Reverse Tullip Education

Through the Lens of Fisherfolks: Understanding Shark Fishing in Ghana for Management and Conservation Purposes

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Abstract

Shark fishing has been practiced in Ghana for decades, with shifting characteristics that have impacted the population of dependent fish species. As a result, the research focuses on shark fishing activities in Ghana from the standpoint of fishermen. From March to May 2021, 86 shark fishermen were interviewed using semi-structured interview guides at four landing sites; Apam, Dixcove, Tema, and Axim. According to the study, Tema, Axim, and Dixcove were the most productive sharking fishing sites, whereas Ivory Coast and Togo were the most visited international fishing communities by Ghana shark fisherfolks. Overall, 9 species were identified, with *C. carcharius* being the most prominent, and Sphyrna spp. and C. leucas having the highest rate of population decline. Dolphin, Sardinella, and tuna were the most commonly used live bait in all sampling locations, which has significant implications for food security and global dolphin conservation. According to the study, the population of these live bait is currently in decline, necessitating the development of alternative bait for sustainable shark fishing. Again, adopting a species-specific conservation action plan through consultation techniques, community awareness programs, and enforcement of conservation measures is critical to protecting shark species in decline.

Keywords: shark-fin trade, management, conservation, sharks, endangered species

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INTRODUCTION

Ghana is a major elasmobranch fishing nation in the West African sub-region which represents a key source of employment, providing both sustenance and income for many of the poorest Ghanaian coastal communities (Seidu et al. 2022). Shark meat serves as a cheap source of protein to most artisanal coastal fishing communities in Ghana (Duvly et al. 2017). Fishermen, especially those residing along the West Coast of Ghana, have recently resorted to targeting sharks in their quest to cope with the continuous decline of small pelagic fish (e.g. sardines, chub mackerels and sardines) as well as large pelagic species (e.g. tuna, skipjacks). Anecdotal evidence shows a higher income value attached to sharks compared to small and large pelagic species such as sardines and tuna, the reason being that sharks provide a double benefit in terms of both their fins and meat being sellable (Seidu et al. 2022). The high value of sharks in terms of monetary worth has become a source of motivation for fishermen who have been overexploiting shark species off the Western Coast of Ghana (Berchie et al. 2024). These activities of Ghanaian fishermen are not contributing to the conservation of sharks; instead, they are causing the overexploitation of shark species in the area (Amponsah et al. 2023). This article aims to assess the current fishing practices of artisanal fishermen with regard to sharks from the perspective fisherfolk. This will provide vital data for the creation of a national conservation strategy aimed at ensuring the sustainable the exploitation of sharks. Moreover, the scientific knowledge obtained from this study will initiate dialogue among major stakeholders in Ghana, regarding the protection of these endangered species.

MATERIALS AND METHODS

Study area

The research was carried out in four (4) coastal communities in Ghana, namely Tema in the Greater Accra Region, Apam in the Central Region, Dixcove and Axim in the Western Region of Ghana. These communities are known for their high prevalence of shark fishing activities (Figure 1). Fisherfolks in these communities use various fishing gears such as pursing nets, line, ali nets, drifting nets, and set nets (Dovlo et al. 2016).

Data collection

Eighty-six (86) fishermen were given a closed and opened semi-structured questionnaire specifically prepared for this study, with assistance from a local

facilitator. Purposive random sampling wdid as utilized in each of the sample communities to choose study participants. Respondents had to meet two requirements to be considered for inclusion: (i) shark fisherfolks, and (ii) at least 20 years old. In the various sampling villages, key informants were also contacted and interviewed, including Chief Fishermen and Fisheries Technical Officers. From March 2021 to May 2021, early in the morning, during the active hours of 6:30 am to 11 am, interviews were conducted at each of the four landing sites. Local facilitators were used in areas where language was seen as a barrier to effective interview.

Data analysis

The study data was processed using the Statistical Package for Social Sciences (SPSS) software, version 26. Before any analysis, the data was validated for normality using the Anderson-Darling test, as recommended by Zar (2010). To determine whether there were any significant connections between categorical factors in the sampling community, such as gender, years of education, fishing in foreign waters, awareness of management measures, and others, chi-square contingency tests were employed. The qualitative data were entered into an Excel spreadsheet, and basic descriptive statistical analysis was conducted. The results were then presented as tables and figures.
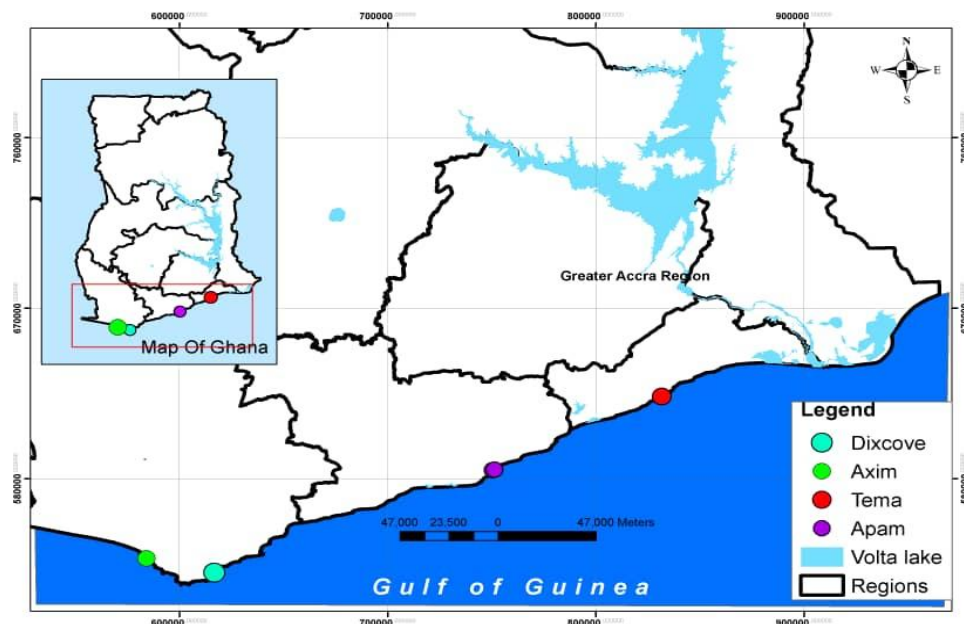

