A Dissertation for the degree of Ph.D. in Geography

Impacts of Overfishing and the Petroleum Industry on the Livelihoods of Fisherfolk in the Western Region of Ghana

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Abstract

This study is concerned with how overfishing and the petroleum industry has affected the livelihoods of small-scale fisherfolk in the coastal communities of Western Region. It investigates the interaction between formal and informal actors in the fisheries and the petroleum sector and the ways in which these actors influence or shape the livelihood adaptation strategies deployed by coastal fisherfolk.

A mixed- methods approach made up of 400 fisherfolk households survey and 42 interviews with stakeholders in the fisheries and the petroleum industries were conducted.. The surveys and interviews were conducted between December 2018 and April 2019 in Ghana. A total of 400 households survey was conducted in Shama (Apo & Bentsir), Nzema East (Axim), Ahanta West (Discove & Akwidaa) and in the (Sekondi-Takoradi Metropolis) Sekondi & New Takoradi.

Respondents for the survey and interviews were selected through snowballing and purposive sampling techniques respectively. The questionnaire included closed, open and multiple-choice questions. The closed ended and multiple choice questions permitted respondents to select specific choice of answers while the open ended questions offered the respondents the opportunity to freely talk about their experiences and knowledge related to the local fishing industry and other relevant issues concerning the marine conservation. The statistical package for social scientist IBM SPSS Version 21.0 and Excel spreadsheet were used to analyze the results from the household surveys. The results from the interviews were translated and transcribed where applicable and organized into relevant thematic themes.

The survey results coupled with the knowledge obtained from interviews shows that fisherfolk in the Western Region of Ghana are under high levels of socioeconomic vulnerability because of decrease fish catch and declining small-scale fisheries opportunities.

Decreased fish catch and low income were found to be the main impact of overfishing on fisherfolk livelihoods. The spatial restriction of fisher's mobility offshore, the destruction and confiscation of fishing gear, the presence of seaweed in the ocean, and the lack of land opportunities are some of the key petroleum industry-induced stressors on fisheries livelihoods. The combined effects of overfishing and oil and gas activities has resulted in decreased fishing space at sea, limited land ownership and farming opportunities and destruction of marine ecosystem. Overall, the natural, financial, human and physical capital were find to be the most impacted by overfishing and the petroleum industry.

Fisherfolk and local fisheries leaders had different perceptions regarding the ecological effectiveness of closed seasons. The survey results coupled with the knowledge obtained from interviews suggest that fisherfolk prefer the state to enforce the laws on illegal fishing rather than the implementation of closed season. The conflicting perceptions appear to be a result of fisherfolk perceived impact of closed season on their financial, cultural and natural capital as well as their level of participation and perceived influence in decision-making leading to the introduction of the closed season. Overall, two different discursive positions were established with respect to the closed season. An open access fisheries narrative together with strict enforcement of fisheries laws and seasonal closures supported by conservation discourses. The open access argument from the fisherfolk to continue fishing were found to be weak compared to the powerful and dominant scientific conservation narratives by the state and the NGOs.

The conflict produced between the local fishers and the petroleum industry occurs at strategic spatial areas at sea (buffer zones -500&1000m radius) around oil fields offshore. These areas are considered ecologically fertile grounds for fisheries and holds considerable oil and gas reserves. On the one hand local fishers seeks to maintain long term access to fertile fishing grounds around the oil fields. On the other hand, oil and gas companies also wants to keep oil reserves in the same seabed to maintain oil exploration and production.

The marine spatial mobility livelihood strategies deployed by the local fisherfolk could be described as a short-term coping strategies. Illegal light fishing and other destructive fishing methods such as the use of chemicals is on the increase and are more prevalent among fisherfolk in the Western Region. The various in situ marine-based adaptation strategies deployed by fisherfolk, especially illegal light fishing and fishing around oil rigs, are unsustainable and are counterproductive in the rebuilding of depleted marine fish stocks.

The integration of the sustainable livelihoods approach and an actor-oriented approach derived from political ecology served as an important analytical package to understand the current coastal vulnerabilities and adaptation strategies as well as the opposing discourses over the rebuilding of marine resources.

Keyword : Small-scale fisheries, overfishing, oil extraction, sustainable livelihoods, political ecology, Ghana.
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Abbreviations

AZ: Advisory Zone

CBFMC: Community Based Fisheries Management Committees

CSR: Corporate Social Responsibility

DDT : Dichlorodiphenyltrichloroethane

EZ: Exclusive Zone

EEZ: Exclusive Economic Zone

EIA : Environmental Impact Assessment

EPA: Environmental Protection Agency

FAO : Food and Agriculture Organization

FEU: Fisheries Enforcement Unit

FIA: Fisheries Impact Assessment

FoN: Friends of the Nation

FPSO: Floating Production Storage and Offloading

GDP: Gross Domestic Product

GLSS : Ghana Living Standard Survey

GNCFC: Ghana National Canoe Fishermen Council

GNPC: Ghana National Petroleum Corporation

GSS : Ghana Statistical Service

IUU: Illegal Unreported and Unregulated

LI: Legislative Instrument

MCSD : Monitoring Control and Surveillance Division

MFRD: Marine Fisheries Research Division

MoFAD: Ministry of Fisheries and Aquaculture Development

NGO : Non-governmental organization

NAFPTA: National Fish Processors and Traders Association

P.E. : Political Ecology.

PNDC : Provisional National Defence Council

SAPs : Structural Adjustment Programme

SLA: Sustainable Livelihood Approach

SFMP : Sustainable Fisheries Management Programme

SDGs :Sustainable Development Goals

SEZ: Safety Exclusive Zone

TEN: Tweneboa Enyenra and Ntomme

UNCLOS: United Nations Convention on the Law of the Sea

USAID : United States Agency for International Development

Chapter 1. Introduction

1.1. Study Background

According to the Food and Agricultural Organization (2018) marine fisheries are currently under crises because of overfishing. Overfishing occurs when more fishes are caught than the population can replace through natural spawning. The issues of overfishing is threatening the livelihoods[1] of coastal communities in developing countries including Ghana. Ghana used to be a major fishing country in the West African sub-region until the 1980s (Atta-Mills, Alder, & Sumaila, 2004; Nunoo et al., 2014; Perry & Sumaila, 2007). The marine fish production has sustained a continued downward trend in production reaching 159,726 metric tons in 2018, which is one of the lowest in recent years with respect to the small-scale fisheries sector. Small-scale fisheries involve the use of low technology and capital. Fishing activities are undertaken by individual fishing households (Afoakwah, Osei Mensah Bonsu, & Effah, 2018).

In this study, small-scale fisheries will be used interchangeably with artisanal canoes. Illegal and unsustainable fishing practices have been reported as one of the main causes of overfishing leading to decreasing fish catch in Ghana (Finegold et al., 2010). The decline in marine fish catch is not only peculiar to Ghana. A recent report by the FAO published in 2018 shows that global marine catches peaked in 1996 with 86million metric tons. After 1996, marine fish production has decreased on average of about 0.2 million ton.

Presently, Ghana imports over 60% of fish consumed locally. In 2016, a whopping 135million US dollar was spent to import fish into the country (Joy News, 2018). The predominant livelihoods of people living in coastal communities in Ghana is fishing and its related activities. It has been estimated that over 2 million people depend on the fishing industry for their livelihood with some 135,000 people engaged in the marine sector contributing to about 1.4% of Ghana's Gross Domestic Product (Finegold et al., 2010; Tanner et al., 2014).

[1] A livelihood is made up of the capabilities, assets, and activities required for a means of living (Serrat, 2008).

The downward trend in marine fish production poses a major threat to the livelihoods of fishing households. It is therefore important to understand how coastal fisherfolk[2] are responding to the decreasing fish catch as well as the declining small-scale fisheries opportunities.

In addition to the problematic issue of overfishing, which is threatening the livelihoods of coastal households, the discovery of oil along the Western coast of Ghana has brought about new set of challenges for fishing households and coastal communities. In 2007, Ghana discovered oil in commercial quantities with production beginning in 2010 (Adjei & Overå, 2019). The major concentration of oil production is located in the Western Region of Ghana, which also happens to be the main source of fish production (Finegold et al., 2010). The oil production was expected to bring significant economic benefits and opportunities (Ackah-Baidoo, 2013; Ayifli, Adom-opare, & Kerekang, 2014; Dowokpor, 2015; Plänitz & Kuzu, 2015). However, a nationwide study conducted by Plänitz and Kuzu (2015) on oil production and transformation of livelihoods of communities in Ghana concluded that the oil-induced growth in the national economy had yet to produce desirable results for the livelihoods of individual Ghanaians. Some of the major socio-economic and environmental impacts of oil activities on coastal community's may include loss of fisheries livelihoods, increase in prices of social amenities such as accommodation and electricity, and pollution of sea water (Plänitz & Kuzu, 2015).

Indeed, coastal communities in Ghana especially fishing communities in the Western Region where there is currently on-going oil and gas production are confronted with multiple vulnerabilities. This therefore reinforces the need to set proper adaptation strategies to reduce such concomitant vulnerabilities. While agricultural livelihoods transformation has received considerable attention in the literature on resource-dependent communities at micro -level , less attention has been paid to coastal villages in developing countries where fishing and its related activities remains the dominant economic activities (Blythe, Murray, & Flaherty, 2014). Furthermore, as noted by Bryant and Baily (1997) livelihoods concerns remain a vital issue in understanding the political implications of environmental resources management.

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[2] Fisherfolk refers to the people doing the fishing and their families and other members of the communities whose livelihood depends on fishing.
Fisher refers to the people who are actually doing the fishing. In the case of Ghana, only men go to fishing while the women are engaged in the trading and processing of fish.

This study is concerned with how overfishing and the petroleum industry has affected the livelihoods of small-scale fisherfolk in the coastal communities of Western Region. It investigates the interaction between formal and informal actors in the fisheries and the petroleum sector and the ways in which these actors influence or shape the livelihood adaptation strategies deployed by coastal fisherfolk.
Using the sustainable livelihoods approach and actor- oriented approach derived from political ecology, the study shows that local fisherfolk are active social agents who construct and shape their livelihoods in the face of declining fisheries opportunities. However, are they successful in their strategies or is coastal Ghana set to follow the problematic tragedy of Niger Delta in Nigeria and other resource endowed countries in Sub-Saharan Africa ?

1.2 Research problem

The United Nations Sustainable Development Goals (SDGs) 2015- emphasize the need to eradicate poverty, hunger and reduce inequality by 2030.The addition of life below water to the SGDs is a manifestation of the significance of incorporating fisheries development programs with the aim of reducing hunger and sustainability of global food security. Globally, marine fisheries directly and indirectly employ over 200 million people (FAO, 2018). About 87% of global fish production is from marine waters with the remaining 13% coming from inland water sources (Ding, Chen, Hilborn, & Chen, 2017).
Small –scale marine fisheries including processing and marketing employs about 90% of people in developing countries in the marine sector. However, it is within the small-scale fisheries sector that poverty and marginalizing is ubiquitous (FAO, 2018).

In Ghana, the small -scale fisheries sector is the largest with annual production of between 60 to 70 % of marine output (Tanner et al., 2014). The fisheries sector contributes about one billion US dollars annually and accounts for 4.5% of the GDP. In 2000, total fish production was 276,275.32 metric tons, in 2010 fish catch declined to 198,936.48 metric tons, and the downward trend continued, reaching 159,726 metric tons in 2018, which is one of the lowest in recent years

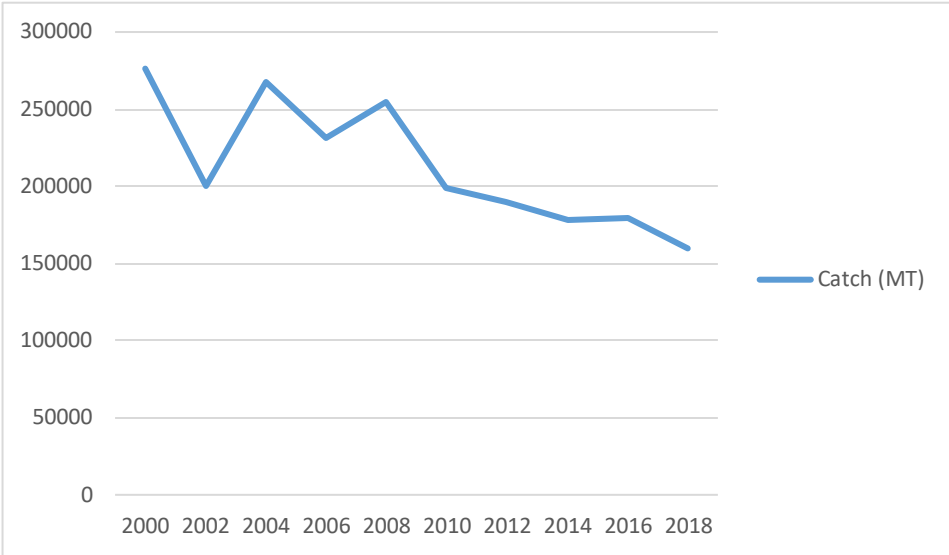

Figure 1. 1.Total marine fish production by artisanal canoe 2000-2018 (metric tons)

Source : Fisheries Commission, Accra, unpublished report.

In response, to the rebuilding of depleted marine fish stock, the Ministry of Fisheries and Aquaculture Development (MoFAD) in consultation with relevant stakeholders, both domestic and international, introduced several measures. MofaD is the official government institution responsible for the management of fish and other related fisheries products in Ghana. Using legislative instrument such as the Ghana Fisheries Management Plan (2015-2019) and the Fisheries Act 2002, MoFad introduced a closed fishing season policy in 2016 for the marine fisheries sector. In 2018, the closed season was extended to the artisanal canoe sector.

Seasonal closures are widely used as an effective conservation tool in fisheries management to allow fish to reproduce during the spawning season before they are harvested (Bucaram et al., 2018). It can involve a specified area/space including time restrictions and are established because of declining coastal resources (Rola et al., 2018). The temporal ban on fishing can protect habitats, support ecosystem structure & functioning, increase species diversity and richness that can led to positive spillovers for local communities (Nathan James Bennett & Dearden, 2014).

Nevertheless, closed fishing seasons have also been met with mixed perceptions and opposition in the situation where particular groups of stakeholders express concern over losing access to resources and disruptions of livelihoods (Nathan J. Bennett et al., 2019; Bucaram et al., 2018; Glaser, Baitoningsih, Ferse, Neil, & Deswandi, 2010;

Rola et al., 2018). This is even more challenging when it comes to ocean related seasonal closures and marine protected areas (Bucaram et al., 2018; Nolan, 2019).

A major concern in the rebuilding of depleted marine fish resources has to do with the inclusiveness of fishers in the fisheries management decision making.

In this regard, one of the aim of this study is to investigate fisherfolk perceptions with respect to the introduction of closed fishing season and how fishing-based households perceive changes in their main source of livelihood due to the temporal ban on fishing and other vulnerabilities. .

The Western Region of Ghana, which is the focus of this study, is recognized as the main source of marine fish production in Ghana (Finegold et al., 2010). As fishing households continue to protect their livelihood because of decreasing fish catch and other environmental pressures, the discovery of oil in 2007 brought new hope and signs of economic relief. According to the Ghana Statistical Services, in 2017 Ghana recorded a real GDP growth rate of 7.8%. Out of this, the oil and gas sector alone accounted for 3.8 %. However, a nationwide study conducted by Adusah-Karikari (2015) on oil production and transformation of livelihoods of coastal communities in the Western Region concluded that the oil production is yet to produce desirable results for the livelihoods of fisherfolk and farmers. As fishing-based households have already struggled to protect their livelihoods in the face of decreasing fish catch and other environmental pressures in recent years (Ackah-Baidoo, 2013; Adjei & Overå, 2019; Adusah-Karikari, 2015), new oil exploration activities have resulted in an additional layer of vulnerability.[3]

Access to the use of coastal waters in Ghana is currently undergoing major transition. Historically, fishing and its related activities were the main economic activities carried out on the ocean space of Ghana (Finegold et al., 2010). However, during the past decade coastal communities and the local fisheries industry in the Western Region have to share the use of coastal waters with oil and gas companies offshore. In the petroleum industry, offshore is used to refer to activities involving the exploration and extraction of hydrocarbons beneath the seabed, including inshore waters and lakes. In fisheries, offshore fishing is practiced further out in the open sea (Arbo & Thuy, 2016). The oil fields are located in the Gulf of Guinea off Cape Three Points, lies in deep waters (11, 000m) and 60-80km south-west of the coastal

[3] Vulnerability refers to the exposure of groups or individuals or ecological systems to a hazard associated with environmental and social change. Vulnerability is made up of the external threats to livelihood security and internal coping capability (Allison et al. 2009).

communities in the Western Region where fishing and its related economic activities are the dominant sources of livelihoods (Adjei and Overå, 2019).

The oil and gas industry's presence at sea is in the form of oil rigs, safety and security zones, floating production storage and offloading (FPSO) vessels, gas pipelines, oil tankers, and supply vessels. These are areas at sea where some fishers also exploit fishes.

Therefore, this study would further seek to examine how fisherfolk livelihoods have been impacted by offshore oil and gas production and the various livelihood strategies deployed by fishers offshore to increase their fish catch.

In other countries such as Nigeria and Brazil conflicts between the petroleum industry and fishing communities have resulted in chaos leading to outbreak of civil wars (Adjei & Overå, 2019). It is therefore important to understand how fishing households and coastal communities are responding to the new set of challenges brought about by new oil and gas production.

1.3 Study objective and research questions

Prior to the introduction of the closed season as well as the emergence of the oil and gas industry offshore, the sea was governed by an open access regime.[4] Fisherfolk practiced their fishing activities without any restrictions at sea. The introduction of seasonal closures and restricted fishing zones around offshore oil fields have constrained the mobility of fisherfolk at sea.

Therefore, the main purpose of this study is to examine the various livelihood adaptation strategies deployed by fisherfolk to increase their fish catch. In doing so, the study investigates how formal and informal actors in the fisheries and the petroleum sector interact and the various ways in which these actors influence or shape the adaptation strategies of coastal fisherfolk. The empirical enquiry is based on small-scale coastal fisherfolk in the Western Region of Ghana.

The following four research questions are addressed;

I. How have overfishing and oil extraction and production affected the livelihoods of fishing households?

[4] An open access regime in this study refers to the period of fisheries governance where there were no regulations on seasons for fish harvesting and mobility of fishers at sea. During this period, fishers could fish all year round and travel freely to other parts of the sea to harvest fish unconstrained.

II. What are the perceptions of fisherfolk with respect to closed season policy to rebuild depleted marine fish stock?

III. What are the types of conflicts produced between the local fisheries sector and the petroleum industry offshore and how do actors in these sectors influence or shape access to the use of coastal waters?

IV. What have been the coping/adaptive strategies deployed by fisherfolk in relation to declining small-scale fisheries opportunities and persistent poverty?

The first research question focuses on the various factors that have contributed to the depleted marine fish stock and decreasing fish catch. It examines the various factors that has contributed to overfishing and the various ways in which overfishing, and oil extraction and production have impacted the livelihoods of fisherfolk.

The second research question is directly linked to the first research question. It investigates the views and perceptions of fisherfolk in relation to the government introduction of seasonal closures to restore depleted marine fish stock. The second research question further explores how fisherfolk perceive seasonal closures and marine conservation.

With respect to the current discord between the local fisheries sector and petroleum industry, the third research question investigates the various types of conflicts produced between the fishers and petroleum industry offshore and how these actors influence access to the use of coastal waters for economic benefit.

The fourth and major research question builds on the empirical findings from the previous three research questions to examine the various livelihood adaptation strategies deployed by fisherfolk to increase fish catch in order to protect their main source of livelihoods.

1.4 Research method

This section describes the processes, techniques and research tools used to answer the research questions in this study. It further discusses the processes of gaining access to the selected study communities and the selection of research participants. In this study, primary qualitative data were obtained from semi-structured interviews with key informants, group interviews, site visits and personal observations. Primary

quantitative data were also obtained from household surveys[5] with the aid of semi-structured questionnaire. These two data sets were complemented with secondary data from desk reports- analysis of public and private published reports, non-published reports, online newspaper articles and scholarly articles. Reports such as the Fisheries Act 625 (2002), Ghana fisheries management framework(2015-2019), reports from Tullow and other oil companies, reports from 'Hen Mpoano' and 'Friends of the Nation' –two major local NGOs contributing towards sustainable fishery management in Ghana were utilized to support the analysis of the study.

The study applied mixed- methods approach through the integration of qualitative and quantitative research methods, techniques, approaches and concepts (Creswell, 2010; Yin, 2014). Mixed- method approaches have gained prominence over recent decades as a useful method in multi-set data gathering to answer complicated research questions (Creswell, 2003; Hay, 2010; Yin, 2014).

Qualitative research techniques help to answer research questions related to the where, what, how and why whilst quantitative techniques like surveys involving households provides an overview of household characteristic's like income differences and general conditions of the household. Creswell (2010) noted that there is a growing interest among researchers in using mixed- method procedures within narrative studies, within experiments and case studies.

In this study, multiple case studies[6] were used to investigate fisheries livelihoods and the political ecology of petroleum industry using mixed- method techniques. Empirical results from multiple case studies in understanding contemporary phenomenon are considered to be more compelling and more robust (Yin, 2014). The use of multiple cases studies in a mixed- method setting is suitable to compare the similarities and differences between and among the study areas to provide new areas of enquiry with respect to the discourse on vulnerability and adaptation.

Because of financial constraints and time, it was impossible to administer questionnaires and conduct interviews among residents in the entire selected villages. Therefore, the study applied purposive and snowball/chain sampling techniques as the two main non - probability-sampling methods to select desirable participants for

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[5] Household surveys –provide a convenient unit for empirical data and helps researchers to appreciate micro-level economies (de Haan & Zoomers, 2005). A household refers to a person or co-resident, group of people often based on kinship who contribute to and accrue benefit from a joint economy in either cash or domestic labor (Turner, 2012).

[6] A case study is concerned with empirical inquiries that investigates a contemporary phenomenon in depth and within its real world context (Yin, 2014).

interviews and questionnaire surveys. Purposive sampling technique was applied to identify key informant for face-to-face in-depth interviews and where necessary through telephone calls. According to Collins (2010) key informants are perceived to have deep knowledge and information about the phenomenon that is being investigated. In this regard, key informants in the study areas selected include the chief fisher, chief fish trader, assembly members, community and youth leaders and local journalists. Government officials with the Fisheries Commission at the district, regional and national level, leaders of the Ghana national canoe fisherman council, official of oil and gas company, official from the Ghana navy and officials from NGOs were all selected because of their in-depth knowledge on the issues investigated in this study.

1.4.1 Data gathering techniques

Qualitative data were gathered with the aid of semi-structured interviews. Interview is defined as 'face to face verbal interchange in which one person, the interviewer attempts to elicit information or expressions of opinions or beliefs from another person or persons' (Dunn, 2010, p. 101). Semi-structured interview is among one of the interviewing methods used in gathering data. It involves the use of an interview guide and organized sets of questions focus on specific themes but can also be flexible enough to allow the respondent to freely talk about other related issues of interest to him or her (Dunn, 2010; Barbour , 2008). It is however, the responsibility of the interviewer to maintain control and ensure that respondent's answers are within the domain of the set of issues currently under discussion. Interviews provide a good source of gaining access to information about events, opinions and experiences. This type of information gathering provides the respondent the opportunity to reflect and share his or her own perspectives about a particular phenomenon, which could not have been possible with the use of questionnaire survey (Dunn, 2010).

A semi-structured interview guide was used to conduct the interviews. Interviewees were allowed to freely talk about certain issues, which they considered relevant but was not covered in the interview guide. Indeed, most of the additional issues and concerns raised by the participants generated quite an interesting perspective to the discussion on marine conservation, enforcement of fisheries laws and regulations and other related topical issues such as overfishing and oil exploration and production. The key informant's interviews lasted an average of 30 to 60 minutes per participant. All the interviews were recorded with permission from the respondents with the aid of a smartphone with an inbuilt audio recorder. This

enabled me to focus on the interview and pay more attention to the respondent. Interviews with government officials, NGO officials and local journalists were conducted in English whereas those conducted with community leaders such as chief fisher, youth leaders and fish traders were conducted in local languages such as Twi, Fante and Ga. The interviews took place at the landing beaches[7], respondent's residence, recreation parks and offices. All the interviews were translated and organized into relevant thematic themes to support the research analysis. Where necessary respondents answers were quoted verbatim to support the analysis of the study. See table 1.1 for the list of key informants interviewed.

In addition to the key informant interviews, there was an attempt to conduct focus group discussion among selected fisherfolk using the purposive sampling technique. However, it proved to be a very difficult task to mobilize fisherfolk and organize a venue suitable for such discussion. In addition, fisherfolk rather opted to freely talk and discuss the issues in their recreational parks/tents or at the landing beaches. Therefore opting to conduct group interviews instead of focus group discussions, as this method was best suited to the prevailing conditions encountered. Specifically, respondents who have encountered some form of conflicts with the oil and gas industry at sea were considered to have some experience and knowledge to share on conflicts between fisheries and oil and gas industry offshore.

Group interviews consist of small group of individuals engaging in a discussion about a specific topic or issue defined by the researcher and normally include 6 to 10 people (Cameron, 2010). The interviews can last between one or two hours and it can be formal with a specific & well-structured purpose or it can be informal taking place in a field setting where the researcher presents the topic for discussion (Frey & Fontana, 1991). Besides being an effective data-gathering instrument, it is suitable for investigating discourses that shape the everyday practices and lives of people, the ways in which knowledge is constructed based on people's perception and understanding of social phenomenon's (Cameron, 2010). Group interviews collate a diversity of meaning, opinions and experiences (Dunn, 2010). Participants provide insights into the different opinions or debates during the discussion and when a respondent makes a factual mistake, another member can correct him or her. Issues discussed included conflicts with oil and gas on sea, closed fishing seasons, overfishing, alternative livelihoods and migration.

Three group interviews were organized during the fieldwork. The first group interview was organized at Sekondi for three canoe owners and five fishers at their

[7] A landing beach refers to a stretch of coastline on which fish is usually landed and canoes are beached.

recreational tent. The issues discussed included – how the oil and gas industry has influenced their fishing activities, conflicts between fishers and the navy patrol stationed to protect oil installations offshore and closed season.

The second group interview was conducted at Akwidda with six fishers and two community leaders. The major issues discussed included systems of fishing pratices, oil and gas impacts on fishing and alternative livelihoods. The final group interview was conducted at Axim with four canoes and four fishers –issues discussed included the closed fishing season, and impacts of oil and gas on fishing activities.

Quantitative data gathering technique was applied with the aid of semi-structured household questionnaire. Snowballing/chain sampling techniques was used to administer household survey by asking participants to recommend other potential respondents considered to have the requisite knowledge about the issues under investigation to join the survey. Snowball sampling techniques have been used by several authors to investigate fisheries livelihoods and coastal vulnerabilities in Sub-Saharan Africa. (Penney, Wilson, & Rodwell, 2017; Yang, Owusu, Andriesse, & Dziwornu Ablo, 2019; Owusu, 2019).

Four hundred surveys were conducted in the communities of Shama Apo and Shama Bentsir in the Shama district, Axim in the Nzema East district, Dixcove and Akwidaa in the Ahanta West district, and in Sekondi and New Takoradi in the Secondi-Takoradi Metropolis.

The questionnaire survey was divided into five broad thematic areas of enquiry covering basic socio-economic and demographic information, fishing practices, overfishing, closed fishing season, petroleum industry & fisheries livelihoods, and conflicts over the use of ocean space and adaptation strategies. The questionnaire included closed, open and multiple-choice questions. The closed ended and multiple choice questions allowed respondents to select specific choice of answers while the open ended questions offered the respondents the opportunity to freely talk about their experiences and knowledge related to the local fishing industry and other relevant issues concerning the topic under investigation. The questionnaire survey lasted from 40-50 minutes on average per person.

The empirical enquiry included questions on basic household structure and income, fishing activities (technique and tools, domestic or commercial, issues of illegal fishing and experience), overfishing, closed fishing season, fuel subsidies, alternate livelihood option, knowledge and perception of climate change-related issues, conflict within fisheries and between the fisheries sector and the petroleum industry.

Careful observation of daily activities in the village and other related events during the fieldwork was recorded using field note. Photographs were taken to capture relevant images and provided visual interpretations and meanings into the

phenomenon under investigations. Through the acts of watching and taking photographs, one could appreciate the diverse array of human activities and their interaction with natural environment.

Table 1. 1 Stakeholder interviews (key informant and group interviews)

Category	**Institutional level /location**	**Number**
Government officials	National (head office)	1
Government officials	Regional	2
Government officials	District	3
Lecturer (University of Ghana)	Regional	1
Oil company official	Regional	1
Non-Governmental Organizations	Regional	2
Media personnel	Regional	2
Ghana National Canoe Fisherman Council National	National	1
Chief fisherman	Community	5
Canoe owners	Community	6
Fishermen	Community	8
Fish traders	Community	5
Community leaders	Community	5
TOTAL		**42**

Source: Fieldwork (2019).

1.4.2 Data analysis and interpretation of results

Researchers analyze qualitative (interview) data to unearth meaning from the data by constructing relevant themes, establishing relations between variables and patterns in the data (Dunn, 2010). Appropriate analytical tools were adopted to aid in the interpretation and analysis of collected data. The qualitative research data generated from this study included results from key informant interviews, group interviews, open-ended questions from semi-structured questionnaire and field observations. All stakeholder interviews were recorded with the aid of recorder and later translated. Because of my knowledge in the local languages that was used to

conduct the survey it was not difficult in translating the interviews. Narrations from the interviews together with the results obtained from open-ended questions in the semi-structured questionnaire were coded and organized into relevant thematic themes after translating. The qualitative data were analyzed using the thematic network technique.

Thematic network analysis is a data reduction technique that shows a web-like illustration of networks, which summarizes the main themes constituting a text. This analytical tool aims to explore the understanding of an idea rather than attempting to reconcile conflicting definitions of a problem (Attride-Stirling, 2001). It seeks to discover the themes salient in a text at different levels and organize them into relevant thematic themes. This includes: (1) the basic theme- which is the lowest order premises extracted from the text, (2) the organizing theme- encompasses a collection of basic themes with similar characteristics to form the middle order themes. Global themes (3) – the organizing themes are analyze in relation to the basic themes and brought together to form the super-ordinate themes. A thematic theme is developed starting from the basic theme and working inward toward a global theme. The relevant themes are presented graphically as a web-like net devoid of any hierarchy while emphasizing the interconnectivity of the themes in the entire network.

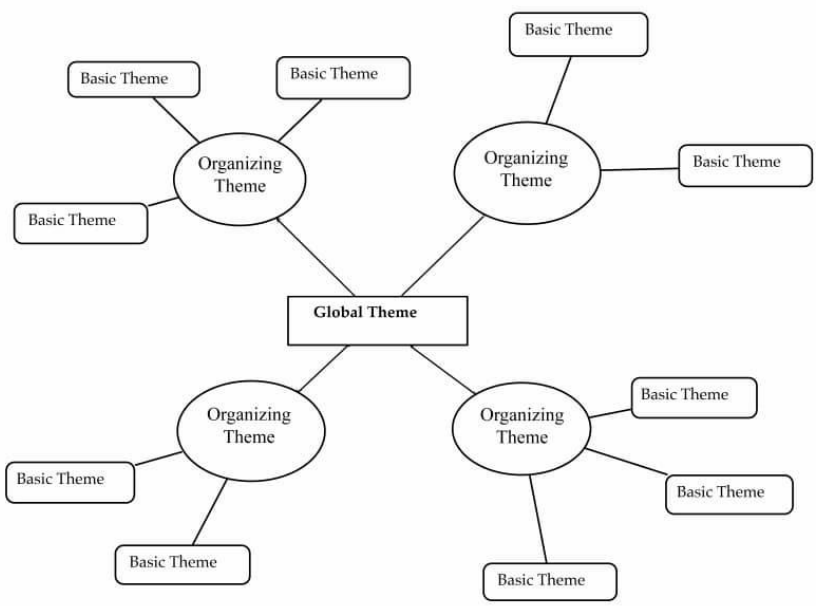

Figure 1. 2. Thematic Network analysis
Source : Attride-Stirling (2001)

The statistical package for social scientist IBM SPSS Version 21.0 and Excel spreadsheet were used to analyze the results from the household surveys. Descriptive statistics including frequencies, percentages, means, median and standard deviation were used to describe household demographic characteristics. Relevant charts, tables and diagrams were used to analyze and describe factors accounting for decreasing fish catch and the corresponding adaptive strategies. Chi –square analysis was applied to support the analysis of the study.

Table 1.2 shows the types of fisherfolk that participated in the household survey. The captain a of canoe could sometimes act as a crew member, that's why there were fewer number of captains. The captain is the leader of the crew and are generally in-charge of the welfare of crew members. They ensure that the necessary safety and other related fishing materials including food are available for the crew members before embarking on fishing. The crew members assist in fishing at sea and are either relatives or non-relatives of the canoe. The main responsibility of the canoe owner is to make sure that all the necessary fishing inputs such as fuel and food are provided for the fishers. The canoe owner can be a man or woman. In most instances, as encountered in this study many of the canoe owners are also active in fishing, they therefore act as canoe owners and crew members at the same time.

Table 1. 2. Type of fisherfolk surveyed.

Type of Fisher	Frequency	Percentage
Captain	2	0.5
Crew member	278	69.5
Canoe owner	120	30.0
Total	400	100.0

Source : Fieldwork (2019).

Table 1. 3 Summary of research tools applied to targeted respondents.

Tools	Contents	Target
Semi-structured questionnaires	Focus on vulnerabilities in fisheries, local adaptive strategies, power relations & Out-migration.	Fisherfolk
Key informant interviews	Changes in fisheries livelihoods, closed fishing season, conflicts with oil & gas companies, illegal fishing practices	Local leaders Chief fishers Fish traders Government officials
Group Interviews	Illegal light fishing, conflicts with oil and gas, out-migration	Fishers, Canoe owners
Transect walk	reconnaissance survey of community resources and important infrastructure	Community representatives
Field observations	local residents -individual activities such as mending nets, fish trading	Residents in local communities

Source : Fieldwork (2019).

Gaining access to the fisherfolk for the household survey was proved to be very hectic. Majority of the fisherfolk complained about the lack of developments in their communities as well as their deteriorating standard of living. The apathy showed to me and research assistants by the fisherfolk confirms their level of dissatisfaction towards the level of development in their community. It was also uncommon for some residents to approach us to inquire whether we are officials from an oil and gas companies. Overall, throughout the informal interactions with the local residents, it

emerged that they have had very high expectations of the oil and gas industries to improve their livelihood conditions and transform their communities.
Gaining access to government officials even proved to be more challenging, after submitting official letters from my thesis supervisor to the relevant departments, it took several days if not weeks before l was able to interview some government officials.

1.5 Organization of the study

The thesis is organized into six chapters including the introduction.
Chapter 2 discusses the sustainable livelihoods approach and the actor-oriented political ecology as the two main theories used for the study. It engages with previous literature using the Sustainable Livelihoods Approach (SLA) and political ecology in coastal fisheries resources management and development. This chapter consists of three main sections. In the first section, the key components of the SLA are discussed. It focuses on how fishing households combine the available livelihood capital assets to construct their everyday livelihoods in the face of multiple vulnerabilities.
The second section of chapter 2, introduces the concept of political ecology with a focus on actor-oriented approach. It reveals the various types of power possessed by different types actors and how they are exercised to shape/ influence the access to vital environmental resources. The final section in chapter 2 introduces the analytical framework of the thesis.

In chapter 3, the case study of the research is introduced. This chapter consists of three parts. The first part describes Ghana and the selected study areas. The second part provides a comprehensive overview of the fisheries industry in Ghana. It explores the key actors responsible for fisheries management. The third part provides lessons from other oil producing countries in Sub-Saharan Africa that can serve as a guide for the peaceful co-existence of the fisheries and petroleum sector in Ghana.

Chapter 4 presents the first part of the empirical results from the study. This chapter is divided into three main parts. The first is concerned with coastal fisheries vulnerabilities associated with overfishing and the petroleum industry. It investigates the impact of overfishing and petroleum industry on the livelihoods assets of coastal fishing households. The second part of chapter 4 examines the perception of fisherfolk in relation to government introduction of seasonal closures in the local fisheries industry. The third part examines the conflicts produced between the fisherfolk, and oil and gas production offshore. It provides insights into how the actors in these two sectors interact offshore. The findings from chapter 4 will provide

vital insights into the various forms of livelihood strategies deployed by fisherfolk to circumvent the political and administrative control over access to use of coastal waters.

Chapter 5 continues the discussion of the empirical findings. Chapter 5 is divided into two main parts. The first part builds on the previous findings from chapter 4 to examine the various livelihood adaptation strategies deployed by fisherfolk in response to decreasing fish catch and declining coastal livelihood opportunities. The second part discusses the results from the empirical findings of the research.

Chapter 6 presents the conclusion of the study with key research findings and relevant policy recommendations.

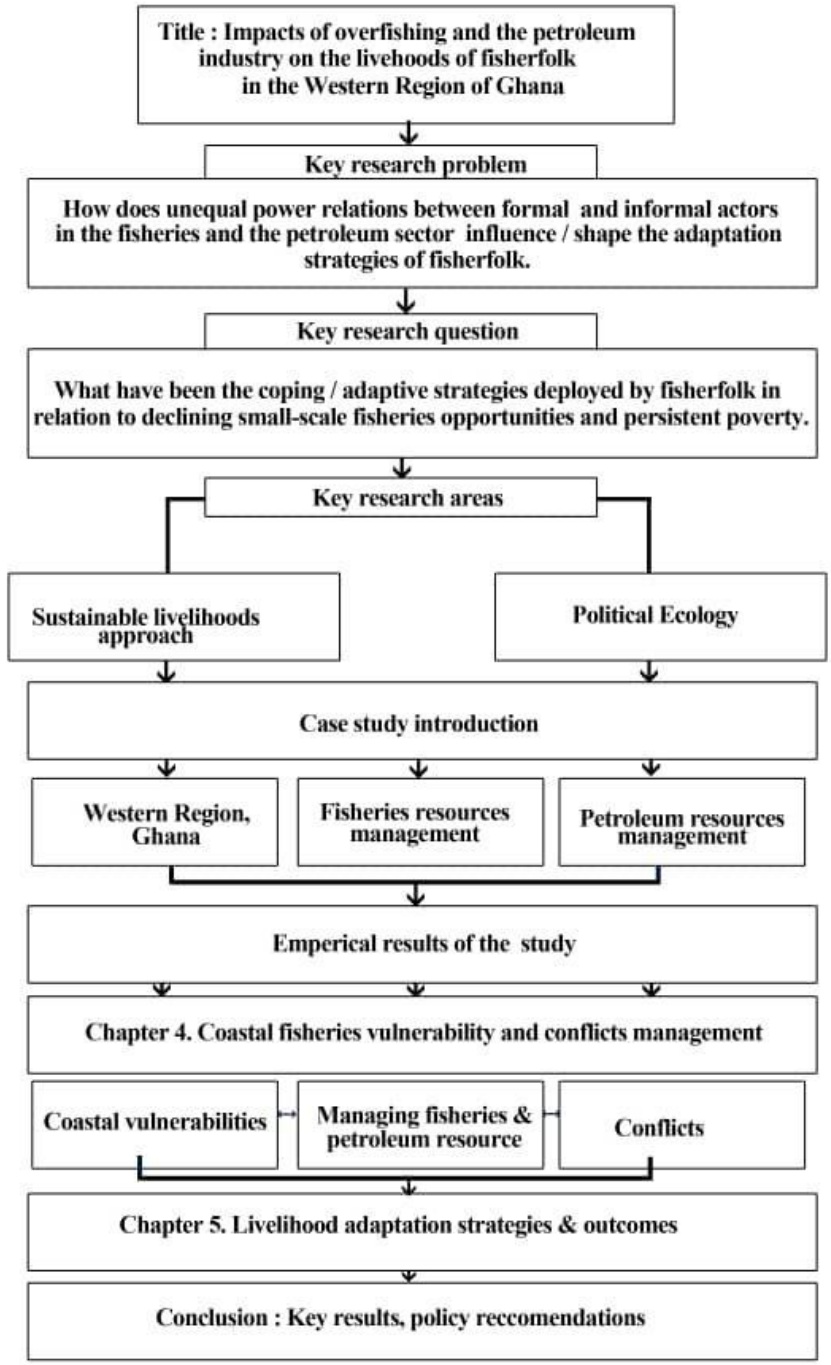

Figure 1. 3. Organization and structure of the study.

Chapter 2. Literature Review

This chapter will thoroughly elaborate on the concepts and theories applied in this study. The central theme of this thesis is that access to environmental resources is constrained by unequal power relations between actors. Theoretically, the empirical results from this study is grounded on the integration of the sustainable livelihood approach and political ecology. Theories provide the framework for researchers to understand the real world situations and enable them to determine the type of data to collect and the strategies for subsequent data analysis (Yin, 2014). The SLA is applied as an analytical tool to explore the livelihood trajectories of fisherfolk in relation to overfishing and oil and production activities offshore. The use of political ecology will provide the tools to effectively analyze how access to environmental resources is mediated by unequal power relations with respect to access to coastal waters in the Western Region of Ghana. The livelihood capital assets, vulnerability and livelihood strategies will be the key concepts applied from the SLA. In the political ecology, the concept of actor-oriented approach will be the main analytical tool. The actor oriented-political ecology is applied to analyze the link between the fisheries sector and the petroleum industry.

2.1. The Sustainable Livelihoods Approach

The SLA is a schematic framework that allows for thinking about the objectives, scope and priorities for development (Figure 2.1). It is an all-inclusive approach that seeks to understand rural livelihoods with the aim of reducing poverty through livelihood diversification(Ferrol-Schulte, Gorris, Baitoningsih, Adhuri, & Ferse, 2015). The SLA has attracted growing interest from academics and development practitioners since its introduction in the 1990s. SLA has been widely used by NGO's and other developmental organizations in addressing challenges of rural development mainly in the global south. In this study, the term global south will be used interchangeably with developing countries and third world countries.

While various versions of the SLA has been produced and used for analyzing different phenomenon, this study will use the version developed by the Department for International Development in 1999 (Figure 2.1). The SLA serves as an important tool for researchers and development practitioners to better understand the livelihoods of the poor and marginalize people. It particularly focus on the factors that restrict the access to assets and or enhance livelihood opportunities with people

as its central focus (Serrat, 2008). The SLA also recognizes the role of institutions, organizations, policies and processes in facilitating or transforming livelihood strategies to determine livelihood outcomes.

The SLA has been widely applied to understand the poverty reduction strategies in coastal communities among individuals and households that depend on fish and fishing related activities in different geographic locations (Allison & Ellis, 2001; Allison & Horesman ;2006, Badject et al 2010 ; Cinner et al 2018).

