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

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## V2V Working Paper Series

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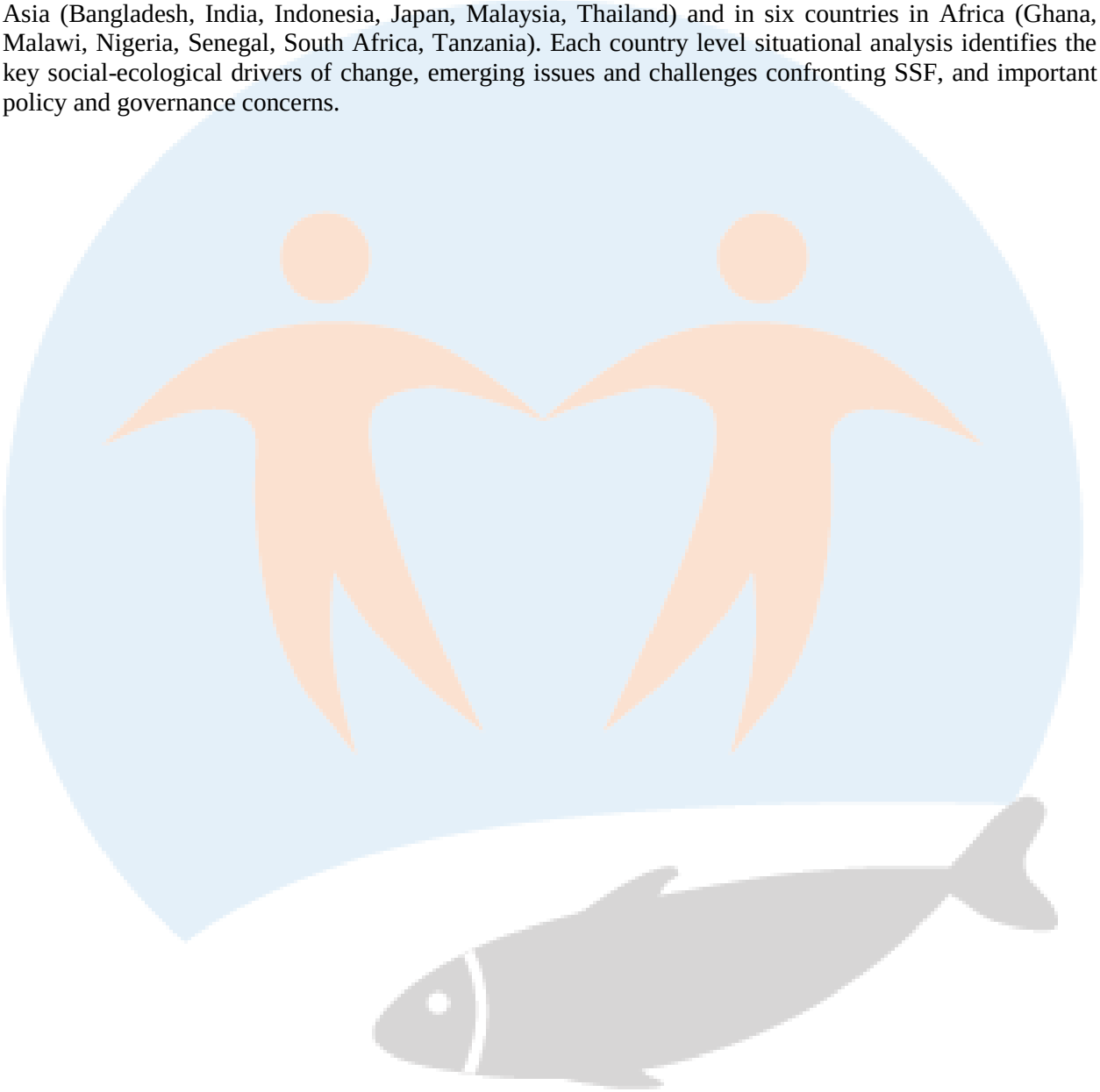
## A V2V Situational Analysis of Small-Scale Fisheries

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 Nigeria: From Vulnerability to Viability

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## 1. Introduction

Nigeria is the most populated country in sub-Saharan Africa with over 200 million people and a total land area of 923,773 km$^2$. The country is naturally endowed with a vast network of rivers, estuaries /flood plains, natural and artificial lakes and reservoirs, as well as brackish waters, lagoons and creeks that provide rich biodiversity of aquatic fisheries (Olaoye & Ojebiyi, 2018). In addition, it has over 800 km of often surf-beaten coastline with sand and mud beaches with five nautical miles from coast to sea. Coastal waters exclusive to artisanal fisheries cover nine coastal states in Nigeria, with a total area of 39,644 km$^2$.

Small-scale or artisanal fisheries have been described as fisheries capturing fish from natural water bodies such as coastal waters, rivers, streams, lakes, and ponds by small-scale fisherfolks using both traditional and modern fishing gears (Olaoye & Ojebiyi, 2018). Artisanal fisheries include local fishermen and women who carry out fishing activities on a full-time or part-time basis at subsistence level making use of different sorts of gears and techniques, which may be destructive, cheap, and locally sourced (Olaoye et al., 2018). It is a heterogeneous, multi-species, multi-gear, multi-craft and multi-techniques, non-industrial fishery that covers the activities of small-scale canoes operating in the coastal areas, creeks, lagoons, inshore water, and the inland rivers targeting exclusively freshwater, brackish water and inshore pelagic fish stocks (Olatunji & Olah, 2012; Akintola & Fakoya, 2016).

Some of the gears used by small scale fishers include gill nets, cast nets, drift nets, stow nets, bag nets, fyke nets, beach seine, wounding gears, pots, traps, hooks and longlines (Fisheries Statistical Bulletin, Kanji Lake, 1997; Olaoye & Ojebiyi, 2018). The type of boat used depends on each fishery, but boats commonly used include the 3m to 18m long planked or dug-out canoes, half dugout or half planked canoe, and Ghana dugout canoes with outboards ranging from 15 to 45 horsepower. The average crew on the boat vary from three to five persons and the number of trips per week varies from one to five days depending on whether it is a marine or freshwater fishery (Inoni & Oyaide, 2007).

Most of the major fishing related activities in the country occur in fishing settlements located along the coastal area of the southern and exploit inshore demersal fisheries with industrial fishing trawlers (Akintola & Fakoya, 2017). Artisanal fisheries in Nigeria are categorised between coastal and inland artisanal fisheries. Coastal fisheries resources are multi-species and include fin and shell fishes with migration of species from the open sea to estuaries and creeks and vice-versa. Some common coastal commercial fish species are Croakers (*Pseudotolithus spp); Bonga Fish (Sardinella spp); Barracudas (Sphyraena*); Threadfin:(*Polydactylus quadrifilis)* Tongue Sole (*Cynoglossus; spp*); Grunter (*Pomadasys jubelini*); Red Snapper (*Lutjanus spp)* (Olaoye and Ojebiyi, 2018). The more common commercial freshwater fish species

are *Sarotherodon galilaeus*, *Clarias gariepinus*, *Chrysichthys nigrodigitatus*. *Cynoglossus senegalensis*. *Polydactylus Quadrifilis*. *Parachana obscura*, *Hepsetus odoe*, *Mormyrus rume*, *Barbus callipterus*, *Malapterurus electricus Heterotis niloticus* and *Marcusenius senegalensis* (Bolarinwa & Popoola, 2013; Komolafe et al., 2014).

## 1.1 Historical development of fisheries management in Nigeria

The management of fisheries in Nigeria started in 1941 with the colonial government: there was no real developmental policy in place, rather, programmes focused mainly on the activities in experimental brackish water culture and canoe fishery survey. Priority was accorded the acquisition of small, motorized crafts for exploratory fishing in the estuaries, creeks, and lagoons (Agbeja, 2012). There were also efforts to improve the social conditions of fishers and active extension services to increase coastal canoe fisher adoption of improved fishing techniques and gear (Gaffar, 1999).

