area

The study was conducted in five migrant estuarine communities in three coastal regions along the coast of Ghana (Figure 4). The coast of Ghana lies between Latitudes 4° 40' and 6° 25' North and longitudes 0° 45' east and 3° 05' west. Estuarine communities formed the study area from major rivers (Ankobra, Pra, Kakum, Densu and Volta). The vegetation types along the coast of Ghana cut across the Wet evergreen and the coastal savannah vegetation with major rivers connecting to the sea (estuaries), which serve as destination grounds for fisher migrants. The residents of the study communities rely on the estuary as a source of fish and water for domestic activities. The primary economic activities of the study communities are fishing, farming, and petty trading.
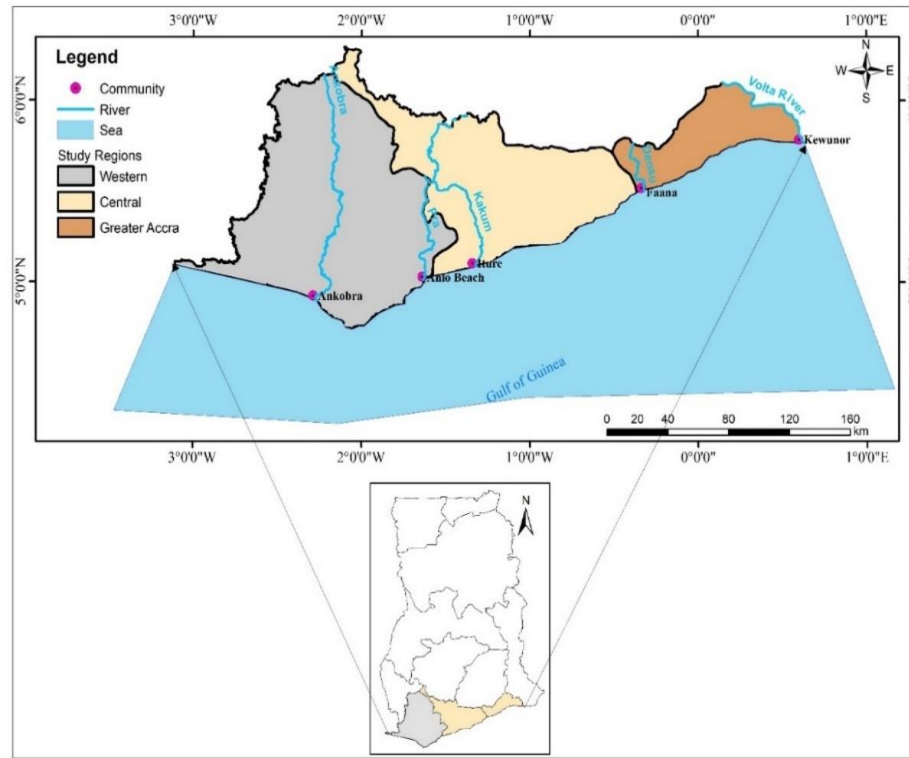
Figure 4: Map of the Study Area.
            Source: Author's Construct (2021)

Philosophical Worldview/Paradigms

There are many worldviews or paradigms in research, including positivism, post-positivism, social constructivism, interpretativism, and pragmatism. According to Creswell (2009), these paradigms are all world views. However, each worldview has a diverse standpoint on axiology, ontology, epistemology, methodology, and research rhetoric. For this research, the study adopts the pragmatism philosophical paradigm. As a research paradigm, pragmatism believes that the emphasis should be on the philosophical and/or methodological approach that works best for the research problem being studied (Tashakkori & Teddlie, 1998). This paradigm is often connected with mixed-methods (Biesta, 2010; Creswell & Clark, 2011) with its emphasis on the consequences of research and on the research questions rather than the methods.

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Pragmatics advance several ways of understanding the world and undertaking research; hence, no single belief can give a holistic representation, as there may be several realities which propose a diversity of methods. According to Morgan (2014), pragmatist behaviour cannot be detached from the circumstances and settings in which they occur. Thus, pragmatism allows researchers to combine qualitative and quantitative methods to aid in understanding social reality to generalise results from a sample to a population and gain a deeper understanding of the phenomenon under investigation (Hanson et al., 2005). This contrasts with positivism, which allows for only quantitative methods and constructivism, which uses only qualitative methods. Pragmatism philosophy believes that knowledge and reality are based on perceptions and habits that are socially constructed. Using both qualitative and quantitative data enables triangulation in a single study and, allows the researcher to confirm information from different sources for credibility, validity and ensures richness of data (Creswell, 2003). Depoy and Gitlin (2005) opined that pragmatist mixed method aids for richer and possibly more valid interpretations as it helps the researcher to advance in-depth understanding of the phenomenon being researched and complements the strength of the qualitative and quantitative methods. This study, therefore, relied on the pragmatism philosophy to generate, analyse and interpret livelihood adaptation and migration along estuaries communities along the coast of Ghana. Hence, the study used a mixed methods approach, whereby quantitative and qualitative data were combined to provide further evidence regarding the phenomenon under study.

Research Design

According to Burns and Grove (2003, p. 201), descriptive research "depicts a picture of a situation as it naturally happens. Dudovskiy (2018) indicated that descriptive design studies could be in the form of case studies, cross-sectional studies, longitudinal studies, and retrospective studies.

The pragmatic paradigm permits a case study design strategy which needs diverse sources of evidence in a research study and, thus, allows the use of different data collection methods and analyses for qualitative and quantitative data (Ihuah & Eaton, 2013). Creswell (2013) and Yin (2003) added that the case study approach fits well into the pragmatic paradigm through mixed methods. To achieve the study objectives, a **case study** design was applied to assess the relevance of estuary ecosystems on the livelihood adaptation and migration patterns of the migrants and the anthropogenic pressures on the estuaries along the coast of Ghana. Abobi and Alhassan (2015) and Atuobi (2016) used the case study approach in the various fisher-related migration studies.

Sampling and Sampling Methods

From the pragmatic stance, a multistage sampling technique was used for the study. In the first stage, purposive sampling of all rivers with estuaries along the coast was selected. Thus, river Pra, Ankobra, Volta, Kakum, and Densu river estuaries were selected for the study. These rivers were selected because they are the major rivers whose tributaries have estuarine communities along the coast of Ghana. In the second stage, one estuarine community was selected from each selected river along the coast. For River Pra (Shama Anlo beach), Ankobrah (Ankobra), Volta (Kewunor), Kakum

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(Iture) Densu (Faana). These communities were purposively selected because they were communities located near estuaries. Since the number of migrants and indigenes in the selected communities was unknown, so a sample size could not be determined. A household listing technique was used to generate a list of households for each case (migrants and indigenes). The last stage involved using a systematic sampling technique to select migrants and indigenes household heads for the study. Table 1 shows the sample size for the study.

Sample Size

Krejcie & Morgan, (1970) sample size formula was used in computing the sample size for the study.

Equation 1: Sample Size Formula **S=X^{2}NP (1-P) /d^2 (N-1) + X^2 P (1-p) …**

Equation 1

"Where: S = required sample size

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841) that is 1.96 *1.96 = 3.841

N= the population size.

P= the population proportion (assumed to be 0.50 since this would provide the maximum sample size)

d= the degree of accuracy expressed as a proportion (0.05)."

This formula was used by Anamoa-Pokoo (2016) and Rasouliazar, Fealy, and Branch (2013) in their studies. Bukola (2018) also used this method in selecting the sample size in a fisher-related study in Ondo State, Nigeria.

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Table 1: *Sample Size for the Study*

Region	Communities	No of Households	Sample Size
Western	Ankobrah	256	153
	Anlo Beach	790	255
Central	Iture	81	66
Accra	Faana	156	110
	Kewunor	84	68
	Total		652

(Source: Ghana Population Housing Census 2010)

Recruitment and Training of Field Assistance

Four research assistants were recruited and trained on data collection using the KoboCollect. The criteria for selecting the field assistants were the ability to speak the native language of the study communities, knowledge of the study area, and experience in similar data collection.

Methods of Data Collection

The sampled respondents were interviewed using a structured interview schedule with close-ended and open-ended questions focused on migration, the contribution of the estuary to their livelihood adaptation and anthropogenic activities influencing the degradation of the estuaries. The face-to-face interview method was used in this study. According to Phellas, Bloch and Seale (2011), an interviewer's presence permits difficult questions to be clarified, if necessary, to the interviewee. Mathers et al. (2002) indicated that face-to-face interview helps when the issue is very delicate. Therefore, the face-to-face interview method was adopted with the aid of an interview schedule to collect data migration issues, fishers' perception and conflicts of interest between migrants and indigenes (research questions 1,2,3,4 and 5). Plate 1 below shows a face to face interview session held with a fisherman in

Kewunor community at the residence of the respondent. Kutir et al. (2015) and Shams and Shohel (2016) also used this method in their various studies.

Plate 1: Interview Sessions with a Fisherman in Kewunor

For triangulation, focus group discussions were held with experience adults (18+) with knowledge of fisher livelihood adaptations and migration patterns. According to Krueger (2002), applying the focus group discussion technique permits the researcher to collect the right quantity of rich data in a short time. Many researchers argue that a focus group discussions should have preferable 6-8 participants; thus, the group be small enough that every person has an opportunity to share his opinions and big enough to provide a diversity of perceptions (Krueger, 2002; Morgan, 1988; Oppenhein, 1993). Research findings indicate that the inclusion of both genders in group discussions has a positive impact on the quality of the discourse and its results (Freitas, Oliveira, Jenkins, & Popjoy, 1998; Nyumba et al., 2017). This study, therefore, adopted 8 (4 males and 4 females) mixed gender participants for the focus group

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discussion. In all seven (7) Focus Group Discussions (FGD) were conducted for the study, with two in Iture and Sanwoma (Ankobra). One focus group discussion was held each for migrants and indigenes. However, one FGDs was held in Faana, Anlo beach and Kewunor respectively. This is because fisher households in the last three communities were an all migrants. This was to help obtain empirical qualitative data to support quantitative findings from the structured interviews. The FGD guide was also used to gather data on research questions 3 and 4. Plate 2 below shows of a FGD session in held in Faana community. Crona et al. (2010) used this method to study fisher migration along the Kenyan coast. Kramer et al. (2002), Shams and Shohel (2016), and Wanyonyi et al. (2016) also used this method in their studies.

Plate 2: Focus Group Discussions Sessions in Faana

Similarly, key informant interviews were conducted with migrants with in-depth knowledge of migration patterns and the importance of the estuarine ecosystem goods and services on their migration trajectory. Key

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informants included the chiefs, opinion leaders, and chief fishermen who migrated to the community for the past ten years and above. Key Informant interviews were held with the chief, elders, and some opinion leaders of the indigenes of the study community. This KII guide was used to gather data on research questions 1 and 4. Plate 3 below shows a KII session with the chief fisherman of Sanwoma held in his residence. Cripps (2009); Crona et al. (2010); Onyango (2015); Limuwa, Sitaula, Njaya and Storebakken (2018); used key informant interviews in their various fisher's related studies. The study was conducted a total of 15 key informant interviews. That is, 2 key informant interviews (chief/elder/ opinion leader and chief fisherman) in each selected community. The respondents were given the liberty to choose a comfortable location for all data collection, as shown in the pictures. This was done to ensure that they felt at ease while expressing their opinions and engaging in discussions, without any apprehension or obstacles.

Plate 3: Key Informant Interview Session with the Chief Fisherman of Sanwoma

Spatial Data collection and processing

In addition, data was collected for the land use land cover analysis. A Global Positioning System (GPS) was used to collect spatial data coordinates. of salient features around the estuaries for ground truthing. The study's satellite image of the study area was gotten from Landsat TM, ETM + and Landsat 8 images for 1986 and 2020 (NASA, 1986 and 2020).

The land use and land cover changes in the estuaries were assessed using satellite Landsat Thematic Mapper data, Landsat Enhanced Thematic Mapper data, Landsat 8 Operational Land Imager (OLI) data, and Thermal Infrared Sensor data (TIRS). The main goal was to collect consistent time series data for all the study sites to understand and compare the changes. As a result, these datasets were chosen for the investigation because satellite images were available for three of the study locations. However, cloud free satellite images were not available for the Densu and Kukum estuaries.

The research area's satellite data was gathered from the Global Land Cover Facility GloVis (usgs.gov) and the Earth Explorer site (http://earthexplorer.usgs.gov/). The images covered 34 years. Most images were captured in the dry season; thus, they were good quality and had less cloud cover. The images were in UTM coordinates (WGS1984/Zone 30N) and a 30m spatial resolution. The study's satellite data are summarised in Table 2.

These data sets were imported into ENVI version 5.3 satellite image processing software. The layers were stacked, and the Region of Interest (ROI) was a subset of the entire image for classification. A Summarised description of the data set used for the land use land cover analysis of some estuarine communities in Ghana (Table 2).

Challenges of Data Collection

Language barrier severely limited the research. Ewe, Fante, Adangbe were the dominant languages in the study areas. Since the researcher did not speak the native language of the study locations, communication during data collection was difficult. I acknowledge that if I had been conversant in the languages of the study areas, my research would have been more successful. It would have allowed me to establish rapport and trust with my respondents, particularly during the focus group discussions, as well as to determine how accurate my research assistant's translation was. This would have enhanced the breadth of data that I would have gathered from the research respondents. However, the researcher overcame this problem by engaging a translator, who transcribed the interviews and focus group discussions. However, using a translator may result in incorrect interpretations and information loss. To circumvent this, a second person transcribed the same recording to compare authenticity.

In addition, the data was collected during the Covid – 19 pandemics. Thus, posing health risk to the researcher and respondents. In adherence to the Covid-19 protocols, each selected respondent was given a nose mask to wear during the data collection. Both the researcher and field assistants also always wore nose masks during the data collection process. In addition, participants and respondents were also given hand sanitizers to use before the commencement of interview and focus group sessions.

Furthermore, a significant portion of the coastal population experienced research fatigue due to the extensive research conducted. The heads of some households expressed their dissatisfaction openly and even

refused to take part in the study. They believed that the researchers were solely interested in collecting data for their own gain, as they observed no efforts to enhance their communities and livelihoods. In certain instances, none of the household members agreed to participate in the study. To overcome this obstacle, the researchers promptly substituted the household heads who declined to participate with individuals from a predetermined list. This approach ensured a 100% response rate, enabling the researchers to address this challenge effectively.

Table 2: *Description of data set for land use and land cover analysis of the selected study estuaries of Ghana*

Study Estuary	Study Community	Acquisition date	Path/ row	Landsat	Sensor
Ankobra	Sanwona	1986/12/29	194/057	Landsat 4-5	TM
		2020/03/29	194/057	Landsat 8	OLI/TIRS
Pra	Anlo Beach	1986/12/29	194/056	Landsat 4-5	TM
		2020/01/09	194/056	Landsat 8	OLI/TIRS
Volta	Kewunor	1986/04/10	193/056	Landsat 4-5	TM
		2020/04/07	193/056	Landsat 8	OLI/TIRS

Source: Data was Acquired from Global Land Cover Facility GloVis (usgs.gov)

Image Pre-processing

Pre-processing looked for abnormalities like stripping, sensor effects, sun, and topography. Radiance values were transformed from digital numeric values. The images were calibrated and corrected for atmospheric effects before classification using ENVI 5.3. The boundary shapes of the study areas were used to subset the image of the study areas.

Radiometric Correction

A raw satellite image comprises digital numbers; thus, radiometric correction is needed before it can be used in any analysis and compared to other satellite data across time (Chuvieco & Huete, 2010). The satellite images

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were processed using ENVI 5.3 classic software to acquire the sensor's reflectance data. The software calculates the actual top-of-atmosphere reflectance captured by the sensor of image acquisition using the images' metadata.

Geometric Correction

Geometric correction is used to give images real-world coordinates. These repairs geometric inaccuracies in satellite photos for various causes such as instrumental errors, sensor swath width, and sensor rotation angle. Satellite images were geo-referenced and projected to World Geodetic System (WGS) 1984 Universal Transverse Mercator Zone (UTM) 30 North Projection to ensure they were allocated their correct ground coordinates. The study's datasets were geometrically calibrated using the UTM zone 30 North projection. The input satellite images were colour-coded in red, green, and blue to make it easier to see and distinguish surface features. The flowchart in Figure 5 summarises the methods used in this investigation.
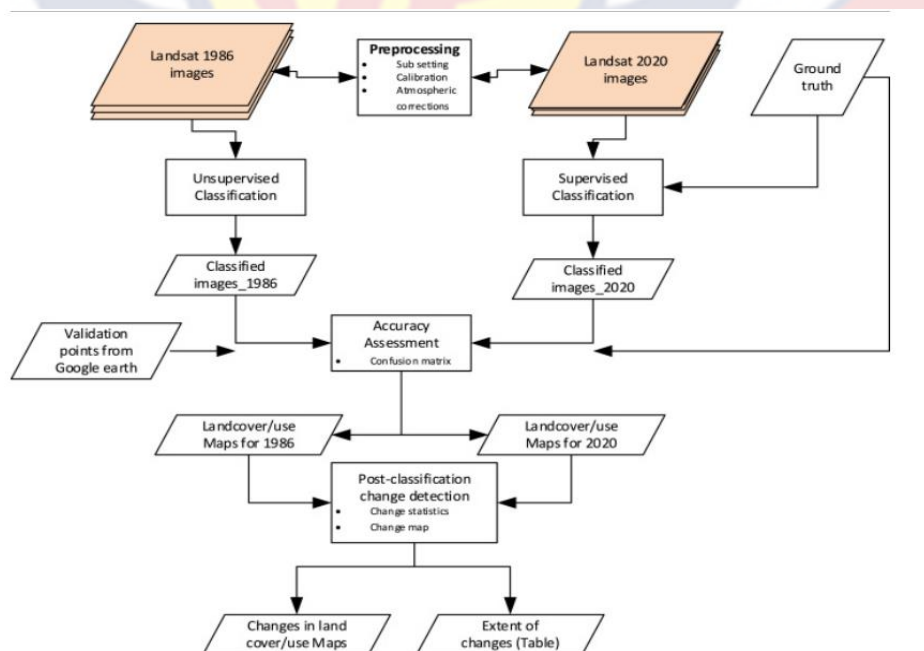
Figure 5: Methodological Flow Chart for LULC Classification.
Source: Adopted from Thakkar et al. (2014)

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Land Use and Land Cover Classes

The study used Anderson (1976) classification system for a level one classification as the primary LULC classification scheme. Water, bare land (settlement included), and Vegetation (Forested Wetlands) were the three LCLU classes used in the classification scheme. These classes are described in Table 3.

Table 3: *Land use and land Cover classes used to Categorized Changes in Ghana's Estuarine Communities*

Land cover or land use class	Description
Bare Land/Settlement	Built-up lands (houses), open spaces (Anderson, 1976; Brown & Amanor, 2006)
Vegetation	Forested wetlands, mangroves, crop fields and other vegetation (Anderson, 1976; Oyedotun, 2018)
Waterbody	Surface waters (rivers, seas) (Anderson, 1976); (Adnani et al., 2019)

Image Classification

Two classification algorithms were used to perform the classification in ENVI 5.3 software. The ISO-based unsupervised classification was performed on the 1986 Landsat images, and supervised classification using the Maximum Likelihood algorithm was used to classify the 2020 Landsat images. ISO data algorithm requires the number of classes, the number of alterations, and convergence. In contrast, the Maximum Likelihood algorithm assumes that all classes have identical probabilities and that the input bands have normal distributions.

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Ground Truth Data Collection

Ground truth data points were collected to serve as training samples for the supervised classification based on the approach of Tewabe and Fentahun (2020). The approach outlines that it is critical to understand the area, the classes desired, and the algorithms to be used. Ground truth field data were obtained to validate and evaluate the supervised classified image's accuracy Thus, reducing thematic information extraction errors. Congalton and Green (1999) recommend 50 ground truth points per class sample size. Hence, using a GPS device, a stratified random sampling procedure was used to collect 70 ground truth data points per class, 210 points per research area, and 630 points for the whole study. This data collection was undertaken in March/April of 2021.

Accuracy Assessments

The accuracy of a LULC assessment measures how well the classified image performed compared to reality (ground truth data) (Congalton 1991). Two indices, total accuracy and the Kappa index were tested for this investigation. Congalton (1991) defines overall accuracy as the number of correctly classified values divided by the total number.

The overall accuracy$=\dfrac{\text{The number of correct points}}{\text{The total number of reference points}}*100$ ....Equation 1

The kappa coefficient measures how well categorisation and actual values agree. A perfect agreement has a kappa value of 1, while no agreement has a value of 0. The kappa coefficient is calculated in the following way:

$$k = \frac{N\sum_{i=l}^{r}X_{ii} - \sum_{i=l}^{r}(x_{i+} * x_{+i})}{N^2 - \sum_{i=l}^{r}(x_{i+} * x_{+i})}$$ ....Equation 2

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Change Detection Analysis

Between 1986 and 2020, land use and land cover changes in the selected study sites were quantified using change detection analysis. In LULC, change detection is critical. To detect LULC changes, the post-classification change detection method was chosen (Coppin et al., 2004; Lu et al., 2004). Song et al. (2001) also indicate that it lowers mistakes caused by atmospheric and sensor differences between two bitemporal images. In addition, the method is straightforward in generating the change matrix, which is paramount for analysing the magnitude of change between the images. Between 1986 and 2020, the analysis revealed qualitative and quantitative changes in land use and land cover types.

Data Management

Quantitative data from the semi-structured interviews were collected using the KoboCollect mobile app. This ensures easy data collection and eliminates errors in typing the data as data is easily downloaded in excel from the software. Also, codes were given to respondents instead of their real names for confidentiality purposes. Two audio tapes were used to record the focus group discussions and in-depth interviews. The two tape recorders served as data backups on the field. At the end of each field trip, the collected data was safely stored to prevent any third party from having access to them. At the end of the data collection, data were processed for analysis, and the true identities of participants were not part of the results; instead, pseudonyms were used.

Ethical Issues

Ethical clearance is vital, especially in social research. Social researchers must avoid bias, use appropriate methods and accurate information, and protect respondents' rights. The University of Cape Coast, Institutional Review Board, examined and approved the research protocols for the study (UCCIRB). The ethical clearance code for this research is UCCIRB/CANS/2020/05. The study collected, handled, and analysed data with prior informed consent, anonymity, and privacy of respondents.

First, the aim of the study was explained to participants in English Language or their local dialect using an information sheet. Also, participants' identities were not attached to the survey data sets to ensure anonymity. Informed consent forms were signed before the commencement of the data collection. Participants were further assured anonymity and confidentiality, and the principal researcher transcribed audio-recorded interviews to maintain confidentiality. When interviews were recorded, the respondents' consent was sought for approval before the recording was done. Likewise, respondents were informed to skip any question they felt was too private or made them uncomfortable or exit from the study completely if they were not comfortable.

Respondents were also assured that no part of their information would be released to any third party, lest confidentiality, privacy, and anonymity be breached. The right to not participate was respected, ensuring privacy. As a result of the use of pseudonyms, none of the responses can be traced to specific individuals. The observance of these ethics not only improved the quality of the collected data but also fostered trust between the participants and researcher and fostered a cordial atmosphere during the data collection

process. This increased the participants' confidence in providing accurate information. The data collection process was performed concurrently with data analysis to a lesser extent. As the process progressed, inferences were made to guide subsequent data collection.

Data Analysis

Socioeconomic data were analysed using statistical software STATA 16, and spatial data were analysed using GIS ArcMap and ENVI.

Objective 1

Pattern analysis using ArcGIS software was used to determine the flows of migrants to the estuary's communities. The place of origin, destination, year, and counts are considered in pattern analysis. The analysis uses ten dominating flows, and some outliers are represented to show the migratory flows. In addition, a Chi-Square test was used to determine if any significant differences exist between ethnicity and specific characteristics of the estuary.

Image Classification: Maximum likelihood classification (supervised and unsupervised) and post-classification change detection was conducted to generate a land cover/land use map using Erdas Imagine 10 software. Quantitative analysis to determine the extent of change was done using excel.

To explore community assessment of the degradation status of the estuary, a binary logistic regression was used to analyse the factors influencing the degradation of the estuary to see the nature of the relationship and how these factors influence the degradation of the estuary.

Empirical Model

The dependent variable was represented with binary outcomes in the regression analysis. The state of the estuary was either degraded or not degraded.

Deegal et al. (1997), who created the Estuarine Biotic Index (EBI), discovered that damaged estuaries contained fewer fish species at a lower abundance. Therefore, the contextual term "degraded estuary" refers to the lack of preferred fish species in the estuary. The nature of having access to and use of the estuary, coupled with the theories of resource use, guided the selection of these variables (Table 4). A binary logistic regression model requires a dichotomous dependent variable and either continuous, dichotomous, or categorical independent variables. The binary logistic model is for a dichotomous dependent variable, Y (Menard, 2002). A dichotomous dependent variable's probability of success, X1, … Xk, is:

$$P(Y=1) \ = \ \frac{e^{(\alpha+\beta_1 X_1+\beta_2 X_2+...+\beta_k X_k)}}{1+e^{(\alpha+\beta_1 X_1+\beta_2 X_2+...+\beta_k X_k)}} \ \text{……………………} (1)$$

$$Logit(Y=1|X_i) \ = \ \alpha+\beta_1 X_1+\beta_2 X_2+...+\beta_k X_k \quad \text{……………} (2)$$

Table 4: *Description of variables for the binary logistics regression model*

Variable	Description	Data type
State of Estuary	The availability of fish species is referred to as the estuary's state. If preferred species are scarce, the state is degraded; however, if preferred species are plentiful, the state is not degraded. It was coded as 1 for degraded and 0 for not degraded.	Dichotomous
Procedure,	The term "procedure" refers to how fishers perceive the process of getting access to fish in the estuary. Fishers' perception was measured as fair and unfair. The procedure was coded 0 for fair and 1 for unfair.	Dichotomous
Attitude	The willingness of the fisher to follow the procedure established to regulate access to the estuary is referred to as attitude. It was measured whether the person was willing to follow the laydown procedure. The willingness attitude was coded as 0, and the unwilling attitude was coded as 1.	Dichotomous
Regulations	Regulations refer to the existence of rules/taboos on the use of the estuary. Coded 0 for the existence of rules/taboos and 1 for the nonexistence of rules	Dichotomous
Sanctions	Sanctions refer to the imposition of penalties on fishers who violate the established procedures/rules for gaining access to the estuary for fishing. It was coded 0 for enforcement and 1 for non-enforcement.	Dichotomous
Number of years in using estuary (fishing)	The number of years refers to how long a person has been fishing or fishing mongering in the community, expressed in years.	Continuous
Ethnic diversity,	The number of ethnic groups involved in fishing in each community is ethnic diversity. It was a continuous variable that was measured.	Continuous
Member of Fisher Group/ Organization	The term "member of a fisher group/organization" refers to whether the fisherfolk are members of any fishing organizations. It's coded as 1 if you are not a member and 0 membership	Dichotomous
Relationship Among User Groups	Refers to whether the estuary's various user groups have a friendly or hostile relationship with one another. It is coded 0 for cordial and 1 for not cordial	Dichotomous
Type of Fishing Gears	Refers to the types of fishing gears used by fisherfolks at the estuary. It is measured as a continuous variable	Continuous

Source: Author's Construct (2021)

To examine competing/conflict of interest between migrants and indigenes in using the estuary. Qualitative content analysis was used. Themes was developed and in-depth description and narration of conflicts issue.

