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A fisheries observer's model as a tool for sustainable management of the marine trawl fishing in Cameroon

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Abstract
Since, the mid fifties with the opening of the industrial trawl fishery in Cameroon, data collection system is based on landings and vessel captains' statements and logbooks, difficult to use for stock assessment purpose and thus proper management. Various stocks assessments surveys conducted, show an overexploitation of the costal resource and the decrease of the resource base (Meke, 2015). Besides, the country is threatened by a self-ban of shrimp's exports to EU countries since 2006 and yellow card due to INN fishing issues in 2021.
This paper examines and suggest a fisheries monitoring model of the trawl fishing industry. Findings of the study indicate that boarding observers on vessels at sea will close the data gap necessary for effective fisheries management.The study recommends that Cameroon management authorities adopt the model.

Keywords: Fisheries observers, fisheries management, trawl fishery, data gap

1. Introduction
Cameroon with almost 26 million inhabitants in 2019, presents a costal length of 402 Km where occur intense fishing activities (industrial and artisanal). The fishery is endowed with a diversity of species, where operate various engine and actors; -in the industrial sector operate both shrimpers and fish trawlers; while for the semi-industrial fishing, purse seines with more than hundred (100) wooden or plank canoes are encountered; in the maritime artisanal sector with twenty four thousand six hundred thirty five (24 635) fishermen using seven thousand three hundred thirty five (7335) canoes fish with gill nets, surface, and bottom and cast nets., (Meke, 2020) [1]. In 2012, the fisheries contribution to real GDP dropped sharply from 1.2% to 0.37 (74.2 billions) in 2021, due mainly to self-suspension of shrimp products to EU countries (Meke, 2020) [1], though these exports are oriented today in other markets such as Malaysia. Eight species of the Cameroon continental shelf contribute to 80% of the main_demersal landings dominated by the sciaenid community of Longhurst. The fish species belong to the following families: Ariidaes, Cynoglossidae, Polynemidea, and Sciaenid. Almost 81.3% of catches are made at shallow waters less than 20 meters with 98.2% of species either from swampy/muddy or sandy bottoms (Meke S.P.N., 2011) [2]. Landings catches statistics has been decreasing sharply as shown by Njock, (1990) [3] from 10 000 tons to less than 3200 t for almost the same fishing effort. (Meke S.P.N., 2005) [4] Found similar figures of the catch composition analyzed from landings data with the following percentages: croakers **(**45%); Arius sp (15%) *Pentaneamus quinquarius* (16%) Sphyraena sp (17%) Trichurus sp (2%). In 2004, the working group of the Fishery committee for the Eastern central Atlantic held in Togo (third session of the scientific sub-committee), conducted a stock assessment. A variety of methods were used including the analysis of long-term trends in fishery data (landings, effort, catch per unit of effort (CPUE); fishery-independent surveys. The group came up with the following results: there was overexploitation of *Penaeus notialis,* the main export product, thus, the need to reduce the current fishing effort; for some main fishes in Cameroon, such as *Pseudotolithus spp*; *Galeoides decadactylus*, Cynoglossus spp., there was uncertainty in the assessment and the main recommendation was to avoid any increase in the fishing effort until a new stock assessment is performed (FAO, 2005) [5]. The other stocks assessments surveys carried out, using the oceanographic vessel Fridtjoff Nansen, since 1982 and from 2004 to 2007, show an overexploitation of the costal resource [6-8].

However, the exploitation of the abundant deep sea demersal resources such as Sparids (*Dentex* sp), Ariommatideas (Ariomma. sp) not included on actual landings statistics [9], constitute a great opportunity for Cameroon to increase fish production by the industry. Since the mid-fifties when started the industrial fishing, mesh size regulation and licensing are the sole management technique. The data collection system is based on vessels captains' statements, logbooks and landings data of nominal catches in common fishing names, from commercial vessels at Douala port, and very recently at Kribi or Tiko. These data are usually registered as such by the fisheries agents for the annual report (table 1) when actually many other missing data would have been collected by qualified observers. These include by catches and discards; length frequencies of main commercial species; fishing zones and related depths useful for monitoring fishing operations, stock assessment and management purpose.

