

Enhancing SMEs Organization in Small Scale Fishing Communities as A Tool for a Better Contribution to Cameroon's Economy

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Abstract

Original Research Article

Cameroon is endowed with abundant water resources including a coastal area of 402km length and a suitable hydrographic network, where occur intensive fishing and aquaculture activities. While the industrial sector is well structured in terms of enterprises, the small scale fisheries (maritime and inland) though composed with more actors, operate informally in remote areas usually with poor landing infrastructures, using a multitude and various fishing gears, with limited accountability, making it difficult for the country to manage and reap the benefits from that sector and its real contribution to the economy. It was estimated that, barely 457 109 413 CFAF, (7.6 %) of taxes were levied from a total turnover of 23 717 462 831 CFAF generated by the four main actors involved in fisheries Meke *et al.*, [1]. This paper, based on secondary data and from a socio economic survey carried out in 2020, examines the case of CECOPAK as a model of support facilities to fisheries development activities in Cameroon. Findings of the study indicate that, the level of taxes perceived is better compared to other fishing camps. Structuring these main individual actors businesses into SMEs with appropriate landing infrastructures will better of the sector's contribution to the economy.

Keywords: SMEs, economy, taxes, small scale fishery, trade, Aquaculture, landing infrastructures.

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CONTEXT AND BACKGROUND

Cameroon is a country of Central African region with an area of almost 475,442 km² of which 402 km of coastline which are the core of intense industrial and small scale marine, multispecies and gears fishing activities. Located in the Bay of Biafra, the sea is covered with hot water temperature T ° > 25° C. it is a salt sea (S <35 p 1000) watered by major runoff trusted into coastal rivers, estuaries and organic elements from the mangroves which affect the biophysical environment (spawning of fish resources). Although the country is endowed with abundant natural resources, productivity of the sea seems to be limited by the lack of fertilizing phenomena (upwelling), compared to countries of the region (Gabon, Mauritania, Senegal, Ghana, Guinea Conakry, Guinea Bissau), Njock [2]. The fisheries sector plays a key role in Cameroon because of its contribution to self-sufficiency protein feed (46% of the total protein consumed), jobs and incomes. It is estimated that roughly 200,000 persons derive their livelihoods on the artisanal and industrial marine fisheries Ngok *et al.*, [3]. The fisheries contribution as a whole to Cameroon

real GDP [¹] dropped sharply from 1.2% in 2012 to 0.37 in 2017, (74.2 billions), due mainly to self-suspension of shrimp products to EU countries Meke [4], with a share of taxes estimated at 0.044% of 1 665.80 billions of taxes and taxes net of grants, INS [5]. The maritime finfish resources are exploited by three main groups the artisanal, semi-industrial and industrial fishery: the *artisanal fishery* and *semi industrial fishery* operate mainly into the creeks, estuaries and shallow inshore waters within a depth of 25 m and above the thermocline, an area dominated by "white fish" (mostly Clupeidae and Carangidae). Since 1912, when started the marine industrial fishing and mainly the early

¹Economic growth is the sustainable increase in a country's economic activity, seen through changes in prices, production and incomes. In most international statistics, economic growth is assessed by the Gross Domestic Product (GDP). The GDP growth rate is calculated from the following formula: $[GDP(n) - GDP(n-1)] \div GDP(n-1) = \text{annual economic growth}$. n being the current year and n-1, being the previous year.

Source:

<https://epargne.ooreka.fr/astuce/voir/536875/croissance-economique..>

1990's, 82 % of boats on average targeted the shrimps for exports. Due to small mesh size (44mm) in the codend, this results in a huge amount of juveniles' discharges² with poor or no commercial value. The fish catch is dominated by the sciaenid community of Longhurst, in which ten species belonging to the following families: *Ariidae*, *Cynoglossidae*, *Polynemidae*, and *Sciaenid*, contribute to 89 % of the main demersal landings and revenue of the Cameroon continental shelf, Meke [6]. Maritime artisanal fishermen are established along the coast on fishing camps, almost 300 main access is on water plants MINEPIA [7] (Fig-1). Detailed information on the structure of maritime artisanal fisheries can be found from Kébé *et al.*, [8], Njifonjou *et al.*, [9]; Njifonjou [10], and MINEPIA [7], while the main characteristics are presented (Table-1). The main species caught include pelagic species and demersals. Pelagic species are generally smoked with mangrove wood, which constitute a danger for the ecosystem. Catch data on the artisanal fisheries are not yet adequate; but on the basis of the work of SCET - International 1980, the total artisanal annual catch is estimated to be 55 000 tonnes of which bonga/*Sardinella*, white shrimp and demersal fish contribute at 58 %, 27 % and 15 % respectively. Artisanal fishing units operate at a distance of three nautical miles from the shore, however due to the increase of the number of fishermen; they operate far beyond creating many conflicts with the industrial fishing, which result in the destruction of their nets, meanwhile, encroaching of the nets on trawls' otterdoors can contribute in waste of time for trawlers. Moreover, due to oil exploration close to shallow waters in the Rio del Rey, many incidents are reported. This activity is dominated by migrant fishermen from Nigeria, Ghana and Benin, making management plans and policies difficult to implement. Findings of the 2009 survey indicate that during *high season* (September to April) corresponding to dry and small raining season, when fishermen perform three (3) to – six (6) outings per week, fish production was estimated at 153 775 tonnes. In *low season* (May to August), corresponding to the beginning of heavy raining season, with less than three outings per week, fish production is estimated at 18 768 tonnes for a global production of 172 543 tonnes [7].

