RESEARCH ARTICLE
eISSN 2234-1757
Fish Aquat Sci. 2024;27(11):753-768
https://doi.org/10.47853/FAS.2024.e70
FAS Fisheries and Aquatic Sciences

Effects of the closed fishing season on small-scale fisheries and coastal livelihoods in Ghana

Victor Owusu*

Department of Geography Education, University of Education, Winneba, P.O.BOX 25, WINNEBA, Ghana

Abstract

The main aim of fisheries management is to achieve sustainability of the resource. This paper investigates the potential of closed fishing season as an effective conservation measure in increasing fish stocks in Ghana. The study contributes empirically to the literature on fisheries governance and marine conservation challenges in Sub-Saharan Africa using a political ecology approach. The study utilized a mixed-methods approach, which consisted of 300 household surveys and 40 interviews with major stakeholders. The study's findings revealed no significant increase in fish production since 2016, after implementing the closed season in Ghana. The seasonal closures have further impoverished fisherfolk livelihoods through low fish catch and income. These findings suggest that implementing the temporal fishing bans alone without other management interventions would not yield positive ecological and economic outcomes. Therefore, fisheries managers must collaborate with fisherfolk, the coastal communities, NGOs, and other concerned stakeholders to achieve sustainable management of fisheries resources. The study recommends stringent enforcement of the rules and regulations concerning illegal fishing activities and the introduction of social intervention programs to ameliorate the economic hardship of fisherfolk during the closed season.

Keywords: Small-scale fisheries, Closed season, Marine sustainability, Fisheries livelihoods, Coastal Ghana

Introduction

In Africa, many countries depend on seafood for their main source of protein intake (FAO, 2022; Hasselberg et al., 2020). The fisheries and aquaculture sector employs about 58.5 million people, and about 21% are women (FAO, 2022). The small-scale fisheries (SSF) provide livelihood support and income for people living in coastal states in developing countries (Andrews et al., 2021). Globally, the SSF employs more than 40 million people and accounts for roughly 50% of the capture fisheries in developing countries (FAO & WorldFish, 2020). Most women are involved in the SSF as processors, traders, and fishers (Andrews et al., 2021). Despite the significant contribution of the fisheries to livelihoods and food security, there are concerns about the overexploitation of fisheries resources that has led to a decrease in fish production (FAO, 2022). For instance, in 2015, an estimated 60% of the reported world fish resources were harvested at maximum sustainable levels, while 33% were overexploited

Received: May 22, 2024 **Revised:** Jul 18, 2024 **Accepted:** Aug 6, 2024
***Corresponding author:** Victor Owusu
Department of Geography Education, University of Education, Winneba, P.O.BOX 25, WINNEBA, Ghana
Tel: +233-055762784, **E-mail:** vowusu@uew.edu.gh

(FAO & WorldFish, 2020). Globally, fisheries resources are declining because of illegal fishing activities involving both SSF and Industrial vessels, climate change, and competing for ocean space with oil and gas industries (Andrews et al., 2021; Nolan, 2019; Owusu et al., 2023).

The SSF contributes significantly to the national economies of countries in West Africa (Nolan, 2019). In Ghana, fisheries resources support coastal communities by providing livelihoods and income. Fish is widely consumed in Ghana, with yearly per capita consumption projected at 26 kg compared with the worldwide average of 20 kg (Asiedu et al., 2017). The fisheries sector contributed about 4.5% of Ghana's Gross Domestic Product, generating more than USD 1 billion in revenues annually (MoFAD, 2015). The sector supports the livelihoods of about 3 million people engaged directly and indirectly in the fisheries and aquaculture (Fisheries Commission, 2022). However, the nation's fisheries resources have rapidly depleted due to overfishing and mismanagement (Hasselberg et al., 2020; Lazar et al., 2020). The decline in fish production has been attributed to unreported, illegal, and unregulated (IUU) fishing by industrial and SSF (Owusu & Andriesse, 2020).

The overexploitation of fisheries resources threatens the productivity and sustainability of the fishery. In 2016, the national government introduced the closed season policy to reverse the declining fish production. The closed season was endorsed by sections 76(3) and 84 of the Fisheries Act, 2002 (Act 625) by the Fisheries Commission and Ministry of Fisheries and Aquaculture Development.

The closed season policy conforms with Ghana's Fisheries Management Plan (Marine Fisheries Sector, 2015–2019) and (2022–2026) that aims to replenish dwindling fish stocks through a reduction in overfishing and high fishing pressure (MoFAD, 2015). The closed season policy has been implemented in various countries such as Senegal, Cote Dvoire, Benin, Guinea, Mauritania, Morrocco, and the Philippines to control the overfishing of certain species and allow them to recover (Lazar et al., 2016; Napata et al., 2020; Owusu & Andriesse, 2020; Rola et al., 2018).

Ghana's Fisheries ACT 2002 (ACT 625) defines closed season as "a period during which a ban is placed on fishing activities irrespective of the type of fish, area, zones, method of capture or any parameters specified in the notice." Although the policy was promulgated in 2002, its implementation began in 2016. The temporal fishing bans encompass 228,000 km^2 of Ghana's coast's Exclusive Economic Zone (Kwadzo, 2022).

The implementation of the temporal fishing bans in developing countries is associated with several challenges, such as inadequate sensitization or awareness creation, non-involvement of fisherfolk in decision-making, non-compliance by fisherfolk, lack of alternative livelihood, and lack of enforcement (Chimba & Musuka, 2014; Owusu & Andriesse, 2020). There has been limited research on the outcome of the closed-season policy in Ghana. Existing literature has focused on the socio-economic implication of the closed season on coastal communities (Adom et al., 2019; Kwadzo, 2022; Nyavor et al., 2023; Ofori-Danson et al., 2019; Owusu & Andriesse, 2020) and compliance of the policy (Owusu et al., 2023). This paper fills the literature gap by documenting the closed-season policy's impact on marine fisheries resources and coastal livelihoods. This paper investigates the potential of closed fishing season as an effective conservation measure in increasing fish stocks in Ghana. An increase in fish stock would manifest through increased fish catch and improved living conditions of fishing households and coastal communities. This paper also investigates the political forces behind the closed-season implementation and its ramifications for fisheries' livelihoods and marine sustainability. The study contributes empirically to the literature on fisheries governance and marine conservation challenges in Sub-Saharan Africa. Using the political ecology approach, the paper seeks to show that other salient issues that influence the governance of environmental resources and consequently contribute to conservation challenges and declining SSF opportunities.

The political ecology of the closed season and marine sustainability

The main aim of fisheries management is to achieve resource sustainability. Accomplishing this requires a proactive approach, including actively seeking ways to improve the benefits derived from the resources available. Temporal fishing bans is one of the management strategies to achieve sustainability of marine resources (Lazar et al., 2016).

Closed seasons are enforced as a way of decreasing overharvesting of fish when they are most productive by giving the fish a space to lay eggs to replace the lost population due to overfishing and other natural causes (Bucaram et al., 2018; Lazar et al., 2016; Rola et al., 2018). Assuming that adequate number of fish remain to breed, the "closed season" can, by "protecting the pregnant fish," increase the stock available for fishing in just a few years (Apetorgbor, 2018; Lazar et al., 2016). The temporal fishing bans aims to contribute to effort reduction, control over-

https://doi.org/10.47853/FAS.2024.e70

fishing, and subsequently improve the socio-economic benefits of fishing households and coastal communities (Lazar et al., 2016; Macusi et al., 2022). However, as Bennett (2019) noted, the power issues are conspicuously missing from much of the fisheries literature on marine conservation and governance. Understanding power relations is vital to appreciate the mechanism that 'controls distribution benefits (access to natural resources) and burdens (impacts of environmental degradation) in a socio-ecological context' (Nolan, 2019). Through political ecology, this paper examines the opinions of different actors concerning the outcomes of the closed-season policy.