Table 1: Trends of catch and effort data in the Cameroon trawl Fisher 2010-2020

		Years	2010	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sctfc and family names	**FAO English name**	**Commercial names**										
Pseudotolithus senegalensis, typus	Long neck croaker	bar	613150	2477967	1436482	1962840	2574643	2 632 356	3 130 789	4 114 700	3 884 000	2 652 810
Sphyraena piscatorium	Guinean barracuda	brochet	12600	343144	166523	292968	367640	275 278	313 668	350 710	379 000	366 920
Pseudotolithus elongatus	Bobo croaker	bossu	13400	329454	565935	997978	1162238	1 231 355	1 415 459	1 500 280	1 429 000	1 020 260
Galeoides decadactylus		Pt capitaine	195380	960780	206867	158306	201675	173 505	171 580	169920	19000	131140
Polydactylus quadrifilis	Small African threadfin	G Capitaine	14760	60777	84577	160118	190470	166 449	191 517	232730	240000	216580
Carangidea		Carangue		318064	377519	594337	434554	356 608	294 891	479910	819000	477310
Lutjanus spp	Snapper	carpe	14890	125697	84925	128968	133327	82 981	84 963	109300	128000	135520
Conger, Paracongerarisoma	Conger	congre	2580	69905	25767	59417	135617	122 136	129 651	191850	214000	195250
Drepane africana	African sicklefish,	Disque	40170	150 547	33 317	26585	43071	33 242	55 940	69 760	136 000	89 160
Pentenamus quinquarius	Royal threadfin	Divers	597890							380	3000	690
Pomadasis jubelini	Sompat grunt	Dorade G	42920	954956	151885	112156	183344	172 161	159 021	167570	206000	158890
Dentex spp, *Pagellus* sp.	Red sea bream	Dorade R	2220	54401						340	2000	
Pentanemus quinquarius, Pteroscion peli		friture	311200						250 515	185480	59000	118280
Arius sp,	Sea catfish	mâchoirons	62730	392908	120032	195698	279894	366 052	501630	570720	499000	411750
Epinephelus sp	Grouper	Mérou	3620	32964	3912	3396	15500	13 349	5 651	1310	5000	1440
Dasyatis margarita	Stringray	Raie	145116	479486	84237	75479	91563	59 175	40 618	49400	57000	128090
Ethmalosa frimbiata		Ethmalose		11500	71852	254279	310379	306 415		95890	239000	180220
elasmobranche		Requins	1200	152040	19393	10245	7806	3 402	172	1540		200
Sardinella maderensis		Sardinelles	1060	23803	15158	25047	38695	11 331	52 837	256010	142000	246180
Cynoglossus sp	Tongue sole	Soles	437940	1138214	164726	145003	240912	334 330	502 760	683 930	589 000	435 550
Trachirus lepturus	(poisson –sable commun)	Ceintures	36680	429559	492783	620544	650057	358 608	446 751	646710	526000	303950
Umbrina cirrhosa		Ombrines		3080					440			
Psetta maxima		Turbot	2200	38600	20685	6854	7659	5 896	211			390
Scomberomus tritor		Thon		47782	62505	107429	182443	81 362	78 466	260	145000	147300
		Total, Poisson, Kg	2551706	8445081	4 433 891	5937647	7251487	6785991	7 827 530	9 125 010	4 732 000	3 873 440
Penaeus notialis	Pink shrimp			5068		55366	28645	72 348		64560	98000	74130
Penaeus kerathurus	Caramote prawn			75307		45127	32124	47 301		145680	110000	97110
Parapeneopsis atlantica	Guinean shrimp	cr grises		391236	176172	68565	41467	41 775		80380	125000	107900
Penaeus monodon		crev Zébrée		218753		58065	44244	56 692		91810	81000	73170
		Total Crev	236 476	690364	176172	227123	146480	218116	289616	382 430	414 000	352 310
Panulirus regius	Royal spiny lobster	Langouste						57	261	20		1020
Portunus validus	Smoothswim crab	crabes		5068	38000	63292	41467	61198	358217	100130	71000	51910
Sepia officinalis	Cuttle fish	Seiches				28770	24692	28768		88840	26000	
Loliginidae	Squid	Calmar		4479	30639				28355			15400
		Tortues										
		Total, comm	2 788 182	9 305 057	4 257 719	6 263 672	7 464 304	7 094 130	7 827 530	10 471 390	10 401 000	7 840 260
Fishing effort	number of Vessels		39	65	20	20	34	37	29	57	57	59

Source: Compiled by the author from The Littoral Region Delegation of Livestock, Fisheries and Animal Industries annual reports, from 2010 to 2020.