The Semi Industrial Fishery

This fishing technique was introduced by Ghanaian and Benin fishermen using canoes of 18-22 m LOA, propelled by 40 hp engines, pulling long purse seines (600-1000m length) also called 'Awasha'. The target species are mainly pelagic *Ethmalosa fimbriata* (bonga) and *Sardinella maderiensis* (bilolo) with

²It is estimated that in a catch of 100 kg from a shrimp trawler, 52 % is retained and 48 % discarded; of which 12 % of shrimps and 88% of fish and the fishery operate under open free access regime, Meke, (2015) [4].

catches rates lying between 3 and 28 tonnes per month Njifondjou *et al.*, [9]. Total catches are estimated at 16 000 and 22 000mt/ year representing 30% of pelagic catches of Cameroon. The number of units is estimated at 50 active canoes against 80 before. The catches are mainly landed at Douala (Youpwe) and Downbeach where they are processed and Mabeta. Despite the huge catches flooded in the market, this activity is fairly integrated to Cameroon economy in terms of employment because, all the crew members (20-23 per canoe) are mainly Ghanaians or from Benin.



Ph 1: The Awasha canoe Idenau



Ph 2: Awasha canoe, Limbe

Socioeconomic studies on artisanal fisheries in Cameroon

Ngok *et al.*, [3] conducted a study on the economic and social contribution of artisanal fishing to sustainable livelihoods and poverty reduction in Cameroon. The study methodology was developed according to the principles of the guide for the Sustainable Livelihoods Program in Fisheries (SLP) and supplemented by the national accounts approach. The study revealed on food security, that the country's fishery potential makes it possible to supply nearly 180,000 tonnes of fishery products, 51.6% of which come from maritime small scale fishing and 41.5% of inland fishing (74,700 tonnes). Apparent availability is highly dependent on imports of fishing products, which represent 52.9%. As regards the contribution of artisanal fishing to the creation of national wealth, the fishing sector contributed at 1.7% in 2003, or 119.4 billion FCFA of added value [³]. The fishing activity

³ This is broken down as follows: artisanal fishing (52.4 billion FCFA, i.e 0.44 %), processing activities: drying and smoking (16.8 billion FCFA), services related to fishing: marketing, catering, repairs, etc., (41.4 billion FCFA), Ngok, et al, (2005) [3].

produces a positive balance for the national economy: the fishing activity employs nearly 200,000 people, 62.5% of which come from artisanal fishing (maritime and inland). In terms of investment, the level remains relatively low in the activity of artisanal fishing (capture) and stood at 8.5 billion FCFA in 2003, 43% of which was for the purchase of fishing equipment; 34.7% for the purchase of engines and 22.3% for the purchase of fishing gears. The study recommended,

among other things: - *the holding of regular framework surveys over a periodicity that could be five years, given the density and cost of the operation (Table-1); -a complete mapping of the sector to determine the number of boats, fishing gear and fishermen, fishmongers and processors, the cost of acquisition per canoe and per gear, the existing institutions and their role, the sociology of sector, etc.*



Fig-1: Main fishing camps of the Cameroon, maritime and coastal area,
 Source: Njifondjou, 1995 [9].

Table-1: Main characteristics of the artisanal marine fishery from socio-economic surveys

Framework and Socio-economic surveys	1962-1965*	1983 *	1995	2009
Number of main fishing camps and villages along the coast		57	206	293
Number of canoes	1 697	6 011	7 335	12 911
Range of canoes length		4-17 m	4-20 m	-
Non motorized canoe		67 %	73 %	56%
Total number of fishermen	4 965	18 625	24 136	36 691
Total number of fishing masters/ canoes owners	1 941		6 847	8 143 of which 2 158 cameroonians
Total number of crew members	3024		17 289	16 887
Women involved in fish processing (smoking)				-1178, Cameroonians ; -5221 foreigners (76% Nigerians)
Fish mongers				1398 Cameroonians and 495 foreigners of which 482 Nigerians
Number of purse seines 'awasha'	316	-	59	50
Beach seines				998
Surface and Bottom gill nets	921	-	10 253	14 202
Cast nets	2 926			616
Shrimp nests and nets	4 335	-	24 475	35 625
Hooks and Longlines	858	-	-	3 513
Traps, nests,	150			3 933
Percentage of national fishermen		10%	17%	21 %
Percentage of foreign fishermen		90%	83%	-79%

Sources: Compiled by the author from: J. Laure, ORSTOM [11], Njock [2], Njifonjou *et al.*, [9], MINEPIA, 2009. [7]*
Framework surveys only;

**Ph 3: Shrimp nest****Ph 4: The ngoto (shrimp trick)**

Apart from the coastal area, Cameroon's hydrographic network participates in the drainage of a vast ensemble covering about a third of the total area of the African continent, shared by 23 states, i.e. nearly half of the countries of Africa, sharing of water resources [4]. The exploitation of inland fish resources is conducted within two main groups of watersheds: the rivers and barrage dams, built along those rivers. This network is distributed within 04 main bassins [5], (Fig-2), Olivry [12]. As part of its energy policy, Cameroon has embarked in very huge investment in terms of building hydrographic dams which are at the core of intense inland fishing and aquaculture activities, fish

⁴These states include : Sierra-Leone, Guinea Conakry, Mali, Nigeria, Chad, Soudan, Centrafrican Republic, Equatorial Guinea, Gabon, Zambèze, Mauritania, Algeria, Côte-d'Ivoire, Burkina-faso, Niger, Benin, Congo, Democratic Republic of Congo, Rwanda, Burundi, Angola, Tanzania, Zambia. Source, Olivry, (1986) [12].

