

SHARED MANAGEMENT OF FISHERY RESOURCES IN TANZANIA

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ABSTRACT:

In Tanzania, the overall objective of the National Fisheries Policy is to develop a robust, competitive and efficient fisheries sector that contributes to food security, nutrition, employment, growth of the national economy and improvement of the wellbeing of fisheries stakeholders. The overall goal of fisheries management is to produce sustainable biological, social, and economic benefits from renewable aquatic resources for the present and future generations.

However, the main constraints of fisheries sector in Tanzania are lack of reliable, accurate, adequate and up - to - date fisheries statistics (data). The use of illegal fishing gears, law enforcement, infrastructure, human capacity and financial resources are among other constraints. In realising this, government agreed to introduce co-management concept i.e. community participation in fisheries management so that fishing communities be used in fishery-dependent data monitoring i.e. to participate in data gathering, control and surveillance as, this may enhance a feeling of “ownership” among the community members and motivate them to implement management and conservation measures. This can be done in the absence of human resources (fisheries expert). Unfortunately, all these needs human and financial resources as the key factors in fisheries management.

This paper is an attempt to devise ways to improve the management of fishery resources through Beach Management Units who involved in data collection and conservation of fishery resources. It describes Tanzania sampling protocol, how Beach Management Units used as data enumerators, how it cost for fisheries Development Division to collect fisheries data and its implication on fisheries resource management.

1.0 Background information:

Tanzania is a coastal state lying in the South West Indian Ocean on area 51 according to FAO major fishing areas (FAO, 2007). The country’s coastline extend from the North where it borders with Kenya at latitude **39°1139.414S** and longitude **04°4429.619E** in Jasini landing site to the South at Msimbati Landing site at Latitude **10°22S** and Longtude **40°21E** to the boarder with Mazambique which covers about 1,424 kilometers long. The country has a territorial sea of about 64,000 km² and Exclusive Economic Zone (EEZ) covers an area of 223,000 km² which is yet to be fully exploited. The major fresh water bodies include the three great lakes of Africa namely Lake Victoria (shared by Kenya 6%, Uganda 43% and the remaining share of 51% for Tanzania), Lake Tanganyika (Burundi 8%, DRC 45% and Zambia 6% with 41% for Tanzania) and Lake Nyasa in which Tanzania has 20%. The country has numerous other small inland water bodies including minor lakes, dams, rivers (Ruvu, Rufiji, Pangani, Mbwenkuru, etc. covering an estimated area of 5,000 km². The country is reasonably rich in marine and inland fishery resources which plays an important role in terms of employment, food security, livelihood and income. Economically, fisheries sector in Tanzania contributes to **2,4%** of the

GDP (Planning Commission 2014). There is also a significant contribution of fisheries to foreign earnings (10%) from export of fish and fishery products and the current fish production is estimated to 375,854 metric tons.

1.1 Fisheries categories:

Fisheries sector is among the economic sub sector in Tanzania and fishing activities are carried out in both inland and marine waters; however, its contribution to the Gross Domestic Product (GDP) is still low 2.4% (2014); it considered to be low but this is due to lack of information and reliable data especially on Intermediate consumption of fishing units due to small and unmechanised nature of the small fishing vessels used especially in Artisanal fisheries. Unfortunately, industrial fisheries is concentrated in the Exclusive Economic Zone but do not benefited Tanzanians in a large extent due to lack of national fleet and fishing labour.

1.1.1 Artisanal fisheries:

Artisanal fisheries is the most important fisheries in Tanzania and it takes place within the territorial waters (12 nautical miles stretch). In terms of technological development and nature of fisheries characteristics, artisanal fishery consist of small Dugout Canoes, Dhou, Small Boat, Ngalawa and in some places like Kinondoni few uses “Kota“ - Sailing craft used for water sports which do not have a parachute (Fig. 1). The artisanal fishers mostly catches fin fishes and to a small extent of crustaceans like shrimps, squids, octopus, crabs, etc. It is dominated by the coastal inhabitants who normally depends on fisheries for their livelihood.



