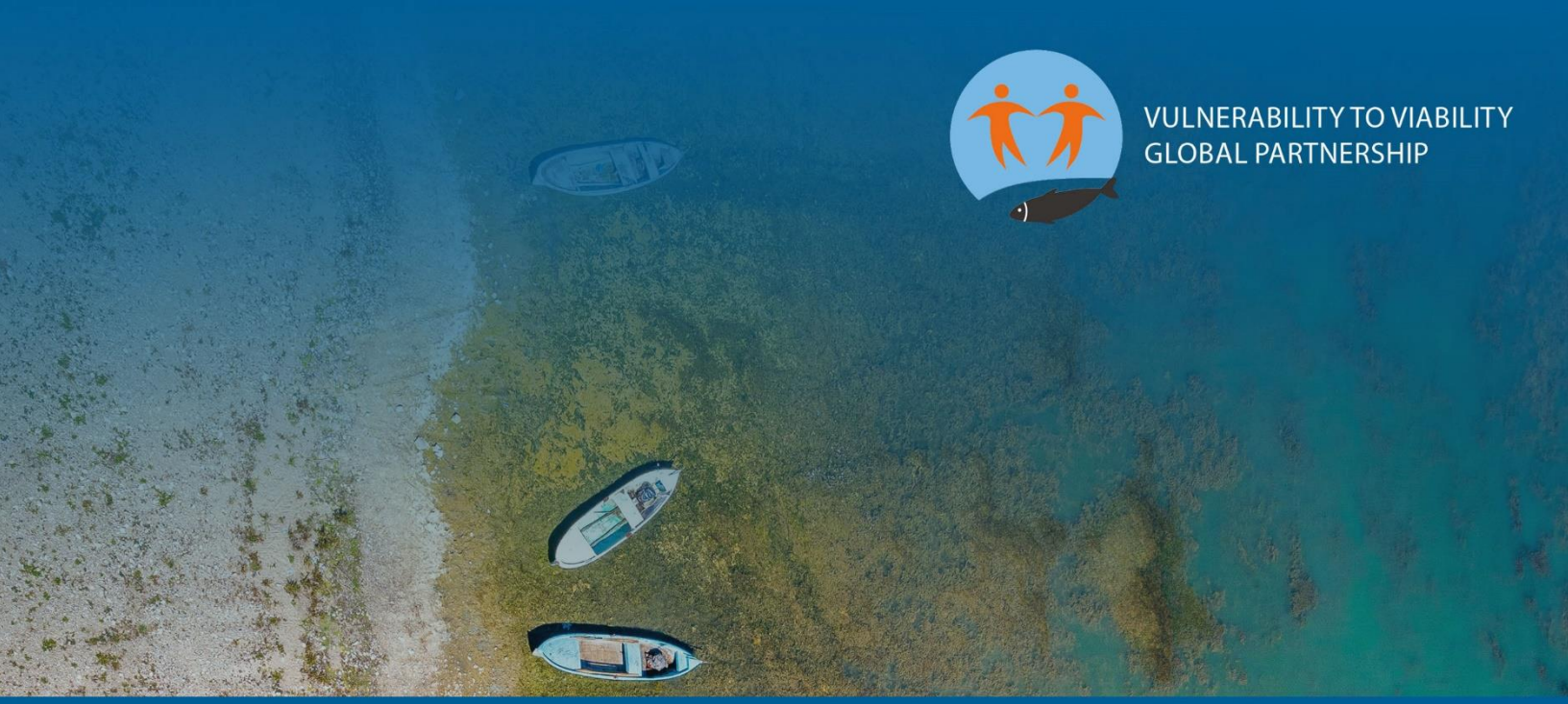

VULNERABILITY TO VIABILITY
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A Situational Analysis of Small-Scale Fisheries in Ghana: From Vulnerability to Viability

V2V Working Paper No. 2021-2

Evans Kwasi Arizi, Alberta Ama Sagoe, Esinam Attipoe,
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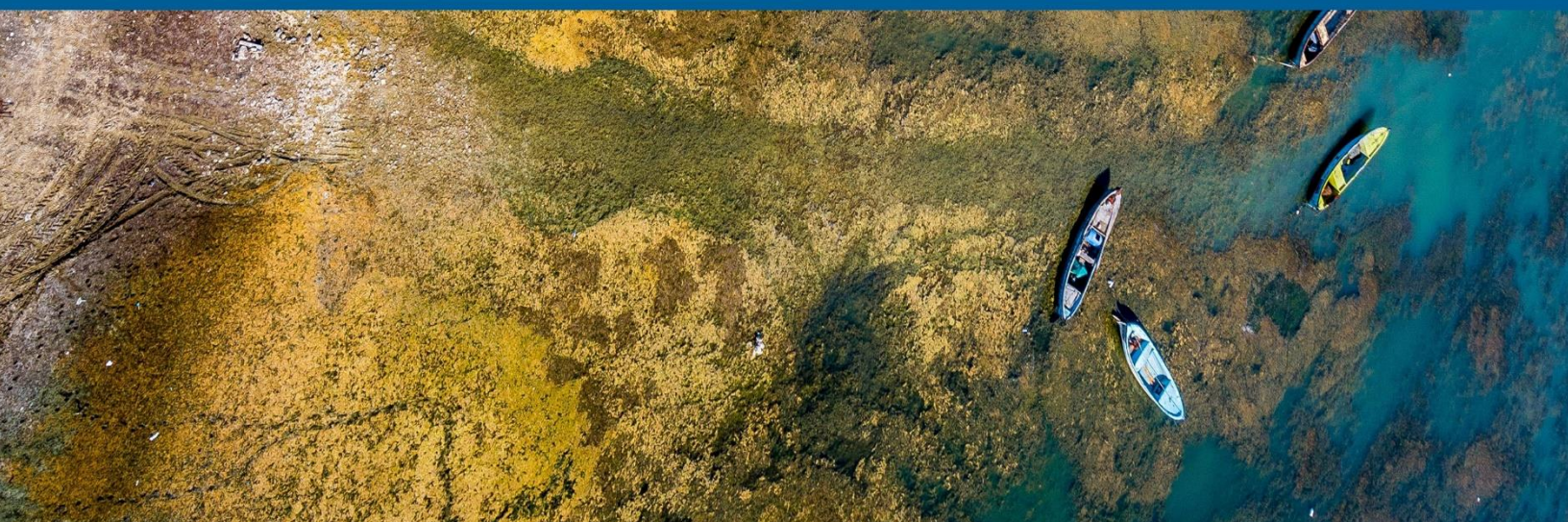
December 2021