⁵ The Atlantic ocean basin that includes all the rivers discharged into the atlantic Ocean : the sanaga River, Wouri, Mungo, Dibamba, Nyong, Lobe, Lokoundjié. The Niger basin including the Benoue river ; the lake Chad Basin with the Mbere and Vina, mayos and yaeres rivers Logone and Chari ; The Congo basin including, the Doume, Boumba and Ngoko, Sangha, Dja, Kadey rivers,

production [6] and the concentration of fishermen (Table-2). Inland small scale fishery operations occur along these dams by both men, women and young on partial time shared with agriculture and husbandry activities. Despite the recognition of the importance of inland fisheries to fish supply in Cameroon, Sheves *et al.*, [13], very few studies on fisheries on these inland rivers and dams have been conducted so far.

A survey following the sustainable Livelihood approach was conducted in the Lagdo barrage located 60 km to Garoua in the North region of Cameroon, MINEPIA [14]. In total, 121 villages and fishing camps were registered on the Lagdo reservoir. The socio-economic survey was carried out in 42 fishing camps (21 large and 21 small), that is 35% of the whole camps taking into account their geographical distribution. Actors (142) from different socio-professional categories were surveyed, namely: 66 fishermen boat owners (46%); 24 processors (17%); 28 fishmongers (20%); 11 canoes carpenters (8%); 13 others (4 fishing equipment traders, 1 basket weavers, 1 outboard engine repairer,

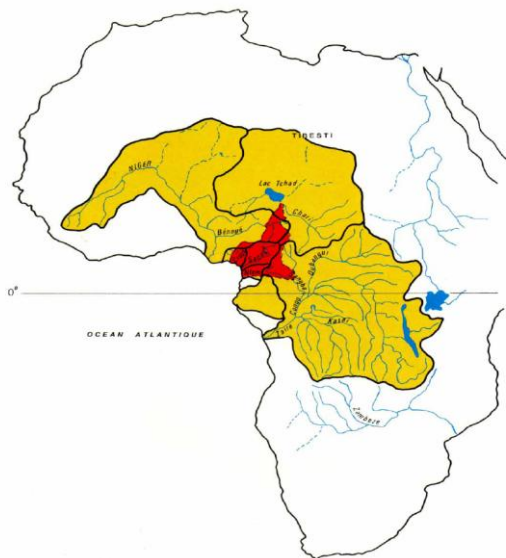


Fig-2: Place of Cameroon in the African hydrography.

Source: Olivry JC. 1986 [12]

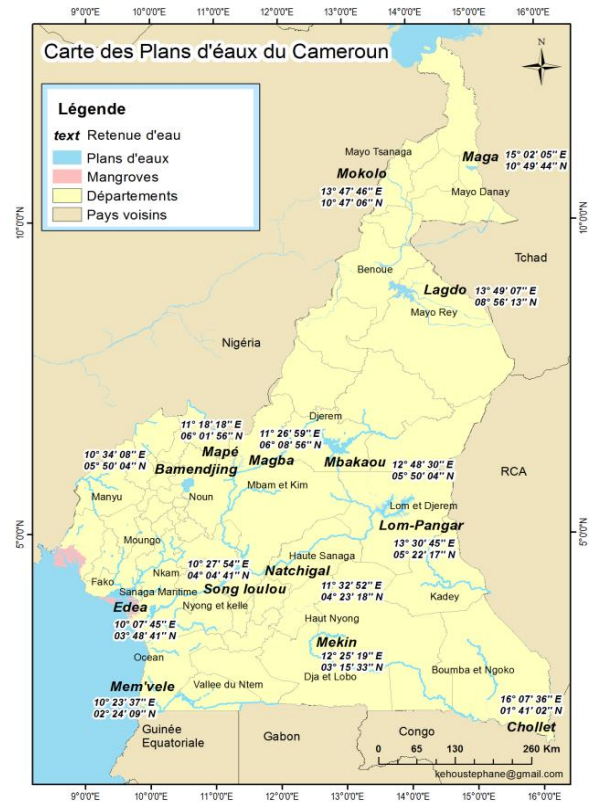


Fig-3: Main water plans for inland small scale fishery in Cameroon

Source: Meke *et al.*, 2018 [1].

6 These reservoirs create new aquatic environments favorable to the development of species adapted to still, native or introduced waters, but also disrupted the cycle of the species most dependent on the seasonal regime of the river. Since trees are not usually cut off, the decomposition of this organic matter consumes oxygen but releases nutrients. This results in a phase of high phytoplankton production, favorable to phytophages, which lasts a few years before stabilizing at lower production levels (IRD, 1999).