Fig 1. Map showing the study sites

RESULTS

The majority of the respondents (50 out of 86 respondents) indicated that they fish in coastal waters aside from their natal waters while a few (36 out of 36 respondents) mostly fish in their natal waters (Table 1). More than half of the respondents (64 out 86 respondents) affirmed the use of live bait in their fishing activities while a few (22 out of 86 respondents) reported retrospectively (Table 1). Unfortunately, many of the respondents reported that the population of the live baits (e.g. dolphin, tuna, and sardines) used in shark fishing is gradually declining (Table 1).

Table 1: Characteristics of shark fishing in Ghana

Variables		Number	Value	df	Asymptotic Significance (2-sided)
Do you fish in non-natal waters	Yes	50	67.483	3	< 0.001
	No	36			
Status of live bait population (declining)	Yes	64	25.081	3	< 0.001
	No	22			

Eleven internal marine waters were recorded as shark fishing grounds within the Ghanaian waters (Figure 2). Of the eleven internal coastal waters, Dixcove, Tema, and Apam were the main fishing grounds for sharks, accounting for 72% of the responses (Figure 2). Six (6) international marine waters were reported by respondents as fishing grounds for sharks (Figure 3) with Ivory Coast and Togo (i.e. 91%) as the main foreign marine waters for shark fishing by Ghanaian fishers. The remaining international fishing grounds for sharks included Benin, Guinea, Liberia and Nigeria.
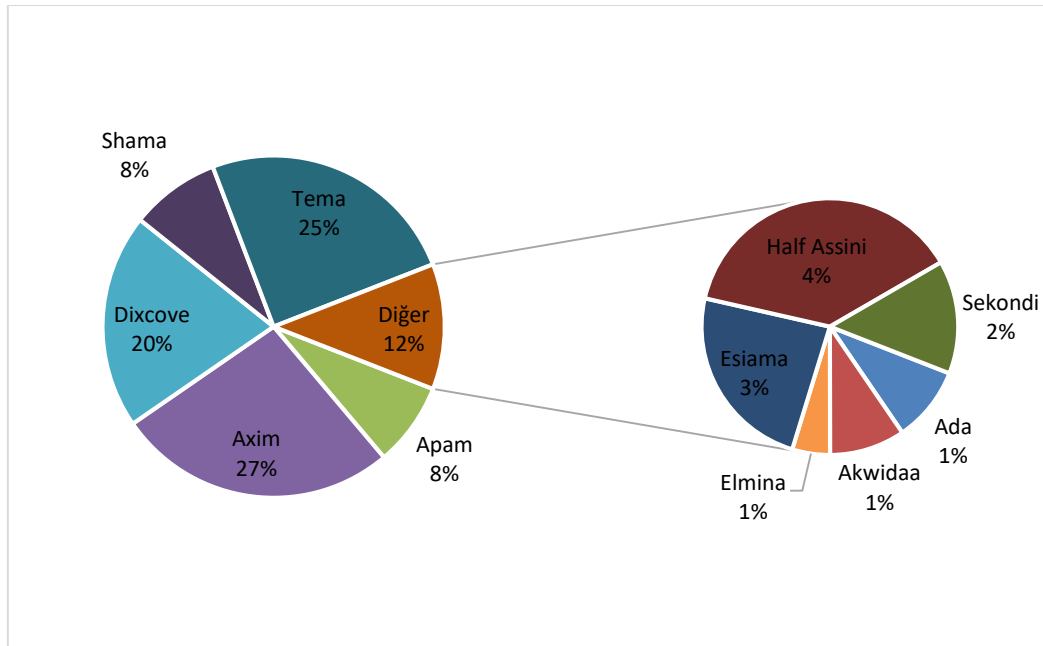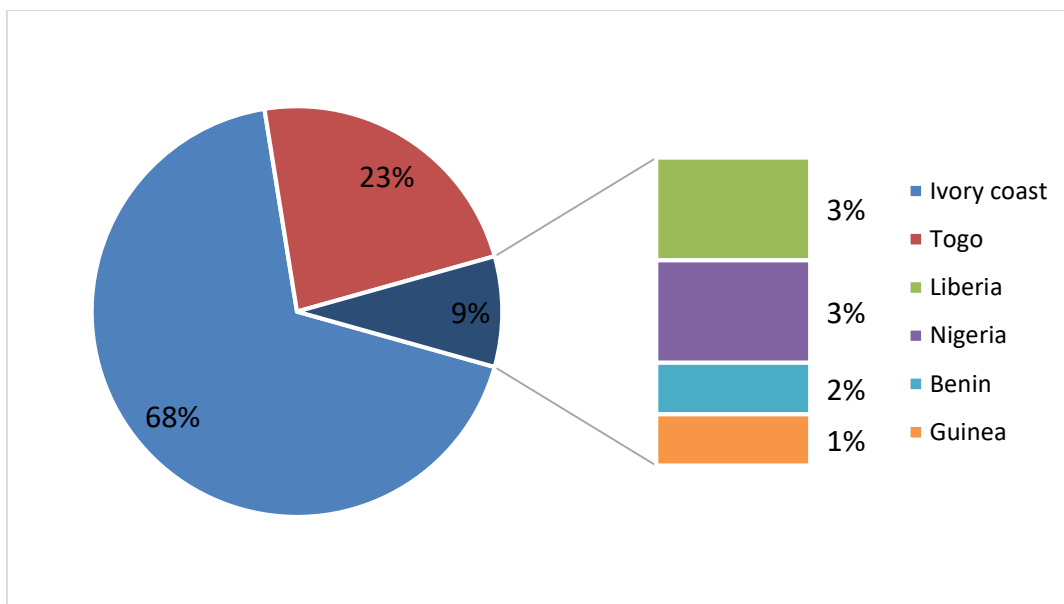
Figure 2. Fishing grounds for sharks in Ghana