Political ecology seeks to unpack the political forces associated with environmental management (Robbins, 2011). "At the heart of political ecology research is the notion that politics should be put first to understand how human-environment nexus could be connected to the spread of environmental degradation." (Bryant, 1998). Political ecology is concerned with how unequal power relations influence the governance of environmental resources (Bryant et al., 1997; Nolan, 2019). Political ecology provides the conceptual tools for interrogating human-environment interaction and the consequences of unequal power relations for differently situated actors (Robbins, 2011). Political ecology has been a useful tool to comprehend the interaction between governance of environmental resources, poverty, conflicts, and development in Africa (Ayifli et al., 2014; Nolan, 2019; Owusu & Adjei, 2020).

This paper focuses on how unequal power relations influence fisheries' governance, specifically Ghana's closed fishing season policy. Thus, power and politics are central to analyzing political ecology. According to Bryant et al. (1997), power refers to 'the ability of an actor to control their interaction with the environment and the interaction of other actors with the environment.' Power is an important theme in political ecology in relation to the management of natural resources (Bennett, 2019; Bryant, 1998). Power relations influence the interaction and outcomes between different actors such as the state and fisherfolk (Bryant, 1997). This is because different actors have varied power and capacity over the control of environmental resources (Adjei et al., 2023; Bryant et al., 1997). Political ecology explains how narratives, knowledge, and scale are used to legitimize and shape policies in the governance of the ocean space (Bennett, 2019).

States and institutions derive their power from access to economic resources, access to knowledge, and the ability to enact legislation (Nolan, 2019). Political power may enable the state to enact regulations that control the use of environmental resources (Nolan, 2019). This can be seen in several projects, such as the establishment of no-fishing zones offshore, the creation of Marine Protected Areas (MPAs), Area closures, temporal fishing bans, and eco-tourism parks (Adjei et al., 2023; Bucaram et al., 2018; Rola et al., 2018). Power is directly associated with the use of narratives and knowledge production (Bennett, 2019). Narratives can be used deliberately to explain what account for rational or reasonable policies (Ayifli et al., 2014; Bennett, 2019). The state can use narratives to provide legitimacy to an important set of environmental policies such as marine conservation initiatives (Bennett, 2019). Powerful actors such as the state can apply power through various discourses in a particular manner that serve their interests over other actors (Ayifli et al., 2014). These discursive power dynamics reveal the causes and outcomes of conflicts and cooperation resulting from interacting among these actors (Adjei et al., 2023; Bennett, 2019). Fisherfolk often lacks the power to obtain equitable access to fisheries resources or influence management programs (Nolan, 2019). Building on the work of Owusu & Andriesse (2020), the study engaged political ecology to critically question the outcome of the closed-season policy and wider concerns of political interferences in fisheries law enforcement and regulations.

Materials and Methods

Study context

The fisheries sector in Ghana is made up of marine fisheries, inland fisheries, and aquaculture. The marine sector comprises artisanal or small-scale, semi-industrial or inshore, industrial, and tuna fisheries (MoFAD, 2016). The most important small pelagic include round sardinellas, flat sardinellas, anchovy, chub, and horse mackerels, accounting for 60%–70% of total marine fish production (Fisheries Commission, 2022). The demersal species include sea breams, red snappers, groupers, grunts, croakers, cephalopods, and shrimps, together with the large pelagic (Bigeye, Yellowfin, and Skipjack) (Fisheries Commission, 2022).

The annual landings by the artisanal sub-sector of marine fisheries accounted for about 80% of the landings in the 1990s but have declined to 61% in recent years (Lazar et al., 2020). The decline in fish production has consequences for the Ghanaian economy. Ghana is experiencing a significant increasing inequality, uncertainties in fish availability, and unsustainable fisheries management (Hasselberg et al., 2020). Demand for fish surpasses the domestic supply, and the deficit is covered by about

200,000 tons of imports (MoFAD, 2016). The total export for 2021 was 67,786.03 mt (provisional) in 2021 and 37,156.70 mt in 2020, a significant 30,629.33 mt increase. The country imported 273,382.32 mt in 2021 as against 193,226.87 mt in 2020, which saw an increase of 80,155.45 mt (Fisheries Commission, 2022). The national government is enforcing a mandatory seasonal closure for all fishing fleets to replenish depleted fish stock and rebuild fisheries livelihoods. Table 1 presents an overview of closed-season implementation in Ghana. The first closed season was implemented for the industrial vessels for a month in 2016. It was later extended to two months in 2017 and 2018. The temporal fishing ban was extended to cover the SSF and semi-industrial vessels in 2018. However, during the first year of the implementation of the closed season for the artisanal canoes in 2018, because of the limited consultations with the stakeholders, particularly local fisherfolk, and the timing of the closure, which coincided with "bumper" harvest seasons and also a period for several traditional festivals contributed to misunderstanding and resistance among local fisherfolk and community leaders. The national government was compelled to postpone the closed season to May-June 2019. However, biological studies for small pelagic carried out before and after the May-June 2019 closed season concluded that the May 15 to June 15, 2019 timing for the closed season did not coincide with the peak spawning season (MoFAD, 2022). Subsequently, the implementation of the closed season for the canoe has been changed from May to June to July (Table 1).

Table 1. Overview of the closed season in Ghana

Period of the closed season	Prohibition
November 1 to November 30, 2016	Ban on fishing for industrial vessels
February 1 to March 31, 2017	Ban on fishing for industrial vessels
January 1 to February 28, 2018	Ban on fishing for industrial vessels
May 15 to June 15, 2019	Ban on fishing for artisanal canoes & semi-industrial (inshore) vessels
July 1 to August 31, 2019	Ban on fishing for Industrial Traw Fleet
January 2020 to December, 2020	No fishing bans[1)]
July 1 to July 31, 2021	Ban on fishing for artisanal canoes & semi-industrial (inshore) vessels
July 1 to August 31, 2021	Ban on Industrial Trawl Fleet
July 1 to July 31, 2022	Ban on fishing for artisanal canoes & Semi-Industrial (inshore) Fleet
July 1 to August 31, 2022	Ban for Industrial Trawl Fleet
July 1 to July 31, 2023	Ban on fishing for artisanal canoes & Semi-industrial (inshore) fleet
July 1 to August 31, 2023	Ban on Industrial Trawl Fleet

[1)] In 2020, because of the effects of the Covid 19, fishing and its related activities were classified as essential for food and nutrition security amidst the challenges, and thus, there was no closed season for all fleets with the exception of the tuna fleet MoFAD (2022).
Data from MoFAD (2022); CITI NEWS (2019).

Three coastal districts in the Western Region were selected for this study (Fig. 1). The Western Region of Ghana, has a population of 2,060,585 million (Ghana Statistical Service, 2021). The Western Region accounts for 30 percent of Ghana's coastline, with about 20 to 30 landing sites (Finegold et al., 2010). The study areas were selected because the major economic activity is fishing and its related activities, such as processing and trading. There are also concerns about the impact of temporal fishing bans on coastal livelihoods and declining SSF opportunities.