Table-2: Barrages of Cameroon

Designation	Location and year of built	Total area and water volume	Estimated cost in CFAF
Sanaga hydroelectric barrage	Edea, Songloulou, (1954)	NA	NA
Lagdo reservoir	Garoua, (1982)	30,810 km ²	50 billions
Bamendjin reservoir**	Bamendjin, 1968 Noun and Sanaga	33,000ha ; -1.8 billions of water m ³	
Mape reservoir**	Magba/Foumban, (1988)	50 000ha ; 3.2 billions of water m ³	27 billions
Mbakaou reservoir**	on the Djerem river, (1974), Tignere	50,000 - 60,000 ha, 2.6 billions of water m ³	25 billions
Maga dam*	Built in 1978	620 millions of water m ³	
Memvele dam	on the Ntem river		450 billions
Mekin	On the Dja river		34.5 billions
Lom Pangar	Junction of Lom and Pangar rivers, Deng-Deng, (2016), East Cameroon	540 000ha, 6000 millions of water m ³	300 billions
Nachtigal barrage	On sanaga river	27.8 millions of water m ³	665 billions

Source: Compiled by the author. *Maga is an hydroAgriculture dam initially designed for rice production, management by SEMRY, Sergio Mora-Castro et MSc. Javier Saborío-Bejarano, 2012 [15]. ** Three dams-reservoirs to regulate the Sanaga River for a total of 7.6 billion m³ distributed as follows: Mbakaou (2.6 billion m³), Mape (3.2 billion m³) and Bamendjin (1.8 billion m³), Source, Tchataat G, 2014 [16]. Grand Ewen and Cholet Dams are not yet operational.

5 carriers and 2 freezers) (9%). The fishing activity depends on seasons: during the high season (November to April) [7], the fishing effort is 6.5 outings / week [8], that is 6 to 7 / week (97% of respondents), corresponding to 312 to 364 outings / year; in low season (May to October), 61% of respondents go fish 5.3 times / week, or 275 trips per year. There was a gradual decline in fish production from the reservoir, which fell from 12,000 tonnes in 1995 to less than 6,000 tonnes in 2000. The number of artisanal fishermen was estimated at 3000 [17]. This figure rose to more than 5,137 in 2007 with the present survey, including 502 Nigerians, 129 Malians and 309 Chadians. Following this good period, the total fishery production [⁹] started to decline to represent only 6000 t in 1999/2000 [17], reason why a biological rest period was introduced. Similar studies were conducted in

Mape dam MINEPIA [20] and Mbakaou [¹⁰], MINEPIA [21], Maga and for the first time in the Nyong River.

The Maga Dam survey was conducted MINEPIA [22] in the far North region of Cameroon. The water reserve was created following the building of a dam of 27 km around a swampy flat area flowded by three small rivers, the Mayo Guerleo, Mayo Boula and Mayo Tsanaga, destined mainly for rice culture. Gradually, fish production grew up leading to an important fishing activity. In total, 53 villages and fishing camps were registered. Out of 7212 persons who derive their revenue from fishing activities, almost 6180 were involved in fish capture of which 2064, (33.40%) fishermen, 3250 (52.29) crew members, (an average of one fishing master for 2 crew members), 8.72% fish mongers, 288 fish processors (4.19%), and 1.40% canoe carpenters. A study on the river Nyong 640 km length, which source is in the Eastern region of Cameroon before discharging at the Atlantic ocean near Kribi at Petit Batanga was conducted [23]. 118 fishing camps were surveyed while only 10% of these were involved in the socioeconomic survey. Almost 10504 actors were identified of which: 929 fish processors (75% women), 705 fish mongers et 337 canoes

⁷ February, March and April correspond to the optimal fishing period. (CEDC, 2002).

⁸ These figures confirm those obtained in 1992 by the NEB project.

⁹ According to Michelet (2001) [18], fish production reached an absolute maximum of 13,400 t in 1987, or 339 kg / ha / year, beyond forecasts which were of the order of 50 to 100 kg / ha / year. According to Lévêque and Paugy (1999) [19], the high productivity reached in 1987 with regard to estimates is a classic phenomenon observed in this type of artificial environment: the planktophagous and detritivorous species experience a population explosion during the phase following the impoundment of the reservoir *MINEPIA, (2003) [21], Framework survey and socio-economic study on the Mbakaou dam.

¹⁰ Fishermen in Mape make an annual revenue estimated 240 000 CFAF. Main species include : *Oreochromis niloticus*, *Hemichromis fasciatus* et *Clarias spp.* Fish species in Mbakaou include : *Tilapia sp.*, *Lates niloticus (capitaine)* (figure5), *Clarias lazera et Clarias anguillaris (Silure)*, *Hétérobranchus*, *Labeo coubie*, *Mormyrus Rhume*, *Hémichromis Faciatus*, *Mormirops*, *Alestes Macrolepidodus (Queue rouge)*, *Genre Hydrocynus*, *Synodontis*, *Auchenoglanis (Silure-panthère)*, etc. Minepia, 2003 [21].

carpenters ; 8483 fishermen using 3465 monoxyle non motorized canoes of 5.4 m LOA costing almost 40 000 CFAF, pulling 155 134 fishing gears, 18.2 engines/fishermen. Fishing gears include bottom and surface gillnets, hooks and lines, Nests and tricks for *Heterotis niloticus*. Catfish represent 22 % of the catch, the

parachanas sp 18 %. Unfortunately the study doesn't elaborate on earnings, taxes levied, nor the average catch per canoe or total catches. The fisheries characteristics in surveyed barrages and rivers in Cameroon are given (Table-3).

Table-3: State of actors in selected barrages and rivers surveyed in Cameroon

Item	Number of fishermen nationals	Foreign fishermen (Nigerians, Chadians and Malians)	Fish processors	Fish mongers	Number of canoes	Fishing gears*	Canoe carpenters
Lagdo	4197	940	1967	1000	3289		18
Lom pangar	2500				1152	12 516	
Mbakaou	1946*	24	385	305	1628	9028	29
Maga	2064 +3250 (crew)		259	534	2567	49 562	86
Mape	2618	535**	1 526	154	2 024	3975	-
Bamendjin							
Nyong river	8483		929		3465	155 134	337
Total	21 808	1499	5066	1993	14125	242 712	470

*Fishing gears include, gillnets, hooks and longlines baited or not, cast nets, goura (nest), circling gillnet, in Maga, Lagdo, ** foreign fishermen include Malians, Nigerians and Ghanians, in the 128 fishing camps of Mape, MINEPIA [20].