After independence in 1960, several projects aimed at boosting the local supply of fish were embarked upon by the Federal Government in response to the high fish consumption and increasing demand. These projects were mainly implemented during the Third and Fourth National Development (1975 - 80 and 1981 - 85) Plans Examples of these projects included Inshore Fisheries Development Project to enhance fish production and generate employment opportunities; National Accelerated Fish Production Project (NAFPP) and Canoe Mechanization Scheme (CMS), Special Fisheries Development Project; and Processing and Marketing Project, Fadama I-III among others (Tiamiyu et al., 2015). Modern-styled cooperatives were also introduced to the fishery sector in the 1970s and 1980s to facilitate the distribution of all state-sponsored credit and technical assistance (mostly, subsidized outboard engines and fishing nets) to fishers (SFLP, 2002).

These projects yielded an increase in fish supply; however, due to policy shifts, unsustainable implementation and a rapid population growth, the fish supply declined gradually over the years. The implementation of International Monetary Fund (IMF)/World Bank-supported Structural Adjustment Programme (SAP) in 1986 at the heels of national economic recession further contributed to a decline in the overall performance in SSF production (Ovie & Raji, 2006; Mabawonku, 1990). The SAP is a government initiative introduced in 1985 meant to address the fundamental economic and financial problems confronting the country. SAP implemented subsidy withdrawal on fishing inputs, currency devaluation and a sharp upward adjustment in prices of petroleum products; these changes caused the cost of fishing operations to rise uncontrollably by inflation (Jinadu, 2000). Still, artisanal fishing and fishing-related occupations remain the lifeblood of most rural coastal economics.

## 1.2 Governance in Nigeria

Post-independence, several policies are laws were enacted to regulate fisheries. A few examples include: the 1961 Sea Fisheries (Lagos) Act, the 1965 Sea Fisheries Law, the 1967 Sea Fisheries (Motor Fishing Boats Licensing) Regulations, and the 1969 Sea Fisheries (Licensing) Regulations for monitoring and regulating the coastal industrial fisheries. The Federal Military Government promulgated the Sea Fisheries Decrees of 1971, 1972, 1978 and 1992 on the recommendation of the Federal Office of Fisheries; objectives included: to manage and regulate coastal industrial fisheries; licensing of commercial fishing boats; outlaw obnoxious fishing; regulate net mesh sizes and size of fish species to be captured and restrict the activities of business fisheries within five nautical offshore(Akpu, 2013; Nwosu et al., 2013; Etim et al., 2015). However, most of those laws focused only on coastal industrial fishing with no attempt to regulate inland and coastal artisanal fisheries.

In 1975, the National Institute for Freshwater Fisheries Research (NIFFR) and the Nigerian Institute for Oceanography and Marine Research (NIOMR) were established to: conduct research projects in fisheries; ensure proper management and control of fishing activities; and promote sustainable exploitation of both inland and coastal artisanal fisheries resources. Despite not being specific on the sizes of fishes allowed for capture, the national institute for oceanography and marine research (NIOMR) was tasked to provide the scientific bases to determine the minimum sizes of fish species to be caught annually (Nwosu et al., 2011; Olaoye & Ojebiyi, 2018).

Coastal fisheries in Nigeria are governed by the Federal Government through fisheries decrees and Acts, while inland fisheries are governed by each state's locale governments and enforced by their department of fisheries. However, not all the states have enacted fisheries edicts; those with fisheries edicts need to update their policies to better address SSF's vulnerabilities. The important law governing small-scale fisheries in coastal waters is the Sea Fisheries Law of 1992, which protects the exclusive rights of the artisanal fishers within the five nautical miles from shore. This was designed to protect SSF from competition with industrial fisheries.

In Nigeria, traditional institutions play an informal but very effective role in fisheries management. There is no formal policy in place confirming devolution of fisheries management to traditional institutions; however, they are still accorded recognition as traditional fisheries managers by both the federal and state department of fisheries.

In northern Nigeria, there are traditional and mixed systems of fisheries governance. In the traditional community-based systems, head fishers, also known as Sarki Ruwas, are vested by custom to manage the fisheries resources at the community level and are accountable to the district chiefs known as Bualama/Wakili (Ovie & Raji, 2007). The governance and influence of both the district head and head fishers are strong under existing traditional norms, culture, and values (Ovie & Raji, 2007). The informal local fisheries management system gives the district heads the power to determine closed fishing season areas and to enforce fishing gear restrictions. The Argungu Emirate presents an example of such community-based management, where the use of gillnet and cast net is prohibited to prevent overfishing during the annual Argungu fishing festival (Eyo and Ahmed, 2005). These community-based management systems are also common in the management of communal fish shelters popularly called Acadia, widely spread in most inland water bodies in Nigeria **(**Olopade et al., 2008**)**.

The mixed system is akin to fisheries co-management. It occurs at village levels in major fishing communities of Kainji/Jebba and Chad basins, the confluence of the Niger/Benue, and Nguru–Gashua Wetlands, North-East Nigeria. The Village Heads or Sarkin Ruwas (Head Fishermen) act as link persons between the rural community and village authorities such as the local representative of the Federal Department of Fisheries (Neiland & Ladu, 1998; SFLP, 2002) and these arrangements operate through long-standing customary rules, norms, and taboos.

Although Nigeria lacks a formal fisheries co-management or decentralization policy (Ovie & Raji, 2006; Lewins et al., 2014), a community-based management was experimented with through a donor-funded project – Kainji Lake Fisheries Management and Conservation Unit (KLFMCU). The Kainji Lake Fisheries Promotion Project (KLFF-T) also practised co-management with strict regulation for fishing gears and prohibition of beach seines for fishing with considerable success in catching offenders and increasing landing. A community-based fisheries management outfit, the Kainji Lake Fisheries Management and Conservation Unit, oversaw regulating and succeeded in ensuring sustainable fishing in the Kainji Lake fisheries till the funding for the project stopped in 2002 (Eyo and Ahmed, 2005).

Access rights in the coastal fisheries are usually open-access and regulated through traditional norms, religious rites and fork tales among others which translate to close and open season. However, there are no

standard regulation of access (Fakoya & Akintola, 2018a). In contrast, the security of tenure and access right in inland fisheries is dependent on extant traditional tenure practices. Security of tenure to land and water is influenced by customary tenure practices, prevailing land–use administration, statutory laws, forces of demographic changes, climate, and geography. Common or communal property regimes are the most prevalent.

## 2. Meaning and status of small-scale fisheries

### 2.1 Small-scale fisheries contribution to Nigeria

SSF provide a host of contributions such as essential ecosystem services comprising food, nutrient cycling in water, employment, income, enhance the socioeconomic development of urban and rural areas and support livelihood to millions of people. In Nigeria, it accounts for approximately 70% of domestic fish production and consumption, producing over 600,000 metric tons, and constituting a substantial portion of the 0.88% contribution of fisheries to the nation's agriculture GDP component, providing over 5.8 million direct employment and over 20 million employments along the value chain (FDF, 2015). However, it reported contribution to the nation's GDP does not reflect the true picture of its contribution to the country. In fact, its real value is often underestimated due to the lack of accurate catch landing data. SSF are the dominant source of local fish production in Nigeria but like many fisheries worldwide, they receive little attention for their contribution to food and nutritional security (Akintola & Fakoya, 2017).

Historically, living aquatic resources have provided livelihoods and income for Nigerians, especially, those living along with the isolated riverine and coastal communities (Ipinmoroti, 2012). Fish is the cheapest source of animal protein consumed by the average Nigerian, accounting for up to 50% of the total animal protein intake. Wild fish have high nutritional value, providing a high-quality source of protein, fatty acids, and micronutrients vital to combatting malnutrition and disease, and particularly necessary in the diets of pregnant women, infants and lactating mothers (Bogard et al., 2015; Thilsted et al., 2016). The contribution of SSF has been further enhanced with new studies reporting that its nutritional value may exceed that of cultured fishes (Thilsted et al., 2016; Bogard et al., 2017).