To assess the livelihoods of migrants in estuarine communities along the coast. A household livelihood security index was computed for respondents and the selected communities. Structural equation modelling was done using SmartPLS 4 to see how the various household livelihood security indices influence fishery's overall household security index in migrant estuarine communities. In addition, Multivariate probit analysis was done to determine the influence socio-demographic factors have on the various livelihood security indices (financial security, food security, health security, education security and empowerment security).

Descriptions of Manifest Variables Used in the Structural Equation Measurement Model

The consistency and validity of the manifest variables will be evaluated when a measurement model is assessed (Memon & Rahman, 2014). Individual manifest and construct reliability tests are utilised to perform consistency evaluations (Hair et al., 2012). The validity of the variables is determined based on convergent and discriminant validity (Hair et al., 2012). On the other hand, individual manifest reliability calculates the standardised outer loadings of the manifest variables to explain the variance of personal manifest in relation to latent variables (Gotz, Liehr-Gobbers, & Kraf, 2010). According to Tenenhaus et al. (2005) and Gotz, Liehr-Gobbers, and Kraf (2010), manifest variables with an outer loading of 0.7 or greater are excellent. Although a loading value of 0.5 is considered acceptable, any manifest

variables with a loading value of less than 0.5 should be removed (Chin, 1998; Hair et al., 2010; Memon & Rahman, 2014). Figure 6 shows the variables used in the measurement model.
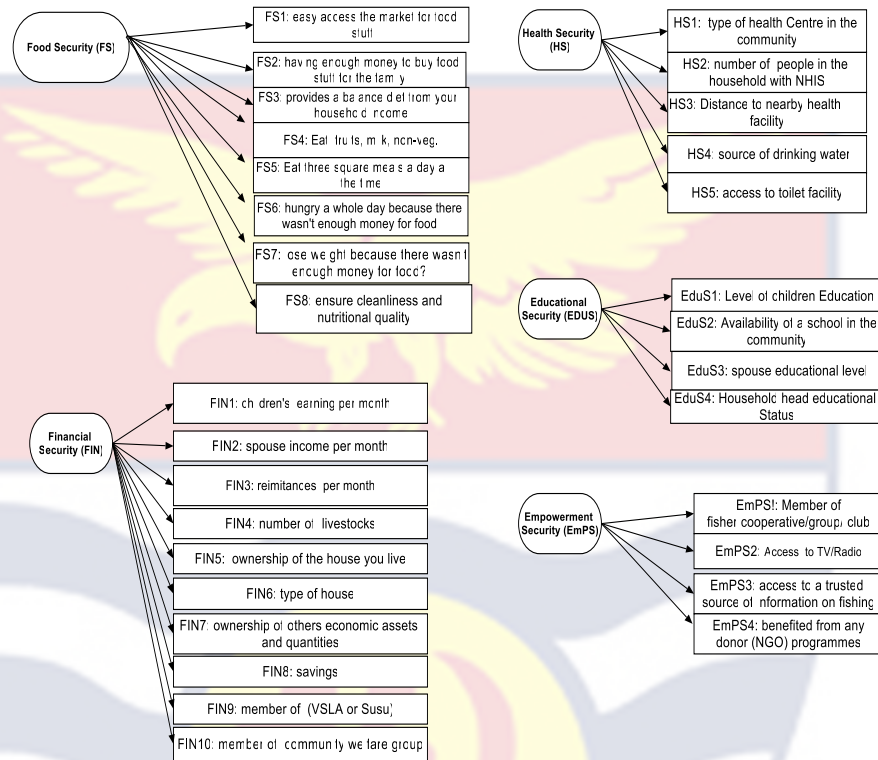
Figure 6: Description of manifest variables used in the measurement model.
Source: Author's Construct (2021)

Empirical Model for Multivariate Regression Analysis

The association of sociodemographic characteristics on the various fisher household livelihood security indices was tested using utilizing a Multivariate Multiple Regression Model (MMRM), which relates more than one dependent variable with more than one independent variable. The MMR model is expressed below:

$$y_1 = \beta_{01} + \beta_{11} X_1 + \beta_{21} X_2 + \ldots + \beta_{k1} X_k + \varepsilon_1$$

$$y_2 = \beta_{02} + \beta_{12} X_1 + \beta_{22} X_2 + \ldots + \beta_{k2} X_k + \varepsilon_2$$

$$\ldots y_m = \beta_{0m} + \beta_{1m} X_1 + \beta_{2m} X_2 + \ldots + \beta_{km} X_k + \varepsilon_m$$

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Where:

β_{ij}, i= 1, 2, k and j= 1,2,…,In the effect of the ith predictor, m is the predicted regression coefficient of the jth response.

The jth response's intercept parameter is β_{0j}.

Y: the n xm matrix, which contains m column vectors of observations for each dependent variable.

X: the n x (k+1) matrix, which consists of a column of ones followed by the k column vectors of independent variable observations.

β: the (k+1) m x matrix, which is made up of column vectors of parameters that need to be estimated.

ε: the n x m matrix, which is made up of random error column vectors.

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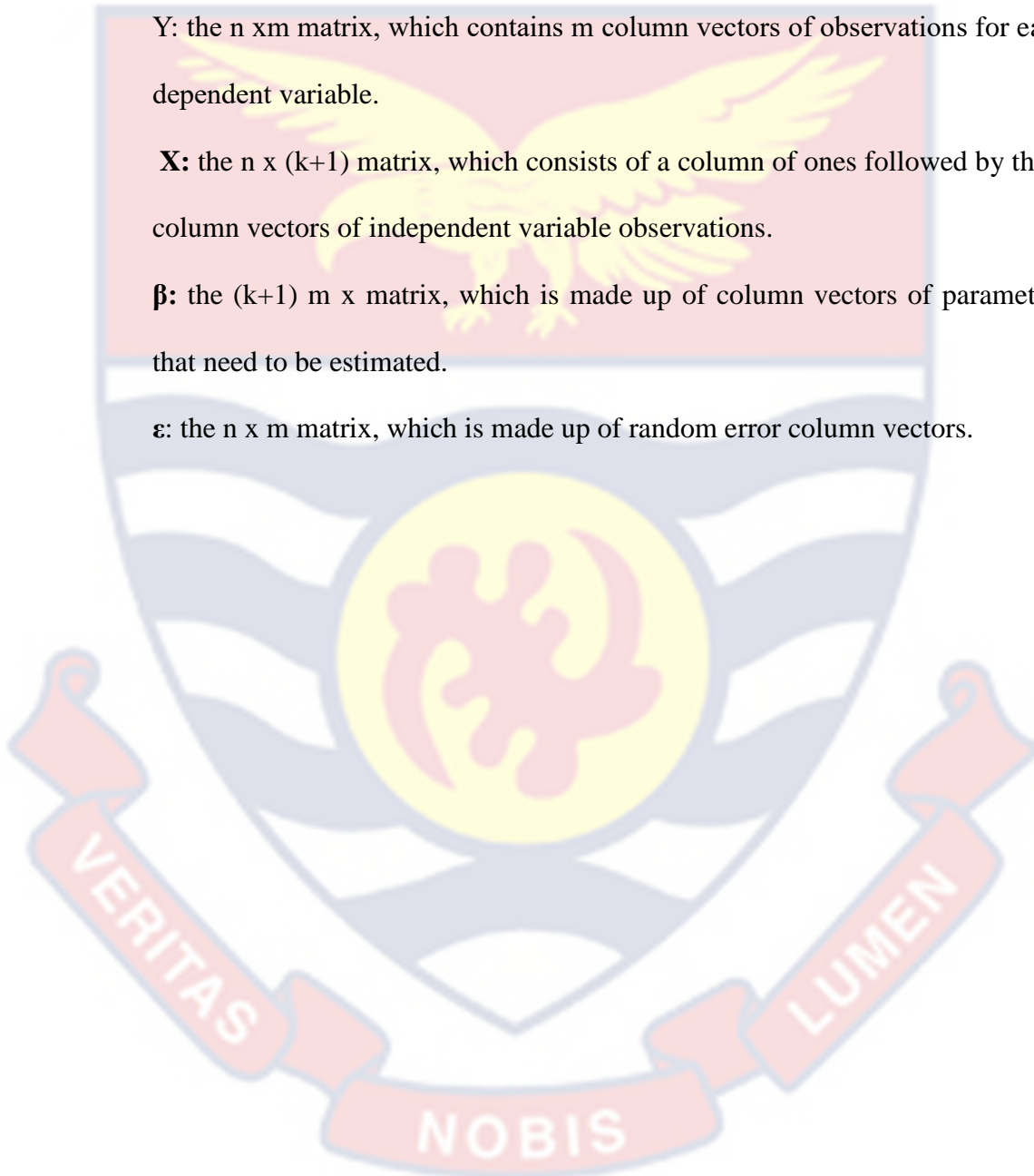
Table 5: *Description of Explanatory Variable for the Multivariate Multiple Regression Model*

Variable	Description	Data Type
Gender	The refers to the gender of fisher household head coded as 0 for male and 1 for Female	Dichotomous
Age of Household Head	Refers Age of fisher HH	Continuous
Marital Status of Household Head	Refers to whether a household head is married =1, Single=2, divorced =3 and windowed=4	Categorical
Educational Status	Refers to whether a fisher household is educated or not. Coded 1 for educated and 0 for not educated	Dichotomous
Household Size	Refers to the number of people living in a fisher household	Continuous
Status of Origin	Refers to fisher a fisher was a migrant coded 1 and native coded 0	Dichotomous
Ethnicity	Refers to the ethnic groups fisherfolk belongs to coded Anlo Ewe=1, Fantes =2, Nzema =3, Ga =4 and others =5	Categorical
Household Livelihood Security	Refers to whether the overall household livelihood security index (HLSI) of fishers. Coded 1 if HLSI is secured (i.e., above 50%) or 0 if is less than 50%	Dichotomous
Financial Security	Refers to the Financial Security (FinS) index of fishers. Coded 1 if FinS is above 50% and 0 if is below 50%	Dichotomous
Food Security	Refers to the Food Security (FS) index of fishers. Coded 1 if FS is above 50% and 0 if is below 50%	Dichotomous
Empowerment Security	Refers to the Empowerment Security (ES) index of fishers. Coded 1 if ES is above 50% and 0 if is below 50%	Dichotomous
Educational Security	Refers to the Educational Security (EduS) index of fishers. Coded 1 if EduS is above 50% and 0 if is below 50%	Dichotomous
Health Security	Refers to the Health Security (HS) index of fishers. Coded 1 if HS is above 50% and 0 if is below 50%	Dichotomous

Source: Field Survey (2021)

CHAPTER FIVE

RESULTS

Introduction

This chapter focuses on the findings of data analysis based on the study's objectives. It begins with the demographic characteristics of the respondents, migration flows into estuarine communities, land cover/use analysis, community perceptions of estuary degradation status, and competing interests between migrants and natives in the usage of the estuary. Finally, the chapter examines the livelihood security of both migrants and natives in the studied communities. It also considers the findings of a multivariate probit regression model on the factors that influence household livelihood security.

Demographic Characteristics of Household Heads

Of the 652 households surveyed, 344 (53%) were female-headed, whiles 308 (47%) were male-headed. Most of the fisher household heads, 65%, were married, while only 9% were single. In addition, 14 % of the respondents were divorced, and 12 % were widowed.

Also, most respondents were between the ages of 41 and 50, accounting for 24.23 % of the total (Table 5). This meant that most fisherfolks in the research area were in their Middle Ages; thus, they were economically active, able to handle stress and had the manpower to carry out labour-intensive livelihood adaptation strategies. This has a favourable implication for the fishing industry. In addition, most respondents (49.85 %) lived in households with fewer than five people, with the largest and lowest household sizes being 25 and one member, respectively.

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Table 6: *Age distribution of fisher respondents in the surveyed estuarine communities of Ghana*

Age Range	Frequency	Percentages
21-30	59	9.05
31-40	147	22.55
41-50	158	24.23
51-60	139	21.32
61-70	101	15.49
>70	48	7.36
Total	**652**	**100**

Source: Field Survey (2021)

The results also revealed most of the respondents, 67%, were migrants, while the indigenous/natives were 33%. These towns primarily consist of migrant settler populations with only a few natives/indigenes. Most of the respondents representing 34.36%, attained Junior high school, whiles 28.37% had no formal education (Figure 7).
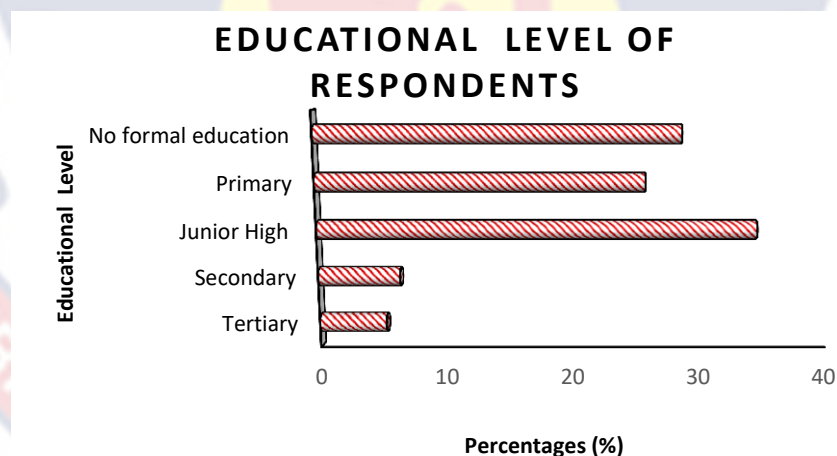
Figure 7: Educational attainment of fisher household heads in the surveyed estuarine communities of Ghana.
Source: Field Survey (2021)

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Influence of Fishers Demographic Characteristics on Migration

Nearly a quarter of the respondents were aged between 41 and 50, while 65% were married and in their economically active years (19 to 64). In addition to these findings, it was found that marital status, educational level, and ethnicity all influence fisherfolk migration. The association between marital status and migration was analysed using a chi-square test of independence. The relation between these variables was significant, X^2 (3, N = 652) = 24.8, p = 0.001. with a Cramer's V = 0.1952. This implied that married fishers were more likely to migrate.

Similarly, the relationship between ethnicity and migration was significant, X^2 (4, N = 652) = 327.57, p = 0.000, Cramer's V = 0.71. Thus, there was a significant strong positive association between ethnicity and migration among fishers. Thus, indicating a strong positive association between ethnicity and migration in the study areas. Equally, the relation between educational status and migration was significant, X^2 (4, N = 652) = 23.89, p = 0.000. with a Cramer's V = 0.19. indicating that the educational level of fishers' weakly influences fishers' migration, with most fishers without formal education being the group that easily migrates.

However, other demographic characteristics such as gender, age of household heads and members of the fisher group were not significant factors influencing the migration of fishers in the study. Supplementing this finding, the majority of the respondents (67 %) were migrant fishers, while the indigenes were (34%). This trend was most notable in Anlo Beach, Faana and Kewunor where most residents were migrants of different generations (1st, 2nd,

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and 3rd generation of migrants). However, the reverse was seen in Iture and Ankobra where the indigenes dominated.

Temporal aspects of fisher's migration along the coast of Ghana

The influx of migrant fishers into estuarine communities is a continuous process because of variations in fish stocks and catch and the expansion of social networks. For example, out of the 125 first-generation fisher migrants, 2% settled in Anlo Beach around 1930-1939 and the population continuously increased. However, most of the migrant fishers, 26%, arrived in Anlo Beach between 1970 and 1979. Relatively more recent migration occurred between 2000 -2009: 34% of the first-generation came to Ankobra, 50% to Iture 41% to Faana and 41% to Kewunor (Figure 8). However, the 2nd and 3rd generation migrants were born in the selected estuarine communities by their first-generation migrant parents but still owe allegiance to their original hometowns.
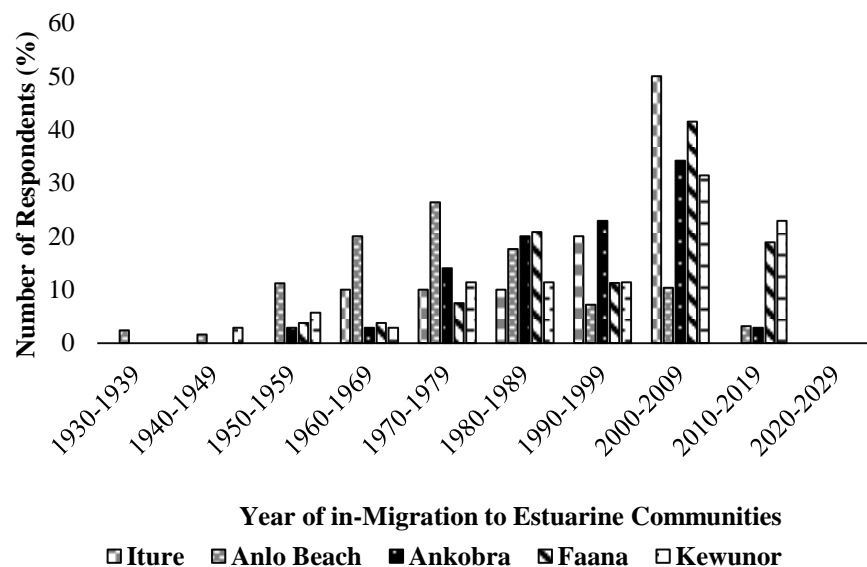
Figure 8: Temporal Dimensions of In-Migration Trajectory to Estuarine Communities Along the Coast of Ghana.
Source: Field Survey (2021)

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Spatial aspects of Fisherfolk migration along the coast of Ghana

The most common migration into estuarine areas along the coast of Ghana was within-country. The maps show fishers' movements to the selected estuary communities from 1930 to 2020. The dominating migrant fisherfolk group found along estuarine communities were Anlo-Ewes, with the most outflows from areas of Anloga, Dzita, and Keta.

For Ankobra estuary (Figure 9), the indigenous fisherfolks dominated. Only a few migrants (mainly Anlo-Ewes and Fantes) were present. However, out of the 35 first-generation fisherfolk migrants in Ankobra, most of them (12) migrated from Anloga.
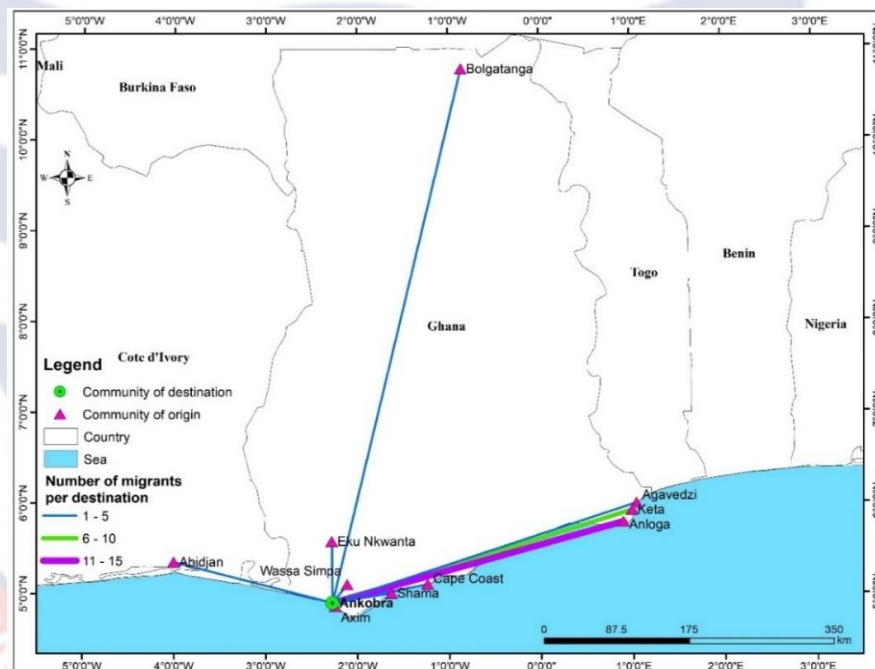
Figure 9: The Origin/Destination of Fisher Migration in Sanwona (Ankobra Estuary), Ghana.
Source: Field Survey (2021)

Clear migration patterns emerged in the pattern analysis of Anlo Beach: a homogenous migrant community of fisherfolks of the Volta Region, with most migrants from Atiavi, Keta, Dzita and Agordome (Figure 10), with the majority (23) of the first-generation fisher migrants from Anloga. The

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residents were almost all first or second-generation migrants from the Volta Region. High tides, coastal erosion and flooding in the past inhibiting fishing activities at their home shore were a pushed factor for out-migration. Access to the river Pra and open sea made estuarine communities, particularly Anlo Beach, a suitable site for in-migration.
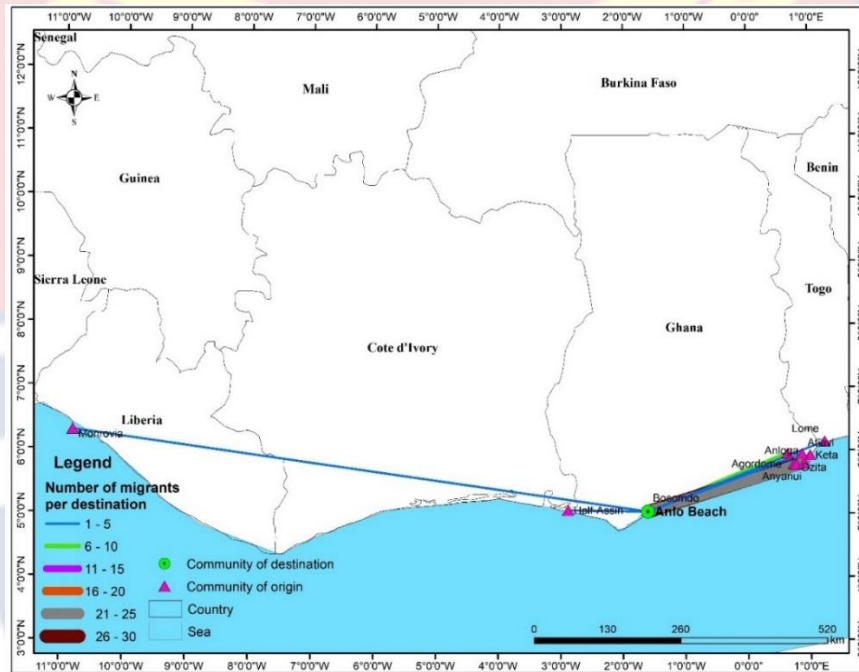
Figure 10: The Origin/ Destination of Migrant Fishers in Anlo Beach (Pra Estuary).
Source: Field Survey (2021)

Similarly, Faana is also a migrant community, with only a few residents from the original population. This community is primarily inhabited by Anlo-Ewes, who emigrated from Dzelukope, Anloga, Tegbi, and Keta to search for fishing opportunities. The findings revealed that 18 first-generation fisher migrants (18) migrated from Keta, while only (1) from Sagakope (Figure 11).