Figure 3. Fishing grounds for sharks in foreign waters

Nine (9) shark species were recorded from the study with *Carcharodon carcharias* (26.1 %) and *Sphyrna spp.* (21.8 %) as the dominant shark species (Figure 4). The remaining species identified from the study were *Alopias spp., Carcharhinus leucas, Prionace gluaca, Carcharias taurus, Galeocerdo curvier, Rhizoprionodon actus,* and *Isurus oxyrinchus*. All the shark species except *I. oxyrincuhs* were found in Dixcove and Axim (Figure 5). *C. carcharius, Sphyrna sp., Aliopas spp.*, and *C. leucas* were common in all four sampling locations (Figure 5). *I. oxyrinchus* was found in only Tema.

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Chi-square analysis revealed significant difference in shark species landed in all the four study locations (X^2 = 53.4, df = 3, p-value < 0.001).
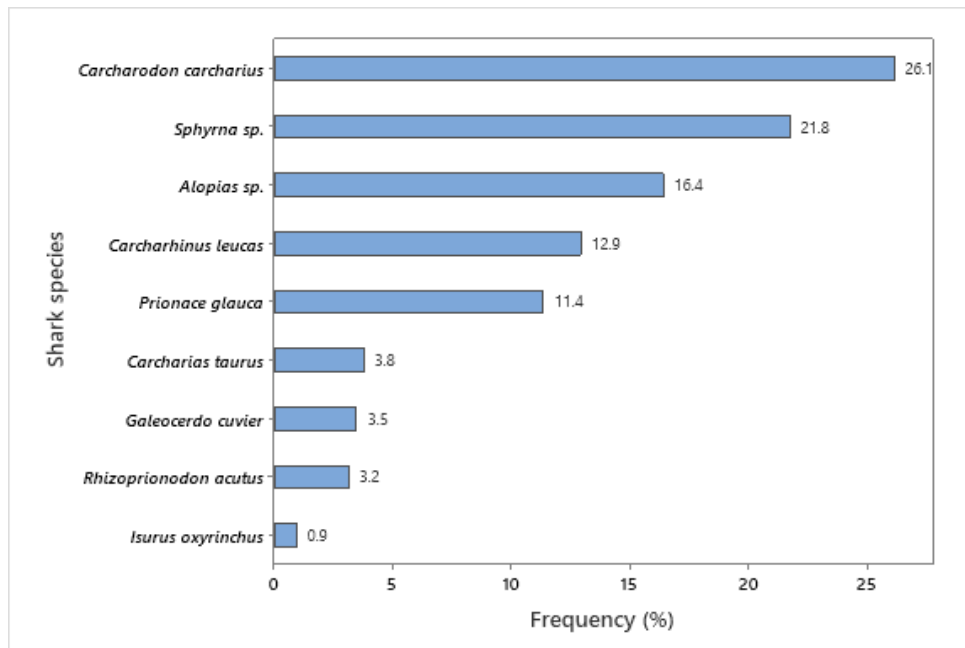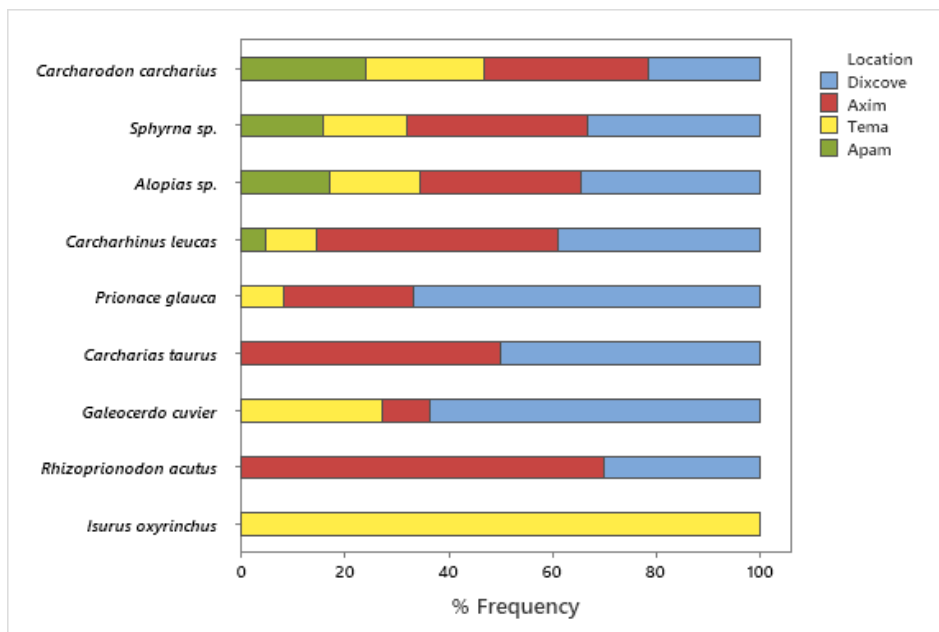