In this study, the sustainable livelihood approach and political ecology (with a focus power relations) were used to analyze the vulnerabilities of small-scale fisheries and local adaptive capacity of fishing households in the Western Region of Ghana. Overfishing, oil & gas activities are presented as major forms of shock and stressors that is disrupting small-scale fisheries livelihoods. The SLA is applied to fishing communities at the individual and household level in order to gain in-depth knowledge and better understanding of the various factors that constraints or enhance the access to fishery resources at the micro scale. The various adaptation strategies deployed by fishers could serves as an entry point for successful fisheries management and natural resource development.

The SLA is used to investigate the link between individual or households assets and the activities in which households can engage with a given asset portfolio and the mediating policies, institutions and process (PIPs) including social relations, markets and organizations(Allison & Horemans, 2006; Scoones, 2009).

The complex interaction between the five capitals (human, social, physical, economic and natural capital) , the vulnerability context and institutions , organizations, policies and legislature translate into livelihood strategies which in turn determines livelihood trajectories/outcomes and environmental sustainability(Allison & Horseman., 2006; Serrat, 2008). Subsequently, these livelihood trajectories are expected to serve as a feedback mechanism for developing and making new ideas, changes, and improvements in relation to the five capitals and transformation structures and process in reducing the vulnerabilities(Sumadio, Andriesse, Aprilianti, & Sulyat, 2017)

The next section discusses the key components of this framework namely; livelihood assets, vulnerability, institutions, policies and process, livelihood strategies (adaptation) and livelihood outcomes.

2.1.1 Livelihood assets

There are five different types of asset in the SLA (Figure 2.1).These assets have been framed as capital assets (human, natural, physical, financial and social capitals).

The vulnerability context in this study is framed within the context of overfishing, and oil exploration and production. These two factors are considered to have an effect on each type of the livelihoods asset and have the ability to transform household's livelihoods strategies and outcomes.

Human capital

Human capital comprises education, skills, knowledge, health, nutrition, capacity to work and the capacity to adapt, it also includes available labor markets (Serrat, 2008 ; Allison and Ellis, 2001). The level of quality and the available quantity of human capital in a household or community affects their economic situation. Relevant skills acquisition and training are regarded as crucial for the development of human capital. In the case of fisherfolk their human capital is mainly their set of skills, knowledge and the ability to undertake fishing as economic activity (Ayifli et al, 2014).

The oil and gas sector is characterized by high-level technical skills, sophisticated technology which relies on heavy capital investment. It is therefore not surprising that the oil and gas industries mainly employ people who are highly educated and well trained to undertake operation of facilities such as the offshore platforms and on-shore infrastructure such as pipelines and refineries (Ayifli et al., 2014; Plänitz & Kuzu, 2015). The high expectations held by the local population about the prospects of getting employment in the oil and gas sector could face setbacks as majority do not have the requisite sets of skills to work in that sector. The lack of job opportunities in the oil and gas sector could trigger anger and tensions in the community, which if not well managed, could result in conflicts.

Natural capital

Natural capital may include land and produce, water and aquatic resources, trees and forest related products, wildlife, wild food & fibers, biodiversity and environmental resources. The productivity and quality of these resources maybe degraded/reduced or improved by human management (Serrat, 2008). Natural capital is often exposed to external shocks and stress such as floods and storm surges, tidal waves, drought and famine and other climate change impacts like sea level rise. Declines in fish stocks often leads to over-exploitation of marine and other ecosystem services like felling of wood from mangroves which reduces the ability of species reproduction. In addition, sea level rise and extreme events like storm surges can reduce the availability and quality of freshwater sources for fishing communities (Badjeck, Allison, Halls, & Dulvy, 2010).

Furthermore, the activities of oil and gas operations is linked to the negative impact on marine resources and ecosystems. Oil exploration and production activities like the installation of oil rigs in the ocean can affect the breeding patterns and production

of fish (Doworkpor, 2015). Furthermore, oil operations is usually accompanied by some level of noise and disturbances that is linked to bulk vessels and drilling activities. Fish and some other species such as whales are affected by the sound elevation as a result of their dependence on sound for reproduction, feeding and avoidance of hazards from predators and navigation (Ayifli et al, 2014).

Physical capital

Physical capital includes infrastructure like transportation, roads, buildings, water supply systems and sanitation, energy, communications and other elements of tools and equipment for production such as seed, fertilizers, pesticides and traditional technology (Serrat, 2008). In fishing households, valuable physical capital may include boat, nets, subsidized fuel and outboard motor engine.

Oil and gas activities often led to increases in price of rent and other consumer goods and services at both national and local level. Coastal communities especially those in developing countries that depend on natural resources like fish for their livelihoods are the most affected as a result of the changes in the micro-level economy.

Besides coping with the general increases in commodity prices, coastal fisherfolk also have to compete with the petroleum industry for space at sea and on land. Environmental change and extreme events can disrupt the local economy and production systems. Floods and storms can destroy productive assets and infrastructure such as roads, landing sites and fishing tools (Badjeck et al., 2010).

Financial capital

Financial capital includes savings, credit, debts, remittances, pensions and wages (Serrat, 2008). It includes all sources of revenue available for individuals and households. Considering that wealth is unequally distributed –certain individuals and households might have access to more financial capital then others. Most often it is those that have access to greater financial capital (wealthy people) that invest more in fishing inputs to intensify fishing efforts in times of declining fish stocks rather than the poor. In Tanzania, fisherfolk who were more likely to intensify their fishing efforts in response to lower catch where those who had more financial assets (wealthy) but at the same time lack flexibility to diverse their livelihoods (Cinner et al , 2018). Other related study by (Blythe et al., 2014) found that although fishing community in Zalala beach in Mozambique is wealthier compared to Inhangome community, fishers in Zalala intensify their fishing efforts in response to decreasing fish catch while those in Inhangome who are relatively poor make efforts to diverse their source of livelihoods.

Oil and gas production and its related activities attract influx of domestic and foreign talents hoping to be employed in this sector, in such circumstances this may cause increases in certain goods and services. For instance (Plänitz & Kuzu, 2015) found

that even though the production of oil and gas has contributed to growth in the national economy, it has caused increases in the prices of basic goods and services like electricity and accommodation. local residents living in communities where oil and gas activities is on-going tends to suffer the most as their expenditure increases causing lower savings and reduced financial capital.

Social capital encompasses all social and community networks- that builds trust, support and promote mutual understanding for peaceful co-existence in the community. Networks /associations can be formal or informal and are guided by a set of rules & regulations, values and behaviors. They provide avenues for collective actions through representation, participation in decision making and other related matters like persuading local and national authorities for support (Serrat, 2008).

2.1.2. The vulnerability context

The vulnerability context in SLA explores the changes in the external environment and how it affects or influences people livelihoods. The understanding of the failures and success of people in their attempt to secure their livelihoods in the face of multiple threats associated with shocks, stresses, trends and seasonality can facilitate the design of suitable policies and better interventions to assist people to improve their existing coping and adaptation capacity (Allison & Horemans, 2006). Vulnerability has two distinct features; the external sides of shocks, seasonality's and critical trends and the internal coping mechanism deployed by people (Chambers & Conway, 1992; Serrat, 2008; Allison and Ellis, 2001).

Shocks is defined to include incidences of wars and conflicts, diseases, and naturally occurring disasters such as storms, floods, drought and famine. At the household level, sudden illness and death of family member including loss of properties like house, boats and nets in the event of flooding has the potential to further exacerbate the vulnerabilities of fishing households (Allison & Horemans, 2006).

Critical trends may include changes in demographics, environmental resources, governance and technology (Serrat, 2008; Allison and Horemans, 2006). Changes in environmental resources may include depleting fish stock, which could lead to overfishing and conflict over access to resources.

The internal coping mechanism comprises the various livelihood capital assets available to rural households. These livelihood capital assets (natural, social, human, physical and financial) are utilized to construct livelihood strategies.

2.1.3. Policies, Institutions and Processes (PIP)

Access to livelihood assets and activities is enhanced or constrained by policies, institutions and processes (PIPs), including social relations, markets and organizations (Allison and Horemans, 2006 ; Allison and Ellis,2001).

Policies

The state upon the powers bestowed on it has the authority to develop and implement policies related to all sectors of the economy. These policies could promote or constraint access to assets. For policies to be successful there should be a framework to allow all relevant stakeholders including grassroots actors like fishers and farmers to participate and for their views and opinions to be included in the implementation process. Policies that fail to incorporate the opinions of other actors/stakeholders are most likely to be highly contested (Hadjimichael, Bruggeman, & Lange, 2014; Wang, Cater, & Low, 2016). The enforcement of formal territorial use rights in Chile without the consideration of existing informal institutions/actors resulted in increased conflict among fishers, lowering of trust, adaptive capacity and ecological resilience (Finkbeiner et al., 2017).

Institutions

According to North (1990, p.3), institutions refers to the 'formal rules, conventions, & informal codes of behavior that comprise constraints on human interactions'. There are formal and informal institutions that usually work together to regulate and control access to environmental resources. In contemporary times, formal institutions is made up of the state and its related agencies (Political, legislative & representative bodies, executive agencies & judicial bodies) are responsible for the regulation and implementation of environmental policies(Plänitz & Kuzu, 2015). In Ghana, state institutions that govern access to environmental resources include –Ministry of Land and Natural Resources, Ministry of Environment, Science & Technology, Ministry of Energy, Environmental Protection Agency, Ministry of Food and Agriculture. The Fisheries Commission, and Ministry of Fisheries and Aquaculture are two important state agencies that have direct oversight over fishing and fishery related products management in Ghana. Other informal institutions may include traditional authorities and community-based associations that make byelaws [8] to regulate the access and management of

[8] Byelaws refers to a set of rules and regulations enacted at the community level to facilitate the sustainable management of community-based resources. In the case of

environmental resources (Allison & Ellis, 2001). Non-Governmental Organizations (domestic and international) and civil society organizations are also important institutions that support especially grassroots actors in their quest for equity and economic freedom.

Processes

Processes refers to the implementation framework developed to facilitate the enforcement of laws, regulations, policies by state authorities (Serrat, 2008). Policies cannot work in vacuum – it needs the participation of appropriate institutions (formal and informal) and processes through which policies can be implemented (Bennett & Dearden, 2014). Processes are very important in all aspect of livelihood development and depending on the existing institutional arrangements; process can deny or provide access to assets. As noted by Serrat(2008), "one of the main problems the poor and vulnerable face is that the processes which frames their livelihoods may systematically restrict them".

2.1.4. Livelihood strategies and outcomes

Adaptation and coping strategies have often been used interchangeably. While coping refers to the activities and actions that take place within existing structures, adaptation usually comprises of changing the framework within which coping takes place (Eriksen, Brown, & Kelly, 2005). Strengthening the coping strategies is a means of facilitating or building ones adaptive capacity. The choices and activities of livelihoods may lead to different adaptation pathways.

In the fisheries literature adaptation strategies are normally classified into marine and non-marine based livelihoods. Marine-based adaptation strategies may include intensification of fishing. Fisherfolk can increase their fishing efforts by spending longer hours at sea. Fisherfolk could also change their fishing gears depending on financial capital as well existing socio-cultural beliefs (Perry & Sumaila, 2007; Wallner-Hahn et al., 2016). The uptake of marine -based products like aquaculture development is evident among Asian countries like Vietnam and Philippines. However, Andriesse (2018) posited that the uptake of seaweed growing in the Philippines over the past two decades is yet to produce desired results. Incidences of extreme weather events like the 2013 Typhoon Yolanda and the 2015-2016 El Niño phenomenon disrupted fisheries and seaweed production.

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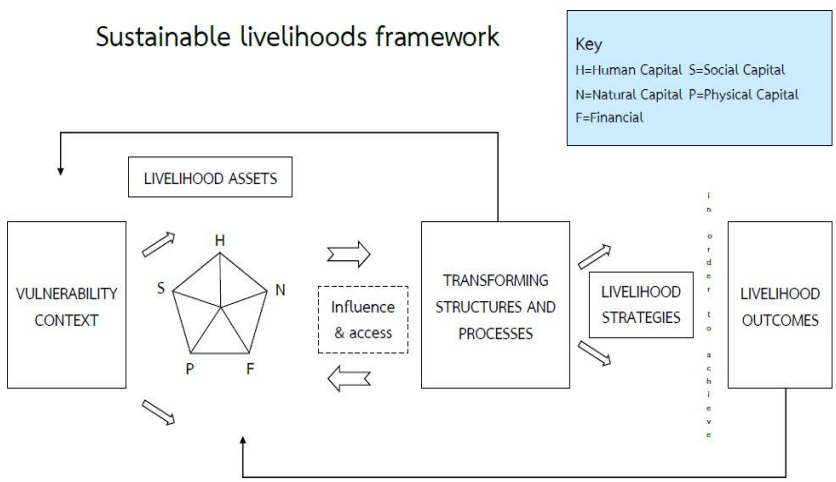
coastal fishing communities in Ghana, fishing and fish trading activities is prohibited on Tuesdays.

Non-marine based adaptation strategies may include diversification [9] into farming, tourism activities, small businesses including migration and remittances (Serrat. 2008; van Hoof & Kraan 2017). During resource scarcity and multiple external threats –adaptation strategies is often confronted with short- term versus long-term goals. Depending on the type of adaptive strategies deployed more revenue can be earned leading to reduction in vulnerability, overall improvement in well-being , improved food security, sustainable use of environmental resources and decrease in potential conflicts and vice versa.

Despite the usefulness of the SLA in understanding of poverty reduction and livelihood development, the framework has received several criticism. Several authors (Finkbeiner et al 2017 ; Cinner et al, 2018; Turner,2012) have criticized the SLA in relation to its less focus on issues related to unequal power relations between stakeholders/actors and its mediating role in facilitating access to environmental resources.



(Department of International Development - DFID; 1999)

Figure 2. 1. Sustainable Livelihoods Approach.

[9] Diversification refers to the situation where individuals and households engage in multiple income generating activities. It has widely promoted in academic literature and policy papers as a strategy to reduce vulnerability and promote sustainable resource harvest (Brugere et al ,2008).

In addition, the SLA has been criticized for its overly focused on assets and resources and limited attention to the power relations in mediating access to environmental resources (Bryant & Bailey, 1997; Scoones, 2009; Car, 2015). de Haans & Hommers (2005) in their comprehensive review of livelihood studies found that access to livelihoods is governed by social relation, institutions, organizations and that power as an important explanatory variable has often been ignored in analyzing livelihoods.

The integration of SLA and the actor-oriented approach derived from political seeks to provide comprehensive overview of fishery livelihoods and the struggles of access to environmental resources between actors in the fisheries and the petroleum industry. Political ecology is applied to analyze the interaction between the fisheries sector and the petroleum industry with respect to closed season policy and restricted fishing activities around oil fields offshore with a major focus on power relations.

2.2 Political Ecology

Political ecology is useful in investigating how differently situated actors interact with the environment and influence the outcomes with respect to the use of natural resources. Political ecology has been applied to understand the nexus between natural resources, conflicts and development in Sub- Saharan Africa (Adusah-Karikari, 2015; Ayifli et al., 2014; Nolan, 2019; Turner, 2004).

The concept of political ecology originated from the 1970s and 1980s (Bryant & Bailey, 1997). Blaikie and Brookfield (1997) define political ecology as "the combined concerns of ecology and a broadly defined political economy". The concerns of political economy, social power and ecology is suitable for the investigation of the interaction between environment and human activities at different scales (Zimmerer, 2014). Table 2.1 shows how the works of early political ecologist shaped the discourse on natural resource development and conflicts.

Table 2. 1 Earlier studies using the concept of political ecology

Author (S)	Year	Themes
Michael Watts	(1983a)	Silent Violence; Food, Famine and Peasantry
Michael Watts	(1983b)	The Poverty of Theory &Natural Hazards
Pers Blaikie	(1985)	The Political Economy of Soil Erosion,
Harold Brookfield & Piers Blaike	(1987)	Land degradation & Society

Source : Bryant, 1998; Bridge et al,2014 ; Tan-Mullin, 2006.

These earlier works were mainly focused on the links between disasters and natural hazards with respect to the political economy and its subsequent impact on environmental resources.

The ensuing debate and intellectual discourses about the interaction between environmental change and human actions produced four school of school thoughts spanning different time scales. Byrant and Baily (1997) classified them into (Ecological Anthropology, Cultural Ecology, neo-Malthusian and Radical development Geography).

Ecological anthropology and culture ecology emerged in the 1960s and 1970s -was underpinned by ecological thinking. This school of thought pursued the links between cultural form and environmental management practices in relation to the adaptive behavior inside a closed system (Byrant and Baily,1997). The use of 'ecology' was aimed to emphasize the homeostatic and apolitical nature of human-environment interaction (Ibid). Globalization process and the integration of rural economies into global value chains weakened the idea of apolitical and homeostatic (Tan-Mullins, 2007). From the 1970s to the mid-1980s the intellectual discourse shifted away from cultural ecology to radical development geography and rejection of simplistic view of neo-Malthusians[10] narration of environmental doom and crisis. Political ecologist argued that the interaction between nature and society is rather embedded in the political economy, marginalization, capitalism and the power of the state (Bridge et al 2014).

2.2.1. Themes/Approaches of Political Ecology

There are five main approaches to the study of political ecology.

The first approach is concerned with specific environmental problem. This could be issues such as overfishing, marine pollution, deforestation among others. This approach embraces the 'traditional' geographical research theme (the impacts of societies action on the natural environment) but its also linked to the broader perspective of the political economy (Tan-Mullins, 2006).

[10] Earlier work by Thomas Malthus in 1798 titled "An Essay on the Principle of Population" argued that unregulated human population growth will surpass resources which may lead to increasing poverty (Finkbeiner et al, 2017). This line of thinking resurfaced with neo-Malthusians scholars claiming that overpopulation of the earth would put pressure on natural resources leading to degradation of environmental resources (Finkbeiner et al., 2017; Tan-Mullins, 2007).

The second approach focuses on concepts that is acknowledged to have important associations with political ecological questions (Bryant & Bailey, 1997). The ways in which ideas are developed and understood by different actors and how the ensuing discourses are developed to enhance or constraint the promotion of a certain actors interest over others (Tan-Mullins, 2006). Issues such as the social construction of climate change, adaptation, natural disasters and vulnerability as well as the general discourse on sustainable development are some of the examples of concepts that is viewed differently by the actors involved in shaping the narrations (Watts, 2014). Within the small-scale fisheries, industry in Ghana, Adjei and Overa (2019) found that artisanal fishers have been tagged with the image of irresponsible fishers applying unsustainable fishing methods and gears as one of the factors responsible for depleted marine stocks.

The third approach explores the relationships between political and ecological problems within the context of a specified region. Regional political ecology broadly concerns about environmental changes and the spatial differences in relation to resilience and sensitivity to land and theories of regional growth (Bryant & Bailey, 1997).

The fourth approach seeks to explore political –ecological questions from socio-economic perspectives such as class, ethnicity and gender. Essentially works on this theme highlights how politically and economically marginalized groups like peasant farmers and artisanal fishers suffer from environmental degradation (Tan-Mullins, 2006).

The final theme is concerned with an actor-oriented approach. In this study, the empirical analysis of power relations will be conceptualized using the actor-oriented approach. This approach seeks to understand conflicts and cooperation as an outcome of the interaction between different actors pursuing different interests. It explores the linkages between different actors to the social, political and environmental processes (Bryant & Bailey, 1997).

Bury (2008) used an actor -oriented approach to explore how local residents at Peruvian Andes respond to changes in the local economy and the environment in response to the activities of multi-national gold mining firm.

Turner (2012) also applied actor-oriented approach to unearth the everyday struggles among the Hmong in the Upland of Vietnam in negotiating their livelihoods with the state and neo-liberal policies that seek to insert their economic activities into the global value chains. In this study, the concept of an actor-oriented will be applied to explore the interaction between actors in the fisheries and the petroleum sector and the ways in which these actors influence or shape the livelihood adaptation strategies and outcomes of coastal fisherfolk.

2.2.2 Power and actor-oriented political ecology

Power is a central theme in political ecology with respect to the governance and management of environmental resources (Nathan J. Bennett, 2019; Bryant, 1998; Finkbeiner et al., 2017; Tan-Mullins, 2007).

Power has often been associated with possessing the material capabilities or resources that allows an actor to exert control over another actor. From geopolitical perspectives, such power can be derived from material capabilities such as a states military strength (Flint, 2011). The dimensions of power has however shifted to focus more on social relations and the abilities of an actor to compel or persuade another actor to act in its favor (Adjei & Overå, 2019) . Power therefore results from a series of processes that shape the outcome of human activities.

Power relations shape the interaction and relationship between actors such as the state, domestic and international businesses, grassroots (fishers and farmers) and NGOs (Bryant, 1997). These social relations are unequal because different actors possess different power and asset capabilities in negotiating access to environmental resources (Bryant & Bailey, 1997).

Power through political lens refers to 'the ability of an actor to control their own interaction with the environment and the interaction of other actors with the environment' (Bryant & Bailey, 1997. p.37). Different group of actors have the ability to transform the livelihoods of other actors. In such an actor-oriented approach to power, all actors have agency, which means that 'marginalized actors within constraining structures have various options and can exercise resistance' (Adjei & Overå, 2019).

An actor-oriented political ecology approach - is concerned with the interests, characteristics, and actions of different actors in relation to the processes and outcomes that shape environmental resources (Bryant & Bailey, 1997). One of the importance of the use of an actor-oriented approach in political ecological studies is that 'it allows researchers to draw direct causal relationships between the activities of particular actors operating at a variety of scales and local resource transformation and utilization' (Bury, 2008, p.308).

The power relationships that influence interactions between actors are mutual, but not necessarily equal, in nature. An actor-oriented approach analyses of environmental outcomes reveals the struggles over resources, identify and examine the relevant actors, the networks that link them together and their interaction with the environment (Bury, 2008; Tan-Mullins, 2007).

Byrant and Baily (1997) identified five different group of actors that are of relevance to the study of how power relations influence or shape access to environmental

resources. These group of actors are includes; the state, multilateral institutions, businesses, environmental NGOs and grassroots actors. In this study, the key actors under consideration are; the state, multinational oil and gas companies, environmental NGO's and grassroots actors (fisherfolk and coastal communities).

Using the actor-oriented approach the major sources from which different actors derive their sources of power is framed into material and non- material/discursive. The material dimension of power concerns how individuals and groups of people control and mediate access to environemntal resources of other actors, non-material / discursive relates to the dorminant narratives and knowledge posses by different group of actors(Penney etal, 2017; Bennette, 2019, Byrant, 1998).

Access refers to the ability to obtain benefits from resources (Penney et al., 2017). Actors may possess political, economic and social power and can mobilize these in a number of ways in order to control and maintain access to vital resources (Ayifli et al., 2014; Nolan, 2019). The political and economic power will be important to this study as it enables the understanding of how different actors with diverse strategies promote or obstruct access to vital environmental resources. The scope or range of scale at which a particular type of natural resource could be access is a highly contested issue. Access to natural resources at different geographic scales through the lens of political ecology is economically and politically constructed. Actors seek 'to maintain or reformulate existing power relations and social-ecological outcomes' (Bennett, 2019, p.73).

Political power may give the state the authority to enclose a particular a piece of land and or establish a no fish take zone in the form of marine protected areas. (Nolan, 2019). Economic power may enable powerful actors such as oil and gas companies the ability to influence existing rules and regulations in order to access the resources of local coastal communities offshore (Adusah-Karikari, 2015; Nolan, 2019; Obeng-Odoom, 2014)

In a related by Adjei & Overå (2019) and Arbo & Thuy (2016) they found that fishers mobility offshore have been unduly restricted because of oil extraction at sea. In Ghana, the emergence of the petroleum industry offshore has led to the introduction of buffer zones around oil and gas installations offshore. A 500m radius safe zone and another 1000 m radius exclusion zones have been set around each offshore petroleum production facilities (Adjei & Overå, 2019; Adusah-Karikari, 2015). Fishers are therefore not allowed to fish anywhere near the 500m as well as the 1000m radius exclusion zone.

Applying an actor-oriented political ecology Penney et al (2017) and (Nolan,2019) show how industrial trawlers[11] access fisheries resources in fertile fishing grounds reserved for artisanal canoe sector because of their political and economic power. Tan-Mullin (2007) focusing on small –scale fisheries and industrial trawlers show how access and control over fisheries resources is mediated by unequal power relations between local fishers and industrial fishing vessels.

Power is closely linked to narratives and knowledge (Bennett, 2019). Political ecology provides vital insights related to the influence of power and the manner in which narratives, knowledge, and scale are used to legitimize and shape policies in the governance and management of the ocean space(Bennett, 2019; Bryant, 1998). The non -material / discursive forms of power relates to the dominant narratives and knowledge possessed and exercised by different group of actors to control the access of other actors to vital environmental resources. According to Ayifli et al (2014, p.341) discourses refers to "knowledge regimes that produced shared meanings". This knowledge regimes are not static but are very dynamic and often expressed in the form of narratives and storylines 'aimed at convincing the public and policy makers that a given situation exists and requires policy intervention' to remedy it (Adjei and Overå, 2019, p. 191). Narratives can also be used purposefully to explain what constitutes rational or logical policies or actions and can be applied by actors to provide legitimacy to important set of environmental policies (Bennett, 2019).
This type of power will also be relevant for this study as different stakeholders hold different views and opinions concerning the causes of decreasing fish catch and the broader issues of conservation as well as the governance of marine and petroleum resources. Actors can exercise power through discourses in specific ways that serve their interests over other actors (Bury, 2008). The discursive power dynamics among formal and informal actors reveals the causes as well as the outcomes of conflicts and or cooperation resulting from the interaction of these different actors who sometimes pursue different aims and interests (Adjei & Overå, 2019; Nathan J. Bennett, 2019).
Local fisherfolk and coastal communities can use narratives as a tool to resist or mount campaign against the introduction of certain policies such as close fishing season. Therefore power relations has the ultimate potential to influence or shape the adaptive capacity of local resources such as fisherfolk

[11] Trawlers refers to the type of fishing vessel used in the industrial fisheries sector.

2.3 Rational for the integration of SLA and Political ecology (PE)

The SLA is applied to investigate the links between fisheries livelihoods and the larger context of offshore oil and gas extraction and production. It will help to unearth the main types of assets available to fishing households that enable them to construct their livelihoods in the face of multiple vulnerabilities.

The actor-oriented approach derived from political ecology will helps us understand the livelihood decision-making processes and struggles over access to vital resources between the fishers and oil and gas companies. In every conflict, there are winners and losers. Political ecology seeks to show the winners and losers of environmental conflicts from the perspective of unequal power relations. The following reasons support the integration of SLA and political ecology in this study.

Firstly, SLA and PE share some similar characteristics; they both emphasize on the marginality and vulnerabilities of grassroots actors like fishers and farmers as well as their struggles to protect and secure their livelihood. Both approaches aim to secure better livelihood outcomes for poor people who depend on the environment for survival.

Secondly, the integration of SLA and PE will provide the framework to better understand and explore the complex interaction between different actors at the local, national and international level that shape/influence access to vital environmental resources.

Thirdly, the SLA and PE recognizes institutions/actors as important agents of livelihood transformation and access to environmental resources. However, sustainable livelihoods approach assumes that strong and efficient institutions, organizations, are sufficient to mediate livelihood strategies in order to determine favorable livelihood outcomes in the context of assets and vulnerability. The actor oriented-approach focuses on the power relations between actors and how power is exercised to the benefits of an actor at the expense of other actors.

2.3.1 Analytical framework of study

The SLA is combined with an actor-oriented political ecology to help us better understand how access to fishery resources is constrained by powerful actors such as the state and multinational oil and gas companies.

The vulnerability context is investigated from two perspectives; first in terms of the external shocks and stresses to livelihood security and secondly, in terms of the

internal coping mechanism. Overfishing, and oil exploration and production are presented as key shocks and stresses within the local fisheries sector. The internal coping mechanisms is facilitated by the available livelihood capital assets. Fishing households have certain assets, which they use to construct their livelihoods in the face of multiple vulnerabilities.

The main livelihood capital assets available to fishing households includes natural, human, financial, social and physical capital.

Fisherfolk construct their livelihoods base on these five capital assets. The ocean and fisheries resources are key natural capital available to fishers. Fishers extract fish from the ocean. Other natural capital such as land could be key to the livelihoods of fisherfolk. In terms of social capital, fisherfolk have formal and informal networks/association that provide avenues for collective action. Their human capital includes the knowledge, ability and skills to organize fishing activities for subsistence and commercial purposes. Their physical capital includes fishing inputs such as nets, canoes and other materials. Their fishing technique usually relies on low technology. In terms of financial capital, fisherfolk relies on savings and credits, remittances and pensions. The local fisheries sector is characterized by low financial investments.

Assets may also include the power to influence or shape the decision-making processes and outcomes of important environmental policies. The study attempts to position power to represent actor's rights as a claim to an asset.

The interaction between the formal and informal actors in the fisheries and petroleum sector is framed using the actor-oriented approach derived from political ecology. The framework will apply the material (political and economic) and non-material (discourses, narratives) forms of power to analyze how they are exercised to the benefit of a group of actors at the expense of other actors. The actor-oriented approach provides the mechanism to understand the political dimensions of the interaction between human activities and the environment. The main actors under consideration in the informal group are the fisherfolk and coastal fishing communities collectively referred to as grassroots actors. The main actors in the formal group are state fisheries agencies, environmental NGOs and, oil and gas companies.

An actor –oriented approach to livelihoods analysis recognizes that each actor possess some form of power that can be exercised to the advantage of a group of actors at the expense of other actors. It explores the interests, characteristics, and actions of different actors in relation to the decision-making processes and outcomes that shape environmental resources. To understand livelihood-based struggles, it is important to appreciate the fact that struggles for sustaining livelihoods are also

largely a manifestations of political processes; that are also directly linked to issues of control and entitlements (Ayifli et al, 2014).

The state introduction of closed season policy to restore depleted marine fish stock and restriction of fisherfolk coastal mobility offshore to protect oil production facilities are manifestations of various ways in which powerful actors transform the livelihoods of grassroots actors such as fisherfolk. Grassroots actors also have power. Fisherfolk may attempt to circumvent the political and administrative control over the use of the ocean space by engaging in illegal fishing activities. Coastal communities and fisherfolk can also use narratives to resist certain policies, which they perceive to have a negative impact on their livelihoods.

The state, small-scale coastal fisherfolk, and petroleum companies are not operating in a political vacuum. They are operating within a highly politicized environment. In such a politicized environment, power can be exercised in an unbalanced manner to transform not only the social relations but also livelihood systems (Ayifli et al, 2014 : Byrant and Baily, 1998). The relationships between diverse actors are 'nested together into different forms of power systems and with discourses that operate within specific or intertwined socioeconomic contexts' (Ayifli et al, 2014).

The interaction between the actors in the fisheries and the petroleum industry could influence livelihood the adaptation strategies of coastal fisherfolk as well as the eventual livelihood outcomes.

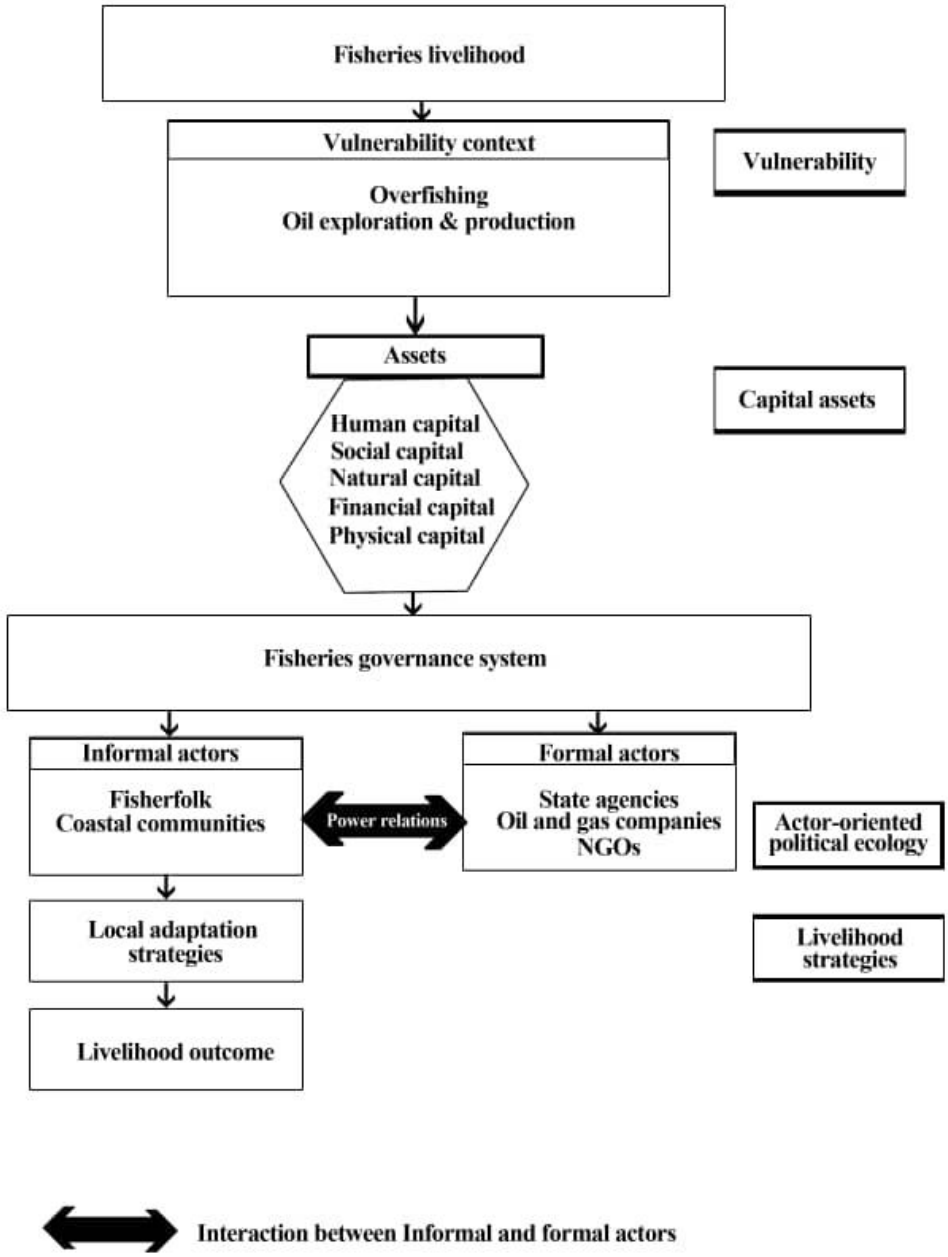


Figure 2. 2 Framework of the study.

Research gaps

This research seek to contribute to four main research gaps with reference to the literature on sustainable fisheries livelihoods, and natural resources development and conflicts. The study will contribute to the spatial organization of small-scale fisheries by examining how local fisherfolk explore new economic opportunities while also resisting policies that seeks to reduce or deprive them of their rights to access community based resources.

Firstly, the study will contribute to the vulnerability literature by revealing the combined effects of overfishing and offshore oil and gas production on the livelihoods of coastal fisherfolk with respect to marine fisheries sustainability.

Secondly, the study will contribute to how unequal power relations influences or shapes access to use of marine resources for differently situated social actors. It will reveal the different types of power possessed by formal and informal actors in the fisheries and petroleum industry and its implication for the adaptation strategies of fisherfolk

Thirdly, the study will contribute to the adaptation literature on marine fisheries livelihoods by investigating the coastal mobility strategies of fisherfolk in respond to declining fisheries livelihoods. The understanding of adaptation strategies deployed by fisherfolk could serve as important solution to fisheries management and relevant policy intervention.

Fourthly, the study will contribute to the local marine ecological knowledge of fisherfolk and its relevance for marine conservation.

Finally, the study will contribute to the opportunities and challenges associated with multi-stakeholder participation to help us better understand the decision making and implementation process of environmental policies in developing country context with reference to small –scale marine fisheries in Ghana.

Chapter 3. Case study introduction

This chapter is divided into three main parts. the first part describes the study areas. The second part provides an overview of fisheries management and the current state of the marine fisheries sector. The final section discusses lessons from the petroleum industry in Sub-Saharan Africa. The discussions in this chapter serves as an important background information towards the understanding of the historical developments of the fisheries industry in Ghana as well as the current vulnerabilities. It provides insight into the trends and changes that has occurred over the past decades.

3.1 Introduction to Ghana

Ghana is Anglophone country located in West Africa. Ghana share border with Côte d'Ivoire to the west, Burkina Faso to the north, Togo to the east, and the Atlantic Ocean to the south. Ghana's population is concentrated along the coast and in the principal cities of Accra and Kumasi. Ghana now have sixteen regions, which until 2018 was ten. The Western Region which is the focus of this study is now divided into two ; namely Western Region and Western north. Since 2010, Ghana's economy has been dominated by the services sector. In 2017, the services sector alone contributed 45.6 per cent to GDP compared to 33.2 per cent for industrial sector and 21.2 per cent for the agricultural sector (Ghana Statistical Services, 2018). The decrease in output from the agriculture sector can be a major food security problem. Already in the fisheries sector the country is importing huge quantities of fishery related products to support the shortage of fish supply in the domestic market.

Ghana has often been hailed as success story in Africa for its peace and stability in a region that has often been engulfed with conflicts and violence. Since 1992, Ghana has enjoyed 25 years of multi-party democracy with relative peace and good stability. Ghana is classified as a lower middle-income country with an estimated GDP per capita of USD1, 648.3 in 2017 (Nketiah-Amposah, 2015). The country's democracy is however characterized by growing inequality between the wealthy and the poor and high levels of corruption among elected and government officials.

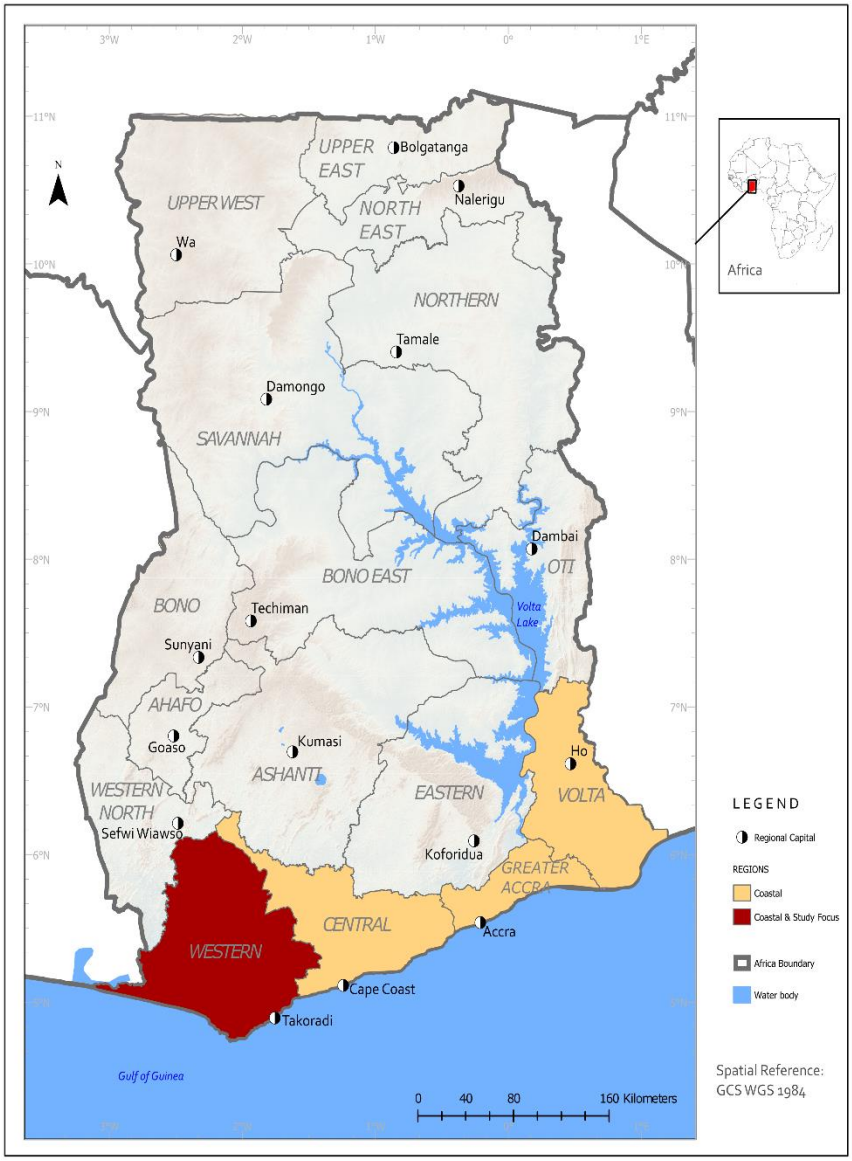


Figure 3. 1. Map of Ghana showing the Western Region of Ghana

Table 3.1 shows that there have been improvement in reducing the number of people living in poverty. However, even though there was a decline of poverty from 2012/3 (8.4)to 2016/7 (8.2), in absolute terms more people are living in extreme poverty from 2.2 million in 2013 to 2.4 million in 2017 (GLSS, 2018). In addition, there is a growing trend of income inequality, within a decade income inequality has increase from 40 per cent in 2006 to 42 per cent by 2016.This attest to the fact that the growth in the economy has not been pro -poor and skewed towards the benefit of only few people

Table 3. 1. Socio-economic indicators since the beginning of multi-party democracy-1992.

Years	1991/1992	1998/1999	2005/2006	2012/2013	2016/17
Population (mil)	14.9	18.1	22.2	26.3	30
Extreme Poverty	33.2	24.4	16.5	8.4	8.2
Poverty levels	56.5	43.9	31.9	24.2	23.4
Income inequality	37	39	40	41	42
Unemployment	4.7	8.2	3.6	5.2	4.6

Sources: GLSS (2018).

Households with heads as farmers and other agricultural jobs like fishing remains the poorest in Ghana (Ibid). On the other hand, households with heads employed in the private sector, self-employed, or public sector workers are less likely to experience poverty. Poverty in Ghana has been described as a rural phenomenon.
The next section discusses on the history of fisheries management and governance in Ghana.

3.1.1 Western Region of Ghana.

The Western of Region of Ghana with a population of 3,023,529m is a major fishing hub in Ghana (Ghana Statistical Services, 2018). The Western Region accounts for 30% of the Ghana's coastline with 20 to 30% landing sites (Finegold et al., 2010). Before the commencement of oil and gas activities fishing used to be the main livelihood activity in Western Region which remains the same (Ayifli et al., 2014).
According to MoFAD in 2016, the Western Region lost two fishing villages. The survey also reported that the number of landing beaches in the Western Region decreased to 89 compared to 96 in 2013. The Western Region is therefore one of the most affected in relation to the declining small-scale fisheries opportunities.
The table 3.2 shows the breakdown of the number of fishermen across the four coastal regions in Ghana.