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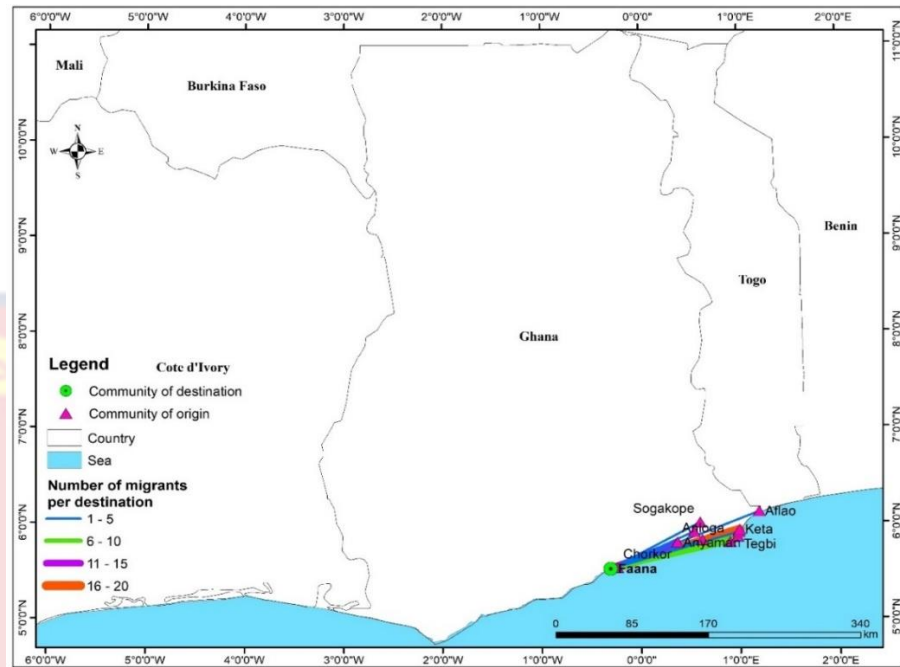
Figure 11: The origin/Destination of Migrant Fishers in Faana (Densu Estuary).
Source: Field Survey (2021)

Iture has relatively few migrants from Ankaful, Elmina, and Lome. Most of the migrants are women who migrated for marriage purposes (Figure 12).
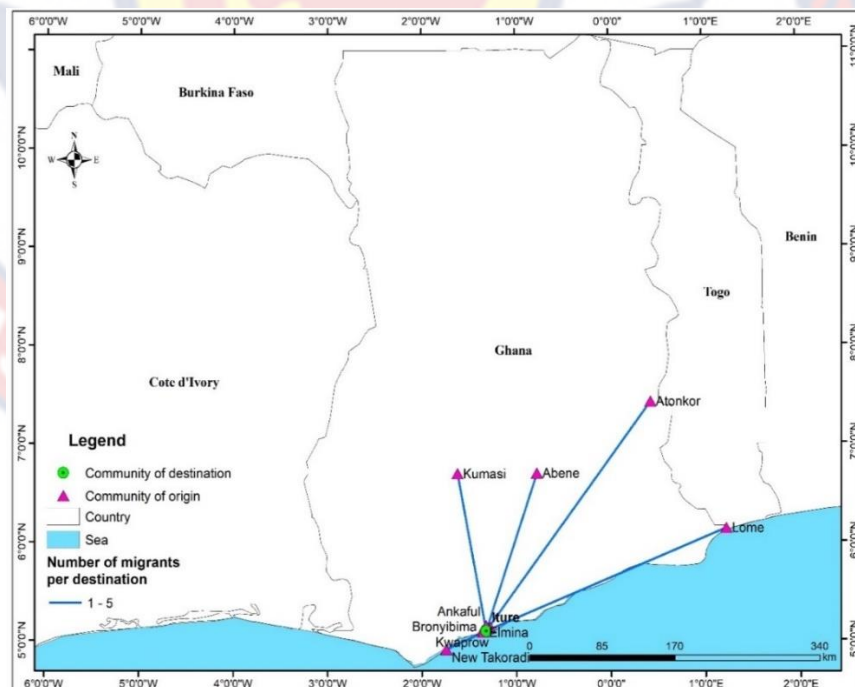
Figure 12: The Origin/Destination of Migrant Fishers in Iture (Kakum Estuary).
Source: Field Survey (2021)

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The reverse is seen in the origin-destination flow of migrant fisherfolks to Kewunor, as shown in Figure 13, where most of the migrant Fisherfolk of Kewunor came from Azizakope, Anloga, and Keta of the Volta Region, with a majority (14) of the 35 first-generation migrants coming from Keta. In addition to the Ghanaian migrants, some fishermen came from Benin, Togo and Cote d'Ivoire.
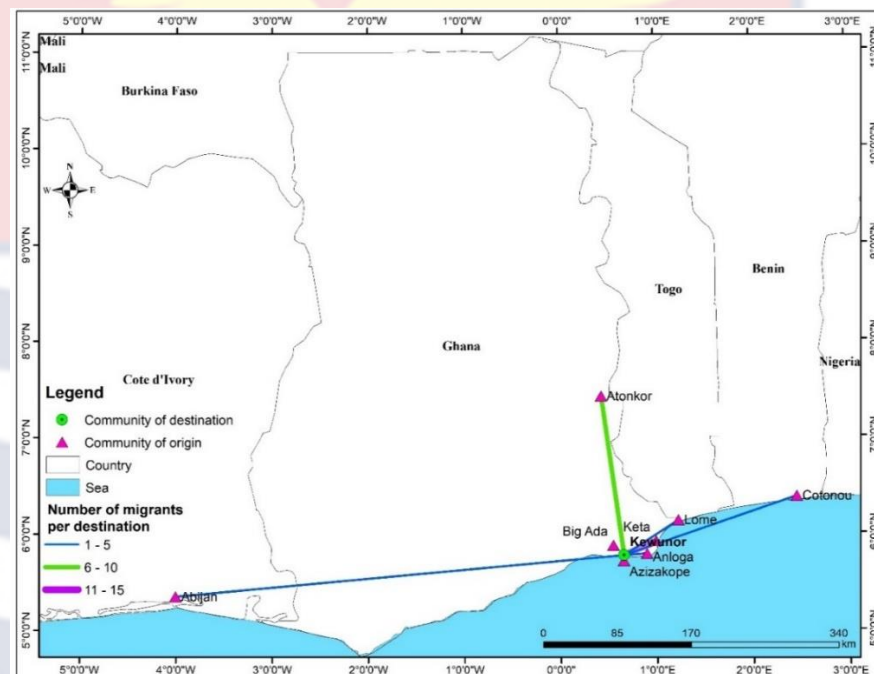
Figure 13: The Origin /Destination of Migrant Fishers in Kewunor (Volta Estuary).
Source: Field Survey (2021)

Pull Factors to Estuarine Communities

Pull factors to the selected estuarine community differed from community to community. The results showed having access to the river/sea/land and ethnicity were the pull factors that attracted 32.8% of fisherfolks in Anlo Beach and 37.1% of migrant fisherfolks in Kewunor. However, the reverse is seen in Iture where 80% of migrants indicated other reasons, such as marriage as the pull factor. The study shows that social networks (having people from one's hometown/ethnicity) in a destination area

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cannot be undermined as it is a significant factor for in-migration (Figure 14). Similarly, 28.3% representing the majority of migrant fisherfolks, revealed having other people from their ethnicity was the reason for choosing Faana as a destination location.
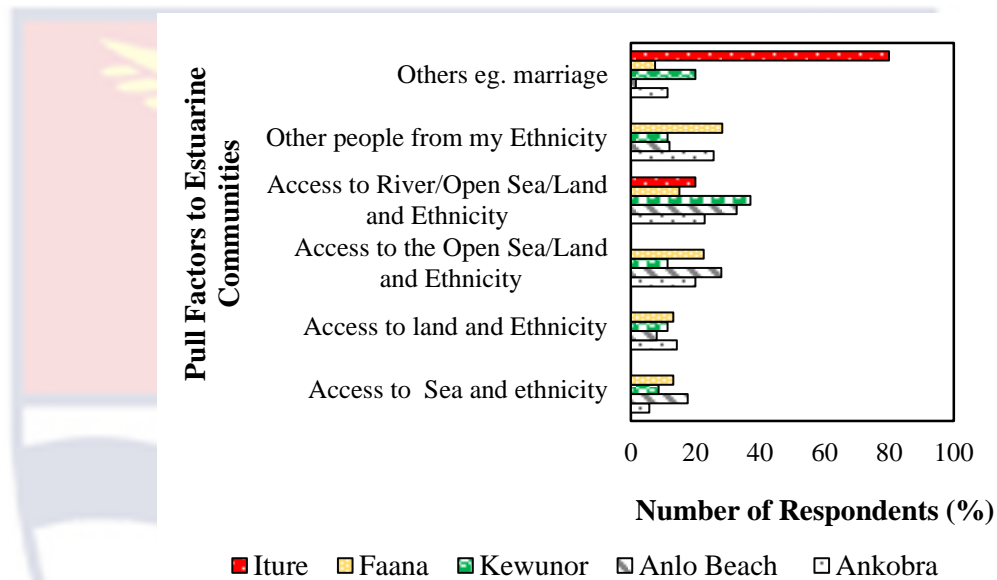
Figure 14: Pull Factors Influencing Migration into Estuarine Communities along the Coast of Ghana.
Source: Field Survey (2021)

Relationship between Unique Characteristics of the Estuary and Ethnicity

Among the 652 respondents, the most ranked highly characteristic of the estuary was the river (27%), followed by the open sea (26%). The least rated was the vegetation (5%). The ranking was to determine which of the unique features of the estuary was of paramount value to fisherfolks. Complementing this finding was the ethnic difference in ranking these unique features of the estuary (Figure 15).

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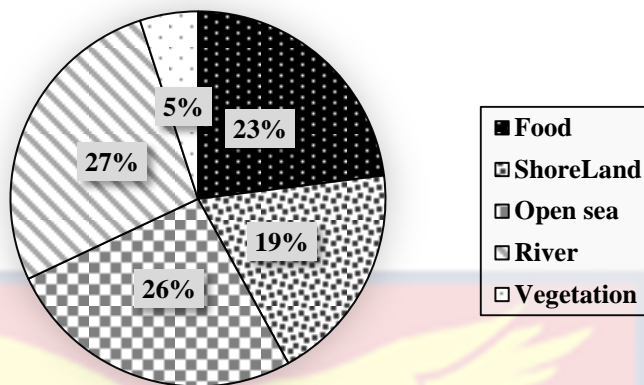
Figure 15: Preferred Unique Features of Estuarine Ecosystems among Migrant Fisherfolks in Selected Estuarine Communities Along the Coast of Ghana.
Source: Field Survey (2021)

The data revealed about 30% of the Anlo Ewe's ranked the river highest pull factor for their migration. While most of the Fante's ranked the open sea (28.6%) as their first choice. However, most Nzema's fisherfolks (41.8%) ranked food/fish highest among the other characteristics. The shoreland was also ranked highest by the migrant fisherfolks of Faana (41.9%) (Figure 16). This implied that the value placed on a feature varies among ethnic groups.
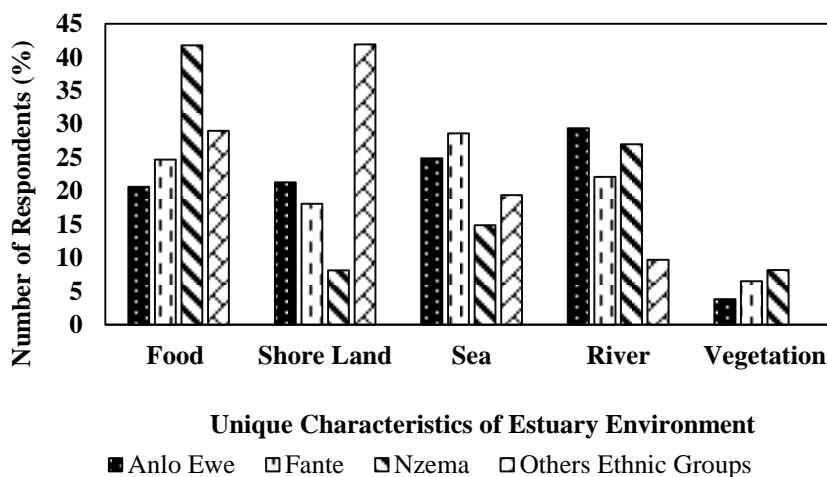
Figure 16: Preference of Unique Features of Estuarine Ecosystems among Migrant Fisherfolks in Selected Estuarine Communities Along the Coast of Ghana.
Source: Field Survey (2021)

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Complementing these results was the Chi-Square test which confirmed that a significant relationship exists between the preference for unique characteristics of the estuary and ethnicity. The relation between ethnicity and preference for estuary ecosystem goods and services was significant, X^2 (12, $N = 652$) = 66.265, $p = .000$. Supplementing this finding is a Cramer's Value of 0.2, which revealed a weak association between ethnicity and preference for distinctive estuarine traits (Table 7).

Table 7: *Assessment of the association between ethnicity and choice of unique characteristics of the estuarine environment in Ghana*

Ethnicity	Counts	Food (fish)	Shoreland	Sea	River	Vegetation	Total
Anlo - Ewe	Observed Counts	87	90	105	124	16	422
	Expected Counts	106.9	77.9	95.9	112.7	26.4	
	Chi-square Contribution	3.7	1.9	0.8	1.1	-7.2	
Fante	Observed Counts	19	14	22	17	5	77
	Expected Counts	19.6	14.3	17.6	20.7	4.8	
	Chi-square Contribution	0	0	0.3	1.6	3.6	
Nzema	Observed Counts	51	10	18	33	10	122
	Expected Counts	31.1	22.6	27.9	32.8	7.7	
	Chi-square Contribution	16.9	7.1	8.5	0.2	0.7	
Others	Observed Counts	9	13	6	3	0	31
	Expected Counts	8.4	6.12	7.5	8.7	2.1	
	Chi-square Contribution	0.7	0.1	0.3	0.9	16.9	
Total		**148**	**127**	**169**	**177**	**31**	**652**

Pearson chi^2 (12) = 66.265   Pr = 0.000, Cramer's V = 0.2
Source: Field Survey, 2021

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Physical Changes in Estuaries along the Coast of Ghana

The land use land cover classified maps of the Pra, Ankobra and Volta estuaries are represented by Figure 17, 18 and 19 respectively. The change statistic graph, which depicts the changes in the land cover classes, is represented in Figure 20.

The classified land use and land cover maps of the Pra Estuary for 1986 and 2020 are presented in Figure 17. Around the estuary in 1986, there were more patches of bare land/settlement and marshy terrain (Map A). However, in 2020 (Map B), bare land/settlement decreased in the eastern portion of the research area and along the coast, with a greater concentration in the south-eastern. The extension of sand bars along the beach and abandoned houses due to seawater erosion were recognised for the increasing bare land/settlement along the sea. The estuary's location had also shifted from Shama to Anlo Beach, reducing the water-covered area. Natural and human factors play a role in land use/cover variations.
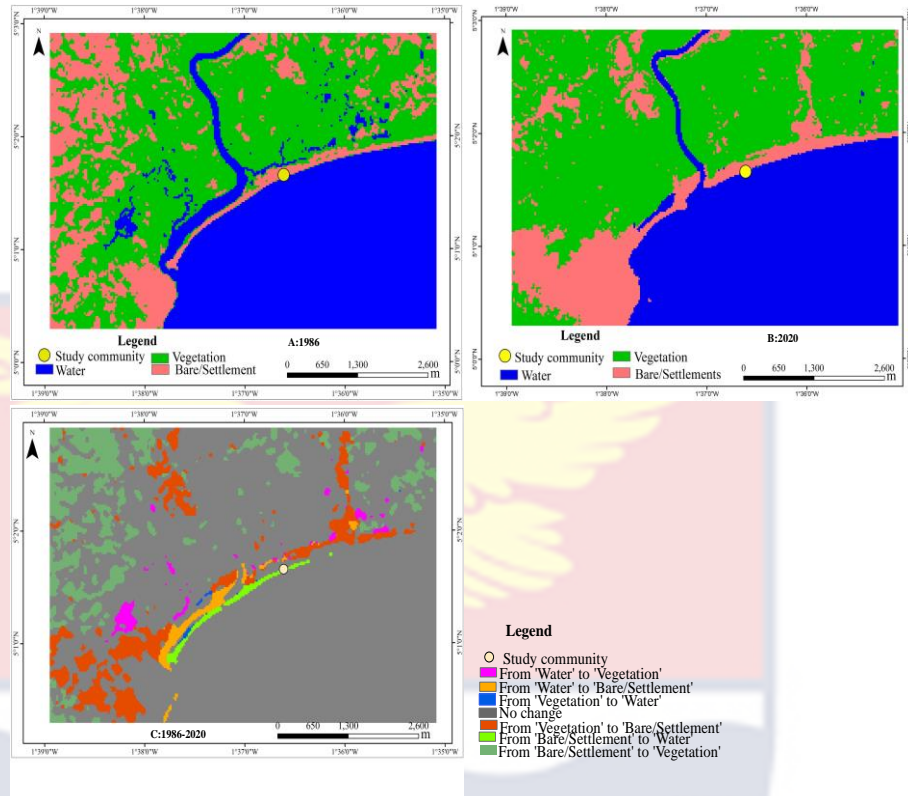
Figure 17: Land Use Land Cover Maps for Anlo Beach (Pra Estuary).
Source: Author's Construct (2021)

Change detection statistics and Figure 17 reveals that over the 34 years under study, some areas covered by vegetation changed to bare land/settlements during the period under study. The change land use land cover statistics (Figure 20) shows a -4.4% reduction in the water area and a -13.7% reduction in the bare land/settlements around the estuary area. The accuracy assessment of the classified maps indicates both Anlo Beach 1986 and 2020 maps have 85.7 % overall accuracy and a Kappa coefficient of 0.8%.

Similarly, from Figure 18, Map A (1986) of Ankobra Estuary, the areas covered by water increased in Map B (2020). The change detection map and statistics of the Ankobra estuary indicate that bare land/settlements have reduced by -18.8% around the estuary area. The advancement of water bodies due to erosion and inundation led to an increase in the water area by 17.1%, as

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shown in Figure 20. Water has now submerged some vegetation-covered areas, including coconut trees and bare land/settlement areas. This could have been due to coastal erosion. Due to increasing coastal erosion and inundation, community members have retorted to building temporary settlements such as thatch and bamboo houses because they are less expensive. The accuracy assessments revealed that Ankobra 1986 map's overall accuracy score was 80.7% with a Kappa coefficient of 0.7, while the 2020 Map scored 86.4% with a kappa coefficient of 0.8.
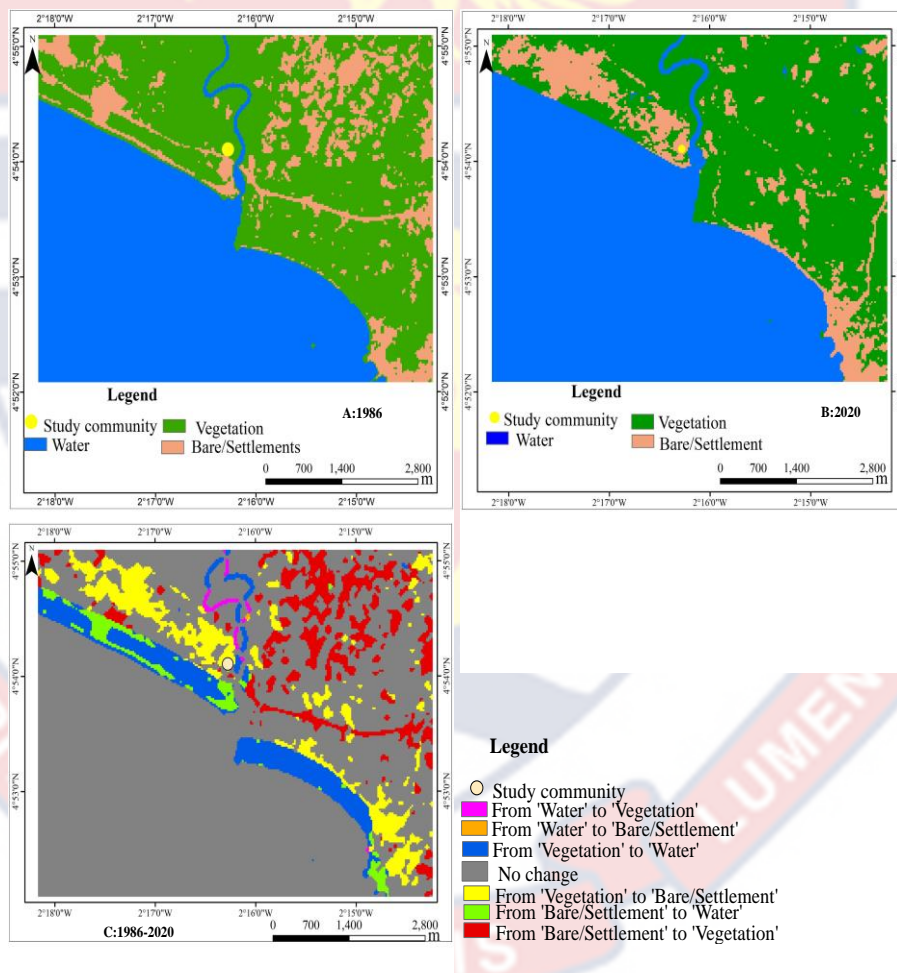
Figure 18: Land Use Land Cover Maps for Sanwona (Ankobra Estuary).
Source: Author's Construct (2021)

In Kewunor (the Volta estuary), the area covered by water and vegetation has reduced. There was a significant reduction (42%) in vegetation

from 1986 to 2020, as shown in Figure 19. Correspondingly, the change statistic graph shows the area of bare land/settlements increased over the period under study by 49.3%, as shown in Figure 20. The accuracy assessments revealed that the overall accuracy of the Kewunor 1986 and 2020 maps was 93.8% and 86.4%, respectively, while the kappa coefficients were 0.9 and 0.8.
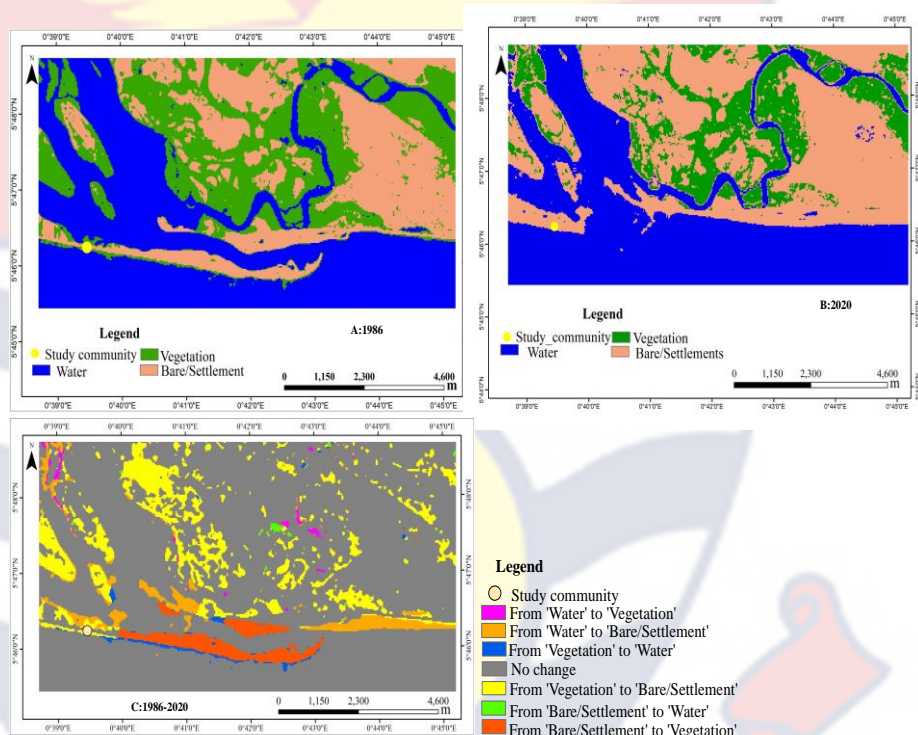
Figure 19: Land Use Land Cover Maps for Kewunor (Volta Estuary)
Source: Author's Construct (2021)

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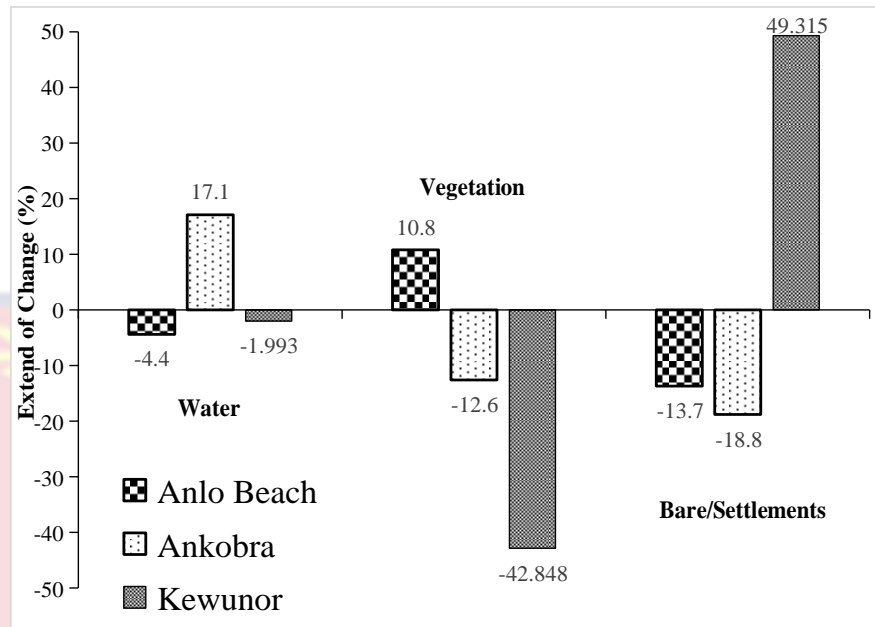
Figure 20: Changes in Landcover Types around Estuaries between 1986 and 2020 in selected estuaries along the Coast of Ghana.
Source: Author's Construct (2021)

Anthropogenic Activities Influencing the Changes of Land Use/Cover around the Estuaries

Various human activities could, directly and indirectly, impact the sustainable management of the Ghana coastal estuaries. About a third of the 476 household heads interviewed indicated deforestation, sand-winning, and indiscriminate waste disposal around and in the estuary as human activities influencing the degradation and change in LULC around the estuaries; about 20% reported small-scale mining activities and sand-winning as the primary human activities. Less than 10% specified overfishing as a human activity affecting the estuary and influencing the LULC change around the estuaries (Figure 21).

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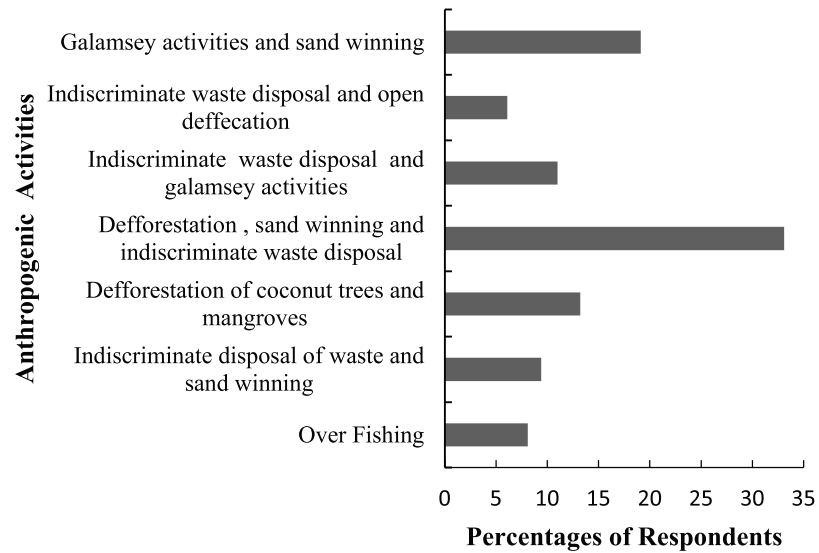
Figure 21: Anthropogenic activities Influencing Degradation and Changes in the Land Use Land Cover around Estuaries along Ghana's Coast.
          Source: Field Survey (2021)

Fishers Perceptions on the Degradation Status of Estuaries

The study showed a clear perception of estuaries' degradation status by fishers. Most fishers in Iture (79%), Ankobra (80%), Anlo Beach (96%), Faana (54%) and Kewunor (96%) revealed that the estuaries in various communities were now degraded. However, 46% of the fishers in Faana perceived that the estuary was not degraded. Similarly, only 4% of Fishers household heads opined that the estuary was not degraded in Kewunor (Figure 22).