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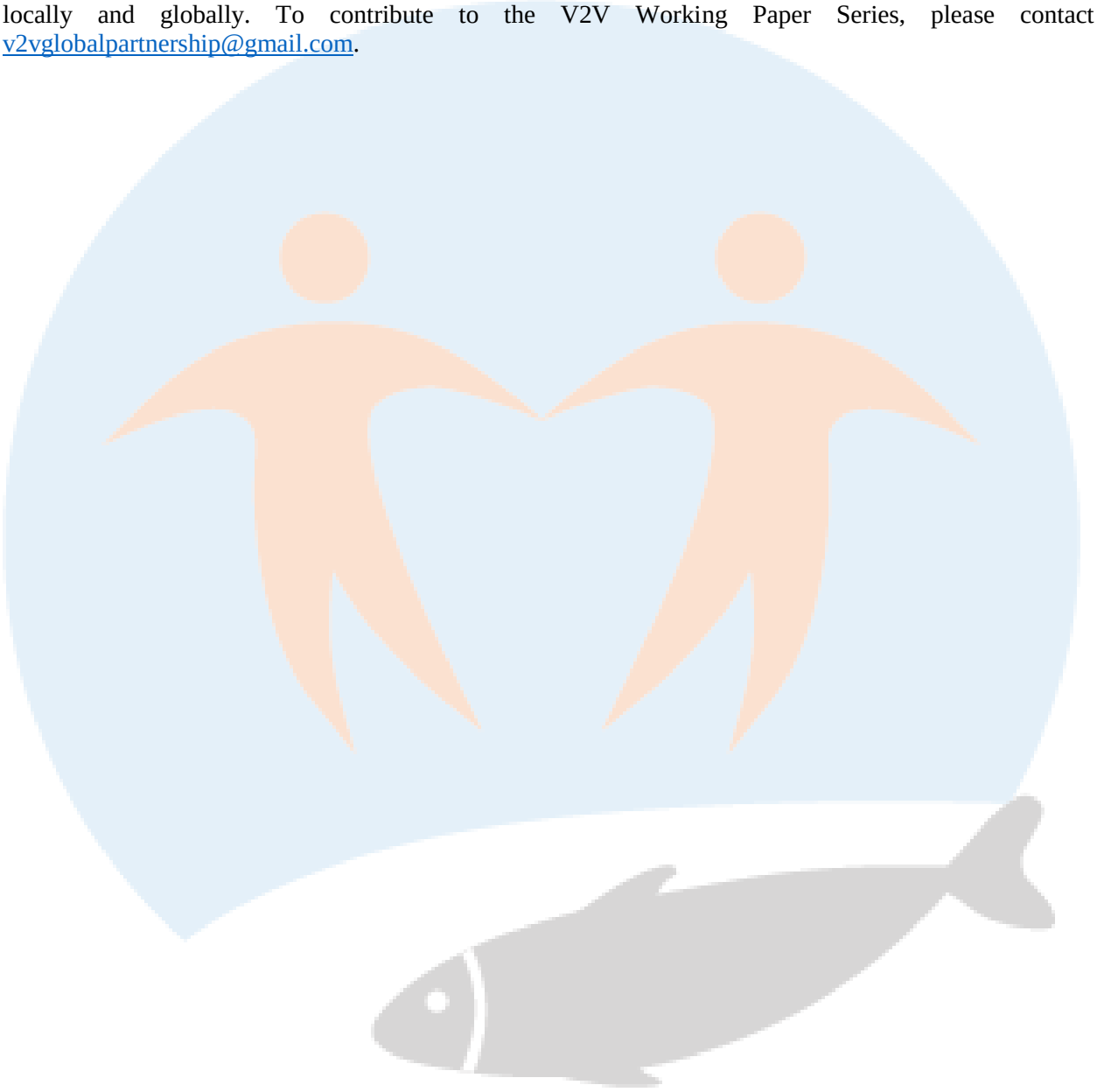
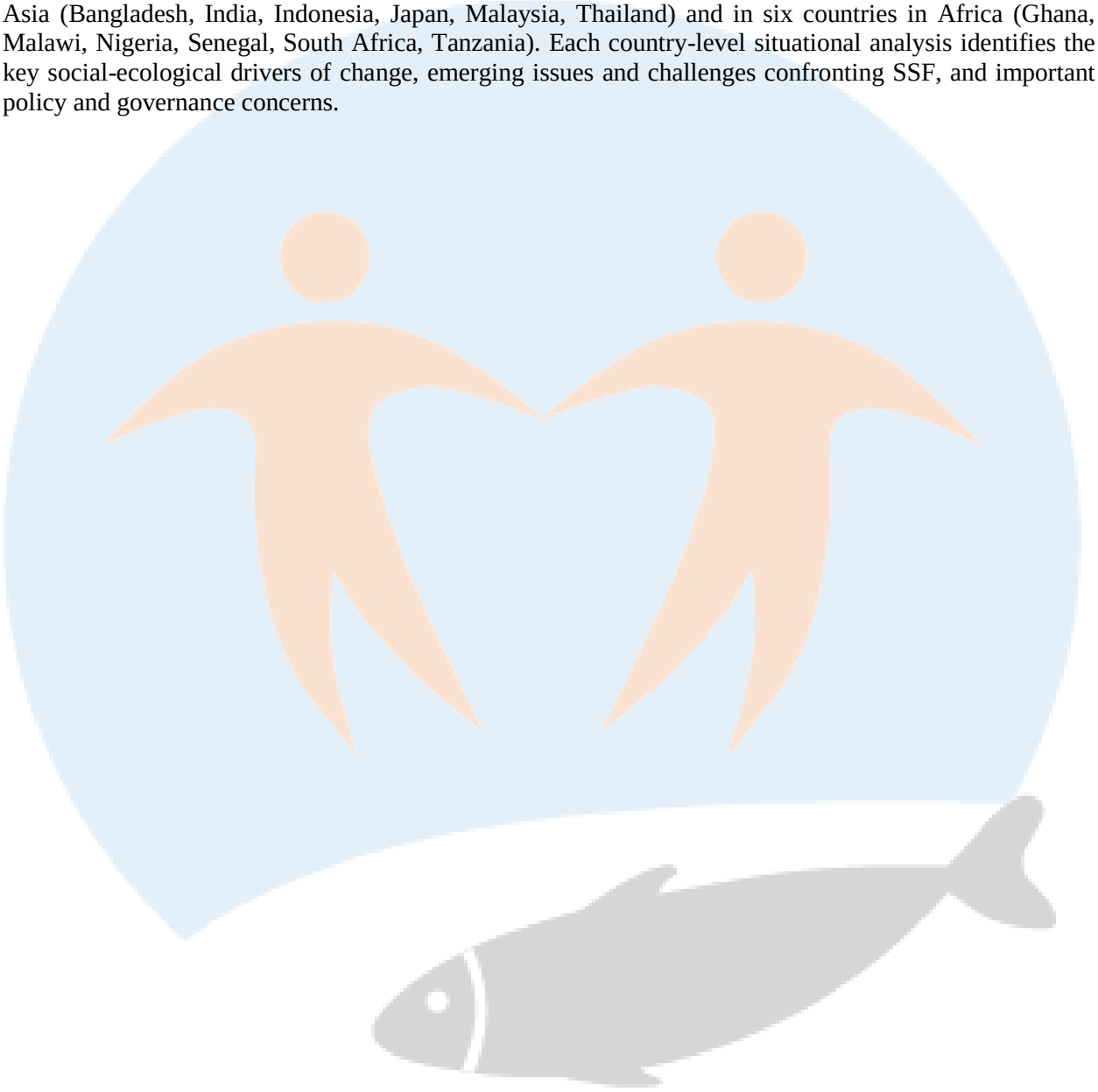


A V2V Situational Analysis of Small-Scale Fisheries

Small-scale fisheries (SSF) are an important economic resource, both at the local and global level; their depletion has ramifications on fundamental aspects of life, spanning from food security to society's wellbeing and culture. On the global scale, SSF provide food security and a source of livelihoods and income for more than 100 million people. The objective of the V2V Situational Analysis is to build a global perspective on key vulnerabilities and opportunities associated with SSF viability across six countries in Asia (Bangladesh, India, Indonesia, Japan, Malaysia, Thailand) and in six countries in Africa (Ghana, Malawi, Nigeria, Senegal, South Africa, Tanzania). Each country-level situational analysis identifies the key social-ecological drivers of change, emerging issues and challenges confronting SSF, and important policy and governance concerns.



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A Situational Analysis of Small-Scale Fisheries in Ghana: From Vulnerability to Viability

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1. Introduction

Small-scale fisheries (SSF) provide food security while shaping Ghana's cultural identity. These benefits become sustainable when the SSF are properly managed (Charles, 2001). However, effective management of SSF is greatly contingent on in-depth scientific knowledge of fisheries. Unfortunately, the information regarding SSF is disaggregated and case specific, particularly in Ghana. Considering the interconnections among the aquatic ecosystems across the world, building a global perspective on key vulnerabilities and opportunities associated with SSF viabilities is fundamental. Against this background, V2V Global Partnership sought to co-develop a global and regional situational analysis of small-scale fishery systems in 12 countries, namely Ghana, Senegal, Nigeria, Malawi, South Africa, Tanzania, India, Bangladesh, Indonesia, Japan, Thailand and Malaysia. To this end, this paper reviews literature on SSF of Ghana with the primary aim of providing information on the key social-ecological drivers of change, emerging challenges in the SSF sector as well as identifying areas to improve SSF viability in Ghana and across the world. The information from this situational analysis together with similar information from elsewhere will provide a platform to leverage opportunities for effective governance of global SSF. This situational analysis specifically focused on four main areas: meaning of small-scale fisheries; drivers of change; emerging issues and challenges; and policy and governance.