Ahanta west municipality

Ahanta West has a total land area of 591 km^2 and a population of 153,140 (Ghana Statistical Service, 2021). Agona Nkwanta is the district capital. Fishing and other related works, such as fish processing and trading, are key economic activities, with over 60% of fisherfolk participating in the industry (CRC & FON, 2010). The main fish species that landed were the Sardines (Sardinella aurita and Sardinella maderensis). Akwidaa and Dixcove were selected in the Ahanta West District. Akwidaa is a coastal community located in the Ahanta West District of Ghana which is bordered to the West by Achona and the East by Cape 3 Points (CRC & FON, 2010) with an estimated 527 fishermen and over 90 canoes are in Akwidaa (MoFAD, 2016). Dixcove is a major fishing community with about 90% of the population employed in fishery-related work. About 1,000 fishermen with over 200 canoes support fishing activities in the community (MoFAD, 2016).

Shama district

The Shama district has a land area of 215 km^2 and has a total of 117,224 (Ghana Statistical Service, 2021). The dominant economic activities in the community include fishing, farming, mining, and trading. The fishing season begins from June to September with major fish catches, including Sardinellas, Frigate Mackerel (*Auxis thazard*), and Long-finned Herring (*Ilisha africana*). The study focused on the communities of Shama Apo and Aboadze. Approximately 948 fishermen have 195 canoes in Shama Apo (MoFAD, 2016). There are about 2,690 fishermen with over 400 canoes in Aboadze (MoFAD, 2016).

Nzema east

The district capital of Nzema East is Axim, located about 64 km

https://doi.org/10.47853/FAS.2024.e70

Fig. 1. Map showing study areas in the Western Region of Ghana.

West of the regional capital (CRC & FON, 2010). The district covers 9.8% of the total area of the Western Region, thus an area of about 2,194 km^2 with a population of 94,621 (Ghana Statistical Service, 2021; MoFAD, 2016). Fishing, fish processing, and trading are the main occupations in the district (CRC & FON, 2010). A lot of fishermen migrate to Axim to fish during the major fishing season (July- September) (CRC & FON, 2010). The main species caught are the sardinellas (MoFAD, 2016).

Data collection

The study used a mixed-method approach to investigate the impact of closed seasons on marine fisheries resources and marine sustainability. The empirical data consists of a questionnaire survey of 300 fisherfolk households and 40 interviews with stakeholders in the fisheries sector. The surveys and interviews were conducted between July and August 2023. 300 household surveys were conducted in the Shama Apo and Aboadze communities in the Shama District, Axim in the Nzema East District, and Dixcove and Akwidaa in the Ahanta West District. The individual interviews were conducted using a semi-structured interview guide. The interviews were conducted with fish processors and traders (n = 30), community leaders (n = 8), and government officials (n = 2) to obtain insights into the perceptions and experiences of different stakeholders about the impacts of the closed season. The data was gathered in the language the participants best understood after acquiring informed consent. The languages used included English, Fante, and Twi. The questionnaire and interview guide were designed in English; however, when a participant did not understand the questions, the local languages were used to clarify the questions.

The household survey covered three broad thematic areas: socio-economic and demographic information, perception of temporal fishing bans, fisheries livelihoods, and marine sustainability. The questionnaire comprised closed-ended, open-ended, and multiple-choice questions. The open-ended questions permitted the participants to freely talk about their experiences and knowledge relevant to marine conservation and other relevant issues concerning the topic under investigation. The survey lasted between 40 minutes to an hour on average per person. The major themes in the interview guide were the socio-demographic information on respondents, perception of the temporal fishing bans, and marine sustainability.

Sampling method and sample size

Purposive sampling and simple random techniques were utilized in selecting participants for the household survey and

interviews. Data on the population of fishers was sourced from the Chief fisherman to constitute the sample frame. A total of 300 fishers were engaged in the research, comprised of 100 randomly selected fishers engaged in small-scale commercial fishing from Shama, Nzema East, and Ahanta West. Fish processors, traders, community leaders, and government officials were purposively sampled. These stakeholders were considered to have the requisite knowledge and experience with fishing and other related activities in the studied communities. Purposive and simple random sampling techniques are efficient data-gathering methods in relation to fisheries livelihoods and coastal management in developing countries (Adjei et al., 2023; Owusu & Andriesse, 2020; Penny et al., 2017).

Data analysis

Excel and SPSS Version 23.0 were used to analyze the results from the household surveys. The socio-demographic characteristics of the respondents were presented in frequency tables. The perception of the impacts of the closed season on marine fisheries, income, and changes in the size and quality of fish were presented in charts. The qualitative interviews were recorded with the participants' permission and was later translated. The transcribed data was coded and arranged into relevant themes in line with the study's objectives. The author read through the transcripts several times to fully comprehend the responses given by research participants and highlighted keywords from the text that capture critical thoughts and answer the research questions. Selected excerpts from the in-depth interviews were then presented as direct quotations to illustrate key findings. Secondary data was collected from published and non-published reports, online newspaper articles, and internet sources to support the analysis of the study.

Table 2. Profile of respondents (%)

Districts	Shama	Nzema East	AWDA
Study sites	Aboadze	Axim	Dixcove
	Shama Apo		Akwidaa
Age (years)			
Below 20	0	0	0
20–39	18.5	30	39
40–59	57.7	65	53.7
Above 60	10.8	5	7.3
Average household size	5	6	6.6
Educational level			
No education	66.7	66	61
Elementary	28.6	24	29.3
Secondary	0	10	9.7
Tertiary	4.7	0	0
Marital status			
Married	76.2	88.2	85.4
Divorced	9.5	5	4.9
Single	4.8	6.8	7.3
Widowed	0		0
Monthly income (fisheries)			
0–199	0	0	0
200–399	23.8	30	44
400–599	52.4	28	45
600–799	9.5	26	2.4
More than 800	9.5	12	0
Monthly income (non-fisheries)			
0–199	7.6	5	8.3
200–399	0	9	10
400–599	4.3	0	0
600–799	0	0	0
More than 800	0	0	0

Results

Table 2 presents an overview of the selected socio-demographic profile of surveyed fishers in the study communities. The study communities in Ahanta West recorded the highest average household number, with 6.6%. Shama recorded the highest number of fishers with no formal education (66.7%). For household monthly income in fisheries, Axim recorded the most people (12%) earning more than GHS 800, followed by Shama, which had 9.5%.

Table 3 presents the results of the surveys of 300 fishermen. The majority of the fishermen had considerably longer experience in fishing. Over 70% have been fishing for over 15 years in Shama and Nzema East. In Ahanta West, 90.2% of fishermen have been fishing for over 15 years. 25% of Shama and Ahanta West fishermen claim their livelihood is worsening. The next section discusses the implications of closed-season marine fisheries sustainability and fisheries livelihoods.

Perception of the impact of the closed season on marine fisheries resources. Across all five study areas, over 80% of the respondents reported that the closed season has not increased fish production (Fig. 2). Interviews with local fisherfolk reveal that the closed season has yielded insignificant ecological outcomes as they continue to experience low catch after four years

https://doi.org/10.47853/FAS.2024.e70

Table 3. Key survey results (n = 300)

Districts	Shama	Nzema East	AWDA
Study sites	Aboadze	Axim	Dixcove
	Shama Apo		Akwidaa
Type of Fisher			
Captain	10	5	5
Canoe owner	20	30	29.3
Crew member	70	65	65.7
Duration of fishing			
Less than 5 years	4	0	0
5–10 years	6	5.5	4.3
11–15 years	20	30	4.7
Over 15 years	70	65.5	90.2
Purpose of catch			
Commercial	100	100	100
Own consumption	0	0	0
Other jobs besides fishing			
Yes	12	15	29.3
No	88	85	70.7
Did you abstain from fishing during the closed season?			
Yes	100	100	100
No	0	0	0
Livelihood situation			
Better before	4	5	5
Similar situation	60.5	55	70
Getting worse	25	35	25
Local support system for the closed season			
Yes	4.5	3	5
No	95.5	97	95

of its implementation. They believe the only positive side of the closed season is when they rest and work on their fishing gear, such as canoes and nets. Some of the fishers, however, explained that they only get good catches for a few weeks after the closed season and start to experience declining catches.