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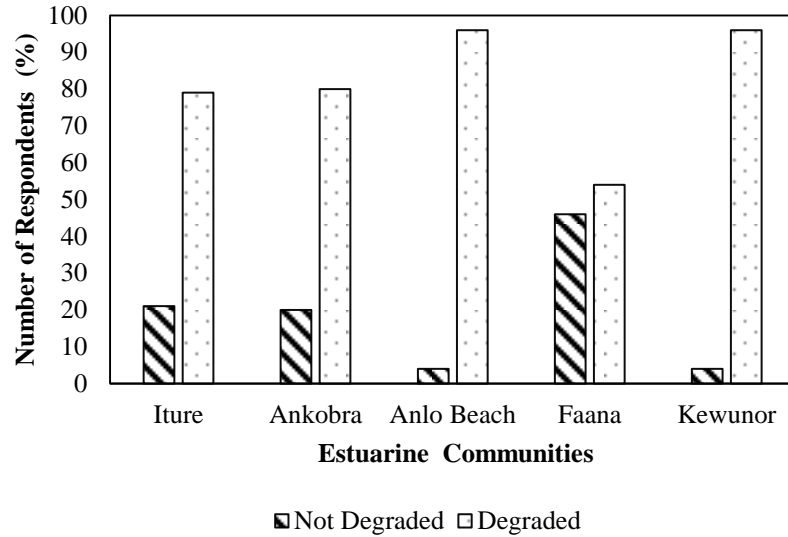
Figure 22: Fishers Perception about the Degradation Status of Estuaries Along Ghana's Coast

Source: Field Survey (2021)

Fishers Perceived Cause of Degradation of the Estuaries

Complementing this finding were fishers' perceived causes of degradation of the estuaries with variation between communities. Most fishers in Anlo Beach (54%) attributed the degradation of the estuary to the change in its location from Shama to Anlo Beach. Similarly, in Faana, 23% of fishers specified poor usage and management of the estuary as the cause of degradation. Nevertheless, the results also revealed that 52% of fishers in Ankobra indicated illegal mining (Galamsey) activities upstream caused the estuary to be degraded. Adding to these findings were natural causes of degradation as perceived by 33% of fishers in the Iture community (Figure 23.).
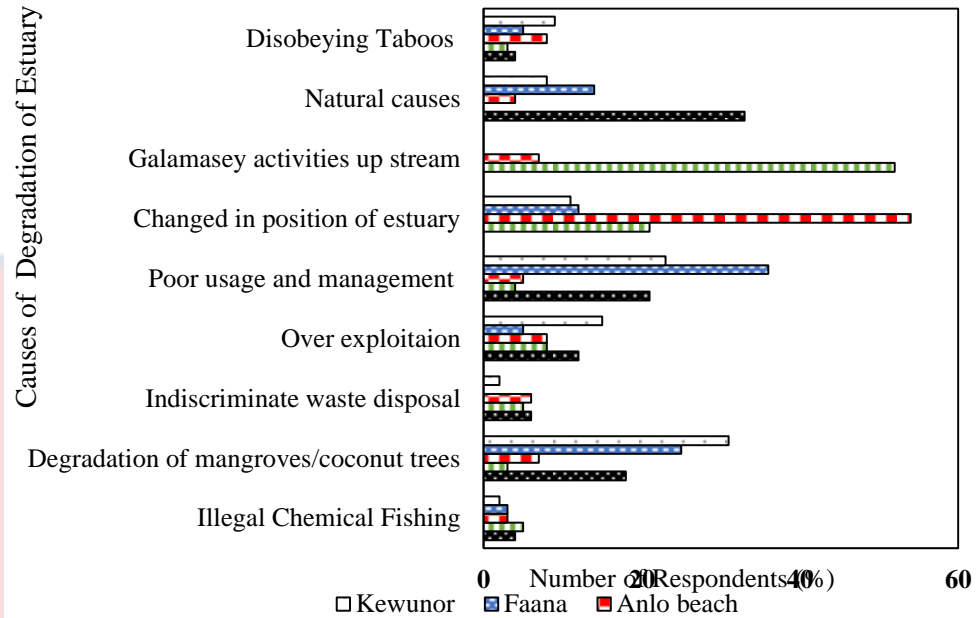
Figure 23: Fishers Perceived Causes of Degradation of Estuaries Along Ghana's coast.
                    Source: Field Survey (2021)

Factors influencing the Degradation of the Estuary

The logistics regression model displayed the best fitness of the model at LR chi2(9) =163.61; prob >chi2 = 0.000). The model with predictors outperformed the null model (model with only constants) by 95%, indicating the predictors' importance in the model (Table 8). Likewise, the Hosmer-Lemeshow test is an important parameter test that assumes no variation between the observed and predicted outcome. Hence, Hosmer-Lemeshow chi2(8) = 5.47 (Prob > chi2 = 0.7669) failed to reject the null hypothesis. The observed and expected cell frequencies generally agree, indicating that the model fits well. The model's performance in terms of prediction indicated an overall rate of correct classification of 80.06%, with 93.49% sensitivity and 36.18% specificity. Complementing these findings, the area under the curve (0.81) specifies an excellent predictive power in differentiating between fisherfolks who perceived the estuary to be degraded and those who did not,

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with an optimum cut-off probability of about (0.81) 81 %. The r-square value of 0.23 indicated that 23% of the variance in the degradation of the estuary can be explained by the independent variables. From Table 8, an odds ratio greater than 1 shows the likelihood of estuary degradation [P(Y=1)] increases when the predictor variable increases, whereas a less than 1 odds ratio designates the probability of the estuary being degraded decreases as the independent variable increases. If 1 is subtracted from the odds ratio and then multiplied by 100 [(odds ratio - 1) x100], the values above 100 indicate an increase, while the negative values indicate a decrease.

The model discovered that fishing experience (years), the number of ethnic groups using the estuary, the type of fishing gear used, sanctions, and regulations all influenced the estuary's degradation at a 1% significant level. Similarly, equal and fair access to the estuary and relationships between user groups were significant at a 5% level. However, fishing groups/association membership and willingness to follow procedures were not significant factors influencing the degradation status of the estuary (Table 8).

The results also show that if all other variables remain constant, if the average length of fishing and fishing mongering increases by one year, the estuary's degraded probability increases by 1.03 times. Thus, the odds that the estuary would be degraded is 3% higher with a unit increase in fisherfolks' years of experience. Suppose a fisherman's experience increases by one year in active years fishing or using the estuary. The chances of the estuary being degraded by the fisherman increase by 3%. This is because when a fisher increases his experience by one additional year, it will manifest as exerting additional and continuous pressure on the estuary. Likewise, when one

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additional fisherman utilizes the correct fishing gear, the likelihood that the estuary will be destroyed is 27% lower. Complementing these findings, the results also clearly show that the estuary's chance of being degraded is 740% higher with a unit increase in sanctions (Table 8). Similarly, every rule (regulation) implemented on the estuary reduces the likelihood of degradation by 68%. In addition, adding one more ethnic group to estuary users will minimize estuary deterioration by 35%.

The results also revealed that the estuary's degradation odds are 53% lower if the relationship among user groups is cordial. Concerning equal and fair access to estuary and regulations, the model reveals they were significant determinants of the degradation status of the estuary. Thus, the estuary's probability of being degraded is 93% lower with a one-unit increase in equal and fair access to the estuary. However, experience in fishing (yrs.) and members of fisher groups/organizations positively influenced the estuary's degradation status. Yet, they were found not to be significant (Table 8).

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Table 8: *Logistics Regression on factors influencing the Degradation of the estuary*

Degradation Status of Estuary	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
Experience in Fishing (Yrs)	1.03	0.01	3.38	0.00***	1.01	1.04
Member of Fisher Group/Organization	0.75	0.21	-1.02	0.31	0.42	1.31
Type of Fishing Gears	0.73	0.04	-5.15	0.00***	0.65	0.82
Number of Ethnic Groups Using Estuary	0.65	0.07	-4.15	0.00***	0.53	0.80
Equal and Fair Access to Estuary	1.93	0.49	2.59	0.01**	1.17	3.18
Regulations	0.32	0.09	-4.02	0.00***	0.19	0.56
Sanctions	8.40	2.41	7.42	0.00***	4.79	14.73
Relationship Among User Groups	0.47	0.14	-2.45	0.01**	0.26	0.86
Willingness to Follow Procedures	1.03	0.24	0.14	0.89	0.65	1.63
_Cons	10.10	4.89	4.78	0.00	3.91	26.08
Model Evaluation						

Test	χ2	df	P (95%)
Likelihood Ratio (LR)	163.61	9	<0.001
Hosmer-Lemeshow (H-L)	5.4	8	0.77
Overall Rate of Correct Classification of 80.06%,	Sensitivity 93.49%	Specificity 36.18%	
R square (R^2)	0.23 (23%)		

Note: *** and ** means significant at 1% and 5% respectively.
Source: Field Survey (2021)

Conflict of interest over estuarine resource use along Ghana's Coast

All fishers in the study communities had clear, equal, and fair access to the estuaries. The research findings revealed that it was only in Iture and Ankobra communities that respondents indicated they never experienced any conflict between migrants and natives in using the estuary. Though the fisherfolks in Iture and Ankobra experience some conflicts, these conflicts are

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mostly related to the use of the sea. However, the reverse was seen in Anlo Beach, Faana and Kewunor. Respondents have experienced some form of conflicts between migrants and natives or migrants and migrants in the use of the estuary resource. From the 255 respondents interviewed in Anlo Beach, 76% indicated they never experienced any conflict related to the estuary, while 24% indicated they had experienced some form of conflict in using the estuary. The situation was more problematic in Faana. The majority (56%) of respondents indicated a competing interest in using the estuary, while in Kewunor only 29% indicated they experienced conflict over using it (Figure 24).
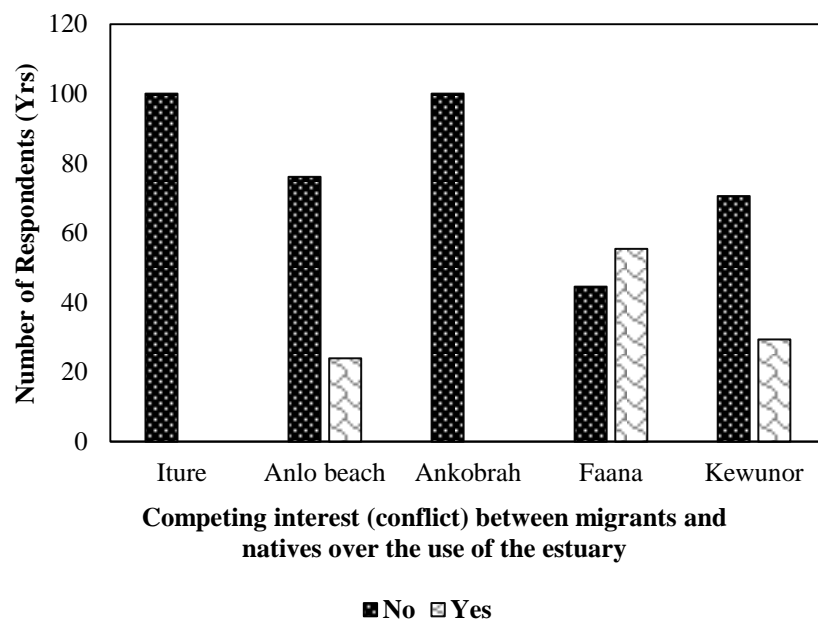
Figure 24: Competing Interest (Conflict) Between Migrants and Natives Over the use of the Estuaries in estuarine communities along the coast of Ghana.
Source: Field Survey (2021)

In Figure 25 below, the majority (53%) of respondents in Anlo Beach agree the conflict occurred between the 1980s and 1990s, while 7% indicated the 1960s and 1970s. Likewise, in Faana, 80% of respondents indicated the

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disputes occurred between 2011s and 2021. In Kewunor, 80% agreed the period of the conflict was between 2011 and 2021.
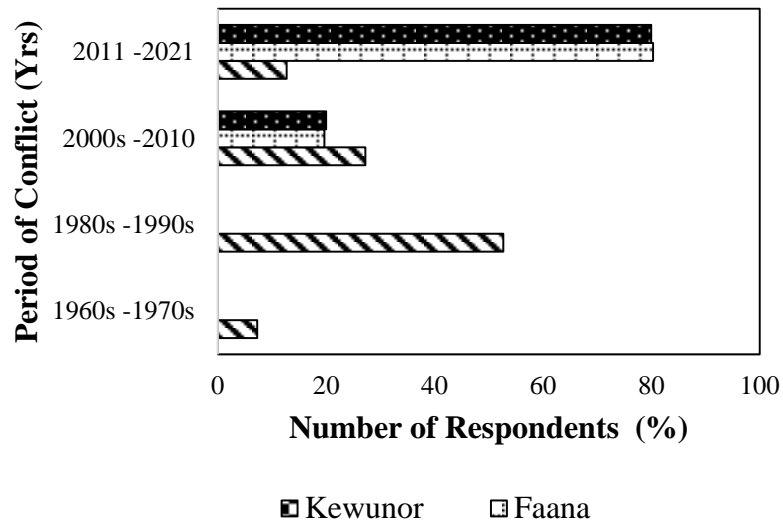
Figure 25: Period of Conflicts Over Use of Estuaries in estuarine communities along the coast of Ghana.
                    Source: Field Survey (2021)

From Figure 26 below, most respondents indicated that the conflict between migrants and natives over the use of the resources was related to specific events in the community. In Anlo Beach, 76%, Faana 64% and Kewunor, 85 % of the respondents indicated the conflict was related to community events. They showed most conflicts happened during the bumper fishing season. According to the respondents, this is when most fisherfolks make a lot of money. Hence, everyone tries to make a lot of sales before the season ends, creating many minor and major conflicts between fisherfolks.

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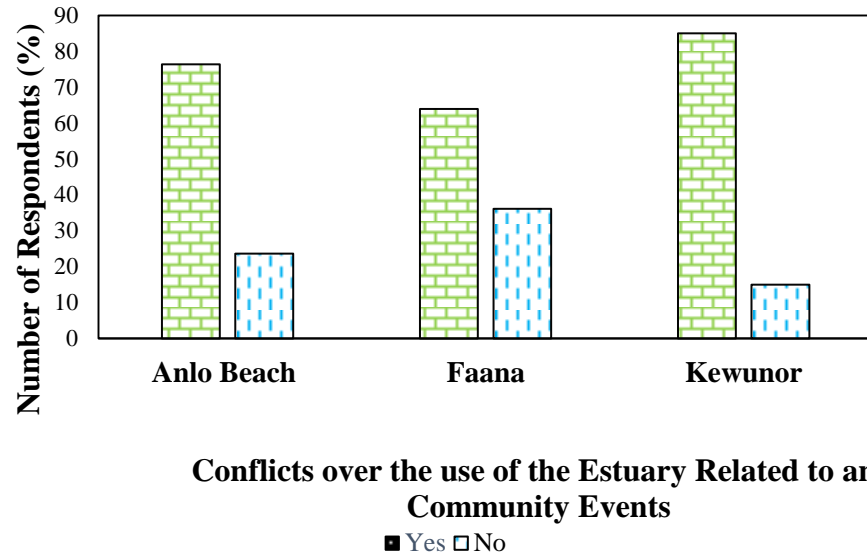
Figure 26: Conflict Over Use of Estuary Relating to Community Event in estuarine communities along the coast of Ghana.
Source: Field Survey (2021)

Narrative Analysis of the Nature of Conflict Over the Use of the Estuary

resource

The Anlo Beach Case

During the Focus Group Discussion on Anlo beach,

> *In the past, we were not allowed to fish at the estuary or cast*
>
> *nets around there, but we used to hide and do it, but when the*
>
> *Shama people see they collect the nets, and our fishermen will*
>
> *pay a fine before their nets are given back to them. Sometimes*
>
> *it resulted in a dagger, paddles and rod fight between the Anlo*
>
> *Beach fisherfolks and the Shama guys. This resulted in people*
>
> *being hospitalized, and the police arrested people...* (Efo a
>
> fisherman during FGD in Anlo beach, 08/04/2021)
>
> *This was around eeerrrh 1995". Thomas, a 65-year fisherman,*
>
> *chips in to correct the date "it was 1996". Efo "yes   1996, and*
>
> *since then, we have not recorded any conflict about the estuary.*

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This incident happened when the estuary was in Shama, but now in Anlo Beach, the Shama fishers don't come here, and the estuary is degraded. Nothing is there any more to fight for hmm (claps hands together to indicate nothing in the estuary (FGD in Anlo Beach, 08/04/2021).

[Hmm] I remember those bloody fights overfishing in the estuary with the people of Shama. We used to get a lot of fish, shrimps, and crabs from the estuary, but now (shakes her head) nothing is there because of the activities of Galamsey; all the water is polluted. (FGD in Anlo Beach, 08/04/2021)

The Faana Case

Mr Kumi, an opinion leader in Faana gave an account of the conflict between the migrant fisherfolks and the natives over the estuary during a KII interview session.

In the past, the estuary was first located in Tsokomey. We used to get a lot of fish from it, but during the rainy season, it usually overflows, flooding our houses, but when we complained to them (natives), they did nothing. So, in 2019 the flooded water was too much and destroyed our homes and properties (sighs). We decided to open another way to allow the flooded river water access to the sea in Faana. Thus, creating another estuary here. That was the beginning of our problem with the natives (hmm). Somehow, we (Faana) were ok, but the water was flooding the houses of the natives. The natives then decided to dredge the original estuary located at

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Tsokomey. Still, we were not happy, so they decided to bring the police to protect them whiles they were forced to dredge the other side, but it closed by itself again. So, the natives ordered the arrest of the community leader, but the chief fisherman, a native, had to intervene... (Key Informant Interview (KII) session with 68-year fisher opinion leader in Faana, 02/05/2021)

From the narration, this conflict was relatively recent (2020). It was more about the location of the estuary, as both natives and migrants wanted the estuary to be located at their side. It must be noted that Faana is a migrant community whiles the natives stay in Tsokomey, a nearby community.

The Kewunor Case

Ebenerza, a fisherman, narrates,

In 2019, the community was experiencing low fish catch due to the continuous activities of the light fishermen from Pram pram and Tema areas. There is no more fish there, so they decided to come to the Ada area to continue light fishing. The fishers of Kewunor did not want to allow them to destroy their fish. So, they organized and took canoes, daggers, and other weapons to block the estuary to prevent the light fishers from returning from the sea. It was very bloody, and people were hospitalized. The government resolved it through the fisheries ministry and asked community members to keep calm while they took time to solve it. Also, we realized some vessels belong to big men in parliament. But we are not happy and still waiting for the

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government to handle it; otherwise, we will fight them again

because we do not catch any fish because of them. (KII with

57-year community Elder in Kewunor, 10/05/2021)

The Intensity of Conflict Over the Use of The Estuary

Results from the study revealed that most respondents (55%) indicated

that the conflict between Anlo Beach fisherfolks and Shama fishers in 1996

was very violent. Similarly, the most (42%) of the respondents in the Faana

community indicated the conflict between the migrants and natives over the

siting of the estuary was violent as the natives brought the police. In

comparison, 39% indicated it was nonviolent. Also, from Figure 27, most

(50%) of the respondents stated the conflict was deadly.
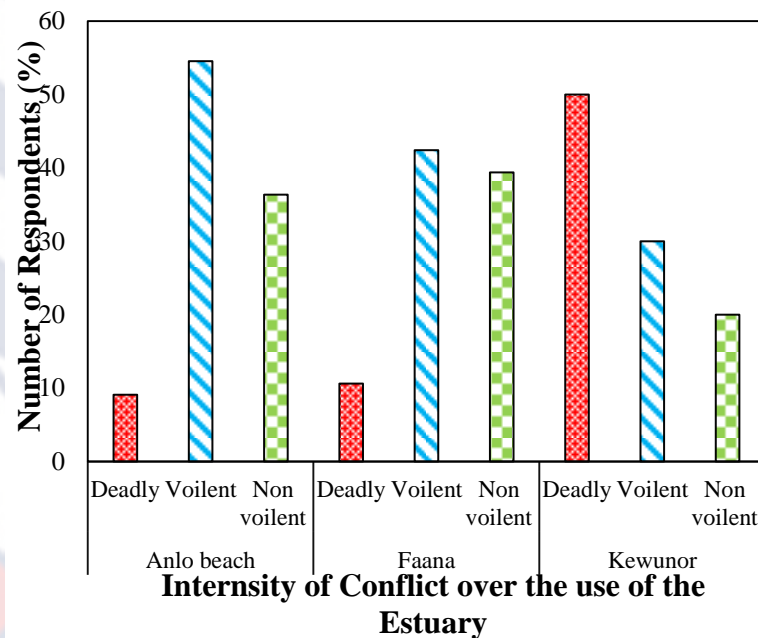
Figure 27: Intensity of Conflict Over the use of the Estuary in estuarine
communities along the coast of Ghana.
          Source: Field Survey (2021)

On conflict resolution, a majority (72.73%) of the respondents in Anlo

Beach revealed mediation and peaceful settlement were used to resolve the

conflict between them and the Shama people. 10.91% opined they used open

confrontation and avoidance to resolve the dispute. Similarly, In Faana, most of the respondents (42.62%) revealed open confrontation, peaceful settlement, and arbitration were used in their conflict resolution. However, In Kewunor, 85% of respondents indicated open confrontation and avoidance as a conflict resolution strategy.

Most (85.45%) respondents in Anlo Beach indicated they were very satisfied with the conflict resolution, as shown in (Table 9), on whether respondents were satisfied with the conflict resolution. They added that the estuary changing position from Shama to Anlo Beach had stopped other fishers from Shama from using it, making it solely theirs. In addition, the conflict was in the past. Now they live peacefully among themselves, coupled with the fact that the estuary is degraded and not of much use to fisherfolks; hence though they are minor conflicts in the community, they are not related to the use of the estuary. However, the reverse is seen in Faana and Kewunor, in which most of the respondents, 88.5% and 100%, respectively, indicated they were very dissatisfied with the conflict resolution. In Faana they noted that they keep having the same issues with the natives during the rainy season with its accompanied flooding. The continuous artificial dredging of the estuary and changing location have contributed to the degradation of the estuary. Nevertheless, In Kewunor, dissatisfaction arises because light fishing is still ongoing, and the government is doing nothing to stop it, affecting their fish catch. According to a respondent, "It's just a matter of time we will soon attack them again, and this   time it will be more deadly if the authorities do nothing" (Fisherman respondent during FGD in Kewunor, 10/05/2021)

Table 9: *Nature of Conflict and Conflict Resolution Process*

Community	Nature of Conflict Resolution	Percentages
Anlo beach	Open confrontation and avoidance	0.9
	Mediation, peaceful settlements	72.7
	Open confrontation, peaceful settlement, arbitration	16.4
Faana	Open confrontation and avoidance	24.6
	Mediation, peaceful settlements	32.8
	open confrontation, peaceful settlement, arbitration	42.6
Kewunor	Open confrontation and avoidance	85
	Mediation, peaceful settlements	5
	Open confrontation, peaceful settlement, arbitration	10
Community	**Satisfaction with conflict resolution**	**Percentages**
Anlo beach	Very Dissatisfied	0
	Partially satisfied	14.5
	Very Satisfied	85.5
Faana	Very Dissatisfied	88.5
	Partially satisfied	11.5
	Very Satisfied	0
Kewunor	Very Dissatisfied	100
	Partially satisfied	0
	Very Satisfied	0

Source: Field Survey (2021)

Household Livelihood Security Index of Migrant Estuarine Communities

Results from the Study (Table 10) revealed that the study's overall household livelihood security index was 67% (0.67). It indicated a medium household livelihood security for the estuarine communities along the coast of Ghana. With a medium index score for Food Security (FS) (61.8%), Financial Security (FinS) (60.4%), and Health Security (HS) (66%). Also, low levels of Educational Security (EduS) (46.9%) and Empowerment Security (EmpS) (38.1%) were recorded for the entire study. However, there were disparities in

the index scores for each community. From the results, Iture had the highest food security index score (72.7%) compared to the rest of the study communities. Likewise, Ankobra (Sanwoma) scored the highest Educational Security score (67.4%). The reverse is seen in Faana and Kewunor which had the Zero (0) mean index score for Empowerment security.

Table 10: *Household livelihood security indices of fisher migrants in selected estuarine communities of Ghana*

Household livelihood Security indicators	Food Security (FS)		Educational Security (EduS)		Financial Security (FinS)		Health Security (HS)		Empowerment (EmP)	
Study Community	Mean	FS index for the Study	Mean	EduS index for the Study	Mean	FinS index for the Study	Mean	HS index for the Study	Mean	EmP index for the Study
Iture <0.5	45.3		25.4		45.9		0		32	
>0.5	72.7		65.5		63.2		78.1		65	
Anlo Beach	48.1	61.8	17.2	46.9	43.4	60.4	0	66.0	11.6	38.1
	56.1		50		62.9		77.2		60	
Ankobra	45.3		33.5		42.3		40		36.7	
	69.2		67.4		56.4		62.1		65.4	
Faana	38.4		16.2		41.9		0		7.2	
	55.4		50		59.2		61.7		0	
Kewunor	46.2		14.5		41.8		40		6.76	
	55.7		0		60.2		51.1		0	

Source: Field Survey (2021)

Figure 28 reveals that most of the households in Ankobra (93.46%) score a moderate to high food security index of 50% and above, with very few

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households (6.5%) with a very low food security index. On Educational Security, all the study communities had very low index scores, with the worst cases found in Faana and Kewunor in which 98% and 100% of their households scored very low.

Similarly, most households in Iture (80.30%) and Anlo Beach (77.25%) had a moderate to high index. The reverse is seen in Ankobra, where most households (58.17%) had a very low index. However, all the study communities fared well in health security as almost all the households had very high health security index scores.

Regarding Empowerment Security, it was found that all the respondents' households had a very low level of empowerment security, especially in Anlo Beach, Faana, and Kewunor, with almost all respondents scoring below 50%, as seen in the figure below.
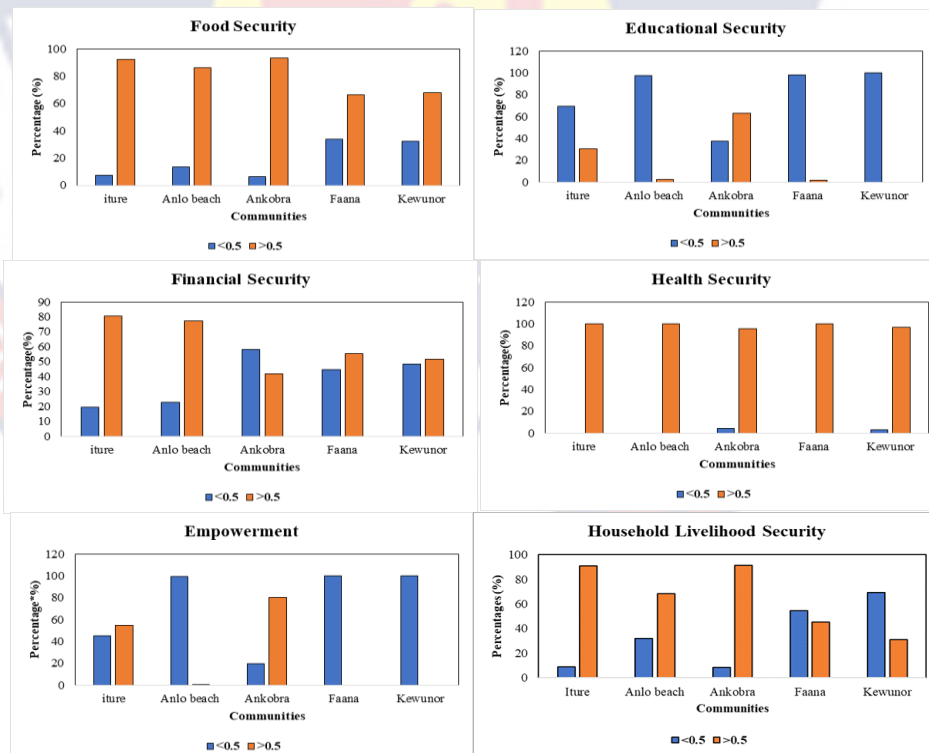
Figure 28: Household Security Indices Scores of the Estuarine Communities along the coast of Ghana
Source: Field Survey (2021)

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The results reveal that majority of the fisher household's livelihood security in Iture (90.8%), Anlo beach (68.24%), and Ankobra (91.50%) is sustainable, as most of the households scored between 0.5 to 0.7. Only a few households had a score above 0.8 in all the communities. This indicates that most households in Iture, Anlo beach, and Ankobra are not poor but efficiently manage their livelihood assets and decent living. The contrary is seen in Faana and Kewunor where the majority, 54.55 % and 68.11% of the households, are poor, as their household security index was below 0.5. (Table 11).