In Ghana, the terms "small-scale fishery" and "artisanal fishery" are synonyms. Amongst the different fisheries sectors (i.e., semi-industrial and industrial fisheries), SSF constitute an important one in Ghana as the majority of vessels, employment and fish landing are predominantly small-scale. Small-scale fishery (SSF) is technologically simple but labor-intensive. The presence of SSF in Ghana can be traced back to the 1700s (Lawson & Kwei, 1974). One of the popular tribes of Ghana known as Fantes or Fantis, who mostly dwell along the central coast of Ghana, were identified as the pioneering fisher folks to have established fishing businesses across the country (Agbodeka, 1992). Early fishermen used dugout canoes for their fishing expeditions within shallow coastal waters, including estuaries and lagoons. Over time, decline in stocks of shallow waters became evident in the face of high demand for fish protein in Ghana. To meet the demand for fish in the country, local fishers strove to get their catches from offshore areas. Consequently, traditional canoes were upgraded and modified to withstand West African surf and rough seas thereby creating easy access to fish in deep waters (Agbodeka, 1992).

The fishing activities of the Fante people were reportedly extended to other West African countries such as Benin in early 1800s (Overå, 2001), Cote d' Ivoire in 1906 (Delauney, 1991), Liberia in 1920s (Haakonsen, 2001) and Nigeria in 1961 (Overå, 2001). According to Overå (2001), fishing expeditions of the early Ghanaian fishers were not limited to the West African sub-region alone but were also carried out during the 1940's in coastal waters of some countries within the southern part of Africa. These fishers took advantage of the weak governance and the absence of independence in other African countries to maximize their catches. The benefits of the fishery became noticeable in the 1950's and 1960's (Atta-Mills et al.,

2004). However, the new structured governments formed after independence were mindful of the possible damages Ghanaian fishers could cause to marine resources and so expelled local fishers from their waters. This also led to immediate actions taken to expel foreign fishers from Ghanaian waters (Atta-Mills et al., 2004). The arrival of non-native fishers in Ghana resulted in high fishing pressure on fish stocks with consequent decline in the small pelagic fish stocks. This has been the case until now, although landings reportedly peaked at some point in 1992 (Koranteng, 1998).

Presently, the fishery has a fleet of modified dugout canoes with length ranging from 4 – 20.5 m and width, ranging from 0.5 – 2.9 m (Dovlo et al., 2016). The canoes are usually built from *Triplochiton scleroxylon* and *Ceiba petandra* locally known as "Wawa" and "Onyina", respectively (Akyeampong et al., 2013). As of 2016, there are about 11,583 canoes in the fishery and approximately 80% of these canoes are propelled by outboard motors with engine power ranging from 8 – 40 hp (Dovlo et al., 2016). Ghanian canoes account for 11% of the total canoes roaming SSF waters in West Africa (Franz et al., 2019). Most of these canoes are beautifully decorated with colors and designs, with names, expressions or slogans stylishly printed on them (Kraan, 2006). The crew size per canoe ranges from 1 – 20 (Tanner et al., 2017). Fishers in these fisheries utilize various types of fishing gear that are well adapted to the local fishing conditions. These gears include purse seine (poli, watsa and poli-watsa), beach seine, gill net (ali and drift gill net), set net, hook and line, cast nets and traps. The key fish species that are exploited in the artisanal fishery include round sardinella (*Sardinella aurita*), flat sardinella (*Sardinella maderensis*), anchovy (*Engraulis encrasicolus*), Atlantic horse mackerel (*Trachurus trachurus*), round scad (*Decapterus punctatus*) and chub mackerel (*Scomber japonicus).* Canoes and fishing gear are typically owned by Ghanaian individuals or families.

The fishery is largely marine based which is closely tied to coastal communities dotted along the 550km long coastline and so fishing activities mostly occur within inshore waters of Ghana. There are about 186 fishing villages and 302 landing beaches along the coast of Ghana (Akyeampong et al., 2013). About 150,000 fishers are in the artisanal fisheries and this constitutes approximately 80% of the total number of fishers in the marine fisheries of Ghana (MoFAD, 2018).

Many groups work in the industry. Although the majority of fishers are men, women play an important role in the artisanal fishery sector through fish processing, preservation and marketing (Mensah et al., 2006). About 40% of the fisher folks in the artisanal fishery have no formal education (Dovlo et al., 2016). The major ethnic groups in the coastal fishing communities include the Anlo-Ewe, Fante and Ga whilst the Effutu, Nzema and Ahanta constitute the minority (Mensah et al., 2006). The fishing communities are mostly rural because the majority of them are located outside the mainstream social and economic centers.

Fishers are generally poor and desperate to support themselves and their families to the extent that they would do anything to maintain daily catches. For instance, these fishers use light, dynamite, detergents, calcium carbide, and small mesh sized nets to boost fish production or maintain daily catch (DFAS, 2016; Afoakwah et al., 2018). Unfortunately, the fishery is open-access where local fishers have negligible restrictions to access the fisheries resources (Akpalu, 2008). Hence, there is little to gain when a fisher tries to conserve fish resources for future exploitation, as the fishing resources might be exploited by others. As a consequence, fish stocks in the territorial waters of Ghana have been subjected to high fishing pressure leading to decline in fish stocks (Lazar et al., 2016). The fishery is legally governed by the Government of Ghana through the Ministry of Fisheries and Aquaculture Development (MoFAD) and Fisheries Commission (FC) but traditionally governed by chief fishers, although they are not lawfully recognized (Yamoah, 2012).

The fishery is bedeviled with several conflicts. For instance, there is a conflict between the local fishers and the workers on the Jubilee oil rig of Ghana over the use of marine space for oil extraction and fishing. Ghana began large-scale commercial production of oil from its territorial marine waters in 2010. As a result,

a buffer zone of 500m was established around the oil rig infrastructure to prevent fishers from interrupting oil extraction and on grounds of safety of the fishers. Unfortunately, the establishment of this zone has been generating conflicts between the local fishers and the workers on the oil rig (Owusu, 2018).

Conflict also exists between artisanal and industrial fishers (Hen Mpoano, 2015). In Ghana, vessels in the industrial fishery sector are licensed to engage in demersal trawls. However, some of these industrial fishing vessels sometimes extend their fishing activities into the inshore zone that is exclusive to artisanal fishers. This ends up destroying passive fishing nets belonging to SSF fishers. The actions of the fishers in the industrial sector influence some artisanal fishers to carry out their fishing activities in estuaries and open lagoons which are known to serve as nursery grounds for many fish, thereby resulting in further depletion of fish stock.

Indeed, increasing global seafood demand over the last couple of decades has resulted in overexploitation of certain fish species by industrial fishers. This phenomenon has threatened the livelihoods and food security of SSF communities worldwide. In Ghana, fish transshipment (locally referred to as Saiko) has been catalogued as one more negative practice that is exacerbating an already dire situation (Hen Mpoano, 2015). In this activity, some local people take trips to offshore waters on canoes to purchase slabs of frozen fish from industrial fishing vessels. The local fishers take such trips as if they are going for fishing expeditions but interestingly, these so-called fishers return to landing sites with frozen fish for resale.

A report by Hen Mpoano indicates that "Saiko fishing" is a threat to the artisanal fishery of Ghana because of the relatively higher proportion of frozen small pelagic fish in the landings. This implies that some industrial trawlers are using nets with small mesh sizes to fish in inshore waters. Meanwhile, the industrial trawlers in Ghana are only permitted to catch large pelagic and demersal fish with a limited percentage (<10%) of by-catch (GoG, 2002). The massive exploitation of small pelagic fish by the industrial trawlers results in the depletion of fish stock in the inshore waters of Ghana. This reduces artisanal fish production, thereby producing lower profits, high unemployment and food insecurity. The situation often induces conflict between the regular fishers and those in the "Saiko fishing" business with some cases already taken to court for resolution (Hen Mpoano, 2015).

2. Meaning and status of small-scale fisheries

SSF can be defined in quite different ways with respect to the use of stocks, technology, vessel type and crew, etc. This section provides information on how the SSF of Ghana is defined as well as captures the status of the SSF at the national level.

2.1 Small-scale fisheries contribution to Ghana

The artisanal fishery of Ghana plays a key role in the growth of the national economy by contributing to its gross domestic product (GDP), providing employment opportunities, helping to alleviate rural poverty and by providing animal protein to the population. Together with the other sectors of Ghana's fisheries, artisanal fishery contributes about 3% to national GDP and generates revenue of $341 million per year (Belhabib et al., 2015). The fish industry constitutes one of the major sources of employment, employing about 2.7 million individuals, which is about 10% of the population (World Bank, 2018). Of this 10%, 80% are artisanal fishers: this means that SSF fishers are responsible for providing approximately 80% of the total fish production and about 30,000 fish processors have been identified in the fishery (MoFAD, 2018). This implies that the fishery plays a key role in poverty alleviation, especially in rural coastal areas.