The interviews with fisherfolk in Dixcove and Akwidaa support the findings presented above; Since fishes in the sea have a breeding period, the idea was to let the fingerlings breed and grow well during the closing season. Previously, fingerlings were caught before they could mature fully; this closing season would allow them to grow. Indeed, it has been four years since this policy began. I believe that when this policy was implemented the first time in 2019, there was a great improvement in catch, but apart from that year, the second and third years have not been so good. The worst has been this particular year. We barely catch anything. Things were better when the sea was not closed. We are suffering losses, and this year has been very bad. Before the closed-season implementation, we caught between 15 and 35 trays/ pans per fishing trip. After the implementation of the closed season, the landed catch has gone down. We barely catch about ten trays/pans per fishing trip (Canoe owner and Fisher, Akwidaa, Ghana).

We were here, and they came (the government) and told us that they had done investigations and found that there are some months we do not have to go fishing. Because that is the month the fish breed and produce fingerlings, they will be caught if they are not close to the sea. The closing of the sea is not profitable. It does not change anything. The government could just let next year pass without closing it so we could see what happens. This is because since this policy began to take effect, it only worked in the first year and worsened in subsequent years (Canoe owner and Fisher, Dixcove, Ghana).

A recent study conducted by MoFAD to assess the impact of the 2022 closed season on marine fisheries resources found that catches of the canoes were higher after the closed season during August, September, and October. Their results confirm this study's findings that closed season has yet to produce a sustained increase in catch throughout most of the year. Extant literature shows that July and September correspond with the abundant harvest of small pelagic fisheries (Lazar et al., 2016). Temporal fishing bans during the peak spawning season would help to rebuild the depleted fish stocks (Lazar et al., 2016). In Ghana, studies show that the peak spawning season coincided with the major upwelling during July and August (Dovlo, 2020; Lazar et al., 2016).

Fish production data obtained from the Fisheries Commission of Ghana shows that there has not been any significant increase in the country's total marine fish production (Fig. 3). Fig. 4 also presents the annual fisheries production from 2000 to 2022 for the artisanal canoes. A similar trend is observed where landings from the canoes have remained relatively flat but have increased in recent years. The landings recorded in 2018 were the lowest since the year 2000. After 2018, there have been marginal increases in fish production from 159,726 mt in 2018 to 181,498 mt in 2020.

The political ecology of the temporal fishing bans

Responses generated from the interviews with local community

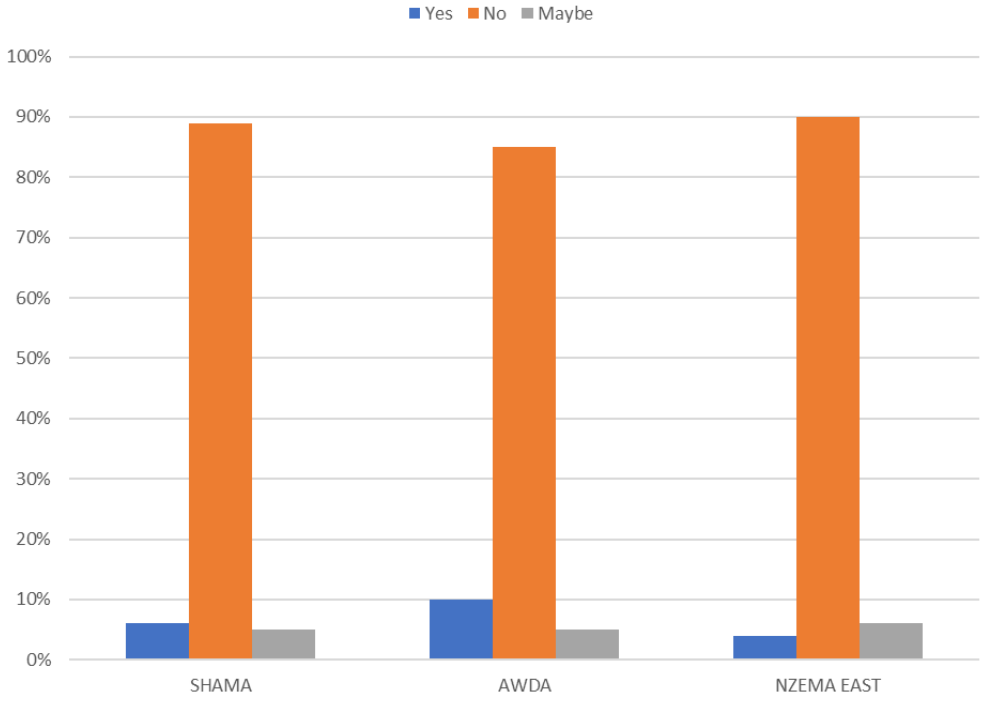

Fig. 2. Fishers' perception of whether or not a closed season has led to an increase in fish production (based on fishers' multiple-choice responses, % of fishers; n = 300).

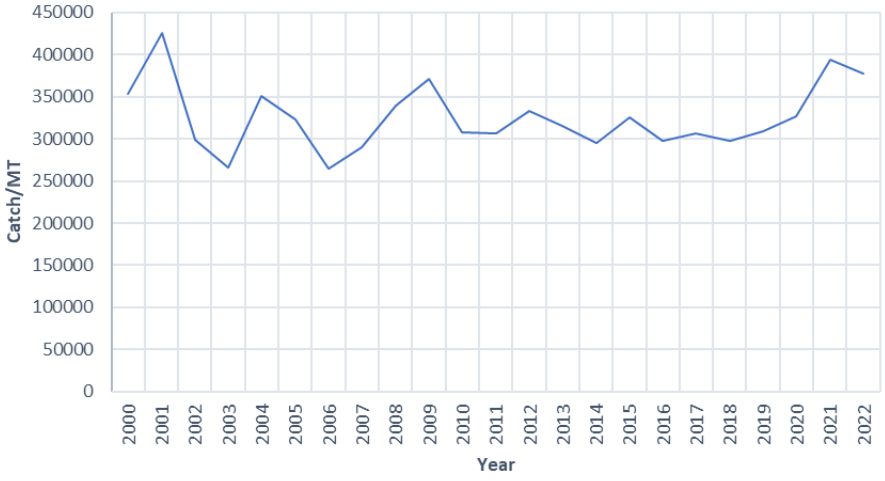

Fig. 3. Total marine fish production (all fleets) in Ghana 2000–2022 (metric tonnes). Dats from MoFAD (Unpublished, 2019, 2022).