Table 11: *Variations between Household Livelihood Security Index among Migrant Fisher Communities*

Community	Household Livelihood Security index	Percentage of Households
Iture	(>=0.5)	90.77
	(<0.5)	9.23
Anlo Beach	(>= 0.5)	68.24
	(<0.5)	31.76
Ankobra	(>=0.5)	91.50
	(<0.5)	8.50
Faana	(>=0.5)	45.45
	(<0.5)	54.55
Kewunor	(>=0.5)	31.88
	(<0.5)	68.12

Source: Field Survey (2021)

Assessment of Measurement Model for fisher's household livelihood security indices

SmartPLS was used to conduct factor analysis and validate the data. The reliability of an indicator is determined by its outer loadings, which must exceed 0.70. If the outer loadings of the indicators fall between 0.40 and 0.70, they should be evaluated for removal if their exclusion enhances composite

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reliability. Consequently, some of the indicators with values below 0.70 for each latent variable were eliminated to enhance the model. The results of the analysis are presented in Figures 29 and 30. Figure 29 indicates that all reflective factor loadings exceed the minimum threshold of 0.7. However, despite having a value lower than 0.7 (0.650), the indicator "HS5" was retained due to its significant impact on the construct. Figure 30 shows that the t-values of the reflective factor loading are greater than the minimum threshold of 1.96, indicating that the constructs are appropriate measures of the variables.
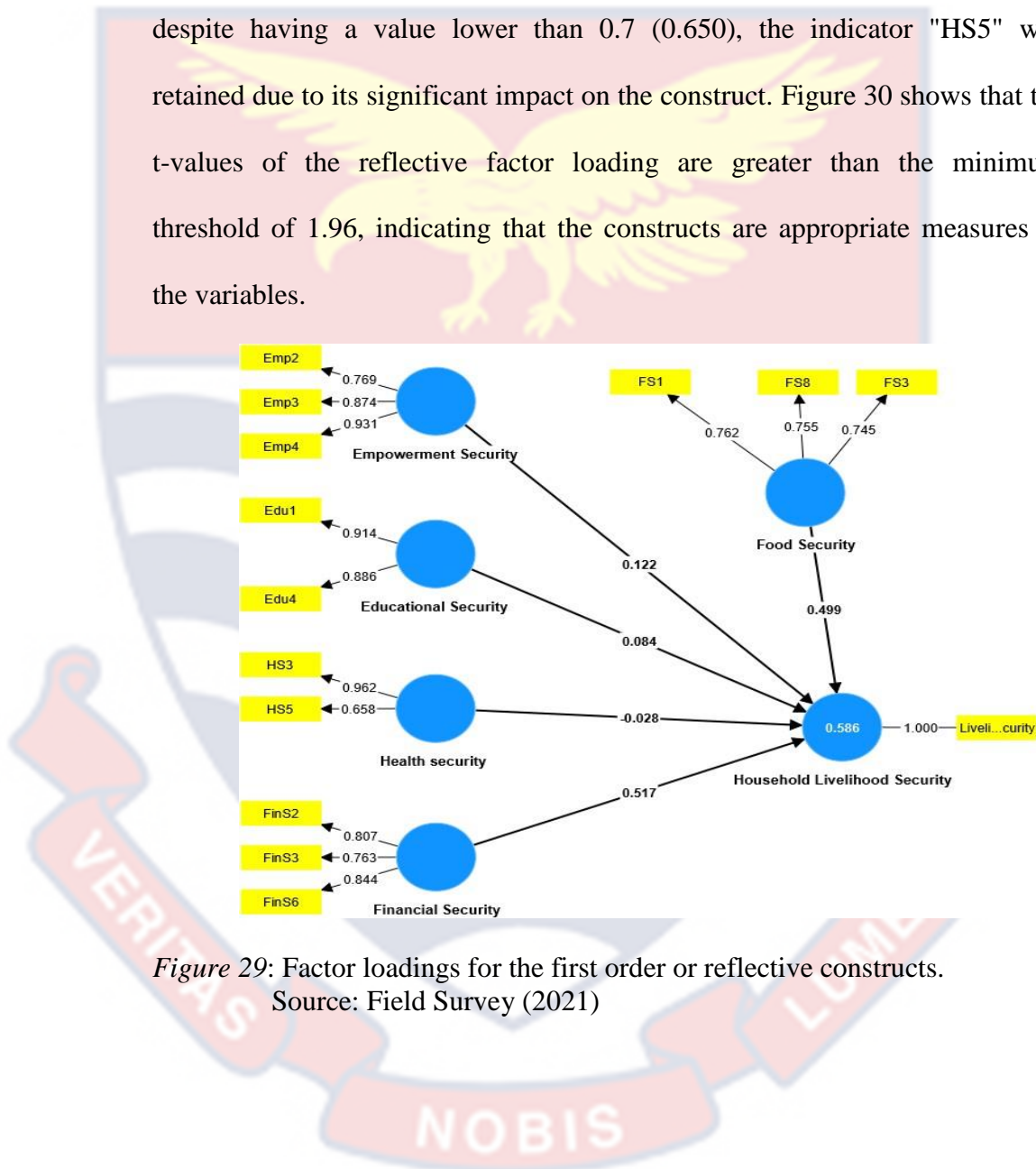
Figure 29: Factor loadings for the first order or reflective constructs.
Source: Field Survey (2021)

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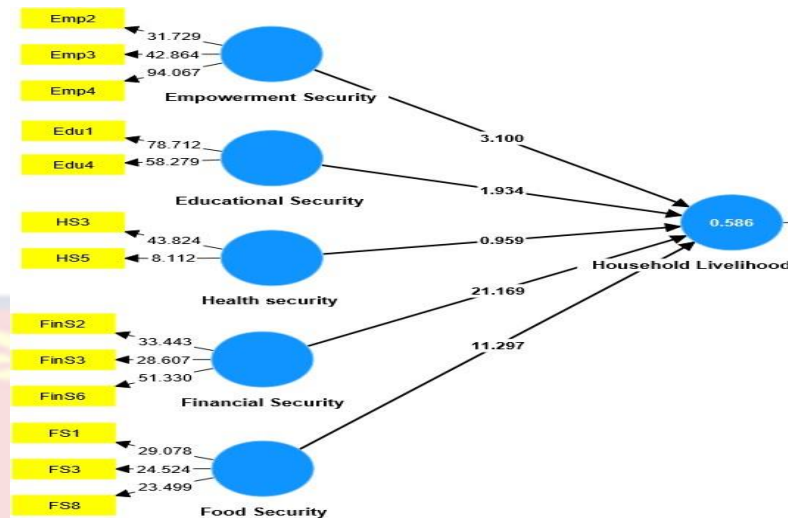
Figure 30: Factor loadings for the first order or reflective constructs.
Source: Field Survey (2021)

Table 12 below presents the statistical measures of reliability and consistency for the formative constructs. It indicates that all the Average Variance Extracted (AVE) values are greater than 0.5, and the composite reliability exceeds 0.6. In addition, Table 13 demonstrates that the square roots of the AVE for each latent variable (represented by the diagonal values of the Fornell-Larcker criterion) are higher than the correlations between the latent variables. The reliability tests are above the acceptable thresholds, with AVEs above 0.50 stated (Hair et al., 2014). As a result, it is appropriate to note that this study has achieved reliability, internal consistency, and convergent validity. In this context, discriminant validity was mainly analyzed to determine how the measures of the study's constructs converge to capture their respective constructs, which were evaluated using the square root of AVE of the individual construct. It displays discriminant validity because the AVEs' diagonal values are more significant than the loadings beneath them.

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Table 12: *Internal consistency reliability and convergent validity*

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Educational Security	0.766	0.766	0.895	0.810
Empowerment Security	0.821	0.834	0.895	0.741
Financial Security	0.754	0.826	0.847	0.648
Food Security	0.641	0.669	0.798	0.569
Health security	0.600	1.027	0.804	0.679

Source: Field Survey (2021)

Table 13: *Reliability of Educational, Food, Health, Financial and Empowerment security in measuring Livelihood security*

	Edu Security	Emp Security	Fin Security	F Security	H security	HLS
Educational Security	**0.900**					
Empowerment Security	0.698	**0.861**				
Financial Security	-0.133	-0.093	**0.805**			
Food Security	0.618	0.602	-0.016	**0.754**		
Health security	0.362	0.341	0.078	0.314	**0.824**	
Household Livelihood Security	0.358	0.387	0.500	0.556	0.223	**1.000**

Source: Field Survey (2021)

This study tested five (5) hypotheses using path coefficients, coefficient of determination, individual contribution (effect size), and the model's predictive weight. In contrast, the bootstrapping method was used for the path-coefficient assessment (hypothesis testing). The hypotheses were

directional when using the path-coefficient assessment (hypothesis testing) (1-Tailed). This is illustrated in Table 14 below.

Table 14: Results of hypothesis testing using path coefficients

Construct	Beta coefficients	Standard deviation (STDEV)	T statistics	P values	Decision
Educational Security -> Household Livelihood Security	0.084	0.043	1.934	0.053	Not supported
Empowerment Security -> Household Livelihood Security	0.122	0.039	3.100	0.002	supported
Financial Security -> Household Livelihood Security	0.517	0.024	21.169	0.000	supported
Food Security -> Household Livelihood Security	0.499	0.044	11.297	0.000	supported
Health security -> Household Livelihood Security	-0.028	0.029	0.959	0.338	Not supported

Source: Field Survey (2021)

Some of the study's hypotheses were statistically and positively significant, supporting the claim that Empowerment Security (EmP), Food Security (FS) and Financial Security (FinS) are strongly associated with Household Livelihood Security as shown in the Table 14 above. Empowerment Security, with a β-value of 0.122 and a t-value of 3.100, the P-value (0.002) was significant at a 1% significance level. A coefficient of determination of 0.122 indicates a significant positive relationship, implying that a one-unit increase in fishers' empowerment will result in a 12.2% rise in household livelihood security, assuming all other factors remain constant. Similarly, FinS with a β-value of 0.517 and t-value of 21.169 with P value (0.000) was also significant. In the same vein, a noteworthy coefficient of determination of 0.517 indicates that an increment in fishers' financial security

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will result in a 51.7% surge in household livelihood security, assuming all other factors remain constant. However, Educational Security and Health security were found not to have significant effects on overall household livelihood security in this study.

Determination of R2

According to Hair et al. (2012) and Kasim (2019), determining the value of R2 is critical when evaluating the structural model. The importance of the coefficient of determination cannot be overstated because it represents the totality of the effects of the exogenous on the endogenous components (Kasim,2019). Inferring to Hair et al. (2019), the R2 value ranges from 0 to 1, with a value below 0.5 being weak, 0.5 to 0.75 being moderate, and above 0.75 being strong. From Figure 31 below, the R2 value of 0.710 indicates that this study's constructs contribute to about 71% of Household livelihood security in the study area.
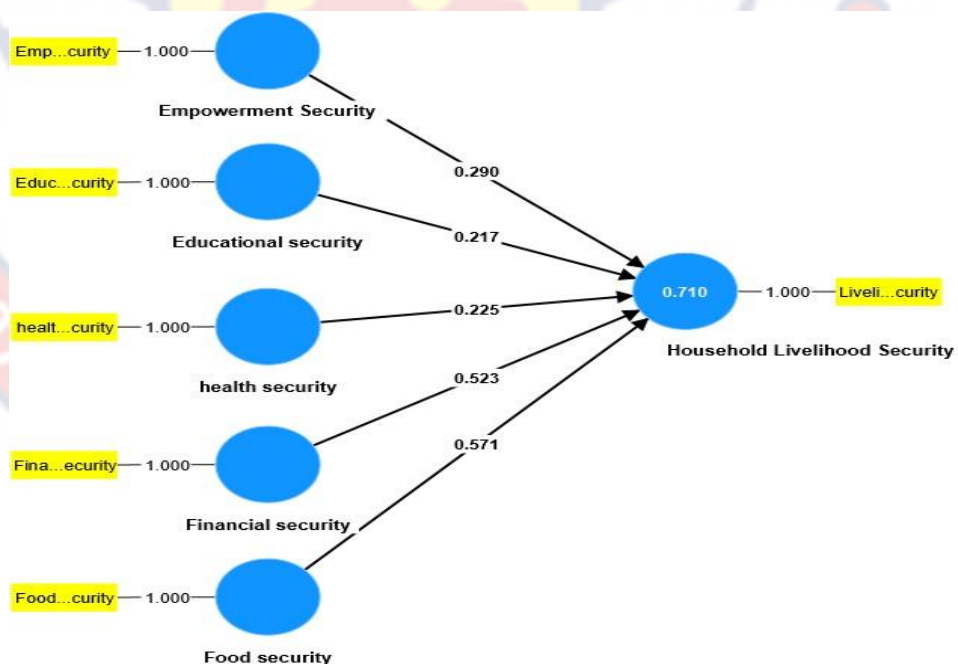
Figure 31: Assessment of the effects of the exogenous on the endogenous components on household Livelihood security.
Source: Field Survey (2021)

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Demographic characteristics influencing livelihood security indices of migrant fishers in estuarine communities

Results from the multivariate regression analysis (Table 14) indicated that gender, marital status, age, educational status, household size, and origin status were significant socio-demographic factors influencing the overall livelihood security of fishers in migrant estuarine communities along Ghana's coast. However, ethnicity was found not to be significant. Thus, from the model, holding all other variables constant, a unit increase in variation in the gender of fisher household head and marital status was associated with a decrease of 0.09 in household livelihood security. However, a unit increase in the age of the household head was found to be associated with a 0.006 increase in household livelihood security. Likewise, a unit increase in fishers' educational status and household size was associated with a 0.05 and 0.01 increase in household livelihood security. However, a unit increase in fishers' origin status was associated with 0.15 decreases in fishers' household livelihood security at a 5% significant level.

Complementing these findings were the impacts of these socio-demographic factors on the various livelihood security indices. The results revealed that only the age of the household head and ethnicity were significant factors influencing financial security at a 1% significant level. Consequently, a unit increase in the average age of fisher households was associated with a 0.006 increase in fishers' household financial security. In contrast, a unit increase in the variations of fishers' ethnicity was associated with a 0.056 decrease in household financial security.

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Similarly, marital status, age of household head and status of origin were significant factors influencing food security among fishers in estuarine communities at a 5% significant level. From the model, a unit increase in marital status and variation in ethnicity was associated with a 0.046 and 0.142 decreased food security. However, a 0.005 increase in food security is expected with a unit increase in the household head's age.

The model also revealed that gender, age, education status, the status of origin and ethnicity were the factors shaping empowerment security. Thus, a unit increase in gender, age of fisher household heads and status of origin were associated with a decrease in empowerment security by 0.071, 0.002 and 0.209, respectively. However, a unit increase in educational status and ethnicity was associated with an increase in empowerment security by 0.035 and 0.129, respectively.

Health security was influenced by educational status and ethnicity at a 5% significant level. Thus, from the results, a unit increase in educational status was associated with a 0.012 increase in fishers' health security. The reverse was seen as a unit increase in variation of fishers' ethnicity was associated with a 0.012 decrease in fishers' health security at 5% significant levels.

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Table 15: Influence of Demographic Characteristics on Fishers Household Livelihood Security Index in Estuarine Communities along the coast of Ghana

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Household Livelihood Security						
Gender of Household Head	-0.089	0.036	-2.433	0.015	-0.160	-0.017
Marital Status	-0.091	0.024	-3.804	0.000	-0.138	-0.044
Age of Household Head	0.006	0.001	4.429	0.000	0.003	0.009
Educational Status	0.046	0.019	2.455	0.014	0.009	0.082
Household Size	0.010	0.005	2.028	0.043	0.000	0.019
Status of Origin	-0.150	0.044	-3.399	0.001	-0.236	-0.063
Ethnicity	0.019	0.016	1.170	0.243	-0.013	0.052
_Cons	0.445	0.104	4.278	0.000	0.241	0.650
Financial Security						
Gender of Household Head	-0.036	0.039	-0.925	0.355	-0.112	0.040
Marital Status	-0.035	0.025	-1.378	0.169	-0.085	0.015
Age of Household Head	0.006	0.001	4.081	0.000	0.003	0.009
Educational Status	-0.006	0.020	-0.279	0.780	-0.045	0.033
Household Size	0.006	0.005	1.264	0.207	-0.004	0.017
Status of Origin	0.029	0.047	0.612	0.541	-0.063	0.121
Ethnicity	-0.056	0.018	-3.189	0.001	-0.091	-0.022
_Cons	0.455	0.111	4.095	0.000	0.237	0.673
Food Security						
Gender of Household Head	-0.058	0.030	-1.937	0.053	-0.116	0.001
Marital Status	-0.046	0.020	-2.347	0.019	-0.084	-0.007
Age of Household Head	0.005	0.001	4.109	0.000	0.002	0.007
Educational Status	0.030	0.015	1.952	0.051	-0.000	0.060
Household Size	0.002	0.004	0.556	0.579	-0.006	0.010
Status of Origin	-0.142	0.036	-3.943	0.000	-0.212	-0.071
Ethnicity	-0.019	0.013	-1.431	0.153	-0.046	0.007
_cons	0.746	0.085	8.773	0.000	0.579	0.913
Empowerment Security						
Gender of Household Head	-0.071	0.029	-2.491	0.013	-0.128	-0.015
Marital Status	-0.032	0.019	-1.719	0.086	-0.069	0.005
Age of Household Head	-0.002	0.001	-2.229	0.026	-0.004	-0.000
Educational Status	0.035	0.015	2.397	0.017	0.006	0.064
Household Size	0.001	0.004	0.299	0.765	-0.006	0.009
Status of Origin	-0.209	0.035	-6.030	0.000	-0.277	-0.141
Ethnicity	0.129	0.013	9.934	0.000	0.103	0.154
_Cons	0.256	0.082	3.131	0.002	0.096	0.417

Educational Security						
Gender of Household Head	-0.039	0.028	-1.390	0.165	-0.093	0.016
Marital Status	-0.017	0.018	-0.916	0.360	-0.052	0.019
Age of Household Head	-0.001	0.001	-0.761	0.447	-0.003	0.001
Educational Status	0.112	0.014	7.952	0.000	0.085	0.140
Household Size	0.009	0.004	2.599	0.010	0.002	0.017
Status of Origin	-0.112	0.033	-3.352	0.001	-0.178	-0.046
Ethnicity	0.082	0.013	6.558	0.000	0.058	0.107
_Cons	-0.124	0.079	-1.571	0.117	-0.280	0.031
Health Security						
Gender of Household Head	-0.005	0.010	-0.571	0.568	-0.024	0.013
Marital Status	-0.001	0.006	-0.195	0.845	-0.014	0.011
Age of Household Head	0.001	0.000	1.917	0.056	-0.000	0.001
Educational Status	0.012	0.005	2.386	0.017	0.002	0.021
Household Size	0.002	0.001	1.820	0.069	-0.000	0.005
Status of Origin	-0.006	0.012	-0.558	0.577	-0.029	0.016
Ethnicity	-0.012	0.004	-2.824	0.005	-0.021	-0.004
_Cons	0.942	0.027	34.572	0.000	0.889	0.996

Source: Field Survey (2021)

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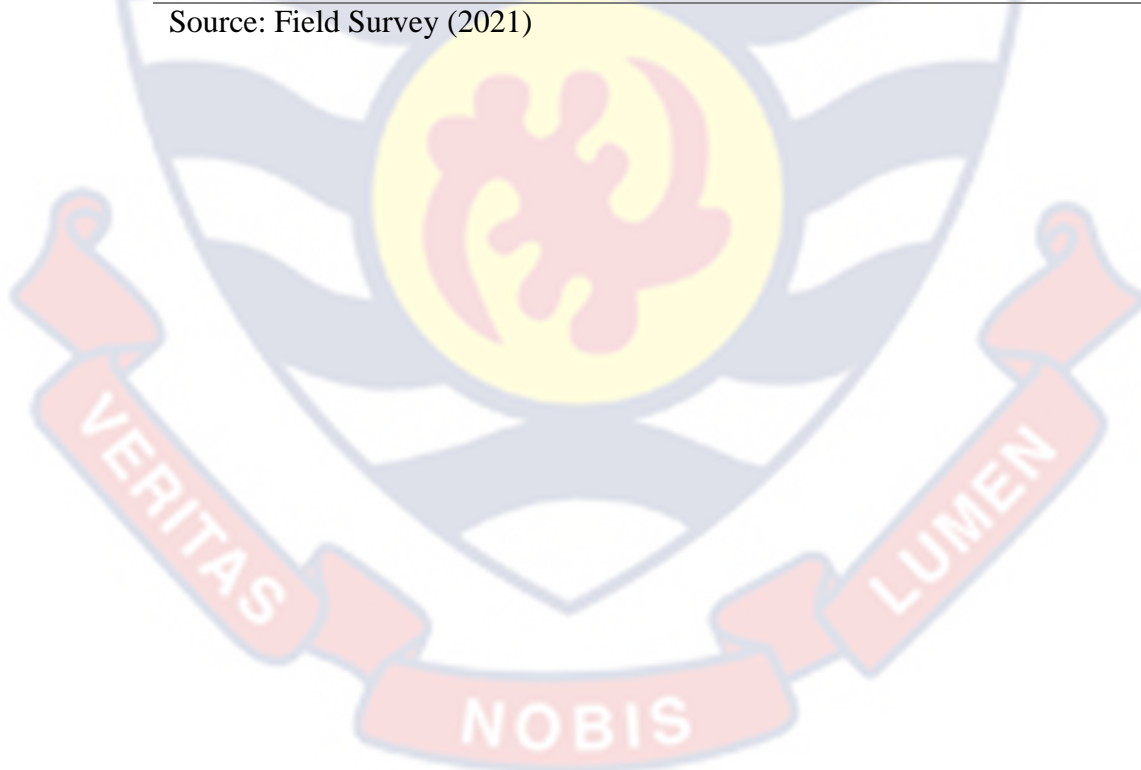
CHAPTER SIX

DISCUSSION

The findings of the study are discussed in this section. The discussion is supported by the conceptual framework, theoretical frameworks, and pertinent literature on fishermen's migration, livelihood adaptation, disputes over natural resources, and sustainable household livelihoods. In this chapter, the results are evaluated and compared to related works.

Demographic Characteristics

Demographics, migrant networks, and wealth disparities are significant determinants of migration (Simpson, 2017). Thus, having most fishers married has a favourable implication for fisher migration. Married fishers engage in supportive endeavours in their fishing activities, which positively impact fishers' livelihoods and reduce post-harvest losses. Accordingly, their partners may be a source of support in after-harvest sales and value addition through smoking and processing harvested fish, among others. This explains the positive relationship between marital status on the migration of fishers. These findings are in support of those of Odotei (1992) and Torell, Owusu, and Nyako (2015), who found that fishers migrate with their wives or kin women who act as their business associates or partner, receiving the catch for processing and sales when they arrive at the shore. In addition, the strong positive influence of ethnicity and migration is evident in the study's theoretical framework that emphasises the role of migrant fishers' social networks in expanding migration flows at the destination places.

Consequently, ethnicity was a strong pull factor for estuarine communities along Ghana's coast. Relatives serve as support systems for new

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migrants by providing temporary accommodations, food, safety nets and even jobs, a conclusion by Munshi (2014) and Comola and Mendola (2015). Lekarapa and Root (2014) also found that ethnicity (social network) influences easy access to jobs among construction artisans from various ethnic groups in the Western Cape. Equally, educated fishers have knowledge that could easily get them white colour alternative jobs. This finding parallels Deshingkar (2008), who specified that poor, lower caste, and less educated people are more likely to migrate. Except for Iture, Anlo-Ewe fishers were the most common migrant fisher group in all research communities. This could be due to the lack of vibrant commercial fishing activities in Iture, with no active landing beach. Though the age of the household head was not a significant factor influencing migration, most fishers were in their active economic ages. This shows that most fishers in the study area were economically engaged, able to handle stress and could adopt labour-intensive livelihood adaptation measures. Thus, age influences productivity, output, and innovation adoption, as Olaoye et al. (2012) concluded.

Temporal and Spatial Aspects of Fisher's Migration Along the Coast of Ghana

It is unknown when the first fisherman migrated and settled in estuarine areas. However, Anlo Beach, Faana and Kewunor are among Ghana's oldest migrant fisher estuarine communities. This continuous increase could be due to the hitherto lucrative nature of the fishing business, and the presence of alternative sources and species of fish (from rivers and sea). It could be deduced that, because there is no restriction or specialisation in habitat for fishing, the rivers and sea are alternative and sustainable sources of

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fish for a fisherman looking for a place to settle. For example, when the sea is rough, fishermen could rely on the rivers for fish. However, this unrestricted use could result in unstainable use of the estuaries and subsequent degradation if not managed properly. Applying Lee's (1966) push-pull theory of migration, the dominant factors at the destination sites, such as bumper fish harvest having alternative sources of fish: the rivers and sea, further pulled a lot of fisher migrants to the study communities. The different generations of migrants encountered mean that there are still migrants' inflows into the estuarine communities and be explained by the expansion of migrant social networks in the destination communities, as indicated by our individual/household complimentary migration theory. These findings also confirm the results of Wanyonyi et al. (2016) on artisanal fisher migration patterns in Kenya, Tanzania and the northern provinces of Mozambique. They indicated that the predominant factors driving fisher migration in were the already high number of fishers (social networks) at the destination sites, overfishing in the fishermen's home shore areas, and bad fish harvest; and the temporal patterns of movement are unique to individual migrant fishers, and we cannot make generalisations about all fishers. While that of the Anlo-Ewe is permanent, the trigger for the onset of migration across the generations needs to be investigated.