About 60% of the animal protein requirements is derived from the artisanal fishery and the annual per capita consumption is estimated at 25 kg, which is relatively higher than the averages of 10.5 kg and 18.9 kg estimated for Africa and the world, respectively (FAO, 2016). The artisanal fishery of Ghana provides fish for festivals and funerals, which are important traditional events in the country. This is highly evidenced in the occasional travels made by migrant fisher folks to their hometowns for the said events (Mensah et al., 2006). As these fisher folks prepare for such events, they smoke a lot of fish of different species (e.g., barracudas, sardinella and mackerels) and package them to augment food that are served to visitors, especially during funerals.

2.2 Small-scale fisheries profile in Ghana

According to the Fisheries Act of Ghana, SSF is the type of fishery in which Ghanian fishers employ dugout canoes to exploit fish stock in the coastal waters of Ghana (GoG, 2002). However, Ghana's team on the V2V project defines SSF of Ghana as the type of fishery in which local fishers employ dugout canoes powered by either outboard motor or paddles to exploit fish stocks from coastal waters for local consumption. Ghanian SSF usually aim to maximize employment opportunities, securing livelihood, reducing poverty, increasing food production and improving nutrition in the coastal rural communities (Aheto et al., 2012; Franz et al., 2019). Table 1 summarizes key characteristics of SSF in Ghana.

The canoes are usually built from trees such as *Triplochiton scleroxylon* and *Ceiba petandra* locally known as "Wawa" and "Onyina", respectively (Akyeampong et al., 2013). There are about 11583 canoes in the fishery as of 2016 and approximately 80% of these canoes are propelled by outboard motors with engine power ranging from 8 – 40 hp (Dovlo et al., 2016). The crew size per canoe ranges from 1 – 20 (Tanner et al., 2017). The average fishing effort in the SSF of Ghana is estimated at 626691 trips per year (MoFAD, 2018).

The gear types that are used in the artisanal fishery of Ghana include purse seine, beach seine, ali, set net, drift gill net, hook and lines, cast net and traps. Among the gear utilized in the marine artisanal fishery, set net forms about 33% constituting the dominant gear in the fishery followed by purse seine (29%) whereas cast net constitutes the less-utilized gear (2%) in the fishery (Dovlo et al., 2016). The traps are mostly used in inland waters (Mensah et al., 2006). Below is a list of main fishing gear and target species:

- Purse seine: round sardinella (*Sardinella aurita*), flat sardinella (*Sardinella maderensis*), anchovy (*Engraulis encrasicolus*), Atlantic horse mackerel (*Trachurus trachurus*), round scad (*Decapterus punctatus*) and chub mackerel (*Scomber japonicus*).

- Beach seine greatly harvests round sardinella (*Sardinella aurita*), flat sardinella (*Sardinella maderensis*), anchovy (*Engraulis encrasicolus*), Atlantic horse mackerel (*Trachurus trachurus*), round scad (*Decapterus punctatus*), chub mackerel (*Scomber japonicus*), burrito (*Brachydeuterus auritus*), red snapper (*Lutjanus fulgens*), grey snapper (*Lethrinus atlanticus*), mullet (*Pseudupeneus prayensis*, ribbonfish (*Trichiurus lepturus*) and shrimps (*Parapenaeopsis atlantica*, *Penaeus kerathurus* and *Penaeus notialis*) (Kwei & Ofori-Adu, 2005).

- Ali (Type of gillnet): round sardinella (*Sardinella aurita*) and flat sardinella (*Sardinella maderensis*). Threadfins (*Alectis alexandrinnus and Galeoides decadactylus*), seabreams (*Dentex gibbosus*, *Pagrus caeruleostictus*, *Dentex congoensis* and *Pagellus bellottii*), bigeye grunt (*Brachydeuterus auritus*), cassava croaker (*Pseudotolithus senegalensis*), left-eyed tongue sole (*Cynoglossus senegalensis*), sharks (*Carcharhinus* spp.), rays (*Raja miraletus* and *Raja straeleni*) and lobsters (*Panulirus regius*) are landed in the set net fishery.

- Drifting gillnet: large pelagics, such as sharks (*Carcharhinus* spp.), tunas (*Thunnus albacares* and *Thunnus obesus*), sailfish (*Istiophorus albicans*) and swordfish (*Xiphias gladius*).

- Hook and lines: seabreams (*Dentex gibbosus*, *Pagrus caeruleostictus* and *Dentex canariensis*), snappers (mostly *Lutjanus fulgens* and *Lutjanus goreensis*), tunas (*Thunnus albacares* and *Thunnus obesus*), sailfish (*Istiophorus albicans*), barracuda (*Sphyraena sphyraena*) and groupers (*Epinephelus aeneus*).

- Cast net: tilapia (mostly *Sarotherodon melanotheron*), mullets (especially, *Mugil cephalus*) (Dankwa & Entsua-Mensah, 1996).

- Traps: *Sarotherodon melanotheron*, *Tilapia zillii* (Mensah et al., 2006) and shrimps (*Parapenaeopsis atlantica*, *Penaeus kerathurus* and *Penaeus notialis*) (Kwei & Ofori-Adu, 2005).

- Some fishers have been reported to use explosives (particularly, dynamite) and chemicals (e.g., Dichlorodiphenyltrichloroethane (DDT), Calcium Carbide (carbide), formalin; Formaldehyde, cyanide, pesticides and powered detergents). However, the use of these chemicals and explosives is illegal (Afoakwah et al., 2018).

SSF stakeholder groups include fisher folk (fishers, fishmongers and fisher associations), Ministry of Fisheries and Aquaculture Development (MoFAD), Fisheries Commission (FC), security agencies (Navy, Police and State Attorney), Non-governmental Organizations (NGOs), universities, research institutions (e.g., Council for Scientific and Industrial Research) and development partners (Yamoah, 2012). Some of the fisher associations include Ghana National Canoe Fishermen's Council (GNCFC), Ghana Co-operative Fisheries Association (GCFA), Ghana National Association of Farmers and Fishermen (GNAFF), National Fisheries Association of Ghana (NAFAG), Ghana Inshore Fisheries Association (GIFA), Ghana Inshore Trawlers Association (GITA) and National Inland Canoe Fishermen Council (NICFC) (Mensah et al., 2006). Development Action Association (DAA), Central and Western Regions Fishmongers Improvement Association (CEWEFIA), Friends of the Nation (FoN), Hen Mpoano are some of the NGOs in the fishery (CRC, 2015).

Table 1

Summary of small-scale fisheries profile in Ghana

Terms used in SSF	Gear types	Vessel types	Ecosystem types	Ecosystem detailed types
• Artisanal • Small scale • Subsistence • Traditional	• Cast nets • Gillnets • Hooks and lines • Seine nets • Surrounding nets • Traps • Chemicals or Explosives	• Canoe • Wooden	• Marine • Freshwater • Brackish	• Intertidal • Beach • Lagoon • Coastal • Lake • Mangrove • Open ocean • Estuary • River • Salt marsh

2.3 The relevant linkages between ecosystems and small-scale fisheries in Ghana

A myriad of ecosystems exists along the coastal areas of Ghana. Some of these ecosystems include estuaries, seashores, lagoons, wetlands, floodplains and mangrove forests. As it stands, there are about 98 lagoons and 10 estuaries that abound on the coastline of Ghana (Yankson & Obodai, 1999). Out of these lagoons, there are 26 open lagoons and 13 semi-open lagoons (Wiafe et al., 2013). These ecosystems provide critical services to augment the livelihoods and survival of the coastal human communities. To a greater extent, the ecosystems are interlinked, consequently, impacts on a particular ecosystem will inevitably affect other adjoining ecosystems. For instance, the interconnections among these ecosystems make it possible for nutrients to be carried from inland ecosystems to the coastal waters of Ghana through open lagoons (e.g., Benya Lagoon) and estuaries (e.g., Kakum River and Ankobra Estuaries), especially during the rainy season (March – October). These nutrients provide high production of phytoplankton which in turn leads to increased production of zooplankton with a possible consequent skyrocketed production of fisheries resources. This is pronouncedly evident in the central and western coastal waters of Ghana whose primary productivity and fish production are relatively high because of high concentration of lagoons and estuaries, as well as because of its wide continental shelf of those areas (Wiafe et al., 2013).