Table 3. 2. Regional breakdown of the number of small –scale fishermen in Ghana

Region	Number of Fishermen
Western Region	33,602
Central Region	33,373
Greater Accra	14,699
Volta Region	14, 699
Total	107,518

Source : MoFAD (2016).

Presently there are six districts (Sharma, Sekondi-Takoradi, Ahanta West, Nzema East, Elembelle and Jomoro) located in the Western Region where oil and gas production is ongoing. Out of these six districts, four district were selected for this study. The seven study areas from the four districts were carefully selected after a thorough review of previous literature which explored and examined the complex relationship existing between the local fishing and the oil & gas industries and environmental factors (Adjei & Overå, 2019; Dowokpor, 2015; Finegold et al., 2010; Manu, 2012). The study areas were selected because they share some similarities as well as differences in relation to socio-economic activities and vulnerabilities to fisheries livelihoods. Firstly, the primary economic activity is fishing and its related activities; secondly, there are varying degrees of the impact of oil extraction and production activities and finally there are concerns with declining fisheries livelihoods and natural resource conservation concerns.

Ahanta West Municipality

Table 3.3 provides a brief summary of fishery characteristics of the district. The study focused on the communities of Akwidaa and Discove in the Ahanta West District. Akwidaa is a small coastal community located the Ahanta West District of Ghana. It is bordered to the West by Achona and to the East by Cape 3 Points (CRC, 2010). Fishing is the major economic activity with over 60% of men and women participating in the industry (Manu , 2012). There is an estimated 527 fishermen and over 90 canoes in Akwidaa with a population of about 1,344 in 2000 which is now estimated to be about 8000 (MoFAD, 2016, CRC,2010).

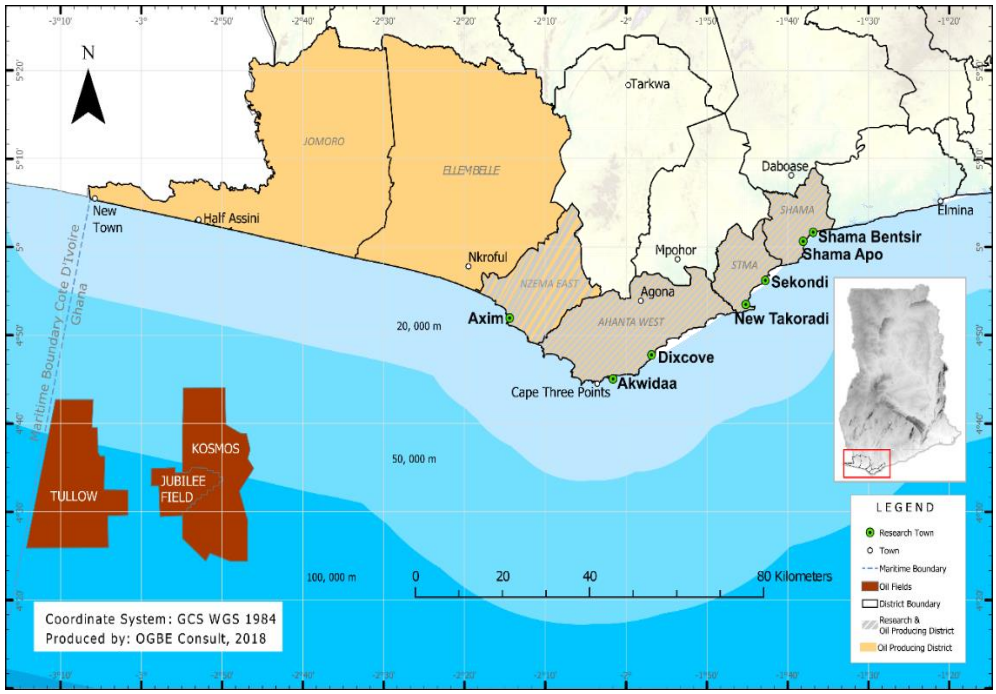


Figure 3. 2. Map of Western Region showing the major districts and study areas.

Akwidaa close proximity to Cape 3 Points- where Ghana's first commercial discovery of oil took place has placed it in the spotlight by attracting national and global attention (Manu, 2011). Due to its geographical topography (low-lying), the community of Akwidaa is prone to multiple climate change related hazards such as coastal erosion and flooding (CRC, 2010).

Dixcove is a major fishing and historical settlement in Western Region of Ghana. Over 90% of the population are engaged in fishing and its related activities like processing and marketing. Other economic activities in the community includes farming, tourism and trading (Kruijssen & Asare, 2013). MoFAD (2016) estimated that there are over 800 fishermen with over 200 canoes in the community. The community is divided into lower and upper Dixcove with population estimated to be 7000 in 2013 (Ibid). It has about forty-two former European trading forts and beautiful beach scenery. Korea International Cooperation Agency (KOICA) co - developed a project with the local district in 2010-2012 and designated Discove as a key tourist town with the theme 'Heritage and Village' (Hilary et al, 2013).

SHAMA

Shama Apo and Bentsir are key coastal communities and major fishing towns located in Shama District. Shama Bentsir is located West of Shama characterized by houses that extend to the shoreline. Apo is however located towards the East of Shama Bentsir (CRC, 2010). The major economic activities in the community includes fishing, farming, mining and trading. There are estimated 948 fishermen with 195 canoes in Shama Apo and another 765 fishermen with 163 canoes at Shama Bentsir (MoFAD, 2016). The major fishing season commences from June to September with some of the major fish catch including-sardines, mackerel, tuna, sharks, dolphins, barracuda, cassava fish and lobsters. Environmental pressures including coastal erosion and flooding together non-natural factors like decreasing fish are negatively affecting the local fishing industry.

NZEMA EAST MUNICIPAL ASSMBLY

Axim is the capital city of the Nzema East Municipal Assembly and located about 64km West of the regional capital –Sekondi Takoradi (Adusah-Karikari, 2015). Axim is perhaps the most developed community in relation to infrastructure and social amenities in Nzema East (Adjei & Overå, 2019). Axim is made up of two communities (Lower and Upper) Axim with each having its own traditional ruler and chief fisherman. Due its close proximity to the oil production facilities offshore, artisanal fishers in Axim have had to compete with the petroleum industry for ocean space which is perceived to have affected the local fishing industry (Adusah-Karikari, 2015). Fishing is the main occupation in the municipality, which serves as the backbone of the local economy. Majority of the inhabitants of Axim relies on fishing as their major livelihood, during the bumper harvest season (July- September) there are influx of fishermen and boats from other coastal towns and from neighboring countries.

SEKONDI-TAKORADI METROPILITAN ASSEMBLY

Sekondi-Takoradi is a twin- city with Sekondi serving as the administrative capital of the district. The town is a major center for commercial and industrial activities including the petroleum industry. Fishing is a major economic activity in the Sekondi settlement. According to MoFAD (2016) there are over three thousand fishermen and over 250 canoes in Sekondi. There is influx of people from Ghana and expatriates workers around the globe presently residing in Sekondi (Fiave, 2017). The influx of people into the town has led to price increases in basic commodities and rent.

New Takoradi is a major fishing community with over 400 fishermen and 120 canoes located in the Sekond-Takoradi Metropolis (MoFAD, 2016). With a population of

about 14000 the town is located just about 3 km from the central business district of Takoradi.

Table 3. 3. Characteristics of fishery sector among the four study districts

Municipality/ District	Ahanta West	Shama	Nzema East	Sekondi-Takoradi
Population	136,044	366,579	190,435	710,517
Fishing Village	20	10	20	6
No.of Fishermen	6031	7710	6614	4542
No.of Canoes	1107	1086	405	664
No.of Motors	794	1037	353	646
Major fish catch	sardines Mackerel	Tuna, sardines, Long-finned hierring, Lobster, barracuda	Tuna, sardines	sardines,
Major gears used	Pursing net, lobster net drifting net	Pursing net, Ali net Drifting net, lobster net	Pursing net lobster net, beach seine Ali net	Pursing net, line, lobster net
Annual fish output	16,977mt	43,488mt	6191mt	40,00mt

Source : MoFAD, 2016; Dowokpor,2015; CRC, 2010.

3.2. Fisheries management & governance in Ghana

Fisheries resources management in Ghana has undergone through several phases of challenges during and after colonialism. This section will provide an overview of formal and informal fisheries management institutions that has led to the current state of fisheries from colonial and post –colonial perspectives.

Formal fisheries management

Following the classification of Finegold et al (2010), the fisheries management is divided into five main governance regimes. These includes; the colonial era, state-led era, decentralization, co-management and rebirth co-management.

The colonial fisheries management era was characterized by an open access regime. In 1946, the British colonial government established the Department of Fisheries and enacted the first fisheries regulatory law called Fisheries Ordinance , Cap 165 (Antwi-Asare & Abbey, 2011; Finegold et al, 2010) This institution was mandated to oversee fisheries development and its related activities such as the introduction of semi-industrial boats and outboard engines (Finegold et al, 2010). Prior to the establishment of the fisheries department in 1946, fisheries management and conservation related issues were largely under the control of the traditional local authorities composed of mainly the chief fisherman and chief mongers (Tsamenyi, 2013).

The period of fisheries governance under the British colonial government after the establishment of the fisheries department was characterized by open access which led to increase in fishing efforts –use of modern vessels aimed at increasing fish catch (Finegold et al, 2010, ; Penny et al, 2017). The open access nature of fisheries governance by the British government through policies like the introduction of the Ali nets[12] to boost fish catch resulted in conflicts with the local authorities who opposed the use of such fishing gear (Peeny et al, 2017). For instance, the Supreme Court of the (Gold Coast) now Ghana reversed a local law banning Ali nets in Teshi-a suburb in Accra on the premise that the law was not in place before the Supreme Court Ordinance of 1876 (Finegold et al , 2010). Local authorities were deprived of their legitimacy to make and enforce any byelaws to protect the fisheries resources. The British colonial judicial courts governed the ocean spaces under maximum exploitation using the argument that the most efficient fishing net is the one that yields maximum catch (Peeny et al, 2016; Finegold et al , 2010). Presently the Ali nets remains one of the most widely used fishing nets in Ghana. There are over 1,000 Ali nets currently in use by canoe fishermen across Ghana (MoFAD, 2016).

After attaining independence in 1957, the national government motivation was to expand the fishing industry from the dominant artisanal canoes to industrial-based in order to increase its contribution to national income and food (Atta-Mills et al,

[12] Ali net is type of fishing gear commonly used by coastal fishers in Ghana, because of its small mesh size; it is able to catch both fingerling and mature species.

2004). The state fishing corporation was established in 1961 and necessary resources like trawler vessels, cold stores was acquired to facilitate the increase in fish production and total revenue for the state (Atta-Mills et al 2004; Finegold et al , 2010; Peeny et al , 2016). The Fisheries Regulation LI 364 of 1964 was also enacted to regulate fishing related activities in the country (Antwi-Asare & Abbey, 2011; Tsamenyi , 2013). The new fisheries law LI 364 of 1964 served more as a basis for administrative work rather than controlling of fishing capacity leaving the ocean space free access and unregulated (Finegold et al 2010). The chief fisherman and traditional authorities at coastal fishing communities were the main actors responsible for the introduction and enforcement of regulations that seeks to promote marine conservation (Tsamenyi, 2013). The institution of the chief fishermen was particularly seen as an important agent of marine conservation. They provided strong leadership in the local-level fisheries management and conservations in the 1960s and 1970s where the state failed to do so.

The Ghanaian government under leadership of the Provincial National Defence Council (PNDC) with the help of the World Bank implemented a comprehensive economic reform programme called the Structural Adjustment Program (SAPS) in 1987 (Acquay, 1992). As part of the structural adjustment program, the government embarked on decentralization -where some functions which was originally performed by the central government was delegated to newly formed regional government units and District Assemblies (DAs) (Ayee, 1997). Under these arrangements –the Ministry of Agriculture, which also comprises the fisheries department, was decentralize. Fisheries management and implementation of fisheries policies transfered to the District Assemblies. At this stage as noted by Acquah (1992) the fisheries department capability and capacity to manage marine fisheries was further weakened because of restrictions on hiring of new staff and the high cost of imported fish monitoring equipment led to fewer purchases, which affected the capacity of fisheries related research.

Throughout the 1980s and 1990s there was expansion in the number of industrial trawler vessels and introduction of pair trawling with possible concerns of overfishing and overcapacity starting to emerge but with little or no enforcement of fisheries laws and regulations on marine conservation (Finegold et al, 2010). The exploitation of marine fisheries therefore continued unabated with consequence on future productivity of fisheries. It also important to recognize that other global and regional events contributed to increasing fishing capacity in Ghana. In 1983, Ghana ratified the United Nations Convention of the Law of the Sea (UNCLOS) (Antwi-Asare & Abbey, 2011). The law of the sea (UNCLOS) Article 56(1) allowed coastal states the right to claim and to have the sovereign rights to govern and manage their

coastal waters and other resources within their exclusive economic zones. Before this law came into effect, the majority of Ghanaian fishing vessels were operating in the waters of other African countries such as Liberia, Senegal, Cote D'voire , Congo and Mauritania. As many other African states attained their independent and restricted access to their fishing grounds, many Ghanaian fishing vessels were compelled to return home to fish in Ghanaian waters (Ameyaw, 2017). This situation contributed to the increase in number of fishermen and fishing vessels putting more pressure on marine fisheries.

In 1997, the Work Bank funded the fisheries sub-sector capacity-building programme in partnership with the government of Ghana (Abane, H., Akonor, E., Ekumah, E., Adjei, 2013). Out of this project a total of 133 Community Based Fisheries Management Committees (CBFMCs) was created and spread along 300 landing beaches between 1997 and 2002 (Tswamenyi, 2013). The CBFMCs was created based on the existing principles of local traditional systems of fisheries practice in coastal areas in particular that of Mumford in the Central region of Ghana where there was a local systems of fisheries management which empower selected members of the local committee with enforcement powers (Finegold et al 2010). The local committee consisted of the chief fisherman and seven village leaders with the responsibility to enforce fisheries related regulations in consultation with all relevant stakeholders in the community. The main aim of the concept of CBFMCs was to make fisheries governance and management representative and all-inclusive. According to Finegold et al (2010) some of the rational for the creation of the CBFMCs includes but not limited to empowerment of traditional authority (chiefs, elders and chief fishermen) to enforce existing fisheries laws and byelaws. It also seek to encourage the participation and involvement of local people in decision-making process and implementation of fisheries laws and byelaws & to educate community members on sustainable fishing practices. As a partner in the co-management initiative, the national government via the District Assemblies (DAs) were responsible to ensure the sustainability of CBFMCs while providing the necessary legal and financial support to CBFMCs. The DAs were supposed to collaborate with the Department of Fisheries in enforcing regulations and approve the byelaws and levies introduced by CBFMCs (Finegold et al 2010). Majority of the CBFMCs failed to live up to expectation whilst the greater number of them also collapse. Co-management institutions gradually become ineffective and failed to achieve the purposive for which it was established.

Since 2000, successive governments have made efforts to create a dedicated ministry for the governance and management of fisheries resources in Ghana. In 2005, Ministry of Fisheries was established with its own sector minister appointed

by the government in power (Finegold et al , 2010). The Ministry of Fisheries and Aquaculture Development was later created with its own sector minister. The Fisheries Commission serves as an advisory and implementing agency with regional and district coordinating offices spread across the country. MoFAD is primarily responsible for the management of fish and fisheries related resources and products in Ghana. MoFAD in consultation with the Fisheries Commission and other relevant stakeholders and institutions develops strategies that seek to address challenges in the fisheries sector in order to achieve food security, employment creation and poverty reduction (MoFAD, 2016). The institutional arrangements of MoFAD and FC includes the Directorate of Fisheries which is made up of the ; Marine Fisheries Management Division, Marine Research Division, Inland Fisheries Management Division as well as the Monitoring, Control & Surveillance Division .

The major management concerns during this period have to do with overfishing, increasing fishing effort and capacity, illegal fishing and the rapidly depleting marine fish stocks in the country (Figure 3.4). The Fisheries Act 2002 (ACT 625) and the Fisheries Management Plan of (2014-2019) are two major fisheries management framework with specific policies that seek to reverse the dwindling fortunes of the fisheries sector. Some of the policy prescriptions includes regulation of new entrants into fishing via licensing, marking and registration of vessels, enforcement of existing fisheries laws and regulations on illegal fishing activities, seasonal closures and marine biodiversity conservation.

However, the most drastic management policy has been the introduction of closed seasons (Figure 3.4). The closed season commenced in 2016 for the industrial trawlers and extended to the small-scale fisheries sector in 2019. The closed fishing season for 2019 was scheduled as follows; for the Artisanal Canoes and Inshore Fishers (15th May to 15th June), whiles that of the industrial Trawlers is scheduled to commence form 1st August to 30th September. Article 269 of the 1992 constitution, the Fisheries Act (2002) Act 625 and the Fisheries Amendment Act, 2014 (Act 880) and the LI 1968 and LI2217 mandate the MoFAD and the Fisheries Commission to close the sea during certain period of the year, which is considered suitable for the purposes of rebuilding fish stocks and biodiversity conservation

Indeed, many valuable lessons can be discerned from the various approaches to governing the ocean space in Ghana over the past decades. Evidently, over the past decades fisheries management and governance in Ghana has dominantly been predominantly top down and where efforts was made to broaden the scope of participation of diverse stakeholders such as the creation of the Community Based Fisheries Management Groups (CBFMGs) it failed to live up to expectation.

Table 3.4 shows the laws and fisheries regulations of Ghana. Some of the notable fisheries management policy documents includes; Ghana National Fisheries and Aquaculture Policy 2008, Ghana Fisheries and Aquaculture Development Plan 2011-2016 and the Fisheries Management Plan (2015-2019). Table 3.4, clearly shows that Ghana has sufficient regulatory laws to ensure the sustainable harvest of fisheries related resources. The lack of enforcement of such laws may have partly contributed to the current state of depleted marine fish stocks

Table 3. 4. Overview of Legal and Regulatory Framework in Ghana's Fisheries Sector.

• Fisheries Ordinance, 1946 CAP (165)
• Wholesale Fish Marketing Act passed in 1963
• Fisheries Act 1964
• Fisheries Regulations LI 364 of 1964
• NRCD 87 of 1972 (Fisheries Decree 1972)
• Fisheries (Amendment) Regulations 1977
• AFRCD 30 of 1979 and the accompanying regulation
• Fisheries Regulation 1979 LI 1235
• Fisheries Regulation 1984 LI 1294
• Maritime Zones (Delimitation) Law, 1986
• PNDC Law 256 of 1991
• Fisheries Commission Act of 1993
• Fisheries Act 625 of 2002
• Fishers Regulation 2010 (L.I. 1968) gave effect to the Fisheries A ct 2002 (Act 625)
• Fisheries Amendment Act 2014 (880)
• Fisheries Amendment Regulations 2015 (LI 2217).

Source : Afoakwah et al.2018; Finegold et al.2010.

Figure 3.3 shows that between 1950s to the early 2000s the fisheries management was largely characterized by an open access regime. The focus was on maximizing the output of the marine fisheries. Some of the initiatives such as the establishment of the state fisheries corporation, introduction of industrial vessels-(1960s),

introduction of outboard motors and light fishing[13] were aimed at achieving maximum fisheries output (Finegold et al, 2010). All this effort was made by the state to increase fish production. The periods from 1960s onwards witnessed rapid increases in both industrial vessels and artisanal canoes. Light fishing and the use of monofilament net by canoe fishers and semi industrial vessels increased from the 1980s to 2000s.

Relevant legislative instruments such as Fisheries Act 1964 and PNDCL 256 (1991) failed to control the over exploitation of fisheries resources. Indeed, the PNDC Law 256 of 1991 gave legislative support for the introduction and enforcement of closed fishing seasons for marine fisheries. However, closed fishing season was not implemented until 2016 even though there were signs of overfishing. Leadership of the chief fisher and the traditional authorities provided vital efforts to sustain the fisheries industries. Strict enforcement of one day fishing holiday in a week – was the main the tool for controlling overfishing.

The introduction of closed fishing season seems to appear as a desperate measure to restore the depleted marine fish stock. However, without effective monitoring and enforcement of existing laws on illegal fishing practices, it will be extremely difficult to achieve considerable gains in rebuilding of depleted fish stocks.

[13] Light fishing is a form of illegal fishing practices commonly among artisanal fishers, fishers use the light to attract fish for easy capture (Afoakwah et al.,2018). The technique was introduced by the state fisheries agencies into the industrial sector to increase fish catch, it is however no longer recognized and classified as illegal method.

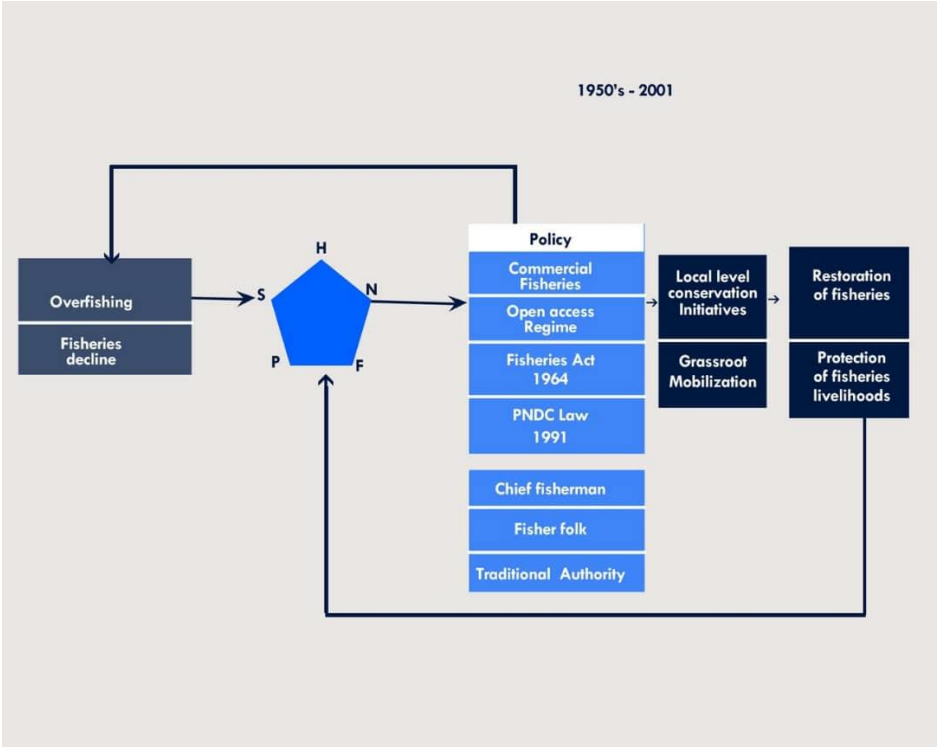


Figure 3. 3. SLA showing timeline of fisheries policy from 1950s to 2001.

Since 2005, there has been a dedicated fisheries management institution with centralized system of governance. Figure 3.4 shows that there was more focus on state led interventions to end overfishing and restoration of the fisheries.
The Introduction of marine protected areas in the form of closed seasons for artisanal canoes is the first of its kind in Ghana. More powers is now concentrated at the national level.

Informal fisheries management

Traditional institutions and local political authority have remained important agents of natural resource management and conservation related issues in Ghana. In the fisheries sector, the institution of village chiefs, the chief fisherman, chief fish monger/processor and chief fish trader have serve as an important agents of governance and management of fishing in coastal communities. In the Fante fishing communities especially in the Central Region, old military companies known as *Asafo* still remains an important organization in the management of fishery resources (Overa, 2001).

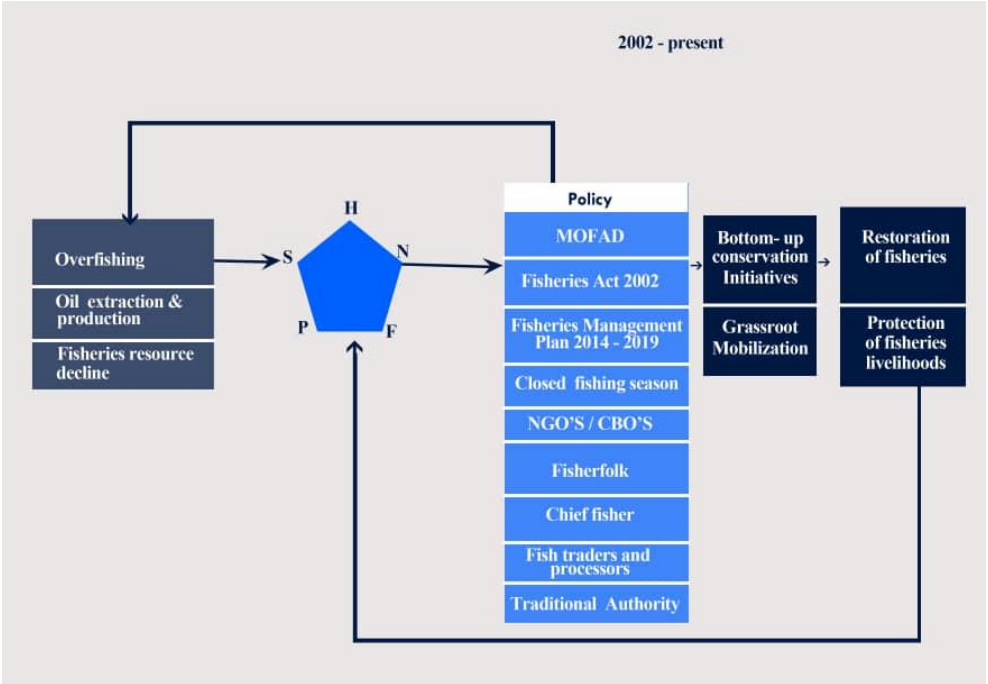


Figure 3. 4. SLA showing timeline of fisheries policy from 2002 to present.

The local traditional authority in most fishing communities have strived to maintain their uniqueness and relevance in the 21st century system of modern governance and contributed positively toward the development of the fishing industry in the country.

Village Chief (*Omanhene or ohene*)

Local chiefs acts as custodians of the land and the ocean and govern with the assistance of council of elders and sub-chiefs (*beesonfo*). The position of the chief including the sub-chiefs are mainly hereditary and are determine based on ones lineage (Odotei, 1999). The chief council may also include a woman called queen mother with the responsibility of speaking on behalf of women and providing advice where needed to the chief (Finegold et al , 2010). In many coastal communities across Ghana, the sea is considered as a sacred and pure entity with many taboos . One of such taboos is the ban on fishing and fish trading activities on Tuesdays. The traditional leadership have kept and enforce this practice generation after generation.

Chief Fisherman

The chief fisherman (*Apofohene*) just like the local chief (*Omanhene*) in some communities is selected based on lineage while in other communities, experience and expertise is the main criteria for the selection (Finegold et al,2010). The chief fisherman is also assisted by a council of seven elders (Odotei, 1999). Some of the

duties of the chief fisherman includes conflicts resolution among fishermen and between fishermen and fish buyers, he gives advice to fishermen and together with the priests of the sea god (Bosompo) and the other gods he performs fisheries related rituals for safe and good fishing (Overa, 2001). In coastal communities where fishing and its related activities like processing and selling is the main economic activity, the institution of the chief fisherman compared to that of the local chief becomes even more important in relation to economic and political significance (Finegold et al , 2010, ; Overa, 2001). The chief fisherman work and collaborate with state agencies such as the MoFAD, EPA, Agricultural Development Bank and other domestic and international non-state actors such as World Bank, NGOs , USAID towards the sustainable fish practices and welfare of local fishermen . One of the first point of contact when a migrant fishing crew arrives at a new location is the chief fisherman, who in return the collects a small fee from the migrant fisherfolk and permit them to fish in his territory (Finegold et al , 2010).

The chief fishmonger/ processor

The chief fish processor also known locally as *Konkohene* is woman who work with assistance from her seven council of elders (*Beesonfo*). At the landing beaches, the *Konkohene* represents the interest of the women in the bargaining process, she negotiate with fisherfolk at the coast for fish pricing (Odotei, 1999).In the event of conflict outbreak between women competing over the buying of fish , the *Konkohene* is called upon to settle the dispute (Ibid). One of the key responsibility of the chief fishmonger/processor is maintaining serenity between fishermen and fish traders by working with the chief fisherman to amicably settle pertinent issues related to the quality and prices of fish at the coast (Finegold et al , 2010). Some of the other responsibilities of the chief fish processor/trader includes settling of debt cases between women and between men and women, she also contributes in cash and or kind to ritual performances for the sea gods (Odotei, 1999).

The chief fish trader

The chief fish trader *(Kokonhene/Enamhene*) whose major duties are connected to the inland markets addresses problems such as arranging of transportation for goods, selling and debt collection (Finegold et al, 2010). In most cases, new fish traders are supposed to inform the chief fish trader before the commencement of business in the market, in some cases this can also be done after the commencement of the business with small fee payment to the chief fish trader (Odotei, 1999). She also acts as an intermediary between the women fish traders and the local traditional authorities and also presents fish to the traditional authorities during festivals, funeral or ritual occasions and when official guests visit the town (Finegold et al, 2010). Some of her other functions includes taking care of injured fish traders in the case of accident and

in the case of death she assist to arrange for transportation to carry the dead body to the demise hometowns (Odotei, 1999).

3.3 Structure and overview of Ghana's marine fishing sector

Ghana is endowed with a coastline of about 550km long and maritime area, comprising of the territorial sea of 12 nautical miles (mm) and the Exclusive Economic Zone (EEZ) of 228,000km² (MoFAD, 2015; FAO, 2016). The marine capture fisheries is by far the most important in relation to total fish landings accounting for 80 per cent total fish catch with an annual average fish production of 300,000 metric ton (FAO, 2016). The marine fisheries capture sector is made up of three main types of fishing fleets. This includes; industrial vessels, semi-industrial and artisanal canoes.

Industrial vessels

The industrial vessels are classified into large-scale trawlers, shrimp trawlers and tuna boats. This vessels are foreign built with steel hull and possess the capacity to operate in areas outside national jurisdiction with their ability to stay at sea for longer periods of time (MoFAD, 2015). The industrial vessels specifically operate from Tema and Sekondi fishing ports where there is harbor. The industrial vessels with freezing facilities on-board mainly target demersal species such as sparids, groupers, cuttlefish and snappers and are earmarked for the export market (Finegold et al, 2010; MoFAD, 2015).These vessels normally operate on joint venture partnership involving a Ghanaian owner and a foreign partner.

Foreign flag vessels started tuna fishing in Ghanaian waters with about 80 vessels operating at its peak in 1970 (Finegold et al 2010). Subsequently in 1973 Ghanaian flagged vessels commenced tuna fishing in 1973 with the last foreign vessel leaving by 1984 (Ameyaw, 2017). Industrial tuna vessels only operate from Tema Port and it is normally managed through a joint venture ownership where at least 25 per cent of stake should belong to a Ghanaian at same time 75 per cent of all crew members should be Ghanaians (Ibid). The industrial tuna vessels fishing in Ghanaian waters are restricted to 50-75m deep water, even though they frequently deviate into shallow waters (Antwi-Asare & Abbey, 2011).

The tuna vessels often target species with different gears further away from the Ghana's EEZ into deep seas that is beyond the reach of other fleets operating in Ghana such as the semi-industrial and artisanal vessels (Finegold et al, 2010). Because of this the tuna industrial vessels sub sector is governed by the International

Commission for Conservation of Atlantic Tuna(ICAT) and is often treated as a separate entity (Ameyaw, 2017).

The tuna fishers normally use purse seine or pole and line with live bait (anchovy) attached to land species such as skipjack, yellow fin and bigeye (Antwi-Asare & Abbey, 2011). At the artisanal level, tuna is not a major catch because tuna is not usually found close to shore and it is usually outside the range of artisanal fishermen. Tuna that are often landed by artisanal fishers are of smaller size or juveniles and it is sold directly to market women at the landing sites (Antwi-Asare & Abbey, 2011). The industrial sector contributes 6% of total marine production in Ghana (Afoakwah et al, 2018)

Semi-industrial sector

The semi-industrial sector also known as inshore fleets are generally classified into two types; the larger ones with length ranging between 20 to 30m using mostly bottom trawl and the smaller vessels which range between 8 to 10m mainly using purse seines (MoFAD, 2015). These vessels are mostly manufactured domestically, planked wooden-hulled vessels with inboard diesel engines ranging between 90 and 400 horse power (Finegold etal, 2010).These vessels operate from only a few selected landing sites and ports along the coast. The small semi-industrial vessels which mainly uses the purse seine are allowed to fish within the 30m depth (EEZ) but the larger semi-industrial vessels which are mainly trawlers are restricted by law from fishing in the EEZ (Ameyaw, 2017). The small semi-industrial purse seiners target small pelagic whereas the large trawlers go for the demersal species like shrimps, seabreams and cuttlefish during the major and minor upwelling periods with the trawler catches mainly reserved for export(Ameyaw, 2017; Finegold et al , 2010). The small semi-industrial vessels have between 20 to 25 crew members compared to 7 to 10 for the large trawlers (Ameyaw, 2017). The small semi-industrial purse seiners fish in the inshore waters between 30-50m depth and thus compete with the traditional canoe fleet for fish ((Antwi-Asare & Abbey, 2011). The competition for ocean space and fish sometimes results in conflict between the artisanal canoe fishers and the small semi-industrial vessels (Ameyaw, 2017). The semi-industrial sector contributes about 2 per cent of total marine output in Ghana (Afoakwah et al., 2018).

Figure 3. 5. Semi-industrial vessels, New Takoradi

The artisanal canoes.

Artisanal fishing or small scale fisheries sector is characterized by low –technology, low investment and are operated by individual members from coastal communities (MoFAD,2015). The canoes are locally made from wood with different configurations and capacities. *Triplochiton scleroxylon* and *Ceiba petandra* locally known as Wawa and Onyina respectively are the main type of wood used for the manufacture of these canoes (Doworpkor). The canoes are classified by their size and the type of gear used. Finegold et al (2010) classified them into; small or 'one man canoe', mid-sized canoes and large canoes. The small size canoes range between 4 -5m long and are also called 'one man canoe'. This type of canoe is too small to be operated by outboard motor and so they are propelled by paddle and are often done only on subsistence basis (Ibid). The mid-sized vessels range between 6 to 11 m long with a crew between 2 to 11 fishers. They are synonymous with bottom-set, drifting gil nets, beach seine nets and line fishing (Afoakwah, et al 2018; Finegold et al 2010). Depending on the size and capacity, the canoes can be propelled by paddle or with 8hp and 40hp outboard motors (Finegold et al 2010). The large canoes ranges between 12-19m long and 1.2-2.4m wide and are used to operate ali/poli/watsa nets , propelled by outboard motor with engine capacity between 25 to 40hp (Afoahkwah et al, 2018). Depending on the capacity of the vessel, it can carry between 10 to 25 crew members and more recently fishers have adopted the use of more sophisticated and modern gadgets like fish finders and Global Positioning Systems (GPS) to aid fishing activities (Afoakwah et al 2018; Finegold et al, 2010, P.9).

Artisanal fishing is dominated by both subsistence and commercial purposes.. Due to its low capital intensive and low technological capacity it is often argued that this system of fishing is more environmentally sustainable compared with industrial fishing with little or no impact on marine ecosystems (Afoakwah et al., 2018). This sector contributes the largest in terms of marine fish volumes. The artisanal canoe sector contribute about 80% of total annual marine fish catch by volume (Mofad, 2015).

Figure 3. 6. Artisanal canoes; Dixcove, Ghana.

3.3.1 Increasing capacity amidst decreasing fish catch

Primary data on fish production, total number of fishermen, number of vessels and other related information was obtained from the Fisheries Commission of Ghana and the 2013 and 2016 National Canoe frame survey reports. The period between 1980 and 2018 were chosen for marine fish production to show the annual and decadal trends in fish production.

The general trends observed from the data (figure 3.7) indicates a consistent decrease in marine fish production for all the fishing sectors since 2000.

Whereas, there is decrease in the quantity of fish catch, the number of vessels and fishermen are on the ascendancy. The substantial increase in the both the industrial

vessels and artisanal canoes have led to declines in catch per unit effort (larzer et al, 2016). For instance in 2014 there were 12,000 canoes, 403 semi-industrial vessels and 107 industrial vessels. However, the number of vessels required for sustainable harvest of fisheries for that same year should have been 9,095 canoes, 272 semi-industrial vessels and 48 Industrial vessels. The decrease in fish catch has compelled fishing fleets from all the sectors (artisanal canoes, semi-industrial and industrial vessels) to compete over the ocean space for fish which has led to overfishing (Ameyaw, 2017).

Figure 3.7 shows that there was consistence increase in fish production between the 1980s and early part of 1990. Total fish production increased from about 185,000 tons to 370,000m ton in 1992. However, after 2000 the total fish production recorded a sustained decline from about 354000m tons in 2000 to 293, 000m tons by 2018.

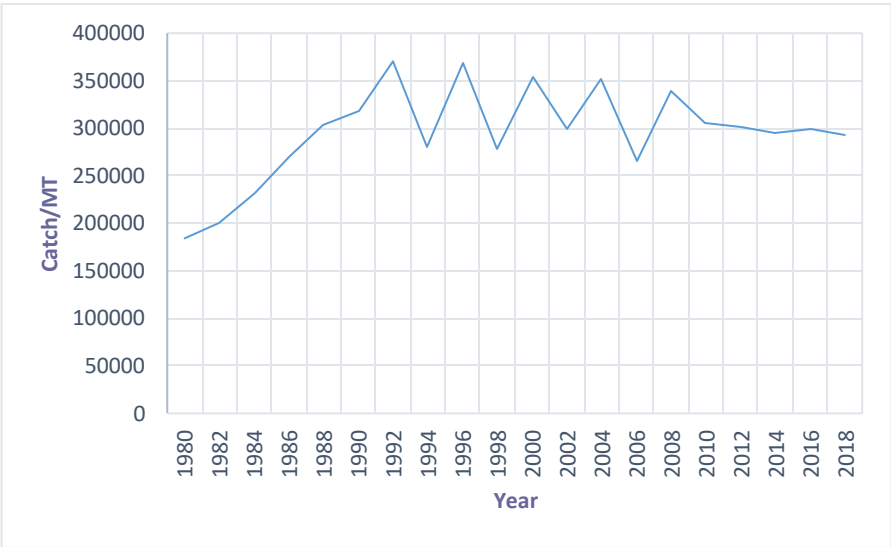


Figure 3. 7. Total marine fish production for all fleets (artisanal canoe, semi-industrial, industrial and tuna vessels) 1980-2018.

To gain better insights into the performance of the various sectors, the total marine fish production for the three fisheries sector have been presented (Figure 3.8). The trend for the industrial sector from 1980 to the late 1990s mark a period of high and low production with a general steady growth up to 1996. The total fish production increased from about 13,000m tons in the 1980s to about 17, 000m tons by 1998. After 2002, the production decreased to about 14,000m tons and again pick up the momentum with increase in production from 17,400m tons in 2006 to 33,500m tons by 2018.

The semi -industrial sector has sustained regular decline in catch since the 1990s. Within a decade, the sector recorded a percentage decrease in fish production of about 60 per cent from 1986 to 1996. The total fish production decrease from about 21,000m tons in 1986 to just 8,350m tons in 1996. This trend has continued with catch level reaching a little over 9600m tons in 2018.

Figure 3.8 shows that fish production by the artisanal canoes recorded growth from the 1980s to the mid part of 1990s. Fish production increased from 141,000 m tons in 1980 to about 298,000m tons in 1996. After 1996, there has been sustained decrease in annual fish production reaching about 180,000m tons in 2013. There was marginal increase between 2013 and 2015 afterwards there has been continues decline from 180,000m tons in 2016 to about 160,000m tons in 2018.

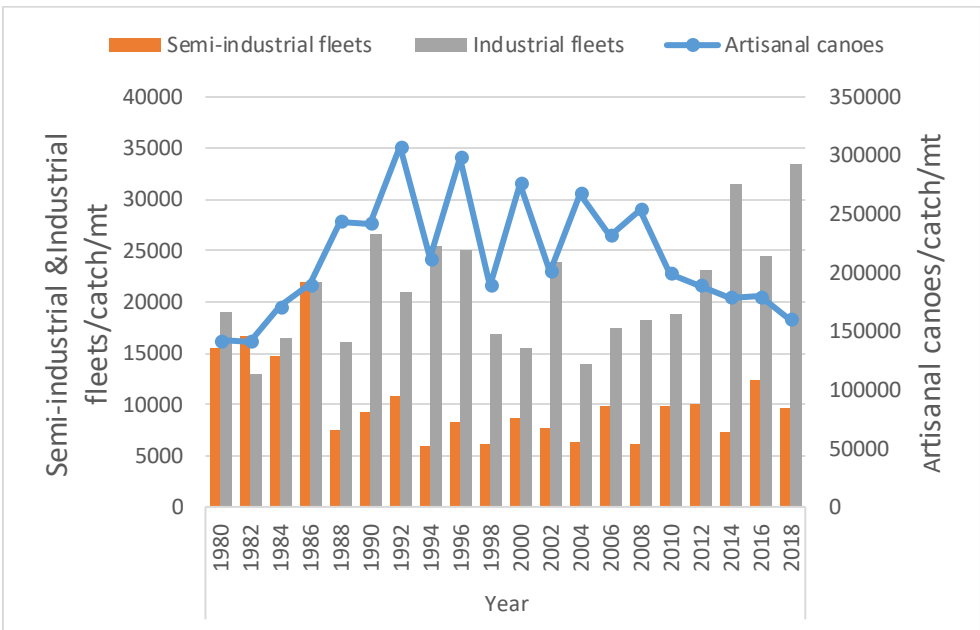


Figure 3. 8. Total marine fish production for artisanal canoes, semi-industrial fleets and industrial fleets (1980-2018).

According to Finegold et al (2010) and Lazer et al (2018) the decline in fish landings is largely because of the artisanal fisherfolk over exploitation the small pelagic under open access regime through the use of more bigger and efficient fishing gears and technologies.

Figure 3.9 shows that since 1989 the number of small-scale fishermen has increased continuously until it reached its peak in 2013 with 139,155 fishermen. In 2016, the number of fishermen decreased to 107,518 representing 22.7 per cent decrease rate. The number of canoes increased consistently from 1997 with 8,610 to

12,728 in 2013. After 2013, the number of canoes decreased to 11,583 representing 8.9 per cent decrease rate. There have also been recorded increases in the number of outboard motors that powers the canoes. Within two decades, the number of outboard motors has increased more than 100 percent. With just about 4250 outboard motors in 1986, the number increased to 9122 in 2016. However just like the number of fishermen and number of canoes, the increase in the number of outboard motor reached its peak in 2013. The number of motors decreased from 9313 in 2013 to 9122 representing a 2.1 decrease rate.