Ph 5: Shorkor oven, Maga, 2011



Ph 6: Transport of smoked fish, Maga, 2011



Ph 7: Tin canoe type



Ph 8: Plank canoe (326)



Ph 9: Monoxyle canoe type

5 - 8 m LOA, 90 -95 cm width 81.18% ; 8 -13 m LOA and 1.5 – 1.8 m width; 2- 3 m LOA, 30 - 50 cm width. Source, MINEPIA [22].

Problem statement and rationale for SMes development in small scale fisheries for sustainable management : The Gordon –Schaefer fishery model

Industrial fishing companies are well identified, in the contrary of the small scale fishery, where several individuals using canoes and multiple fishing gears operate and exploit the same resource base with poor accountability. In the case of inland fishery, fishermen mostly part time, are also involved in agriculture and husbandry. Both of the groups operate informally without landing infrastructure apart from CECOPAK in Kribi. To improve the effectiveness and accountability of fisheries management and to increase the returns to the nation in terms of taxes, jobs from fisheries, management objectives are: -to pursuit effective and cost effective management; -consistency with ecologically sustainable development; -maximum economic efficiency; Accountability to the industry and broader community; and achievement of government cost recovery targets, Gooday and Galeano [24]. *According to the theory, the socially optimal level of effort and corresponding harvest is determined both by biological dynamics of the stock and the economy of the industry. If not restricted, harvest continues to a breakeven point- an effort level where total revenues just cover total costs (open access equilibrium (OAE). This unregulated equilibrium is socially inefficient (sub-optimal) because more resources are used in the fishery than they are necessary [25].* The maximum economic yield (MEY) is the economically optimal solution, since it equates the marginal revenue of additional unit of effort with its marginal cost (which reflects the opportunity cost of the investment) (Milon *et al.*, 1999) cited by Agbesi [26]. Thus the need to structure these individual workers (fishing master with three to four crew members) into SMes.



Ph 10: Cast net fishing in the river Nyong
Source: MINEPIA 2014 [22].



Ph 11: Main vue of the Lagdo Dam, MINEPIA, 2008
Source: MINEPIA 2014 [22].

The Gordon Schaefer model and rents estimation (The economic rents of the fishery and the maximum economic yield (MEY))

The Schaefer logistic model represents the simple biological theory of population dynamics where stock growth is a function of the biomass (in weight). This is a density dependent model and it assumes that the equilibrium yield curve is logistic (bell-shaped) (Fig-3). At first, the level of landings increase with effort, when competition between units of effort (vessels, fishing gear, trips, days fished, discards, etc) continues to increase, this will eventually affect negatively the catch per unit of effort (CPUE). In that case, each additional unit of effort will yield few landings. If effort continues to increase past the MSY level, total landings will decline and the fishery may collapse. The Schaefer specification is presented as follows:

$$H = \alpha E - \beta E^2 \dots\dots\dots (1)$$

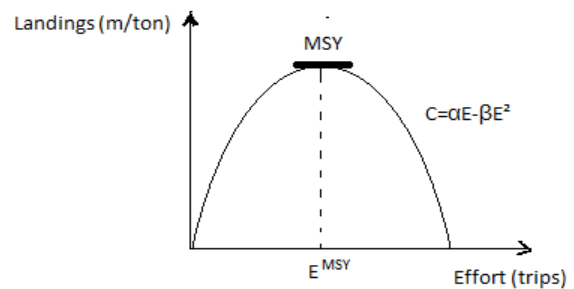


Fig-3: The maximum sustainable yield solution of the Schaefer model

Where (H), the level of landings is a nonlinear function of effort (E) and the positive parameters α and β can be estimated using annual times series data. Mathematically, the MSY [11] is:

$$\frac{\partial H}{\partial E} = 0 \Rightarrow E_{MSY} = \frac{\alpha}{2\beta} \Rightarrow H_{MSY} = (2 - \beta) \frac{\alpha^2}{4\beta} \dots\dots\dots (2)$$

¹¹ The maximum sustainable yield (MSY) is easily found with the Schaefer model by setting the first derivative of the level of landings equation with respect to effort- the slope of the production function-equal to zero.

H_{MSY} is the highest level of landings that can be produced on a sustainable basis which results from the use of E_{MSY} effort units (e.g. trips). When price is constant, MSY [12] (Fig-3) produces the maximum sustainable revenue from the fishery. The total revenue is given by multiplying each point of the sustainable yield curve by price (p), which, for simplicity is assumed constant (but this may not be constant in Cameroonian trawl fishery). It is assumed (for simplicity) that each additional unit of effort incurs an equal increase in cost (c). If it can be assumed that costs increase in direct proportion to effort, this gives rise to a linear total cost function:

$$TC = cE \dots \dots \dots (3)$$

Under open-access management objective, the total revenues (TR) are set equal to total costs to find the optimal level of effort for a common property fishery. Mathematically, the OAE solution is found as follows:

$$TR = TC \Rightarrow P(\alpha E - \beta E^2) = cE \Rightarrow E_{OAE} = \frac{p\alpha - c}{p\beta} \dots \dots \dots (4)$$