leaders, including chief fishermen, canoe owners, fish processors traders, and fishers, revealed that illegal fishing activities, especially light fishing, eroded the benefits that could have been accrued from implementing the closed season. Light fishing involves using a light bulb connected to a wooden pole powered by a generator on board the canoe (Finegold et al., 2010). The pole connected to the light is dropped into the sea to attract the fish (Owusu & Andriesse, 2020). The challenge with light fishing operations is that most of the catch are fingerlings, and with motorized canoes, fishing could be done all year round

https://doi.org/10.47853/FAS.2024.e70

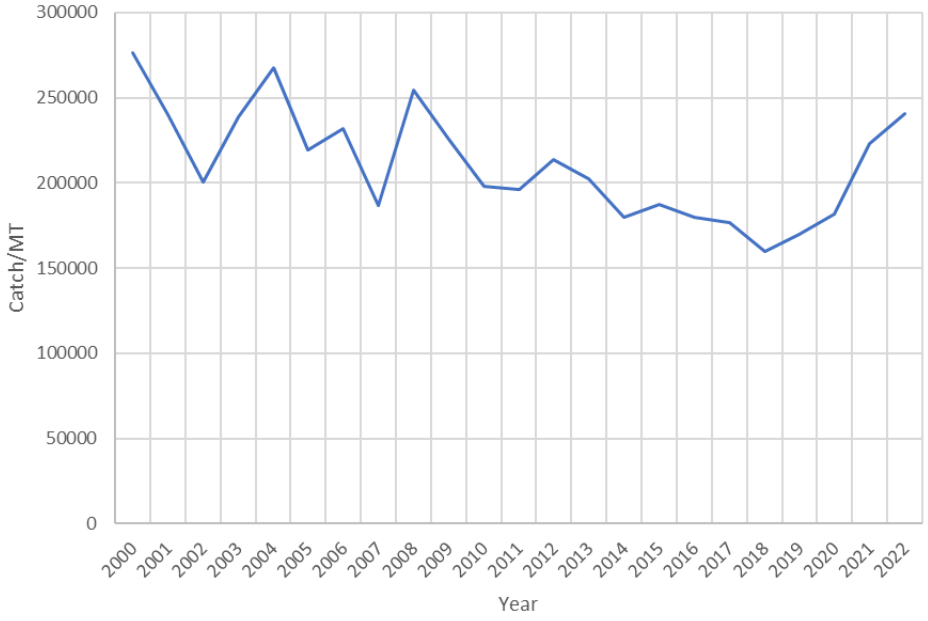

Fig. 4. Total marine fish production by artisanal canoe in Ghana 2000–2022 (metric tons). Data from MoFAD (Unpublished, 2019, 2022).

without a break (Finegold et al., 2010). Interviews with local fisherfolk reveal that light fishing is now more ubiquitous, and governments' inability to curtail the practice has undermined the ecological effectiveness of the regulation. More than 90% of respondents believe that closed fishing season implementation has not resulted in increased fish size and overall quality of fish caught (Fig. 5). They mainly attributed low fish catch and declining quality of fish landings to the intensification of light fishing operations.

The closed season does not help us to get more fish caught. After the closed season, we are supposed to get plenty of fish, but we do not get them, and it continues like that. This month is the best season for fishing, but we are still waiting to see something. When there was no light fishing, we got plenty of fish catch. They were using manpower. However, they use generators, light, and mixing gari with other chemicals for fishing. They use these methods to catch the smaller fishes. The light fishing has made things difficult for us. When there was no light fishing, we were not suffering like this. However, we believe the closed season is helpful because more fish would come without light fishing. When the closed season was not there, we were not catching some species, but right now, we catch other fish species (Canoe owner and fisher Akwidaa).

A canoe owner based in Aboadze also commented: I do not see the purpose of the closed season. They said the closed season will help fish to reproduce and increase in quantity. But the period that closed season is scheduled is when we get more fish. That is the month of July, we get more fish. The closed season will be effective if light fishing, dynamite use, and chemicals are seized in all coastal areas in Ghana. If the government has been able to implement a closed fishing season in all coastal regions, why can't they ban all illegal fishing activities, especially light fishing? Immediately after the closed season, the light fishing operation also resumes. We were told the government would use the closed season policy to seize light fishing, but it is still ongoing even before and after the closed season. Since light fishing is still ongoing, the closed season should be canceled (Community leader and canoe owner, Aboadze, Shama, Ghana).

A fish processor and trader based in Shama Apo also opined; We do not get fish like we used to. Recently, the fish have become scarce, so we mostly incur losses. When they open the sea, i.e. (after the closed season), some fish we get are big, but after three months, all the fish you will get are small. The small fishes that will grow to big ones have been caught using light fishing. I think some fishermen are also to be blamed for using fishing gears that destroy the sea. The fish caught with light are very fragile and have a short shelf life (Fish processor & trader, Shama Apo, Ghana).

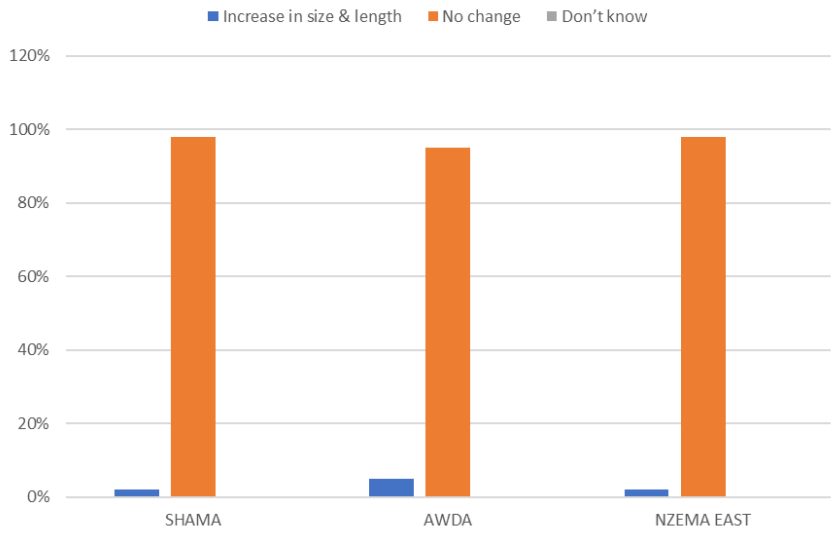

Fig. 5. Perception of fishers – whether the closed season has led to changes in the size of fish and the quality of fish caught.

The quotes above reveal issues about the state's inability to enforce the regulations on illegal fishing activities. The excerpts from the above interviews show that the government used its political mandate to tackle illegal fishing to solicit support from fisherfolk to implement the closed season. However, after the implementation of the closed season, it appears that the government has reneged on its promise to enforce the laws on illegal fishing. Interviews with district fisheries suggest that the government has not reneged on its mandate to tackle illegal fishing. They believe the government continues to do its best to reduce illegal fishing activities despite lacking financial resources and inadequate personnel to enforce the fisheries laws. They, however, agreed that the government needs to conduct a comprehensive fish stock assessment to determine the impact of the ecological and economic viability of the closed season on fisheries' livelihoods and marine sustainability.

A study conducted by Owusu & Andriesse (2020) before implementing the first closed season for the artisanal canoes argued that a closed season would only yield positive ecological and economic outcomes if regulations on illegal fishing activities were strictly enforced. Since the implementation of the closed season in 2016, the government has yet to be able to eradicate and or reduce the practices of light fishing operations. Many fishers also linked the inability of the government to curb illegal fishing to the politicization of fisheries management. Some of the fisherfolk claim some politicians are actively involved in the local fishing industry, making it very difficult for the government to enforce the laws on those engaged in illegal fishing activities. According to MoFAD (2022), political interference in fisheries enforcement and regulations and the lack of political will to implement measures are major challenges hindering fishery recovery. The next section presents the experiences of fisherfolk during the closed fishing season.