The Anlo-Ewe dominate fisher migration to Ghana's estuaries. Wanyonyi et al. (2016) also found that destination of migration, gear and fishing space differs among different fishing cultures. According to Akyeampong (2001), the Anlo-Ewes used the beach seine method of fishing, which helped them become a more permanent migratory fishing group. While the estuarine

communities also had Fante and Ga fishers, they fish in different spaces using different gears. Migration of these fisherfolk is a livelihood issue to seek bumper harvests and higher incomes. Marquette et al. (2002) found that Ghanaian fisher migrants send their proceeds home to build houses, pay school fees, and fulfil other family responsibilities. These migrant fishers improved conditions back home by using migration incomes or remittances to buy livelihood assets for poverty alleviation (Deb et al., 2002). Since the person to initiate the migration are usually breadwinning males, it could be adduced that migration for fishing boosts male status in Ghana. Scarcity of fish (livelihood) couth therefore trigger this cultural or innate trait of the Anlo-Ewe, causing them to migrate. These findings are consistent with that of Ngo Likeng (2006) who also found that circular internal migration was practised by the Mousgoums fishers from Lake Chad who migrate to Cameroon's coast for fishing.

Pull Factors to Estuarine Communities

Inferring from our complimentary theory of migration, the decision to migrate is not always easy as several factors influence one's decision to migrate. Push factors such as overpopulation, low fish catch, coastal flooding, and other stressors compel fishers to migrate for livelihood adaptation. While pull factors such as having easy access to the river, open sea and land were the dominating pull factors in destination areas, the role of social networks cannot be overlooked. These findings are like those of Wamukota and Okemwa (2009) and Wanyonyi et al. (2016). They discovered that open and easy access to the sea contributes to a greater likelihood of the entry of migrant fishers in East African regions that accept migrant fishers. In addition, despite the

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numerous pull factors, social network (ethnicity/ relatives) inspired migration, especially among the Anlo-Ewes, as it was the most common reason among all other pull factors. This might be justified by the fact that social network helps provide free labour and function as a financial assistance system in times of need. The results confirm Grafton's (2005) assertion that social networks and capital are vital because they support fishers to catch a specific amount of fish at a lower cost while also increasing the probability that the resource will be maintained in the long term.

Relationship between Unique Characteristics of the Estuary and Ethnicity

According to Allendorf and Yang (2013) and Muhamad et al. (2014), geography, socioeconomics, culture, and life events influence an individual's perspective on ecosystem goods and services. Consequently, priority to a good or service will differ from person to person. From the results, several reasons accounted for how each fisher household head ranked their preference for a unique estuary feature, with the most important to them as the first choice. For instance, most of the Anlo-Ewes ranked the river highest compared to their preference for the other unique features of the estuary. The multiple uses of the river for fishing and other domestic purposes could explain this. The Anlo-Ewes were the dominating migrant fisher group for the entire study. This explains why the river was the highest-ranked unique feature of the estuary. They advanced that staying by the estuary offers them alternative fishing avenues compared to other fishers. Thus, during high tides, the river serves as the primary source of fish.

Additionally, it is prohibited for fishermen in Ghana to go fishing on Tuesdays; thus, most fishermen go fishing in the river on these days to

supplement their income. Thus, the complimenting role of the river/estuary for the livelihood security of migrant fishers is critical. An Anlo-Ewe respondent who ranked the river first (1st) explained that:

> *The river is the wife of the sea; as such, the sea impregnates the*
>
> *river through the estuary and gives birth to more fishes that go*
>
> *back into the sea; wherever there is a river and a sea, there are*
>
> *more fish…* (Efo a fisherman in Anlo beach, 08/04/2021)

This statement stresses that he knew the estuaries' vital breeding role in the fishery sector's sustainability. This may explain the high influx of Anlo-Ewes at the Pra estuary, as indicated by a male fisherman "news of how lucrative and bumper harvest spread around the coast of Volta region, so the majority of us moved here to fish" (a 48-year-old fisherman during FGD session in Faana, 02/05/2021)

Many Fantes prioritised the sea. Their fishing gear (purse seine) is designed for deep-sea fishing. This is in accordance with Goldbach et al. (2018) assert that socioeconomic factors, such as employment status and resource relationship, are crucial to coastal resource valuation. The Faana fishermen who built their homes on the shore ranked the shoreland first because shelter is one of man's basic psychological needs (Maslow Hierarchy of Needs). Without shoreland, they couldn't build homes. The difference in ranking among the different ethnic groups is in line with the findings of Orenstein and Groner (2014). They observed a noteworthy difference in ecosystem ranking between diverse ethnic groups in southern Arabah Valley. Thus, understanding ecosystem users' cultural preferences is crucial, especially for conservation efforts and local development planning that incorporates

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long-term livelihoods for ecosystem users (Hartter et al., 2012). These results are comparable to those of Cuni-Sanchez et al. (2016). They found that culture and ethnicity influence the value rural communities in Northern Kenyan place on their forest resources and choice of plant species for providing ecosystem services.

Physical Changes in Estuaries Along the Coast of Ghana

Estuaries connect land, freshwater, and marine ecosystems (Thrush et al., 2013). Centuries of overfishing, habitat loss, and contamination have compromised estuary ecological resilience (Adger et al., 2005). According to Oglethorpe et al. (2007) movement of people can affect biodiversity through habitat fragmentations, clearing of land for settlements, and other land uses, among others. The reduction in the water area found in Anlo Beach (Pra estuary) and Kewunor (the Volta estuary) due to the development of sand bars shifted the estuary's position. These findings were in line with a previous study conducted by Sreenivasulu, Jayaraju and Prasad (2014). They reported a reduction in water area in their Land use/cover assessments of the Pennar River estuary in India. In their assessments of LULC analysis in and around the Manakudy Estuary on India's southwest coast, Muthusamy et al. (2014) found a decrease in the water from 1991 to 2001. Despite the lower water levels in estuary areas, coastal floods and erosion significantly impact these towns.

Nevertheless, the increase in vegetation cover around the Pra estuary could be attributed to the various mangrove reforestation projects carried out in the community over the years; the Environmental Protection Agency (EPA) in the year 2008 planted 1000 mangrove seedlings along the Anlo Beach

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estuary. Also, USAID Sustainable Coastal Landscape Projects in 2018 supported the community with 3500 mangrove seedlings. In addition, Friends of the Nation (FoN), with support from the International Union for Conservation of Nature (IUCN) in their conservation of the estuarine wetland project between 2009 to 2014, planted over 14,000 mangrove trees to cover just a part of the over 76 hectares loss of mangrove cover within the wetland complex of the Pra estuary (FoN,2015). These, among other NGO interventions, might have contributed to the increase in vegetation cover in the study area. This conclusion complements Nayak and Fulekar (2017). They found an increase in mangrove area from 2.72% to 4.47%t over 27 years of assessing the mangrove area in Gujarat, India's west coast, due to participation in government initiatives for conservation and sustainable development. These findings are like that of Misra and Balaji (2013), who found an increase in vegetation in their 38-year land use land cover assessments of the Mandovi–Zuari estuarine complex due to the rise in mangroves growth along the river.

Hawkins et al. (2003) suggested that climate is a critical feature characterizing the ecosystem resulting in increased salinity, water, and coastal flooding from rising sea levels (EPA, 2008; Aheto, 2011). Thus, the increase in water in the Ankobra estuary was not surprising. According to studies conducted in Ghana, sea-level rise will result in direct flooding or submergence of low-lying wetlands, increased salt in estuaries and aquifers, and worsened coastal flooding and storm damage (EPA, 2008). Due to increasing coastal erosion and inundation, community members have resorted to building temporary settlements such as thatch and bamboo houses because they are less expensive. Most community members live in their second, third,

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or fourth houses due to the continuous destruction of their homes by coastal flooding and shoreline recession. These findings align with Parab et al. (2011), who claim that Goa beaches erode due to waves and currents. As the water level rises, the amount of usable coastal area decreases. The significant growth in the beach area can be attributed to the seawater intrusion into the land. Mangrove destruction, garbage, and sewage disposal are influenced by demographic variables such as habitation.

Thus, increasing in-migration to these estuarine communities has resulted in an upsurge in bare land/settlements around the estuary area in Kewunor (Volta Estuary), a predominantly migrant community. Despite the decrease in population in 2010, bare land/settlements have increased, mainly around the estuary area. This could be attributed to the estuary's beach resorts and other tourist infrastructures. According to Oyedotun (2019), increased in-migration has led to population shifts in Anhui province, resulting in a 21.69 % increase in Chaohu Lake's built-up area. Adnani et al. (2019) also recorded a significant increase in built-up area from 1985 to 2017 in their study of the Sebou estuary, Morocco, due to massive in-migration of the rural populace. In their study of the Mandovi–Zuari estuary complex in Goa, India, Misra and Balaji (2013) noted an increase in the urban class (184.8%) from 1973 to 2011 due to increased population and tourist influx. It also compliments the results of Sreenivasulu, Jayaraju and Prasad (2014), who recorded an increase in built-up land in the LULC assessment of the Pennar River Estuary, India. However, most community members relocated their settlements away from the estuary and shoreline due to coastal flooding and property destruction. This

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could be blamed for the decrease in bare land/settlements around the Pra and Ankobra estuaries.

Anthropogenic Activities Influencing the Changes in Land Cover/Use around the Estuaries

Small-scale illegal mining (Galamsey) in the rivers, particularly the Pra and Ankobra rivers, has polluted these water bodies making them muddy and unsuitable for fish growth and breeding purposes. Increased turbidity limits oxygen for aquatic organics in water (Allan, 1995). This can also contribute to fish migrating to more comfortable areas or dying due to limited oxygen. This finding confirms the findings of Okyere (2019) who found that the Pra estuary of Ghana was degraded as of the siltation from illegal mining resulting in high turbidity and poor water quality. In addition, sand was wined from the shoreline for construction purposes in the study communities. This activity tends to increase coastal erosion and flooding. Thus, changing usable land and vegetation into water areas (sea). These practices were rampant in Anlo Beach and Ankobra communities.

Also, the estuaries were dumping grounds for garbage at Anlo Beach and Sanwoma (Ankobra). Lastly, mangroves were harvested as fuelwood in the study communities. According to community members of Ankobra, the excessive degradation of mangroves around the estuary now exposes them to yearly flooding, which destroys their homes and properties. Mangrove harvesting for fuelwood and construction purposes has also contributed to the decline in vegetation in the study areas. However, Kewunor (Volta Estuary) had a clean estuary due to the beach resorts. These findings align with Vu

(2018), who indicated that anthropogenic activities degrade the Dong Ho Estuary in Vietnam.

Fisher's Perception of Degradation of the estuary

Many authors have pointed out that understanding coastal communities' social and economic components, such as demography, economics, perceptions, attitudes, and values about estuarine ecosystems, is critical to estuary management (Burger, 2003; Hoguane et al. 2021; Huppert et al., 2003; Wester, 2023). For the communities, the estuary provides a source of fish and other aquatic species and various domestic uses. However, fishers have experienced declining and extinction of their preferred fish species from the estuaries along Ghana's coast. Thus, most fishers perceived the estuaries as degraded. This study's findings support those of Giglio et al. (2015) and (Reis-Filho et al. (2016). They reported that fishers in Eastern Brazil and the Central Coast of Brazi perceived a drop in the largetooth sawfish Pristis pristis. According to Rochet et al. (2008), fishers in the eastern English Channel ecosystem have also seen a drop-in fish species. The level of degradation of estuarine ecosystems is linked to the economic background of the people that utilize the resources, according to McAuliffe et al. (2014). As a result, the absence of other livelihood choices in fishing villages could be blamed for massive pressures on the estuarine ecosystem and consequent degradation. According to Huppert et al. (2003), Ecosystem management necessitates local public perspectives and collaboration. As Burger (2003) pointed out, understanding how people use estuarine resources and what they regard to be the most important activities is key to their assessment and management.

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Perceived Causes of Degradation of The Estuaries

Fishers alleged that illegal mining (galamsey) activities upstream, changes in the location of the estuary, poor usage and management and degradation of mangrove vegetation, illegal fishing, breaking taboos, and natural factors were the causes of estuary degradation. These findings are in line with Reis-Filho et al. (2016). They found that illegal fishing gear influenced fish population declines and subsequent degradation in 5 estuaries on the central coast of Brazil. The findings also align with those of Vu (2018), who indicated that anthropogenic activities degraded the Dong Ho Estuary in Vietnam. The results also collaborate with the conclusions from (Sukdeo et al., 2016), who observed that excessive agricultural and industrial pollution and effluent disposal into the Mvoti Estuary have severely degraded the estuary. The results of this research are consistent with the findings of Fianko and Dodd (2019), which identified various human activities as the causes of environmental degradation in the wetlands of the Songor Ramsar site in Ghana. These activities include improper waste disposal, residents' negative attitude towards environmental conservation, and wildfires, among others.

Factors Influencing the Degradation of Estuaries Along Ghana's Coast

Fishing experience, as measured by the years spent actively fishing and the sort of fishing equipment employed, significantly impacts the estuary's degradation. This is because when a fisher increases his experience by one additional year would manifest as exerting additional and continuous pressure on the estuary. The results contradict the findings of Siddique et al. (2014) who found that fishing nets designed to catch fish regardless of their size or species will devastate the Meghna River Estuary in Chandpur, Bangladesh.

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Similarly, the findings of this study differ from that of Pradhan et al. (2017), in their study on fishing gear in Indian estuaries, who indicated illegal fishing gear and overfishing of juvenile fishes as the cause of fish stock and loss of revenue from fisheries in India. This could be explained by the fact that majoritity of the fishers in this study indicated only the use of approved fishing gears. This aligns with the results of Raju et al. (2016) who found no destructive fishing practices in Kolleru Lake, India, thanks to good management practices. Consequently, if fisherfolks resolve to use the right and approved fishing gear, the degradation of estuaries along Ghana's coast will reduce, as shown by the model.

Similarly, increasing the number of ethnic groups using the estuary reduces the likelihood of degradation. Complementing this finding is Barnes-Mauthe et al. (2013). They quantitatively demonstrate that ethnic variety has a major impact on network structure and cross-scale links, influencing the capacity for collaboration and overall management of Hawaiian Island's common pool coastal resources. However, the results contradict the findings of Aabeyir and Agyare (2020) who found the number of tribes using woodland was influencing its degradation among charcoal producing in Kintampo, Ghana. This may be explained by the fact that most of estuarine communities were mono-ethnic community in which all members are related may have the same culture and believe in the rules /taboos relating to the estuary.

It should also be noted that sanctions and regulations substantially impact estuary degradation, as sanctions and rules are required for successful resource management because they prohibit individuals from degrading resources. Thus, every rule (regulation) imposed on the estuary reduces the

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odds of the estuary being degraded. These findings collaborate with Darkwa and Smardon's (2010) results in which rules through a set of taboos were used to manage the Fosu Lagoon of Ghana. In addition, Alexander et al. (2017) indicated that formal regulations and taboos helped protect and manage Sea Turtles in Ghana. However, it was also revealed that the estuary's likelihood of degradation is higher with a unit increase in sanctions. The results are contrary to expectations, yet it can be explained that fisherfolks have limited alternative livelihood opportunities. If the sanctions are in monetary units, they would have to degrade the estuary more to be able to pay.

Furthermore, the degradation of the estuary is influenced by equitable and fair access to the estuary and user group relationships. The estuary's degradation rate is lower if the relationship among user groups is cordial. As a result, a friendly connection between user groups will translate into effective participatory estuary management. This conclusion is consistent with (Hen-Mpoano, 2016), who opined that there was no conflict of interest among users of the Ankobra Estuary in Ghana. This is attributed to the high obedience to traditional regulations governing the use of resources. However, the findings contradict Masalu (2000), who documented an uncordial relationship between fishers and farmers in Mapopwe Creek, Chwaka Bay, due to pesticides washed into the Bay from Cheju irrigated rain-fed rice farms.

On the other hand, the membership of fishing groups/organizations and readiness to follow protocols did not affect the estuary's degradation status. This is likely because most fisherfolks were not members of any fisher association. Likewise, there were no procedures to follow before using the estuary as it was open access and fair.

Conflict of interest over estuarine resource use along Ghana's Coast

Coastal resources in Ghana, like the most common pool of natural resources, are open to all. No regulations offer specific permission or restrict community rights to use coastal and marine resources. As a result, community members and residents of adjacent villages have equal and fair access to estuaries. Therefore, it was unsurprising that migrants and natives had free and equal access to the estuary in all the study sites. Coastal resources, particularly estuaries, are tremendously competitive and overexploited due to their open-access nature. This research supported the conclusions of Campbell, Whittingham, and Townsley (2006), who stated that coastal resources are potentially competitive systems because of their open-access nature, especially among the poor. These findings are also consistent with Purwaka (2002), who discovered that members of the Sulamu community and other surrounding communities have access to Kupang Bay in Indonesia.

The open-access and competitive nature of fisheries-related natural resources result in conflicts among users due to competing goals coupled with the constant migration of fishers, increasing pressure and competition on coastal resources. As a result, disagreement develops, leading to conflicts and marginalization. Numerous estuary-related confrontations between migrant and native fishers occurred in Anlo Beach, Faana, and Kewunor due to differing user aspirations and management perspectives, particularly regarding the use of destructive gears by migrant fishers. The findings complement WorldFish (2006), which describes a conflict in Thailand between resident small-scale and migratory large-scale anchovy fishers over access and gear damage. The findings are also like Tunje et al. (2016). Their research on fisher

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conflict throughout the Kenyan Coast discovered that fish theft from gears, harmful behaviours of aquarium fishers, and the use of unapproved gears were the leading causes of conflict between fishers. In addition, our findings parallel those of Glaesel (2000) and Wanyonyi et al. (2016) found that the entrance of large groups of Pemba fishermen along the Kenyan coast has created confrontation with local communities and artisanal fisheries over the use of harmful fishing equipment. However, in the Iture and Ankobra communities, there were no conflicts between migrants and natives overusing estuaries. This was because there were no thriving fishing activities in Iture. Therefore, the estuary was primarily used for subsistence fishing. The opposite is true in the Ankobra community, a thriving fishing town, where natives control the fishing sector and migrants adhere to the established norms governing the use of the estuary. This collaborates with the findings of Hen Mpoano (2016), who concluded that there is no conflict of interest among users of the Ankobra Estuary in Ghana due to their strict adherence to the traditional regulations governing the utilization of the resources.

The Intensity of Conflicts Over the Use of The Estuary

Most victims at Anlo Beach and Kewunor were injured, indicating the severity of the clashes. Thus, the conflict was severe and brutal, resulting in many migrants and natives being injured. According to a fisherman in Kewunor

> *I sustained deep wounds on my hand during the clash [paused*
> *to show the interviewer the wounds] the pain was unbearable,*
> *and the healing process was slow, but I will fight them again if*
> *the authorities do nothing because their activities are serious*

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affecting our source of survival… (A youth fisherman during FGD in Kewunor, 10/05/2021).

Similarly, the opinion leader of the Anlo Beach community indicated that their conflict with the natives over the estuary in the past was very brutal. He revealed that:

> *I remember that fight with the Shama fishermen was brutal and bloody because we were tired of their constant control over the estuary. Fortunately, no body die but now that the estuary is located in Anlo beach the Shama fishermen don't even come here and the estuary is also degraded with no fish inside.* (Opinion leader of during a KII session, Anlo Beach, 09/04/2021).

This finding is also consistent with the findings of Glaser et al. (2019). They found that the regions surrounding Tanzania's southern Lake Victoria had the highest levels and intensities of fisheries conflict. The findings also corroborate those of Devlin et al. (2022), who found 496 injuries and 406 deaths in fisheries-related conflicts across the Horn of Africa. It must be noted that the nature and intensity of fisher related conflicts have repercussions for fishers' livelihoods as indicated by Ameyaw (2017), conflicts in tropical fisheries can create challenging circumstances for individuals living in poverty, as fisheries hold significant socio-economic importance in tropical nations.

Fishers Conflict Resolution Strategies

Fisheries' resource-use conflict management strategies are well-documented worldwide (Heck et al., 2004; Olomola, 2008; Warner, 2000).

Fishers use a variety of traditional and 'modern' conflict resolution mechanisms to resolve conflicts and avoid future ones amicably (Tunje et al., 2017). Open confrontation, peaceful settlements, arbitration, and avoidance were the conflict resolution strategies used to resolve a fishery-related conflict over the use of the estuary. This finding was in line with Tunje et al. (2017). They found that arbitration, vetting, and dialogue, among other conflict resolution strategies, were used in managing conflict among artisanal fishers of the Kenya coast. The findings are consistent with Dahlet (2019), who stated that negotiation, mediation, arbitration, adjudication, and coercion are the most widely used fisheries conflict resolution mechanism.

The migrant fishers of Anlo Beach were very satisfied with the conflict resolution between them and native's fishers overfishing in the estuaries. The change in the location of the estuary over the years from Shama to Anlo Beach also helped permanently resolve this conflict. Most native fishers stopped using the estuary, coupled with the degraded state of the estuary made fishing in the estuary unprofitable. The reverse was seen in Faana, and Kewunor where community members were very dissatisfied with the conflict resolution mechanism. Thus, the conflict over the estuary keeps happening every year due to the failure of authorities to find a lasting permanent solution to these conflicts. The researcher observed an increase in light fishing in the Kewunor areas, the root cause of the conflicts. Thus, most fishers indicated that if the government does not intervene in time, they will attack the light fishers again as their activities are detrimental to their livelihoods. This result agrees with Bennett et al. (2001), who found that most fishers in Bangladesh and the

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Caribbean were unsatisfied with Fisheries Advisory Committee (FAC) conflict management.

Sustainable Household Livelihood Security Indices of Migrant Fishers in Estuarine Communities

The paper assesses how house food, health, financial, education, and empowerment securities influence the household securities of selected estuarine communities along the coast of Ghana. The empirical result of this study proved that there exists a significant positive relationship between the exogenous latent constructs (Food security, financial security, Health security, Educational Security, and Empowerment) of the Study and the endogenous latent construct of Household Livelihood Security

HLS domain levels were slightly elevated in the studied estuarine communities. Faana and Kewunor, on the other hand, were in a much worse predicament. Communities differed significantly regarding food security, education, health care, and empowerment. This is due to the difference in prevailing socioeconomic conditions in the study communities. These findings align with that of Akter (2017), who found low domains of HLS in his Study Investigating Multiple Domains of Household Livelihood Security: Insights from Urban Slums in Bangladesh. Also, according to Kamaruddin and Baharuddin (2015), access to human assets improves livelihood outcomes, resulting in increased income, which could help reduce poverty. However, it was revealed that most respondents did not own any economic assets nor had savings resulting in low-income levels increasing their vulnerability to economic stressors, especially in Faana and Kewunor communities. Thus, the findings collaborate with Unmesh and Nayaranan (2015), who emphasized the

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effect of financial assets on income and livelihood strategy, which affect livelihood outcomes and poverty reduction. Also, according to Ibrahim et al. (2018), financial assets are essential for improving living standards. Furthermore, diversification increases household income and thus improves overall household well-being (Loison et al., 2017).

Per Olawumi (2012), improved household livelihood outcomes result from increased educational attainment, vocational skills, and training. Thus, a low (46.9 %) index of educational security for the study could account for the low to medium livelihood security index. The education security index is severely low in Faana and Kewunor where all respondents scored low to zero for educational security. This corroborates the claim that a lack of education and skills leads to poverty (Olawumi, 2012). Likewise, Empowerment security was also quite low for the study, 38.07%. This could be attributed to the lack of cooperative groups, NGO interventions, and inadequate access to livelihood-related information in the study areas. Access to and control of resources, participation, and influencing the decisions at family, social and political levels are often considered essential components of empowerment (Kabeer, 2000). Akter and Rahman (2014) The HLS domains are significantly positively correlated, implying that improvement in one domain is associated with improvement in the other domains and vice versa. Therefore, a low score in Educational and empowerment security will adversely impact the overall HLS index. Health security was the highest index (66.02%) score among the HLS domains in the study, indicating that most people in the selected communities were healthy. This finding is in line with Kumar et al. (2018),

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who found health security as the highest domain in their Study of HLSI of livestock farmers in rural Tamil Nadu.

In addition, according to the findings of this study, all five HLS domains (Food, financial, educational, health, and empowerment) have a positive relationship with Household Livelihood Security Index. This finding is consistent with the results of previous studies that asserted that increased income improves livelihoods and well-being, of which adequate food consumption is a component, such as the studies by Kamaruddin and Samsudin (2014); Kasim et al. (2017); Lim and Mansur (2015) and Unmesh and Narayanan (2015). Therefore, this implies that governments and individuals must focus on enhancing the various HLS domains in the study areas for poverty alleviation.

Fishers' Socioeconomic Factors Influencing Household Livelihood Security

On socio-demographic factors influencing household livelihood security indices, the age of fisher household heads also depicts their years of fishing experience since most fishers in the study areas started fishing at a very tender age. Thus, they acquire various skills and experiences that could positively affect their livelihoods. Thus, the findings align with that of Saleh, Baiquni and Yunus (2016) found age to be an essential determinant of household livelihood security in Gorontalo Regency. Similarly, educational status and household size positively influence household livelihood security. This could be explained by the fact that educational status improves one's access to various complementing livelihoods. If some household members are

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also involved in other economic activities, it will increase household financial security, increasing overall household livelihood security.

According to Shiferaw et al. (2003), the household head's demographic characteristics, such as gender, age, and education, were expected to influence food security positively, while the family size was expected to influence food security (Muluken, 2005) negatively. The findings of this study were in line with that of Shiferaw et al. (2003), in which the age of household heads positively influenced household food security. However, marital status and status of origin of fishers' households were negatively associated with food security in this study. This is because being married translates into an increase in household size and, consequently, increased expenditure on food. According to Babatunde et al. (2007), larger households are more likely to be food insecure than smaller ones. Our findings corroborate with Sekhampu (2013), who found that marital status was negatively associated with household food security in Kwakwatsi, South Africa. However, Ngema, Sibanda and Musemwa (2018) found that marital status though negative was not a significant determinant of household food security in Maphumulo Local Municipality, South Africa.