### 2.2 SSF profile in Nigeria

SSF can be described as heterogeneous, multi-gear, multi-technique, multi-habitat and multi-species activity that more than often employ simple crafts like dug-out wooden canoes, bamboo rafts, with or without the outboard engine, or no boat and traditional gears, which include traps, hook and line, cast nets, gill nets, harpoons, and beach seines (Akintola & Fakoya, 2017). Generally, SSF are characterized as being labour intensive; relatively low capital investment; operating in poorly developed infrastructural facilities, such as cold storage and processing plants. They are geographically scattered, usually in remote and hardly accessible settlements, which makes evacuation, distribution, and marketing of products rather difficult task (Onuoha, 2009; Omorinkoba et al., 2011). SSF not only refers to the amount of technology being employed by fishers, but also includes economic and social overturns; and sometimes family-based fisheries. The catch will be either for the family's consumption or subsistence and, or for sale. In Nigeria, it is multi-species fisheries as often, a wide range of species are caught within different context.

In Nigeria, SSF can be classified into three broad categories according to the type of ecosystems: brackish, coastal and inland artisanal or small-scale fisheries. However, there is high interconnectivity between the brackish and coastal fisheries with regular migration of fish between the two ecosystems and continuous flow of nutrients between them. Nigeria adopted FAO's definition for its SSF. Food and Agricultural

Organisation defines small-scale and artisanal fishing as: "fishing households using relatively small amount of capital and energy, relatively small fishing vessels, making short fishing trips, close to shore and mainly for local consumption" (FAO).

**Table 1**

*Summary of small-scale fisheries profile in Nigeria*

| Terms used in SSF | Gear types/species | Vessel types | Ecosystem types | Ecosystem detailed types |
|---|---|---|---|---|
| • Artisanal<br>• Coastal<br>• Commercial<br>• Indigenous<br>• Inland<br>• Inter-regional<br>• Inshore<br>• Small boat<br>• Small scale<br>• Subsistence<br>• Traditional | • Cast nets/ *Citharinus citharus, Tilapia* spp<br>• Gillnets/*Tilapia ziili, Orechromis niioticus, Ethmalosa fimbriata*<br>• Gleaning/ Periwinkles, mangrove oysters<br>• Harpoons<br>• Hooks and lines/ *Lutjanus* spp, *Channa* spp., *Clarias gariepinus, Heterotis niloticus, Polydactylus quadrifilis, Psuedotolithus typus*.<br>• Lift nets<br>• Poison/explosives<br>• Recreational fishing gears<br>• Seine nets/ *Clupeid* spp, *Megalops atlantica, Cynoglossus senegalensis, Clupeid* spp<br>• Surrounding nets/ *Ethmalosa* spp.<br>• Traps/ *Clarias* spp., *Lates Niloticus*<br>• Trawls/ *Sphyraena* spp., shrimp<br>• Baskets<br>• Pots<br>• Gourds<br>• Fyke nets | • Canoe[1]<br>• Wooden<br>• Fiberglass<br>• Gourd or calabash<br>• Brush-parks | • Marine<br>• Freshwater<br>• Brackish | • Beach<br>• Coastal<br>• Estuary<br>• Intertidal<br>• Lagoon<br>• Lake<br>• Mangrove<br>• Open ocean<br>• River |

[1] Canoes are usually between 3 to 18m long planked or dugout canoes, half dug out or half planked canoe, Ghana dugout canoes with or without outboards engines ranging from 15 -45 horsepower; average crew on the boat is three persons and number of trips per week vary from one to five days depending on whether it's marine or freshwater fisheries.

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

There is inter and intra-connectivity within Nigeria's marine, coastal and inland ecosystems ensuring the flow of nutrients and completion of life cycles of major target species for the sustainability of SSF. Coastal ecosystems include a network of estuaries, creeks, lagoons, and mangrove swamps of varying salinity flowing into the open sea and inclusive of the inshore waters of the sea itself. There occurs vertical migration of some fish species from the open sea to estuaries and creeks and vice-versa; as well, we observe a flow of nutrients to the sea from the network of brackish waters (Olaoye & Ojebiyi, 2018). Correspondingly, fishers in the coastal zone have the advantage of fishing both at sea and in the lagoon,

estuaries, or creeks. During the rainy season, when the sea is particularly rough, several motorized canoes are restricted from operating in the open sea and resort to fishing in the coastal lagoons, creeks, and in the bar-built and lagoon-like estuaries (Ssentongo, 1986).

Inland ecosystems include freshwater systems consisting of a vast network of rivers, flood plains, natural and man-made lakes and reservoirs. The Nigerian freshwater system is principally characterized by the Niger and Benue Rivers systems with their major tributaries. River Niger is fed by more rivers than River Benue, with tributaries flowing into it from all directions, including from outside Nigeria. Fed by smaller rivers, both Ogun and Osun rivers flow directly into the Lagos Lagoon before discharging through creeks and swamps into the Atlantic Ocean. Few rivers flow directly to the Atlantic. One of these is the Cross River fed by many tributaries originating in the Cameroon mountains that flows into the Atlantic Ocean with limited delta formation. The Kwa Iboe River also flows through a zone of mangrove swamps linked by creeks and lagoons before discharging directly into the ocean (Ita, 1993).

## 3. Social-ecological changes and key drivers

### 3.1 Climate change

Climate change is one of the key drivers affecting SSF in Nigeria and has altered the regime of fishing activities. Evidence of changes in fisheries includes the relocation of coastal fishing communities such as Awoye, Abereke, and Sekelewu in Ondo State that has been sacked by the floodwater from ocean surge; additionally, in the next decade, coastal erosion will further remove ten more coastal communities (Fabiyi, 2012; Oyekale; 2013). The southwest coastal states are also victims of coastal erosion, with the erosion of sand from Lagos and mud in Ondo along the coast leading to a loss of its fishing community. On the other hand, the mud eroded in the southwest is being deposited in the Niger Delta creating new fishing camps and settlements in Jalla, Kantu, Yokri Egbe Igbekebo areas of Delta state, as well as intertidal habitats for molluscs such as crabs, lobsters and prawns (Fabiyi & Yesuf, 2013).

Coastal flooding is also a frequent phenomenon in coastal states affecting fishing activities, fish preservation and processing. Increased intensity and frequency of storms, surges and tidal waves make fishing hazardous for fishers. In inland fisheries, climate change has been mainly responsible for the reduction in Lake Chad Basin to one-fifth of its original size resulting in seasonal drying of the Nigerian portion of the lake. The intrinsic relationship between climate-induced rainfalls has resulted in major dams overflowing with water, flooding the networks of River Basins, flood plains and manmade lakes. Indeed, this comes with its attendant consequences for the riverine communities. Artisanal fishers have reportedly complained that fishing is almost impossible due to the high level of the water depriving them of income for their livelihood.

Various studies have reported flooding of coastal fishing communities in southern Nigeria (Adeoti et al., 2010; Akankali & Jamabo, 2011; Adelekan & Fregene, 2014). The changes in dynamics of the coastal and oceanographic properties, especially temperature, has resulted in the vertical migration of some fish species to cooler waters outside the exclusive artisanal fishing zone, exposing them to conflict with industrial fishing trawlers. SSF contribute the least to climate change but unfortunately, they suffer the most impact as exacerbated by non-climate stressors, resulting in further vulnerabilities.

## 3.2 Population growth

Population growth has led to the overexploitation of both inland and coastal aquatic resources through overfishing using destructive fishing methods with unregulated mesh sizes, active gears, chemicals, poisons, and an increased use of outboard engines. This scenario has resulted in excessive demand leading to sales of every fish caught irrespective of size or species. The effect is a disruption in fish recruitment through excessive capture of fish juveniles, depleting fish stocks and increase in bycatch, pollution of the aquatic environment, loss of biodiversity and aquatic environmental degradation (Oruonye, 2014; Bolarinwa et al., 2017).

Population growth has its benefits for fishers as it increases demand. By providing them with a larger market, fishers are guaranteed a steadier income for their livelihood sustenance while also providing labour for fishing activities which is labour intensive. It also ensures succession and continuity of fishing activity by providing a ready pool of young fishers looking for employment. An increased population in fishing communities may also attract political attention where a substantial voting block is formed. This may have the overarching effect of attracting favourable policies that enhance employment opportunities for these communities.

## 3.3 Economic development

The SSF landscape is changing significantly due to pressure face from urbanisation fuelled by Nigeria's oil exploration which constitutes the bulk of the nation's GDP and a major source of foreign exchange. Although agriculture still contributes to the nation's GDP and remains the largest employer of labour, its financial contribution is a long way from the income derivable from crude oil. Economic development is intrinsically tied to population growth and together they influence most drivers of SSF.