Figure 4. Types of shark species

Figure 5. Shark species identified per sampling locations

Four (4) shark species including *Sphyrna spp., C. leucas, C. carcharis,* and *Alopias spp* were reported to be experiencing a drastic decline in their population (Figure 6) with *Sphyrna sp.* (64%) as the species with the most prominent population decline (Figure 6).
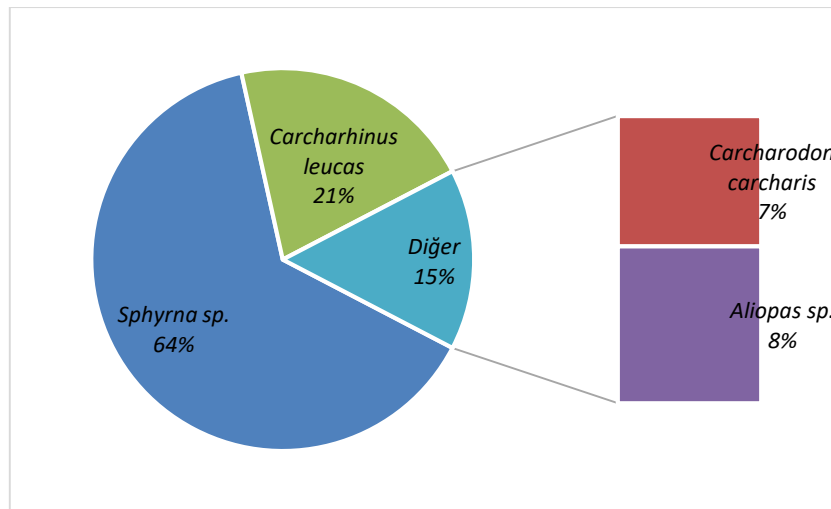
Figure 6. Shark species with declining population status

Per location, all four shark species with a drastic population decline were reported by respondents in Dixcove while in Axim, only *Sphyna sp.* and *C. leucas* were reported to be the only shark species with declined population. In Tema, respondents indicated that *Alopias sp.* was the only species with a population reduction. However, the absence of response from Apam could suggest that these fishermen are migrant shark fishers roving from community to community without recourse to any species with a population declining status (Figure 7). Chi-square analysis showed that significant difference among these species between the sampling communities ($X^2 = 29.01$, df = 3, p-value < 0.001).
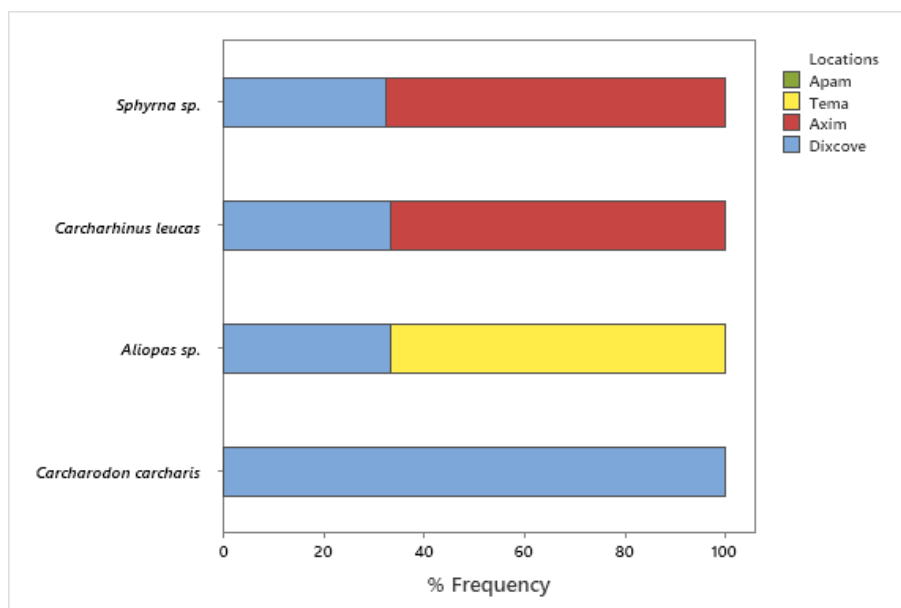

Figure 7. Shark species with declining population status based on locations

Factors reported by respondents to be responsible for the observed decline in population of these sharks' species were high number of canoes (40 %), seasonality (19 %), and Illegal unreported and unregulated fishing (IUU) practices (11 %) as shown in Figure 8. Concerning location, these outlined factors driving the decline of shark species were prominent in both Axim and Dixcove decline in prey item (feed item) which was only cited in Axim. For Tema, high number of fishing canoes was the only cited factor driving the decline in shark species populations (Figure 9). Chi-square analysis showed that significant difference among these species between the sampling communities (X^2 = 51.2, df = 2 p-value < 0.001).
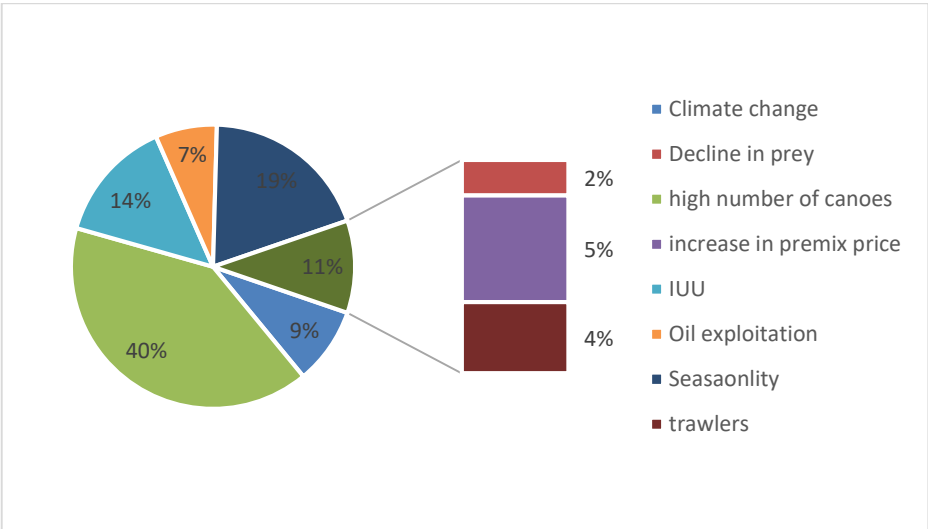