Similarly, the age of household heads translates into an increase in fishers' experience and perfection of the craft in fishing, and subsequent harvest could explain why age was positively associated with the financial security of fishers. However, ethnicity was negatively associated with financial security. This could be explained by the fact that most fishers in the study areas were migrants from different ethnicities from the locals/natives who did not have landed properties or property housing and lacked alternative

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livelihoods. Consequently, having low financial security, gender, age, and origin of fishers were also negatively associated with empowerment security. The lack of social empowerment programs and the inability of migrants to get social support systems in destination communities could be blamed for the negative influence of the status of origin on empowerment security. However, educational status ensures easy access and understanding of information about one's livelihoods through formal and informal sources. This could explain why the educational status of household heads was a significant positive factor influencing empowerment security. Also, membership in ethnic networks or associations, the ability to obtain support from others in a crisis, the ability to borrow from family and friends, and participation in community concerns could explain why ethnicity positively influences household empowerment. The results parallel Abrar-ul-haq, Jali and Islam (2016), who found gender, social networks, and educational status influence household empowerment in rural Pakistan. Lastly, the educational status of fisher household heads positively influences household education and health security. Better education is linked to stronger perceived personal control (associated with improved health and healthy behaviours), social position, and social support (Bharmal et al., 2015). These findings are in parallel with Bharmal et al. (2015), who found educational status is positively associated with health.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This chapter summarises the study's main findings based on the research questions and objectives. The observations, reviewed literature, and theories are used to derive additional inferences. It also suggests improving fishers' migration as a livelihood adaptation strategy, its effects on estuarine ecosystems, and the sustainable management of estuaries along Ghana's coast for policymakers and other stakeholders. The chapter concludes with proposed areas for additional research.

Summary

Livelihood activities are critical to sustainable development, and any threat to livelihoods, particularly the poor, threatens sustainable development. Most of the world's population is the rural poor who depend on natural resources for their livelihood. Thus, uncertainty about sustainable livelihoods has become a critical issue of concern at all levels because it sometimes leads to migration, particularly among fishers and its associated problems. Coastal areas provide many vital ecosystem services, such as the storage of nutrients, high biodiversity, and climate regulation. They reduce pollution and serve as habitats for marine fish. Estuaries are among the most productive coastal ecosystems; they serve as attractive destination grounds for many fishers.

According to the National Geographic Society, several cities have developed around estuaries, including Jakarta, Indonesia, New York City, New York; and Tokyo, Japan. However, coastal ecosystems are characterized by significant periodic species variations at fluctuating time-based and spatial

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scales. Numerous marine fish species move over large temporal and spatial scales coupled with increasing coastal population over-exploitation and coastal erosion, among others threatening the livelihoods of coastal people/fishers. The livelihood of fishers is further worsened by the effects of climate change on fisheries characteristics, and it stated that the existence, growth and distribution of individual fish species are adversely influenced by climate change. Therefore, an important part of the fishing profession is migration which is seen as a livelihood adaptation to a dynamic situation rather than a response to degrading conditions. Thus, migration in pursuit of better livelihoods is a vital component of human history. Though migration could be a positive livelihood strategy among fishers, the increasing flow of migrants can put additional pressure on resources in destination areas and threaten the livelihoods of sending and receiving area inhabitants. In addition, migration threatens the earth's rich biodiversity, particularly wetlands, as a rapid unforeseen increase in population growth resulting from increasing pressures on the natural resources and thereby contributes to unforeseen negative impacts on coastal resources, particularly estuaries. Several studies have investigated the migration patterns of fishers in Ghana.

Nevertheless, these studies rarely look at internal migration. Much focus is on Ghanaian fishers' international migration patterns, representing a small fraction of fishers' migration since internal migration is comparably much higher. This study, therefore, seeks to assess the influence of estuarine ecosystems on the migration patterns of fishers and the anthropogenic impacts on the sustainability of the estuaries and the sustainability of migrant fishers' livelihoods for government intervention and policy actions, especially along

the coast, which could further be expanded to look at other forms of migrations in the country. The specific objectives of the study were to

1. To assess the contribution of the estuarine ecosystem on fisher's migratory patterns along the coast

2. To assess the trend of physical changes in estuaries in Ghana

3. To explore community perception of the current state of the estuary.

4. To examine competing interests between migrants and indigenes in the use of the estuarine resources

5. To examine the household livelihoods security of migrants in estuarine communities along the coast.

To achieve the study objectives, a case study design was used and applied to this study to assess the relevance of estuary ecosystems on the livelihood adaptation and migration patterns of the migrants and the anthropogenic pressures on the estuaries along the coast of Ghana.

Multistage sampling was used from a pragmatic perspective to select 652 fishers' household heads for the study. Three data collection methods were used in the study. Sampled respondents were interviewed using a structured interview schedule with close-ended and open-ended questions focused on migration and the relevance of the estuary to their livelihood adaptation and anthropogenic activities. For triangulation, focus group discussions (FDG) were held with experience fisher household heads (18+) with knowledge of fisher livelihood adaptations and migration patterns. Key informant interviews were conducted with individuals with in-depth understanding of migration patterns and the importance of estuarine ecosystem goods and services on their

migration trajectory. Chiefs, opinion leaders, and chief fishers who have lived in the community for ten years or more were the key informants.

The data were analyzed using the statistical software STATA 15. The study's findings were presented using both descriptive, inferential statistics and narrative analysis. These were summarized in graphs, tables, figures, regressions, and structural equation modelling.

Major Findings

1. Estuarine communities along the coastline of Ghana have been a significant hotspot for migrant fishers since the 1930s. The dominant migrant fishers' ethnic group along the coast of Ghana were Anlo -Ewes, who migrated from the Volta Region of Ghana. There was a significant strong positive association between ethnicity and migration among fisherfolks with a Cramer's V = 0.71. Thus, indicating ethnicity influences migration in the study areas. Despite the numerous pull factors to estuarine communities, social capital (having relatives from hometown or ethnicity) was the most dominant reason for choosing a destination community, especially among the Anlo Ewes. Among the 652 respondents, the most highly ranked characteristic of the estuary was the river (27%), followed by the open sea (26%). The least rated was the vegetation (5%). Thus, the estuarine/ rivers provide alternative fishing grounds for migrant fisherfolks. Therefore, different ethnic groups prefer and value these unique features differently, indicating a relationship between ethnicity and preference for unique features of the estuary.

2. For research objective 2: The findings showed that over time, settlements and bare land in Anlo Beach (Pra Estuary) (13.7%) and Ankobra (Ankobra Estuary) (18.8%%) had been submerged by coastal flooding and

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erosion. In addition, it was noted that anthropogenic activities in the neighbourhood, coastal flooding, and erosion all contributed to a decrease in the vegetation area near the Ankobra Estuary (12.6%) and Kewunor (Volta Estuary) (42.8%). However, mangrove reforestation efforts at Anlo Beach (Pra Estuary) increased the vegetation area (10.8%). It was discovered that the sustainable management of Ghana's coastal estuaries could be impacted by various human activities, both directly and indirectly. Deforestation, sand winning, and indiscriminate waste disposal were mentioned by about a third of the 476 household heads who were interviewed as human activities that have affected the degradation and change in LULC near estuaries; small-scale mining and sand winning were mentioned as the main human activities by about 20% of respondents. Less than 10% of respondents identified overfishing as a human activity influencing the LULC change in the estuaries and impacting the estuary itself.

3. On community perceptions of estuary degradation and causes, the study revealed fishers' perceptions of estuarine degradation. Iture (79%), Ankobra (80%), Anlo Beach (96%), Faana (54%) and Kewunor (96%) fisherfolk said their estuaries were degraded. Most Anlo Beach fishers (54%) blamed the estuary's location change from Shama to Anlo Beach for the estuary's degradation. In Faana, 23% of fishers blamed poor estuary use and management for degradation. 52% of Ankobra fishers said illegal mining upstream (Galamsey) degraded the estuary. 33% of Iture fishers cited natural causes of degradation. The logistics regression found that fishing gear, sanctions, and experience negatively influence the degradation of Ghana's estuaries.

4. All study communities' fishers had clear, equal, and fair access to estuaries. Only in Iture and Ankobra did respondents say migrants and natives never fought over the estuary. Iture and Ankobra fishers have some conflicts, but they're mostly about the sea. Anlo Beach, Faana, and Kewunor were different. Respondents have seen conflicts between migrants and natives or migrants and migrants over the estuary. Faana was worse. Fifty-six percent (56%) of respondents indicated competing for estuary interests, while in Kewunor only 29% did. Fifty-three percent (53%) of Anlo Beach residents say the conflict happened in the 1980s and 1990s, while 7% say the 1960s and 1970s. Eighty percent (80%) of Faana respondents said disputes occurred between 2011 and 2021. In Kewunor, 80% agreed the conflict period was 2011-2021. Therefore, three findings emerge from our investigation. One of the biggest reasons for conflict among estuarine communities over the usage of the estuary was the presence of migrant fishermen, both permanent and temporary (light fishers). Second, in the research locations, the employment of destructive fishing gears such as beach seine at the estuary, improper net size, and destructive fishing tactics such as light fishing and chemical fishing were the leading causes of conflict. Third, the community's fishery conflict over estuary use was addressed through conflict resolution strategies such as open confrontation, arbitration, avoidance, and mediation. However, most parties engaged found these unsatisfactory because the source of the problem seemed to be recurring.

5. The overall household livelihood security index was 67% (0.67), indicating a medium household livelihood security index. With medium scores for food (61.82%), financial (60.38%), and health security (66%). Educational

Security (46.85%) and Empowerment Security (38.07%) were low overall. However, each community's index scores varied. This study tested five hypotheses using path coefficients, covariance, individual contribution (effect size), and predictive weight. The path-coefficient assessment used bootstrapping (hypothesis testing). Path-coefficient analysis revealed directional hypotheses (hypothesis testing). Empowerment, food, and financial securities hypotheses were statistically and positively significant, supporting the claim that, Empowerment Security, Food Security, and Financial Security, are strongly associated with Household Livelihood Security. Gender, marital status, age, educational status, household size, and origin status were significant socio-demographic factors influencing the overall livelihood security of fishers in migrant estuarine communities along Ghana's coast. Ethnicity wasn't a factor.

Conclusions

From the above major finding, it can be concluded that:

Estuaries have contributed to some Ghanaian fishermen's migration patterns. Most migrant fishers in Ghana's estuarine communities are Anlo-Ewes from the Volta Region. Easy access to the river, sea, land, and ethnicity draws migrant fisherfolk to estuarine communities, boosting harvests and incomes.

Growing coastal populations and in-migration have led to the deterioration of many coastal ecosystems, especially estuaries, through anthropogenic changes in LULC. Overfishing, habitat fragmentation, and degradation have harmed Ghana's estuaries' ability to breed aquatic organisms.

These LULC changes explain migration's impact on long-term resource management and estuarine community survival.

Fishers in Ghana's estuary communities unanimously stated that estuaries are now degraded as most of their favoured fish species were extinct, or few coupled with excessive turbidity. The type of fishing gear, Sanctions and Experience in fishing have a considerable harmful impact on the degradation of estuaries along Ghana's coast.

The study concludes that most of the estuaries along Ghana's coast are mismanaged, resulting in user conflict. Despite the several causes of conflict, the study concluded access to fishing areas, illegal fishing, migrant fishers, and artificial breaching of the estuary's mouth caused the most conflict. From the study, the overall household livelihood security index was 67% (0.67), indicating a medium household livelihood security for the estuarine communities along the coast of Ghana.

Recommendations

1. The results show estuaries contribution to migration patterns of fishers along the coast of Ghana, with social capital playing a vital role in the choice of destination estuarine community, particularly among the Anlo Ewes, who were the dominant migrant group along the coast of Ghana. A positive association between ethnicity and preference for unique features of the estuary shows the important role culture plays in the value and use of ecosystem goods and services. Thus. the inclusion of migrant fishers in regional fisheries management policies is crucial for effective fisheries management in Ghana. Local, regional and national authorities have the opportunity to utilize current institutions to incorporate socioeconomic and environmental considerations

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that influence the migration patterns of these fishers. This approach will also help mitigate any potential negative effects of the migrants' activities on the natural resources.

2. To prevent conflicts in the use of coastal resources, especially estuaries, it necessitates an integrated resource management system that addresses co-management by both migrants and locals. Thus, the government and stakeholders should promote integrated watershed management in Ghana by implementing laws, regulations, sanctions, and revising access procedures to ensure peaceful coexistence among fishers. Furthermore, it is imperative to provide education to both migrant and native fishers regarding strategies for harmonious coexistence and peaceful resolution of conflicts. Additionally, educating them about the vital role of the estuaries for their livelihoods, the entire community, and the fisheries sector as a whole is crucial in fostering coexistence and effective management of the estuaries along Ghana's coast.

3. Similarly, the MMDAs should help alleviate some of the push factors of migration, such as coastal flooding and related disasters reported yearly, by building seas defence and providing alternative livelihood opportunities to reduce out-migration, especially from the Volta region of Ghana.

4. Our finding provides relevant insight and literature to migration governance institutions and policymakers such as the Ministry of Interior, and the Immigration Services, among others, in the quest to achieve SDG10.7 on facilitating orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well- managed migration policies in Ghana. Despite the existence of a National Migration Policy in Ghana, its implementation has not been effectively decentralized to

the MMDAs. Consequently, migration is not given high priority by the MMDAs as it is perceived as a national issue. To ensure effective migration governance, the study suggests an effective collaboration and coordination among various actors, resources, and practices that regulate all forms of migration, including fishers' migration (both international and internal) for sustainable development.

5. The study points out anthropogenic cause and factors influencing the degradation of estuaries including illegal fishing and galamsey activities happening up streams. These activities have resulted in the release of harmful chemical such as mercury and causing excessive turbidity of the water which have adverse effects on estuaries and the function they play. The research recommends that a successful execution and implementation of mining regulations and monitoring of mining operations can be achieved through a productive collaboration among all relevant stakeholders. This will aid in mitigating the negative effects of illegal mining on the major rivers along the Ghanaian coast that are essential for sustaining estuaries.

6. The issue of rural livelihoods and poverty reduction remains a multifaceted challenge, particularly in fishing communities. To improve the livelihoods of households, it is imperative that government bodies, NGOs, CSOs, and other stakeholders work together to introduce alternative livelihoods and improve access to livelihood assets for fishers. Furthermore, relevant stakeholders should implement measures to enhance education and empowerment securities in fishing communities, both through formal and informal institutions, in order to boost the overall household livelihood security index.

7. There are two significant recommendations that should be emphasized for future research. Firstly, it is crucial to further investigate the ecosystem-based migration in Ghana, focusing on other natural resources that act as pull factors for migration. This can be accomplished by employing the same approach and methodologies used previously or by utilizing a purely qualitative methodology to gain a comprehensive understanding of the role these natural resources play in migration patterns in Ghana and the potential consequences of migration on the sustainability of these resources. Secondly, it is essential to explore the push factors at the places of origin and the impact of migration on these areas, particularly in the volta region where the majority of fisher migration originates from.
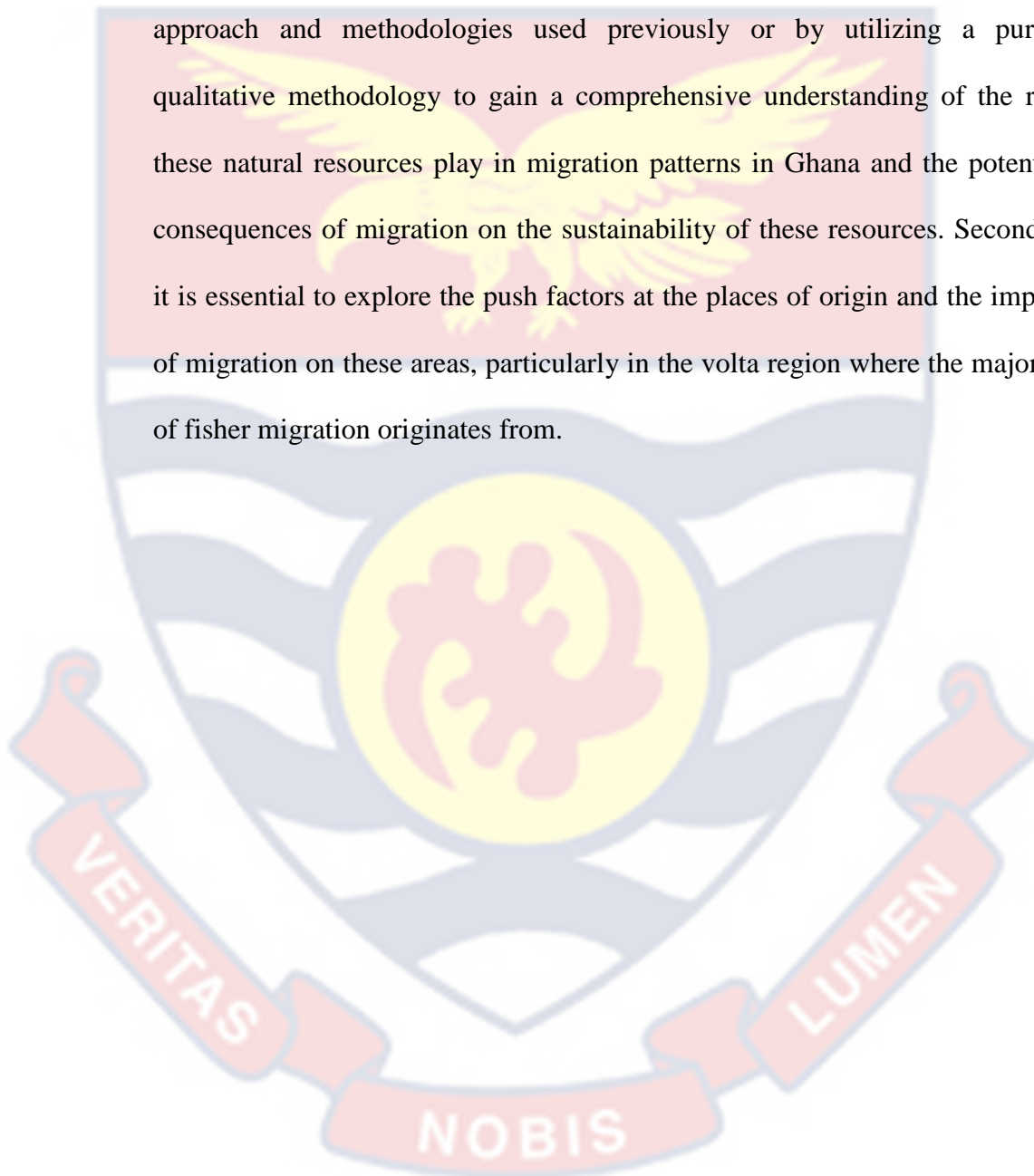
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APPENDICES

Appendix A: Structured Interview Schedule for Migrant Fishers

To the respondent*: This questionnaire is meant to solicit information on Livelihood Adaptations and Migration: A case of selected estuarine communities along the coast of Ghana. The information being solicited is purely for a PhD thesis and not for any financial gains. The researcher is a student at the University of Cape Coast, Ghana. Information provided by respondents will be treated confidentially by not revealing the identity of respondents. You are, therefore, urged to feel free and provide the data being asked for. Thank you in anticipation of your cooperation.*

Community…………………

Date

Questionnaire No. …………….

Initials of Interviewer…………………………

Instruction: Please fill-in or select the appropriate answer where applicable, for each of the following questions.

1.	Sex of the household head: (a) Male (b) [ ] Female [ ]
2.	Age of the household head (in years)
3.	Marital status: (a) Married [ ] (b) Single [ ] (c) Divorced [ ] (d) Widowed [ ] (e) Other (Specify)...
4.	Educational Status (a) Primary [ ] (b) Secondary/Technical/Vocational [ ] (c) Tertiary [ ] (d) No formal education [ ] (f) Other specify..
5.	Respondent household size:
6.	Which ethnic group do you belong to?

	(a) Anlo Ewe (b) Fante (c) Ga (d) Others please specify………………………………
7.	Respondent number of years of experience in fishing ………………
8.	Are you a member of any fisher association/group? (a)Yes [ ] (b) No [ ]
9.	If yes, what is the name of your fishers Organization/group?..........................
10.	What is your primary occupation? (a) Fishing [ ] (b) farming [ ] (c) Trading [ ] (d) Hair Dressing (e) Fish mongering (f) Others (specify)..
11.	If fishing what type of fishing gears do you use? (a) Beach Seine (b) Purse Seine (c) Set Gill Net (d) Hook and Line (e) Traps (f) Others specify
12.	How many days do you go for fishing in a week?
13.	How many buckets of fish do you get from each trip?
14.	How much is a bucket of fish in this community?……… ………….
15.	What is your average household income per month? (a) 50 – 100 (b) 150 – 200 (c) 250 – 300 (d) 350 – 400 (e) 500+
	To assess the influence of estuarine ecosystem on fishers migratory patterns along the coast
16.	Were you born and bred in this community? If yes, were did your parents originate from in Ghana
17.	If no, where did you migrate from …………………
18.	Is your place of origin an estuary community? (a) Yes (b) No

	If yes, what was your main livelihood activity in that community?..
19.	Why did you migrate? (a) Environmental reasons (b) economic reason (c) social reasons (d) All the above (e) Others specify………………………….
20.	Which year did you settle in this community?...........................
21.	What specific characteristic of the estuary influenced your choice of destination? (a) Availability of fresh water for domestic purposes………………… (b) Access to the sea for …fishing……………… (c) Access to land (d) Others please specify……………………… What characteristics of this community motivated you to migrate to this community?
22.	Which ecosystem goods or services are unique to the estuary?
23.	Do you have any special attachment to estuaries (a) yes [ ] (b) No [ ] If Yes, what are the special attachments…………………………
24.	What are the procedures involved in settling in this community? (a) ………………………………… (b) ………………………………… (C)………………………………………. (D) …………………………………………
25.	What are the procedures to follow before fishing in this community? (a) …………………………………………………………… (b) …………………………………………………………… (c) …………………………………………………………… (d) ……………………………………………………………
26.	Are the procedures fair to migrants? (a) Yes [ ] (b) No [ ]
27.	Explain your answer: ………………………………
28.	What challenges do you have with the procedure to follow before fishing? (a) ……………………………………… (b)
29.	Do you think everyone follows the procedure? (a) Yes [ ] (b) No [ ]
30.	Explain your answer…………………………

31.	What are the ethnic groups currently using the estuary? (a) ………………………………………….. (b) ………………………………………….. (c) …………………………………………. (d) ………………………………………… (e) ……………………..
32.	Do you have intensions for future migration? (a) Yes [ ] (b) No [ ] If yes why………………………………………
	Explore community perception of the current state of the estuary.
33.	What are the preferred fish species from the estuary?..
34.	Do you still find adequate amount of these preferred species in the estuary? (a) Yes [ ] (b) No [ ]
35.	On the average, what quantity of fish were you able to harvest per day when you first came here?
36.	On the average, what quantity of fish do you harvest now?
37.	Do you have an equal and fair access to the estuary? (a) Yes (b) No If no Why?..
38.	What are the regulations pertaining to the use of the estuaries at the national level? A. ………………………………………………………… B. ………………………………………………………… C. ………………………………………………………… D. ………………………………………………………… **At community level** A. ………………………………………………………… B. ………………………………………………………… C. ………………………………………………………… D. ………………………………………………………… **At the association level** A. ………………………………………………………… B. ………………………………………………………… C. ………………………………………………………… D. …………………………………………………………
39.	What sanctions are prescribed for those who bridged the don'ts **at the community level**? A. ………………………………………………………… B. …………………………………………………………

	C. …………………………………………………………… D. …………………………………………………………… E. …………………………………………………………
40.	Are you willing to follow the rules and regulations? (a) Yes [ ] (b) No [ ] If No, Why
41.	Are the regulations fair to both migrants and natives? (a) Yes [ ] (b) No [ ]
42.	How would describe the vegetation cover around the estuary when you came and now?
43.	How would you describe the management of the estuary when you first came into the community and now?
44.	How would you describe the quantities and preferred species of fish when you came compared to now?
45.	Do you think the estuary is Degraded? (a) Yes [ ] (b) No [ ]
46.	If yes, Do you think Migrants have contributed to the degradation of the estuary? (a) Yes [ ] (b) No [ ]
47.	Explain your answer
	To examine competing interests between migrants and indigenes in the use of the estuarine resources.
48.	List the different categories of users of the estuarine resources.
49.	How is relationship among these user groups? (a) Cordial [ ] (b) Hostile [ ]
50.	Rank the natural resources in and around the estuary in order of importance to you? (a) Fresh Water (b) Land (c) Vegetation/ Mangroves (d) Open sea (e) Food (fish)
51.	Which of the resources of the estuary is very competitive in this community? (a) Fresh Water (b) Land (c) Vegetation/ Mangroves (d) Open sea (e) Food (fish)

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52.	Has there been any conflict between migrants and natives of this community for the resources of the estuary? (a). Yes [ ] (b).No [ ] If yes, when did the conflict start?
53.	Which month of the year do most fisher related conflicts occur? (a) January – March (b) April –May (c) June – August (d) September -December
54.	How regular are such the conflicts between migrants and the natives? (a) Frequent [ ] (b) Occasional [ ]
55.	What was the cause of the conflict?..
56.	Are these conflicts related to any event/activity? (a) Yes (b) No
57.	If Yes, Which Event?.........................
58.	How would you typify the intensity of the conflict? (a) Non-violent [ ] (b) violent [ ] (c) Deadly [ ] (d) Other specify……………………………………………….
59.	What conflict management strategy was used? (a) Avoidance [ ] (b) Arbitration [ ] (c) Mediation [ ] (d) Open confrontation [ ] (e) Peaceful settlement [ ] (f) Others specify………………………………………..
60.	Which institutions are involved in the conflict resolution? (a) The community leaders [ ] (b) The traditional council [ ] (c) Local government [ ] (d) Law enforcement agency [ ] (e) Others [ ] specify.....................................
61.	Are you satisfied with the outcome of the resolution process? (a) Very satisfied [ ] (b) Partially satisfied [ ] (c) Dissatisfied [ ] (d) Very satisfied [ ] Explain
62.	Any other comments?

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	To examine the security of livelihoods of migrants in estuarine communities along the coast.
	ECONOMIC SECURITY
63.	What alternative livelihood activity do you engage in? (a) Fishing (b) Farming (c) Fish mongering (d) Petty trading (e) Hair dressing/ dress making. (f) Carpentry (g) Laborer (h) Others specify
64.	How much do you earn from alternative livelihood activity per month?
65.	What livelihood activity is your spouse engaged in? (a) Fishing (b) Farming (c) Fish mongering (d) Petty trading (e) Hair dressing/ dress making (f) Carpentry (g) Laborer Others specify
66.	How much does she earn per month?
67.	Do you have Children? (a) Yes (b) No
68.	Is any of your children who is still living with you working? (a) Yes (b) No
69	If Yes What livelihood activity is he/she engaged in? (a) Fishing (b) Farming (c) Fish mongering (d) Petty trading (e) Hair dressing/ dress making (f) Carpentry (g) Laborer Others specify
70	How much does he/she earn per month?
71	How much money does the household obtain from remittances per month?
72	Who sends remittances to the household?
73	what is the place of origin of the remittances
74	What type of livestock does this household own and how many of each?