Where, the open-access harvest level is found by substitution: $H_{OAE} = \alpha E_{OAE} - \beta (E_{OAE})^2$. The total cost from the fishery is represented by TC and is estimated as follows: $TC = cE$, where c is the average cost of effort (E°). In this case, a higher cost of effort would entail the use of fewer units of effort at the OAE solution, (Fig-4). The effort level at open access is presented as (E_{OAE}). The resources used under open-access are not efficient as the same level (or more) landings can be achieved at lower level of effort (E_0)

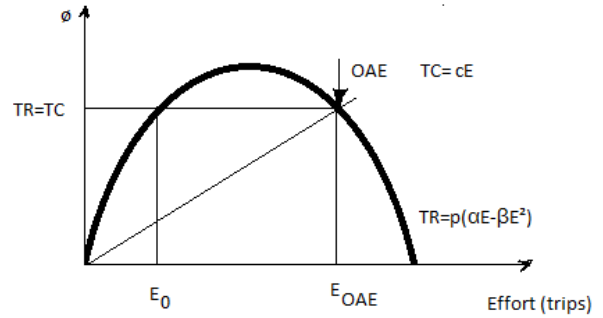


Fig-4: The open-access equilibrium of a fishery

The level of economic profit or resource rent) generated in the fishery is given by:

$$\Pi = p(\alpha E - \beta E^2) - cE \dots \dots \dots (5)$$

Since rent is the difference between the value of a good produced from using a natural resource and the costs associated with turning that natural resource into a good, rent is considered an economic ‘surplus’ Hartwick and Olewiler cited by Agbesi [26], Gooday and Galeano [24]. Rents represents the economic value of harvesting the resource since the cost of the combination of factor inputs (value of the labor (wages), capital, materials and energy) used to convert the resource into the product-have been netted out. MEY [13] is more conservationist than MSY, Kompas [28] as presented in the (Fig-5). The sustainable rent is maximized at MEY where the distance between the cost and the revenue curve is the greatest as depicted in figure (5). Mathematically, the MEY¹⁴ solution is found as follows:

¹² However, the maximum sustainable yield (MSY) and the corresponding maximum gross value of landings (Maximum total revenue) are not appropriate as fishery management objective. They don’t take into account the cost of fishing and also will result in maximum landings consisting largely on discards at the expense of more valuable species that may be on the declining in landings under heavy fishing pressure required by MSY (Panayotou, 1982) [27]. In open-access fishery, there is a lack of property rights to restrict the entry of the harvesters from a fishery. Similarly, no fisher can prevent another from using or exploiting the resource. It is completely non-exclusive because entry will occur as long as profits can be made. Without entry or effort restrictions, the industry will be in equilibrium where total revenue equals total cost (i.e. zero profits) (Gordon 1954) [24].

¹³ This rent, according to Milo et al., (1999) cited by Agbesi 2002 [26], excludes the value of any externalities associated with the industry or the product. Externalities can possibly reduce the value of the industry or the product. Economically, the Maximum economic yield (MEY) is found to be an appropriate goal for the fisheries management because, it results in the maximization of a society’s net benefit from the fishery. This keeps more options open in the light of inadequate knowledge of ecological relationships, and it reduces the risk of collapse of certain species, Panayotou, (1982) [27].

¹⁴ The equilibrium is found by equating the marginal revenue (MR) to marginal cost (MC), that is, by equating the slopes of the total revenue and total costs curves.

$$MR=MC \Rightarrow \frac{\partial TR}{\partial E} = \frac{\partial TC}{\partial E} \Rightarrow p(\alpha - 2\beta) = c \Rightarrow E_{MEY} = \frac{(p\alpha - c)}{2p\beta} \dots\dots\dots (6)$$

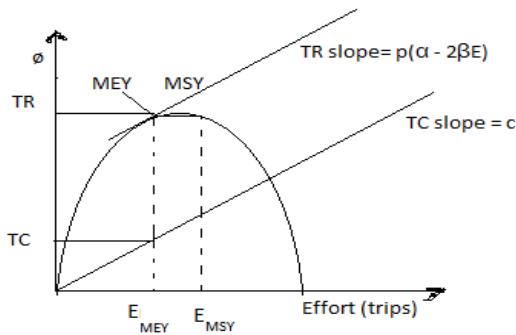


Fig-5: The maximum economic yield solution of a fishery

Where the corresponding level of harvests is found through substitution, $H_{MEY} = \alpha E_{MEY} - \beta E_{MEY}^2$. In many bioeconomic analyses, prices are assumed to be constant [15]. Hence, revenue is directly proportional to the level of landings, and the revenue curve will be symmetrical (based Gordon-Schaefer model).

What matters with the small scale fishery? estimates of the potential contribution of the small scale fishery

The small scale fishery is characterized by a wide range of engines and gears types, multiple individual actors, operating solely and generally informally, in lakes and rivers, landing at different if not structured and insufficient landing infrastructures, some accessible only on water sheds and or others in the continent with poor road facilities. Within this context, it becomes challenging to define a standard fishing effort or to assess and follow up these activities and thus the contribution to the economy. In Fig-6, are depicted the fish trade flows in the central african corridor. Unfortunately these routes are informal in the sense that there are no specified enterprises. In the model described below, some features are the same, the fish resource, the price, the cost of the fishery, but what differs much is the structure of the exploitation where, the model refers to sole enterprises. In like manner to reap the revenues and benefits derived from the small scale fishery operations, there is a need to turn these individual entrepreneurs to legal, structured entities with proper follow up mechanisms.