The data therefore suggests that there has been decrease in fishing capacity and efforts since 2013 in relation to the number of fishermen, canoes and motors. The most important question to ask is whether the downward trend in fishing capacity has contributed to increase in fish catch. Perhaps the level of reduction in the number of canoes and fishermen is yet to reach the desired level for sustainable fish capture.

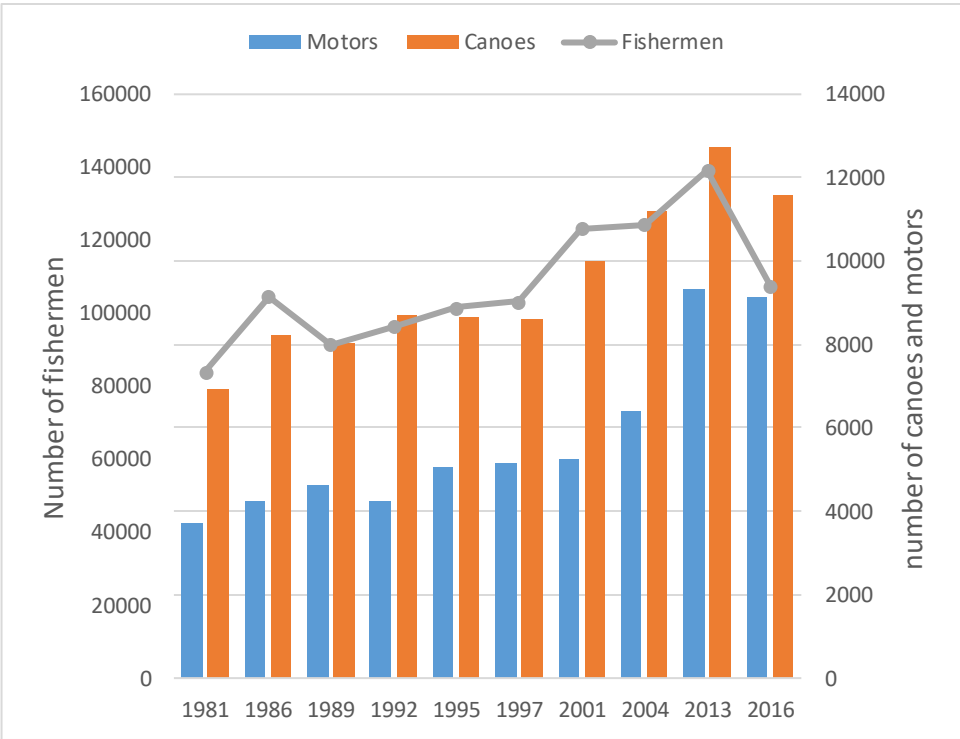


Figure 3. 9. Changes in the number of canoes, motors and fishermen from1981 to 2016

There have been canoe surveys every 3-4 years from 1969 to 2016. However, between 2005 and 2012 there was no canoe surveys conducted. Therefore, the

number of canoes in 2008, 2010 and 2014 were based on estimates provided by Finegold et al (2010) and Lazer et al (2016).

Figure .3.10, provides interesting perspectives from the 1980s to the mid-1990s in relation to increase in the number of canoes and total fish landings. The increase in the number of canoes corresponded with general increases in fish catch. When the number of canoes increase from 6938 in 1981 to 8610 in 1997 there was a corresponding increase in fish catch from about 150,000 tons in 1981 to 215000m tons in 1997. However, from 1997 onwards there was fluctuations in fish production with persistent increase in the number of canoes until 2010. From 2010 to 2016, the number of canoes decreased, as there was also decrease in fish production. For instance, in 2010, the number of canoes was estimated to be 13,500 and the annual fish production was about 200,000 tons, by 2016 the number of canoes has decreased to 11,583 with annual fish production of 180,000 tons.

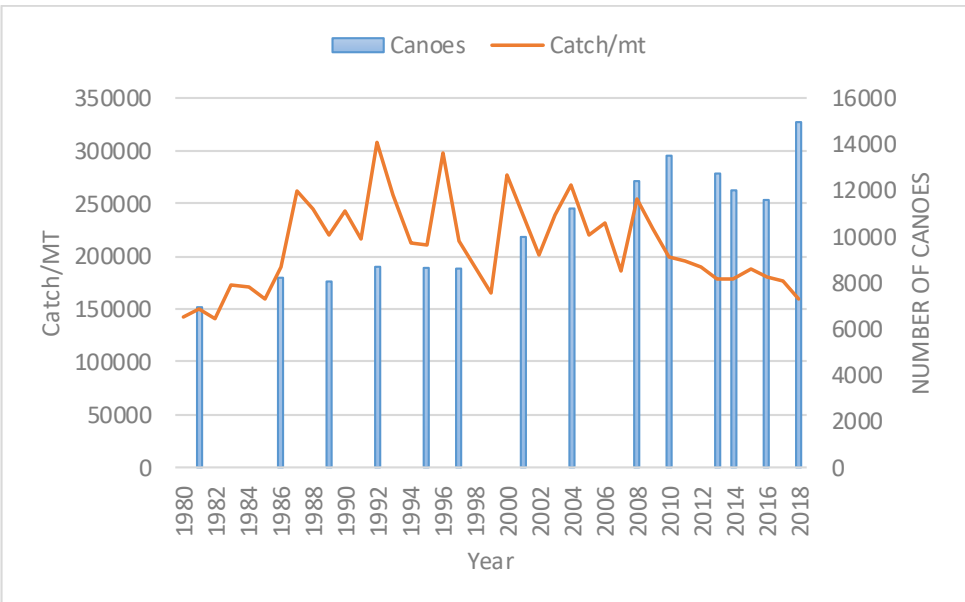


Figure 3. 10. Total marine catch by artisanal canoes in orange and effort in the number of canoes in blue from (1980-2018).

In 2018, even though the number of canoes has increased again to about 14,000 the annual fish catch decreased further to about 160, 000m tons. The is no linear relationship between increase or decrease in the number of canoes and fish catch quantity. The changes in the number of canoes therefore can only partly account for the decrease in fish catch. Besides the problematic issue of increase in the number of canoes and motors , other possible factors might also account for the low fish

catch and therefore management policy should not only seek to implement policies targeting reduction of canoes but a more holistic approach towards the sustainability of fisheries industry.

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3.4 The emerging oil and gas industry in Ghana.

Offshore oil and gas development has emerged as important economic activity across many parts of the world (Arbo and Thuy, 2016). Global offshore oil production in 2015 was estimated at 10 billion barrels, accounting for 29% of total global production (American Geo sciences Institute, 2018).

The production of oil in Ghana dates back to the 1970s when oil was first drilled along the Western Coast of Ghana (Plänitz & Kuzu, 2015). Commercial quantities of oil and gas was discovered in the coastal waters of Western Region in 2007.

The current production in the Deep-water Tano block and the West Cape Three Points block was named Jubilee Field in commemoration of Ghana's 50th anniversary as an independent nation (Plänitz & Kuzu, 2015). Oil production started in December 2010 with a daily production of 80,000 barrels per day and has currently reached a production level of 120,000 barrels per day (Ablo, 2018).

Since 2007, more oil field discoveries have been made, these have led to increases in oil exploration activities into newer oil fields offshore. (GOG, 2019; Ayifli et al, 2014). Notably among the new oil fields includes; the Owo field by Tullow, Dzata field by Lukoil, Banda-1 by Kosmos and Akasa-1 by Anadarko and Sankofa-Gyema Oil fields. The second major field Tweneboa-Enyera-Ntomme (TEN) has an estimated reserve of about 245 million barrels (mmbls) of oil and about 365 billion cubic feet (bcf) of gas (Ablo, 2018; Ayifli et al, 2018).

The oil and gas industry involves three main activities; exploration, field development and production, and decommissioning and the abandonment when the oil reserves have been depleted (Obeng-Odoom, 2014). Ghana is currently at the stage of new explorations, field development and production.

Article 257(6) of the constitution of Ghana gives power to the state as the custodian over mineral resources in the country. Just like the fisheries, the state with power vested in the president is mandated to explore and exploit petroleum products and where necessary allocate access rights to foreign companies.

The key state agencies responsible for petroleum sector includes; Ministry of Mines and Energy, Petroleum Commission, Environmental Protection Agency, Ghana National Petroluem Corporation. Other institutions such as The Geological Survey Department, The Minerals and Mines Inspectorate, the Ghana Chamber of Mines,

the Minerals Commission and EPA are involved in the regulation of the extractive industry.

The major oil and gas companies operating in Ghana includes- Tullow Ghana Ltd, Anardako Petroleum, KOSMOS Energy, GNPC, Eni, Hess and Sabre Oil and Gas collectively referred to as ' Jubilee Partners' (Obeng-Odoom, 2014; Adjei and Overa, 2019).

Oil and gas contribution to the national economy.

In 2017, total oil revenue received by the national government was USD362.58 million (GHS1,552.13 m) (Government of Ghana, 2019).This amount increased to USD723.55m (GHS3,292.20m) by 2018. Agriculture, infrastructural development, education, health, road and railway development projects across the country are some of the key sectors that received substantial support from the oil revenues

In addition, the oil and gas companies are involved in corporate social responsibility across the country.

Human capital development and provision of social services dominate the corporate social responsibilities from the oil and gas companies. This is done through the awards of scholarships and construction / or renovating of school blocks. There are other projects such as rural water services, community health centers, rural electrification and construction of seas defense structures.

a. b.

c d

Figure 3. 11 Community Projects by Oil companies in the Western Region. a. Sea defence wall at New Takoradi, b. Model school at Amenano, Shama, c. drinking water system (borehole) by GNPC, Axim. D. Model school at Shama.

The oil and gas sector is now a major contributor to the Gross Domestic Product of Ghana accounting over 7% in 2017. On the other hand, the fisheries sub-sector recorded a negative growth rate of -1.4 (Government of Ghana, 2019). Table 3.5 shows the declining contribution of the fisheries sector to the national economy.

Table 3. 5 The Growth rate of the Agriculture sector compared to the fisheries sector

	Agriculture	Fisheries
2007	2.5	-7.2
2008	5.1	17.4
2009	6.1	-5.7
2010	5.2	1.2
2011	0.8	-8.7
2012	2.3	9.1
2013	5.7	8.9
2014	4.6	-5.6
2015	0.04	5.3
2016	2.9	3.1
2017	6.1	-1.4

Source : Siakwah, 2017.

The oil fields are located in the Gulf of Guinea off Cape Three Points, lies in deep waters (11, 000m) and 60-80km south-west of the coastal communities in the Western Region where fishing and its related economic activities is the dominant sources of livelihoods (Adjei and Overa, 2019).

As the oil companies extract petroleum products from the ocean, fisherfolk also exploit fish from the ocean, the co-existence of this two sectors on the ocean has raised concerns that needs to be addressed. Obvious among these concerns is the competition to extract resources for economic benefits.

3.4.1 The petroleum industry, environmental impacts and conflicts: lessons from Sub-Saharan Africa.

Sub-Saharan Africa (SSA) holds 62.6 billion barrels of confirmed crude oil reserves. In 2012, the region produced about 6m bbl/d of liquid fuels, which represented about 7 per cent of global oil output (EIA, 2013). Nigeria and Angola remains the two

major oil & gas producing countries in Africa. Together they account for over 75% of oil production in Africa (EIA, 2013; Baumuller et al, 2011). Other notable oil & gas producing countries in SSA includes Equatorial Guinea, Sudan, South Sudan, Gabon, Ghana, Cameroon, DR Congo, Mozambique and Ivory Coast. Presently, it is estimated that there are over 500 oil companies operating across Africa with the majority of those firms coming from Western Europe and the United States of America. Major players in the oil& gas industry includes ExxonMobil, BP, Total, Chevron, Eni, Kosmos and Tullow (Baumuller et al, 2011). In recent years there has been increasing participation from Asian countries like China, South Korea, India and Malaysia in Africa's petroleum industry. After decades of oil and gas production in SSA, several studies (Baumuller et al, 2011; Obi,2010; Peggy & Zabbey, 2013) have concluded that the activities oil companies have induced conflicts , social unrest, marginalization , environmental degradation and unemployment.

The experiences with Nigeria shows that after decades of oil production, the people living in the Niger Delta whose livelihoods depends on fishing and farming are among the poorest in Nigeria (Obi, 2010; Pegg & Zabbey, 2013) . In contrast, the oil and gas industry in the Niger Delta contributes to more than 90% of Nigeria's foreign exchange earnings (Albert, Amaratunga, & Haigh, 2018). The major economic activities in the Niger Delta are farming and fishing, however decades of oil& gas exploration and production amidst spill overs, discharges, gas flaring have severely damaged the livelihoods of local people (Obi, 2010). (Pegg & Zabbey, 2013) narrates how the 2008 oil spillages at Boko Creek located in the Niger Delta collapsed the local fishing industry. The fishes were killed by oil pollutants while the mangroves that serves as the spawning and nursing grounds for fish and other species was destroyed. The Niger Delta of all the oil wealth it produces lacks basic social amenities such as electricity, portable drinking water, schools, hospitals, poor sanitation and waste management problems (Ebegbulem et al, 2013).

Cabinda is a major oil & gas producing region in Angola. Cabinda is endowed with land-based and offshore deposits which accounts for over % of Angola's total oil output (Rodríguez, Rodríguez, Gutiérrez, & Major, 2014). Compared to the Niger delta, Cabinda has recorded less oil spillage but gas flaring activities remains considerably significant (Baumuller et al, 2011). One of the recent oil spillages in Cabinda occurred in 2015 and was reported to have affected four coastal beach communities (Angop, 2015). Sea erosion, deforestation, water and air pollution including loss of livelihoods remains some of the negative effects of the petroleum industry on the people of Cabinda (Rodríguez et al., 2014).

The livelihoods situation of oil & gas producing communities in Angola is not different from the Niger Delta. Empirical results from Baumuller et al (2011) confirms that the petroleum industry has negatively affected the local fishing industry. Local fishers in Cabinda reported of their inability to go fishing for two weeks after the 2015 oil spillage by Chevron (Reuters, 2015).

The perceived negligence by the state and multinational oil companies in Nigeria , Angola and other oil& gas producing countries in Sub-Saharan Africa have led to resistance and strives by local residents and communities many of which has been characterized by vandalism of oil infrastructure such as pipelines and siphoning of oil which is traded in the black market (Obi, 2010). It is estimated that between 2005 and 2009 regular attacks on oil installations in the Niger Delta compelled the Nigerian government to shut down 25 to 40 % oil production activities (Ibid).

The narrations above suggests that the government of Ghana has a daunting task to ensure not only fair and equitable redistribution of revenue from the petroleum sector. The government needs to work closely together with relevant stakeholders in the petroleum industry, small-scale fisheries and the local communities to achieve sustainable development of the oil & gas sector as well as the fisheries sector.

The next chapter explores the vulnerabilities of coastal communities in relation to the issues of overfishing and petroleum industry.

Chapter 4. Coastal Vulnerabilities and Conflicts Management.

This chapter reveals the empirical results of the first three research questions. The chapter is divided into three main part. The first part is concerned with coastal fisheries vulnerabilities associated with overfishing and the petroleum industry. It investigates the impact of overfishing and petroleum industry on the livelihoods assets of coastal fishing households. The second part examines the perception of fisherfolk with respect to the introduction of seasonal closures in the local fisheries industry. The third part examines the conflicts produced between the fisherfolk, and oil and gas production offshore. It provides insights into how the actors in these two sectors interact offshore.

The next section presents the results of research question one on the impacts of overfishing and the petroleum industry on fisheries livelihoods. Before the discussion of the impacts, the key socio-demographic information of the surveyed fisherfolk is presented below.

4.1 Overview of Household Survey

The predominant age group is between 40-59 (59.5%), followed by 20-39(37%). Fishing is becoming unattractive to young people from coastal areas. Indeed, majority of the fisherfolk mentioned that they would prefer their children to go school and get a better job than fishing.

Over 80% of the respondents are married and in most cases living together with their family. The education level of artisanal fishermen in Ghana are generally low. Only 3.8% of respondents have attained secondary school education. The majority 59.8% have no formal education. In a related study, Acheampong et al (2013) found that 52% of fisherfolk in Ghana have no formal education. The low education among fishing households could reduce their ability to enter into other sectors of the economy where minimum level of reading, writing and analytical task is required.

Majority of the surveyed fishers have a considerable long experience in the fishing business. About 60% have been fishing over the past 15 years followed by 27.3% for the past 11-15 years. The rich ecological knowledge acquired by fisherfolk over the past decades yielded vital information on the issues of overfishing, conservation and alternate livelihoods. Subsistence fishing is not practiced to any extent in the

study communities. 90.5% of respondents are engage in commercial small-scale fishing.

Table 4. 1. Basic characteristics of household survey, all seven study areas (N=400)

Variables	Categories	Frequency	Percentage
Age	Below 20	2	0.5
	20-39	148	37.0
	40-49	238	59.5
	Above 60	11	2.8
Marital Status	Single	33	8.3
	Married	353	88.8
	Divorced	7	1.8
	Separated	7	1.8
Level of Education	No formal education	239	59.8
	Elementary school	145	36.3
	Secondary School	15	3.8
	Tertiary	1	0.3
Duration of fishing	less than 5 years	1	0.3
	5-10 years	26	6.5
	11-15 years	109	27.3
	Over 15 years	263	65.8
Purpose of catch	Commercial	362	90.5
	Commercial & domestic	38	9.5
Food security	Enough food all year	244	61.0
	Not enough but ok	155	38.8
	Food shortage every year	1	0.3

Source : Fieldwork , 2018, 2019.

Table 4.2 shows that there has been significant changes in the catch volumes and the income levels reported by fisherfolk. Despite the declining opportunities in the small-scale fisheries, the majority of fisherfolk still depend on fishing for their main source of livelihood.

Table 4. 2.Overview of coastal vulnerabilities and adaptation strategies (n = 400)

Variables	Categories	Frequency	Percentage
Catch quantity changes (over the past 10 years)	No change	20	5.0
	Decreased	361	90.2
	Seasonally variated	19	4.8
Income changes (over the past 10 years)	Lower	397	99.2
	Higher	3	0.8
	No change	-	-
Livelihood situation (Before & after oil production)	Better before	210	52
	Similar situation	20	5.0
	Getting worse	170	43.0
Adaptation strategies	Only fishing	284	71.0
	Farming	68	17.0
	Small business	48	12.0

Source : Fieldwork, 2018, 2019.

Table 4.3 shows that the study communities in Shama recorded the lowest household size of 4.9 while Sekondi and New Takoradi recorded the highest with 6.6. The average household size among the study areas is six (6). The national average household number is four (GLSS, 2016). Therefore, the average household size among coastal fishing communities seems to be higher compared to the national average. Perhaps the high demand for labor in fishing and its related activities could partly explain the big family size in coastal communities. (Marquette, Koranteng, Overå, & Bortei-Doku Aryeetey, 2002) described the small-scale fisheries in Ghana as a family business. There is high dependence on children and other relatives as a source of direct labor in fishing activities. Boat owners could employ a large part of male family members (brothers, nephews, cousins) to serve as crew members and wives or female relatives to work as traders and processors.

In relation to educational attainment, fisherfolk in Shama recorded the highest levels of education. 54% of fisherfolk have completed elementary school in Shama. Ahanta West recorded the highest number of fishermen with no formal education (80%). Only one respondent among the four hundred have attained tertiary education. There seems to be a relationship between household size and educational attainment. Fisherfolk in Shama recorded the highest rate of elementary school attainment and the lowest average household size.

Table 4. 3. Characteristics of the seven (7) study areas.

DISTRICTS	STMA	SHAMA	AWDA	NZEMA EAST
Study sites	Sekondi New Takoradi	Shama Apo Shama Bentsir	Discove Akwidaa	Axim (Upper&Lower)
Population	47,915 (2 towns)	10,886 (2 towns)	40,736 (2 towns)	28,000 (1 town)
Household size	6.6	4.9	5.9	6.3
Education				
No education	65(64.4 %)	42 (42.0%)	80 (80.0%)	45 (40.9%)
Elementary	33 (32.7%)	54 (54.0%)	20 (20.0%)	45 (40.9%)
Secondary	1 (1%)	4 (4.0%)	-	10 (10.0%)
Tertiary	1 (1%)	-	-	-
Type of fisher				
Captain	-	-	-	2(1.8%)
Canoe owner	28 (72%)	66 (66.0%)	29 (29.0%)	30(27.3%)
Crew member	72 (28%)	34(34.0%)	71 (71.0%)	68 (61.8%)
Monthly income (fisheries) Ghana Cedi **(GHS).**	0-199 , (0.0%) 200-399 (29%) 400-599 (16%) 600-799 (35%) Above800(20%)	0-199 (0.0%) 200-399(11%) 400-599(42%) 600-799(33%) Above800(14%)	0-199 (0.0%) 200-399(32%) 400-599(28%) 600-799(36%) Above800(4 %)	0-199 (5%) 200-399(44%) 400-599(40%) 600-799(2%) Above800(1%)
Monthly income (Non-fisheries)	0-199 (14.9%) 200-399 (6.9%) 400-599(2.0%)	0-199 (8.0%) 200-399 (4.0%) 400-599 (0.0%)	0-199(38.0%) 200-399(0.0%) 400-599(0.0%)	0-199 (5.5%) 200-399(5.5%) 400-599(0.0%)
Agricultural Opportunities	Yes, 0 (0.0%) No, 100 (100%)	Yes,0(0.0%) No, 100(100%)	Yes 31(31.0%) No 69(69.0%)	Yes 36 (32.7%) No 64 (58.2%)

Source: Fieldwork, 2019; CRC, 2010

Exchange rate 1USD = 5.2GHS as at July 2019.

In relation to household income (fisheries), Sekondi-New Takoradi recorded the most people (20%) earning more than 800GHS(USD 153) followed by Shama with 14%. The lowest income was recorded at Nzema East (Axim) with 5% of fisherfolk earning less than 199GHS (USD38) per month. The average monthly income earned from fishing is between 400-599 GHS (77-115 USD). Household income from non-fisheries economic activities is considerable low. Coastal communities in Ahanta West had the most respondents earning less than 199GHS (38USD) per month. Only 2% recorded non-fisheries income between 400-599GHS (77-115USD) monthly. Fisherfolk have invest much of their resources into the fishing business. Very few people have opportunities in agricultural. Ahanta West and Nzema East have the most people with agricultural opportunities while Sekondi-New Takoradi reported no agricultural opportunities.

4.2 Impacts of overfishing on the livelihoods of fisherfolk

The impacts of overfishing on the livelihoods of fishing households were classified into social, economic and environmental.

The results from the household survey coupled with the interviews shows that fisherfolk are recording very low catches in recent years. According to table 4.2, about 90% of fishers reported decreased fish catch over the past ten years. Many of the fisherfolk mentioned that their income has decreased over 90% during the past ten years. The decrease in fish catch and the low income among fisherfolk has a negative implication on the natural and financial capital base of fishing households. What is even more worrying is the fact that, majority of fisher's spouses are directly engaged in the fisheries business as processors and traders. Recent studies has revealed the declining fisheries opportunities and the persistent poverty among coastal small-scale fisherfolk in the Western Region of Ghana (Adjei & Overå, 2019; Adusah-Karikari, 2015; Obeng-Odoom, 2014).

In addition to the decreased fish catch, interviewed fishers also mentioned the changes in the quality of fish caught because of overfishing. According to the fisherfolk herrings used to be very common near the coastline, which were easily accessible. However, in recent years, fishers have to travel further distance at sea to able to access herrings. Moreover, the majority of the fish caught are fingerling (small fishes) which are low in economic value.

The decrease in fish catch and changes in the quality of fish has affected the income levels of fisherfolk.

The interview with the chief fisher in Axim provides some insights into the changes in the local fishing industry.

July –September used to be our major fishing season-but it's no longer the case. Some years ago if a fisherman owes you, he will ask you to come for your money in 'Manwura' (August)-because he knows from July to September he can settle that debt. Now it is no longer the same because of low fish catch.

The decreasing fish catch has also affected the quantity of available for fish traders for onward sale to processors. The excerpts below from the interview with a fish trader in New Takoradi shows how the changes in fish supply has affected her business.

Compared to 5 -10 years ago there have been lot changes in this business. Now the prices of fish have gone up. One pan of fish used to be sold at GHS 300; presently we are buying it at GHS 500. Before if l have 1000GHS l can buy 3 pans of fish. Now l can buy only two pans with the same amount. Because they are not catching enough, the prices keep on increasing. So when the bumper harvest come we don't have enough money to buy in large quantities. Because of the increases in the prices we unable to buy in large quantities. This is the only job l do, l do not have any job besides this one.

a. b.

Figure 4. 1 Fishing processing and trading.
a. Woman processing fish at New Takoradi. b. women buying landed fish at Dixcove

Fish traders are incurring extra cost to buy same or even less amount of fish they used to buy compared to some years ago.

The economic viability of the small-scale fisheries is on a downward trend. The recent small-scale fisheries survey in 2016 conducted by MoFad recorded a 22.7 % decrease in the number of fishers from the previous survey in 2013. The number of fishermen in the artisanal sector has decreased by 31,637 people from 139,155 in 2013 to 107,518 in 2016.

The reduction in fish catch is yet to significantly affect the food security of fishing households. Table 4.1 shows that over 60% of respondents have access to enough food throughout the year. However, with 39% indicating that the food is not enough, could indicate the possibility of some level of hunger in the course of the year. A related study by Crawford et al (2016) found that 70% of fishing households reported no hunger, while 21 % reported moderate to severe hunger.

Fish provides an important source of cheap animal protein especially in coastal communities. It is therefore important to sustain the productivity of the fisheries in order to avert a potential food security problem.

Fisherfolk attributed the decline in fish catch and changes in the quality of fish caught to the illegal and destructive fishing activities.

Among these illegal fishing activities, light fishing seems to be the most problematic and widely used illegal fishing method. Light fishing involves the use of a light bulb connected to wooden pole powered with a generator onboard the canoe The pole with the light is lowered into the ocean and serves as aggregative device to attract the fish. The major problem with illegal light fishing is that the bulk of the catch are fingerling, and with motorized canoes fishing can be done all year round without a break (Owusu, 2019).

Some of the local fisheries leaders expressed concerns about the health implications of consuming fish caught using light. Most of the fish caught with the lights are – fingerling which is very soft and causes itching of the tongue when consumed.

Both government officials and local fishers agree that bad fishing practices have partly contributed to the current state of fisheries in the country. According to the official from fisheries commission, the use of bad fishing practices such as unapproved nets and illegal light fishing are some of the major drivers of overfishing which is pushing the fisheries to a point of collapse.

The use of unsustainable and destructive fishing methods degrade marine ecosystems by killing large number of fishes and mammals in the ocean (Afoakwah et al, 2018). In a study by Belhabib et al (2016) they concluded that over-exploitation of marine fishes across West Africa have altered species composition of fishes as well reduction in the quality of the marine ecosystem to withstand adverse impacts

climate change. Persistent fishing amidst decreasing fish catch can destroy the sustainability of marine ecosystem.

4.3 Impacts of the petroleum industry on the livelihoods of fisherfolk.

Four main issues were identified concerning how the oil extraction and production have affected the local fishing industry. These includes the spatial restriction of fishing on the oceans, presence of seaweeds, the destruction & confiscation of fishing gears and land grabbing.[14]

Restricted spatial fishing at sea.

The Jubilee Partners (Consortium of oil and gas companies operating in Ghana) have set aside a 500m radius exclusion and another 1000m advisory zone around each offshore petroleum production installation (Tullow, 2016). Fishers are not permitted to access fish anywhere near the 500m radius as well as the advisory zone of 1000m. However, many of the fisherfolk in the study communities reported that they used to fish in areas of the ocean now declared no fishing zones.

Besides, majority of the fishers articulated that the oil rigs have powerful lights that attract the fishes to the oil installations at sea. Fishers claim because of the presence of the lights on the oil rigs- there is a lot of fish at that side. According to a canoe owner and community leader at Sekondi-the light on the oil rigs produce heat which leads to the warming of the sea and when that happens the fish aggregates around where the lights are. The representative from a local NGO based in the Western Region supported this assertion:

It's obvious, scientifically proven that fish like light and so whenever there is light – it attracts them. When you look at the rig, the light intensity over there is so high that it can attract many fish as possible. So it's very true that many of the fish go to the rig that is why fishers will try to fish over there.

(Representative from a local NGO, Sekondi Takoradi)

[14] Land grabbing is synonymous with ocean grabbing, it describes the actions, policies, or initiatives that deprive local resources users, dispossess vulnerable populations of coastal lands, and or undermine historical access to land and areas around the sea (Bennette, Govan and Satterfield, 2015).

However, fishers are not allowed to access fish in those areas where they believe the can get more fish. Fisherfolk have therefore link the decreased fish catch to the ongoing oil exploration and production offshore. They contend that they have been unduly deprived of accessing fish around the fertile fishing grounds near the oil rigs offshore.

Those fishes that are around the oil rigs appear on the surface of the sea and those that are on the surface of the sea are more than those at the bottom, therefore anytime we get near the rigs we become satisfied but the problem is that we are not allowed to fish there.
(Canoe owner, community leader, Sekondi).

Another canoe owner in Axim mentioned that they could not access the fish below the sea around the oil rigs. However there are some big fishes like tuna that floats on the surface of the water – and its possible for them to catch but they are not allowed to fish there.

The presence of the oil and gas industries offshore, has reduced the coastal mobility of fishers. This has negative consequences on their natural and financial capital. The spatial restrictions offshore, have reduced their natural capital (ocean) from which they extract their resources (fish). Considering the fact that the ocean is the main natural capital from which coastal fishers livelihoods and survival depends on, such restrictions offshore has the potential to cause conflicts between the oil and gas industrial and the local coastal communities over issues of legitimacy and the rightful owner of the sea.

Figure 4. 2. Jubilee FPSO , Kwame Nkrumah, coastal waters of Ghana.

Presence of seaweeds on the ocean

The presence of *sargussum (free*-floating seaweeds) on the ocean was also mentioned as a major hindrance to fishing activities. The local fisheries leaders and some of the interviewed fishers reported that the presence of the seaweeds coincided with the extraction and production of oil in the sea. In addition to trapping the nets of canoe fishers, the seaweeds also produce offensive smell.

The main problem we have with the oil companies has to do with the seaweed because of the oil extraction. When the seaweeds appear on the ocean, we are unable to catch fish. The seaweed traps our net.
(Fisher and community leader, Akwidaa).

A 61 year old man with over 40 years of fishing experience in Axim also mentioned that the seaweed disturbs them a lot and makes fishing difficult. A study by Acker-Baido (2013) showed how the presence of seaweed have disrupted the fishing activities of fishers in the Western Region of Ghana.

However, there is contention about the origins of the seaweed. According to the fisheries officer interviewed, they are aware of the presence of the seaweed on the ocean but they cannot confirm the sources of the seaweed. The fisheries officer further mentioned that there have argument that the seaweed are because of climate change, and in countries that don't even explore oil –there is the presence of this seaweed on the ocean. The coincidence of the oil and gas production and the presence of the seaweed could explain why the fisherfolk are attributing the presence of the seaweed on the ocean to the oil companies. In addition, the representative from a local NGO also mentioned that, they cannot confirm the origins of the present seaweeds (sargussum) which is brownish in color.

However, the government representative interviewed at Axim attributed the presence of the seaweed to oil extraction and production. He mentioned that periodically, when the oil and gas industrials discharges their waste materials as a result of fixing new oil rigs the seaweeds are produced.

Irrespective of the discourse on the origins of the seaweed, the perception among some of the fisherfolk that the seaweed originates from the oil and gas companies offshore is widespread.

Landlessness

Fishing households have also sought to associate the declining agricultural opportunities to the presence of the oil and gas companies.

Many of the fisherfolk reported that they do not practice agriculture activity because of lack of land. Among the fishers that practice farming –the issue of land ownership was very problematic. Only 57% of those who practice farming as alternative or supplementary income to fishing own their land.

We don't have agricultural opportunities because of oil companies, railways development, port development, and the presence of other factories.
(Canoe owner/community leader, New Takoradi).

The excerpts of the interview with official of a local NGO gives an insight into the landlessness problem.

There have been land grabs in the Western Region because of the oil and gas industry. When you move from here -Takoradi to Agona Nkwanta-you realize that lots of the land have been cleared and factories have been set up.
(Representative from a local NGO, Sekondi Takoradi).

A related study by Obeng-Odoom (2014), posited that there has been large- scale land grabbing in the oil industry involving several acres of land in the Western Region.
Another study by Adusah-Karikari (2015) reveals the negative transformation of farming and fisheries livelihoods because of the presence of the oil and gas industries.

Another form of the petroleum industry impact on local fishing industry is the destruction of fishing gears by oil supply vessels. The Fisheries Commission officer in Takoradi confirmed- that there have been reports where oil supply vessels have destroyed fisherfolk boats and nets. Sometimes there are collision between canoes and oil supply vessels at sea. This collision often results in the destruction of fishing canoes and sometimes results in death (Adjei & Overå, 2019).

4.3.1 Livelihood situation before and after oil and gas extraction and production.

The discussions so far suggests that fisheries livelihoods have been negatively affected by oil exploration and production.
Figure 4.3 shows the district and community perspectives with respect to changes in livelihoods before and after the commencement of oil and gas production. From

figure 4.3, it can be observed that the majority of fisherfolk in all study areas reported that oil exploration have negatively affected their fishing activity.
However fisherfolk from Sekondi , New Takoradi, Axim and Dixcove recorded the highest levels of impacts of oil extraction and production on their livelihoods. This could partly be explained from the fact that these communities are traditional fishing towns- where the local fisheries is the mainstay of the local economy.

The majority of the fisherfolk surveyed in these communities reported that they used to offshore where there is currently ongoing oil exploration and production activities. However, they are now confined to specific areas at sea where they claim they are unable to catch more fish. In places like Shama Bentsir and Akwidaa, fishers reported relatively similar livelihood situation after the onset of the oil production. Many fisherfolk from this communities reported that they do not fish deep seas where the current oil production activities is ongoing.

I have been fishing over the past 15 years. 4 to 5years ago we can get about 500 to 600GHS monthly. Now when the oil and gas came everything has changed. It is difficult to even get 200GHS. Our work has gone done drastically. It has become difficult to take care of our families. From here to Cape 3 Points – Half Assini- they have destroyed the seas. Before the oil and gas came there used to be lot of fishes from here to Half Assini.
(Fisher, Axim).

Currently, oil and gas companies have been performing corporate social responsibility mainly in the form of human capital development and the provision of social services as a way of reducing vulnerabilities and developing harmonious working relationships with the coastal communities (Owusu, 2019). In interviews, oil company officials, fisheries officers, and community leaders mentioned scholarship schemes introduced for children in the coastal communities, construction and renovation of school facilities, provision of potable drinking water, and community recreational centers. These have not helped the fisherfolk's livelihood situation, however, as many contend that it has worsened since oil production started (Table 4.2).
The government needs to work closely together with relevant stakeholders in the petroleum industry, small-scale fisheries and the local coastal communities to achieve sustainable development of the oil & gas industry as well as the fisheries sector

Table 4.4 shows that natural, financial and human capital has been the most affected by overfishing and the petroleum industry. The rapidly depleting marine

fish stocks has affected the natural resource base of coastal communities. The once very productive ocean is no longer the same after decades of over-exploitation. The presence of the oil and gas companies offshore have further constrained the mobility of fishers resulting in decrease natural resources to extract fish.

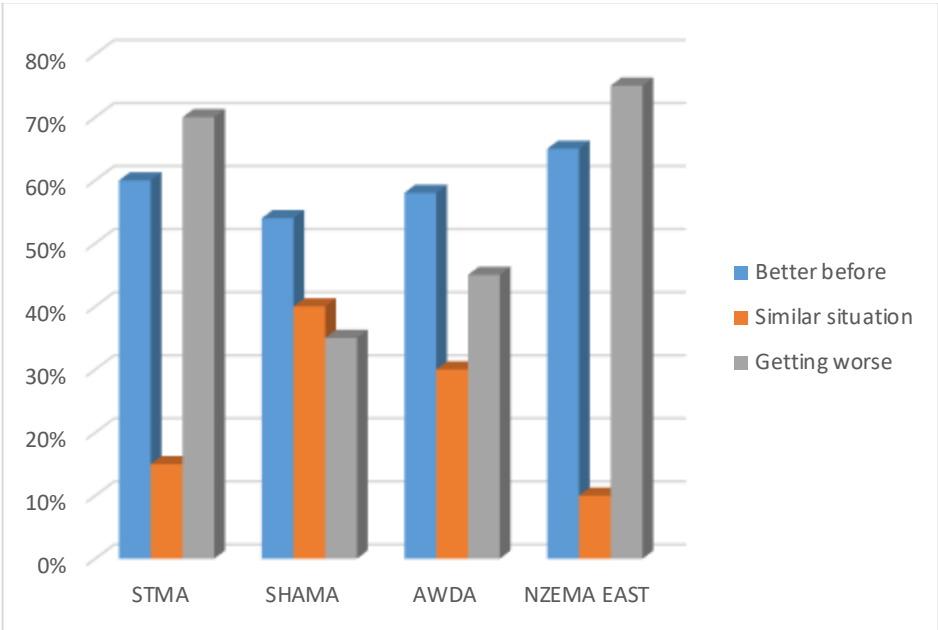

Figure 4. 3. District level differences with respect to petroleum industry impacts.

In addition, the oil and gas companies presence onshore (land) has led to the acquisition of large tracts of land in coastal communities for the establishment of industrials and other related factories.

The decrease in the natural capital base of coastal communities has led to decreased financial capital and rising unemployment. The unprofitability of the fisheries industry have compel many fisherfolk to abandon fishing and its related activities.

As noted by the chief fisher in Axim, because of the low fish catch people with access to land have moved to practice farming. He further stressed that rubber plantations is becoming more popular as the alternative to fishing or to compliment fisheries income. Chapter 5 will further explore the livelihood adaptation strategies deployed by fisherfolk in response to the declining small-scale fisheries opportunities.

Table 4. 4. Impacts of overfishing and petroleum industry on the livelihood capital assets of fisherfolk.

Capital assets	Perceived impact
Natural capital	Reduction in fishing space , restricted access to the ocean, limited land opportunities
Financial capital	Decreased income, low savings will affect disposal income available to the family
Social capital	Conflicts between fishers and state agencies, Lack of trust between local fisherfolk and the state
Cultural capital	New set of social rules and ways of doing things, coexistence of fishers and oil companies on the sea and the land, socio-cultural changes.
Human capital	Incidences of death and injuries, environmental pollution affects the well-being of fishing households.
Physical capital	Destruction of nets and canoes, limited ownership of productive assets.

4.4 Differences and commonalities of vulnerabilities within and among the study areas

From figure 4.4, overfishing seems to be a major problem across all the study sites. The use of illegal light fishing is a major problem in the Western Region of Ghana. According to the Ghana National Canoe Fisherman Council, fisherfolk in the Western Region are among some of the coastal communities that have intensified the use of light fishing. In this study, it was only in Akwidaa located in the Ahanta West District that fisherfolk mentioned low use/absence of light fishing.

Fisherfolk in Shama reported low activities of illegal fishing. Perhaps this maybe because of the stronger local leadership. According to the chief fisherman in Shama Bentsir he made all efforts to prevent bad fishing practices such as the use of light and unapproved nets. However, activities of industrial vessels fishing in their waters is beyond his control.

Most fisherfolk in Axim also reported of industrial trawler vessels from Sekondi and New Takoradi coming to fish in their waters without authorization and in most cases using illegal fishing gears. It was also uncommon for fisherfolk in Axim to

mention that –a lot of their fishermen are involved in the use of light fishing. Even though light fishing is low in Akwidaa the use of monofilament was widespread. Across all the study communities with the exception of Shama there is considerable activities of illegal fishing practices. The government of Ghana partnership with USAID to end illegal fishing is visible throughout the coastal communities in the stud areas. Despite these efforts the activities of illegal fishing is still common at least from the narrations of the fisherfolk, which was corroborated by the fisheries officers at both the district, regional and national level.

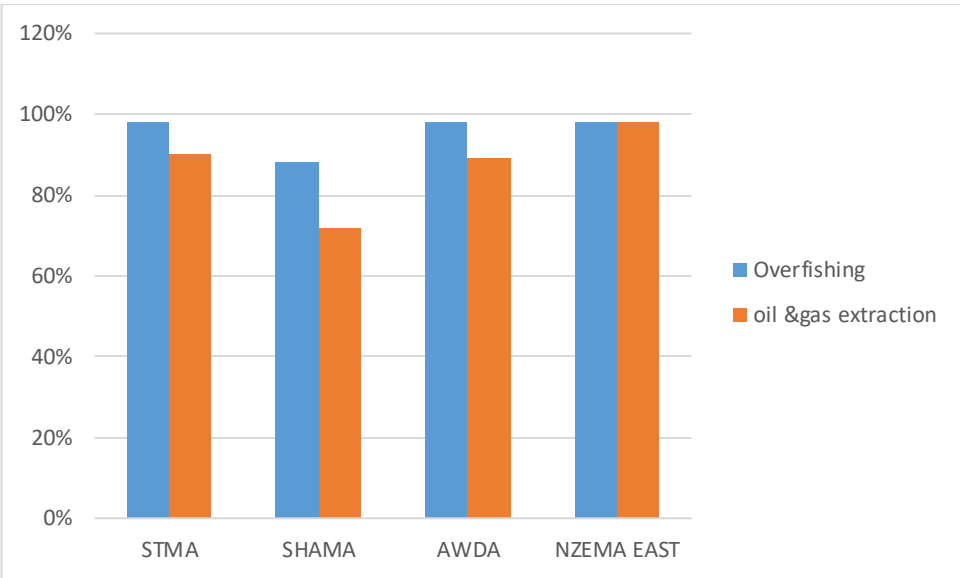

Figure 4. 4. District perspectives on vulnerabilities in study areas.

With respect to the petroleum industry, I found that more fisherfolk in Sekondi, New Takoradi , Dixcove and Axim reported of fishing near the oil and gas installations than the other study areas. Fishers from the coastal communities reported the highest levels of impact from oil extraction and production on their livelihoods. Majority of fishermen in Axim, Dixcove and Akwidaa reported of the presence of seaweeds in the ocean that disrupts their fishing. The emergence of the seaweeds according to the fishers coincided with the extraction and production of oil.

It must be noted that, overfishing and petroleum industry are not the only factors affecting the local fisheries industry. Many of the fisherfolk also attributed the decrease in fish catch and declining coastal livelihoods to the lack of a regular supply of premix fuel for fishing. According to the fisherfolk, the situation has gotten worse

because of the political nature in which premix fuel is distributed. This assertion has been corroborated with findings from recent studies (Tanner et al., 2014; Nolan, 2019; Freduah et al., 2017).

In addition, there were concerns about the rapid increase in the number of canoes as a contributing factor leading to depleted marine fish stocks. According to the fisheries officials, there are about 4000 canoes in the Western Region which has led to the decline in the catch per person.