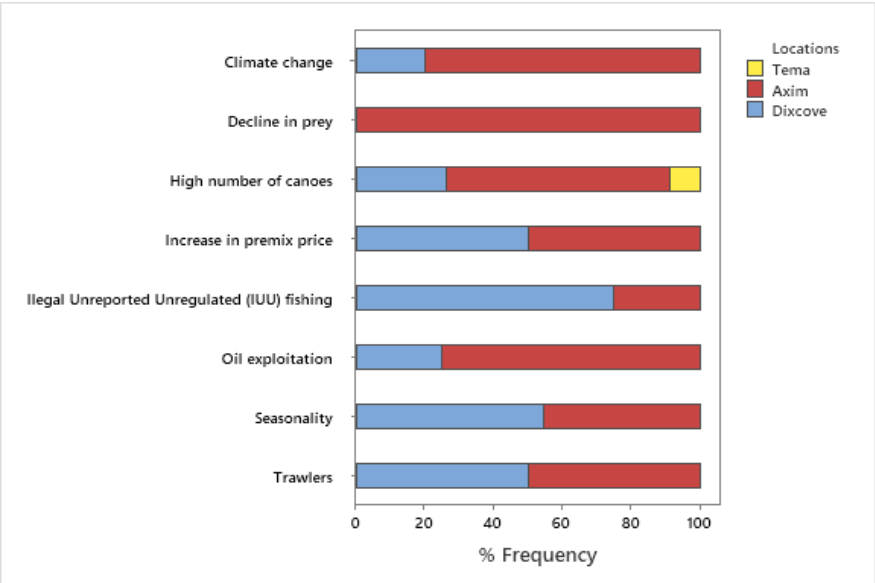**Figure 8. Factors influencing the declining of shark species**

Figure 9. Factors driving the decline in shark population based on sampling locations

Respondents indicated that August to September is the period of landing a high number of shark species while May and November were the period of low abundance of shark landings at the various sampling locations (Figure 10). Mann Whitney test suggested no significant difference in responses for periods of high and low abundance of shark species (Mann-Whitney Test, W = 129.50, p-value = 0.248).
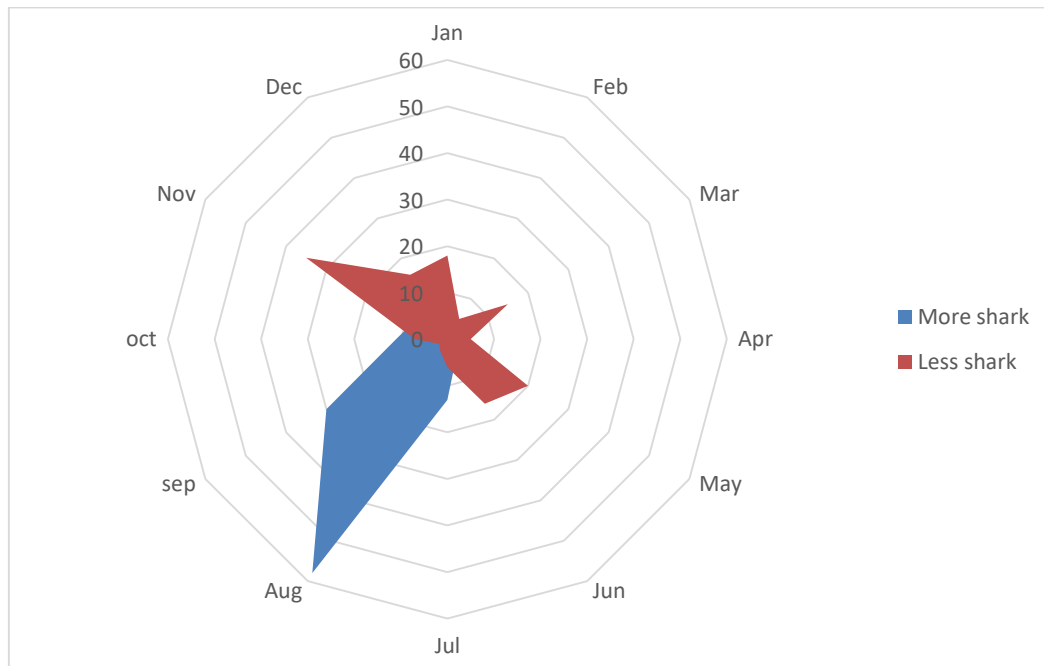