The estuaries and open lagoons also provide a conducive environment for the juveniles of several fish species to feed and be nursed. According to Dankwa and Entsua-Mensah (1996), about 50 fish species utilize estuaries and lagoons as their feeding and nursery grounds and the preponderant ones include *Gerres melanopterus, Ethmalosa fimbriata, Sarotherodon melanotheron, Mugil sp., Caranx hippos, and Lutjanus goreensis*. Some of these fish species form part of the stocks that are exploited in the SSF of Ghana (e.g., *Ethmalosa fimbriata, Lutjanus goreensis, Caranx hippos* and *Mugil sp*). In some cases, the local fishers resort to fishing in estuaries and lagoons to augment fish production from the marine waters for either subsistence or commercial purposes.

The coastal zones of Ghana are characterized by the presence of relevant mangrove forest. So far, six species of mangroves have been identified in Ghana, including *Acrostichum aureum, Avicennia germinans, Conarcarpus erectus, Laguncularia racemosa, Rhizophora harrisoni*, and *Rhizophora racemose* (UNEP, 2007). Among these species, *Rhizophora* sp. (red mangrove) and *Avicennia germinans* (black mangrove) are the most common ones (Nortey et al., 2016). These mangroves provide suitable nursery grounds for the juveniles of finfish (e.g., mullets) and shellfish (e.g., crabs and prawns) dwelling in the coastal waters of Ghana. These juveniles find shelter among the roots of the mangroves. The mangroves also trap the sediments and pollutants that would otherwise flow out to the marine environment causing nuisance. In addition, the mangroves provide fuel and building materials for the fisher folks of some fishing communities along the coast of Ghana (Aheto, 2011).

The entry points of freshwater into marine waters are sometimes used as avenues for recreational purposes, especially during festivals. For instance, as part of the "Bakatue" festival celebration at Elmina to offer thanks and prayers to gods for a good fishing year. Then, some women in "kente" cloth and local headgear, ride on the Benya Lagoon using canoes while singing and dancing. Meanwhile, fishers are usually found boat racing (Regatta); at some point, the chief priest casts his net three times into the Benya Lagoon and all the fish caught is offered to the gods symbolizing thanks for the year's harvest (Koufie, 2019).

However, rapid urbanization and unplanned settlements have contributed to the pollution of coastal environments. At the same time, increased exploitation of local resources culminated in the depletion of many aquatic resources leaving several species of fauna and flora on the verge of extinction (Wiafe et al., 2013). As a result, the sustainability of these coastal ecosystems has been affected. Meanwhile, there are limited options for managing the coastal ecosystems as well as conserving the biodiversity because of the rising hardship and poverty in Ghana.

3. Social-ecological changes and key drivers

This section presents information on the key social-ecological changes as well as the key drivers of change with respect to vulnerabilities and viabilities of Ghanian SSF. It also highlights the long-term and the short-term changes, while providing details on the temporal and spatial scales of change.

3.1 Climate change

3.1.1 Changing physico-chemical parameters of marine ecosystem

Globally, the adverse effects of climate change (swells, storms, extreme rainfall, rising temperatures, rising sea levels, etc.) are anticipated to heavily impact SSF around the world. As the human population of grows, the demand for energy to provide power for homes and industries increases. In most cases, the energy is generated by burning fossil fuels which often produces large volumes of CO2. The CO2 contributes to global warming. A continuous warming of the marine ecosystem coupled with changes in ocean nutrient inputs, oxygen concentration and current patterns, will likely result in a change in the ecosystem productivity. Ultimately, this will affect fish stock, which will likely result in lower overall catch. Considering the importance of small pelagic fish in the artisanal sector of Ghana, such effects are already changing the status quo and will continue to do so, which will heavily impact livelihoods, food security and nutrition.

Elsewhere, studies have shown that an increasing rise in sea temperature has been observed in conjunction with a decreasing fish stock in Eastern Central Marine waters (Kifani et al., 2019). Though similar studies have not been conducted in Ghana yet, it is safe to assume that a similar trend is taking place in Ghanian waters. In fact, it may be anticipated that climate change will impact the upwelling mechanism. Upwelling is the mixing of surface and bottom water of the sea when the surface of the sea cools. Nutrients (nitrates and phosphates) in the benthic zones reach surface waters leading to increased productivity of the sea. Phytoplankton population increases followed by zooplankton and fish.

Upwelling is the most important hydrological feature of Ghana's coastal water that leads to fisheries abundance. In many cases, there is a bumper harvest of sardines (*Sardinella* spp.) as well as an increase in catch of other pelagic fish as well, e.g., chub mackerel, jacks, tunas. Major upwelling seasons occur from July to September/October, while the minor upwelling in January/February. Usually, a reduced sea surface temperature (< 25°C) is required for "good" upwelling to occur. Increasing sea surface temperatures will, therefore, negatively impact fish production to the detriment of artisanal fishers (McGlade et al., 2002; Lazar et al., 2016).

3.2 Social change

3.2.1 Population explosion and high dependency on coastal related income

Over the years, the population in Ghanaian coastal communities has been steadily increasing (Marquette et al., 2002). The population explosion has resulted in a high demand for fish, which in turn created more opportunities to earn an income through coastal-related activities. An increase in population and a high demand for fisheries-related income, contrasted with finite coastal resources, have led to overexploitation and depletion of fish stock. The current state of the Ghanaian artisanal fisheries is symptomatic of the characteristics of a Malthusian overfishing as fisher-folks have been adopting bad fishing practices; for example, more are employing the use of unapproved fishing mesh size nets (Koranteng, 2002). Now, both young and adult fish are harvested; additionally, some fishers do light fishing in which fish is captured

outside the major fishing season with serious implications on spawning stock biomass (Bannerman & Quartey, 2005).

3.2.2 Coastal pollution

Pollution in the coastal areas of Ghana has been on the rise as a result of high patronage of plastic materials by the increasing population. Most of the gutters in Ghana are open, making them repositories for solid wastes, including plastic materials (Kodua & Anaman, 2020). Unfortunately, some of these gutters are connected to the sea and so, high quantities of plastics enter the sea through water runoffs, especially during the rainy days. These plastic materials are known to cause entanglement, suffocation, lacerations, internal injuries, infections, reduced swimming and ingestion-related death to aquatic organisms (IUCN, 2021). In Ghana, sea turtles are one of the species that suffer plastic pollution the most because they often mistake the plastic materials for jellyfish, onto which turtles prey (Elias, 2019).

In recent times, fishers have been catching plastic garbage instead of fish (Nyabor 2020), thereby reducing catch rates with consequent decline in fish production. The fishers then have to spend several hours removing plastic materials from their nets. In some cases, the untidy nature of plastic materials on the beaches of Ghana leads to poor sanitation and this affects the safety and quality of fishery products that are sold to consumers. Hence, much education on improving sanitation in the fishing communities must be given in the face of enforcement of stringent local sanitation laws.

3.3 Change in governance system

3.3.1 Industrialization and modernization of fisheries sector

The management of fisheries dates back to the 1930s when the colonial masters developed interest in understanding the viability of investments in fisheries in West Africa. A deficit in the local supply of fish was noted in 1932 when the Gold Coast (now Ghana) imported canned and preserved fish to the tune of £123,853 (Akyeampong, 2007). To better understand the situation at hand, a fisheries survey was conducted in both marine and freshwater to aid the design of tailored laws. The first fisheries regulatory law (Fisheries Ordinance Cap 165) was birthed in 1946 based on the recommendations from the survey (Alabi–Doku et al., 2020). From the 1950s through to the late 1980s, a massive boom in the fisheries industry was recorded.

The political milieu of Ghana, like other developing countries at the time, was centered on an aggressive nationalism and intense struggle for economic opportunity in the wake of independence. Governments felt the need to produce rapid economic results and major social improvements. Against this political background, most government actions and policies were geared towards massive investments in the fisheries industry. This form of management/governance fostered all sorts of negative practices in the industry, and resulted in gross inefficiency and mismanagement, owing to a growing number of motorized vessels and fish landings.

With a growing global awareness on the need to conserve fisheries resources, and Ghana's ratification of the United Nations Convention on Law of the Sea (UNCLOS) in 1983, successive governments enacted legislation geared toward sustainable use of fisheries. The laws enacted post-UNCLOS were designed in conjunction with a narrative of developing countries having inefficient, underfinanced and incompetent fisheries institutions managing the fisheries resources of these countries. The discourse of good governance/management requires the strengthening of institutions through modernization, with the aim to achieve efficiency in their daily operations (Overå, 2011). The modernization of these institutions also transferred responsibilities to local communities in the management of fisheries resources through local

participation. In Ghana, SSF has evolved to include co-management as a means to sustainable management of resources. Yet, fish stocks have continued to decline regardless of the various governance measures that have been designed over the years.