A B

Figure 4. 5. Campaign to end illegal fishing supported by USAID.

A. Ahanta West Municipality welcoming visitors with say no to illegal fishing.

A- C- awareness creation of illegal fishing in Dixcove.

The local fisheries leaders mentioned that in the past, the sizes of the canoes do not reach 40ft, the biggest maybe between 25 ft and 30ft. Nowadays one boat can reach 60ft powered with outboard motor with 30-40hp. Fisherfolk also complained about the activities of Industrial fishing trawlers. According to the fishers the

industrial trawlers access fish in fertile fishing grounds reserved for artisanal canoes. What's more, they have been found to be engaged in various forms of illegal fishing activities such as the use of unproved nets that destroys marine ecosystem productivity (Penney et al, 2017; Afoakwah et al., 2018; Finegold et al., 2010).
Furthermore, in coastal communities such as Shama Apo, Bentsir, Dixcove, Axim and Akwidaa fisherfolk reported of stronger waves and tides that has contributed to the rapid erosion of coastline. In communities such as Shama Apo and Bentsir as well as Akwidaa fishers mentioned about the reduction of space along the beach to dock their canoes.

The Government of Ghana is working together with domestic and international partners to restore the depleted marine fish stock.
According to fisheries officer in the Western Region, government in collaboration with NGOs organize training programs for the fish processors and traders to assist them with modern fish processing techniques and. Some of the NGOs also supported the fish mongers with advanced smoking materials.
Government working in partnership with the Sustainable Fisheries Management Program (SFMP) have provided some of the fishing communities with fish storage facilities. These projects are aimed at improving the efficiency of fish processing as well as the preservation in order to decrease the wastage of fish resources.
The state fisheries agencies are also working to control / limit the number of canoes in the Western Region.
Perhaps the most contentious management intervention introduced by the national government to rebuild depleted marine fish stock is the closed fishing policy.
The next section explores the perception of fisherfolk with respect to the state introduction of closed fishing season as a major policy to restore depleted marine fish stock and rebuilding of coastal livelihoods.

4.5 Contesting access to the use of coastal waters: The political ecology of closed season.

This section addresses research question two, it explores the perceptions of coastal fisherfolk in relation to the closed fishing season policy introduced by national government to rebuild depleted marine fish stock and other coastal vulnerabilities.

Background to the introduction of fishing season

Ghana's marine waters has operated by an open access regime for the past seven decades, even though there were signs of overfishing from the 1990s. There was no concerted efforts to enforce the fisheries law on closed season for the artisanal canoes.

In 2016, Government of Ghana in collaboration with USAID under the SFMP requested for technical and scientific assistance on the appropriate timing of a closed season to be implemented for the artisanal canoes. The SFMP including local environmental NGOs s recommended the month of August for the sea to be closed for local fishing. The main scientific reason was that, August corresponds with the bumper harvest season as well as the most fertile period for fish spawning. Therefore closing the sea in August will increase the reproduction of fishes. Examples were giving in other countries such as the United States, Philippines, Senegal, Guinea Conakry, Mauritania and Morocco that are reaping the benefits of closed season (Lazer et al , 2016).

The closed season was introduced in 2018 for the artisanal canoes sector. The closed fishing season was introduced as a conservation measure aimed at rebuilding the depleted fisheries resources based on scientific studies and recommendations from relevant stakeholders. The National Fisheries Management Plan (2014-2019) and the 2002 Fisheries Act 625 provided the regulatory and legal framework for the introduction of closed fishing season.

Closed season it's a management measure , it's not only for the canoe sector, it has been implemented for the industrial trawlers and the semi-industrial sector for the past 2 to 3 years. It is not something that is new –its a strategy that is implemented to rebuild the fisheries.
(Official, Fisheries Commission, Western Region).

Excerpts from the interview with official and fisheries scientist of a local NGO gave some background information in relation to the introduction of the closed fishing season in Ghana in 2018.

We have scientific basis as to why there is the need for immediate action as in the need for closed season. The maximum sustainable yields we used to get – our all-time best catch was recorded in 1996. Afterwards, the decline have been rapid and presently we at between 13-14 percent of the all-time best catch. Scientific calculations suggests that if you hit 10% of your all-time best –it means you have gotten to a point we call collapse, so the fisheries will then collapse. Scientifically we are estimating by 2020 if care is not taking and we go on business as usual we will hit the 10%.
(Representative from a local NGO, Sekondi-Takoradi).

According to the representative of the local NGO, the eminent collapse of the fisheries is specific to the sardinella. The sardinella (tuna, mackeral, anchovies) provides cheap protein and food for Ghana and it serves as a food for the big fishes in the sea.
However, interviews with fisherfolk and sections of the local fisheries leaders provided conflicting views about the relevance of the seasonal closures introduced by the state.

Perceptions of fisherfolk on the closed fishing season to rebuild depleted fish stock.

According to Bennette (2019) how knowledge is utilized by different groups of actors to legitimize or promote specific policies or actions in natural resource management provides useful insights into the struggles of power.
Interviewed fisherfolk had different perceptions regarding the ecological effectiveness of closed seasons. The conflicting perceptions appear to be because of fisherfolk perceived impact of closed season on their financial, cultural and natural capital as well as their level of participation and perceived influence in decision-making with respect to the closed season.
According to many of the fisherfolk August is the period they catch more fish and are able to make more money to defray their debt. Therefore, fisherfolk believe the closed season will affect their financial capital as well as their ability to provide for their families.

The 'manwura' (August) is against us. It is in august that we catch a lot of fish.. Therefore, when there is close season it will worry us. If anyone owes at the bank it is during this period that he can pay back.
(Chief fisher, Shama Apo).

The secretary to the chief fisherman in New Takoradi also agrees with the chief fisher in Shapo.

The month of August happens to be the period our fishermen makes a lot of money. Anybody that has gone for loan it is in August that the person can pay back.
(Secretary to the chief fisherman, New Takoradi).

In addition, August also happens to be the month that other traditional and cultural rites are performed at sea for safe fishing and bumper harvest. Excerpts from the interview below attests to this assertion.

The timing of the period also coincided with the GA (Greater Accra) traditional festival celebration which is tied to some ritual performances on the sea. August is the traditional festival celebration of the GA people and the period for the closed season coincided with this.

(Secretary, Ghana National Canoe Fisherman Council).

There is a relationship between the nature of a society and their belief systems, in the case of coastal fishing communities in Ghana, the sea is considered as sacred entity with a set of rules and taboos that must be strictly adhered to (Abane, et al., 2013). Fishing communities have a strong attachment to their traditional ways of lives and have a strong sense of place and purpose (Andriesse, 2019).

The sea is our father, uncle, brother, sister and everything. We as women even have more burden/ responsibilities compared to the men. We manage the house and everything. This close season will bring a lot of economic hardship to us.

(Fish trader, Sekondi).

Another problem that emerged with the introduction of the closed season has to do with the issue of fisherfolk participation in decision making during the implementation process of the policy. Majority of the fishers reported that they were not consulted prior to the introduction and enforcement of the closed season. Table 4.5 shows a positive association between stakeholder engagement and local support for marine conservation(χ^2= 14.473, p=0.01). Excerpts from the interview with local fisheries leaders support this assertion.

You see now l was telling you everything is politics. On 21st May 2014- government started to dialogue with us about the closed season in relation to the depleting fish stocks. The education should have continued but it didn't . We only did one of such education in 2015. In 2016, we did three to four meetings concerning the closed season and paused because of the incoming national election. In 2017, we started the dialogue again but no major decision was reached. In 2018 – 7th august to 4th September government announced the enforcement of the closed season.

(Secretary to chief fisher, New Takoradi).

Table 4. 5 Results of chi-square test.

Variable	Local support closed season				Statistics
Stakeholder engagement	**Agree**	**Not Sure**	**Disagree**	**Total**	
Yes	11(23.4%)	5(10.6%)	31(66.0%)	47(100%)	χ^2=14.473
No	90(25.5%)	5(1.4%)	258(73.1%)	353(100%)	d/f=2
Total	101 (25.3%)	10(2.5%)	289(72.3%)	400(100.%)	p=0.01
Vote against government	**Agree**	**Not Sure**	**Disagree**		
Yes	50(21.3%)	1(0.4%)	184(78.3%)	235(100%)	χ^2=16.253
No	51(30.9%)	9(5.5%)	105(63.6%)	165(100%)	d/f=2
Total	101(25.3%)	10(2.5%)	289(72.3%)	400(100%)	p=0.00
Alternative Livelihoods	**Agree**	**Not Sure**	**Disagree**		
Yes	34(29.3%)	5(4.3%)	77(66.4%)	116(100%)	χ^2=3.988
No	67(23.6%)	5(1.8%)	212(74.6%)	284(100%)	d/f=2
Total	101(25.3%)	10(2.5%)	289 (72.3%)	400(100%)	p=0.136

Note χ^2 =Chi square value obtained, d/f= degree of freedom, p=statistical significance at a confidence level of 95% ($p<0.05$).

The chief fisher in Axim also supported the claim that the time for education and consultation among the coastal communities was not too short.

Some of us did not go against the close season but said there was limited time for education. They waited until some few weeks to August before they came to announce the close season. So we could not prepare our fishermen, there was little time for education.
(Chief fisherman, Axim).

Fishing is what we do to support our families, so when someone tell you to stop fishing without any notification, its serious matter, you are taking away his source of income and livelihood. Government should have sent some people here to talk to us concerning the close season before implementing it. If we were informed earlier

about the closed season, l would have mobilized my crew and go to lvory coast for fishing.
(Canoe owner/community leader Sekondi).

According to the chief fisher at Shama Apo many of the fishers choose to migrate when government announced the closed season. In chapter 5, the various livelihood adaptation strategies deployed by fisherfolk in response to closed season and other vulnerabilities introduced by the presence of the oil and gas industries will be examined.

The leaders in the fisheries commission from the district, regional to the national level blame the declining fisheries stocks on local fisherfolk use of illegal and destructive fishing activities.

As noted by Adjei & Overå (2019), the image held by formal actors in government institutions about local fisherfolk being ignorant, illiterate, traditional and irresponsible affects thier inclusiveness in policies that shape their livelihoods. Even when they included in the decision-making processes they lack the power to influence policies that shapes their livelihoods because of the powerful and dominant views of government officials and environmental NGOs.

The local perceptions of national marine parks in Thailand were largely negative because of restricted access to fishing grounds and the lack of broader participation and consultation in the management of the protected areas (Benett & Dearden , 2014). Other related studies such as (Nathan J. Bennett et al., 2019; Bucaram et al., 2018; Glaser et al., 2010; Rola et al., 2018) shows that broader stakeholder engagement of local resources users such as fisherfolk influence the level of their support of conservation as well as the success of the project.

Table 4.6 shows that natural, financial, social and cultural[15] are perceived by fisherfok to be the most affected by closed season. The traditional SLA, does not include cultural capital in the assets based of local resource users. However, it has emerged that coastal fishing communities have a very strong attachment to the sea, because of its cultural significance. The customs and traditions of fishing households and coastal communities are closely linked to the sea.

The restriction of fishing activities during the month of August will not only result in income decrease for fishers but also for the women whose livelihoods depends on fish trading and processing. In this regard, a household with the entire members

[15] Cultural capital refers to the traditions and belief systems, and other resources that are closely tied to people's identity as well as the means, processes to conserve those shared beliefs, and practices (Bennett and Dearden, 2014).

participation fully in the local fisheries industry stand to lose the most. Already fishing households are confronted with severe economic conditions because of overfishing and other vulnerabilities. The closed season will add additional layers of vulnerabilities to fishing households in the short-term.
It is therefore important to investigate how fisherfolk are responding to decreasing fish catch and declining coastal livelihoods.

The challenges posed to the fisheries livelihoods by the introduction of the closed season cannot be explained only in terms of the discourse of loss of livelihoods. The above narrations by fisherfolk represents well-coordinated forms of resistance to challenge the power of the state agencies. Before the introduction of the closed season, fisherfolk and coastal fishing communities had unrestricted access to the use of coastal waters for various economic and cultural practices. Fisherfolk feel that their main source of livelihoods is under threat. What's more, they think, they are losing their legitimacy as the main custodian of the sea to the state and other new actors such as the oil and gas industries.

Table 4. 6. Perceived impact of closed season on the livelihoods of fisherfolk

Capital assets	Perceived impact
Natural capital	Reduction in fishing space , restricted access to the ocean
Financial capital	Decreased income, low savings will affect disposal income available to the family
Social capital	Conflicts between fishers and state agencies,
	Lack of trust between local fisherfolk and the state
Cultural capital	Marginalization of fisheries livelihoods, traditional believes
	and cultural practices

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4.5.1 Bottom-up initiatives verse top down approaches

Through the engagement with the fisherfolk on the closed season, it emerged that fishers would rather prefer government to enforce the existing laws on illegal fishing. The majority of the fishers reported that there is no need for the closed season, government should rather focus on enforcing the laws on illegal fishing activities.
Fisherfolk were of the view that it is the destructive fishing practices especially light fishing that is causing the depleted fish stocks. They therefore needs government support (in a form of partnership with the navy, policy, judiciary) to set up local

committees with the powers to arrest people caught fishing with illegal gears. They believe when the laws are enforce on illegal fishing the fisheries can be rebuild and there will be no need for closed seasons. Some also mentioned that, the failure of government to enforce the laws on illegal fishing as the main reason for the introduction of the closed season.
Excerpts from the interviews of local fishers and their leaders –shows that they would rather prefer government to enforce the fisheries laws instead of the closed fishing season.

Our older generation do not know closed season, during that time there was no dynamites, carbide, DDT –illegal fishing practices, there was no small mesh net size, there was no monofilament net, no light fishing. If government is able to stop these five things l have mentioned –there is no need for closed season. Government can go ahead and close the sea in August, but if they are unable to the stop the five things l have mentioned there will be no use of the closed season. If people have stayed in the house with hunger for the past month and you open the sea what do you think will happen –people will rather intensify the use of illegal fishing methods to make up for the lost they incurred during the closed season.
(Secretary to chief fisher, New Takoradi).

The chief fisher in Axim also supports the formation of local task force to combat illegal fishing.

Let's form a task force comprising of the navy, marine policy, chief fisherman and other leaders and ensure that fisherman here don't use dynamites, light fishing and unapproved nets. If we are able to restrict certain things, l believe the fisheries will be able to reproduce. But they (government) think if we go for the close season and nobody is fishing –during the reproduction period in August, the fisheries will multiple. But what's the relevance if the sea reproduce more fish and we catch all the (fingerling)which ones will grow and mature again .

There is strong perception among local fisherfolk that the closed fishing season will fail to rebuild the depleted fish stocks if the laws on illegal fishing especially light fishing are not enforced.

When government closed the sea and ensure that by the time they open the sea they have also stopped light fishing that will be good. But when they close and open the

sea , and the light fishing continues , then its better for us to be at home for government to take care of us.
(Canoe owner/fisher, Axim).

The dynamites and carbides are explosive devices set off underwater to kill fish, the underwater shock waves produced by the explosives stuns the fish and cause their swim bladder to rupture. DDT (Dichloriphenltrichloroethane) it's a chemical sprayed or poured on the surface of the sea water to stress the fish.

Table 4. 7. Summary of the perceptions of the different actors/ stakeholders interviewed on closed fishing season

Actor/stakeholder	Key views
State agencies	• Closed season is permitted under the National Fisheries Management Plan (2014-2019) and the 2002 Fisheries Act 625. • It's a management strategy implemented to restore the depleted Marine fish stock.
NGOs	• August was recommended for the closed season based on scientific analysis of the marine fish stock. • The fisheries will collapse by 2020 if closed season is not enforced.
Coastal fisherfolk	Closed season will have negative impacts on fisheries livelihoods : • Economic impacts: August correspond with the bumper harvest, we cannot take care of our families if we are not allowed to fish. • Cultural impacts: Certain cultural and traditional rites are performed at sea in August. • Social impacts: loss of trust in state –level fisheries agencies, lack of trust in the decision-making processes. • Ecological impacts: closed season will fail to rebuild depleted marine fish stock if the laws on illegal fishing are not strictly enforced.

The management of small-scale fisheries in Ghana is not devoid of politics. National government applies political power in solving socio-economic problems with respect to perceived political benefits or losses. I agree with, Harvey (1993), that 'all ecological projects are simultaneously political –economic projects'.
As noted by Hadjimichael, Bruggeman, & Lange (2014, p.19) 'management is about choices and trade-offs, during decision-making is a matter of values and political

philosophies, which may differ among individuals.' Whereas fisherfolk perceive the introduction of closed season as a threat to their main source of livelihoods, the state and representatives from environmental NGOs see the closed season as a key conservation strategy to restore the depleted marine fish stock.

Table 4.5 shows a strong association between the voting behavior of fisherfolk and support for closed season (χ^2= 16.253, p=0.00). More people are willing to vote against the current government when they enforce the closed fishing season. This gives an indication that fisherfolk exercise their political power in relation to policies that may affect livelihoods during national elections.

Working towards reducing overfishing and rebuilding of depleted marine fish stocks through policies such as closed season has proven to be very challenging. Overall, two different discursive positions emerge with respect to the closed season (Figure.4.6). An open access fisheries narrative together with strict enforcement of fisheries laws and seasonal closures supported by conservation discourses. The open access argument from the fisherfolk to continue fishing was found to be weak compared to the powerful and dominant scientific conservation narratives by the state and the NGOs.

The political power of informal actors such as the fisherfolk and their leaders at the national level is low and for that matter government introduced the closed fishing season. The top- down approach failed to recognize that fishing is a way of life to the coastal communities rather than serving only as source of food and income. The posture of government institutions and the NGOs representing the scientific community made it difficult for local informal actors like fisherfolk and community leaders for their voices to be heard on issues that concern their livelihoods.

As noted by Bennett & Dearden (2014) perceived impacts are not necessarily the same as actual with respect to marine conservation impacts on coastal livelihoods, but they are instructive and worthwhile.

The narrations by fisherfolk and other community leaders concerning the perceived impact of closed fishing season on livelihoods of fishing households eventually compelled government to postpone the introduction of the closed fishing in August 2018. However, the closed fishing season was later introduced and enforced in May-June 2019.

Figure 4.6 depicts the interaction between the state, NGOs, fisherfolk and coastal communities on the political ecology of closed season. There is unequal discursive power between the state, NGOs and coastal fisherfolk. Government agencies and NGOs exercise power through the justification of their actions on the need to restrict access to fishing during certain period of the year. Local fisherfolk and coastal

communities lacks the power to influence decisions that have impacts on their livelihoods. Considering the fact that, fisherfolk have enjoyed unrestricted access to the use of coastal waters for several decades, government should have consulted more extensively with fishing communities before the introduction of the closed season policy. The limited period allocated to engage fisherfolk and the lack of broader consultation shows the dominance of the state over local resource users. Although some of the fisherfolk and thier local leaders mentioned that they were involved in the decision making process, their inputs had no significant influence on the final decision. The unequal power relations between fisherfolk and the state agencies was manifested through the dominant natural science knowledge applied by government and NGO representatives on the need for the closed season. Such scientific knowledge failed to consider the socioeconomic and cultural aspects of the local fisheries livelihoods.

The state applied its political power to enforce the closed season at the expense of fishing households. However, the state's inability to enforce the laws and regulations on illegal fishing activities gives more power to the fishers to exploit marine resources.

Furthermore, the postponement of the closed season from 2018 to 2019 as well as the change in the period of the closed season from August to May-June means fisherfolk have some level of power to influence policies at the national level.

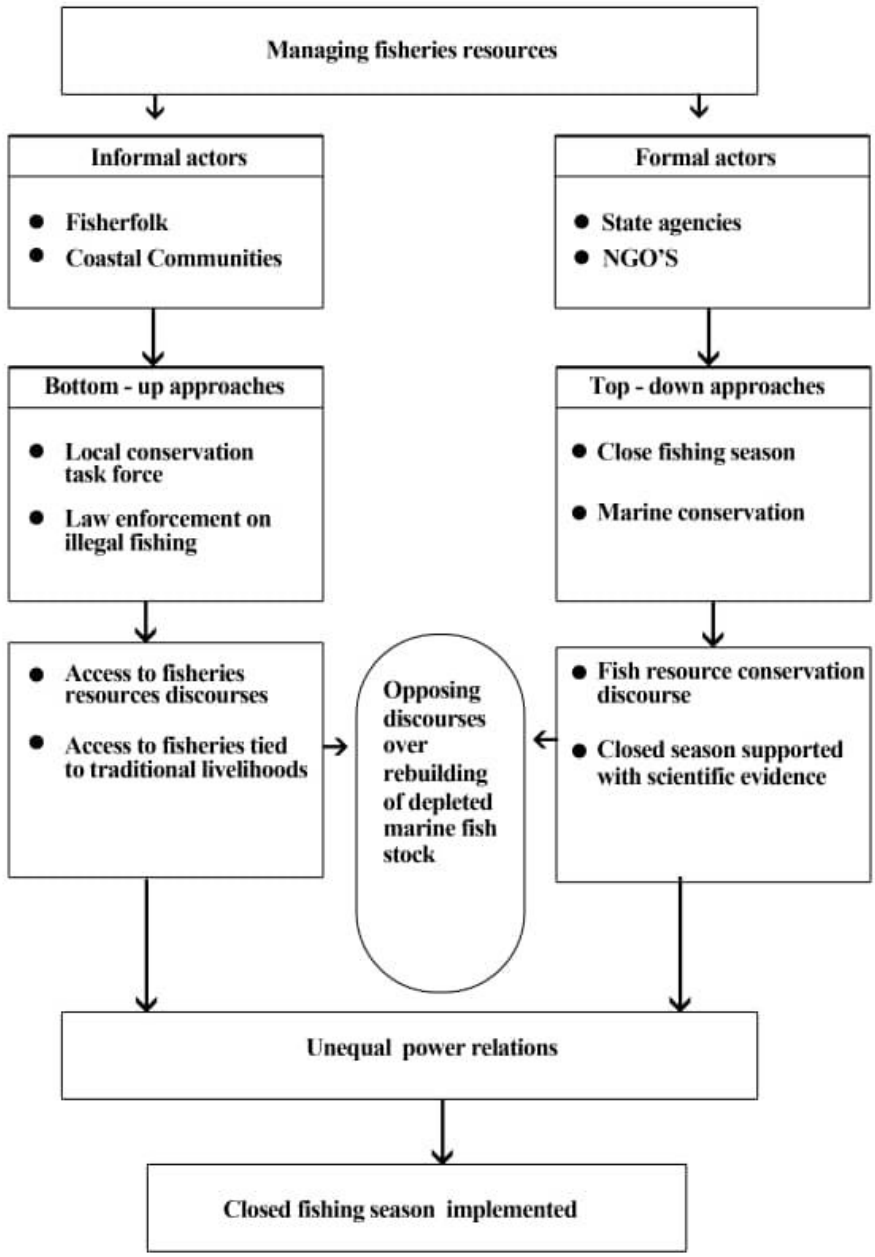

Figure 4. 6.Opposing discourses over rebuilding of depleted fish stock.

4.6 Differences and commonalities of local support for marine conservation

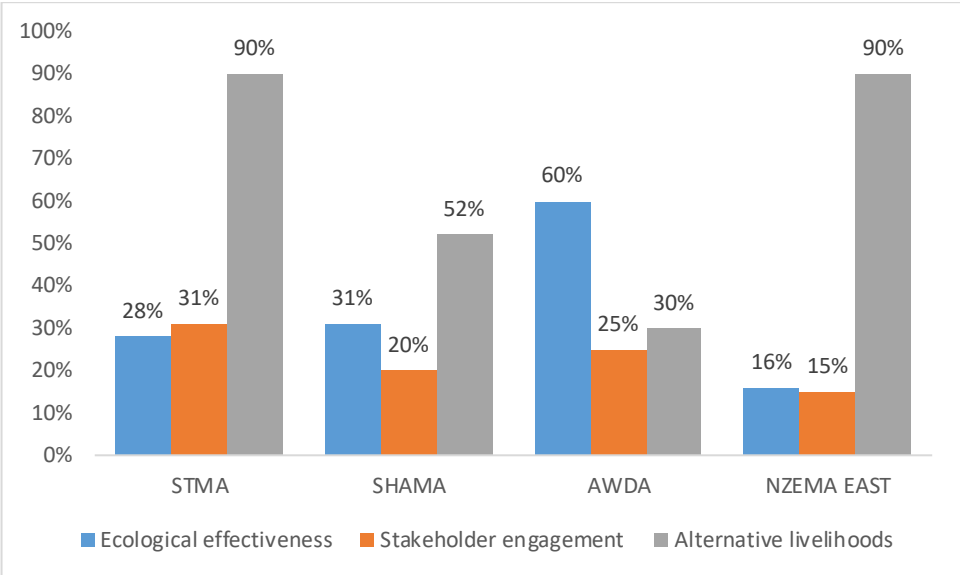

Figure 4. 7. District-level differences and commonalities of local support for conservation

Local level politics and conflicts of interests could influence local support for closed season. In places like Sekondi , New Takoradi and Axim there were strong opposition against elected government officials involvement in the local fisheries business. Many of the fisherfolk and community leaders in these places believe, it was government inability to enforce the fisheries laws that led to the introduction of the closed season. Majority of the fisherfolk believe that, the closed season can only achieve ecological effectiveness when the laws on illegal fishing activities are strictly enforced. Therefore, fishers in Axim, New Takoradi and Sekondi strongly opposed the closed season policy because of the perceived government interference in the local fisheries industry.

Interviews with local NGOs confirmed the active participation of elected government officials in local fisheries, especially when they are in power. This situation can become problematic with respect to the enforcement of certain laws largely because of conflicts of interests.

However, the NGOs also commented that, Some of the chief fishers are corrupt – they have associated themselves with the political parties. Politics have infiltrated

into the local fisheries. There is no transparency in the local leaderships and off course, corruption has become the new normal.

Across all the study communities, majority of the fisherfolk reported that, they did not partake in the decision making process with respect to the closed season policy. The local fisheries leaders were generally appalled by the limited time allocated to them to deliberate on the relevance of the closed season for marine conservation. The stakeholder engagement occurred in the form of top-down management instead of providing the medium for active political participation by fisherfolk.

Majority of the interviewed fishers expressed their shock and frustration about the sudden introduction of closed season leaving them with little time to develop appropriate livelihood strategies to provide the loss of income during the temporal closure of the sea. The limited stakeholder engagement was heavily criticized by fisherfolk in places like Sekondi, New Takoradi, Shama Apo, Dixcove and Axim where the fisheries industry is the mainstay of the local economy.

Table 4.2, shows that people in Akwidaa have more land opportunities. Many fishers in Akwidaa engaged in farming activities to supplement thier income from fisheries. Compared to the other study areas, fishers in Akwidaa perceive closed season could be successful without the provision of alternative livelihoods.

However in places like Sekondi , Shama, New Takoradi and Axim where the fisheries is the backbone of the local economy many fishers agree that the closed season should come along with alternative livelihoods or some of compensation during the time they are not permitted to fish.. Even though some fisherfolk in Axim engaged in farming they believed closed season will fail without some form of alternative livelihood/or compensation..

In coastal communities such as Sekondi, New Takorad, Shama and Axim including Dixcove there is a strong attachment to fishing as the main traditional livelihoods. It can therefore be suggested that even when they are provided with alternative livelihoods, it would be difficult for them to abstain from illegal fishing activities during the seasonal closures.

Table 4.5 shows that there is no positive association between the alternate livelihoods and local support for closed season (X^2=3.988, p=0.136).

Within Shama, more fisherfolk in Shama Apo do not support closed season. Perhaps the strong local leadership in Shama Bentsir may have partly contributed to the support of closed fishing season. Whereas the chief fisher in Bentsir declared its support for closed season, his counterpart in Apo rejected it. The differences in opinions with respect to closed season may have been communicated to fishers in

their respective communities, which could have infulenced the level of support of their members

As for me, l am a fisherman and have acquired some level of education. I therefore support the closed season.(Chief fisherman Shama Bentsir).

The chief fisherman in Shama Apo also have this to say;

So when there is close season it will worry us. If anyone is owing at the bank it is during this period that he can pay back. (Chief fisherman, Shama Apo).

Considering the close geographical proximity between Shama Apo and Shama Bentsir it could be assumed that they may share similar or have same opinion on the closed season but this was not the case. Nonetheless, variations in local leadership can also influence local support for conservation.

Local support for conservation is associated with social impacts, stakeholder engagement and political factors. The ecological effectiveness of closed fishing season is strongly underpinned by good governance process that address the power relations between formal and informal stakeholders. It is also important to pay attention to the determinants of local area differences and intra-village dynamics with respect to policies such as closed season and other related environmental interventions.

4.7 Negotiating marine space in coastal Ghana: the political ecology of fishing and the petroleum industry.

This section continues with the discussion on the interaction between formal and informal actors in the management of fisheries resources. It addresses research question three by investigating the conflicts produced between small-scale fisheries and the petroleum industry offshore. Through the application of an actor-oriented political ecology, the thesis continues the discussion with how unequal power relationships shape the politics and outcomes in relation to the management of the ocean for different level of stakeholders/actors. Power is now understood as a "product of human activities through series of social process and relations." (Adjei & Overå, 2019).The actors under consideration here includes the state, oil and gas companies, artisanal fisherfolk and coastal communities. All these actors possess some agency that enables them to exercise their power (Bryant & Bailey, 1997).

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Conflicts between local fishers and petroleum industry offshore.

The conflicts produce between the fishers and the oil and gas companies appear to be because of fisherfolk perceived impact of oil exploration and production on their natural, financial, social, physical and cultural capital as well as their level of participation and perceived influence in decision making concerning the use of coastal waters.

Tullow Ghana (2019) defines access to the sea –"as process through which the company gains social right and opportunity to secure unfettered passage, occupancy and utilization of the sea for exploration, development, operations and closures of its offshore/ onshore hydro carbon operations." In order to protect offshore petroleum production activities a safety exclusion zone of 500m radius and advisory zone of 1000m has been established around each oil rig. International and domestic maritime laws authorize the creation of safety zones around offshore installations and structures (Tullow, 2019; Arbo and Thuy, 2016).

Fishers are therefore not allowed to fish anywhere near the 500m as well as the 1000m radius exclusion zone. However, according to many of the fishers they used to fish in the areas now declared no fishing zones. According to the chief fisher at Shama Apo there was no initial consensus that the oil extraction and production could have negative consequences on fishing activities.

Excerpts from the interview with the chief fisher at Axim below, provides some insights into the occupancy and utilization of the sea as well as the spatial restriction.

The fisherman was the only tenant to the sea. Apart from the fisherman , the next person was the navy, the trawler vessels –which travel from country to country. When you talk about the fishing industry-the local fisherman used to be the sole tenant. Now it is not like that anymore. The oil and gas companies are on the sea so there is a problem. They have asked fishermen to stay away 500m from the oil rigs for their safety and that of the oil facilities. However where the oil rigs are located its where we get lot of fish.

As noted by Owusu (2018) in his illuminating thesis that seek to provide historical antecedents to the conflict between the petroleum industry and local fisheries industry with relevant historical maps. He concluded that despite the intensive trading activities that occurred along the coast of the Western Region between the local people and Europeans since the fifteenth century, it is the oil and gas industry[16] that has directly appropriate ocean space from the local fishing industry.
Statements such as government has sold the sea to the oil and gas companies from some of the fishers invokes the feelings of the loss of fishing fertile grounds to the petroleum industry.

Nonetheless, officials from the oil and gas companies and government downplays the impact of the oil exploration and production on fisheries livelihoods.
They consider the impact of the oil and gas activities on local fishing industry to be marginal.

There are plans for the setting up of marine protected areas and its even in the law that certain areas can be assigned as marine protected areas. But this has not been done yet. But the oil installations are there and they have declared 500 meters around it. So in a way this is serving as a marine protected area. In any case the oil rig also have lights –and it is true that lights attract fish. But l don't know if all the fishes in the sea can be attracted to the 500m radius around the oil rigs. In any case, if all the fishes have been attracted to that place, they will certainly move out of that place. But in the long term l am thinking the establishment of marine protected areas

[16] Three oil fields cover a total ocean space of 915km square; jubilee field (110kmsquare) Tweneboa Enyenra Ntomme (TEN) field (800km²) and Saltpond field (5km) (Adjei & Overå, 2019).

will be good for the fisheries industry. After the decommissioning of oil installations –that area can be earmarked as a marine protected area.
(Officer, Fisheries Commission, Western Region).

The representative from the oil company seems to agree with the view of the fisheries officer concerning the negligible impacts of the petroleum industry on fishing activities.

The irony is that, off course the rig has lights on them and the fish like light so some of the fish do move closer to the rig. However the fish that go to the sea, they stay there and then they reproduce and so we are even doing the local fishers a favor. The local fishers are using some type of nets, that is illegal according to the fisheries commission. Therefore, we having our rigs offshore and the fishes coming around the rigs we are saving you. The fish will be there, they will spawn, and when they spawn, they will spread.

The state and the petroleum industry blames the local fishers for the decreasing fish catch rather the presence of the oil and gas industry offshore. Officials from the oil and gas sector and the petroleum industry contended that the decreasing fish catch started before the commencement of oil production offshore.

When you do a little research, you will realize that the decreasing fish catch started before 2010 and even our first commercial production of oil and gas started in 2010. So is there is no correlation but when you talk their mind is already made up and it is difficult to diffuse such misconception.
(Officer, Oil and Gas Company).

From figure 4.8.it can be observed that decrease in fish catch started before the commencement of oil production in 2010. Nonetheless, the data also shows that after 2010, fish catch has continued to decline. In 2000, total fish production was 276,275.32 metric tons, in 2010 fish catch declined to 198,936.48 metric tons, and the downward trend continued, reaching 159,726 metric tons in 2018, which is one of the lowest in recent years. According to the official from a local NGO, if you restrict fisherfolk from fishing in certain places there will definitely be some level of impact.

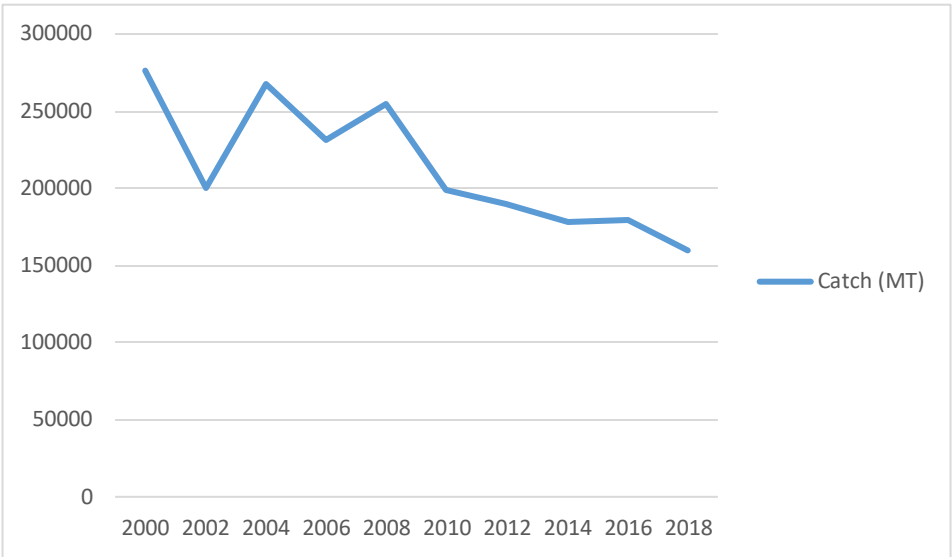

Figure 4. 8. Total marine fish production by artisanal canoe 2000-2018 (metric tons)
Source : Fisheries Commission, Accra, unpublished report.

It has also been suggested that the ocean is a big so why should fisherfolk complain, when there are just a couple of oil rigs in the ocean, there are other vast fishing grounds to access for fish.

The size of the oil rig on the sea is like a tip of matchstick it's so insignificant. The sea is big, the rig is just a miniature something on the sea and so there is a misconception about.
(Officer, Oil and Gas Company).

The local journalist based in Sekondi- Takoradi seems to echo the same sentiment that the size of the oil rig on the ocean could be insignificant to the discourse on decreasing fish catch.

Fishermen used to fish at any part of the sea but because of the oil and gas companies –they are no longer able to fish in certain part of the sea. However, the sea is big so they can move to other side/part of the ocean to continue their fishing there.

However, according to the fisherfolk and their leaders though the ocean is big, it's not everywhere that is accessible for fisheries resources.

Someone will say the ocean is a big , so staying away 500m from the oil rig is nothing. But, it is not everywhere on the sea that fishermen can catch fish. Where the oil rigs located is where we can catch the fish.
(Chief fisher, Axim).

Another fisher from Sekondi supported the assertion that it's not any everywhere on the ocean that they catch.

The fishes around the oil rigs appear on the at the surface of the sea, species like 'doctor fish' and tuna. Those near the surface of the sea are more than those at the bottom, therefore anytime we get near the rigs we become satisfied but the problem is we are not allowed to fish there.

According to the representative from a local NGO, in some countries they have the technology to disperse the fish after sometime when they realize that a particular rig area is becoming full of fish. They disperse the fish so fisherfolk can catch them. Since Ghana is yet to have that technology the only option is to allow the fish to be around the rig area probably until the decommissioning of the rigs.
In addition, Ghana is yet to undertake a marine spatial planning[17] to scientifically identify fertile fishing grounds to be protected. Presently wherever oil is find offshore production activities is initiated.

Fisherfolk expressed concerns about new oil discoveries such as the recent discovery by Aker Energy –which is 450-550million barrels and perhaps the biggest oil find in Africa . With such new oil discoveries, it means many new oil rigs are going to be planted offshore which will further reduce the fishing space of fishers. Some of the fishers and their local leaders complain that the naval officers stationed offshore to protect oil fields sometimes intercept their canoes and confiscate their fishing gears when they fish near the oil fields offshore. Some also complained that the navy chase them away when they are not even fishing near the oil fields offshore.

[17] Marine Spatial Planning is a 'process that considers all of the natural resources processes, and human uses of a given area of ocean or coastal space to identify areas that are appropriate for specific uses, resolve conflcits, between existing and future users, and a range of conservation, development, and management objectives' (Smythe, 2017).

Anytime we get near the rigs they chase us away until we reached home with nothing. The navy boats sometimes cuts through our nets when we are not even close to their rigs. They destroy our nets, and canoes. The seized items are brought to the naval base but are not released to us. Our leaders go and talk to them without any success. (Chief fisherman , Shama Apo).

Another canoe owner from Sekondi shares the same sentiments :

They have stationed some of own people the (navy) –near the rigs, anytime we approach there, they seize our fishing nets and chase us away, we return empty handed. My own fishing nets have been seized several times and many people here nets have also been seized. The moment you get there – they use something to track us and chase us away until you return home empty handed. Sometimes they enter our boats –take our nets and fish from us.
(Canoe owner, community leader, Sekondi)

According to the officer with the Ghana navy- Western Regional command, they do not have any problem with the coastal communities and fisherfolk. It is the duty of the navy to protect the demarcated safe zone around the oil rigs and other facilities offshore. Therefore, any fisherman caught fishing or approaching the safe zone is arrested and handed over to the appropriate authorities like the police to continue with the investigation

However, according to the interview with local NGO official, fishers knowledge about the boundaries of the buffer zone/safety areas is limited. Sometimes they may not know they are within the buffer zone or are at the edge. They maybe at the edge of the buffer zone but their net maybe already in the safety zone. Recent study by Adjei and Overa, (2019) has called on the national government and oil companies to intensify the education for fishers with respect to the boundaries of buffer zones offshore as well as the consequences of fishing within the those restricted zones.

Fishers themselves confirm that it is difficult to recognize the boundaries of the restricted areas/buffer zones. They have therefore recommended to the national government and the oil and gas companies to put some identification marks offshore to clearly show the limits of the buffer zone but their requests have not been met.

The oil and gas has come and its good for the country but the leaders are not putting the law where it is supposed to be. The 'blind person' can appreciate signs but cannot read , if you ask a 'blind person' not to go certain part of the sea - you need to put certain indicators/symbols to show the demarcation. So we have asked the oil

companies to put some 'white balls' at the demarcation area –so that we can know the boundaries of the safety zones. However, they do not listen to us. We started requesting for those balls to be placed since 2013.
(Secretary to chief fisher, New Takoradi).

Other forms of conflicts produced between fishers and petroleum industry offshore include; oil supply vessels causing traffic at sea, collision of oil supply vessels with fishers boats. Many of the fishers interviewed claim that they do not receive adequate compensation from the oil and gas companies even if it's established that the accident was caused by the oil supply vessels. The fisheries officer in Sekondi confirmed of reports of oil supply vessels colliding with local fishers boats. This type of conflicts reduces fishers mobility at sea and in some cases such accidents at sea results in death and other bodily deformations (Adjei & Overå, 2019; Arbo & Thuy, 2016).

Table 4.8 shows that natural, financial, social, physical, and cultural capital are perceived by fisherfok to be main affected capital assets. The restriction of fishing activities offshore will affect the catch volume of fishers, it will also affect the quantity of fish available for the women whose livelihoods depends on fish trading and processing. Offshore exploration and production of oil and gas will further exacerbate the vulnerabilities of fishing households.

Table 4. 8. Impacts of the conflicts between petroleum industry and fisherfolk on assets of fishing households.

Capital asset	Perceived influence of petroleum industry
Natural capital	Reduction in fishing space, declining small-scale fisheries opportunities.
Human capital	Increased risks of collision and accidents at sea.
Financial capital	Decreased fish catch, low income, and low savings affect investment into other economic sectors.
Physical capital	Destruction of nets and canoes, limited ownership of productive assets such as canoes.
Social capital	Increase social tension and conflicts over the co-existence of fishers and oil and gas companies at sea.
Cultural capital	New set of social rules and ways of doing things, coexistence of fishers and oil companies on the sea and the land, socio-cultural changes.

Table 4. 9. Summary of the perceptions of the different actors/ stakeholders interviewed on offshore oil exploration and production

Actor/stakeholder	Key views
State agencies	• The impact of oil exploration & production on fisheries livelihoods is negligible. • The restricted zones around oil rigs are serving as marine conservation.
Oil and gas companies	• The impact of oil production of fisheries is marginal, the decline in fish catch started before we started oil production. • Fishers are responsible for the decreasing fish catch because of the bad fishing methods they apply.
Coastal fisherfolk	Oil exploration and production has negatively impacted fisheries livelihoods : • Economic impacts: Restricted access to fertile fishing grounds offshore. Confiscation and destruction of fishing gears. • Social impacts: increase social tension over the co-existence of fishers and petroleum companies offshore.

Unequal access to the use of coastal waters.