Figure 10. Period of abundance of shark landings in sampling communities

Eight (8) live baits were reported by respondents from the various sampling sites (Figure 11). from the eight live baits provided, Dolphins and tuna were the most used species. Pork and *Dactylopterus spp.* were the least used live baits. The remaining live baits were octopus, beef, pork, *Scomberomoras spp.,* and Sardinella sp. (Figure 11). From Figure 11, dolphin and tuna species were the only live bait commonly used by fishermen in all the sampling locations. Dactylopterus sp. and octopus were mostly used in Axim Landing Beach. Beef, *Sardinella spp.,* and *Scomberomoras spp.* were applied as live baits in only Axim and Dixcove whereas pork was used by fishermen in only Dixcove (Figure 12). Chi-square analysis showed that significant difference among these species between the sampling communities (X^2= 19.7, df = 3, p-value < 0.001).
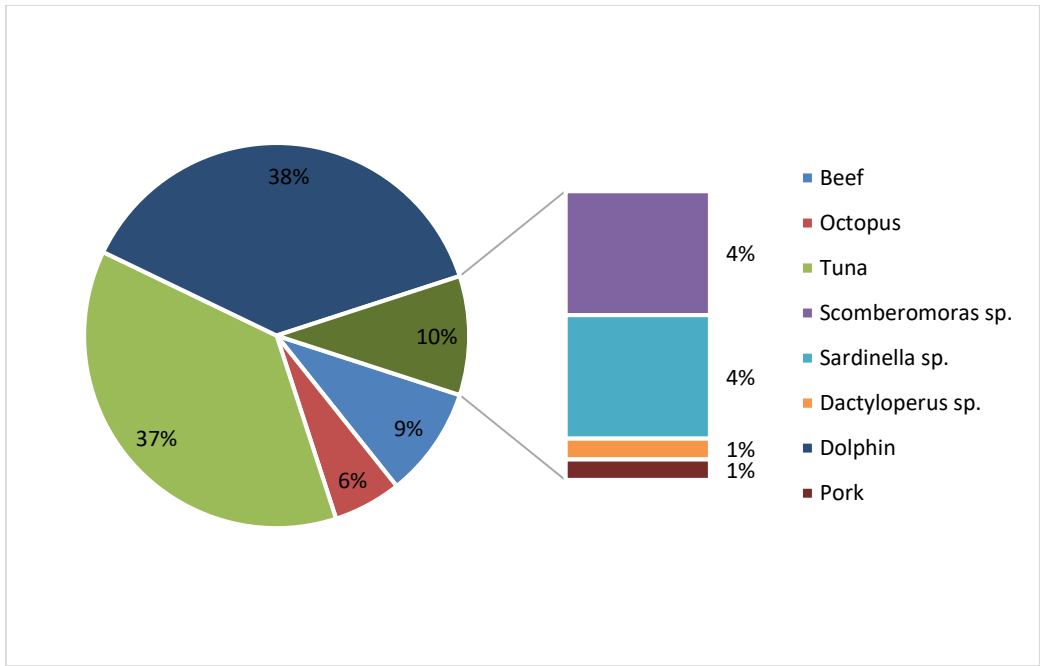
Figure 11. Types of live baits used for shark fishing in Ghana

Figure 12. Location-specific live baits used for shark fishing in Ghana

DISCUSSION

Sekey et al. (2022) from the coast of Ghana recorded nine (9) species, which was similar to the number of species reported in the current study. However, in Sekey et al. (2022) study, they did not record *C. Carcharias* which was present in our study. In addition, Gelber (2018) reported six (6) species from the coast of Ghana. Though shark

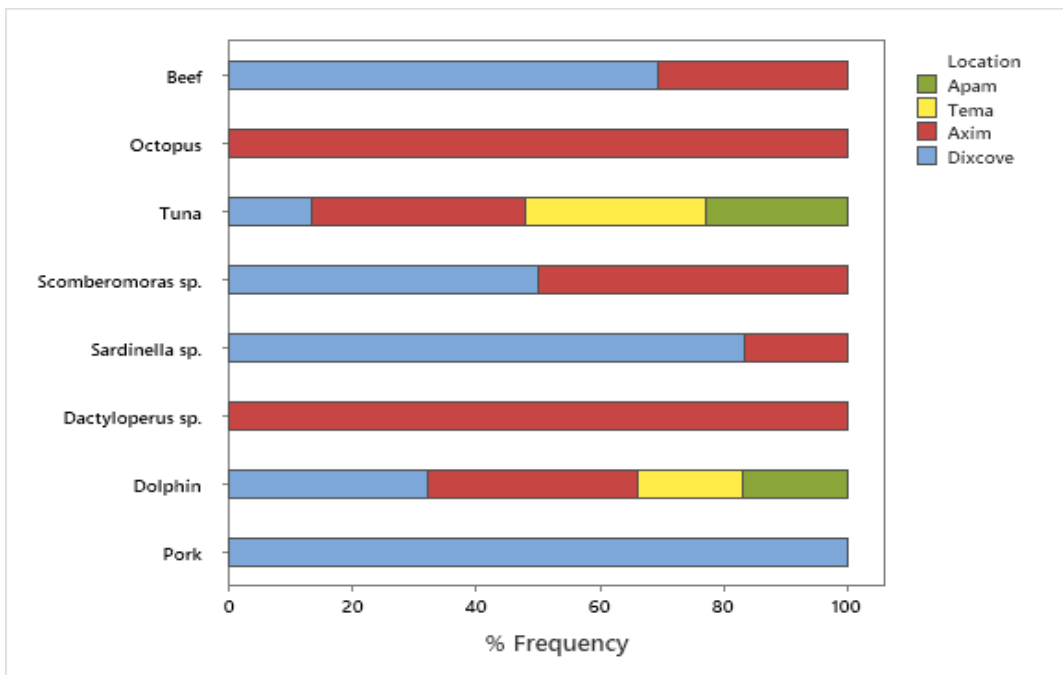fishers migrate in their quest to fish for sharks, certain species of sharks may be prominent in some selected fishing communities while absent in other communities. Potentially local knowledge on the feeding and breeding grounds of certain shark species may have played a role in the landing of specific shark species in particular fishing communities. Sekey *et al.* (2022) found that Thresher and Hammerhead sharks were abundant in their sample communities. This finding is consistent with the current study, which also indicates that *Sphyrna spp.* and *Aliopas spp.* are the most prevalent species in all the sampling communities. As the dominance of some shark species is comparable across all Ghanaian fishing communities, it is necessary to develop a species-specific action plan for the conservation of these dominant species and implement such strategies in all the fishing communities. Furthermore, knowledge about the feeding and breeding grounds plays a key role in the landing of specific shark species in certain fishing communities.