The artisanal fisheries who are sometimes refers to small scale fisheries characterizes various features including they are big in numbers due to free access entry, they have a lot of big challenges including poverty, small attentions receivers, and the resources they are dealing with are either overexploited or in declining. In most cases artisanal fishery have weak data that's why its difficult to calculate their running and intermediate costs. The factors that contribute to small scale fisheries to be poor including lack of information, education, skills, poor status of fisheries resources, lack of credits,

Fig1: Kota fishing vessel

poor organizations and political representation, unexpected loss of life, lack of alternative employment, lack of infrastructure and access to work. In most cases, these can be solved through effective management for sustainability through Responsible fisheries, Ecosystem Approach to Fisheries management and good governance in respect to capacity building.

1.1.2 Commercial fisheries:

The commercial fishery is mainly concentrated in the Exclusive Economic Zone (EEZ) for Tuna and Tuna-like species. The fishing in EEZ is currently done by Distant Water Fishing Nations (DWFN) under license agreement using Purse seiners or Long liners. However, due to lack of fishing harbour which would have facilitated EEZ fishing vessels to land and declare their catches, these foreign fishing vessels used to fish and landed their catches in neighboring fishing harbours or at their respective countries, thus the fishery do not benefiting the country. This makes Tanzania to lose various opportunities including revenues, employment, royalty and other multiplier effect of the fishing harbour.

2.0 Introduction:

Knowledge of the status and trends of capture fisheries, including socio-economic aspects, is a key to sound planning and policy-development, better decision-making and responsible fisheries management in all artisanal type of fishing. It is necessary at the national level for the maintenance of the food security, food balance sheet and for describing social and economic benefits of fisheries. Such information is very crucial for assessing the validity of fisheries policy and for tracking the performance of fisheries management with respect to fishing output (catch). The most important sources of primary data/information are long-term collections of information on fishing efforts (Frame Survey – fishing input), together with the associated landings in weight and value of catches/production (Catch Assessment Survey - CAS), biological information about the catches, trip costs, and details of fishers, this can be refers to continuous monitoring. In addition, more detailed data (fishing vessels, gear and operations; socio-economic data; intermediate costs, etc) from a sustainable sample-based fishery surveys is an important source of fishery information of wide utility and scope.

A sample-based fishery survey is considered sustainable when:

- its design is robust enough to permit continuity when changes occur to the fisheries being statistically monitored;
- training of field and office staff is appropriate and regular so that data collection and processing/analysis are safeguarded against staff changes and turnover; and
- It is continuously monitored and evaluated to ensure high quality of fisheries statistics produced.

Fishery statistics refers to data and information that describe the current and past status of the fisheries and show trends on the development of the fisheries sector that can be used for policy, planning and management. It is the primary means to measure the performance of fishery within social, economic, biological and environmental framework in which it is conducted. Fisheries statistics comprise of a large number of parameters (variables and indicators) that can be recorded and including most importantly the qualities of data collected. The collection of fishery data is based on relatively designed concepts and approaches which will differ from country to country depends on fisheries policy and management objectives. Obviously a choice has to be made about what exactly will be collected, who will collect depends on decisions often taken at

national level on what information is required. In Tanzania, Catch Assessment Survey (CAS) is the collection of inland or marine small-scale coastal catches (production) data. CAS in most developing countries is often considered extremely unreliable due to the nature of the artisanal fishery and its characteristics described above.

In Tanzania, the important source of information of catch data is Catch Assessment Survey through Catch sampling. Fish can be measured and weighed at the landing sites (by enumerators). Samples can be obtained to determine the estimated CPUE then, estimated total catch. A primary source of information is the Local Government Authority (LGA) staff and Beach Management Units members (BMU) who are involved in fishery - dependent data monitoring.