Heralding the economic growth fuelled by rural-urban migration has been increasing incursion and displacement of fishing communities by the government to establish new coastal towns. The Lagos State Government forcefully destroyed fishing communities in Makoro, Ilubrin, Kuramo, Otodogbame and embarked on land reclamation from the ocean front to develop urban coastal towns. This action provide land for state housing' needs and expand its economic base (Fakoya & Akintola, 2019). Similar land reclamation led to the development of new coastal towns such as Victoria Garden City, Banana Island in Lagos and new Port Harcourt in Rivers, resulting in a decrease in fishable areas (Odunuga et al., 2018).

Sand mining activities because of rapid urbanization also contribute to aquatic degradation and erosion at the banks of rivers leading to the destruction of natural fish spawning grounds (Akintola & Fakoya, 2017; Bolarinwa et al., 2017). Industrialization and urban development pollute aquatic environments through the discharge of industrial and domestic waste into the water bodies, leading to eutrophication. In inland waters, the construction of dams for agriculture and generation of electricity tinkers with fish biodiversity by disrupting the natural migration of fish. Meanwhile, the periodic release of water from dams often leads to flooding of fishing communities along the riverbanks.

This said, economic development is in some respect beneficial to SSF as it increases the number of people with the financial capacity to purchase fish products, ensuring that fishers draw profit from their catch. Also, dams create new fishing reservoirs, sustaining fishers' livelihood. Dams also provide irrigation for agriculture and electricity for the fishing communities. Industrial and domestic wastes introduce nutrients into the water bodies which increase their primary productivity and fisheries. Urban development opens up coastal fishing communities and provides more opportunities for income diversification and access to basic social amenities usually lacking in most fishing communities.

## 4. Emerging issues and challenges

The challenges of artisanal fisheries in Nigeria are complex, multifaceted, and interwoven and revolve around ecological, socio-economic, cultural and particularly governance issues. The challenges confronting the development and sustainability of artisanal fisheries in Nigeria are not unique to the country and are common to other developing countries in the world. Some of the challenges are interwoven and vary from one fishing community and ecosystem to another. The general challenges of SSF in Nigeria are addressed below.

### 4.1 Open access nature of the fisheries

The open-access property regime which most of the inland and coastal fisheries operate in Nigeria reduces the need for protection since ownership are often communal. The challenges of open access are more visible in SSF where control and jurisdiction are poorly managed. Arguably, open access ensures fair and equitable access to coastal aquatic resources. This said, helping fishers travel longer distances to fishing grounds of their choosing, has made it difficult for fishing communities to manage access to (Fregene, 2007).

In the Sea Fisheries Decree, there are limited provisions regarding the management of fishing activities of coastal and brackish water fisheries. Proper monitoring, control and surveillance is impeded by the massive number of fishers involved and also by the geographical spread of scattered fishing communities. Acquisition of license is mandatory for any fishing vessel to fish in Nigeria's water body and EEZ. Presently, there is no license regime for SSF operators though, the need to have their fishing vessels registered in being muted. By definition, a motor fishing vessel within the decree is any fishing vessel propelled by means of steam, burning or other machinery except one or more portable outboard engines. This excludes SSF fishers who mostly use motorized fishing canoes propelled by one or two outboard engines from 15 to 45 hp. This implies that from a legal point of view, coastal small-scale fishers cannot be restricted from fishing by means of licensing. Licensing is used as a measure of fishing efforts.

In inland fisheries where communal property regimes and user rights to fishing grounds prevail, fishers are bound by ethics not to fish unless they have secured fishing rights. The extent to which fishers respect the ethics of legitimate fishing and spatial boundaries of the fisheries resources is determined by the strength of the social norms in the community and collective social capital action. Therefore, fishers display passivity to the conservation of the exploited fish stock if there is no collective action to limit fishing effort. Consequently, the fisher is free to fish as pleased anytime and the frequency of fishing increases with higher capital investment (Fakoya & Akintola, 2018b). This is further exacerbated by the lack of enforcement of extant regulations in inland fisheries, mainly due to lack of manpower, equipment, funding and political factors (Ifunanya, 2010).

### 4.2 Poor Governance

The poor management of water bodies by the relevant government authorities results in low productivity and consequently low catches by fishers (Akankali & Jamabo, 2011; Adesoji & Kekere, 2013, Olopade et al., 2017). This can be attributed to the inadequacies in the fisheries edicts in most inland states and the inability to enforce edicts by local authorities. A typical example is the return of beach seines and fishing of fish juveniles in the Kainji lake fisheries after the stoppage of project funding from the German government in 2003. Lack of proper monitoring and management of the Lake's fisheries has also resulted in the use of undesirable fishing gears by some fishers and the application of very destructive fishing methods by others (Ekpo & Essien, 2013; Oruonye, 2014).

Governance is also an important driver of artisanal fisheries controlling and regulating its activities in both inland and coastal waters. Governance relating to SSF in Nigeria is quite weak. Management of the nation's fisheries resources is plagued by a top-bottom approach to policymaking monopolized by state institutions. The status quo is weakened by political and economic instability; bureaucracy; weak institutional capacity; insufficiently qualified personnel; lack of equipment; logistics; finance and inadequate data resulting in the poor management and over-exploitation of fisheries resources (Ovie & Raji, 2007, Olopade et al., 2017). Artisanal fishers were not involved in the drafting of laws affecting them and they lack a role in the management of the artisanal fisheries. The existing legislations are not complemented by sufficient administrative structures for their administration, mainly due to lack of resources, weak database and weak law enforcement strategies (Olopade et al., 2017). Furthermore, because fisheries and water resources management in Nigeria is undertaken by all tiers of government, there are frequent legislative overlaps and conflicts (Akintola & Fakoya, 2017; Akintola et al., 2017). The legislations have not only become outdated, but also the intra-sectoral focus of fisheries excludes external threats and opportunities which are not addressed in fisheries policies and management (Fakoya & Akintola, 2018a).

Extant laws and regulations are not driven by strong scientific data and analyses to promote evidence-based management and adoption of management measures such as permissible fishing gears, closed area/season, fish species, current biological data on fish species and low fines for offenders (Akpu, 2013, Tiamiyu et al., 2015; Olopade et al., 2017). This is largely because the existing laws and regulations lack fundamental biological scientific data, upon which sustainable fisheries exploitation is based. For instance, tthe laws do not consider fin fish gear selectivity and information stipulating gear types to be used in coastal waters (Ita, 1993; Nwosu et al., 2011). Although the law made provisions for the National Insitute of Oceanography and Marine Research to publish minimum sizes of fish species to be caught annually, the agency has not been carrying this out due to inadequate administrative structure, logistical and financial challenges (Nwosu et al., 2011).

### 4.3 Over exploitation

Historically, people have the erroneous notion that fisheries resources are inexhaustible. Fish is a renewable resource; however, stock takes time to regenerate, making fish susceptible to overexploitation. Overexploitation has been attributed to the invention and increased sophistication of fishing gear and crafts (Etim, 2010). Overfishing can result in a negative biological, economic and sociological impact as reported by different studies. Some fish species are fast disappearing and the number of stocks caught is decreasing in average size due to overfishing, as in the Benue River system for example (Oruonye, 2014; Olapade et al., 2017).

### 4.4 Obnoxious/illegal fishing practices

Fisherfolks could be found practicing obnoxious fishing with chemicals like Gammalin 20, or extracts from roots, leaves, fruits and flowers from poisonous plants. Plant extracts pollute the environment and reduce the fish stocks through uncontrollable mortality. Illegal fishing practices also include the use of explosives like dynamite and locally made hand grenade and to kill fish. This fishing method risks the extermination of precious macro and micro-organisms that are essential to the ecosystem. The use of inappropriate fishing gears in many inland waters of Nigeria, such as nets of very small mesh sizes, destabilizes the natural balance of the aquatic ecosystems (Omorinkoba et al., 2011; Nwabezez & Erie, 2013). This leads to over-exploitation whereby the juveniles that would have been recruited into the fishery are caught along with the adults. Rising poverty levels in face of a declining economy further aggravate the health of SSF as illegal

fishing becomes a lucrative alternative for fishers. Meanwhile, the existing penalties are not punitive enough to discourage potential violators, thereby encouraging obnoxious and destructive fishing practices.