The high abundance of shark landings in certain fishing communities such Tema could be linked to the presence of greater marketing opportunities such as customers, traders for shark fin trade and other value chain actors for shark products that occur in these fishing communities. Taking cognizant of the high shark fishing trade in these communities, many fishers from other fishing communities such as Shama, Sekondi, and others migrate to these communities to fish and trade in shark products. The high rate of shark fishing on the West and Central coast of Ghana has been confirmed by Sekey et al. (2022) who documented that shark fishing in Ghana is prominent along the West and Central coast of Ghana. This dominance of shark fishing in the Western coastline of Ghana maybe possibly due to efficiency of these fisherfolks in shark fishing activities. As a result, continued usage of these small pelagic fishes as bait may not only hasten the extinction of these species but also have a significant impact on food security, particularly in fisheries-dependent populations. As a result, it is critical for scientists and relevant officials to conduct reliable research, find, and promote additional sources of non-commercial value bait for use by shark fishermen in Ghana.

In terms of migration, the study found that Ghanaian shark fishermen relocate to other international waters for shark fishing, mainly Ivory Coast and Togo (Berchie et al. 2022). Migrating to these international waters for sharking fishing activities is generally motivated by shortage of resources in migrant fishers' home grounds (Aliou et al. 2022). Furthermore, the under-exploitation and favourable conditions for shark species hasten the migration of migrant fishers who have the technical skills to exploit

these virgin marine habitats utilising advanced fishing tactics. However, in their quest to catch sharks in these international waters, migrant fishers frequently engage in illegal, unreported, and unregulated (IUU) fishing activities, such as fishing near marine protected areas (MPAs) or fishing in foreign waters without paying landing fees, which are mostly resolved through dialogue (Aliou et al. 2022; Berchie et al. 2022).

Sharks are abundant off the coast of Ghana, especially between August and September, which coincides with the country's peak upwelling season. This demonstrates that seasonality is important in the availability and quantity of shark species (Seidu et al. 2022). As a result, a shift in seasonality caused by climate change may have an impact on the population status of these species, including availability and accessibility. It is not unexpected, then, that respondents reported that seasonality has influenced shark species abundance. It is evident that fishers are well aware of the devastating effects of climate change on aquatic resources, particularly on endangered shark species. Therefore, the government must take proactive measures and educate these fishermen on the harsh realities of climate change. By implementing robust programs, the number of fishers participating in the illegal, unreported and unregulated (IUU) fishing industry. This will help to protect and preserve our marine ecosystems for generations to come.

The alarming rate at which some shark species are declining in abundance possibly hinges on high fishing pressure caused by an increased number of fishing efforts, seasonality, and illegal fishing activities (IUU). The decline in shark species including Hammerhead sharks lends credence to findings by other researchers such as Ayres et al. (2024) and Magnuson (2023). This decline in the abundance of these species was consistent across all sampling locations, underscoring the fact that fishers are acutely aware of the precarious state of shark species in the coastal waters of Ghana. As such, there is a strong likelihood that they will comply with any management methods aimed at rescuing these declining species from the brink of extinction. The IUCN Red List classifies most of these species as critically endangered, endangered, vulnerable, or near-threatened. *Aliopas spp.* is one such species that has been listed in CITES Appendix II as being at risk of extinction unless trade is strictly controlled. To assess and monitor the biodiversity status of these shark species, as well as define priorities for conservation action, Silva et al. (2021) suggests using the IUCN Red List of Endangered Species as reference. The precarious situation of sharks in Ghana demands immediate and decisive action to prevent their population from facing

extinction (Pacourean et al. 2021). It is imperative to enforce strict management measures without delay, and to conduct aggressive outreach programs in fishing communities to educate people about the critical need to conserve these endangered species.

The use of dolphins and tuna as bait by fishers in Ghana to catch large quantities of sharks has been confirmed. This finding is in line with the discovery made by Sekey et al. (2022), who found that dolphins are used as bait by fishers along Ghana's west and central coasts. Afoakwa et al. (2018) also conducted previous research that confirms the use of dolphins as bait by Ghanaian fishers. As per Ofori-Danson et al. (2003), fishers utilize calves or juveniles as bait due to their low quality and quantity of meat, which leads to them being sold for lower rates by traders. The use of dolphins generates global concern because these animals are listed as endangered worldwide. Furthermore, the presence of dolphins in the marine ecosystem helps to maintain the ecosystem's greenhouse integrity since these animals sequester carbon in their bodies. As a result, regularly employing these species as bait may have major effects for marine ecosystems' ability to adapt to climate change. As a result, the government must educate fishermen on the need of decreasing or discontinuing their use of these cetaceans for their conservation. Furthermore, the use of tuna and sardine species as bait by shark fishermen has the potential to accelerate the decline of pelagic fish species, particularly other small pelagic fishes (e.g. Sardinellas), which are already in rapid decline in Ghana (Berchie et al. 2021). These little pelagic fishes, often known as people's fish, provide a low-cost source of protein to many fishing communities in Ghana, assuring food security (Hassleburg et al. 2021).