It's very hard to collect artisanal fisheries data due to their characteristics, as they are big in numbers due to free access nature (entry into the fishery), they have a lot of big challenges, poverty, small attentions receivers, weak data and the resources they are dealing with are either overexploited or in declining. Most of their fishing units are so complicated in such a way that they are multigears resulted into multispecies, they are almost non controllable. Not only do fishing in the coastal waters their intermediate values are very difficult to calculate and their catches are sometimes small. To complicate things, an overwhelming number of variables like catch, effort, and price make straightforward data collection difficult and test the limitations of gear and technology. It's simply impossible to accurately record each fishing vessel come back from fishing and in all landing sites in Tanzania at a time. This is the main challenge in artisanal fisheries data collection and processing in most of the developing countries.

FAO, 2002 considered this as a global issue and came up with smpling framework with respect to time and location. I'm going to explain in this paper, Tanzania sampling protocol, effect of decentralization on fisheries data collection, use of Beach Management Units (BMU) as data enumerators, data recorders and processors and the costs which fisheries department incurred to have fishery dependent - data through BMU.

2. Tanzania Sampling Protocol:

The fishery resources of Tanzania have been monitored since the 1950s (East Africa High Commission, 1953) and fisheries catch records have been kept since 1960's. The catches of various species are known with a considerable degree of accuracy (Fisheries Development Division, 1966). Fish production was estimated from the amount of fish caught and its effort, while the fishing inputs like fishing vessels, fishing gear and fishermen were enumerated. Initially, the East African Freshwater Fisheries Research Organization devoted a considerable amount of funds and effort to analyzing fisheries statistics of the fish caught in Tanzania specifically in Lake Victoria (East Africa High Commission, 1959). The organization assessed the trends in various fisheries and fluctuations of fishing effort. The Ministry responsible for fisheries was given mandate to produce annual fisheries statistical reports following the establishment of the Fisheries Development Division in 1965. However, data collection and processing procedures were not standardized through the 1960s and into the 1980s. In the 1990s, FAO came up with a standardized estimation process of using frame surveys and sample surveys of catch and effort data from daily catches and related efforts.

Fisheries in Tanzania is taking place in marine and freshwater bodies. In marine waters there are five (5) coastal regions whereby each region is composed of a number of districts in which fisheries is taking place. In total there are sixteen (16) Coastal districts in which they were stratified into Administrative location (Districts) which used as strata. In each stratum, two landing sites were used as primary sampling unit. From a list of landing sites (259) obtained from the frame surveys of 2009, 32 landing sites are randomly selected (however, sometimes the selection is bias due to the fact that the landing sites should be easily accessible by enumerators). The secondary sampling unit is the day. The data were collected for 16 days per month, which are selected randomly through random table or by make use of Excel Program. At the sampled landing sites, fishing gears are randomly sampled within the sampling day by recording 32 gears of such type in each sampling month (Stamatopolus, 1992). The basic data collected are landings by species by boats of specific types, using specific gear in specific landing sites and the fishing effort used. The collected data were entered into ten computers which were distributed to 5 districts. The data by then were transferred by diskettes to central computers at the Fisheries Development Division for analysis and reporting.

Aggregating and expanding according to the total number of boats, total number of fishing days and the boat utilization ratio of these data can be used to generate estimates of total landings by species, boat types and fishing gear by districts and landing sites (Appendix 2). The catch trends are usually reported in national annual fisheries statistics reports.

Although, the Fisheries Development Division has made some efforts towards improvement of the reliability and the accurateness of Tanzania fisheries statistics but its custodian does not go to the collection point. The Division mandate are from processing, analyzing, management and dissemination of the data. The one who is responsible for data collection from its sources (landing sites) are the Local Government Authorities (LGA's). This is due to change of government system from Centralized to Decentralized systems.