The economic and political power of the oil and gas companies dominates over the local fisheries industry. Whereas the petroleum industry is made up of high capital intensive, sophisticated technology and highly skilled labor force the local fisheries industry is less capital intensive, uses low technology and employs people with low educational background. This is manifested in the uneven access to marine waters for different social actors. While the oil and gas companies continue to explore and develop new oil fields offshore without any restrictions, the mobility of fishers has been confined to specific spatial areas at the sea. Before the emergence of the oil and gas industry, fishers were the main 'tenants' of local marine waters and practiced their trade without any restrictions. Statements such as the government has sold the sea to oil and gas companies invokes the feeling that fishers have lost their status as the sole tenants to the sea. They now have to co-exist with the petroleum industry offshore.

As noted by Ayifli, Adom-opare, and Kerekang (2014) and Nolan (2019) the presence of the oil and gas industry offshore has led to the reconfiguration of access to the use of the coastal waters through new sets of rules and regulations.

Fishers access rights to the use of the coastal waters based on moral and historical claims has been challenged by the oil and gas companies. In a related study by Adjei and Overå (2019) they found that local fisherfolk in the Western coast of Ghana do not consider the sea as the property of fishers, the state or the oil and gas companies but as a common property resource[18], that local coastal communities can exploit for fisheries. Compared to land-based resources, access and rights to large common pool resources such as the ocean is often problematic. Ayifli, Adom-opare, and Kerekang (2014) posits that establishment of such enclosures at the sea takes political influences to set up such a system, clout to maintain but most importantly to also protect. They further argued that it is the manifestation of such power that becomes a target for competition and highly contested by other actors.

The changing power dynamics[19] over the use of the ocean space for economic benefits is also associated with the high revenues obtained from the oil companies. The Government of Ghana desperately needs the revenues in the form of (taxes and royalties) from the oil companies. The increase in oil production has contributed to the significant growth rates in Ghana's Gross Domestic Product (GDP). In 2017, the country recorded a significant GDP growth rate of 8.5 per cent largely because of increased oil and gas production. During the same year the fisheries sub-sector contribution to the GDP recorded a negative growth rate of -1 per cent within the agriculture sector (Owusu, 2019). In addition, the government itself is involved in the oil industry. The Ghana National Petroleum Corporation (GNPC), is involved in the petroleum industry. Government acting both as an industry player and as mediator could create conflicts of interest and its decision maybe tilted towards the petroleum industry.

The interaction between the local fishers and the oil and companies offshore is producing 'new forms of power -fields leading to the emergence of unequal but also contesting fields and control as well as entitlements over the coastal resources where fishing activity is currently on-going alongside oil and gas exploration.' Ayifli, Adom-opare, and Kerekang (2014, p. 349). If there can be no take zone for fish, why can't there be no take zone for petroleum?.

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[18] Common property resources is similar to what Ostroom (2002) describes as common-pool resources. Examples of common property resources includes the ocean, irrigation systems. These large resources allow multiple users to simultaneously extract resources from it.

[19] Power dynamics in this study refers to the interaction between the actors in the fisheries and the petroleum sector and how these actors exert control over each other.

Figure 4.9 shows the interaction between fisherfolk, the state and oil and gas companies as depicted in figure 2.2. Before the emergence of the oil and gas activities offshore, the sea was governed by an open access regime, where fisherfolk and coastal communities had the right to the utilization of coastal waters for socioeconomic and cultural purposes inhibited. Presently, the coastal mobility of fisherfolk is confined at specific areas offshore because of oil exploration and production. Actors in the oil and gas industries have economic and political power. Ghana needs the oil revenues as well as the need to secure future energy needs. Fisherfolk claim to the use of coastal waters base on moral, historical precedents and entitlement is relatively weak in the face of the state desire for oil revenues and securing the energy needs of the country. Consequently, in order to promote oil and gas production, the coastal mobility of fishers offshore has been has been restricted, with the Ghana navy stationed at the frontlines of the bufferzones to prevent incursion from fishers around the oil fields.

According to Foucault (1982), in order to understand how power relations influence or shape the social, economic and political processes of society, it is important to investigate the forms of resistance against different forms of power. It has been established in this study that there exists unequal power relations between fisherfolk, state fisheries agencies and the oil and gas companies. The next section will explore the different livelihood adaptation strategies deployed by fisherfolk in response to decreasing fish catch and the perceived marginalization by formal actors in the fisheries and petroleum industry.

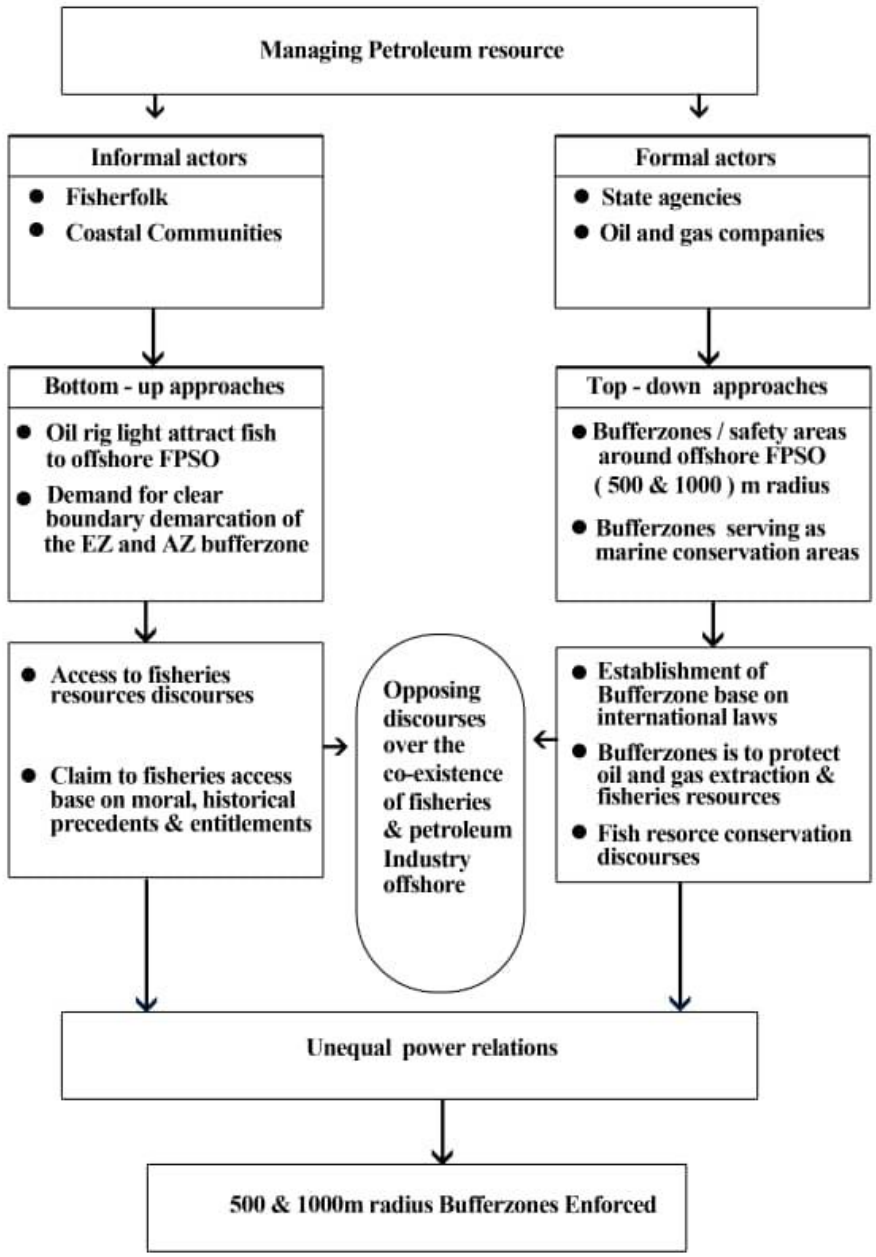


Figure 4. 9. Opposing discourses over the co-existence of the fishers and oil companies offshore.

Chapter 5. Livelihood Adaptation Strategies

This chapter addresses research question four and is divided into two main parts; the first part examines the various livelihood strategies deployed by fisherfolk in response to decrease fish catch and declining small-scale fisheries opportunities, the second part discusses the results from the research. Before the emergence of the oil and gas industry as well as the introduction of the closed season, the sea was governed by an open access regime. Currently, the situation has changed fisherfolk have to endure one-month ban on fishing and restricted access to fertile fishing grounds around offshore oil installations. Considering the fact, that majority of fisherfolk are engaged solely in fishing, they are likely to attempt to reclaim their natural capital and restore their legitimacy as the main custodian of coastal waters. Therefore, the focus will be on the coastal mobility strategies deployed by fisherfolk to increase their fish catch.

Coping and adaptation will be use interchangeable to refer to the livelihood strategies of fisherfolk. However, coping is used to distinguish the short-term strategies from the long-term livelihood adaptation strategies.

The livelihood strategies deployed by fisherfolk are classified into marine- and non-marine-based strategies. Marine-based strategies include efforts to remain in fishing, while the non-marine-based strategies involve farming and engaging in small businesses. Table 4.2 shows that about 71 % of fisherfolk are engaged only in fishing activities, the remaining 29% combine fishing and other jobs such as farming and petty trading.

5.1. Non-marine based adaptation strategies

The chief fisher in Axim mentioned that because of the low fish catch, some of the fisherfolk have moved into farming as an alternative to fishing or as a complement to their fisheries income. The common and most dominant alternative or supplement source of income to fisherfolk is from farming activities (58%). This was followed by petty trading (41%)–where most fisherfolk run their own small businesses in addition to fishing. Some of the most commonly mentioned businesses includes provision stores, carpentry, mason, driver and wielding. Only one person among the 400 surveyed fisherfolk work with a government agency.

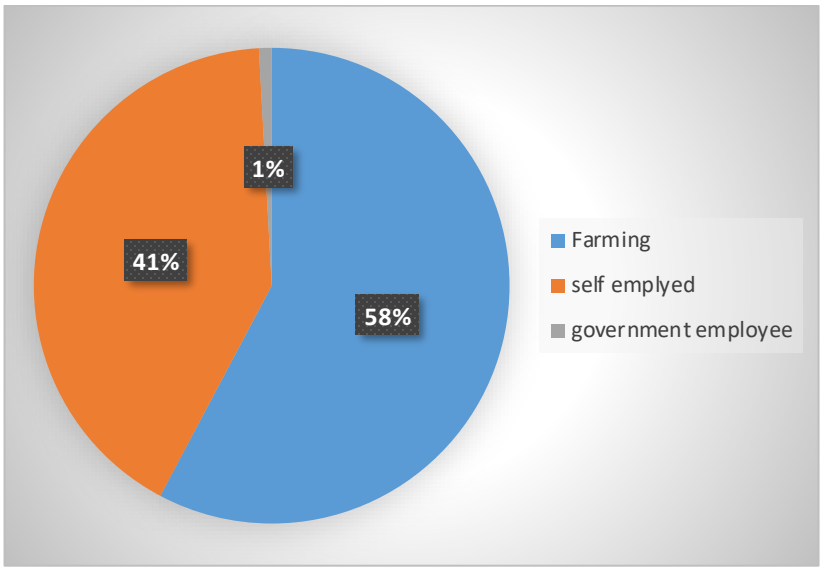


Figure 5. 1.Percentage of fisherfolk having other occupation (multiple choice) in all study sites (% of fishers; n=116)

Other studies such as Yang et al (2019) found that petty trading are among some of the key alternative source of income for fisherfolk in Ghana. Diversification into other sources of income activities could reduce the pressure on fisheries resources and provide income security against low fish catch.
However, as suggested by Andriesse (2018), diversification into marine- and non-marine-based livelihoods does not guarantee increases in income. Incidences of pests and diseases can affect the productivity of crops and plants

Figure 5.2 shows the district level breakdown of other occupation as reported by fisherfolk. Coastal communities in Ahanta West and Nzema East have the greatest number of respondents in farming compared to Shama and Sekondi-Takoradi. The opportunities for land ownership could also be motivating factor to practice farming. Land ownership in Akwidaa is remarkably high, with an average of about one hectare per household compared to less than 0.33 hectare for other coastal communities such as Dixcove and Shama (Kruijssen & Asare, 2013). The landlessness problem could be exacerbated by the presence of the petroleum industry. Some of the fisherfolk reported their inability to practice farming as a result of the scarcity of land. Interviews with local NGOs and local fisheries leaders suggest that large tract of arable farm lands has been purchased by oil and gas companies. Recent studies by Obeng-Odoom (2014) and Adusah-Karikari (2015) shows how the new oil and gas companies have negatively transformed the livelihoods of farmers.

Besides fishing – when it gets to some season- we do farming. We grow crop like cassava, plantain, banana and oil palm.

(Chief fisher, Akwidaa)

Farming is not practiced here at any significant level; fishing is the main occupation here. When we were young there was only about 2-3 fishing seasons. Now fishing is done all year round.

(Chief fisher Shama Apo).

Gordon & Pulis (2010) in their comprehensive review of livelihood diversification opportunities in the fishing communities in Western Region suggested three possible areas that could serve as an important source of additional income. These three areas includes tourism, oil and gas industry and aquaculture development. The empirical survey from this study suggests that none of the above three job opportunities are practiced by the fisherfolk. For instance in an interview with a representative from the local NGO base in the Western Region, he mentioned the lack of land as a major constraint to aquaculture development in the Western Region.

Aquaculture in itself takes a lot of land and fishers in nature are hunters, they are not farmers. So they go after the fish, they do not grow the fish like aquaculture. Therefore, even if we suggest aquaculture -where are the lands to do it, there have land grabs in the Western region because of the oil and gas industry. So when you move from here to Agona Nkwanta, you realize that lots of the land have been cleared and factories have been set up. Therefore where are they going to get the land to practice the aquaculture?. Assuming the lands are there- how many fishermen do we have in Ghana-and then one fisherman tries an aquaculture-and it takes the size of land for about one acre.

Interviewed fisherfolk mentioned that they do not have any opportunities to work in the oil and gas sector because of their low level of education.

A recent study by Siakwah (2017) showed that the training programs in the oil and gas industry provide opportunities for educated people to be employed in the oil sector, while others, such as local fisherfolk whose livelihoods have been directly affected by oil exploration, remain sidelined because of their low educational qualifications.

However, according to the chief fisher at Axim, the Ghana rubber plantation limited (GRILL) offer good incentives to those who enter rubber farming. It is because of

jobs like that that's why most of them are not interested to travel to urban cities to look for non-existing jobs.

When you go to Accra and other big cities, you are now going to start all over again. When you have your own rubber farm and you are hardworking –you will make it here. GRILL only requires that you get a land and they will provide you with everything including seedlings-chemicals and soft loans. They give soft loans to support your rubber plantation activities. After the rubber gets matured and it's ready for harvesting-then they start to deduct the loan from your earnings. Therefore, for those who are engage in it majority have finished paying their loans and now owing the farm. Grill package and export the rubber to France. Chiefs and other people have rubber farms here.
(Chief fisher, Axim).

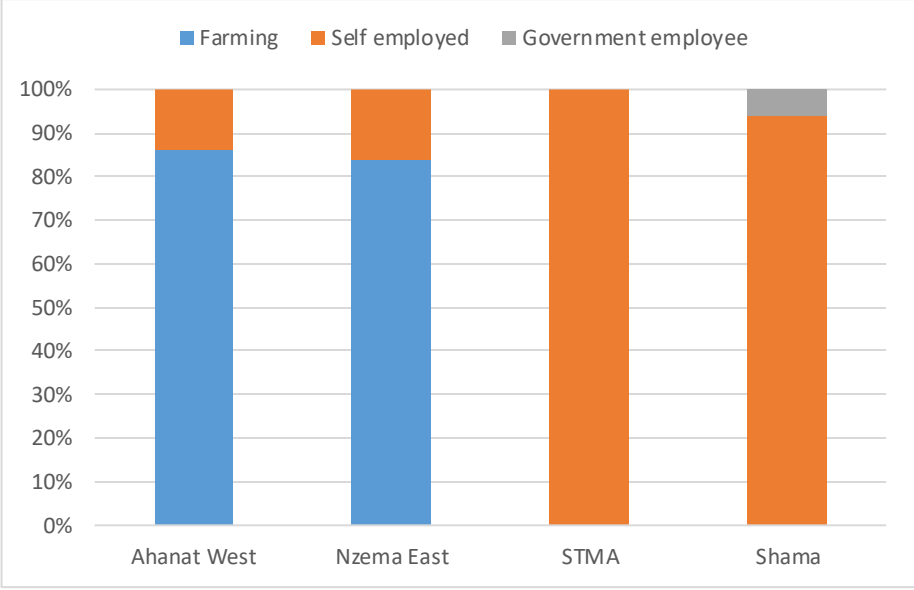


Figure 5. 2 Percentage of fisherfolk other occupation (multiple choice) among the four study districts (% of fishers; n=116).

Table 5. 1 Monthly household income (non-fisheries work)

Income level (GHS)	Percentage
Below 199	70.6
200-399	27.5
400-599	1.8

The majority of fisherfolk (70.6%) earned below 199GHS for practicing other activities such as farming and trading. Even though income from non-fisheries related jobs are low, it could contribute to the financial resources. Only 1.8% of fisherfolk earned a relatively moderate income between 400-599GHS. Income from other jobs serves as a complementary to fisherfolk income rather than substitution fishing with completely new job. This indicates that fisherfolk are still heavily dependent on income from fishing for their main source of livelihood.

Some problems associated with farming practices includes low capital to buy modern tools and implements which means the use of manpower is very common. There are incidence of pest and diseases among the crops. The Ghana Rubber Company Limited (GRILL) facilitates commercial rubber farming, which is quiet popular in Axim and Akwidaa. However, as mentioned by the chief fisher in Axim – individuals interested in rubber farming should have their own land. For those who do not have land they may have to rent it and this may come with additional cost. The maturation period for rubber is also quiet longer, it takes between 6 to 7 years. Fisherfolk therefore have to wait for quite a long time before they can reap the benefits from rubber farms

In Sekondi , New Takoradi and Shama (Apo&Bentsir), small business dominate other activities for income generation. Some of these businesses includes carpentry, provisions store, mason and mechanics. In most instances, l found that businesses were joint ventures where both the husband and wife contributed capital for their operation. Small businesses and trading are a key alternative source of income for fisherfolk in Ghana.

5.2 Marine –based adaptation strategies.

According to the fisheries officer in Sekondi-Takoradi, the fishers are monotonous people, they only think about catching fish so when you present to them other opportunities –only the few semi-literates among them embrace it .
Majority of the surveyed fisherfolk about 71% do not have other jobs besides fishing. The majority of fisherfolk reported that they have heavily invested into the local fisheries business and for that matter, it would very difficult to abandon or substitute the fisheries with other job. In places like Sekondi, New Takoradi, Shama Apo, Axim and Dixcove fishing is done all year round and mostly on a full-time basis. Table 5.2 shows that majority of the fisherfolk do not intend to migrate to other cities for non-fisheries related. This also shows that fisherfolk are strongly attached to their traditional fisheries livelihoods.

For the past 30 years, fishing has been the mainstay of the economy of Shama. Most fisherfolk in Dixcove, Axim and other coastal areas comes from from Shama. We have invested a lot in this fisheries business for us to stop and look for other jobs. As l sit here, l cannot go and learn carpentry, mason, and other work. Those who are even educated are not getting jobs. When l came back from Ivory Coast in 1971, most of us went to work in forestry, cement works, cocoa projects as causal laborers. However in recent times there are very limited job opportunities.
(Chief fisher, Shama Apo**).**

The chief fisher in Axim alluded to the fact that the majority of fishermen do not have other jobs other than fishing which makes them very vulnerable.

Most of this fishermen are very vulnerable –because apart from fishing they can't do any other type of work. Their only additional source of support maybe from their wife.
(Chief Fisher, Axim).

The main marine-based livelihood strategies reported by fisherfolk includes, intensification of fishing, changes in fishing techniques and gears, migration to fish at other coastal towns within and outside Ghana.

Table 5. 2 Adaptation strategies among fisherfolk.

Strategies	Category	Percentage
Changes in fishing technique/gears	Yes	13.5
	No	86.5
Intention of future out migration (non-fisheries work)	Yes	8.5
	No	91.5
Migration within the last 5-10 years (fisheries work).	Yes	69.5
	No	30.5
Joining association/cooperatives	Yes	36.8
	No	63.2
Seeking other occupation	Yes	29.0
	No	71.0

Illegal light fishing and use of unapproved nets

Majority of fishers have intensify their fishing activities through the use of illegal fishing methods in order to increase their catch. The most widely reported method is illegal light fishing in response to depleted marine fish stock.

Light fishing involves the situation where a light bulb is connected to wooden pole and is powered with a generator onboard the canoe. A fisher in Azim describes how the light fishing is conducted together with other destructive tools.

Fishers join the edges of a pole with a wire, place a generator inside the boat and then connect the terminals of the poles with the generator. They apply some medicine to the pole with the light in such a way that when its submerged into the sea it doesn't become soaked. The lights attract the fish, then they apply chemicals such as DDT and carbide, and explosives such as dynamite so that the fishes will come to the surface of the sea for them to catch.

(Fisher, Axim).

The dynamites and carbides are explosive devices set off underwater to kill fish, the underwater shock waves produced by the explosives stuns the fish and cause their swim bladder to rupture. DDT (Dichloriphenltrichloroethane) it's a chemical sprayed or poured on the surface of the sea water to stress the fish. The quality of the fish is reduced when light fishing is combined with chemicals and explosives to increase fish catch (Afoakwah et al, 2018).

There were concerns that light fishing have pushed fishes further away into the sea and this have resulted in increase in the time spent in catching the same amount of fish compared to ten years ago.

When they put the light into ocean –that area becomes warmer/hot, after catching what they want . As soon as they switched off the light, the rest of the fish moves to other part of the sea because they like cooler places. So during another fishing trip- one has to chase the fish further into the sea. Just few years ago fishermen could catch fish near the shore. But this is no longer the case. The use of the light fishing has pushed the fish further away so we don't get enough fish .
(Community leader/fisher, Akwidaa,).

In some situations, the use of explosives among fisherfolk also results in death or deformation of certain parts of the human body. According to the chief fisherman in Axim-not long ago some fisherfolk went to throw dynamites during fishing and one person got killed. This type of disaster has implications on the loss of human capital and will often affect not only the emotions of family members but the financial capital as well.

The use of *gari* (powdered grain), petrol, and *omo (*powered detergent*)* to attract fish is a relatively new phenomenon and was only mentioned in New Takoradi. But the diffusion of innovations among the coastal communities is very high and probably the use *omo* combined with *gari* and petrol to attract fish may be relatively high across the coastal communities. The three ingredients (omo, gari, and petrol) are mixed together. The *gari* serves as a food to attract the fishes. When the fishes eat the mixed food they become weak and are unable to move because of the powered detergent mixed with the petrol. (Afoakwah et al., 2018).
In communities where illegal light fishing was not practiced at any significant level, the use of other illegal fishing gears such as unapproved nets were common.

We don't use light fishing here but some people use the monofilament nets here.
(Chief fisherman, Akwidaa).

Figure 5. 3 Fisherman fixing his generator, Sekondi.

According to the fisheries officer at Axim-the use of monofilament less than one inch is widespread and it catches anything in its path with consequences on fisheries reproduction. Another problem with the monofilament net is that it's a synthetic nets that never rots which implies that it can be used for decades without switching to other sustainable nets.

Illegal fishing around oil rigs offshore.

Fishers have also devised strategies to help them fish near the oil rigs. Excerpts from the interview from the chief fisherman in Axim could partly explain why some fisherfolk have decided to fish around the oil rigs even though it is not allowed.

I have bought premix fuel, l have a canoe, at least l have to buy 2 drums of fuel. If we are fortunate and we get the fuel at control (subsizied) price it cost us 750GHS .. We will have to mix it with a little oil, so let's say all together 800GHS. I will buy ice blocks for about 400GHS, now l have about 1200GHS, l have to provide food and other expenses for the crew members let's say 400GHS making 1,600GHS. The tools for fishing –hooks and other key parts –lets say 400GHS- making 2000GHS. If l do not get for instance the premix at a normal price – in recent times when there was serious shortage of premix one drum was being sold at 800GHS instead of 375GHS. So if l buy the fuel at that price–we are taking about over 2000GHS per

fishing trip. After making all this expenses, and you tell me I shouldn't go near the oil rig- when I know for sure that I can get good catch if I go, what do you expect me to do?.
(Chief Fisher, Axim).

Some of the strategies fishers have devised to fish around the oil rigs without being apprehended includes forming alliance with some officials in the oil & gas companies. These officials from the oil companies inform the fisherfolk about the whereabouts of the navy patrol team in exchange for fish supplies and other financial rewards from the fisherfolk. Excerpts from the two informants in Axim shows how these arrangements are facilitated.

It's the hook and line canoes that go near the oil rigs; net canoes don't go to the oil rig. Anytime we want to go there we have some insiders who inform us whether the navy patrol officers are working or not. We give some of the officials there money and fish to facilitate this arrangement. Within a few hours of arriving there we are able to get the maximum catch. Sometimes we get sharks and big tuna that we can sell for between GHS 400 and 500. But it's dangerous because if there is any mistake and one falls into the ocean that's it … it's death because of the machines.

Whenever we fish around the buffer/safe zone, within the same day we are able to get maximum catch. When we are not fishing around the safe zones, we sometimes spend four days on the sea to get the same quantity of fish. We go fishing around the oil rigs when officials of the company are on holiday or seasonal break.

These strategies could be described as desperate efforts by fisherfolk to increase their catch with detrimental impacts on not only marine ecosystem sustainability but also their personal safety and human capital development. A recent news report mentioned that one fisherman was killed in the coastal waters of Axim when their fishing canoe collided with oil installations offshore. According to the report the weight of the tuna they tried catching was too heavy and in the processes their canoe subsided (UTV News, 2019). Death and bodily harm are also common to those who use chemicals and other explosives in fishing.

The agency of the fisherfolk is being exercised by making incursions in both the advisory zone and the exclusion zones. Figure 5.5 shows the increasing trends of fisherfolk incursions within the safety zones of oil and gas installations offshore. Some of the practices involves fisherfolk tying their nets to parts of the FPSO and

other smaller support vessels. With less than 1000 incursions around the oil and gas installations in 2014, by 2018 the total number of canoe incursions around the oil rigs have increased to 7,015.

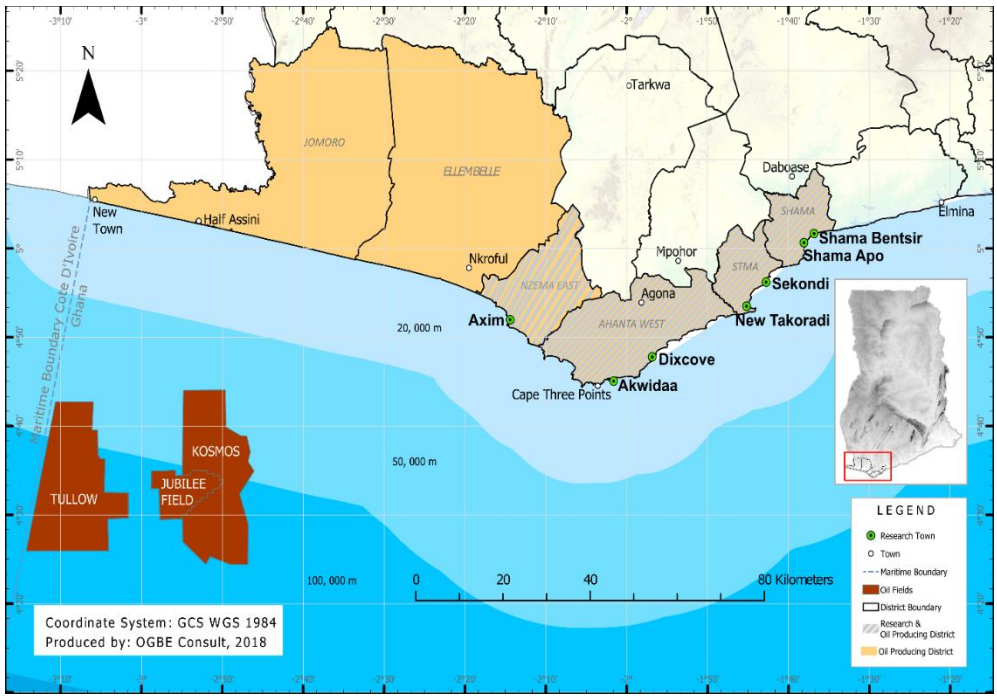
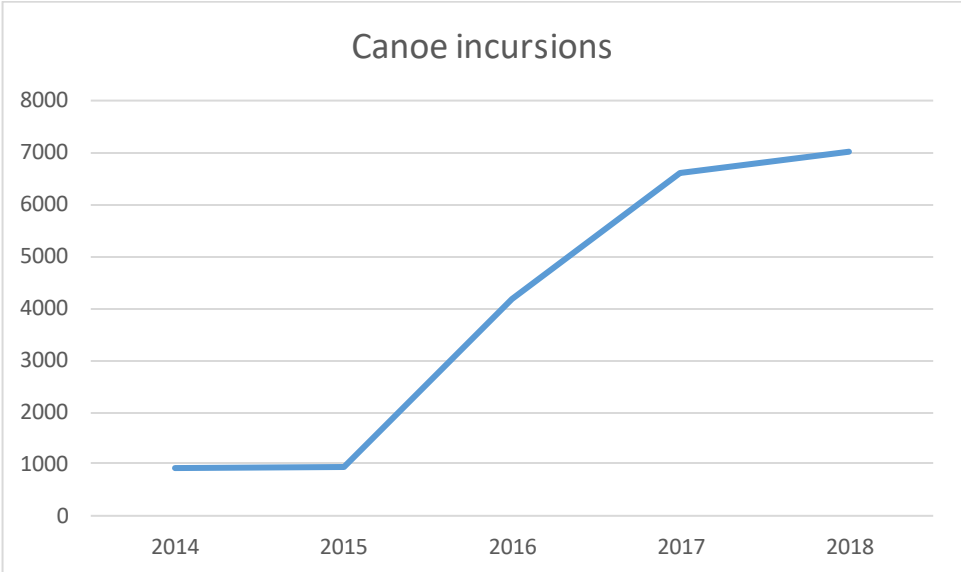


Figure 5. 4 Map of study areas showing Ghana's offshore oil fields.

This practice leads to fishing nets entangling oil-drilling equipment offshore, which may lead to temporal halt of production. It costs between USD 7000 to USD 30,000 for the oil company affected to revert to normal production after such interruptions (Ghana Web, 2019).



Source (GhanaWeb, 2019; Tullow Oil, 2019).

Figure 5. 5 Canoe incursions around oil and gas installations offshore.

According to an unpublished report by one of the oil companies, within just a month , fifty three canoe incursions were recorded within the advisory and exclusion zone oil and gas installations offshore. Majority of the canoes involved were reported to come from Axim, Sekondi, Dixcove and Shama. Some of the actions taken by the navy patrol team included issuance of warnings, education on safety zones, chasing canoes to safer grounds and confiscation of fishing nets .

The narrations from fisherfolk supported by survey interviews suggests that the month of July and August were the period of the year with the most frequent incursion near oil and gas installations offshore. The month of July and August corresponds with bumper fish catch- main fishing season. This also suggests that fisherfolk will travel to the oil rigs more regularly during peak fishing season.
Many of the fishers mentioned that they usually spend between 4 to 6 days fishing at sea but when they are fishing around oil rigs , they spend only some few hours catching more fish than what they get during the 4 to 6 days they spend fishing in other areas at sea.

Source :Tullow Oil, 2019

Figure 5. 6 Artisanal canoes fishing around FPSO offshore in coastal waters of Ghana.

The use of Global Position System and ice bars.

Because of the depleted fish stock, fishers reported that they had to travel longer distances to catch the same quantity or even less than what they had previously caught a few years ago. Travelling further into deeper sea can be dangerous, so some are using GPS to help them safely return.

At first we didn't go far, with just two gallons we can get enough fish. This time we really go far—deep sea. We use GPS so we are able to go about 220 miles, but at first it was not like that, we went just about 20 miles.

(Fisherman, Axim).

The use of modern devices such as GPS also allows fisherfolk to travel to fish around oil rigs. Travelling longer distances at sea means spending more days at sea; therefore, fisherfolk have adopted the use of ice blocks to store and preserve fish while at sea. The use of GPS and ice blocks are more common with short-term domestic fishing trips. The average period spent at sea when not fishing near oil rigs can range from 3 to 6 days.

Figure 5. 7 GPS for sale at Sekondi coastal community.

Figure 5. 8 Women processing ice blocks for onward sale to fisherfolk at the beach, Dixcove.

Short-term domestic fishing trips involves travelling to other nearby coastal communities when fishers perceive they are catching less fish in their local waters. This type of migration can last from a few days to weeks. This migration is largely facilitated by the strong social network among the coastal fishing communities. Some of the local fishers mentioned that, fishers from other parts of coastal Ghana travel to fish around offshore oil fields. Surveyed fisherfolk also mentioned they travel to other districts within the Western Region to fish around oil fields offshore. Presently there are three oil fields offshore operated by the Jubilee Partners. Out of this three oil fields , fishers reported they travel to fish more around one particular oil field because they encounter less harassment and resistance from the navy officers.

The fishing is in such a way that when we hear from our colleagues that there is good harvest somewhere –along other coastal areas like Edina, cape coast and komenda and Axim. We try to go there to catch fish. Sometimes too when we hear of bumper harvest in Axim, we go there to fish.
(Chief fisherman, Shama Apo).

People come from many other coastal areas like Totope, Ningo Prampram, Kone, Osu, Teshie, Labadi, and Winneba to fish here. Lot of people have come here to work. People are chasing the fish. They chase the fish to this place.
(Chairman of premix committee, canoe owner/fisherman, Sekondi,).

Migration for fishing remains a key part of fisherfolk in the Western. Table 5.2 shows within the past 5 to 10 years about 60% of fisherfolk have migrated to do fisheries related work in other coastal areas. The majority of fishers also mentioned that they travel to nearby countries such as Ivory Coast, Nigeria, Liberia, Senegal, and Guinea for fishing during lean fishing seasons in Ghana.
This migration often involves the crew and some family members. With the introduction of the outboard motors in 1960, fisherfolk migration within and abroad have been improved dramatically, because they are able to travel longer distances with their own canoes. It often takes between 3 to 6 days to travel to destinations such as Cote d'lvoire for fishing (Finegold et al, 2010; Marquette et al, 2002).

Whenever we are not getting enough fish here, l mobilize my crew and move to fish at other coastal areas. Sometimes we travel to Ivory Coast to fish over there. We stay there between 3 to 6 months. During this period, l am in regular contact with my wife and family in Ghana. So sometimes, when my wife informs me on the phone that there is scarcity of fish back home, I organize and bring some fish to sell.

(Fisher, Sekondi).

This statement also shows that women provide a very supportive role when their husbands migrate for fishing. They update their husbands on key events unfolding at home while keeping and caring for the family. As noted by Adusah-Karikari (2015), migration for fisheries-related work is not limited to men. Women with the economic capital also migrate to nearby African countries to buy fish in bulk when there is a low supply home.

Migration has been described as transformational adaptation and a suitable strategy to avoid poverty and the risks associated with climate change and other extreme events (Scheffran, Marmer, & Sow, 2012). Temporal or seasonal migration can be used as an important risk-coping strategy for poorer households facing economic uncertainties resulting from both social and environmental vulnerabilities (Castells-Quintana, Lopez-Uribe, & McDermott, 2018).

Marine based migration has the potential to offset the negative constraints associated with mainstream migration (moving to cities and abroad to seek for other works).

Fishing households in the Western Region have developed and established a strong migratory network of kinsmen, friends and extended relatives –both domestic and international that facilitates their access to fishing and other related activities such as fish trading. The presence of this social capital is crucial for successful migration.

However, considering the increasing trend of the use of illegal fishing gears and irregular incursions into oil fields offshore, the sustainability of marine ecosystems is under threat. The introduction of seasonal closure's and restricted fishing offshore has the potential to induced forced migration. Most of the fisherfolk mentioned that they usually travel to nearby African countries to fish during the low fishing season in Ghana. However, with the introduction of seasonal closures many fisherfolk are likely to migrate to nearby African countries since the closed season corresponds with the domestic bumper harvest season. The chief fisher in Shama alluded to the fact that many fishers in his community started organizing themselves to travel when the closed season was announced in 2018.

Another key form of marine-based strategy that emerged is the fisherfolk association. The local fisherfolk association is the main mouthpiece of the coastal fishing communities. The local fishers association is the main platform utilized by fisherfolk to increase their political participation on issues concerning their livelihoods. The chief fisher represent the association in formal meetings with the state fisheries officials as well as oil and gas companies. All the chief fishers

interviewed in this study reported that they regularly engage with the oil and gas companies on issues related to the local fishing industry.

When it comes to financial benefits from such associations and other cooperatives, only (11.5 %) have benefited whereas benefits from information sharing dominates (75.4%) (Table 5.3). Other benefits derived from associations includes village bonding and working together and collective bargaining or negotiating collectively.

Interviews with fishers suggest that the local fisherman association played a key role in their resistance to the closed season policy in 2018. Through the activities of the local fisherfolk association and the Ghana National Canoe Fisherman Council (GNCFC), the local fisherolk were able to present a petition to the national government to express their dissatisfaction when the closed season was introduced in 2018.

Many of the fishers, however complained about the inability of the local fishers association to adequately dialogue with other actors such as oil and gas companies to secure their main source of livelihoods.

Everybody is protecting their source of income and livelihoods. The fisheries officials and local association don't do anything on behalf of us. We are facing a lot of danger at sea. Because of our limited knowledge on the laws officials always cheat us . One of our fisherman was beaten merciless by a navy officer on sea after some incidence broke out.

(Canoe owner, community leader, Sekondi).

Another fisherman and canoe owner also shed some insights into the perceived marginalization by the oil and gas companies.

About a year and half ago – one of the navy boats collided and destroyed two fishing canoes. After the investigation, it was concluded that the fault was from the navy people. Until now we have not received any compensation from the oil people. Our fisheries officials and local associations here are not strong- they are not able to negotiate and represent our interests effectively. They lack the power to do so.

(Chairman of premix committee, canoe owner/fisherman, Sekondi,)

Table 5. 3 Benefits of Collective action.

Benefits	Percentages
Information sharing	75.4
Material benefits	6.9
Financial benefits	11.5
Social benefits (village bonding working together	5.4
Political benefits (collective bargaining)	0.8

Figure 5.9 depicts the various marine and non-marine based adaptation strategies deployed by fisherfolk in reponse to the oil and gas production. The major form of resistance expressed by fisherfolk to challenge the offshore oil exploration and production is the increase in canoe incursion around and within the restricted zones. These activities can be described as well-organized strategies by fishers to reclaim their natural capital.

Social capital is one of the main available capitals mobilized in response to decreasing fish catch and other related vulnerabilities caused by the oil and gas companies. Fishers have established connections and relationships with some officials in oil and gas companies that enables them to access fisheries resources in the excluded zones around oil fields offshore. Fishers mobilize their natural and financial capital to facilitate the arrangements that enables them to fish in the restricted zones offshore. Fishers use part of their earnings (financial capital) and resources from their natural capital (fish) to secure passage into the fertile fishing grounds around oil fields offshore. The coastal mobility of fishers in and out of the dangerous fertile fishing grounds around oil fields offshore highlights fisherfolk unique set of skills and knowledge (Human capital) in fishing activities at sea. Fishing activities around oil fields offshore shows the desperation of fishers to increase their catch. It also provides new insights about their struggles to sustain their main source of livelihoods.

Cooperation alongside conflicts, the emergence of the conflicts produce between the fishers and oil and gas companies offshore has resulted in some form of cooperation. As noted by Turner (2004) conflicts has both positive and negative sides. Whilst the presence of oil fields offshore has encouraged the conflicts, it has also produce some form of cooperation. Fishers have been able to regain some level of

power by circumventing the political and administrative control through the establishment of informal cooperation with some officials from the oil and gas companies. Even though local fishers are considered weaker social actors, their ability to exploit fertile fishing grounds around oil fields offshore, has enable them to increase their power and socio-economic status. As mentioned earlier, fishers who exploit fisheries resources around oil fields offshore are able to reach their maximum catch within some few fours of fishing compared to when they are not fishing around oil fields. The bumper harvest from fertile fishing grounds around oil fields offshore could contribute significantly to the socio-economic wellbeing of fishing households. Yet, are these coastal mobility strategies sustainable in the long term?. Fishing activities around oil facilities offshore is illegal and possess major threats to the co-existence of fisheries and petroleum industry offshore.

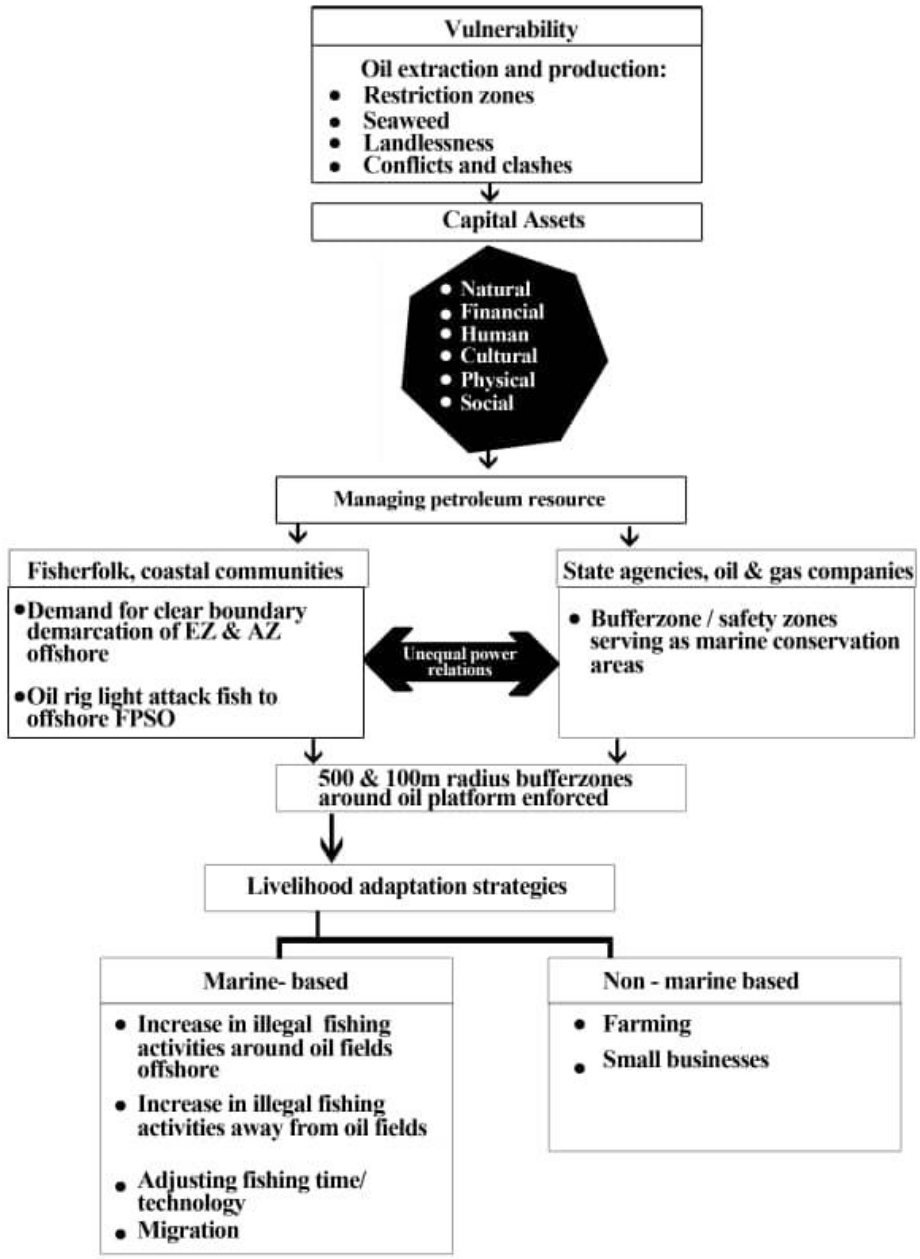


Figure 5. 9 Livelihood adaptation strategies in the context of oil and gas production

Figure 5.10 depicts the various marine and non-marine based adaptation strategies deployed by fisherfolk in reponse to marine conservation and other related vulnerabilities The major forms of livelihood strategies includes illegal fishing activities. Marine based illegal fishing activities such as illegal light fishing and use of unapproved fishing nets may precede the introduction of seasonal closures, however the narrations from fisherfolk suggests that illegal fishing activities are on the increase in the Western Region of Ghana. Notable among illegal fishing activities is the use of illegal light fishing to increase fish catch. In a study by Yang et al., (2019), they found that illegal fishing activities involving the use of light fishing is relatively lower in other parts of coastal Ghana, compared to the Western Region.