3.4 Economic change

3.4.1 Advanced fishing gears/technology

The artisanal fishery of Ghana continuously adopted new technologies and methods in its operations. The 1930s and 1940s were periods where the industry heavily depended on traditional equipment for fishing – mainly canoes, cast nets and small wall-nets. During the mid-nineteenth century, the Fante, Gas and Anlo-Ewes championed an actual technological revolution of the artisanal fishery by introducing three new types of net: the beach-seine net, the drift net and the purse-seine net (Akyeampong, 2007). These nets have high catch volumes, and they require less skill in their operation. They also require more people to join efforts in their operation, i.e., because of their size, more labour is needed to haul them, and larger canoes are needed to carry fishers and their equipment. The impacts of the new nets provided more venues for economic gains.

The introduction of outboard motors further transformed the artisanal fishery sector as it presented opportunities for a greater geographical reach. It also revived interest in investing in the industry. By 1969, the industry had about 75% of dugout canoes operating as outboard motors. It also had key players from private sectors and the State Fisheries Corporation. About 75% of dugout canoes were operationalized using outboard motors. Fishing increased considerably in the late 1960s, from 105,100 tons of marine fish caught in 1967 to 234,100 tons in 1982, composed of 199,100 tons of marine varieties and 35,000 tons of freshwater fish from Lake Volta (BoG, 2008).

3.4.2 Overcapacity and depleting stock

The Ghanaian fish stock has experienced a steep decline over the past two decades. The introduction of subsidized technological innovation (outboard motor, premix fuel, fishing net) has resulted in overcapacity exacerbating overfishing and depletion of stocks (Akpalu et al., 2018). Also, the use of inappropriate fishing gears such as small mesh sizes, as well as inappropriate fishing methods such as light fishing, have greatly contributed to the overexploitation of resources.

Meanwhile, government subsidies have failed to yield the desired increase in catch volumes and subsequent contribution to GDP. These economic losses directly impact fishing communities because the costs of fishing outweigh the income/benefits from the venture. Although most studies in the past decade point to a declining fish stock, especially the round sardinella, the main focus of the government in the past two decades has been on increasing small-scale technological innovation and modernizing small-scale fisheries management (Overå, 2011).

3.5 Impacts of changes on the natural, social, political and governing systems related to vulnerabilities and viabilities in SSF

Changes in the physico-chemical conditions of the marine ecosystem are generally anticipated to have major effects on the abundance and on the distribution of fishery resources. As elaborated by Cochrane et al. (2009), increased sea surface temperature will affect fish physiological processes resulting in both positive and negative impacts on fisheries. Climate change is already affecting the seasonality of biological

processes, altering marine and freshwater food webs, with unpredictable consequences on fish production. In addition, increased risks of species invasions and spreading of vector-borne diseases will soon become a concern. Differential warming between land and ocean in tropical regions will affect the intensity, frequency and seasonality of climate patterns and extreme weather events (e.g., floods, droughts and storms). These events will impact the stability of related marine and freshwater resources.

Extreme events are likely to impact infrastructure and safety at sea and settlements, with communities living in low-lying areas at particular risk. To cope with increasing risks, livelihood strategies will have to be developed; for example, with changes in the migration patterns of fishers due to changes in timing of fishing activities. Reduced livelihood options inside and outside the fishery sector will force occupational changes and may increase social pressures, thereby negatively affecting livelihood options.

The implications of climate change will affect the four dimensions of food security. First, availability of aquatic foods will vary through changes in habitats, stocks and species distribution. Second, stability of supply will be impacted by changes in seasonality, increased variance in ecosystem productivity and increased supply variability and risks. Third, access to aquatic foods will be affected by changes in livelihoods and catching. Fourth, utilization of aquatic products will also be impacted. In response, coastal communities will need to adjust to the new status quo, for example by starting to consume species that are not traditionally popular.

New opportunities and positive impacts (e.g., from changes in species and new markets) will also be part of future changes. At the moment, these opportunities are not well understood, but they will depend on adaptive capacity (FAO, 2008).

3.6 Emerging issues and challenges

3.6.1 Subsidies in the SSF sector

Subsidies in the fisheries sector are capacity enhancing strategies that, in recent times, have become an intense topic of debate. In fisheries, subsidies can be defined as:

> "a financial contribution by the public sector which provides private benefits to the fisheries sector, whether direct or indirect (e.g., forgone tax revenue) or whether in terms of goods or services, or income or price support, but excluding general infrastructure, or purchases goods." (World Bank & FAO, 2008, p. 18).

Subsidies in the fisheries sector have been provided by many governments globally for many decades (Tobey et al., 2016). They were provided to support the growth in fishing capacity, fish production, reduce poverty, reduce fish spoilage, support fledgling fishing industries, and preserve livelihood of local fishers (World Bank & FAO, 2008).

In Ghana, subsidies in the fisheries sector have been used as a strategy since the 1940's, including subsidies for fish landing infrastructure (e.g., pre-mix fuel, fishing gear and outboard motors), and tax exemption programmes (Tobey et al., 2016). Within the SSF sector, the subsidy on pre-mix fuel and outboard motors have been most popular costing the Government of Ghana (GoG) close to US$50 million annually (Tobey et al., 2016). Pre-mix fuel is a blend of petrol and gasoline which has been coloured blue to prevent illegal diversion for use in other automobiles and has been subsidized by the government since the early 1990's (Sackey-Mensah, 2012).

Since the early 1990's, however, the depletion of fish stock resulting from overexploitation of resources has been a direct consequence of these subsidies. To this point, a global conversation with calls by civil society groups to the World Trade Organization has been initiated to regulate subsidies in the sector (Milazzo et al., 2008). In Ghana, several recommendations have been made to remove or reduce subsidies on the fuel, gear and outboard motors to reduce the overexploitation of coastal resources (Akpalu et al., 2018; Sackey-Mensah, 2012; Tobey et al., 2016).

Removing or reducing these subsidies is fundamental to the future of Ghanaian's SSF. Still, one cannot ignore the short-term effects that such governmental action will have on small-scale fishers, a group that faces a plethora of challenges. The current political environment in Ghana, where electoral votes are always a consideration, would make it difficult to remove and or reduce subsidies by any ruling government as this will result in a loss in votes from the fishing community (Akpalu et al., 2018; Sackey-Mensah, 2012). Without alternative or supplementary sources of livelihood, removal or reduction of subsidies may severely incapacitate many small-scale fishers. However, allowing fishing at the current capacity is unsustainable, and it will still lead to financial insecurity with the collapse of the country's fisheries.

To this end, proposals have been made to target this dilemma. Particular attention has been given to improving fisheries management and governance in a way that will eliminate IUU fishing and ensuring licensing and registration of canoes (Sackey-Mensah, 2012). Additionally, government efforts have been made to adopt a co-management approach that will ensure that all fisheries stakeholders have roles and responsibilities in the management of the fisheries sector (CRC, 2013).

3.6.2 Technological advancement in Illegal Unregulated Unreported (IUU) fishing

In recent times, as IUU fishing continues to negatively impact SSF in Ghana, more advanced methods to regulate this type of fishing have become of interest. From simple apps to more advanced electronic monitoring systems, these technologies provide an opportunity to reduce the impact of IUU on SSF in Ghana. The Environmental Justice Foundation (EJF) under the EU sponsored project Far Dwuma Nkodo, developed an app called *"DASE*", which helps small-scale fishers report industrial vessels engaging in illegal fishing within the inshore exclusion zone reserved for canoes (EJF, 2020). This tool is already yielding promising results as it is helping small-scale fishers to provide evidence of illegal fishing by industrial vessels. The evidence generated from this technology can be used by the authorities to sanction the offenders. When the sanction is properly applied, it can deter future potential offenders from practicing illegal fishing and this, in addition to other management measures, can sustain the SSF of Ghana. As it stands, the app is being introduced in other West African countries.