It is only in 2006, that the Monitoring, Control and Surveillance (MCS) of fishing Activities Brigade was created in the Ministry of Livestock, Fisheries and Animal industries responsible for the fishery policy, but without a clear monitoring programme and lack of Inspectors body. Under the framework of a FAO project, Cameroon experienced fisheries observers from 2004 to 2006. The project entitled, "Reduction of the environmental impact of shrimp trawl fishing through the introduction of by-catch reducing devices and change of management strategies", targeted only shrimp trawlers, (Meke S.P.N., 2007) [9]. In 2009, another trial with observers was also conducted during one month on trawlers, when three scientific observers boarded three (03) couple of Chinese vessels. Out of twenty two (22) fishing days were registered, forty five (45) hauls, four (04) hours each and four (04) hours for fish selection. Out of the hundred twenty-five (125) tons of fish retained for trade, forty six (46) tons were by-catches made of juveniles fishes with poor commercial value.

The same year under following the IFOMC conference, July 2009, a three (03) day trial was carried with experts from NOAA in Cameroon that contributed to the West African observer manual. During a three (03) days survey on board a shrimp trawler (Agia Eleni), fishing at an average depth of twenty two (22) meters and a distance less than fifteen (15) nautical miles to shore, the wet mesh size measured was forty two (42) mm at the Codend. It was estimated that in a cash of four hundred forty five (445) kg on board the shrimper (Agia Eleni): fifty two (52) % of the catch retained was composed with 45.7% of fish; 5.7% of shrimp; 0.8% of other species

(crabs, shell fish…), while 48% were discarded. The composition of discard includes: 8.4% of other discards; 16.6% of fish; 8% of shrimp discard; 12.7% of plants discards and 2.1% of plastics (fig. 6). The retained composition was as follows: *Pseudotolithus sp* (57%); *Trichiurus lepturus* (9%); *Pomadasys jubelini* (8%); *Galeiodes decadactylus* (6%); *Cynoponcticus ferox* (5%); *Pentanemus quinquarius* (4%); *Cynoglossus sp* (3%); *Raja miraletus* (3%); *Pteroscion mbizi* (2%); *Epinephelus spp* (1%) (fig.1).

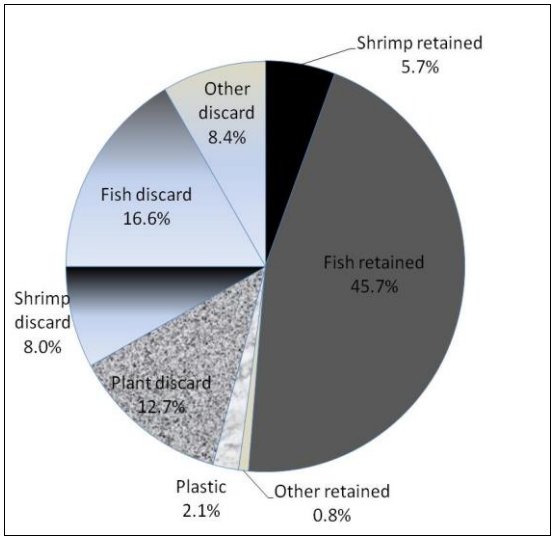

Fig 1: Trends of catch composition of a shrimper in Cameroon waters

The number of vessels has been an increasing while the biological rest though provided in the regulation has not yet been implemented. Economic objectives and associated regulation such as buy-back programme, tax regulation, restriction on capital or fishing effort in the trawl fishery necessary for the fisheries management have never been considered. This situation is to compromise the long term exploitation and sustainability of fish resources. Using a bioeconomic model of the Cameroon trawl fishery, findings of the study indicated that higher profit may be achieved at Maximum Economic Yield (MEY) with an effort level of thirty eight (38) vessels in the Cameroon fishing industry. In the same vein, since catch data and effort are important for the management of fish resources, and get a clear picture of the patterns of the biodiversity, the need of monitoring both by-catches and discards, by setting up a scientific observer programme came out clearly (Meke S.P.N.,2015) [10]. Moreover, under the FAO Nansen programme, stock assessment surveys conducted on board of the research vessel, Dr Fridtjoff Nansen (2004, 2005, 2006, 2007) [6, 7, 8] came out with some shortcomings in terms of sea depth. The vessel due to its size could not explore sea waters less than twenty (20) meters depth, where commercial vessel usually enjoy fishing. Beside the cost of hiring a research vessel is not always affordable to many developing countries, thus reducing the frequency and time allocated for exploration, (five (05) to seven (07) days to complete the cruise in Cameroon waters). As a result, Cameroon fisheries are not surveyed using this direct method of stock assessment. Embarking observers on commercial vessels (indirect method), is relatively cheaper and effective since, this will allow to monitor seasonal variations of catch and effort data, as well as fish population dynamics, which is the main argument in favour of implementing such a programme in Cameroon.