### 4.5 Pollution

Exploration and extraction of oil in coastal waterways and creeks pollutes aquatic habitats and endangers the survival and development of fish stocks. The diverse activities involved in petroleum exploration, extraction and production generate waste. This, along with its varying chemical compositions at various operating stages, pollute Nigeria's Niger Delta. Pollutants affect aquatic life in sediments and open water, resulting in massive fish kills that include all organisms that contribute to the food web of commercially important fish species and destroying nursery and feeding grounds. Furthermore, major declines in fish stocks caused by pollution leads to a further impoverishment of artisanal fishers whose livelihoods are dependent on the health of the ecosystem areas (Ifeanyi-Obi & Iremesuk, 2018). The mangroves of the Niger Delta, which are important fish breeding grounds pollution, have been adversely affected by oil pollution and they will hardly ever be restored. The rampant oil pipelines vandalization is the major cause of these oil spillages. High concentrations of lead and cadmium heavy metals were found in four fish species: *Scomberomorus tritor, Pseudotolithus typus, Trichiurus lepturus and Shyrua zygaena*, harvested from Ibeno coastal area with high levels of lead and cadmium (Nsongurua et al., 2011). The presence of these metals in fish constitutes a great health risk to fish consumers.

### 4.6 Climatic change

Artisanal fisheries are influenced by climatic factors and dynamics of water variables such as temperature, salinity, wind speed direction, ocean currents, and strength of upwelling. Together, these factors affect the abundance and distribution of fish population and fisheries activities (Ekpo & Nbebule, 2012). Climate change impacts on the aquatic environment are evidenced by the increased mean annual temperature; latitudinal and depth shift in range; lower dissolved oxygen concentration, the threat to mangrove swamps, phenology of marine organisms and ocean acidification (Ipinmoroti, 2012). Climate change is responsible for the near disappearance of Lake Chad in northeast Nigeria from the 1970s to 2001 resulting in the depletion of fishery resources and threatening the livelihood of the fishers (Ovie & Raji, 2007). Anthropogenic stressors such as fishing, pollution and habitat alteration, accentuate climate impacts on aquatic ecosystems and the exploited fish population by reducing their resilience and increasing their sensitivity to climate change (Enim, 2012).

### 4.7 Post-harvest losses

Fish spoilage and deterioration are rapid and caused by bacterial action and biochemical changes in the fish, exacerbated by the high temperature of the tropics in Nigeria. This sometimes leads to post-harvest loss: that is, units of catch becoming so spoiled that they are lost. To prevent this, there need to be proper preservation methods and storage strategies (Moses, 2002). Generally, SSF are characterized by inadequate preservation and processing methods and a lack of storage facilities. These losses occur at different levels of the value chain from capture to the final stage of the marketing, with about 30-50% lost in weight of the fish landed (Bolorunduro et al., 2005; Olusegun & Mathew, 2016). Other factors responsible for post-harvest loss include longer duration of the fishing cycle, delay in hauling nets, use of chemicals in catching fish, poor road network and lack of good transportation (Bolarinwa et al., 2017; Adelaja et al., 2018). These losses further impoverish fishers reducing their income and encouraging overfishing as means of recovering

losses. The most common fish processing and preservation methods are the traditional smoke-drying technologies, which are relatively cheaper and less efficacious, when compared to modern technologies. The fish distribution chain consists of a network of fish distributors and marketers that aid the movement of product to the final consumer. The lack of access roads that characterize most riverine communities hampers the movement of fish products and contributes to postharvest losses (Adelaja et al., 2018). Therefore, fast transportation by distributors and marketers will help to reduce spoilage.

## 4.9 Decline in biodiversity

Habitat destruction resulting in loss of biodiversity is a common problem, particularly in developing countries like Nigeria, where a high portion of the population is dependent on aquatic resources. Over-exploited fish population, such as *Protopterus annectens* and *Xenomystus nigri* were reportedly not found again in Ikpa River of Akwa Ibom State, Nigeria (Ekpo & Essien, 2013). Species extinction is generally associated with habitat modification, perturbation and destruction. Common anthropogenic perturbations of aquatic system include alterations in the eco-hydrological regime, habitat area, habitat quality, water quality, substrate quality, biotic interactions and energy source (Ekpo & Essien, 2013).

The introduction of exotic biota could perturb the ecological integrity of aquatic ecosystems, as the alien species may often replace the indigenous species. Some fish species such as *Papyrocranus after, Heterotis niloticus, Gymnarchus niloticus, Citharinus citharus, Labeo senegalensis, Clarias anguillaris, Hepsetus odoe, Ctenopoma kingsleyae, Chromidotilapia gunther* and *Hemichromis elongatus* are among the endangered species in Lake Oguta (Njoku et al., 2010). Similarly, fifteen fish species are under threat in the Hadeja Jama'are Komadugu Yobe Basin, Nigeria. *Gymnarchus* recorded the highest threat, followed by Citharinus, while eight different species (*Alestes, Lates, Hydrocynus, Cynothrissa mentho, Erpetoichyths and Auchenoglanis* recorded the lowest threat (Ladu et al., 2013). Some of the species classified as threatened in some regions may have been sheltered or harmed by the avoidance of aquatic macrophytes such as water hyacinth in inland waters, while others may have been affected by overfishing due to excessive demand (Ladu et al., 2013). In most land water bodies, aquatic macrophytes clog fishing gears, nets, ruin boat engine propellers, restrict navigation, and reduce aquatic productivity by blocking fishing gears, nets and destroying boat engines propellers (Aminu et al., 2017).

## 4.10 Lack of adherence to fisheries regulations

Empirical evidence shows low compliance to fishing regulations by fishers. In Lake Jebba Basin, over half of the fishers never practiced sustainable fishing methods such as the non-use of poison, explosives, fish fences, gear control, declaration of fish catch, fishing effort control, closed seasons and closed areas. Instead, they make use of beach seines, gill nets, hooks and lines (Nwabeze & Erie, 2013). The low conformity to the gears' regulations is due to poor implementation of formal sanctions by law enforcement agents among other factors situated within the context poor governance regime and associated developmental issues in the country.

Fishers in the Lagos coastal waters reported similar low compliance with regulations because they did not believe the regulations were capable of ensuring a sustainable use of fisheries that still yielded them profits (Bolarinwa et al., 2016). The Fisheries Act of 2014 was enacted to ensure that fisheries resources are exploited in a sustainable and socially beneficial manner (FDF, 2014). Despite this effort, little has been achieved on the pathway to sustainability as the parliament did not pass it into law.

## 5. Conclusion and recommendation

SSF make a substantial contribution to human survival in terms of food security, job creation, and economic development. These advantages are in jeopardy because they are challenged by a variety of factors, spanning from human activities, climate change, to illegal fishing. Since SSF provide crucial role in the socio-economic well-being of many Nigerians, there is a need to ensure their sustenance. In turn, this will protect its resources, ensuring sustainability and curbing against stock depletion. Managing fisheries resources sustainably will ensure continued income generation in the long term, as well as good nutrition and income generation for many people.

In light of the constraints highlighted above, our research team proposes ten undertakings to state and non-state actors to support SSF transition to viability.

- First, mass mobilization and enlightenment campaign on the use of sustainable fisheries practices through advocacy, seminars, community meetings, radio and fishing festivals.

- Second, there is a need for the participation of small-scale fishers in fisheries policy formulation, implementation and evaluation towards the realization of fisheries policy and sustainability goals. The Executives of Fishermen Associations could be incorporated as statutory members of fisheries committees at all tiers of government. A mechanism for feedback on the current situation of SSF communities should be communicated to the Executives for onward transmission to the relevant fisheries councils.

- Third, the challenges of SSF are multi-dimensional in nature, hence requiring a multi-sectoral approach. Fisheries policymaking must involve relevant stakeholders from fisheries, economic, environment, water resources, media and security to effectively address the challenges confronting the sector.