Also, the Government of Ghana, Food and Agriculture Organization of the United Nations (FAO), World Wildlife Fund for Nature (WWF), and the International Seafood Sustainability Foundation (ISSF) have partnered under the Common Oceans Areas Beyond National Jurisdiction (ABNJ) Tuna Project to explore ways to use electronic monitoring systems (EMS) to fight IUU in areas outside national jurisdiction. A system that has been tested both in Ghana and in Fiji consists of satellite geolocation, vessel monitoring systems and high-definition cameras to record illegal activities of these vessels (FAO, 2018). This system seeks to complement the existing in-board fisheries observer programs but not as a replacement. Pilot tests have shown that the system was effective in providing verifiable data, while also providing an opportunity to expand the number of fishing trips monitored.

Currently, in Ghana, 14 purse seine tuna fishing vessels operating from the Tema fishing harbour are equipped with this EMS system. The introduction of this monitoring method has improved data, both on the catch composition and where and how the vessels are fishing by the country's Ministry of Fisheries and Aquaculture Development (WWF, 2021). Thanks to word-of-mouth knowledge sharing, Ghana may now

expand its monitoring system to fishing vessels other than its purse seine fleet and to more locations. Beyond Ghana and Fiji, these types of EMS systems are gradually gaining momentum globally in areas such as the Western and Central Pacific Fisheries region. The introduction of technology into fisheries monitoring programmes has the potential to reduce the practice of IUU and improve the sustainability of SSF in Ghana.

The challenge with these technologies is that they currently only target large industrial fishing vessels. There is currently no technology to monitor and report IUU fishing among small-scale fishers who use chemicals, explosives, light, or other unauthorized sizes and techniques to catch fish in ways that are detrimental to the environment and the people who depend on it (Afoakwah et al., 2018). There is therefore an opportunity to explore more technologies that could monitor the IUU fishing operations of SSF.

3.6.3 Supplementary and alternative livelihoods

In the face of declining fish stocks, supplementary and alternative livelihoods have been promoted as a means to reduce overfishing and to provide supplementary income during closed seasons. Also, new livelihoods could encourage youth in fishing communities to engage in alternative livelihoods. This is an opportunity to ensure the viability of the small-scale fishery in Ghana. Aquaculture is one such alternative that the government of Ghana is exploring to sustain per capita fish consumption in the face of declining stocks. Even though aquaculture was introduced in Ghana in 1953, its annual production is just about 3200MT (FAO, 2016) and this is largely from freshwater aquaculture. Mariculture, however, is not widespread along the coast and still requires research to determine its feasibility within Ghana's marine environment (Aheto et al., 2019). Researching species with culture potentials could encourage the local fishers to venture into mariculture as a source of alternative income.

3.6.4 Marine Protected Areas (MPAs)

According to the IUCN, MPA's are natural areas within the marine environment designated for protection according to pre-defined objectives. The objectives for an MPA can range from resource conservation, to biodiversity conservation, to species protection. Several international conventions have been signed towards creating MPAs across the world's oceans and coastal areas. Some examples of such international agreements include: the Convention for Biological Diversity (2010), the United Nations Convention on the Law of the Sea (UNCLOS), the Ramsar Convention on Wetlands of International Importance among others (MCI, 2021). Even though Ghana has six designated Ramsar sites, it currently has no Marine Protected Area.

The Government of Ghana has identified through the Fisheries Management Plan (2015 – 2019) the need to designate areas within its marine environment as MPAs to protect sensitive fish spawning and nursery grounds. The main intent behind this plan is to replenish dwindling stocks. However, lack of knowledge on the specific areas to protect, has hindered the implementation of MPAs in Ghana. Consequently, there is a need for more research into the areas of interest, with the primary aim of identifying sensitive areas to then designate them as MPAs which primarily aim at rejuvenating fish stocks. The success of MPAs greatly depends on high compliance from fishers and so there is the need for a community participatory approach involving the local fishers to ensure that the protected areas are strictly closed to fishing (Sagoe et al., 2021).

4. Policy and governance

SSF in Ghana operate out of fishing communities along the coast and they are characterized by an open-access system in which the right to catch fish is available to all (Aheto et al., 2012). In Ghana, SSF activities are guided by two sets of regulations: those dictated by the state and those set by the coastal communities through a system of traditional rights and common property. Although coastal waters are legally open-access, beaches are a 'common property' resource for the surrounding community. This being said, the Chief Fisherman of that locality has a right of exclusion. Each fishing village has its own particular set of norms that govern behaviour at sea and on the beach.

4.1 SSF governance at the local level

The relationship between men and women in fisheries has been described as mutual: the two work together to serve several purposes, including governance (Ameyaw et al., 2020). For instance, the Chief Fisherman, in consultation with his council of elders (usually made up of canoe owners) controls fishing activities in the communities via dispute settlement, meting out penalties, determining accident at sea response and supervising the distribution of any communal inputs (Bennett, 2002). Bennett further reveals that the Chief Fish Mommy carries out a similar set of roles for the fish processors and traders, who are almost exclusively women. She settles disputes between traders, processors and fishers, and she helps set fish prices. According to Bennett, the Chief Fisherman position is usually hereditary and is accompanied by a considerable amount of power and prestige. The community as a whole is responsible for the day-to-day running of fishing activities in collaboration with the Chief Fisherman. The Chief Fisherman works with the Chief Fish Mommy to set regulations pertaining to the landing and sale of catch. Bennett also explains that none of the regulations laid down by the Chief Fisherman are specifically aimed at protecting the stock, rather, they aim to ensure equitable benefits.

The Local Government Act of Ghana allows various local government agencies to be represented at the local level. This however is not the case for the Ministry of Fisheries and Aquaculture Development (MoFAD). As it stands, the staff of the ministry is neither housed in the Metropolitan, Municipal and District Assemblies (MMDAs) nor catered for in the development plans of the local government administration. As a result, the involvement of the government in the fisheries governance at the local level is highly limited. This entails loss of institutional memory in fisheries, an essential tool for assessment, and a major driver in fisheries management at the local level. Hence, the current system must be reformed to take the staff and activities of the Fisheries Commission into consideration.

4.2 Governance of SSF at the national level

Alongside traditional norms, policy directions and legal provisions are laid down by the state to govern SSF. State regulations concern individual behaviour and fishing practices. At the national level, vessels are segregated based on different gear types and then rules are set for them (GoG, 2002). The state sets out and administers licensing laws and has the power to introduce closed seasons and alter fishing zones as it deems fit (Bennett, 2002).

4.3 Policy evolution in Ghana's fishing sector post-independence

During the post-independence era, between 1964 and 1976, different government administrations instituted various fishing policies and programs and also implemented different legislations aimed at safeguarding this vital sector (Alabi-Doku et al., 2020). In 1964, the Conventions People's Party (CPP) government

instituted Fisheries Regulations (L.I. 364); in 1972, the National Redemption Council (NRC) military government instituted the Fisheries Decree (N.R.C.D.87). These Acts focused on delineating fishing areas, modification monitoring control and mesh size. Within this period, the State Fishing Corporation and the Tema Fishing Habour were set up to mechanize the sector. Also, bilateral agreements were established with Angola, Senegal, and Mauritania for Ghanaian fishers to access their waters. This was targeted at improving the SSF sector and at increasing fish production. These government policies proved successful as in the span of 16 years, SSF landings increased from 32,000 tonnes in 1960 to 118,460 tonnes in 1976 (Alabi-Doku et al., 2020).

Considerable changes occurred between 1977 and 1990. The Fisheries Regulations, 1964 (L.I. 364) was amended by the Fisheries (Amendment) Regulations 1977 (L.I. 1106) in 1977 and in 1979, the A.F.R.C. Decree 30 and L.I.1235 were promulgated by the Armed Forces Revolutionary Council military government, to modify fishing in the country. In this period, fishing zones, fishing vessels and gear, protected species, and fishing licenses were defined. The artisanal sector participated in the modernization of fishing technique with the introduction of purse seine (Alabi-Doku et al., 2020). In 1986, the government authorities established the Maritime Zones (Delimitation) Law (P.N.D.C.L.159) – establishing a 12 nautical mile fishing zone and a contiguous zone. In the late 1980s, District Assemblies were given the explicit responsibility for the licensing of canoes and the preparation of by-laws that support the implementation of national fisheries regulations (CRC, 2013). Again, SSF recorded a rise in fish catch from 151,390 tonnes (in 1977) to 245,460 tonnes (in 1990) (Alabi-Doku et al., 2020).