2. Problem statement and objective of the study

Since the mid-fifties when started the industrial fishing, mesh size regulation and licensing are the management measures. The data collection system is based on vessels captains' statements, logbooks and monitoring of landings data of nominal catches in common fishing names, from commercial vessels at Douala, and very recently at Tiko or Kribi ports. These data are usually registered as such by the fisheries agents in the annual report when actually many other missing data would have been collected by qualified personnel if embarked on vessels. These include by catches and discards; length frequencies of main commercial species; fishing zones and related depths useful for monitoring fishing operations, stock assessment and management purpose. Unfortunately, the 1994 fishery law is obsolete with very weak fine levels for defaulters and yet to take into accounts various international developments in the fisheries sector, such as the FAO, (1995) Code of conduct for responsible fisheries; International plan against UU fishing (2001) as Davies, (2002) [11] puts it. Unfortunately despite, the creation of Monitoring, Control and Surveillance (MCS) of fishing Activities Brigade in 2006, neither a clear monitoring programme nor a fisheries inspectors' body exist. The MCS Brigade [1] is a sub-department in the Department of Fisheries and Aquaculture in charge of Monitoring, Control and surveillance, following the Decree 2012/152 of 4 may 2012. The fishing effort has been increasing; no closed season has been decided yet. Economic objectives of the fisheries necessary for management have never been considered, which is to compromise the long term exploitation and sustainability of fish resources. Whereas since, with the current coastal length and reduction of fishing grounds due to oil exploitation, the trawl fishery cannot achieve its Maximum Economic Yield (MEY) with more than forty (40) vessels, (Meke, 2015) [10].

Thus, the overall objective of this study is to contribute to the sustainable management of maritime fish resources in Cameroon. Specifically, the aim of this paper is to: -Assess the gap of relevant data in the official report of authorities in charge of fisheries management; present and suggest an observer model as a management tool for the trawl fishery that can be implemented.

3. Materials and Methods

3.1 Material

Fishery observers in charge of monitoring fishing operations at sea on commercial vessels, are eye withnesses of the administration and the country. They are trained biological technicians to collect first-hand data on catch and discards. As data gathered by these observers are of high-quality, it can be used to monitor fisheries, stock assessment, and inform fisheries authorities to decide on management options. Therefore, as professionals, fisheries observers are an essential component for tracking fishing activities and provide critical information necessary for sustainable explooitation fish resources and management, https://www.fisheries.noaa.gov/topic/fishery-observers. Data

[1] The brigade is in charge of the followings: -Control and Surveillance of fishing activities; - Control of the respect of fishing regulations; Surveillance of fishing grounds and biological rest periods; -organization and monitoring of the protection of fish resources; control of gears and fishing techniques, commercial size of target species; follow up of landings of fish products from authorized fishing units.

necessary to the model include catch and effort data of the trawl fishery from 2010 to 2021. Information to be collected by fisheries observers are derived from the West African fisheries observers manual, (Dietrich K.S *et al*., 2011) [12]. Those technicians however have no legislative power for enforcement of fishery regulations a duty performed normally by fisheries inspectors. As Davies, (2002) [11] puts it, many arguements justify fisheries managers to board observers: -the reliability of the information provided by vessel operators, is questionable since there are many reasons for them to give inaccurate information; -catch and effort data including retained or rejected species useful for stock assessment and management are not always properly collected by the crew; -fisheries management objectives are different from business interests.

3.2 Methods

Fisheries observers are an essential component in the Monitoring Control and Surveillance (MCS) system, in terms of regular requirement for the measurement of the trends of the fishing effort characteristics and yield that are useful for fisheries management. The set of data gathered by observers provides a source of information by area, time and species not often covered by research cruise and port sampling. According to FAO, (2009) [13], biological data such as length, age, and catch per unit effort data, collected by observers, are now used regularly in stock assessment studies. Thus, monitoring such data is good sign of management. Several authors including Beverton & Holt (1957), Ricker (1975) and Gulland (1969) demonstrated that data on catch and effort collected from commercial vessels are useful and affordable information to determine abundance index measured as the catch per unit of effort (C.P.U.E). Thus, the number of fishing days is a good proxy of the effort measure[14]. For these reasons, a gap assessment is conducted between the data collected from the official report from fisheries authorities and standard data expected from observers that can contribute to effective fisheries management [12].