Perceived impact of the closed fishing season on fisheries livelihoods and coastal communities

The study found absolute compliance with the closed season across all the study communities (Table 2). However, the majority of fishers did not agree with the period of the fishing bans. The major reason was that July corresponds with an abundant fish catch; during this period, they can make much money. They suggested that April and May for the closed season be enforced. More than 50% of respondents reported that their livelihood situation remains unchanged despite the implementation of the closed season in 2019 (Table 2). According to interviewed fisherfolk, the fishing bans have negatively affected their income as they cannot care for their families. Fig. 6. shows that more than 80% of respondents confirm their earnings from fisheries have not changed since the implementation of the closed season.

I have been fishing for over 30 years; I joined the family fishing tradition when l was a little boy. The government promised that the closed season would allow the fish to reproduce and multiply more. However, we have observed that we were catching more fish when there was no closed season. compared

https://doi.org/10.47853/FAS.2024.e70

with after-closed-season implementation. I think the number of fish landings has decreased because of illegal fishing activities. We have not seen any benefits accrued from the closed season. I have lost more than GHS 3,000 over the past years because of the fishing bans (Canoe owner and Fisher, Axim, Ghana).

Another fisher also pointed out that: The closure of the sea has made many of us jobless, making life very difficult for us. Many of us now rely on our mothers and buyers for survival. My business capital has depleted due to the closure of the sea, which has force most of us to resort to borrowing (Fisher Aboadze, Shama, Ghana).

The declining fish catch negatively affects fishery-related businesses, such as fish processing and trading. Some interviewed fish processors and traders expressed the common view that the closed season has resulted in low fish for processing, trading, and increasing fish prices.

The government said they bring the closed season so that the fish can breed more so that we can get more fish to buy and trade. But after the closed season, we are not getting plenty of fish to buy and sell. The regulation is not helping us. The time that they close the sea is when fishermen catch plenty of fish. Even right now, people are incurring several losses in terms of fuel. They are not getting plenty of fish and are losing money on petrol purchases. We, the fish traders, are also suffering. Even the fishermen I work with have incurred a loss of about GHS 2,000 from petrol purchases. At first, they catch plenty of fish when they come, but this is no longer the case, even when they go with ice blocks (Fish trader and processor, Shama, Ghana).

Another fish trader and processor based in Akwidaa also opined; We are suffering because we do not have any job besides the fisheries work, so if it continues, it will affect us. The month the closed season starts happens when the fishermen begin to get more fish. We are in the major fishing season, but nothing even shows that we are in the major season. Before the implementation of the closed season, a tray/pan of fish costs between GHS 100 and GHS 300. However, after the closed season, the price of a tray/pan of fish has increased to between GHS 500 and GHS 800. I find it very difficult to cater to my children's education. Moreover, I mostly pay my children's fees, and as a result, they have to stay home for some time before they go back to school due to financial problems (Fish trader and processor, Akwidaa, Ghana).

Seasonal closures often result in economic hardships for fishing households because they cannot fish (Macusi et al., 2022; Owusu et al., 2023; Rola et al., 2018). During the closed season, fish availability decreases, resulting in low sales and loss of income for fish processors and traders. The uncertainties surrounding the availability of fish have compelled some people to exit the local fishery industry. According to the 2022 national canoe survey, fishermen in the Western Region decreased from 33,602 to 28,676. Table 2 shows that over 95% of surveyed fisherfolk do not support the closed season, citing various reasons such as the lack of political will to enforce the laws on illegal fishing and the economic hardship they experience during the closure of the sea. According to the medium-term plan of the MoFAD (2022-2025), the closed season will be implemented

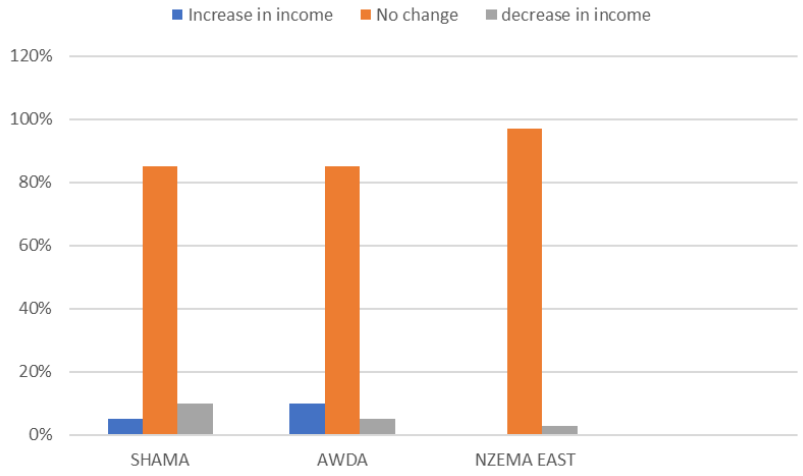

Fig. 6. Fishers' perception of whether or not a closed season has led to an increase in income (based on fishers' multiple-choice responses, % of fishers; n = 300).

throughout 2024 to 2025 despite the challenges associated with the policy. However, the major opposition party in the country has hinted that they will cancel the closed-season policy for the artisanal fisheries sector if they win power in 2024 (Joy News, 2023). The opposition party stated that the closed season will only be enforced for the industrial vessels because the industrial vessels are the ones breaking the Ghanaian fisheries laws (Joy News, 2023). In Ghana, opposition political parties have garnered political support to win political power based on certain promises made to coastal communities concerning improving or maintaining fisheries' subsidies on premix (Tanner et al., 2014).

Discussion

This paper investigates the impact of the seasonal closures on marine fisheries resources and livelihoods. The paper examines whether or not the closed season has led to an increase in fish stock. The study also interrogated the political forces behind the closed-season implementation and its ramifications on fisheries' livelihoods and marine sustainability. The empirical results from the household survey and interviews show that there is no significant increase in fish production after four years of implementation of the closed season for the artisanal sector. The results from data obtained by the Fisheries Commission (FC) from 2000 to 2022 confirm no significant increase in total marine fish production in the country.

Across all the study areas, the perception of the impacts of the fishing bans on marine fisheries' resources was mostly negative because of the persistence of illegal fishing activities, especially light fishing operations. The results from the study show that light fishing activities have a negative implication on fisheries' livelihoods and marine sustainability. A study conducted by Agyekum (2016) found that light fishing operation persists because of the small penalties, poor enforcement for law-breakers, and the need for alternative livelihood opportunities for fishers. Temporal fishing bans during the breeding period do not increase the reproductive output of the population and have minimal effects on yield if the total yearly fishing effort remains the same (Arendse et al., 2007). Temporal fishing bans can be ineffective if the subsequent effort to this ban increases as fishermen prepare to intensify fishing during the open season (Lazar et al., 2016).

Extant literature shows that seasonal closure in multi-species fisheries, like Ghana, does not always lead to increased production (Napata et al., 2020). Napata et al. (2020) found that the implementation of the closed-season policy alone in the Visayan Sea have not been effective in achieving its objective of protecting and increasing sardine stocks. The ineffectiveness of the regulations was attributed to poor management and enforcement of the closed season. On the other hand, Rola et al. (2018) assessed the impact of the closed-season policy on sardines in the Zamboanga Peninsula in the Philippines. The authors reported that the closed season results in an increase in landed catch of sardines after the policy implementation. There was also an increase in the catch of high-value non-sardine species and the income of fishing crews. The closed season imposed on sardines in the Zamboanga Peninsula yielded positive ecological and economic outcomes (Napata et al., 2020). However, despite the closed season being implemented since 2016, Ghana has had no significant spillover effects on artisanal fish production. Thus, the closed season has a minimal impact on the replenishing of fish stocks of the SSF.