Human capital is one of the main available capital fishers deployed in reponse to increase their catch. The use of chemicals such as DDT and explosives (dynamite and carbide) together with light fishing to increase fish catch, shows fishers ability to learn and adopt to new methods to increase fish catch.

The use of human capital is supported by social, financial and cultural capital. Fisherfolk have established social networks with government fisheries and law enforcements officers in order to remain in fishing by engaging in illegal fishing activities to increase their catch. Majority of fisherfolk contend that illegal fishing activities is widespread especially light fishing, however this is made possible, because some government officers encourage it. Many of the fishers alleged that, because it is very easy to bribe the fisheries law enforcement officers, illegal fishing activities thrives. Recent studies have found that the increase in illegal fishing activities among small-scale fishers in Ghana is made possible by some corrupt government officials (Freduah et al., 2018; Afoakwah et al, 2018). In addition, interviewed fishers and local fisheries leaders reported that they are aware that some of their colleagues engage in such illegal fishing activities, however since their survival depends on fisheries related resources they allow them to continue fishing using illegal gears.

This is another form of cooperation between some fishers and government officers. This type of cooperation enables fishers to continue the exploitation of fisheries resources with unapproved methods and gears. Some government officials allows these illegal fishing activities in exchange for financial rewards (bribes). The government inability to enforce the fisheries laws on illegal fishing activities has given more power to the local fisherfolk to continue fishing using illegal methods and gears.

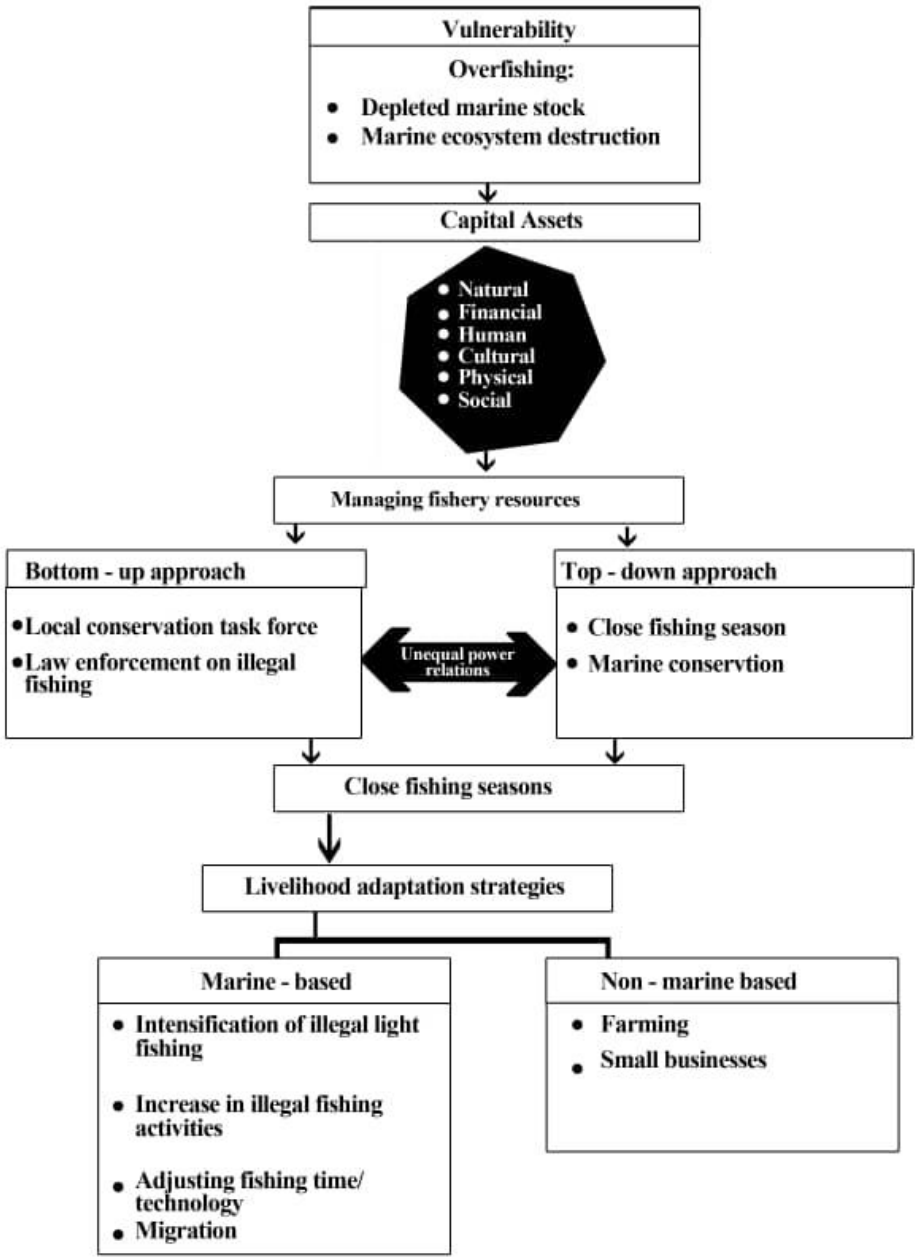


Figure 5. 10 Livelihood adaptation strategies in the context of seasonal closures.

5.3 local area differences and commonalities

The results from the seven coastal communities provides varying degrees of successful application of livelihood strategies. Table 5.4 shows that all the seven coastal communities reported high levels of unsustainable and destructive marine-based in-situ adaptation strategies. These strategies includes the use of illegal light fishing, use of chemicals, explosives and unapproved nets. Besides, communities like Sekondi, New Takoradi, Shama Apo , Dixcove and Axim reported more illegal fishing around oil rigs. These communities also reported high use of ice blocks and GPS because they often travel longer distances to fish.

Regular changes of fishing gears such as net to target new species is considered very sustainable form of marine fisheries harvest (Wallner-Hahn et al., 2016). Nonetheless, the majority of fisherfolk across all the study communities reported very low changes in fishing nets. Only about 10% of fisherfolk in Sekondi and Shama Apo reported changing fishing net with the reaming communities recording less than 7% (Figure 5.11). Recent studies have suggested that Ghanaian artisanal fishers do not regularly change their fishing net , on the other hand they travel further distances to target new fish (Belhabib et al 2016; Yang et al, 2019). These findings are consistent with the findings from this study. The increases in the use of GPS, ice blocks enables fisherfolk to travel further offshore to target new fish by the use of illegal fishing methods such as light fishing and unapproved monofilament nets.

Farming and small businesses as well as informal works such as carpentry, mason, and commercial driver are the main non-marine in-situ adaptation strategies. Diversification into farming activities is more common in Akwidaa and Axim partly because of the availability of land. According to the fisherfolk small-scale commercial rubber plantation is becoming more popular in these communities because of guaranteed market. As mentioned earlier GRILL provides various incentive packages to rubber farmers such as soft loans and technical services including monitoring and spraying of rubber farms. Farmers have to cultivate rubber on their own land and the period of maturation for rubber is quiet long up to seven years. These two factors could prevent other people from diversifying into rubber farming. Other crops like cassava, maize, plantain, pepper, tomato are grown mainly for domestic consumption. The surplus are sold at the local market.

Investment into small family business is also common in all the study areas. A fisherman in Sekondi mentioned that he financially supports the wife's hair dressing (salon) business, so that during lean fishing season, the family can rely on proceeds from the hair dressing business. Across all the study areas, it was common for fisherfolk to mention investment into family-oriented small business.

Recent studies by Behabib et al (2016) and Allison et al (2009) have suggested that Ghanaian artisanal fisheries have high vulnerabilities with respect to overfishing with low adaptive capacities. Nonetheless, migration to other coastal areas for fishing has the potential to reduce these vulnerabilities and contribute towards building the resilience of coastal communities.

Migration for fishing is common practice among all the seven study areas. It includes both travelling short distances to fish in nearby coastal waters and or travelling to different. With the exception of Akwidaa, all the fisherfolk in the rest of the study areas migrate to other African countries for fishing. Migration remains a major component of the livelihood adaptation strategies of the fisherfolk in the Western region of Ghana. In places like Axim, Sekondi and Dixcove migration constituted more than 60% of the other strategies deployed (Figure 5.11). In all these three communities fishing remains the dominant economic activity. More than 90% of residents in Dixcove are employed in the fishing industry either as fisherman or fishmonger / processors and fish traders (Hilary et al, 2013). Axim is one of the busiest fishing settlement in Ghana, according to the chief fisherman there are over 8000 men and women in the local fisheries industry. African countries for fishing. Countries such as Ivory Coast, Togo, Senegal, Nigeria, and Liberia are some of the popular destinations for fishing.

Fisherfolks reported some financial benefits from embarking on such fishing trips.

When income levels reported by fisherfolk from fishing is applied to measure the outcome of livelihood strategies then it can be concluded that fisherfolk in Sekondi and New Takoradi performed relatively better compared to the other study areas (Table 4.2). Fisherfolk in Sekondi and New Takoradi had the most people with income above 800GHS.

However, the results show that fisherfolk in these communities practice illegal light fishing activities, fishing illegally around oil rigs together with the use of chemicals and explosives. Therefore, their short-term financial gains may be unsustainable in the long- term. Fishing around oil rigs is also dangerous and can result in deaths or bodily injuries. Perhaps fishing communities in Shama can provide good examples with higher income balanced with moderate success in livelihood adaptation strategies. Fisherfolk in Shama recorded higher educational achievement with the lowest household size (Table 4.2).

In addition, they came second with fisherfolk earning more than 800GHS. Migration for fishing forms a major part of fisherfolk in Shama livelihood adaption strategy. Many fisherfolk reported higher monetary benefits from migration for fishing. However, unsustainable intensification of illegal fishing especially in Shama Apo can partly contribute negatively to the rebuilding of depleted fish stocks.

Akwidaa and Shama Bentsir also showed some level of strong local leadership with respect to enforcing laws on illegal fishing and support for closed season policy. Figure 5.11 shows that membership in fisherfolk association in these two communities is considerable higher compared to the coastal communities. This may have contributed positively towards the reduction of illegal fishing practices in these communities. In addition, fisherfolk in Akwidaa also enagaged more in farming activities whereas those in Bentsir engaged more in other businesses. Therefore we can use these two case studies to show moderate success in relation to collective action-bottom up initiative towards biodiversity conservation and varying degrees of successful adaptation bearing in mind of the low income from farming and engaging in businesses (Table 4.2).

The current in-situ marine based adaptation strategies are unsustainable and counterproductive to the rebuilding of depleted marine fish stocks. The introduction of closed season may yield positive ecological results, however if the current trend of intensive use of destructive fishing methods persists the closes season exercise will be unproductive in the long-term. Crawford et al (2016) found that illegal light fishing is a major problem and the practice is widespread among fisherfolk in the Western region of Ghana. The closed season policy must be accompanied with strong enforcement of the fisheries law against illegal fishing. The ubiquitous nature of illegal light fishing calls for a collaborate effort to eliminate or reduce it.

Similarly the enclosures by the oil and gas companies risks escalating tension between the local coastal communities and petroleum industry. Fishermen are risking their lives at sea by fishing around highly volatile and dangerous places closer to the oil extraction and production platforms offshore.. Infrastructural projects such as roads, electricity, hospitals, educational facilities and fisheries and or agro processing industries can be considered. There is the need for incentive packages that directly benefits fishing households, scholarships for wards of fisherfolk are good but this are long- term human capital development; there should a more focus on short-term interventions such as financial and or material benefits for fishing households.

Table 5. 4. Summery of assessing major adaptation strategies in the seven study areas.

District	Diversification	Intensification	Migration(coastal)	Success or failure factors
STMA	Non-marine based	Marine-based	Marine-based	
Sekondi	small businesses	illegal light fishing Fishing around oil rigs, use of chemicals & explosives, Use of GPS & ice blocks	domestic & foreign	Benefits from migration, absence of alternative livelihoods, landlessness, local politics & conflicts, death, accidents, unsustainable marine capture.
New Takoradi	small businesses	illegal light fishing, Use of GPS & ice blocks Fishing around oil rigs Use of chemicals & explosives	domestic & foreign	Benefits from migration, absence of alternative livelihoods, landlessness, politics& conflicts, Unsustainable marine capture
SHAMA				
Shama Apo	small businesses	illegal light fishing, use of GPS & ice blocks Fishing around oil rigs	domestic & foreign	Benefits from migration, absence of alternative livelihoods, climate change threats, relocation (expected), unsustainable marine capture local politics& conflicts

Shama Bentsir	small businesses	Use of small size mesh nets, use of GPS & ice blocks	domestic & foreign	Benefits from migration, absence of alternative livelihoods, strong local leadership, local politics
AWDA				
Discove	small bossiness Informal work	illegal light fishing fishing around oil rigs	domestic & foreign	benefits from migration, absence of alternative livelihoods, landlessness, seaweeds on ocean
Akwidaa	farming , informal work	use of monofilament, use of GPS & ice blocks	domestic	agricultural opportunities, some benefits from migration, presence of seaweeds on ocean, Local politics
Nzema East Axim	farming Informal work Small busineses	Illegal light fishing chemicals, explosives Fishing around oil rigs, use of GPS & ice blocks	domestic & foreign	Benefits from migration, agricultural opportunities seaweed on ocean, local politics & conflicts. Death, accidents.

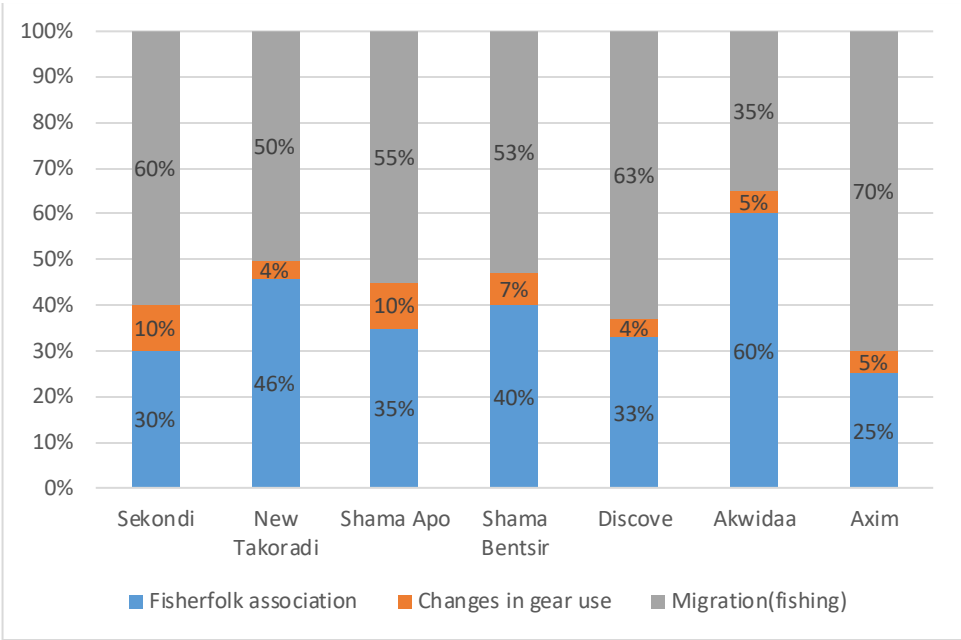


Figure 5. 11.Three bottom-up strategies compared.

In terms of fisherfolk association, only Akwidaa shows high proportion of fisherfolk with membership in local fisherfolk association. In New Takoradi and Shama Bentsir fisherfolk association membership is considerable higher with over 40% . In terms of association membership compared to other coastal areas in Ada East in the Greater region, the Western region can be considered as better. Yang et al (2019) found that fisherfolk association membership in communities in Ada East is considerable lower. The active presence of environmental NGOs such as friends of the nation, hen mpoano, and dasgift Ghana may have influenced the relatively higher number of fisherfolk joining association. Fisherfolk in these study areas mentioned they regularly participated in advocacy and sensitization programs organized by these associations. Besides the fisherfolk association, there are other hybrid forms of community groups such as the 'Sika Dua' in Akwidaa. The leader of the 'Sika Dua' mentioned that the association is not limited to fisherman , they contribute money towards the welfare of the members and organizes occasional clean up exercises on the ocean when the seaweeds appear.

Across all the study communities, fishers expressed their frustrations concerning the high prices of fishing gears and the difficulty in accessing these products. Fisherfolk in Akwidaa complained about their inability to have access to sustainable

fishing nets to buy. In addition, many fisherfolk in Axim, Discove and Akwidaa mentioned that the current fishing gears they are using were inherited from their relatives and that using them serve as a continuation of their families legacies. The ability to switch to more sustainable fishing gear is not only constrained by the lack of capital, the socio-cultural and traditional practices of a society also influences it. Effective institutional arrangements to curb the use of illegal fishing gears is vital. More work needs to be done by the local NGOs and the formal fisheries actors including local coastal communities to reduce the use of destructive and unsustainable fishing gears.

5.4. Towards an all-inclusive and participatory fisheries governance and management.

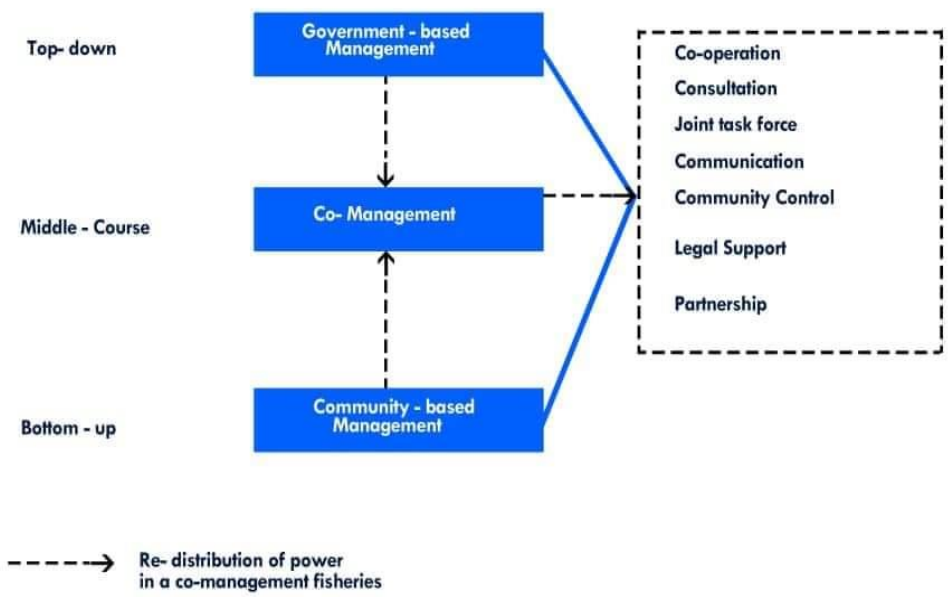
The results from the conflicts produced between the small- scale fishers and state agencies point to three important mechanisms that are currently missing: an effective governance system that incentivize local support for marine conservation, national support for the use of traditional marine ecological knowledge and political will to control illegal fishing activities. The current top-down fisheries management approach where all the power is concentrated at national level is detrimental to sustainability of marine fisheries resources.

The various livelihood adaptation strategies deployed by fishers especially the increases in illegal fishing activities are manifestations of the inherent weakness in current top-down management strategy.

There is the urgent need for effective institutional arrangements that promote local resources users participation in decision-making, as well as transparency and accountability in the management of coastal resources. There should be a mechanism that ensures the inclusiveness of local actors in the decision-making processes with respect to policies that shape their livelihoods. Fisheries governance systems must also cooperate and coordinate with local stakeholders in order to incorporate local knowledge into the management of the fisheries. Fishing households proximate to the coast and dependence on fisheries resources makes them an important group of stakeholders that cannot be excluded in the management of marine fisheries resources. Fishing households have economic stake in the fisheries, unlike the state and other actors such as NGOs. They turn to lose or benefit from policies that constrain or promote their livelihoods. In this case, they consider closed season to have a negative impact on their main source of livelihood. The majority of fisherfolk contend that seasonal closures will fail to yield biological success without the

provision of alternative livelihoods. The provision of alternative livelihoods could reduce the vulnerabilities of coastal communities and increase their support for marine conservation. Since the majority of fisherfolk in coastal Ghana, would still prefer to continue fishing even in the face of depleted fish stock, it is important to view these alternative livelihoods as a supplement to their income rather than a complete substitution of another job (Owusu, 2019).

Perhaps Ghana can learn valuable lessons from Tanzania with respect to the mobilizing of different stakeholder's, working towards sustainable marine biodiversity conservation. The community-based 'Beach Management Units' (BMUs) in Tanzania comprising of local leaders and resource users collaborate with diverse stakeholders to manage fisheries resources by conducting patrols at sea to curb illegal fishing, providing advocacy and mangrove restoration. This type of collaboration has contributed positively towards the reduction of illegal fishing activities and the empowerment of local resources to coordinate and manage their own resources (Yang et al., 2019).



Source (Modified after R. S Pomery and Berkes, 1997).
Figure 5. 12 Fisheries Co-management.

Reviving and or introduction of fisheries co-management[20] could serve as a viable strategy to balance the unequal power relations by promoting fairness with respect to the management of coastal resources (Figure 5.11). It must however be noted that fisheries co-management is not new to Ghana. As l mentioned in chapter 3, during the 1980s, the World Bank in collaboration with Ghanaian government and fisheries stakeholders established the Community Based Fisheries Management Committees (CBFMs). The political and economic environment was however different –the reforms in the fisheries sector in the 1980s was part of a broader national effort to satisfy the conditions of the World Bank for the release of funds to govern the country. The CBFMs failed to live up to expectation and fisheries management remained largely in the hands of government.

Presently, the local fisheries leaders and fisherfolk themselves are calling for the establishment of local conservation task force to end illegal fishing practices. This presents an opportunity for government to form co-management committees at the village level with some form of legal backing. The extent and practice of illegal fishing is too widespread for government alone to tackle control it. It therefore calls for a collaboration with local communities to enforce the laws. New policies like closed fishing season, needs local support in order to succeed.

The co-management strategy in Figure 5.11 advocates for the redistribution of power among formal and informal actors. State agencies must efforts to release some of their power to local resource users to be able to enforce and arrest people caught fishing with illegal gears. As l mentioned earlier, the practice of illegal fishing activities is widespread and policies such as the closed season is likely to fail without enabling condition for local support.

It is also important to emphasize that co-management strategy will thrive in an environment where there is unity and collective action for the need to end overfishing. In addition, government agencies must demonstrate more political will to reduce overfishing by adhering to the enforcement of fisheries laws, especially with respect to light fishing as well as the use of chemicals, explosives including monofilament nets. They must also ensure that sustainable fishing gears such are easily accessible and affordable to the coastal fishing communities.

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[20] Fisheries co-management refers to the sharing of responsibilities and authority between the state and local fisherfolk to manage fisheries resources. It involves various partnership arrangements and degrees of power-sharing as well as the integration of local and centralized management systems (R. S. Pomeroy & Berkes, 1997).

Towards a peaceful co-existence between the fisheries and the petroleum industry offshore.

The empirical results of this study on the conflicts produced between the small - scale coastal fishers and petroleum industry offshore in the Western Region shows that the conflicts is occuring around spatially fixed areas at sea. Before the emergence of the oil and gas industry, the sea was governed by an open access region where local fisherfolk had unrestricted access to the use of the sea. The restricted access to the use of coastal waters to exploit fish by local fishers can be understood from the perspectives of unequal power relations between the local coastal communities and the oil and gas companies. In a related study by Penney, Wilson, and Rodwell (2017) and Nolan (2019) on the conflicts produced between the local fishers and industrial trawlers in Ghana , they concluded that the conflicts is as a result of the unequal access to the use of coastal waters for economic benefit. The economic and political power of the industrial trawlers enabled them to access the fertile fishing grounds –about 30m in coastal waters reserved for local fishers. Similarly, the conflicts produced between the local fisherfolk and petroleum industry offshore is as a result of the unequal access to the use of coastal waters for economic benefits. The petroleum industry has economic power because of the high revenue they generate for the national government.

The current institutional arrangements and management strategies deployed by concerned stakeholders to address the conflicts occurring offshore seems to be inadequate. In the absence of effective governance of the ocean space, fisherfolk resort to illegal fishing activities, causing further conflicts and social unrest (R. Pomeroy, Parks, Mrakovcich, & LaMonica, 2016). As long as fisherfolk in the Western Region feel that they have been unduly deprived of their right to fish in certain parts of the ocean, they will continue to exercise their agency by fishing illegally around the oil rigs.

There are enough experiences and examples to show from other African countries like the Niger Delta in Nigeria about oil induced conflicts and social unrest. The residents of Niger Delta have resorted to various illegal activities including the destruction and siphoning of crude oil from oil production facilities. It also important to emphasize on the point that the resistance from the Niger Delta started with non-violent activities and later transformed into organized violent attacks on oil facilities (Obi, 2010). There is therefore the need to address the discord between the petroleum industry and fisheries sector in Ghana from its root cause.

A growing body of literature has sought to made recommendations towards the reduction of conflicts between coastal communities and the petroleum industry in Ghana. Skills and vocational training for the youth in the Western Region as well as

the provision of alternatives livelihoods for fisherfolk has been suggested (Ackah, Osei, Dery Tuokuu, & Bobio, 2019). Monetary and infrastructural compensation to coastal communities including the establishment of insurance schemes for fisherfolk (Adjei & Overå, 2019). The strengthening of institutions, more specifically institutional arrangements that seeks to balance the power between oil companies, the state and local coastal communities (Ackah-Baidoo, 2013; Ayifli et al., 2014; Obeng-Odoom, 2014).

While all these recommendations are worthwhile and could partly contribute to promote positive synergies between the petroleum industry and local fisheries sector. There is the need for a separate set of policy and management strategy that address the conflicts between the local fishers and petroleum industry from its root causes. Spatially fixed area conflicts over access to perceive abundance of natural resources requires a separate solution to address those problems.

In this study, several interviewees expressed concerns about new oil discoveries that could further exacerbate their living conditions. Such concerns cannot be trivialized considering the fact that the recent oil discovery which is about 450-550million barrels has been touted the biggest oil find in Africa (Joy News, 2019). Another separate discovery which is about 1.2b barrels has been found offshore in the coastal waters of Western Region (GhanaWeb, 2019). With such developments, it means many new oil rigs are going to be planted offshore which will further reduce the fishing space for fishers and could escalate the conflicts between petroleum industry, fishers and coastal communities.

In addition, it's been almost ten years now since the production of oil commenced, it is therefore important for government, fisheries managers and oil companies to develop innovative technologies to disperse some of the fish that aggregate around oil rigs for fishers to catch. This can be an important short-term solution, considering the fact that fishers are reporting very low catch in recent years.

Chapter 6. Conclusion

6.1 Key findings

The study investigated how fisherfolk livelihoods have been impacted by overfishing, and offshore production of oil and gas as well as the various livelihood strategies deployed by fisherfolk to avoid decrease fish catch using the sustainable livelihoods approach and an actor-oriented political ecology. The empirical enquiry was based on household survey and interviews among fishing households in the Western Region of Ghana. Small-scale coastal fisherfolk are under high levels of socioeconomic vulnerability because of decrease fish catch and declining small-scale fisheries opportunities. Yet, there is limited understanding of how fishers construct their livelihood adaptation strategies in an increasingly competitive ocean space involving diverse stakeholders and economic actors. Therefore, the main purpose of the thesis was to investigate how fisherfolk construct their everyday livelihoods in the face of changing access to the use of coastal waters.

To achieve the purpose of the study, the thesis addressed four research questions. The first research question explored the various ways in which overfishing and offshore oil and gas exploration and production has negatively affected the livelihoods of fisherfolk. The second research question, which is directly linked to the first research question, investigated the perceptions of fisherfolk on the closed season policy introduced by the national government to rebuild depleted marine fish stock. The third research question explored the conflicts produced between the fishers and the petroleum industry offshore. Based on the research results from the first three research questions, the fourth research question investigated the various livelihood adaptation strategies deployed by fisherfolk in response to decreasing fish catch and perceived marginalization by state agencies and oil and gas companies.

Chapter 4 addressed the first three research questions.

The survey results coupled with the knowledge obtained from interviews suggests that fisherfolk are active social agents who negotiate with powerful actors such as the state and petroleum companies to secure their main source of livelihoods. Fisherfolk are able to circumvent the administrative and political barriers over access to the use of coastal waters to protect their livelihoods. Fisherfolk apply their natural, social, cultural, physical, financial and human capital to resist policies that seeks to deprive them of their main source of livelihoods. The thesis has also revealed the strong social networking strategies applied by fisherfolk to establish some level of informal cooperation with government and oil & gas officials. This type of informal

cooperation has enabled fisherfolk to increase their catch using illegal fishing gears as well as fishing illegally within the restricted zones of oil fields offshore.

With respect to the first research question, decreased fish catch and low income were found to be the main impact of overfishing on fisheries livelihoods.
Persistent fishing amidst decreasing fish catch has resulted in the changes of the quality of fish caught. Fisherfolk are catching smaller fishes that are low in economic value. Furthermore, compared to some few years ago, species like herrings used to be abundant near the coastline. However, because of overfishing, herrings have moved deep seas compelling fisherfolk to travel longer distances at sea to access fisheries resources. Spending additional money to travel further for fishing as well as the low catch volumes have affected the financial capital assets base of fishing households. These vulnerabilities were found to be exacerbated by the new oil exploration and production. The spatial restriction of fishers mobility offshore, the destruction and confiscation of fishing gear, the presence of seaweed in the ocean, and the lack of land opportunities are some of the key petroleum industry-induced stressors on fisheries livelihoods. The combined effects of overfishing and oil and gas activities have resulted in decreased fishing space at sea, limited land ownership and farming opportunities, and destruction of marine ecosystem. Overall, the natural, financial, human and physical capital were found to be the most impacted by overfishing and the petroleum industry.

In relation to the second research question, the study found that fisherfolk and local fisheries leaders had different perceptions regarding the ecological effectiveness of closed seasons. The survey results coupled with the knowledge obtained from interviews suggest that fisherfolk, prefer the state to enforce the laws on illegal fishing instead of the introduction of closed season.
The conflicting perceptions appear to be as a result of fisherfolk perceived impact of closed season on their financial, cultural and natural capital as well as their level of participation and perceived influence in decision-making leading to the introduction of the closed season. According to many of the fisherfolk August is the period they catch more fish and are able to make more money to defray their debt. Therefore, a closed season in August will not only affect their financial capital but their ability to provide for their families as well.

Overall, two different discursive positions were established with respect to the closed season. An open access fisheries narrative together with strict enforcement of fisheries laws and seasonal closures supported by conservation discourses. The open access argument from the fisherfolk to continue fishing was found to be weak compared to the powerful and dominant scientific conservation narratives by the state and the NGOs.

With respect to the third research question, the study posits that, the conflict produced between the local fishers and the petroleum industry occurs at strategic spatial areas at sea (buffer zones -500&1000m radius) around oil fields offshore. These areas are considered ecologically fertile grounds for fisheries and holds considerable oil and gas reserves. On the one hand, local fishers seeks to maintain long-term access to fertile fishing grounds around the oil fields. On the other hand, oil and gas companies also wants to keep oil reserves in the same seabed to maintain oil exploration and production.

The restricted access to the use of coastal waters to exploit fish around oil and gas production facilities offshore by local fishers can be understood from the perspectives of unequal power relations between the local coastal communities and the oil and gas companies. Fishers claim to use coastal waters based on moral, entitlements and historical precedents were found to be insignificant in the face of oil boom and the desire of government to attract more foreign investment towards the development of offshore oil and gas industry.

Based on the empirical results of chapter 4, chapter 5 explored the various livelihood adaptation strategies deployed by fisherfolk in response to decreasing fish catch and declining coastal livelihoods. The livelihood adaptation strategies were divided into marine and non-marine based.

The marine spatial mobility strategies deployed by the local fisherfolk could be described as a short-term coping strategy. Illegal light fishing and other destructive fishing methods such as the use of chemicals is on the increase and are more prevalent among fisherfolk in the Western Region. These strategies can be described as desperate efforts by fisherfolk to increase their catch. These strategies could result in negative impacts, not only on marine ecosystem sustainability but also on their personal safety and human capital development. The various in situ marine-based adaptation strategies deployed by fisherfolk, especially illegal light fishing and fishing around oil rigs, are unsustainable and are counterproductive in the rebuilding of depleted marine fish stocks. However, the study found that migration, farming, petty trading and regular changes of fishing gears has the potential to positively contribute towards marine ecosystem sustainability.

6.2 Empirical and theoretical contributions

This thesis contributes to the literature on sustainable livelihoods, development geography and natural resources management. The integration of the sustainable livelihoods approach and an actor-oriented approach derived from political ecology served as an important analytical package to understand the current coastal

vulnerabilities and adaptation strategies as well as the opposing discourses over the rebuilding of marine resources. This thesis is among one of the few studies that has combined the sustainable livelihoods approach and an actor- oriented approach derived from political ecology to the study of coastal vulnerabilities and fisheries resources management.

The results from the study shows that the present decline in small-scale fisheries opportunities emanates from the combined effect of social, economic and political factors. The study has contributed to the vulnerability literature by showing the combined effects of overfishing and offshore oil and gas production on the livelihoods assets of coastal fisherfolk with respect to marine fisheries sustainability. In addition, the study has provided fisheries data, showing the catch volume trends before and after the production of oil to support the discourse on the potential impacts of the petroleum industry on local fisheries livelihoods. The data suggests that the catch volumes has decreased significantly after the commencement of oil and gas production.

The study has showed how small-scale fishers construct their everyday livelihoods in the face of changing access to the use of coastal waters. It has revealed the different types of power possessed by formal and informal actors in the fisheries and petroleum industry and its implication for the adaptation strategies of fisherfolk. The study has contributed to the adaptation literature on marine fisheries livelihoods by investigating the coastal mobility strategies of fisherfolk. This study is among one of the first studies focusing on coastal spatial mobility strategies to improve living standards adopted by fisherfolk in sub-Saharan Africa. It has unearthed different coastal mobility practices deployed by fisherfolk to increase their fish catch.

The results show that grassroots actors like fisherfolk also have power. They exercise these power through various forms of resistances such as illegal fishing activities (illegal light fishing and fishing around oil rigs) in response to the various fisheries laws and regulations such as closed season and the restricted access to fertile fishing grounds around oil fields offshore. They also exercise power though the use of organized set of narratives by applying their natural, cultural, human and financial capital assets.

These livelihood strategies are manifestations of the power struggle over access to the use of coastal waters. Until fisherfolk and coastal communities are actively involved in the management of coastal resources and their concerns addressed by the state and petroleum companies, they are likely to continue these strategies that could further exacerbate the conflicts at sea and create more tensions in the coastal communities.

The empirical findings from this study suggest that conflicts between the fishers and petroleum industry occurs around spatially fixed areas at sea. I agree with Penney et al (2017) that conflicts over resource use is not as result of absolute scarcity but those struggles are momentarily efforts to secure the long -term usage. In contrast to the general assumption that conflicts occurs over resource scarcity, this study deviates to show that the current conflicts over the use of the ocean space is a product of socio-economic and political factors.

The study has provided new insights into the conflicts produced between the local fishers and offshore oil and gas companies. It has revealed the cooperation alongside conflicts, produced from the interaction between fishers and some officials from oil and gas companies offshore. It has unearth the complex interaction between local fishers, and oil and gas companies in areas considered ecological significance for fisheries and petroleum resources

Through the engagement of fishing households, the study has revealed vital local marine ecological knowledge that can serve as an important fisheries management strategy and could benefit marine conservation initiatives.

Finally, the integration of the sustainable livelihoods and political ecology has unearth the opportunities and challenges associated with multi-stakeholder participation and implementation process of environmental policies in a developing country context.

Theoretical contributions.

Theoretically, the intergration of the sustainable livelihoods approach and actor-oriented political ecology has led to the emergence of cultural capital. Fisherfolk apply natural, human, financial, physical, social and cultural capital in the constructing of their livelihood strategies (Figure 6.1). The traditional SLA framework does not include cultural capital. However, through the engagement with fisherfolk, cultural capital has emerged as an important livelihood assets to coastal fishing households. The livelihoods of coastal fisherfolk are closely linked to the traditional and other cultural practices associated with the sea. There is a strong relationship between the natural and cultural capital of coastal communities. The findings show that fisherfolk do not perceive their relationship with the sea only from commercial perspectives, their entire ways of life is somehow connected to the sea. Conceptually, the sea is more than an economic asset to coastal fisherfolk, it serves to bind them together, gives them hope and common identity as unique people who depend on the sea for survival.

The study engagements with fisherfolk on issues such as government introduction of closed season and restricted access to fisheries resources offshore around oil fields provides some insights into the political components of fishing households capital

assets. The village-level politics was manifested through the various discursive practices utilized by the fisherfolk to resist fisheries laws and regulations as well as fishing illegally around oil fields offshore.

Power and politics have emerged as very influential factors in shaping the coastal vulnerabilities as well the adaptation strategies and livelihood outcomes. These salient factors have often been under-researched and or missing in the current literature on development of rural livelihood. The focus seems to have been shifted more towards the development of social, human and financial capital (Andriesse 2018; 2019; Yang et al, 2019; Freduah et al, 2018).

Because of power and politics, it is not easy to manage common pool resources, those in power want to keep power, prefer oil revenues, and are not interested in helping the poor, and local people/fishing communities often do not have sufficient capability and power to manage and change things on their own. Local governance only functions if the top-down level facilitates this process. Consequently, involved government agencies, NGOs and the petroleum industry need more understanding of the micro-level cultural politics of natural resource governance in order to achieve sustainable coastal livelihoods development.

This study has also contributed to the discourse on natural resource scarcity and development. More specifically, it has contributed to a relatively small body of literature that examines relative resource scarcity driven conflicts instead of absolute scarcities from a political ecology perspective. The conflict produced between the local fishers and the petroleum industry occurs at strategic spatial areas at sea. These areas are considered ecologically fertile grounds for fisheries and holds considerable oil and gas reserves.

New insights has also emerged with respect to the conflicts produced between the fishers and petroleum industry offshore. The conflicts between these two social actors has led to some form of cooperation. Theoretically, this study has contributed to the emerging literature on the co-existence of conflicts alongside cooperation (Penney et al., 2017).

This study has contributed empirically and theoretically towards the discourse on natural resource governance and rural development through the integration of SLA and political ecology. Ultimately, the fields of human geography, development studies, and environmental studies will be enriched by a well-grounded integration of these two frameworks.

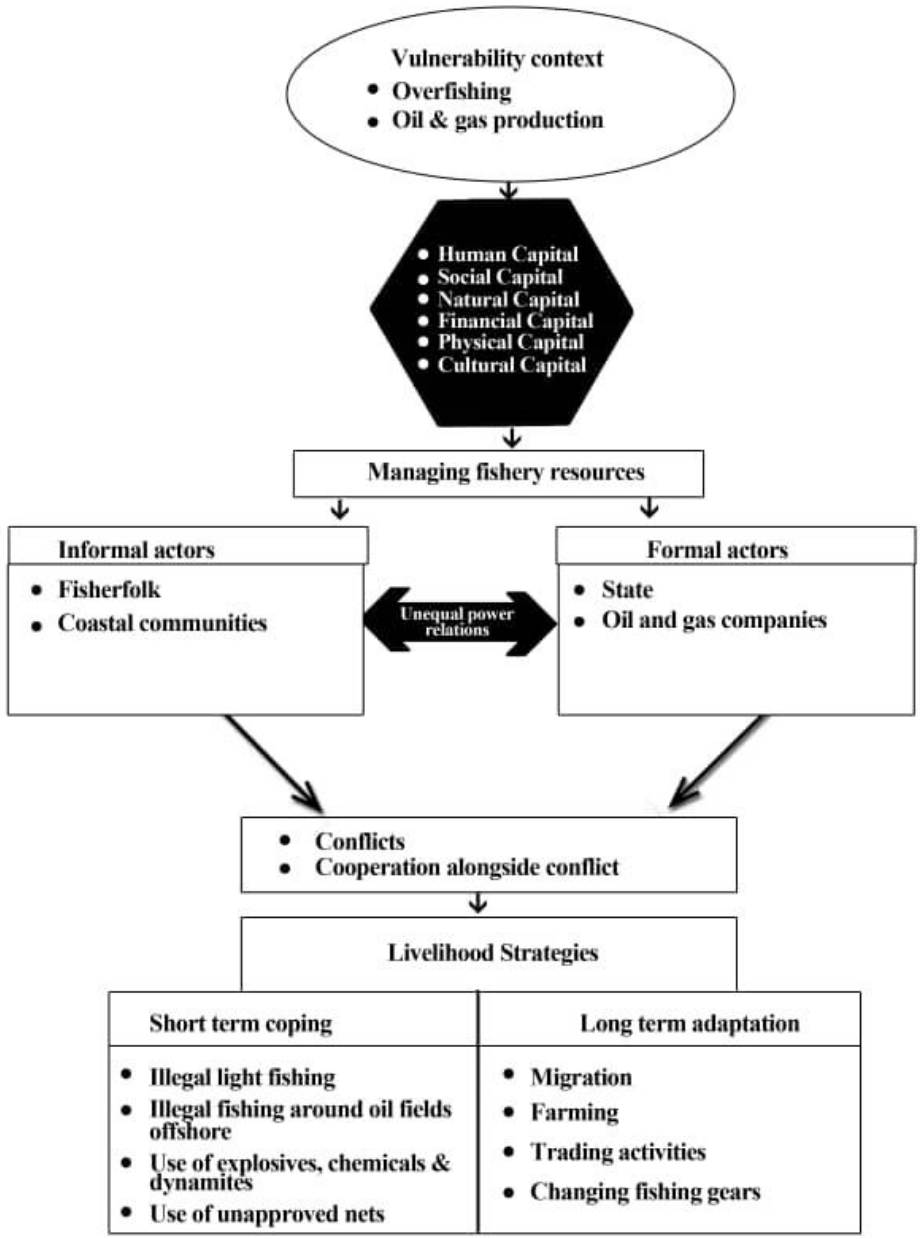

Figure 6. 1.Thesis conceptual contribution.