- Fourth, traditional authorities should be accorded the requisite formal recognition and legislation for the operation of fisheries co-management partners. This partnership will utilize the local capacities and complement the government's ability in providing enabling legislation, enforcement, conflict resolution mechanisms etc.

- Fifth, income diversification through aquaculture and other livelihood strategies should be promoted by the federal government, development agencies and NGOs. This will ideally reduce the pressure on fisheries resources. A holistic approach to fisheries management requires that solutions to the issues of low income in SSF be sourced from outside the fishery within the local context, capacities, aspirations and opportunities to succeed. The provision of enabling environment and access to capital is necessary to encourage artisanal fishermen to engage in non-fishing activities, thereby allowing fisheries the time to recover.

- Sixth, proper enforcement of regulations governing industrial activities, especially oil exploration, should be carried out in an environmentally friendly manner. Wherever damage occurs, appropriate sanctions should be carried out, requiring immediate remediation and adequate compensation. To this end, regular monitoring of the industrial effluent discharges should be mandated. The department of petroleum, National Oil Detection and Response Agency, ministries of environment and water resources should carry out periodic monitoring of oil exploration activities for early detection of oil pollution.

- Seventh, there should be collaboration among institutions through the establishment of partnerships between government institutions and fishers to co-manage SSF.

- Eighth, there is a need to adopt, adapt and implement of the vSSF Guidelines SSF and other right based instruments.

- Ninth, policies should include a gender-inclusive stance, especially given women's dominance of the post-harvest sector. Women should be given equal opportunity for representation and authority in fisheries committees. Tenth, signing the Fisheries Act 2014 of the Federal Republic of Nigeria along with other relevant fisheries edicts to update the outdated regulations. These should properly address the present realities concerning gear selectivity, fish species sizes, illegal fishing activities.

## References


Adelaja, O. A., Kamaruddin, R. B., & Chiat, L. W. (2018). Assessment of post-harvest fish losses Croaker *Pseudotolithus elongatus*, (Bowdich, 1825), Catfish *Arius heudeloti*,(Valenciennes, 1840) and Shrimp *Nematopalaemon hastatus* (Aurivillius, 1898) in Ondo State, Nigeria. *Aquaculture and fisheries*, *3*(5), 209-216. https://doi.org/10.1016/j.aaf.2018.05.002

Adelekan I. & Fregene, T. (2014). Vulnerability of artisanal fishing communities to flood risks in coastal southwest Nigeria. *Climate and Development*, 7(4), 1-17. https://doi.org/10.1080/17565529.2014.951011

Adeoti, A. I., Olayide, O. E., & Coster A. S. (2010). Flooding and welfare of fishers' households in Lagos State, Nigeria. *Journal of Human Ecology*, *32*(3), 161-167. https://doi.org/10.1080/09709274.2010.11906335

Adesoji, A. & Kekere, F.O. (2013). Assessment of the knowledge level of fishers and fish farmers in Lagos State, Nigeria. *International Journal of Knowledge, Innovation and Entrepreneurship*, *1*(1– 2), 41-56.

Akankali, J.A., & Jamabo, N.A. (2011). A Review of some factors militating against sustainable development of artisanal fisheries in Niger- Delta, Nigeria. *Asian Journal of Agriculture Sciences*, *3*(5), 369-377.

Akintola, S.L., & Fakoya, K.A. (2016). Governance and social-institutional arrangement of small-scale fisheries and relationship with non-fishery users in Badagry Creek, Lagos State, Nigeria. In A.M. Song, S.D. Bower, P. Onyango, S.J. Cooke, & R. Chuenpagdee (Eds), *Inter-Sectoral Governance of Inland Fisheries* (pp. 134-145). Canada: TBTI Publication Series.

Akintola, S.L., & Fakoya, K.O. (2017). Small-scale fisheries in the context of traditional post-harvest practice and the quest for food and nutritional security in Nigeria. *Agriculture & Food Security*, *6*(34), 1-17. https://doi.org/10.1186/s40066-017-0110-z

Akintola, S. L., Fakoya, K. A., & Joseph, O. O. (2017). Applying the small-scale fisheries guidelines in Nigeria: status and strategies for Badagry coastal and creek fisheries. In S. Jentoft, R. Chuenpagdee, M.J Barragán-Paladines, and N. Franz (Eds.), *The Small-Scale Fisheries Guidelines: Global Implementation* (14, pp. 635-656). MARE Publication Series 14. Springer. https://doi.org/10.1007/978-3-319-55074-9_30

Akpu, I.V. (2013). Sustainable development in fisheries of Nigeria. 'IAIA13 Conference Proceedings' Impact Assessment the Next Generation 33rd Annual Meeting of the International Association for Impact Assessment 13 – 16 May 2013, Calgary Stampede BMO Centre, Calgary, Alberta, Canada. https://conferences.iaia.org/2013/pdf/documents/Finalpro_13%20web.pdf

Bogard, J. R., Marks, G. C., Mamun, A., & Thilsted, S. H. (2017). Non-farmed fish contribute to greater micronutrient intakes than farmed fish: results from an intra-household survey in rural Bangladesh. *Public Health Nutrition*, *20*(4), 702-711. https://doi.org/10.1017/S1368980016002615

Bolarinwa, J. B. & Popoola, Q. (2013). Length-weight relationship and condition factors of six economic fishes of Ibeshe water side, Lagos Lagoon, Nigeria. In Proceedings of the International Conference on Oceanography, Orlando-Florida, USA, 54-59. https://doi.org/10.4172/2155-9546.1000203

Bolarinwa, J. B., Ogunbona, A. A., Ishola, O. J. & Ogundana, F. O. (2016). Socioeconomic survey and cost-benefit analysis of artisanal fisheries in Egbin Waterside, Lagos Lagoon, Lagos State, Nigeria. *International Journal of Research*, *3*(11), 1-5. https://www.ijraf.org/papers/v3-i11/1.pdf

Bolarinwa, J. B., Ogunbona A.A., Ishola, O. J. & Ogundana, F. O. (2017). Socioeconomic survey and cost-benefit analysis of artisanal Fisheries in Egbin waterside, Lagos lagoon, Lagos state, Nigeria. *Global Journal of Agricultural Research*, *5*(2), 20-25.

Bolorunduro, P. I., Adesehinwa, A. O. K. & Ayanda, J. O. (2005). Adoption of improved fish preservation technologies in Northwestern Nigeria. *Tropicultura*, *23*(2), 117. http://www.tropicultura.org/text/v23n2/117.pdf

Ekpo, F. E., & Nbebule, E. C. (2012). Climatic change impact and adaptation opportunities on agricultural production in communities around Itu bridge-head in Itu LGA, Akwa Ibom State, Nigeria. *International Journal of Environmental Sciences*, *2*(4), 2191-2202. https://doi.org/10.6088/ijes.002020300107

Ekpo, I. E., & Essien-Ibok, M. A. (2013). Development, prospects and challenges of artisanal fisheries in Akwa Ibom State, Nigeria. *International Journal of Environmental Science, Management and Engineering Research*, *2*(3), 69-86. http://www.ijesmer.com/

Enim, U. I. (2012). What concerns Nigerian fishers with climate? Current Issues in Sustainable Tropical Agriculture. *Faculty of Agriculture, University of Uyo, Nigeria*, *1*, 1-13.

Etim, L. (2010). The tragedy of the commons: alleviating the tragedy of the commons in Nigerian Waters. The 27th Inaugural Lecture of the University of Uyo held on 27th May, 2010. *University of Uyo Press, Nigeria*, 60.

Etim, L., Belhabib, D. & Pauly, D. (2015). An overview of the Nigerian marine fisheries subsector and a re-evaluation of its catch data over the past 60 years (1950- 2010). *Fisheries Centre Working Paper.* University of British Columbia, Vancouver. 1-16. https://www.seaaroundus.org/working-papers/

Eyo, A. A. & Ahmed, Y. B. (2005). Management of inland capture fisheries and challenges to fish production in Nigeria. In Proceeding of the 19th Annual Conference of the Fisheries Society of Nigeria (FISON) held on 29th November – 3rd December, 2004, Ilorin, Nigeria

Fabiyi, O. O. (2012). Indigenous knowledge, local responses and community participatory GIS in climate change in rural coastal communities. A research grant report submitted to the Global Change System for Analysis Research and Training (START), United States.