CONCLUSION

This study presents the findings of a survey of shark fishing activities along the coast of Ghana from the perspective fisherfolks. Concluding from the perspective of production, nine species of shark were identified (i.e. *Carcharodon carcharias, Alopias spp., Sphyrna spp., Carcharhinus leucas, Prionace gluaca, Carcharias taurus, Galeocerdo curvier, Rhizoprionodon actus* and *Isurus oxyrinchus*) with some (e.g. *Alopias spp., Sphyrna spp.* and others) listed by IUCN Red List as critically endangered, endangered, or vulnerable. August and November are the periods of high and low abundance of shark species in Ghana respectively. The population of these shark species and bait used in fishing/capture them (i.e. small cetaceans, sardines, and tuna) are declining at an alarming rate largely due to high fishing pressure.

REFERENCES

Abdulla, A. 2014. Status and Conservation of Sharks in the Mediterranean Sea. http://www.redlist.org/info/categories_criteria.html

Gelber, M. J. 2018. Plenty of Fish in the Sea? Shark Fishing and the Fin Trade in Ghana: A Biting Review (Master thesis). University of Florida, in Gainesville, USA.

P.K. Ofori-Danson1, K. V. W. and S. D. 2003. A Survey For The Conservation Of Dolphins In Ghanaian Coastal Waters. Journal of the Ghana Science Association, 5(2).

Sall, A., Failler, P., Drakeford, B., & March, A. 2021. Fisher migrations: social and economic perspectives on the emerging shark fishery in West Africa. African Identities, 19(3), 284–303. https://doi.org/10.1080/14725843.2021.1937051

Seidu, I., Brobbey, L. K., Danquah, E., Oppong, S. K., van 4 Beuningen, D., Seidu, M., & Dulvy, N. K. 2022. Fishing for survival: importance of shark fisheries for the livelihoods of coastal 1 communities in Western Ghana 2 3 Issah Seidu Department of Wildlife and Range Management. https://doi.org/10.1101/2021.01.18.427106

Seidu, I., Brobbey, L. K., Danquah, E., Oppong, S. K., van Beuningen, D., & Dulvy, N. K. 2018. Local ecological knowledge, catch characteristics and evidence of elasmobranch depletions in Western Ghana. https://doi.org/10.1101/2021.01.14.426682

Dovlo E., Amador K., Nkrumah B. 2016. Report of the 2016 Ghana marine canoe frame survey. Information report No 26. Fisheries Survey and Statistical Division. 85 pp.

Hasselberg, A. E., Aakre, I., Scholtens, J., Overå, R., Kolding, J., Bank, M. S., Atter, A., & Kjellevold, M. 2020. Fish for food and nutrition security in Ghana: Challenges and opportunities. In Global Food Security (Vol. 26). Elsevier B.V. https://doi.org/10.1016/j.gfs.2020.100380

Dulvy, N. K., Fowler, S. L., Musick, J. A., Cavanagh, R. D., Kyne, P. M., Harrison, L. R., ... & Pollock, C. M. 2014. Extinction risk and conservation of the world's sharks and rays. elife, 3, e00590.

Aliou Sall, Pierre Failler, Ben Drakeford & Antaya March 2021 Fisher migrations: social and economic perspectives on the emerging shark fishery in West Africa, African Identities, 19:3, 284-303, DOI: 10.1080/14725843.2021.1937051

Asiedu B., Okpei P., Nunoo F.K.E., Failler P. 2021. A fishery in distress: An analysis of the small pelagic fishery of Ghana. Mar. Policy, 129

Afoakwah R., Osei M.B.D., Effah E. 2018. A guide on illegal fishing activities in Ghana. USAID/Ghana Sustainable Fisheries Management Project, Coastal Resources Center,Graduate School of Oceanography, University of Rhode Island, Narragansett, RI (2018),p. 64 Prepared by the University of Cape Coast, Ghana. GH2014_SCI048_UCC

Zar J.J. (2010).Biostatistical Analysis. (fifth ed.), Prentice Hall, Upper SaddleRiver, NJ

Silva PM, Teixeira CM, Pita C, Cabral HN and França S 2021. Portuguese Artisanal Fishers' Knowledge About Elasmobranchs—A Case Study. Front. Mar. Sci. 8:684059. doi: 10.3389/fmars.2021.684059

CITES 2002. Twelfth meeting of Conference of Parties, Santiago Chile, 3–15 November 2002. www.cites.org/eng/news/meetings/cop12.shtml.

Dulvy, N.K. & Forrest, R.E. 2010. Life histories, population dynamics and extinction risk in chondrichthyans. Chapter 17. In J.C. Carrier, J.A. Musick & M.R. Heithaus, eds. Sharks and their Relatives II. pp. 639–679. Boca Raton, FL, USA, CRC Press.

Sekey, W., Obirikorang, K.A., Alimo, T.A., Soku, M., Acquah, B., Gyampoh, B.A., Adjei Boateng, D., Asare-Ansah, O., Ashiagbor, G. and Kassah, J.E., 2022. Evaluation of the shark fisheries along the Coastline of Ghana, West Africa. Regional Studies in Marine Science, p.102434. doi.org/10.1016/j.rsma.2022.102434

Asiedu, B., Failler, P., Amponsah, S. K., Okpei, P., Setufe, S. B., & Annan, A. (2022). Fishers' migration in the small pelagic fishery of Ghana: a case of small-scale fisheries management. Ocean & Coastal Management, 229, 106305. doi.org/10.1016/j.ocecoaman.2022.106305