The results in Table 3 reveal that most fisherfolk surveyed do not support the closed season because of a perceived lack of ecological effectiveness and political will to enforce the regulations on illegal fishing. The study results show high asymmetrical power relations between the state, local fishers, and coastal communities. With its enormous political and economic power, the state can control access to coastal waters by implementing a closed season. However, local coastal fisherfolk also have agency as they can influence the closure timing from August to May-June, even though the government later reverted the policy to July. Fisherfolk also exercises power by adopting illegal fishing activities to offset the economic challenges of closed seasons.

After four years of closed-season implementation, the opinions of fishers, local leaders, fish processors, and traders were mostly negative because of the loss of income and deteriorating livelihood conditions. The results from the study reveal that the seasonal closures have further impoverished fisherfolk livelihoods through low-income and low-catch fish. Even though the temporal fishing ban aims to replenish depleted fish stock, its implementation imposes socio-economic hardships on fishing households, considering that fishing is their primary source of income and food (Macusi et al., 2022; Owusu & Andriesse, 2020). The temporal fishing bans can cause financial burdens to fisherfolk due to no fishing activity resulting in loss of income (Kwadzo, 2022). Chimba & Musuka (2014) examined the impact of the seasonal closures on livelihood of fisherfolk in Zambia. The authors found that most fishers were negatively impacted by the closed fishing season due to no fishing. Their

https://doi.org/10.47853/FAS.2024.e70

study further revealed that most fisherfolk perceive fishing as an important occupation that provided their main source of income to keep their families well, bearing in mind that there were no viable alternate livelihood activities.

The findings from this study show that it is important to implement other interventions together with the closed fishing season policy that will reduce fishing efforts before and after the closure. This study provides two implications for SSF-related policies in coastal Ghana: Strict enforcement of the laws on illegal fishing activities and the introduction of social intervention programs to ameliorate the economic hardship of fisherfolk during the closed season. The government and concerned stakeholders must enforce regulations effectively to curb illegal fishing activities, especially light fishing operations. Failure by the government to enforce laws on light fishing, including mesh size control, dynamites, and chemicals, could render the closed-season policy ineffective in protecting and conserving small pelagic fish stocks. As part of government efforts to curb illegal fishing activities, the Ministry of Fisheries and Aquaculture Development could empower the chief fishers, chief fish processors and traders, and local chiefs to enforce the regulations in collaboration with higher levels of government. These local leaders can enact by-laws concerning how those caught using illegal gear should be punished (Owusu & Andriesse, 2020).

To reduce the economic hardship experienced by fisherfolk and coastal fishing communities during the closed season, the study calls on the government and other concerned stakeholders to introduce supplementary livelihoods and social intervention programs. The provision of supplementary livelihoods could improve fisherfolk's income and well-being. Fisherfolk could be trained in carpentry, masonry, dressmaking, hairdressing, livestock rearing, and plumbing. The study recommends aquaculture training for coastal fishing communities. The training on best practices in small-scale scale-aquaculture will be relevant to fisherfolk in the coastal communities. Especially those directly connected to the fishing industry. To avoid the double dilemma of not getting any fish to trade in and not being able to fish either, this will help relieve economic pressure during the lean fishing season and disruption in marine fishing due to the closed season. Farmed fish can be sold for profit and financial cushion during the period. In addition, the government could extend other social intervention programs such as school feeding and the Livelihood Empowerment Against Poverty (LEAP) to offset the socio-economic impact of the closed seasons (Lazar et al., 2020). In Ghana, the government distribution of food items to fisherfolk during the closed season is limited to canoe owners and fishermen (Nyarvor et al., 2023). The government could extend the distribution of food items to women who work in the fishery as fish mongers, processors and traders during the closed season. The government can also introduce interest-free loans to support fisherfolk to engage in small businesses like cold store and farming. During the closed season most women find it difficult to support their families, having access to interest-free loans could help them buy fish from other places to sell. The interest-free loans could also help fisherfolk engage in cultivation of food crops to mitigate the effects of the closed season. This interest free loans can improve the financial conditions of fishing households during the closed season.

Conclusion

This paper investigated the perception of fisherfolk concerning the impact of a closed season on marine fishery resources and fisheries livelihoods in coastal Ghana. The findings show that there has been no significant increase in fish production after the continued closure of the sea for the past eight years for industrial trawlers and four years for artisanal canoes and semi-industrial/inshore vessels. The results from the study also revealed that the seasonal closures have further impoverished fisherfolk livelihoods through low-catch fish and low income. These findings suggest that implementing the temporal fishing bans alone without other management interventions would not yield positive ecological and economic outcomes. Therefore, fisheries managers must collaborate with fisherfolk, the coastal communities, NGOs, and other concerned stakeholders to achieve sustainable management of fisheries resources. When conservation measures fail to protect and conserve stocks, it is important to consider reviewing the policy (Napata et al., 2020). Temporal fishing bans may be complemented with additional measures such as gear restrictions, MPAs, fishing quotas, fishing vessel licensing, and regulations if the fishing bans alone are ineffective (Lazar et al., 2016; Rola et al., 2018). Finally, future studies can examine the impact of the closed season on marine resources by conducting quantitative analysis using biological and economic parameters. This will help improve the outcomes of conservation policies.

Competing interests

No potential conflict of interest relevant to this article was reported.

Funding sources
Not applicable.

Acknowledgements
The author wishes to thank the anonymous reviewers for their valuable comments which helped to improve the manuscript. I am also grateful to the research assistants and research participants for their support and contribution to this research.

Availability of data and materials
Upon reasonable request, the datasets of this study can be made available by the corresponding author.

Ethics approval and consent to participate
Approval is obtained from the Ethical Review Board (ERB) of the author/s institution. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. All participants and their legal guardians provided written informed consent before the Interviews.

ORCID
Victor Owusu https://orcid.org/0009-0004-4801-0985

References

Adjei M, Owusu V, Essien RS. The role of socioeconomic factors, psychological motivations, and social networks in women's participation in community-based fishery management in Ghana. Coast Manag. 2023;51:211-30.

Adom D, Sekyere PA, Yarney L. A return to the Ghanaian cultural values of closed fishing season in Ghana's artisanal marine fishing: an essential means of restoring small pelagic fish stocks. Transylv Rev Syst Ecol Res. 2019;21:95-110.

Agyekum GA. Light fishing operations in small-scale fishing in Ghana: a case study of the Chorkor and Teshie–Nungua fishing communities in the Greater Accra Region of Ghana [M.S. thesis]. Tromsø: Arctic University of Norway; 2016.

Andrews N, Bennett NJ, Billon PL, Green SJ, Cisneros-Montemayor AM, Amongin S, et al. Oil, fisheries and coastal communities: a review of impacts on the environment, livelihoods, space and governance. Energy Res Soc Sci. 2021;75:102009.

Apetorgbor S. Closed season brief. The USAID/Ghana sustainable fisheries management project (SFMP). Narragansett, RI: University of Rhode Island; 2018. p. 10.

Arendse CJ, Govender A, Branch GM. Are closed fishing seasons an effective means of increasing reproductive output?: a per-recruit simulation using the limpet *Cymbula Granatina* as a case history. Fish Res. 2007;85:93-100.

Asiedu B, Nunoo FKE, Iddrisu S, Yildiz F. Prospects and sustainability of aquaculture development in Ghana, West Africa. Cogent Food Agric. 2017;3:1349531.