METHODOLOGY

Both secondary and primary data were used for this study. Secondary data on number of actors are derived from various socio-economic and framework

¹⁵For many fisheries however, the prices of a specie is a function of the level of landings of that species and the level of landings of other species that may be close to substitutes on the market.

surveys conducted by MINEPIA in 2000, 2003, 2008, 2011 and 2014 in inland waters ; 1995, 2009 in maritime and coastal areas including the CECOPAK 2019 annual report, while the 2020 socio economic survey provided for data on tax levied as well as actors contributions to the CECOPAK operationnal budget (Table-4). For inland fishery, only secondary data were used for fishermen only to allow estimates of taxes levied based on CECOPAK figures. The total tax levied on both coastal and inland fishing were calculated as a share of global taxes levied on total GDP [5]. These taxes were multiplied by the number of canoes, including taxes generated from processing activities.

Discussion of results and policy recommendations

The end result of fisheries and aquaculture is fish trade and business services best organized under formal structures. The government has invested several billions in building these barrage dams, where occur intense fishing activities. It is therefore obvious that actors contribute to this investment by at least the payment of various taxes. Unfortunately, it was estimated that, the level of taxes [16] collected was barely 7.6% out of a total turnover of 23 717 462 831 CFAF generated by the four mains actors fishermen, fish processors, wholesalers and retailers, which operated almost informally, Meke *et al.*, [1]. Data and tax collection necessary for effective fisheries management constitute a challenge both for extension service or other development agencies due to the multiplicity of actors involved, operating solely.

The CECOPAK is a model of a managed landing site, where are registered fishing operations and other related activities. In 2019, the 98 canoes registered landed 504 tons of fish, for a CPUE of 5.5 tons, an average turnover of 13775 CFAF per annum. Table-5 shows the canoes owners contribution to CECOPAK while, the total amount of taxes levied, 3 877 500 CFAF, from their activity, 39 566 CFAF on average and 63 101 CFAF on average as contribution to CECOPAK activities, making 102 667 CFAF in total,

¹⁶ For a turnover of 3,018,361,860 CFAF from fishermen, 103,300,982 CFAF of taxes were levied (3%); while looking at fish processors with a turnover of 4,908,911,418 CFAF, taxes levied were estimated at 32,515,950 CFAF (0.6%); wholesalers achieve a turnover of 13,794,882,662 CFAF and 280,946,731 CFAF represent the amount of taxes levied (2%). The retailers, with a turnover of 1, 995, 306,891 CFAF, only 40, 345,750 CFAF of taxes were levied (2%). Source : Meke et al, (2018) [1], in Bulletin of Animal Health and Production in Africa, Special Edition 2018 - Fish and Fisheries Product Trade and Marketing.

are presented (Table-6). Scattering this amount per 12 months of activity will give 8555 CFAF (less than 20 US dollars) of tax paid per month. If the whole coastal area and inland fishery has such centers or managed landing sites, thus the fishery’s contribution based on the number of canoes 27036canoes [7], the estimated amount of expected taxes would be 1 069 706 376 CFAF per annum. Looking at fish processing, mainly smoking using ovens, which contributes to mangrove

destruction and CO2 gaz emissions. In the marine area, each oven is to pay 50 000 CFAF per annum, which is almost 320 millions CFAF, in which should be added the inland fishery, estimated at 25 000 CFAF as oven taxes for a total of 126 650 000 CFAF, thus a total of 1 516 356 376 CFAF of expected taxes to be levied, representing 0.21 % of the fisheries contribution to GDP which was 72.2 billions CFAF in 2017 [5].

Table-4: Recap of main actors for tax collection in the small scale fishery

Item	Number of fishermen Nationals in inland waters	Foreign fishermen (Nigerians, Chadians and Malians) in inland waters	Fishing effort (canoes), after the inland waters surveys	Number of fishermen in marine and costal areas in 2009	Fishing effort (canoes) in marine and coastal areas, MINEPIA, (2009)	Fish processors in inland waters	Fish processors in mairtime and coastal areas, after 2009, surveys
Total	21 808	1499	14 125	36 991*	12 911	5066	1178, nationals; - 5221 **

*of which 16 887 crew members, ** foreigners (76% Nigerians). Source: Compiled by the author.

Thus for effective collection of these taxes and other information, there is need for Cameroon central government and local councils to invest in infrastructures to facilitate all fisheries and related activities such as landing infrastructures in main fishing camps or villages, whole sale and retail markets; ice-plants; fish processing units; fuel trading for out-board engines and vehicles. Dealing with individual actors can be time consuming and costly, for more efficiency, and a better reflection of the small scale fisheries contribution to the economy, joint efforts between central government and local councils, NGOs and other development agencies are necessary to promote the structuration/transformation of these individual actors into SMEs, cooperatives that will facilitate various development interventions . The fishery sector as whole experience a gap on data collection necessary for effective management, after the framework surveys conducted in Mape, 2000, Lagdo 2008, Maga, 2011, Nyong river (Abong-Mbang-Mbalmayo), 2011, coastal maritime area 1995 and 2009, there is very poor knowledge on what is going on in the other rivers and barrages such as Lom-Pangar, Mekin, Memvele, Nkam river, Cross river, Mungo, Doume, Boumba and Ngoko, Kadey to name a few. There is a need for government to conduct other surveys and update the fishing activities data in all those watersheds as also recommended by Ngok *et al.*, [3]. By so doing, these studies should clearly give estimates of total catches, taxes revenues, revenues extracted from the various activities.