More changes were introduced between 1991 and 2001. Law No. 256 of 1991 was adopted to govern the Ghanaian fisheries sector. This Act introduced different fishing areas, it regulated new fishing equipment and it created permits for the construction of boats. Finally, it introduced a licensing method for fishing vessels and permits to import motor fishing vessels. Noticeably, it guaranteed a 3 nautical miles fishing territory for artisanal fisheries as a means to prevent conflicts among industrial and artisanal fishers. Catches from the artisanal sector increased from 219,750 tonnes in 1991 to 319,200 tonnes in 1996 before declining to 248,850 tonnes in 2001.

By 2014, the amount of fish landed in Ghana decreased from 207,070 tonnes in 2002 to 198,660 tonnes. Efforts to address the rapid decline of Ghana's fisheries led to the enactment of a number of policies. The Fisheries Act, (Act 625) was established in 2002 to provide regulations for the use and management of fisheries to develop a sustainable fisheries industry (GoG, 2002). The Act established the Fisheries Commission and defined its powers and organizational structure. The Act also set up a Fisheries Development Fund, to regulate the management and conservation of fishery resources such as aquaculture and small-scale fishing. In 2010, the government promulgated Fisheries Regulation 2010 (L.I.1968) to implement the provisions of Act 625 (Alabi-Doku et al., 2020). The Ministry of Fisheries and Aquaculture Development (MOFAD) was established in 2013. The Fisheries Commission was then set up as the executive agency of the MOFAD. The regulation of Ghana's fishing industry is under the supervision of the MOFAD, together with the Fisheries Commission (FC) and its technical divisions under the Directorate of Fisheries (DOF) (Nunoo et al., 2015).

In 2015, the Fisheries Commission designed a 5-year National Fisheries Management Plan (2015 -2019). The Plan intends to: halt catch decline, rebuild fish stock and develop aquaculture into a viable industry for job creation and food security. The Plan also aims to implement strategic actions in the artisanal fisheries sector. Some examples include: the surveying and registration of active canoes; the increase of one day to the traditional one day a week fishing holiday (going 1 day off to two days off every week) ; the control of new entrants to the fishery, the implementation of co-management strategies; and the modernization of the fleet by using innovative materials to control increasing effort (MoFAD, 2015).

4.4 Fishing closed season for artisanal and semi-industrial fleets

Within the provisions of the Fisheries Management Plan, there was a ministerial directive regarding the implementation of closed seasons for industrial trawlers and artisanal canoes. The directive intends to protect the spawning brood stock of small pelagic species, mainly the *Sardinella aurita*, the *Sardinella maderensis*, the *Engraulis encrasicolus* and the *Scomber colias* to reduce fishing effort on these stocks. The government thus announced a closed season programme in 2018, but it was fiercely opposed by the fishers. As a result, the programme was suspended (Graphic, 2019).

In 2019, however, the closed season for the artisanal and semi-industrial fisheries, the first of its kind since the adoption of the National Fisheries Management Plan, was implemented from May 15 – June 15 (Graphic, 2020). The fisheries closure covered all marine areas and coastal estuaries of Ghana's EEZ. The closure did not produce the desired effects of maximizing the reproductive potential of small pelagic species during their peak spawning period - August and September. However, a study conducted by Lazar et al. (2020) reported that the period with lowest spawning rates occur from May through June, and in October. Thus, the period selected for the closure was the least preferred period for the biological benefits that were targeted. Nonetheless, the high voluntary compliance and support by fishers and fish processors for a closed season was a good sign for adjusting future seasonal closures within the periods of the peak spawning (Lazar et al., 2020).

5. Conclusions

In conclusion, the importance of the SSF in Ghana cannot be overemphasized given that the fisheries provide food security, employment and income. However, considering the emerging challenges and conflicts in the sector, urgent measures must be put in place to ensure their sustainability. Now, the state, fisher folk and other stakeholders should join forces to fight against all forms of illegal fishing through effective surveillance systems for checking IUU fishing. Finally, permanent institutionalization of fishing closed season and effective involvement of fishing communities in the decision-making process should be implemented.

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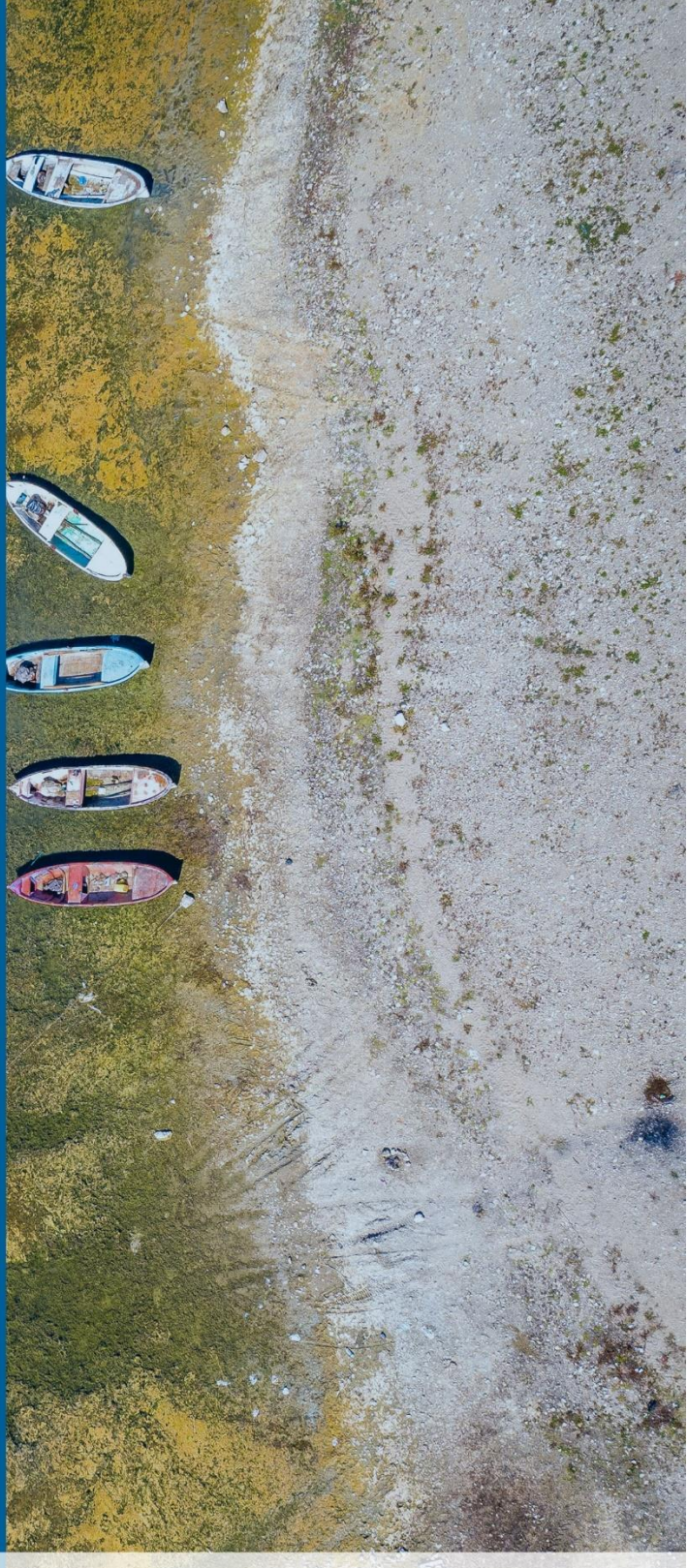
Vulnerability to Viability (V2V) Global Partnership

The Vulnerability to Viability (V2V) project is a transdisciplinary global partnership and knowledge network. Our aim is to support the transition of small-scale fisheries (SSF) from vulnerability to viability in Africa and Asia. Vulnerability is understood as a function of exposure, sensitivity and the capacity to respond to diverse drivers of change. We use the term viability not just in an its economic sense but also to include its social, political, and ecological dimensions.

The V2V partnership brings together approximately 150 people and 70 organizations across six countries in Asia (Bangladesh, India, Indonesia, Japan, Malaysia, Thailand), six countries in Africa (Ghana, Malawi, Nigeria, Senegal, South Africa, Tanzania), Canada and globally. This unique initiative is characterized by diverse cultural and disciplinary perspectives, extensive capacity building and graduate student training activities, and grounded case studies from two regions of the world to show how and when SSF communities can proactively respond to challenges and creatively engage in solutions that build their viability. Further information on the V2V Partnership is available here: www.v2vglobalpartnership.org.



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