Ayifli FK, Adom-Opare KB, Kerekang T. Community perspectives on the impacts of oil and gas activities in Ghana: a closer look and analysis of fishery livelihoods within six coastal districts. In: 5th European Conference on African Studies: African Dynamics in a Multipolar World; 2014; Lisbon, Portugal.

Bennett NJ. In political seas: engaging with political ecology in the ocean and coastal environment. Coast Manag. 2019;47:67-87.

Bryant RL. Beyond the impasse: the power of political ecology in Third World environmental research. Area. 1997;29:5-19.

Bryant RL. Power, knowledge and political ecology in the third world: a review. Prog Phys Geogr Earth Environ. 1998;22:79-94.

Bucaram SJ, Hearn A, Trujillo AM, Rentería W, Bustamante RH, Morán G, et al. Assessing fishing effects inside and outside an MPA: the impact of the Galapagos Marine Reserve on the industrial pelagic tuna fisheries during the first decade of operation. Mar Policy. 2018;87:212-25.

Chimba N, Musuka CG. Impact of closed fishing season on the livelihood of fishers: a case of Stratum I of Kafue fishery. Int J Life Sci Res. 2014;2:49-62.

CITI NEWS. Sustaining gains of closed fishing season [Internet]. 2019. [Cited 2023 Oct 12]. https://citinewsroom.com/2019/09/godfrey-baidoo-tsibu-writes-sustaining-gains-of-closed-fishing-season

Coastal Resources Center/Friends of the Nation [CRC & FON]. Report on characterization of coastal communities and shoreline environments in the Western Region of Ghana. Integrated Coastal and Fisheries Governance Initiative for the Western Region of Ghana. Narragansett, RI: University of Rhode Island; 2010.

Dovlo EK. Catch trends of artisanal fisheries in Ghana, West Africa. Acta Sci Agric. 2020;4:01-4.

Food and Agriculture Organization of the United Nations [FAO]. The state of world fisheries and aquaculture 2022. Towards Blue Transformation. Rome: FAO; 2022.

https://doi.org/10.47853/FAS.2024.e70

FAO and WorldFish. Information and communication technologies for small-scale fisheries (ICT4SSF): a handbook for fisheries stakeholders: in support of implementation of the voluntary guidelines for securing sustainable small-scale fisheries in the context of food security and poverty eradication. Bangkok: FAO; 2020.

Finegold C, Gordon A, Mills D, Curtis L, Pulis A. Western region fisheries sector review. Ghana: USAID Integrated Coastal and Fisheries Governance Initiative for the Western Region; 2010.

Fisheries Commission [FC]. Annual performance report. Ministry of Fisheries and Aquaculture Development. Accra: Ministry of Fisheries and Aquaculture Development; 2022.

Ghana Statistical Service. Ghana 2021 population and housing census; general report volume 3A [Internet]. Population of Districts and Regions. 2021 [cited 2023 Oct 15]. Population of Districts and Regions https://statsghana.gov.gh/gssmain/fileUpload/pressrelease/2021%20PHC%20General%20Report%20Vol%203A_Population%20of%20Regions%20and%20Districts_181121.pdf

Hasselberg AE, Aakre I, Scholtens J, Overå R, Kolding J, Bank MS, et al. Fish for food and nutrition security in Ghana: challenges and opportunities. Glob Food Secur. 2020;26:100380.

Joy News. No 'Closed Season' for artisanal fishers if NDC wins power in 2024–Mahama [Internet]. 2023 [Cited 2023 Oct 30]. https://www.myjoyonline.com/no-closed-season-for-artisanal-fishers-if-ndc-wins-power-in-2024-mahama/

Kwadzo M. Effects of the closed fishing season on the livelihood of fisheries workers: a case study of fisheries workers in Elmina in the Central Region of Ghana. World J Agric Res. 2022;10:102-10.

Lazar N, Yankson K, Blay J, Ofori-Danson P, Markwei P, Agbogah K, et al. Sustainable Fisheries Management Project (SFMP): rebuilding depleted small pelagic stocks in Ghana. Closed fishing season proposal to the Ministry of Fisheries and Aquaculture Development. Narragansett, RI: University of Rhode Island; 2016.

Lazar N, Yankson K, Blay J, Ofori-Danson P, Markwei P, Agbogah K, et al. Sustainable Fisheries Management Project (SFMP): status of the small pelagic stocks in Ghana in 2019. Narragansett, RI: University of Rhode Island; 2020.

Ministry of Fisheries and Aquaculture Development [MoFAD]. Fisheries management plan of Ghana: a national policy for managing the marine fisheries sector 2015–2019 [Internet]. 2015 [cited 2024 Feb 4]. https://faolex.fao.org/docs/pdf/gha160291.pdf

Ministry of Fisheries and Aquaculture Development [MoFAD]. Information report no. 35: Ghana marine canoe frame survey [Internet]. Fisheries Scientific Survey Division, Fisheries Commission, Ghana. 2016 [cited 2024 Feb 4]. https://www.crc.uri.edu/download/Ghana-Marine-Canoe-Frame-Survey-2013.pdf

Ministry of Fisheries and Aquaculture Development [MoFAD]. Fisheries management plan 2022–2026. Accra, Ghana: MoFAD; 2022.

Macusi ED, Rafon JKA, Macusi ES. Impact of COVID-19 and closed fishing season on commercial fishers of Davao Gulf, Mindanao, Philippines. Ocean Coast Manag. 2022;217:105997.

Nolan C. Power and access issues in Ghana's coastal fisheries: a political ecology of a closing commodity frontier. Mar Policy. 2019;108:103621.

Nyavor S, Amposah S, Owusu V, Boateng KJ. Compensation payment for fisherfolk during closed-season fishing: lessons from small-scale fisherfolk in Ghana. Cogent Soc Sci. 2023;9:2282502.

Napata RP, Espectato LN, Serofia GD. Closed season policy in Visayan Sea, Philippines: a second look. Ocean Coast Manag. 2020;187:105115.

Ofori-Danson PK, Asiedu B, Amponsah SKK, Crawford B. Assessment of the socio-economic, food security and nutrition impacts of the 2019 Canoe fishery closed fishing season in Ghana. USAID/Ghana Sustainable Fisheries Management Project. Narragansett, RI: University of Rhode Island; 2019.

Owusu V, Andriesse E. From open access regime to closed fishing season: lessons from small-scale coastal fisheries in the Western Region of Ghana. Mar Policy. 2020;121:104162.

Owusu V, Adu-Boahen K, Kyeremeh S, Demalie I, Eshun P. Factors influencing compliance of closed fishing season: lessons from small-scale coastal fisheries in the Central Region of Ghana. Humanit Soc Sci Commun. 2023;10:20.

Penney R, Wilson G, Rodwell L. Managing sino-ghanaian fishery relations: a political ecology approach. Mar Policy. 2017;79:46-53.

Robbins P. Political ecology: a critical introduction. Hoboken, NJ: John Wiley & Sons; 2011.

Rola AC, Narvaez TA, Naguit MRA, Elazegui DD, Brillo BBC, Paunlagui MM, et al. Impact of the closed fishing season

policy for sardines in Zamboanga Peninsula, Philippines. Mar Policy. 2018;87:40-50.
Tanner T, Mensah A, Lawson ET, Gordon C, Godfrey-Wood R, Cannon T. Political economy of climate compatible development: artisanal fisheries and climate change in Ghana. IDS Work Pap. 2014;2014:1-30.

https://doi.org/10.47853/FAS.2024.e70