Explanation of the model

The model is run for a three years period (full coverage programme, meaning all vessels are monitored by observers) to constitute a data base for the fishery and partial coverage for the remaining fishery life cycle. The standing pillar of the model is the law n^0 94/01 of 20th January 1994 to lay down Forest, Fauna and Fisheries regime and its subsequent decrees, orders and by laws. These include Decree 2001/546/PM of July 2001 to modify and complete some provisions of Decree 95/413/PM of 20th June 1995 to lay down some modalities to implement the fisheries regime as well as international laws [2]. A ship-owner applying for a fishing license should sign an honor statement to contribute to sustainable management of fish resources and accept to embark a scientific observers at his charge. Unfortunately such as programme has not been yet implemented per se. In practice, observers embark on board vessel and stay up to the end of the sea trip. They will sojourn only once on the same vessel. The model is using the level of effort that achieve MEY, 38-40 vessels (Meke S.P.N., 2015) [10] with an average gross monthly salary of 75 000 CfaF for the observer based on current payments of sea-men. The profile of observers is a background on natural sciences and biology.

Data collection, processing, analysis and sampling

The approach for data to be collected will be the same as under REBYC/FAO project, which consisted of a list of sheets: - Biological data such as:-fish identification and catch composition of both retained species; discards and by catches; -length frequencies of main commercial species; -coordinates of fishing grounds, depths and species encountered; - duration of trawling and number of trawls per day, number of sea trip; -Economic and financial performance of the vessels (Earnings, Running and Labor cost, financial duties and Investments); fleet census);- General vessel and trawl characteristics (Length overhaul; Gross Registration Tonnage (GRT); trawl length; Engine Horse power. Data collected will be analyzed using Excel sheet followed by a validation workshop of results with the industry and NGOs or other partners. In case of a partial [3] coverage that can be implemented for the whole span life of the fishery, a gradual reduction from seventy percent (75%) as for the 4th year; fifty percent (50%) the fifth year and twenty five percent (25%) as from the 6th year of the programme, three million six hundred thousand (3600 000 CfaF), the costs will be reduced for the industry. However, all the participants will contribute to bear the running cost while collecting the same data for forty (40) permanent observers boarding randomly. The daily activities include among others: -building a software for data processing; training for the observers (twice a year;); shifting observers to vessels; observers equipment**;** workshop for the presentation of data collected (every 06 months), acquisition of observer working equipments**…;** Running costs: -Transport fees; -Printing collection sheets and typing; - Insurance costs for the observers; -Medical care; -monitoring disembarking/embarking of observers and communications costs; validation workshop on presentation of observers results to the industry.

[2] Article 62 of the United Nations Convention on the Law of the Sea (UNCLOS) ; the FAO Code of Conduct for Responsible Fisheries (CCRF) - supports the appropriate use of observer programmes to ensure effective monitoring, control and surveillance (MCS) ; Article 18 of the UN Fish stocks Agreement (UNFSA) and, Annex 1, Article 6, observer programmes are advocated as a suitable means to verify fishery data in sub-regional or regional fishery management organizations ; the 2001, international plan of action (IPOA) to prevent, deter and eliminate Illegal, Unreported and Unregulated fishing, Under section 24.4, on Monitoring, Control and Surveillance (MCS), states are encouraged to implement, where appropriate, observer programmes in accordance with relevant national, regional or international standards. Davies, 2002[11].

[3] Lower coverage will bear less cost, both to fishery authorities and the fishing industry in the management of an observer programme, while observers are on board. Davies, S.L.; Reynolds, J.E. (ed.) *FAO Fisheries Technical Paper*. No. 414. Rome, FAO. 2002. 116p.