Fakoya, K. A. & Akintola, S. L. (2018a). A contextual analysis of small-scale fisheries governance in Nigeria: building on challenges and opportunities for sustainability. Paper presented at the Nineteenth Biennial Conference of the International Institute of Fisheries Economics & Trade: Adapting to a Changing World: Challenges and Opportunities. Seattle, WA, USA. Compiled by Ann L. Shriver. International Institute of Fisheries Economics & Trade, Corvallis, Oregon, USA, 2019. https://ir.library.oregonstate.edu/concern/conference_proceedings_or_journals/fn1074546?locale=en

Fakoya, K. A. & Akintola, S. L. (2018b). Diagnosis of opportunities and barriers to co-management of small-scale fisheries in Nigeria: The case of Badagry and Epe Lagoons. 3rd World Small-Scale Fisheries Congress (pp. 161-172). October 22-26, 2018, Chiang Mai, Thailand. https://docs.wixstatic.com/ugd/45cb94_3505c589af504d16921ea246deb51036.pdf

Fakoya, K. A. & Akintola, S. L. (2019). Fear of Flight. *Samudra Report, 81*, 13-15. https://www.icsf.net/images/samudra/pdf/english/issue_81/4386_art_Sam_81_art3_Nigeria_TenureRigts_K_Fakoya.pdf

Federal Department of Fisheries. (2014). Fisheries Statistics of Nigeria. Federal Ministry of Agriculture and Rural Development, Abuja, Nigeria.

Federal Department of Fisheries. (2015). Fisheries Statistics of Nigeria, Federal Department of Fisheries, Abuja, Nigeria, 6th Edition (2010-2015).

Fisheries Statistical Bulletin. (1997). Fisheries Statistical Bulletin, Kainji Lake, Northern Nigeria. Nigerian-German (GTZ) Kainji Lake Fisheries Promotion Project. Technical Report Series 9. ISSSN 1119-1449. ISBN 978-037-008-0.

Fregene, B. T. (2007). Profile of fishermen migration in Nigeria and implications for a sustainable livelihood. African Migration Workshop, Understand Migration Dynamics in the Continent, International, International Migration Institute, James Martin 21st Century School, University of Oxford, United Kingdom in collaboration with Centre for Migration Studies, University of Ghana, Legon, Ghana – 18-21 September 2007, pp 1-20. http://www.imi.ox.ac.uk/pdfs/research-projectspdfs/african-migrations-workshops-pdfs/ghanaworkshop-2007/Fregene%20Ghana%2007

Gaffar, J. A. (1994). Twenty years of Fisheries Developing in Nigeria. In A.A. Eyo (Eds.), Proceedings of the 13th Annual Conference of Fisheries Society of Nigeria, (pp. 7-13). http://hdl.handle.net/1834/21408

Ifeanyi-Obi, C.C. & Iremesuk, P. (2018). Environmental factors influencing artisanal fishing in eastern Obolo Local Government Area of Akwa Ibom State. *Journal of Agricultural Extension*, *22*(1), 55-61. https://dx.doi.org/10.4314/jae.v22i1.6

Ifunanya, A.S. (2010). *The impacts of oil spillage on agriculture production: a case study of Ibeno Local Government Area, Akwa-Ibom State, Nigeria*. [Mini Dissertation, University of the Free State]. https://www.ufs.ac.za/docs/librariesprovider22/disaster-management-training-and-education-centre-for-africa-(dimtec)-documents/dissertations/2264.pdf?sfvrsn=2

Ipinmoroti O. (2012). Salvaging fisheries systems in the face of climate change. In L. Etim & B. Oribhabor (Eds.), Current Issues in Sustainable Tropical Agriculture. *Faculty of Agriculture, University of Uyo, 18*, 167-175.

Ita, E.O. (1993). Inland fishery resources of Nigeria. CIFA Occasional Paper, 21, 120p. https://www.fao.org/3/T1230E/T1230E00.htm

Jinadu, O.O. (2000). Small-scale fisheries In Lagos State, Nigeria: economic sustainable yield determination. IIFET 2000 Conference. 11p. http://hdl.handle.net/1834/744

Komolafe, O. O., Arawomo, G. A. O., Idowu, E.O. & Adedeji, A.A. (2014). Status and economic impact the fisheries of Osinmo Reservoir, Ejigbo, Nigeria. *Ife Journal of Science, 6*(2), 309 – 317.

Ladu, B.M., Sogbesan, A.O. & Tafida, A.A. (2013). Fisheries and fishing enterprises in the Hadeja Jama'are Komadugu Yobe Basin, Nigeria. Technical Report, Hadeja Jama'are Yobe Basin-Trust Fund, Nigeria.

Lewins, R., Béné, C., Ousman, M.B., Belal, E., Donda, S., Lamine, A.M, Makadassou, A., Tahir Na, A.M., Neiland, A.E, Njaya, F., Ovie, S. & Raji, A. (2014). African inland fisheries: experiences with co-management and

policies of decentralization. *Society & Natural Resources: An International Journal*, *27*(4), 405-420. https://doi.org/10.1080/08941920.2013.861564

Madakan, S. P., Ladu, B.M., Neiland, A. E. & Sarch, M. T. (2013). Characteristics of the social-ecological system components of three major artisanal fisheries in the north east of Nigeria. *Nigerian Journal of Fisheries and Aquaculture*, *3*(1), 22-33. https://www.researchgate.net/profile/Sun-Madakan/publication/292308181_Characteristics_of_the_social-ecological_system_components_of_three_major_artisanal_fisheries_in_the_North_East_of_Nigeria/links/56accdef08ae28588c5fadb3/Characteristics-of-the-social-ecological-system-components-of-three-major-artisanal-fisheries-in-the-North-East-of-Nigeria.pdf

Mangubhai, S., & Lawless, S. (2021). Exploring gender inclusion in small-scale fisheries management and development in Melanesia. *Marine Policy*, *123*, 104287. https://doi.org/10.1016/j.marpol.2020.104287.

Moses B.S. (2002). Tropical fisheries. Abeam Publishing Company, p150.

Neiland, A. E & Ladu, B.M.B. (1998). Enhancement of inland fisheries in Nigeria: the institutional context provided by traditional and modern systems fisheries management. In T. Petr (Eds.), *Inland Fisheries Enhancement* (No 374, pp. 371 – 393). FAO Technical Paper. https://www.fao.org/3/W8514E/W8514E26.htm

Njoku, D.C., Orji, R.C. & Peter, K.J. (2010). Morpho- meristic analysis and the identity of the moon fish, *Citharinus distichdoides* (Pisces: Citharinidae) of Lake Oguta, Nigeria: Towards a restocking programme for a depleted inland fishery. *Journal of Aquatic Sciences*, *25*(1), 45-51. https://doi.org/10.4314/jas.v25i1

Nsogurua, A.E., Akintola, A., Ishaya, G., Olonipekun, I. & Ibraheem, A.S. (2011). The level of some heavy metals in fish harvested from Ibeno (A coastal area off the Atlantic Ocean). *Journal of Basic Applied Science Research*, *1*(12), 2960- 2964. https://www.researchgate.net/publication/301197166

Nwabeze G.O. & Erie, A.P. (2013). Artisanal fishers use of sustainable fisheries management practices in the Lake Jebba Basin, Nigeria. *Journal of Agricultural Extension*, *17*(1), 123-134. https://doi.org/10.4314/jae.v17i1.12

Nwosu, F.M., Ita, E.O. & Enin, U.I. (2011). Fisheries management in Nigeria: A case study of the marine fisheries policy. *International Research Journal of Agricultural Research and Soil Science*, *1*(3), 070-076. https://www.interesjournals.org/articles/fisheries-management-in-nigeria-a-case-study-of-the-marine-fisheries-policy.pdf

Odunuga, S., Udofia, S., Osho. O.E. & Adegun. O. (2018). Environmental degradation in the Ikorodu sub-urban Lagos - Lagoon coastal environment, Nigeria. *Open Environmental Sciences*, *10*, 16-33. https://doi.org/10.2174/1876325101810010016

Olaoye, O.J. & Ojebiyi, W.G. (2018). Marine fisheries in Nigeria. In Marine Ecology - Biotic and Abiotic Interactions. http://dx.doi.org/10.5772/intechopen.75032173

Olopade, O.A., Sinclair, N.G., & Dienye, H. (2017). Fish catch composition of selected small scale fishing gears used in the Bonny River, Rivers State, Nigeria. *Journal of Fisheries*, *5*(1), 455–460. http://dx.doi.org/10.17017/jfish.v5i1.2017.173

Ssentongo, G. W., Ukpe, E. T., & Ajayi, T. O. (1986). Marine fisheries resources of Nigeria: a review of exploited fish stocks. Food and Agriculture Organization of the United Nations, Rome.