6.3 Policy Recommendations

Firstly, the fisheries co-management strategy suggested in section 5.5 could serve as strategic management tool to reducing illegal fishing activities and promote biodiversity conservation. The focus of the framework should be on power re-distribution to empower local bottom-up initiatives such as marine conservation groups to thrive. The findings from the study suggests that coastal fishing communities are not homogenous with respect to vulnerabilities and the livelihood adaptation strategies deployed. Therefore, national fisheries policy and co-management strategy should not overlook the inherent weakness and or strength of these coastal communities.

Secondly, compared to the Niger Delta in Nigeria, Ghana is yet to record any large –scale oil spillage related pollution (Pegg and Zabby, 2013). Should such a large -scale oil spillage occur in the coastal waters of Western Region, are there adequate plans to mitigate the socio-economic losses?

This requires a comprehensive approach such as the development of marine spatial planning and fisheries impact assessment. In other countries where fisheries exist alongside offshore oil drilling and production there are plans and or already developed marine spatial planning tools aimed at reducing and or eliminating the conflicts between users offshore to promote peaceful co-existence (Arbo & Thuy, 2016; Boucquey, Fairbanks, St. Martin, Campbell, & McCay, 2016; Smythe, 2017; Tsilimigkas & Rempis, 2017).

Perhaps, Ghana can learn valuable lessons from Norway with respect to how they have successfully managed to ensure the peaceful co-existence of the petroleum and fisheries industry. In Norway, the benefits from oil extraction and production are shared equitably among the population, oil revenues are invested in infrastructural and human capital development (Kronenberg, 2002).

In Norway, before new areas are opened up for petroleum exploration and exploitation, relevant state agencies must carry out a strategic impact assessment, in addition to that a separate impact assessment is also carried out by the oil and gas companies (Arbo and Thuy, 2016). This is done to protect ecologically fragile areas. In addition, when areas are made public for the award of oil production licenses, important fishing grounds and spawning as well as nursery grounds are often excluded (Ibid).

In the case of Ghana, there should also be a stronger focus on effective institutional arrangements to fight against corruption in order to promote transparent and accountable management of oil revenues. There are enough examples to show

in Africa that failure to address perceived corruption and unequal distribution of oil revenues could eventually led to conflicts that can destabilize the entire nation.

In addition, Oil and gas companies could build a desirable working relationship with coastal communities by opening a dedicated channel for regular dialogue with coastal communities. Besides, oil officials can join local communities to partake in sports and other traditional activities like celebration of traditional festivals at the community level. This can be important in building a strong community relationship. The oil and gas companies could also contribute towards ending illegal fishing practices, not only around their production facilities offshore but also over the entire Ghanaian coastal area. They could donate modern equipment such as drones and other surveillance equipment to the fisheries ministry to help combat illegal fishing practices.

Fourthly, building the adaptive capacity of coastal communities in response to decreasing coastal livelihoods is very important. The following factors below could be addressed as a necessary pre- requisite for the successful integration in-situ adaptation strategies and marine based coastal migration culminating into successful adaptation strategies:

i. Address the landlessness problem by creating more farming opportunities government can support coastal residents to rent or acquire land for rubber farms. The planting of coconut can also be encouraged in applicable areas. Coconut can thrive near shore as well as inland areas.
ii. Establishment of local factories- agro processing, waste recycling can reduce rural unemployment and discourage rural-urban migration.
iii. Rural enterprise – tourism, eco-tourism development where applicable. The coastal resources in the study areas can support the development of community based eco-tourism development.
iv. Diversification into marine based and inland aquaculture (where applicable). Considering the mobile nature of fisherfolk in the study areas, perhaps they can be supported to migrate for aquaculture farming in other domestic areas where the local environments thrives for fish farming.
v. Construction of sea defense structures and emergency disaster shelters in vulnerable communities for protection against erosion and coastal flooding.
vi. Construction of landing beaches, mini harbors to complement already existing facilities to support the local fisheries industry.
vii. Improvement in fish processing techniques and fish markets.

viii. Fisheries access arrangement for certain types of canoes (those already travelling longer distances to catch fish)- identifying and re-tooling them for international fisheries- access arrangements with nearby countries such as Nigeria, Togo, Senegal, Cote d'voire , Liberia, Sierra Leone to fish their waters.

Fifthly, local NGOs and other community-based organizations must channel more resources in providing advocacy and sensitization programs on sustainable fisheries gear use. Such efforts must also be directed to diffuse the socio-cultural relevance attach to the use of outmoded fishing gears. Government must also show the commitment to make appropriate fishing gears accessible and affordable and in addition to strict law enforcement to end illegal fishing.

6.4 Limitations of the study and future research

Research Limitation

Even though attempt was made to have a representative data from the coastal communities in the study Western Region, because of the lack of time and financial resources the empirical data collection was limited to four coastal districts out of the six districts. Nonetheless, the findings from this study, provides important insights into the struggles of fisherfolk and coastal communities across the Western coast in their attempt to secure their main source of livelihood.

Moreover, the present study focused on the socio-economic vulnerabilities of coastal small-scale coastal fishing communities. Other environmental vulnerabilities such as coastal erosion, floods and severe storms were not considered in this study. In coastal communities such as Shama, Dixcove and Akwidaa, physical vulnerabilities such as coastal erosion and persistent flooding was obvious.

In addition, it is possible that, in the process of translating the responses from research participants some vital information could have been omitted. However, this error was reduced by the daily translating of responses from research participants at the end of each day's fieldwork.

It is also possible that some of the fisherfolk could exaggerate in their responses to some of the research probes, especially concerning their monthly incomes from fishing and other non-fishing sources of income.

Even though, fisheries production data was presented to support the analysis of how oil exploration and production have affected the fish catch volumes of fishers. There is the need to conduct more rigorous scientific and empirical investigation to confirm

the extent to which offshore oil exploration and production could affect fisheries livelihoods.

In addition, there is also the need for more scientific survey of the current marine fish stock in the sea to be able to quantify the exact impact of overfishing on species.

Future research

Researchers and academics working in rural development related themes, must strive to incorporate the SLA and the actor-oriented political ecology in order to have a broader overview of how the micro-level interact with macro level in the management of natural resources.

Future research could empirically investigate how stakeholders seek to increase their political, how do they lose it, what is the spatial reach of political capital, and how does political capital relate to the other capitals such as social and cultural?

Future studies can address these complex but important factors shaping the vulnerabilities and livelihood adaptation strategies of water and land based livelihoods.

Studies could also explore how government is spending oil revenues and the types of development interventions introduced by oil and gas companies for the coastal communities in the Western Region of Ghana and beyond.

In addition, future research could also examine the perceptions of local fishers and coastal fishing communities with respect to the relevance of marine spatial planning.

More studies that are empirical need to be conducted on the interventions of non-state actors such as NGOs in the management and governance of natural resources. More specifically, the interaction between the state, NGOs and local communities with respect to the management of natural resources.

The behavior of multinational corporations towards their host communities in the extractive industries especially in the context of offshore oil exploration and production in developing countries also require further studies.

The issue of lack of fuel for fishing as well as the political nature in which its distributed came out strongly from the fieldwork, future studies could investigate how the scarcity of fuel affects the organization and fishing activities of coastal fisherfolk.

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APPENDIXES

A. SURVEY QUESTIONNAIRE

Impacts of overfishing and the petroleum industry on the livelihoods of fisherfolk in the Western Region of Ghana.

This survey seeks to collect information on the topic above in partial fulfilment of the requirement for the award of Doctor of Philosophy (PhD) Degree in Geography at Seoul National University. All information provided will be used for only academic purpose and shall be treated confidentially.

Date……./……./20….

Name of respondent……

Village name……
Municipality/District……..

Part 1

Socio-demographic information

1. Gender:
male……..female……

2. Age (years)…… (a) Below 20 b. 20-39 c. 40-59 d. above 60

3. Marital status a. Single b. Married c. Divorced d. Separated

4A. Educational Level

a. No formal education b. Elementary c. Secondary d. Tertiary e. Technical Training

B. Education level of spouse (if applicable)

a. No formal education b. Elementary c. Secondary d. Tertiary e. Technical Training

C. Do you have any children? a. Yes b. No If yes what are their names and ages

……..

……..

a. Do all your children go to school?

a. Yes all of them b. Some dropped out c. No

5. Type of Fisher ?

a. Captain b. Crew member c. Boat/Canoe owner

6. Number of people in your household

……..……..……..……..……..……..……..

7. What other jobs do you have besides fishing?

a. farmer b. Self-employed c. Government Employee d. Company Staff

e. others……..……..……..……

8. Jobs of family members who are part of your household

1……..……..……..……..……..……..……..……

2……..……..……..……..……..……..……..……

3……..……..……..……..……..……..……..……

4……..……..……..……..……..……..……..……

Part 2

A – Fishing and other household activities

9. What species do you usually catch?

……..……..……..……..……..……..……

10. How do you share your catch among yourself? Please explain

……..……..……..……..……..……..……..……

11. What do you do with your catch? Own consumption or selling?

a. Domestic use b. Commercial

If selling, who are your buyers and where do they come from?

……..……..……..……..……..……..……
……..……..……..……..……..……..……
……..……..……..……..……..……..……
……..……..……..……..……

12. What fishing techniques & equipment do you use?

……
……
……
……

13. Have your techniques/tools changed in recent years? If yes, please explain and identify the factors that caused these changes?

……
……
……
……

14. How many times per week do you fish and how many crew members are involved per fishing trip?

……

15. Do you own a canoe/boat? a. Yes b. No

16. How long have you been fishing?

a. less than 5 years b. 5 to 10 c. 11-15 d. over 15 years

17. Has your fish catch changed over the past 10 years?

a. increased b. unchanged c. decreased

18. What are some of your adaptation or coping strategies during low fish catch season

……,……
……

19. What would you say contributed to your choice/decision to choose those particular adaptation strategies?

……
……

20. What are some of the factors that constrain your adaptation strategies?

……..

21. Have you observed any positive or negative implications of your coping/adaptation strategies on the following?

a. Marine ecosystem d. household income c. state policies d. petroleum industry e. other please specify……

22. Have there been any changes in relation to your fishing compared to 10 years ago

a. Number of fishermen per trip

b. Frequency of fishing during the week

c. Other pls specify

23. What possible factors could account for these changes?

……

24. Are you fishing in a Marine Protected Area?

a. Yes b. No

If yes, has the Marine Protected Area contributed to an increase in fish stock in your village? Please explain your answer

……
……
……
……

25. Are illegal (small scale and large scale foreign vessels) fishers fishing in this area?

a. No b. Yes……..If yes, where are they from?……
……

26. Do you grow other crops, fruits or vegetables? If yes, what crops?
……
……
……
……

27. What is the size of your land in square meters?

……
……

28.Do you own the land?

No……. Yes…….

If no, do you rent the land and who owns the land? Someone from the village or an outsider?

……
……

If yes, do you have an official land title?

No…… Yes…

If no,
why?……
.....

29. Does your household own any livestock… a. Yes b. No

If yes, what type & quantity of livestock do you own?

……
……

30. Do you have food throughout the year?

a. Yes, enough for all household members b. Not enough but Ok c. Food shortage every year (how many months)……..…

31. Do have your own residential accommodation?

a. Yes b. No

32. Is your house strong?

a. Strong (not easily damaged) b. Average c. Sometimes collapse/damage

33. Can you afford repairing your house?

a. Yes, when necessary b. Sometimes c. No

*Observation about the roof of the house (don't ask)

a. Zinc roof b. thatched roof c.flat roof

*Observation about the type of house

a. Concrete b. Mud c. Mud bricks d . Cement blocks.

34. What is your primary source of cooking energy/fuel?

a. Charcoal b. fuel wood c. LP Gas d. Biogas e. other please specify

2B. Overfishing and ban /closed fishing Seasons

35. Do you think overfishing has contributed to changes in fish catch (quantity, quality of species)?

a. Yes b. No If yes pls explain……..

36. By your estimates how much (in quantity) has your catch decreased compared to 10 years ago?

……..

37. Do you agree that the number of fishermen and boats/canoes should be decreased?

a.Yes b.No Pls explain your answer

38. Do you get regular supply of the Premix fuel?

a.Yes b.No if no Pls explain

……..…….…….…….…….…….…….……
…..

39. Would you support the removal of subsidies on the premix fuel and outboard?

a.Yes b.No pls explain your answer

……..…….…….…….…….……..

40. Is there any local by-laws, traditional belief, and cultural practices in this community that ensures marine conservation?

a.Yes b.No if yes pls explain your answer

…….....…….

41. Do you agree that annual one month ban on fishing in August will help rebuild declining fish stocks

1= Strongly Agree 2= Agree 3. Not Sure 4. Disagree 5. Strongly Disagree

42. Which month would you prefer the ban to be enforced?

……..…….…….…….…….…….…..

43. Did you take part in any consultation process leading to the ban on fishing in 2018?

a. Yes b. No Pls explain your answer

44. In your opinion why do you think government postponed the ban?

……..…….…….…….…….…….……..

45. How do you view government policies in the fisheries sector compared to local by- laws that regulate fisheries at the community level?

……..…….…….…….……

46. Would you vote against the current government in the 2020 election if they implement ban on fishing/ close season in 2019. A. yes b. No

47. Do you think a ban on fishing would be successful without compensation/alternate livelihoods?

a.Yes No. pls explain

48. What type of compensation / incentive package do you need to ensure you do not fish during the ban on fishing?

……..…….…….…….…….……..

49. Would you obey such a ban if it is introduced by the traditional authority (Chief and elders)?

……..…….…….…….…….…….…….……
……..

50. In your opinion what do you suggest can be done to improve the quantity &quality of fish catch?

……..…….…….…….…….…….…….……
……..

Part 3

A-Petroleum industry and fishery livelihoods

51.Do you think the oil and gas industry has contributed to the changes in fish catch (quantity & quality of species).

a. Yes b. No.. if yes pls explain

……..…….…….…….…….…….….

52. How has this impacted the small scale fisheries industry?

a. Changes in prices b. Unemployment c. changes in livelihoods d. other pls explain

53. Is your total household income today higher or lower compared to 10 years ago?

Lower,
because……..…….…….…….…….……..…….…….……
……..…….……

Higher,
because……..…….…….…….…….…….…….……..……
……..…….……

54. Have you accessed loan over the past

a. 6 month b. 1 year c. 2 year d. over 2 years

55. What are some of the barriers in access to loan in this community?

……

56. Has your cost of living increased over the past 9/ 10 years?

a. Yes b. No If yes , in what ways and what do you think are the main causes for such increases……..

57. Are you able to afford clinic or hospital treatment?

a.Yes b.No if yes pls explain

58. Do you think your health and that of your household members has been affected by pollution and other activities from oil and gas?

. a. No……..b. Yes…….. if yes Please explain your answer

59. How would you rate your overall living condition/situation compared to 2009/2010

……
……

B. Petroleum issues

60. Did the policy on oil and gas influenced your voting decision in the last election in 2016

a.Yes b.No if yes pls explain……

61..Do you think there is fair and equal distribution of oil revenue

a. yes b. no if no pls explain your answer

62.Do you know of any development projects financed with oil money in your community

a. Yes b. no

If yes, can you mention some?.....

63. Do you think the activities of the oil and gas can help develop your community?

a.Yes b.No…….if no. pls explain your answers

64.Do you think it is possible for Ghana to become like Nigeria in terms of oil induced violence and conflicts

a. Yes .b No…. Please explain your answer.

Part 4

Collective action

65. Are you a member of a fisher folk association / cooperative/ political pressure group?

a…Yes…..b. No….

If yes, what are the names of the associations/cooperatives/ pressure groups?

……
……
……
……

66. What are the benefits of membership?

a. Information b. Material benefits c. Financial benefits d. social benefits (village bonding, working together) d. political benefits (negotiating collectively, regular supply of premix fuel)

Please explain

……
……
……
……

67. How many years have you been a member?

……
……

68.Is the association or cooperative doing something about oil & gas conflicts, overfishing

No,
because.……
……..

Yes, please explain

……
……

69. A,Please identify if any government agency supported the village in the past or is supporting the village right now to help you with cope with oil & gas conflicts, overfishing and climate change issues?

……
……
……
B.Please identify if any NGO supported the village in the past or is supporting the

village right now to help you with cope with oil & gas conflicts, overfishing and climate change issues?

……
……
……
……

PART 5 . Conflicts

A. Conflicts within the marine fisheries sector

70.What are some of the causes of conflicts in the fisheries sector in your community?

……

71..How frequent are these conflicts and when do they occur most?

……

72. Can you give some examples of conflicts that you have been involved?

……

B. Between fisheries and oil & gas sector

73. Is there any conflict between the fishery and the oil & gas sector?

…a.Yes …b,No

if yes what are the causes of such conflicts…….

74. Have you encountered any problem with the oil &gas industry in your fishing activities?

a. Yes b. No if yes please explain

……..

75.What are some of the consequences of such conflicts and how does it affect fishing activity ?

……

76. How are conflicts resolved and managed and who the main actors/stakeholders involved in managing conflicts ?

……
…

77. In which ways has oil and gas exploration and production affected fisheries and the activities of local fishermen in your community.

……

78. In your opinion what do you think can be done to improve the management of conflicts in the
community……
……

FINAL PART

79.What is your average monthly income from fishing (In Ghana cedis)?

a. 0-199 b. 200– 399 c. 400- 599 d. 600-799 e. More than 800.

80. What is your average monthly income from other income-generating activities?

a. 0 - 199 b. 200 – 399 c. 400- 599 d. 600-799 e. More than 800.

81. Do you have family members who work in another place and who send you money each month? If yes, where do your family members work and how much do they send you each month?

……
……..

82.A. What are the two biggest problems in the village at the moment?

1……..

2……

B.What would you like the government, Oil & gas companies and NGOs to do in order to improve life in the village? Please explain
……
……
……
……
……

83. Would you consider to relocate to another village or move to the city if the economic situation keeps getting worse?

No never…….Please explain
……
……
……
……

Yes perhaps…….Please explain

……
……
……

84.A.Have you migrated to another village or city within the past 5-10 years?

a.Yes b. No if yes where did you go and what type of work did you do ?

……

B..Were you able to make more money when you migrated compared to your current work in this village?

a. Yes b. No Pls explain your answer

85. Would you like your children to be fishermen or fishmongers and continue to stay in this village?

a.Yes b.No if yes please explain

APPENDIX B. INTERVIEW GUIDE.

A. Interview guide for Village leaders (chief, council members, elders)

1. How many people/families live in your village?
2. What percentage of people/families are engage in fishing as their primarily occupation?
3. What's the current state of small scale fisheries in the village?
4. What are some of your major duties in relation to fishing activities in the community?
5. What are major fish species caught in the village? Have they changed recently?
6. What are some of the conflicts in the fisheries sector in your community?
7. To what extent do people here have agricultural opportunities? Do they own the land
8. Is there a problem of overfishing here? If yes, what measures are taken to mitigate this problem?
9. Would you support the removal of subsidies on the premix fuel and outboard?
10. Is there any traditional belief, local by-laws, and cultural practices in this community that ensures marine conservation?
11. Do you agree that annual one month ban on fishing in August will help rebuild declining fish stocks? a. Yes b. No Pls explain your answer
12. Did you take part in any consultation process leading to the ban on fishing in 2018
    Yes b. No If yes please explain your answer

13. How do you view government policies in the fisheries sector compared to local by- laws that regulate fisheries at the community level?
14. Is there a problem of light fishing/ illegal fishing here? If yes, what measures are taken to mitigate this problem?
15. What is your opinion on the future of fisheries/aquaculture?
16. When did oil exploration and production started in your village?
17. What are some of the major projects in this community supported & build by oil companies
18. Was the village adequately informed about the potential impacts of the oil&gas industries on other sectors like fishing and farming?
19. In your opinion what are the major concerns in the village with reference to the oil and oil gas industries?
20. Is there any conflict between the fishery and the oil & gas sector in this village?
21. What are some of the causes of conflicts between the fishery and oil & gas sector?
22. How are such conflicts resolved in the community?
23. What are the type of compensation package given to the winners of such conflict resolutions?

24. In which ways has oil and gas exploration and production affected fisheries and the activities of local fishermen in your community?
25. Is there any communication channel between oil & gas companies and the fisheries sector?
26. In your opinion, what do you think can be done to reduce the conflicts?
27. .In your opinion what do you think can be done to improve the management of conflicts in the community?
28. What are the two biggest socioeconomic problems in the village?
29. What are the biggest coastal/marine/environmental problems in the village?
30. How does the village respond to unfavorable government policies, the perceived marginalization from the Petroleum industry and other related factors?

Appendix C Interview guide for Chief fisherman

1. Can you estimate the number of fishermen and canoes in your community?
2. What are the main fish species caught here and major fishing equipment use?
3. What are some of your major duties as the chief fisherman?
4. What are some of the welfare support for fisher folks in this community?
5. Is it easy to access financial credit / loan in this community?
   Yes NO pls explain your answer
6. Do you have any job besides fishing?
7. During which part of the year do you experience low fish catch and high catch?
8. What are some of your adaptation/ coping strategies during low fish catch?
9. What would you say contributed to your choice/decision to choose the ways you responded?
10. What are some of the factors that hindered your response strategies?
11. Have you observed any positive or negative implications of your coping/adaptation strategies on any of the the following
    a. Marine ecosystem sustainability b. household income
12. Is there a problem of overfishing here? If yes, what measures are taken to mitigate this problem?
13. What is your relationship with government agencies? Are you somehow dependent on government policies or subsidies?
14. Is there any local by-laws, traditional belief, cultural practices in this community that ensures marine conservation and sustainable fish catch?
15. What about the price of fishing inputs like outboard motor, fishing nets etc
16. What type of support does the community want from government, Petroleum industry, NGOs community?
17. Do you support the reduction of fishermen and number of canoes?
    a.Yes b.No Pls explain your answer
18. Do you agree that annual one month ban on fishing will help rebuild declining fish stocks

a.Yes b. No Pls explain your answer

19. Did you take part in any consultation process leading to the ban on fishing in 2018
    a.Yes B. No if Yes Please explain your answer
20. Why do you think closed season was successfully implemented for industry /large scale vessel?
21. What type of compensation / incentive package do you need to ensure you do not fish during the ban on fishing?
22. Are there any specific local political problems in this area?
23. How do you view government policies in the fisheries sector compared to local by- laws that regulate fisheries at the community level?
24. Has there been any changes in the quantity, quality of fish caught since the beginning of oil and gas exploration and production? pls explain your answer
25. What are some of the causes of conflicts between the fishery and oil & gas sector?
26. Have you encountered any problem with the oil &gas industry in your fishing activities?
    Yes b. No if yes please explain
27. What are some of the consequences of such conflicts?
28. How are conflicts resolved and or managed in this community-who the main actors/stakeholders involved in managing conflicts?
29. In your opinion do you think some actors/stakeholders are able to influence the outcome of conflict or dialogue resolutions? Can you mention any key stakeholder in that regard?
30. What are the type of compensation package given to the winners of such conflict resolutions?
31. In your opinion, what do you think can be done to reduce the conflicts?
32. In your opinion what do you think can be done to improve the management of conflicts in the community?
33. In which ways has oil and gas exploration and production affected fisheries and the activities of local fishermen in your community?
34. Is there any communication channel between oil & gas companies and the fisheries sector. Pls explain your answer?
35. How would you describe the future outlook of fishery in the next 10 years in this community
    a.Very good b. good c. not sure d. bad e.very bad
36. Do you agree that government policies favor oil and gas activities compared to fisheries
    A.Yes b. No If yes pls explain your answer
37. How long have you been working as a chief fisherman?
38. What's your average monthly income from fishery?
39. What's your average monthly income from other non-fishing activities?
40. How does the village respond to unfavorable government policies, the perceived marginalization from the Petroleum industry and other related factors

Appendix D. Interview guide for Chief fish traders

1. What are the major types of fish you sell?
2. What are some of your major duties as the chief fisher trader?
3. What are some of the welfare support for your members?
4. Is it easy to access financial credit / loan in this community?
   a.Yes b. No pls explain your answer ?
5. How do you organize your fish trading activities in relation to
   a. Sources of fish supply-where do you get fish from?
   b. How do you determine the price?
   c. Where does your buyers come from?
   d. Have there been changes in quality and quantity of fish supply and prices?
   If yes, what do you think are some of factors causing this changes?
6. During which part of the year do you experience low fish supply?
7. What are some of your adaptation/ coping strategies during low fish catch & supply?
8. What would you say contributed to your choice/decision to choose the ways you responded?
9. What are some of the factors that hindered your response strategies?
10. Have you observed any positive or negative implications of your coping/adaptation strategies on any of the the following
    a. Marine ecosystem sustainability b. household income
11. Is there a problem of overfishing here? If yes, what measures are taken to mitigate this problem?
12. Do support the reduction of fishermen and number of canoes?
13. Would you support the removal of subsidies on the premix fuel and outboard?
    a.Yes b.No pls explain your answer
14. Is there any local by-laws, traditional belief, and cultural practices in this community that ensures marine conservation? a. yes b.no
    pls explain your answer
15. Do you agree that annual one month ban on fishing will help rebuild declining fish stocks
    a. Yes B. No Pls explain your answer
16. Did you take part in any consultation process leading to the ban on fishing in 2018
    a.Yes b.No Please explain your answer
17. What type of compensation / incentive package do you think is needed to ensure people do not fish during the ban on fishing?
18. Are there any specific local political problems in this area?
19. How do you view government policies in the fisheries sector compared to local by- laws that regulate fisheries at the community level ?
20. Has there been any changes in the quantity, quality of fish you trade since the beginning of oil and gas exploration and production?
21. What are some of the causes of conflicts between the fishery and oil & gas sector?

22. What are some of the consequences of such conflicts?
23. How are conflicts resolved and or managed in this community-who the main actors/stakeholders involved in managing conflicts
24. What are the type of compensation package given to the winners of such conflict resolutions?
25. In your opinion, what do you think can be done to reduce the conflicts?
26. In your opinion what do you think can be done to improve the management of conflicts in the community?
27. In which ways has oil and gas exploration and production affected fisheries and the activities of local fishermen and fish traders in your community?
28. Is there any communication channel between oil & gas companies and the fisheries sector? Pls explain your answer
29. Have you been involved in any conflict resolution processes between fishery and oil gas, if yes what role did you play and which other stakeholders were involved?
30. In your opinion do you think some actors/stakeholders are able to influence the outcome of conflict or dialogue resolutions? Can you mention any key stakeholder?
31. How would you describe the future outlook of fishery in the next 10 years in this community?
    a. Very good b. good c. not sure d. bad e. very bad
32. Do you agree that government policies favor oil and gas activities compared to fisheries
    a. Yes b. No Pls explain your answer
33. How long have you been working as a chief fish trader?
34. What's your average monthly income in fishery related activities-trading?
35. Monthly average income from non-fishing related activities?
36. How does the village respond to unfavorable government policies, the perceived marginalization from the Petroleum industry and other related factors

Appendix E. Interview guide for Oil & Gas Company

1. What is your position in this organization?
2. Could you describe your company and the type of operation in Ghana?
3. Is your company doing well, making enough profits?
4. How would you describe your relationship with the community?
5. What have been your major successes?
6. Has your company embark on any development projects for the communities you are operating in ?
7. Has there been any complaints from the community in relation to your presence and operations? If yes, how do you manage such situations?
8. Do you work together with government agencies, other NGOs and village associations/cooperatives? If yes, please explain
    a. How effective is such collaborations?
    b. What are some of the major challenges in such collaborations?
9. How would you describe your relationship with fishermen and fishmongers

in this community?

10. In your opinion, do you think your operations has affected the local fishing industry in anyways?
11. Do you have any arrangements for compensation when there is damage to fishermen gears and other related damages? a. Yes b.No if yes can u explain
12. Have you encountered any problem with fishing sector since you started operation and how was it resolved?
13. Do you agree that annual one month ban on fishing will help rebuild declining fish stocks
    a.Yes b. No Pls explain your answer
14. Did you take part in any consultation process leading to the ban on fishing in 2018
    a.Yes b.No
15. Do you have adequate measures to ensure that in case of oil spillage the harm on the marine ecosystem could be reduced?
16. Does your company have any activities related to mitigating a climate change threat? If yes, what kind of activities?
17. What are some of your major challenges in this community and how do you think this can be managed or resolved?

Appendix F. Interview guide for Government officials (National/ Regional/Municipal /District Officers)

1. How would you describe the current state of small-scale marine fisheries in Ghana?
2. What are some of the key challenges in the small-scale fisheries?
3. What are the major reasons for the introduction of ban on fishing for small-scale fisheries?
4. Why do you think the ban was later postponed to 2019?

5. Do you work together with other government agencies, NGOs and village associations/cooperatives? If yes, please explain
    a. What is the effectiveness of such collaborations?
    b. What are some of the major challenges in such collaborations?
6. What are some of the challenges and concerns between the oil and gas and small scale fishers in Western of Ghana?
7. In your opinion do you think the petroleum industry has affected the local fishing industry?
8. Has your outfit been involved in any conflict resolution processes between fishery and oil gas, if yes what role did you play and which other stakeholders were involved?
9. In your opinion do you think some actors/stakeholders are able to influence the outcome of conflict or dialogue resolutions?
10. What are the type of compensation package given to the winners of such conflict resolutions and are culprit punished in any way?

11. What is the current process / arrangements for issuance of license for foreign vessel?
12. Are there any reports of illegal fishing activities by foreign vessels? How frequent is this and where do they come from?
13. How about climate change issues do you have any programs / trainings on climate change awareness in fishing communities?

Appendix G. Interview guide for Non-Governmental Organizations (NGOs)

1. When and why did your NGO come to this area?
2. Could you summarize the history of the NGO?
3. Is this a domestic or international NGO?
4. What are your aims/goals?
5. What kind of related activities do you? (Common marketing, getting higher prices, product development, other end products, etc.)?
6. What have been your major successes?
7. Have there been any failures?
8. How do you reach out to the local community?
9. What are the biggest socioeconomic problems in this area?
10. What are the biggest coastal/marine/environmental problems in this area?
11. What are some of the causes of conflicts between the fishery and oil & gas sector
12. What are some of the consequences of such conflicts?
13. Have you been involved in any conflict resolution processes between fishery and oil gas , if yes what role did you play and which other stakeholders were involved
14. What are the type of compensation package given to the winners of such conflict resolutions?
15. In your opinion, what do you think can be done to reduce these conflicts?
16. In your opinion what do you think can be done to improve the management of conflicts in the community?
17. In your opinion do you think some actors/stakeholders are able to influence the outcome of conflict or dialogue resolutions? Can you mention any key stakeholder?
18. In which ways has oil and gas exploration and production affected fisheries and the activities of local fishermen and fish traders in your community?
19. How would you describe the future outlook of fishery in the next 10 years in this community?
    a. Very good b. good c. not sure d. bad e. very bad
20. What does your NGO do to mitigate climate change/overfishing/illegal fishing?
21. How would you describe the success rate of your NGO activities related to climate change/overfishing/illegal fishing?
22. Do your agency guide fisher folks to change their fishery/aquaculture performance?
23. Do you work together with government agencies, other NGOs and village associations/cooperatives? If yes, please explain

c. What is the effectiveness of such collaborations?
d. What are some of the major challenges in such collaborations?

24. Are local and central government agencies supportive in your opinion?
25. What could the central government do in order to improve policy implementation?
26. Do you think local communities have become more aware of climate change issues in recent years?
27. Are there any specific local political problems in this area? If yes, please explain
28. To what extent do people here have alternative occupational opportunities? (ex- agriculture aquaculture…)
29. Do you think inequality is severe in this area? Please explain.
30. What is your opinion on the future of this area? Do you expect many people to leave to seek higher standards of living elsewhere?
31. How many more years is your NGO planning to stay in this area?
32. How effective do you think the efforts from NGOs in this area compared to other area?

Appendix H. Interview guide for local journalists

1. How many years have you been journalist in this area?
2. What are the biggest socioeconomic problems in this area?
3. What is the biggest coastal/marine/environmental problem related to fisheries in this area
4. Could you describe the most important changes related to fisheries in this area in the past 5 to 10 years?
5. What alternative jobs do people in this area have to increase family incomes?
6. To what extent do people here have agricultural opportunities? Do they own the land?
7. Have people here changed their fishery/farming performance? (ex- changing key fish target, growing new crops etc…?)
8. Is there a problem of overfishing here? If yes, please explain. And what measures are taken to mitigate this problem by local government/central government/NGOs?
9. Is there a problem of illegal fishing here? If yes, please explain. And what measures are taken to mitigate this problem by local government/central government/NGOs?
10. Do support the reduction of fishermen and number of canoes
11. Would you support the removal of subsidies on the premix fuel and outboard?
    Yes No pls explain your answer
12. Is there any local by-laws, traditional belief, and cultural practices in this community that ensures marine conservation? a. yes b.no
    pls explain your answer
13. Do you agree that annual one month ban on fishing will help rebuild declining fish stocks
    1= Strongly Agree 2= Agree 3. Not Sure 4. Disagree 5. Strongly Disagree

14. Did you take part in any consultation process leading to the ban on fishing in 2018
    a.Yes b.No Please explain your answer
15. What type of compensation / incentive package do you think people here need to ensure they do not fish during the ban on fishing?
16. Is the cost of fishing inputs (outboard motor, premix fuel etc) expensive?
17. How is the arrangement for premix fuel distribution? is it effective
18. What are some of the causes of conflicts between the fishery and oil & gas sector
19. What are some of the consequences of such conflicts?
20. Have you been involved in any conflict resolution processes between fishery and oil gas , if yes what role did you play and which other stakeholders were involved
21. What are the type of compensation package given to the winners of such conflict resolutions?
22. In your opinion, what do you think can be done to reduce these conflicts?
23. In your opinion what do you think can be done to improve the management of conflicts in the community?
24. In your opinion do you think some actors/stakeholders are able to influence the outcome of conflict or dialogue resolutions? Can you mention any key stakeholder?
25. In which ways has oil and gas exploration and production affected fisheries and the activities of local fishermen and fish traders in your community?
26. Is climate change a big threat in this area? If yes, please explain. And what measures are taken to mitigate this problem by local government/central government/NGOs?
27. What is your opinion on the future of fisheries/farming/aquaculture in this area?
28. What is your opinion on the future of this area? Do you expect many people to leave to seek higher standards of living elsewhere?
29. Are there many efforts from domestic NGOs or international NGOs related to fisheries/aquaculture in this area? If yes, please explain. And how effective do you think their efforts are.
30. What should government agencies/NGOs do to support the area for future development?
31. Are there any specific local political problems in this area? If yes, please explain
32. How would you describe the relationships between central government and local government?

Appendix I. Marine fish production (1980-2018).

YEAR	ARTISANAL (MT)	SEMI-INDUSTRIAL (MT)	INDUSTRIAL TRAWLER (MT)	TUNA(MT)
1980	141822.3	15603.6	19087.067	7608.6
1981	1491823.2	167735.1	15380.54	18365
1982	140890.9	16735.1	12985.7	28886
1983	173028.3	19686	16811.8	31657
1984	171233.7	14703.6	16429	29144
1985	159899.4	17979.4	21932.9	36854
1986	190196.5	21893.7	21893.7	34720
1987	261451.3	14931.4	20171.3	33465
1988	244042.2	7414.2	16042	35433
1989	220877.7	12656.9	23073.4	32294
1990	242020.1	9249.6	26588.7	40803
1991	215847.1	7346.5	27892.1	37794
1992	307931.2	10767.7	20933.2	30776
1993	257237.4	5230	18323.2	36856
1994	211746.8	6037.4	25389.6	36973
1995	210659.3	6370.7	20048.6	33905
1996	298249	8352.8	25103.5	37255
1997	215125.44	7293.81	17528.2	53625
1998	189458.6	6137.42	16847.49	65568
1999	164828.98	5149.37	13944.9	83552
2000	276275.32	8668.06	15454.84	53255
2001	240024.50	7605.42	19644.25	88806
2002	200824.91	7784.6	23899.53	66046
2003	238860.0	13317.88	9942	65153
2004	267910.28	6331.2	14010.49	62742
2005	219634.03	7591.29	12494.01	82225.85
2006	231680.63	9866.19	17419.08	6325.44
2007	186816.02	10008.69	19892.83	72335
2008	254184.95	6140.26	18289.31	61452
2009	225705.74	12052.79	20836.69	66469
2010	198936.48	9823.12	18859.29	77873
2011	196200.33	9576.71	19596.90	54241.60
2012	189246.09	10016.72	23197.88	79218.9
2013	178220.74	10482	19407	82899
2014	178686.3	7254.91	31562.43	76844
2015	187414	11889.64	36713	89338
2016	179721.38	12474	24469.24	81618
2017	176578	12747	31990.2	85559
2018	159726	9669.0	33509.74	90222.4

Abstract in Korean.

본 박사학위논문은 아프리카 가나 서부의 남획과 석유 산업이 연안지역사회 소규모 어민들의 생계에 어떤 영향을 미치는지를 연구하였다. 어업과 석유 부문의 공식 및 비공식 행위자와의 상호작용과 이들 행위자가 어민들의 생계 적응 전략을 어떻게 형성했는지 확인하였다.

연구방법은 400 명의 어민 가구들을 대상으로 한 설문조사와 42 명의 핵심 이해관계자들을 대상으로 한 인터뷰를 혼합하여 채택하였다. 설문조사와 인터뷰는 2018 년 12 월에서 2019 년 4 월 사이에 가나에서 Shama 지역의 Apo 와 Bentsir, Nzema East 지역의 Axim, Ahanta West 의 Discove 와 Akiwidaa, 그리고 Sekondi-Takoradi Metropolis 지역의 Sekondi 와 New Takoradi 에서 실시하였다.

설문조사와 인터뷰 응답자는 눈덩이 표집법과 의도적 표집법을 통해 선발되었다. 설문에는 객관식, 단답식, 서술식 질문이 포함되었다. 단답식 그리고 객관식 질문들을 통해서는 응답자들이 특정 답변을 선택하도록, 서술식 질문을 통해서는 현지 어업 관련 경험과 기타 문제에 대해 자유롭게 서술하도록 하였다. 설문조사 결과는 사회과학자를 위한 IBM SPSS 버전 21.0 과 Excel 프로그램을 통해 분석하였다. 인터뷰 결과는 주제별로 답변을 기록하고 번역하였다.

설문조사와 인터뷰의 결과는 아프리카 가나 서부 지역의 어민들이 어획량과 어업 기회 감소로 인해 사회경제적 취약성이 높다는 것을 보여준다.

어획량과 소득의 감소는 남획이 어업 생계에 미치는 가장 큰 영향의 결과인 것이 밝혀졌다. 어민들의 이동 제한, 어구의 파괴 및 몰수,

해초의 존재 및 토지 기회의 부족은 석유 산업에 의해 유발되는 생계 위협의 주요 요인들이다. 남획과 석유 시추 활동의 결합 효과는 해상 어업 공간 감소, 토지 소유 및 농업 기회의 제한, 해양 생태계 파괴로 이어졌다. 전반적으로, 자연적(natural), 재정적(financial), 인적(human), 물리적(physical) 자본이 남획과 석유 산업의 영향을 가장 많이 받는 것으로 나타났다.

현지 어민들과 공동체 지도자들은 금어기(禁漁期, closed fishing season)에 대해 다른 평가를 가지고 있었다. 설문조사와 인터뷰에 따르면, 어부들은 금어기 시행보다는 불법 어업에 대한 법률을 시행하는 것을 선호하고 있었다. 어민과 지도자들의 상충되는 의견은 (1) 금어기 도입에 따른 어민들의 재정적, 자연적, 문화적 자본의 감소와, (2) 의사 결정 과정에서의 참여 수준의 결과로 보인다. 전반적으로 이와 관련하여 두 가지 다른 정치적 담론이 충돌하는 현상이 나타났다. 한쪽은 연안 공동체의 소규모 어민들의 입장으로, 수산법을 엄격하게 시행하는 동시에 모든 어민들이 자유롭게 바다를 사용하는 개방 담론이다. 다른 한쪽은 정부와 환경 NGO 들의 입장으로, 해양 자원의 장기적인 지속 가능성을 위해 계절적으로 바다의 사용을 금지하는 보존 담론이다. 개방 담론은 최근 제시되고 있는 과학적 결과들에 의해 보존 담론에 의해 위축되고 있음이 여러 사례 지역에서 발견되고 있다.

현지 어민들과 석유 기업 사이에서 발생하는 갈등은 해상 유전 주변의 구역(버퍼 구역 500~1,000m)에서 주로 발생한다. 이 지역은 어업적으로 그리고 생태학적으로 매우 중요한 곳이며 상당한 석유 및 가스 매장량을 보유하고 있다. 한편으로 지역 어민들은 유전 주변의 비옥한 어장에 대한 장기적인 사용을 유지하고자 한다. 반면, 석유 및

가스 회사는 석유 탐사 및 생산을 유지하기 위해 동일한 해저에 대한 사용권을 얻고자 한다.

지역 어민들이 전개한 해양 공간 내 이동을 통한 생계 전략은 단기적인 대처 전략으로 해석된다. 서부 지역 어민들 사이에서는 빛과 화학 물질을 사용한 불법 및 파괴적인 어업 방법이 유행하고 있다. 어민들의 경험을 바탕으로 한 적응 전략이 중요하지만, 지속 가능하지 못하며 불법적인 방법들은 해양 어류의 재건에서 역효과를 낳고 있다.

본 논문은 지속 가능한 생계 접근과 정치생태학에서 파생된 행위자 중심 접근을 통합하였고, 이를 통해 해안의 취약성과 적응 전략을 이해하고 해양 자원의 재건에 대한 담론들을 이해하는 분석틀을 제공했다는 점에서 의의가 있다.

키워드 : 소규모 어업, 남획, 석유 시추, 지속 가능한 생계, 정치생태학, 가나
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