Table 2: Costs estimates of a full and partial coverage hypothetical observer programme

Activity/Year	01	02	03	04	05
Number of vessels	40	40	40	40	40
Shrimpers (SH)	06	06	06	06	06
Fish trawlers (FT)	34	34	34	24	14
Number of fishing outings FT (3 /month)	1440	1440	1440	1440	1440
Duration of hauls/day and sea trip					
Number of Observers on FT	68	68	68	48	28
Number of observers on ST	12	12	12	12	12
Observers salaries	72 000 000	72 000 000	72 000 000	54 000 000	36 000 000
Insurances and medical care (5%) of the monthly salary	3600 000	3600 000	3600 000	2700 000	1800 000
Running costs of the programme (10%)	7200 000	7200 000	7200 000	5400 000	3600 000

Note: take, 1US dollar= 500 cfaF. As from the fourth year (partial coverage), 75% of vessels are monitored, but including all the shrimpers. Full coverage means observers embarked on the whole fleet for a particular period.

4. Results and Discussion

FAO, (1997) defines effective fisheries management as "The integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives**.** As depicted in figure 2, information gathering is key to achieve fisheries management. Thus any fishery where such a process is not operating is far from achieving such a goal, especially where observer are lacking. Cameroon fisheries is an exemple, since the 1950s, no observer programme has been put in place, a part from data collected by the vessel captains, and reported as such during landings from their logbooks. Under these conditions, decision makers have no other opportunity to follow or monitor what is going on at sea. Since captain vessels have no reasons to collect other information, apart from retained species quantities for the market, it can be seen that there are critical loopholes on fisheries data that cannot be used either for stock assessment or guidance to management.

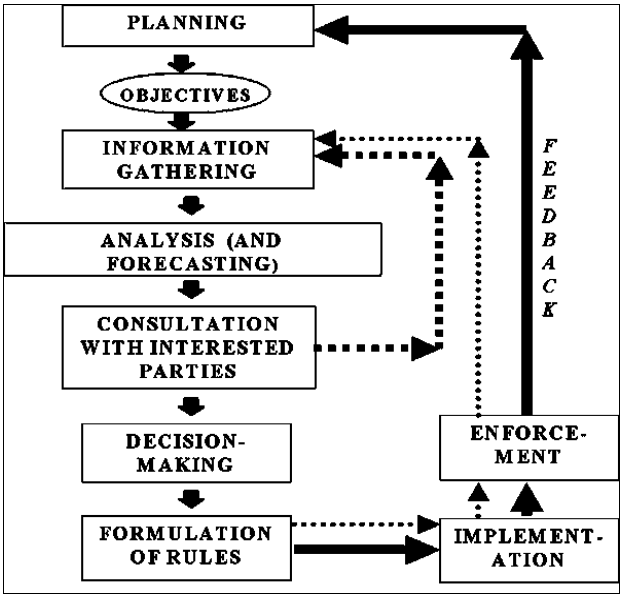

Fig 2 : Diagrammatic representation of the functions and responsibilities of a fisheries management authority in relation to fishing, and the inter-relationships between the functions. Source : Cochrane, K.L. (ed.), (2002)[15]

In table 1, are presented the trends of catch and effort data of the Cameroon trawl fishery and critical issues that need to be adressed such as fish species identification ; fishing effort…In the case of fish identification, many fish species are lacking in the scianids group, such as *Pseudotolithus typus.* The groups identified as fritures and divers are a mix of unidentifed species by the industry and registered as such. Species like Pentanemus quinquarius and Pteroscion peli are lacking in the offiicial statistics making them of limited use for stock assessment purpose. With regard to fishing effort usually specified as the number of vessels, it is important to make a difference between shrimpers and and fish trawlers due to the mesh size at the codend which has an impact of the level of bycatches and discards. Besides, it is possible to better report the daily time allocated for trawling based on the fishermen logbooks, but unfortunately, these data that allow estimates of effective fishing effort are missing. Thus the need of personal and capacity building on data collection and fish identification. Moreover, in the three main categories of fisheries management services identified as suggested in Wallis and Flaaten (2000) and Arnason, Hannesson and Schrank (2000) cited by Ragnar A, (2007) [16], the:- *Research component* (surveys, data analysis, and stock assessment) is mainly under the Ministry of Scientific research and Innovation (MINRESI), but not preventing fisheries authorities to perform any research; - the management services involved in adjusting management settings within an existing management system; recommending amendments or additions to the existing management system and administering the management system (monitoring fishing licenses and catch returns) are under the fisheries authorities including the enforcement services component, which involve