Organization of the United Nations, Rome.

Olopade, O.A., Taiwo, I.O., Ajibade, D. & Aluko, F.A. (2008). Community participation in fishery management: A case study of acadja in Badagry Creeks, Ogun State, Nigeria. *Journal of Agriculture and Social Research*, *8*(1), 28-33. https://doi.org/10.4314/jasr.v8il.288

Olatunji, A.E., & Olah, O.M. (2012). The socio-economic status of artisanal fishers in Cross River, Cross River State, Nigeria. *World Journal of Fish and Marine Science*, *4* (6), 672-678. https://10.0.22.197/idosi.wjfms.2012.04.06.668

Olusegun, O. J. & Mathew, O. S. (2016). Assessment of fish post harvest losses in Tagwai Lake, Niger State, Nigeria. *International Journal of Innovative Research and Development*, *5*(4), 184-188. http://internationaljournalcorner.com/index.php/ijird_ojs/article/view/136221

Omorinkoba, W.S., Ogunfowara, O.O., Aga, N.D. & Mshelia, M.B. (2011). Artisanal fisheries activities in Lake Kainji. In A.A. Raji, N. Okaeme, & M.O. Ibeun (Eds.), *Forty Years on Lake Kainji Fisheries Research* (pp. 43-53). National Institute for Freshwater Fisheries Research (Nigeria).

Omitoyin, S.A., Ogungbure, A.P. & Osakuade, K.D. (2021). Assessment of livelihood vulnerability of fisherfolks in coastal and freshwater fishing communities of Ilaje in Ondo State. *African Journal of Fisheries and Agricultural Research*, *11*(2), 1-14

Onuoha, G.C. (2009). Fundamental Principles of Fisheries Science (New edition). Digital Press, Umuahia, p 164.

Oruonye, E. D. (2014). The challenges of fishery resource management practices in Mayo Ranewo Community in Ardo Kola Local Government Area, Taraba State Nigeria. *Global Journal of Science Fisheries Research*,

*Development, Agriculture and Vetinary*, *14*(3), 15-25. https://journalofscience.org/index.php/GJSFR/article/view/1149/1011

Ovie S. I. & Raji, A. (2007). Fisheries governance analysis in Nigeria and in the Komadugu-Yobe Basin (KYB) of the Lake Chad Basin, Nigeria. National Institute for Freshwater Fisheries Research, New Bussa, Nigeria, Country report for the Research Project on Food Security and Poverty Alleviation through Improved Valuation and Governance of River Fisheries, p. 32. http://pubs.iclarm.net/wfcms/file/bmz/Nigeria_governance.pdf

Oyekale, A.S., Oladele, O.I. & Mukela, F. (2013) Impacts of flooding on coastal fishing folks and risk adaptation behaviours in Epe, Lagos State. *African Journal of Agricultural Research*, *8*(26), 392 – 3405.

Sustainable Fisheries Livelihoods Programme (SFLP). (2002). Contribution of fisheries research to the improvement of livelihoods in West African communities, Case Study: Nigeria. Sustainable Fisheries Livelihoods Programme. SFPL/DFID-FAO.

Ssentongo, G.W., Ajayi, T.O., & Ukpe, E.T. (1983). Report on a resource appraisal of the artisanal and inshore fisheries of Nigeria. FAO Field Document 2. FI: DP/NIR/77/001. FAO, Rome.

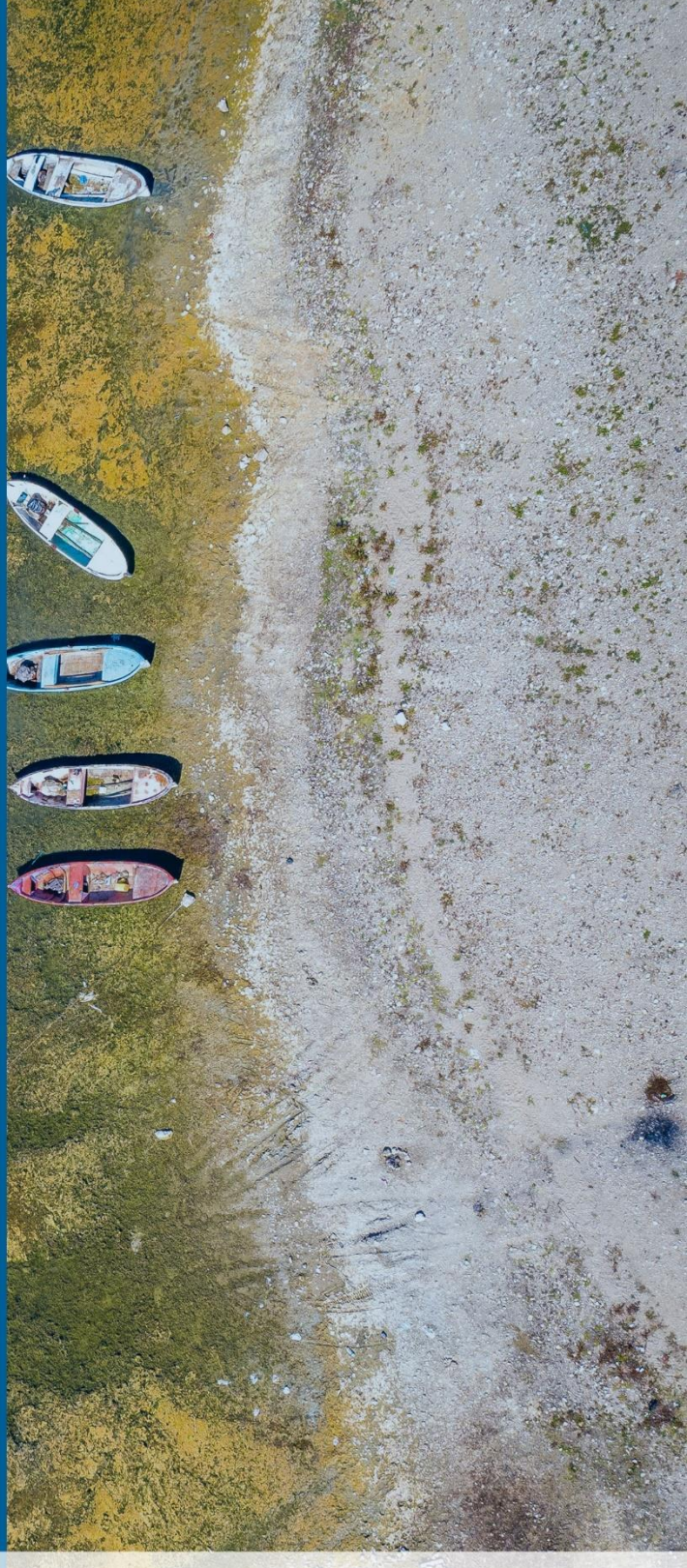
Thilsted, S. H., Thorne-Lyman, A., Webb, P., Bogard, J. R., Subasinghe, R., Phillips, M. J., & Allison, E. H. (2016). Sustaining healthy diets: The role of capture fisheries and aquaculture for improving nutrition in the post-2015 era. *Food Policy*, *61*, 126-131. https://doi.org/10.1016/j.foodpol.2016.02.005

Tiamiyu, S. A., Olaoye, O. J., Ashimolowo, O. R., Fakoya, E. O., & Ojebiyi, W. G. (2015). Benefits derived from national Fadama development project II by fish farmers in Lagos State, Nigeria. *International Journal of Fisheries and Aquaculture*, *7*(4), 54-61. https://doi.org/10.5897/IJFA14.0459

**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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