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75	Who owns the house you live in? (a) Built myself. . . . . 1 (b) Rented house . . . . 2 (c) Extended family ownership 3
76	What type of house do you live in? (a) Mud house with thatch roofing……..1 (b) Mud house with roofing sheets………2 (c) Cement/block house with roofing sheets …3 (d) Others specify……………………………4
78	Any others economic assets?................. (a) Canoes. . . . . 1 (b) Outboard motors . . . . 2 (c) Nets…………………………………3 (d) Land …………………………….4
79	Do you have saving? (a) Yes [1] (b) No [0]
80	If no, are there reasons for not having savings………………………..
81	If yes, what type of savings does the household have?
82	Do you belong to any village savings and loan groups (VSLA or Susu)?
83	If yes, what amount do you save and the frequency?
84	How satisfied are you with your current financial situation? (a) Fully satisfied (b) Less than satisfied (c) Not satisfied (d) Do not know
85	**HEALTH SECURITY**
86	In the last one year, did you or your family members visit any health Centre for treatment? (a) Yes [1] (b) No [0]
87	If yes, which type of health Centre did you visit? (a) Govt. hospital . . . . 1 (b) Private hospital . . . . 2 (c) Traditional healer…………………………3 (d) Others 4
88	Are you registered on the NHIS? (a) Yes (b) No…….
89	If No why?
90	How many people in the household have NHIS?

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91	Is there a health facility in this village? (c) Yes [1] (a) No [0]
92	If not, where do you get treatment? ………………………………… ………………………………………………………………………… …………………
93	Distance from home to hospital? (km)…..
94	What was the mode of transportation?
95	Do you use herbal Medicine in treating common diseases? (b) Yes [1] (c) No [0]
96	What is your source of drinking water? (a) Pipe/borehole (b) River (c) Well (d) Dugouts (e) Others specify
97	Where do you attend to natures call (Toilet)? (a) Toilet at home (b) Public toilet (c) Open defecation (d) Others specify
98	Are your needed food stuffs available in the local market? (a) Yes [1] (b)No [0]
99	If No why…………
100	Do You easily access the market for food stuff? (a) Yes [ ] (b) No [ ] If no why……
	HOUSEHOLD FOOD SECURITY
101	Over the past six months have your household gone without certain types of food because of the price of food? (a) Yes. . . . . ….... 1 (b) No. . . . . ….... 2
102	If Yes, how often? (a) Once a month (b) Once a week (c) More than once a week but less than everyday of the week

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	(d) Everyday
	(e) I don't know
103	Are you able to manage balance food for all from the family income?
	(a) Fully 1
	(b) Partially 2
	(c) Rarely 3
104	In the past six months do you have enough money to buy food stuff for the family?
	(a) Yes
	(b) No
105	Do your household eat three square meals a day all the time
	(a) Yes [ ]
	(b) No [ ]
	If No why…………………………………
106	Over the past 6 months, did you ever cut the size of your meals or skip meals because there wasn't enough money for food?
	(a) Yes
	(b) No
107	If yes How often?
	(a) Almost every month
	(b) Some months but not all months
	(c) Weekly
	(d) Others specify
108	Over the last six months, did you ever go hungry a whole day because there wasn't enough money for food?
	(a) Yes
	(b) no
109	Do you ensure cleanliness and nutritional quality while preparing food?
	(a) Yes
	(b) no
110	How do you consider the current level of food consumption of your family ?
	(a) More than adequate
	(b) Adequate
	(c) Less than adequate
	(d) I don't know
	EDUCATION SECURITY
110	Are you a literate?
	(a) Yes [ ] 1
	(b) No [ ]. 0
111	If literate, what is the level education?
112	If no, specify the reasons?
	School too far away 1
	Transport facilities not available 2
	Education not considered necessary 3

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	Required for work on owned farms . . . . 4 Required for outside work for payment in cash or kind . . . . .. 5 Costs too much . . . . .6 Required for care of siblings . . . .7 Not interested in studies . . . .8 Early married . . . . … 9 Illness or death of family member……………………..10
113	Availability of schools in the village (a) Primary …………………………. 1 (b) Middle …………………………. .2 (c) Secondary ………………………. 3 (d) Higher secondary ……………….4 (e) Tertiary …………………….......5 (f) Others specify……………………………..
114	Estimated distance from home to school, one way (km)?
115	Are all you children educated/in school? (a) Yes [ ] (b) No [ ]
116	If No why……………………………………….
117	If yes which level are they…………………………………
118	Is your spouse a literate? (a) Yes [1] (d) No [0]
	Empowerment security
119	Do you belong to any group/ society/ club? (a) Yes [ ] (b) No [ ]
120	If yes what is the name and what is the group about?
121	If no why?
122	To you have access to media information? (a) Yes [ ] (b) No [ ]
123	If yes what kind of information do access from the media?
124	What is your preferred source of media information? (a) Radio (b) Television (c) Newspapers (d) Others specify
125	Which other source to you hear information that influence your

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	livelihood activity? (a) Friends (b) Fisher cooperative groups (c) Neighbor (d) All the above (e) Others specify………………………………………………………………… …………
126	Do you trust information from these other sources? (a) Yes [ ] (b) No [ ]
127	If No why?...
128	Have you benefited from any donor (NGO) programmes/ projects in the past? (a) Yes [ ] (b) No [ ]
129	If yes how has that influenced your livelihood activity?
130	What other benefits have you received from it?
131	In your opinion do you think your livelihood is sustainable? (a) Yes [1] (e) No [0] Explain your answer…

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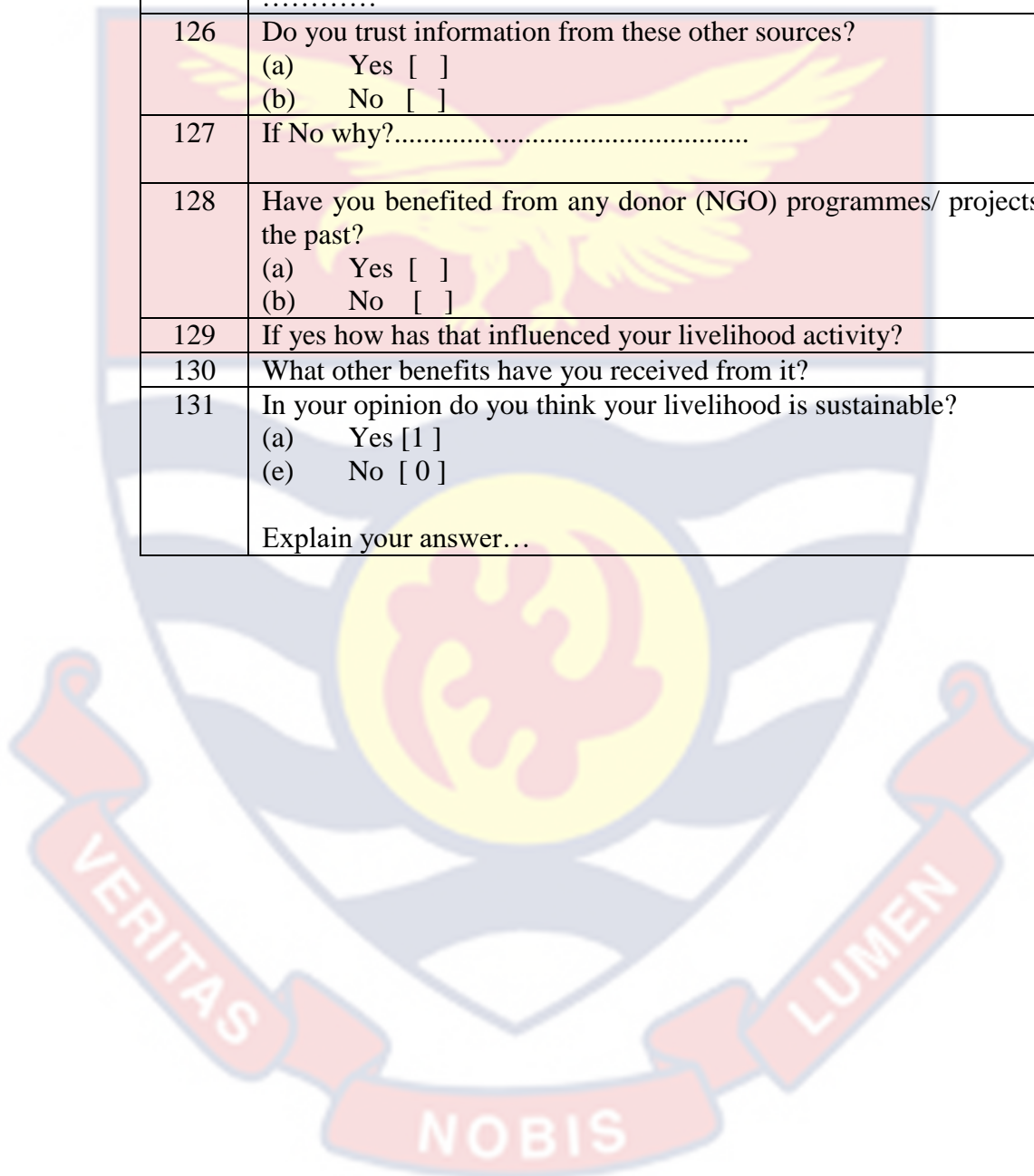
Appendix B: Structured Interview Schedule for Native Fishers

To the respondent*: This questionnaire is meant to solicit information on Livelihood Adaptations and Migration: A case of selected estuarine communities along the coast of Ghana. The information being solicited is purely for a PhD thesis, not for any financial gains. The researcher is a student at the University of Cape Coast, Ghana. Information provided by respondents will be treated confidentially by not revealing the identity of respondents. You are, therefore, urged to feel free and provide the data being asked for. Thank you in anticipation of your cooperation.*

Community……………………………………. Date: …

Questionnaire No. ……   Initials of Interviewer……

Instruction: Please fill-in or select the appropriate answer where applicable, for each of the following questions.	
	Gender of the household head: Male [ ] Female [ ]
	Age of the household head (in years) 16 – 20 21 – 30 31 – 40 41 – 50 51 – 60
	Marital status: (a) Married [ ] (b) Single [ ] (c) Divorced [ ] (d) Widowed [ ] (e) Other (Specify)..
	Educational Status (a) Primary [ ] (b) Secondary [ ] (c) Tertiary [ ] (d) No formal education [ ] (f) Other specify..
	Respondent household size: a. 1-3 b. 4-6 c. 7-10 d. 11-13 e. Others specify…………………………….

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	Respondent's number of years of experience in fishing ………………………………………………………………
	Are you a member of any fisher organization/group? (a)Yes [ ] (b) No [ ]
	If yes, what is the name of your fishers Organization/group?....................
	What is your primary occupation? (a) Fishing [ ] (b) farming [ ] (c) Trading [ ] (d) Others (specify)...
0	Do you have access to credit for production? (a) Yes [ ] (b) No [ ]
1	If Yes, from where?...
2	Do you have access to other forms of support? (a) Yes [ ] (b) No [ ]
3	In what form?………………………………
4	Do you have access to the extension service? (a) Yes [ ] (b) No [ ]
5	Which ethnic group do you belong to? a. Anlo Ewe b. (Fante c. Ga d. Others please specify…………………………
6	What is your average household income per month? a. 50 – 100 b. 150 – 200 c. 250 – 300 d. 350 – 400 e. 500+
	Explore community perception of the current state of the estuary.
7	What are the preferred fish species from the estuary?..
8	Do you still find an adequate amount of these preferred species in the estuary? (a) Yes [ ] (b) No [ ]

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	If no why?...
9	Are there regulations pertaining to the use of the estuary? (a) Yes [ ] (b) No [ ] A.
0	If Yes, what are some of the regulations (don't) pertaining to the use of the estuaries? B. …………………………………………………………… C. …………………………………………………………… D. …………………………………………………………… E. ……………………………………………………………
1	What sanctions are prescribed for those who bridged the don'ts? A. …………………………………………………………… B. …………………………………………………………… C. ……………………………………………………………. D. …………………………………………………………… E. ……………………………………………………………
2	Are you willing to follow the rules and regulations (a) Yes [ ] (b) No [ ] If No, Why …
3	Are the regulations fair to both migrants and natives? (a) Yes [ ] (b) No [ ]
4	Are you happy sharing the estuary with migrants? (a) Yes [ ] (b) No [ ]
5	If no Why …
6	How many years have you being fishing in the estuary? ……
	To examine competing interests between migrants and indigenes in the use of the estuarine resources. **CAUSES OF FISHER CONFLICT**
7	How is your relationship with the natives of the community? (a) Cordial [ ] (b) Hostile [ ]
8	Is there equal and fair access to the use of the estuary and other resources by all in the community? (a). Yes [ ]

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	(b). No [ ] If no, Why………………………………………………………..
9	Has there been any conflict between migrants and natives of this community? (a). Yes [ ] (b).No [ ] If yes, when did the conflict start? ....
0	How regular is the conflict between migrants and the natives? (a) Frequent [ ] (b) Occasional [ ]
1	What was the cause of the conflict?..
2	Were you personally involved? (a). Yes [ ] (b). No [ ]
	EFFECTS OF CONFLICT
3	How would you typify the intensity of the conflict (a) Non-violent [ ] (b) Low intensity [ ] (c) High intensity [ ] (d) Other specify……………………………………………….
4	Were there weapons involved in the conflict? (a) No [ ] (b) Yes [ ] If yes, what type of weapons specify..
5	What are/were the other economic effects of the conflict on your livelihood? (a) Decrease income [ ] (b) Insecurity [ ] (c) Inability to pay loans [ ] (d) Inability to participate in local market [ ] (e) Lost of livelihood activities [ ] (f) Others specify………………………………………………………..
6	How did the relationship affect your livelihood?....................................
7	Did the conflict affect your children's education? (a) Yes [ ] (b) No [ ] If yes, to what extent?
8	Have you experienced damage as a result of the conflict? (a) Emotional [ ] (b) Financial [ ]

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	(c) Physical (to your health) [ ] (d) Social [ ] (e) Other..
9	Have you witnessed any physical harm as a result of the conflict? (a) Yes [ ] (b) No [ ]
0	Who was/ were involved?
1	What form was it? (a) Death [ ] (b) Injury [ ] (c) Rape [ ] (d) Others, Specify…………………
2	Do you feel insecure living in this community? (a) No [ ] (b) Yes [ ]
3	If No, do you have plans for future migration? (a) No [ ] (b) Yes [ ] If yes, to where?...............
	CONFLICT MANAGEMENT
4	What conflict management strategy was used? (a) Avoidance [ ] (b) Arbitration [ ] (c) Mediation [ ] (d) Open confrontation [ ] (e) Peaceful settlement [ ] (f) Others specify………
5	Where do you report the conflicts when they occur? (a) Police station [ ] (b) The traditional ruler [ ] (c) The community leader [ ] (d) Others specify…………………………………………………..
6	Which institutions are involved in the conflict resolution? (a) The community leaders [ ] (b) The traditional council [ ] (c) Local government [ ] (d) Law enforcement agency [ ] (e) Others [ ] specify.............
7	Do you receive compensation for the damages caused? (a) Yes [ ] (b) No [ ]
	If yes, what form did it take?

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8	(a) Financial [ ] (b) physical (gears) [ ] (c) Other [ ] specify................
9	What normally is the outcome of the resolution?....................
0	Are you satisfied with the outcome of the resolution process? (a) Very satisfied [ ] (b) Partially satisfied [ ] (c) Dissatisfied [ ] (d) Very satisfied [ ] Explain......................
1	Has the conflict completely been resolved? (a) Yes [ ] (b) No [ ] If no what measures should be put in place to ensure that the conflict does not occur again? ………………
2	How would you assess the roles played by the following institutions? a. The traditional council............. b. The local police service........ c. The local government...............
3	Any other comments? ....
	To examine the livelihoods of migrants in estuarine communities along the coast.
	ECONOMIC SECURITY
4	What is the average household income from all the sources of income per month?
5	How much money does the household obtain from remittances per month?
6	Who sends remittances to the household?.......
7	From where are remittances sent?
8	What type of livestock does this household own and how many of each?
9	Who owns the house you live in? a. Own alone . . . . 1 b. Owns jointly . . . . 2 c. Doesn't own 3
0	What type of house do you live in? a. Mud house with thatch roofing……..1 b. Mud house with roofing sheets………2 c. Cement/block house with roofing sheets …3

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	d. Others specify……………………………..4
1	Any others economic assets?.. Own alone . 1 Owns jointly . . . . 2 Doesn't own………………………………3
2	Do you have any alternative livelihood activity? (a) Yes [ ] (b) No [ ] If yes, how much do you earn from it monthly………………………….
3	Have you ever benefited from any government subsidies in the past 5 years? a. Yes [ ] b. No [ ]
4	Do you have saving? (a) Yes [ ] (b) No [ ]
5	If no, are there reasons for not having savings………………………..
6	If yes, what type of savings does the household have?
	HEALTH SECURITY
7	In the last one year, did you or your family members visit any health Centre for treatment? a. Yes [ ] . . . . 1 b. No [ ]. 0
8	If yes, which type of health Centre did you visit? a. Govt. hospital . . . . 1 b. Private hospital . . . . 2 c. Traditional healer…………………………..3 d. Others 4
9	The nature of disease identified if any? ………………………………………….
0	Is there a health facility in this village? a. Yes . . . . 1 b. No 0
1	If not, where do you get treatment?
2	Distance from home to hospital? (km)…..
3	What was the mode of transportation?
4	What is the cost of transportation?
	What was the cost of buying the medicines?

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6	Are you aware of HIV/AIDS and the method of controlling AIDS? a. Yes [ ] . . . . 1 b. No [ ] 0
7	Are you aware of the polio treatments and its importance to child health? a. Yes [ ] . . . . 1 b. No [ ] 0
8	How many children in your family had polio treatment?
9	Is anyone in your family suffering from diseases-Influenza, Asthma, and Cough etc. and Special Diseases? (T.B., Heart related, Diabetes etc.) (a) Yes [ ] (b) No [ ]
0	Has anybody suffered from epidemic disease in family during last five year? a. Fully . . . . 1 b. Partially . . . . 2 c. Rarely 3
1	Do you use indigenous herbals in treating common diseases? a. Fully . . . . 1 b. Partially . . . . 2 c. Rarely 3
2	Do you get access to clean drinking water? (a) Yes [ ] (b) No [ ] If No why……………………………………………………………
3	Do you have access to sanitation facilities such as Toilet facilities? (a) Yes [ ] (b) No [ ] If no where do you go………………………………………….
	HOUSEHOLD FOOD SECURITY
4	Do you get the required food items easily? a. Fully . . . . 1 b. Partially . . . . 2 c. Rarely 3
5	Do you always get good quality of food? a. Fully . . . . 1 b. Partially . . . . 2 c. Rarely 3
6	Are you able to manage balance food for all from the family income? a. Fully 1

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	b. Partially 2
	c. Rarely . . . .….... 3
7	Do you make available the fruits, milk, non-veg. items, Green vegetables etc in family food throughout the year? a. Fully . . . . ….... 1 b. Partially . . . . 2 c. Rarely . . . .….... 3
8	Do your household eat three square meals a day all the time (a) Yes [ ] (b) No [ ] If No why……………………………………
9	Do you ensure cleanliness and nutritional quality while preparing food? a. Fully . . . . …….... 1 b. Partially . . . . 2 c. Rarely . . . .….... 3
	EDUCATION SECURITY
0	Are you a literate? a. Yes [ ] . . . . 1 b. No [ ]. 0
1	If literate, what is the level education?
2	If no, specify the reasons? School too far away . . . . 1 Transport facilities not available . . . . 2 Education not considered necessary . . . . … 3 Required for work on owned farms . . . . 4 Required for outside work for payment in cash or kind . . . .. 5 Costs too much . . . . .6 Required for care of siblings . . . .7 Not interested in studies . . . .8 Early married . . . . … 9 Illness or death of family member……………………………10
3	Availability of schools in the village a. Primary ……………………… 1 b. Middle ……………………….2 c. Secondary ………………… 3 d. Higher secondary ……………. .4 e. Tertiary ……………………......5 f. Others specify………………………..
4	Distance from home to school, one way (km)?
5	Are all you children educated? a. Yes [ ] b. No [ ]

6	If No why………………………………………
7	If yes which level are they………………………………
	Empowerment security
8	Do you belong to any group/ society/ club? a. Yes [ ] b. No [ ]
9	If yes what is the name and what is the group about?
00	If no why?
01	To you have access to media information? a. Yes [ ] b. No [ ]
02	If yes what kind of information do access from the media?
03	What is your preferred source of media information? a. Radio b. Television c. Newspapers d. Others specify
04	Which other source to you hear information that influence your livelihood activity? a. Friends b. Fisher cooperative groups c. Neighbor d. All the above e. Others specify………………………………………………
05	Do you trust information from these other sources? a. Yes [ ] b. No [ ]
06	If No why?...
07	Have you benefited from any donor (NGO) programmes/ projects in the past? a. Yes [ ] b. No [ ]
08	If yes how has that influenced your livelihood activity?
09	What other benefits have you received from it?

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Appendix C: Focus Group Discussion Guide for Migrant Fishers

To the respondent*: This questionnaire is meant to solicit information on Livelihood Adaptations and Migration: A case of selected estuarine communities along the coast of Ghana. The information being solicited is purely for a PhD thesis and not for any financial gains. The researcher is a student at the University of Cape Coast, Ghana. Information provided by respondents will be treated confidentially by not revealing the identity of respondents. Therefore, you are urged to feel free to provide the data being asked for. Thank you in anticipation of your cooperation.*

To assess the influence of the estuarine ecosystem on fishers' migratory patterns along the coast

Why did you migrate from your various communities?

Did you settle anywhere before arriving in this community, and why leave those communities?

Why did you settle in this community?

Did the estuary influence your choice of destination community?

What characteristics of the estuary are of much value to you when prioritizing the unique characteristic of the estuary

What are the procedures to follow before settling in this community?

What is your opinion about the procedures?

What are the procedures to follow before fishing in the estuary?

To explore community perception of the current state of the estuary.

What is your perception of the current state of the estuary?

Have you observed any changes in the estuary over the years?

What are the rules pertaining to the use of the estuary?

What are the sanctions for breaking the rules?

Describe instances where you thought there was/wasn't equality and fairness in enforcing the rules.

What were the common preferred fish species from the estuary when you first arrived in the community?

Do you still harvest an adequate amount of these fish species?

What are the reasons for the increase/decrease in the harvested species?

What are some of the anthropogenic activities that adversely affect the estuary?

In your opinion, how can we manage and conserve the estuary for sustainable use?

To examine competing interests between migrants and indigenes in the use of the estuarine resources

Is there any conflict between fisher migrants and natives in using the estuary?

Give narrations of the conflicting issues and how it was resolved

Have you witnessed any intra-indigenes conflicts over the estuary? Give an account of what happened.

Have there been any intra-migrant conflicts in the use of the estuary? What happened, and how was it resolved?

How did the conflict impact your livelihoods?

Do you feel accepted and fairly treated in this community?

Do you have intentions of future migration?

To examine the livelihoods of migrants in estuarine communities along the coast.

Do you think migration is a good livelihood adaptation strategy? Explain your answer?

Do you think generally the livelihoods of migrants have improved through migration, and how?

Appendix D: Focus Group Discussion Guide for Natives Fishers

To the respondent: This questionnaire is meant to solicit information on *Livelihood Adaptations and Migration: A case of selected estuarine communities along the coast of Ghana. The information being solicited is purely for a PhD thesis, not for any financial gains. The researcher is a student at the University of Cape Coast, Ghana. Information provided by respondents will be treated confidentially by not revealing the identity of respondents. Therefore, you are urged to feel free to provide the data being asked for. Thank you in anticipation of your cooperation.*

To assess the influence of the estuarine ecosystem on fishers migratory patterns along the coast

Why do you think people come to settle in your community?

What role does the estuary play in attracting people to your community?

Do you think the migrants place the same value on the estuary as you do?

What are the procedures to follow before settling in this community?

What is your opinion about the procedures?

What are the procedures to follow before fishing in the estuary?

Do all migrants follow these procedures?

To explore community perception of the current state of the estuary.

What is your perception of the current state of the estuary?

Have you observed any changes in the estuary over the years?

What are the rules pertaining to the use of the estuary?

What are the sanctions for breaking the rules?

Is there equality and fairness in the enforcement of the rules?

What were the common preferred species of fish from the estuary?

Do you still harvest an adequate amount of these fish species?

What are the reasons for the increase/decrease in the harvested species?

What are some of the anthropogenic activities that adversely affect the estuary?

In your opinion, how do we manage and conserve the estuary for sustainable use?

To examine competing interests between migrants and indigenes in the use of the estuarine resources

Is there any conflict between migrants and natives in using the estuary?

Give narrations of the conflicting issues and how it was resolved

Have you witnessed any intra-indigenes conflicts over the estuary? Give an account of what happened.

Have there been any intra-migrant conflicts in the use of the estuary? What happened, and how was it resolved?

Are migrants still coming to this community?

Do you have intentions of future migration?

To examine the livelihoods of migrants in estuarine communities along the coast.

Do you think the livelihoods of natives are generally better than migrants and how?

Appendix E: Key Informant Interview Guide

To the respondent*: This questionnaire is meant to solicit information on Livelihood Adaptations and Migration: A case of selected estuarine communities along the coast of Ghana. The information being solicited is purely for a PhD thesis, not for any financial gains. The researcher is a student at the University of Cape Coast, Ghana. Information provided by respondents will be treated confidentially by not revealing the identity of respondents. Therefore, you are urged to feel free to provide the data being asked for. Thank you in anticipation of your cooperation.*

Community…………

 Date: ……………………………………

Questionnaire No. …………….

Initials of Interviewer…………………………

1. How long have you lived in this community and held your position?
2. What is your opinion about fisher-related migration for livelihood adaptation?
3. What period did this community witness a major influx of fisher migrants?
4. What influence does the estuary have on migration patterns and why?
5. What is your opinion about the current state of the estuary and why?
6. Do you think migrants have a role to play in the state of the estuary?
7. Are there procedures, roles and sanctions pertaining to the use of the estuary?

  (please explain with evidence and examples)
8. What are the challenges you encounter in enforcing these roles and sanctions
9. What anthropogenic activities are degrading the estuary?
10. Do you think the estuary in its current state would continue to support fishers' livelihoods soon and why?
11. What measures should be implemented to conserve and sustain the estuary?
12. Have there been conflicts between migrants and natives over the use of the estuary
13. Give an account of the most serious conflict you have experienced and how it was resolved?
14. Are the livelihood of migrants improved, unchanged or deteriorating? Give examples and evidence for your answer
15. Please, do you have anything to say?