surveillance of compliance with fisheries law, both at sea or on land (checking of catch, by-catch, licenses, fishing gears), prosecution of non-compliant with fisheries laws. Unfortunately, the fishery main law [4], is obsolete and doesn't include recent requirements on fisheries transparency and the current subdepartmennt in charge both of industrial and artisanal fisheries is yet to address issues related to daily monitoring of fisheries data. In table 3, are listed some of data relevant both for fish stock assessment and management to be collected by fisheries observers at relatively low costs. It can be noted on a set of almost twenty four (24) type of relevant data, that only ten (10) are monitored by fisheries authorities. Recent developments in the fisheries sector, including yellow card by the Europ union against IUU fishing combined with self suspension of fish exports show that, fisheries authorities have only to adopt drastic relevant measures either on standalone or under FAO ongoing projects, FISH4ACP or Ports state measures agreement (PSMA). In terms of benefits or advantages, on a yearly basis, the industry apart from license payment and other taxes will contribute at around seventy two million (72 000 000 CfaF) per annum for three years during a full coverage period and half of this amount at the fifth year under partial coverage that can be easily performed every year.

Table 3: Data gap between official reports and expected from fisheries observers

Data to be collected by observers	Availability in official reports	Observations
1/Biological data		
-Fish identification (specie)	x	
-fish catch composition	x	
-Retained species in (Kg)	NA	
-By catches in (Kg)	NA	
-Discards	NA	
-Length frequencies of main species in cm	NA	
-Mammals (Sea turtles/whales)	NA	
Fishing effort parameters		
-Number of shrimpers	x	
-Number of trawlers	x	
- Duration of trawling per sea trip	NA	
-Coordinates of fishing grounds per haul	NA	Available in captain logbook
-Fishing depths and species	NA	In logbooks
-number of sea trips	x	
2 Economic and financial performances		
-Quantity of fuel and oil per sea trip	NA	
-Value of fuel and oil per sea trip	NA	
-Fish price /Kg in CfaF	x	
-Value of fish landings	x	
-Monthly salaries of the personnel	NA	
-Cost of other inputs (plastic bags; ice;	NA	
-Quantity exported	x	
3-Vessel and trawl characteristics		
-Length overall (LoA)	x	
-Gross Registration Tonnage (GRT)	x	
-Engine power (Hp)/Kwh	x	
-Trawl length/ width	NA	

***Source*:** gap assessment table from the author. NA stands for not available

As presented in table 2, for the remaining life span of the fishery, a contribution of three million (3600 000 CfaF) can allow to continue a light data collection while contributing to tracking industrial fishing operations on a yearly basis. This model shows that monitoring fisheries activities with such an instrument can satisfy several management needs: data collection of vessel operations; tracking catch, fishing effort and grounds; vessel positions; monitoring of other environmental factors such as climate, mammals, birds… and contribute to stock assessment and management. Such a tool is also interesting in many aspects, and according to Davies (2002) [11], observer programmes offer advantages in terms of: -job opportunities especially for young people;-strengthening capacities for both skilled and unskilled people through vocational training (young engineers graduated from Fisheries colleges and those from Foumban vocational veterinary and zootechnial school can be recruited); - providing baseline information for compliance control and scientific monitoring of a fishery; -not relying heavily on high technological hardware or skills; - interest to donor organizations with compatible objectives;-reasonable cost; and relatively short start-up periods compared to scientific cruises on board research vessels. Moreover, these programmes are flexible in relation to their size, since being large or small will certainly allow its expansion once their success is evaluated.

Conclusion and Recommendation

Since the 1950s, the Cameroon fisheries management has been relying on catch and effort data from captain vessels statements registered in their logbooks. Such data unfortunately are likely to be of limited use either for stock assessment or management purpose. Thus, this study was conducted to suggest a simple fisheries observer's model to implement in the industrial fishing moving from a three years full coverage, to a decreasing partial coverage up to 25% for the remaining life span of the fishery. Findings of the study indicate that there are more advantages in setting up such a model and benefits from valuable data useful both for research and management purpose. These data can be collected from commercial vessels at cheapest costs compared to a research vessel and close the current data from fisheries authorities. The main recommendation is that Cameroon fisheries authorities commit themselves in upgrading the MCS system with such a tool that will contribute to effective fisheries management.

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[4] There is need to update the current fisheries law based where mesh size regulation and licensing are main management techniques, as King puts it, because no single management strategy measure will produce the desired results compared a combination of several instruments. (King, 1995)[17].

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