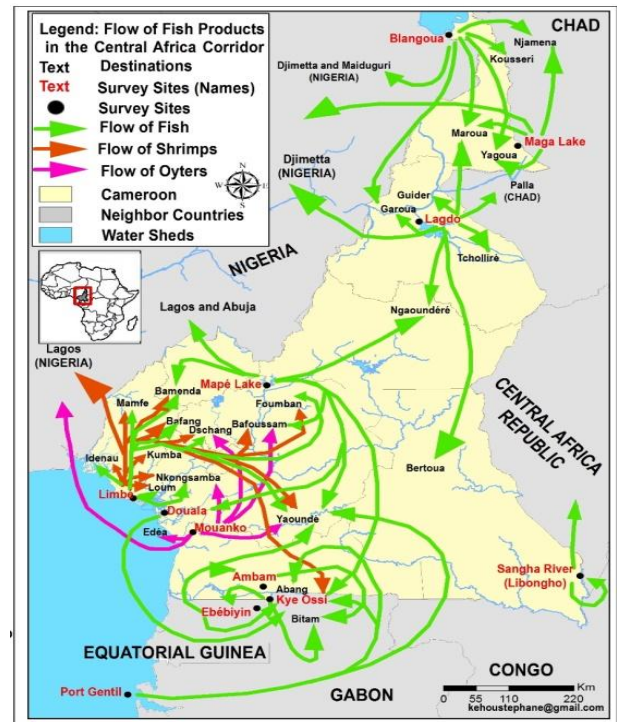


Fig-6: Map showing fish trade routes in the central African corridor.

Source: Meke et al., 2018 [1]



Ph 12: Smoked fish at Lom Pangar Central African Corridor
 Source: Fish trade surveys, Meke *et al.*, (2018) [1].

Table-5: Financial contribution of some working bodies to the operating budget of CECOPAK

Renting and Other services Working bodies	working days/week	Renting of space and others	Renting of isothermal boxes	Ice purchase	Fish market space	Registered canoes owners
Canoe owners /fishing masters	7days/7	2 430 000	200 000	2 238 900	1 100 000	215 000
Fish mongers	7/7	1 701 000		359 000		
Restaurant owners	7/7	3 761 000		955 000		
Peti traders	7/7	855 500		25 000		
Scale removers	7/7	142 500		1 320 000		
Artisanal object sellers	7/7	305 000				
Canoes carpenters	6/7	915 000				
Mechanical shop	6/7	220 000				
Total		9 446 500	200 000	4 897 900	1 100 000	215 000
General total				15 859 400		

Source: CECOPAK, annual report 2019. (Payment of dues and other services in CFAF).

Table-6: Annual taxes levied for the state treasury (amounts in CFAF)

Annual Taxes Working bodies	Registration of new canoes	Canoes renewal fees/annum	Production taxes	Veterinary sanitary Inspection	Fish products handling taxes	Fishing permits	Total taxes levied/working body
Canoes owner and fishing masters	272 500	2 210 000	540 000	-	-	855 000	3 877 500
Fresh fish whole saler	-	-	-	144 000	-	-	144 000
Restaurant owners	-	-	-	120 000	72 000	-	192 000
General Total	272 500	2 210 000	540 000	264 000	72 000	855 000	4 213 500

Source: CECOPAK annual report, 2019.

Fishermen are already constituted informally into groups of three to five persons (fish master + crew members), women dominate fish processing, whole sale and retail activities operating usually alone, making them vulnerable and failing to reap the fruits of various assistance programmes. Young men also lack funding to start up their own business and usually start as crew members for fishermen, retailers, or work with Women in processing activities where they assist in the transport of fish products. All these actors need to be empowered in SMEs creation and management so that they have easy access to investment funds and benefit from various programmes in force. However, the conditions for accessing to investment funds must not be very

stringent to avoid denying SMEs an opportunity to access the funds.

Up to now, efforts to curve the gap between demand and supply of fish products in Cameroon are yet to meet expected results, Government and privates should invest in cage culture development in these lakes and dams. However, due to the decline of catches observed (10-15 years) after the phase following the impoundment of the reservoir, Lévêque and Paugy [19], there is a need to develop aquaculture, with fingerlings station, feed units; cage building stores, cold store around table size fish production. Therefore, the government should set up a participatory platform

including the Ministry of Livestock, Fisheries and Animal Industries, the Ministry of Finance, The Ministry of Trade, the Ministry of Economy, the Ministry of Local Development and stakeholders or non-state actors to better address the opportunities offered by the sector, ease the constraints for full fisheries development.

Almost 185 829 tonnes of fish products, were imported in 2019, including aquaculture products such as Clarias and Tilapia, MINEPIA [29], draining the economic trade balance with almost 129 968 000 000 CFAF. Thus, the government and the private sector to curb this situation should produce at least 150 000 000 fingerlings of these species grown in net cages, on a yearly basis in the main reservoirs Bamendjin, Mbakaou, Lagdo, Mape, Lom Pangar and the same amount of feeds to produce, which is a big industry to develop. Besides adequate road infrastructures linking those barrages will allow the fishery sector to improve its contribution in terms of salaries to workers, profits to entrepreneurs involved, taxes revenues to the government, better supply of cheaper and affordable essential proteins to the population under a well management of environmental impacts.



Ph 13: Smoke in oven



Ph 14: Traditional ovens



Ph 15: traditional oven



Ph 16: Mangrove wood for fish smoking.

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