3.0 Decentralized system and data collection:

Previously, there was a formal link between Central Government (Ministry of Agriculture, Livestock and Fisheries specifically Fisheries Development Division) who is the custodian of fisheries statistics in Tanzania responsible for coordination of data collection, analysis and dissemination of national fisheries information with Local Government Authorities (responsible for data collection). The formal link has been broken since 1995 following the implementation of a decentralized administration system, whereby regional/district fisheries officers (and their subordinates) are no longer answerable to Director of Fisheries from the central government). From that time, no annual statistics reports disseminated due to limited amount of data (from district level). Data collection resumed in 2010 when BMU were established and trained to involve in routine data collection i.e. Fishery data dependent monitoring.

Tanzania has been collecting fisheries data as far as 1960, the system was efficient until 1995 when the government retrenched most of the data collectors under the World Bank's Structural Adjustment Program (SAPs) 1997 – 2001. The period refers to dormant period and there were no data recorded from any landing sites for the whole country. In 2006 – 2009 FAO/UNU initiated CAS as a tool for fisheries statistics and IOTC updated CAS under WWF and RECOMAP. In these years Fisheries Development Division spent \$15,800 thousands on training of 32 data enumerators and 46 BMU members from 16 Coastal district of marine waters. Basically, the funds were used for transport to and from the venue, DSA for participants,

conference facilities, working tools (bicycle, motorbikes, weighing scales and printing of data collection forms, etc).

4.0 Fishery - dependent monitoring:

Initially, fisheries resources were monitored in three management regimes. In the pre - colonial period the fishery was purely community managed. During the colonial period, up to and including 1990's management of the coastal fishery was under the central government. Currently, there is a partnership arrangement whereby the fishery resources are managed by the government in collaboration with communities (co-management) through the establishment of Beach Management Units (BMUs).

Fisheries management decisions are often based on population models, but the models need quality fisheries data to be effective. The data should be reliable, accurate and up-to-date in the sense that, fisheries managers would be better served with simpler models and improved data. The primary limitation in fisheries management decisions is the absence of quality data because only well informed decision makers can make good decisions in harvesting to ensure sustainable utilization of fishery resources.

In most cases, collection of data requires enough manpower at the source where the data is recorded. In developed countries, for example, scientific research surveys are a vital component of the stock assessment. Research vessels and commercial fishing vessels, operating under charter agreements with the research institutions are used to conduct surveys of fish abundance, stock assessment, etc. These surveys are the primary source of fishery-independent data. Paul et al (2002) realize that, fishery-independent monitoring through at sea survey is difficult to maintain by developing nations specifically those with artisanal type of fisheries (like Tanzania). They are too expensive and besides, cannot generate the full data needed for the evaluation of status or changes in fish stocks, not to mention the economic aspect of the fishery and they are only 65% correct (Paul et al, 2002). However, in the developing nations, fishery-dependent monitoring can be extremely useful for generating both biological data and fisheries input (fishing effort) and output (catch). In the absence of fisheries staff (data enumerators) to record the data, fishing community members can be used (Sobo, 2004). The community members represent data enumerators at those landing sites where there are no data enumerators from district authorities to collect data (Table 2), though the data gathering by local people may not always be of the highest quality (Sobo, 2004), but their involvement can result in gathering large quantities of reasonably reliable data and perhaps more importantly, enhance a feeling of "ownership" among the community members while motivation to them to implement conservation measures (TCMP, 2003) will be another challenge.

Table 1: Number of BMU in marine waters practice fishery-dependency data collection

Region	District	No of Landing Sites	Landing Sites for Fishery – dependent data collection	Landing Sites collected data by Fisheries staff

Coast	Bagamoyo	11	1	1
	Mafia	43	5	1
	Mkuranga	15	1	1
	Rufiji	31	5	0
Dares Salaam	Ilala	1	0	1
	Kinondoni	6	2	0
	Temeke	16	2	1
Lindi	Lindi District	14	1	1
	Lindi Munic	6	1	1
	Kilwa	27	1	1
Mtwara	Mikindani	23	1	1
	Mtwara Rural	5	2	1
Tanga	Mkinga	20	0	1
	Muheza	1	0	1
	Pangani	13	1	1
	Tanga City	25	0	1
Total		257	23	14

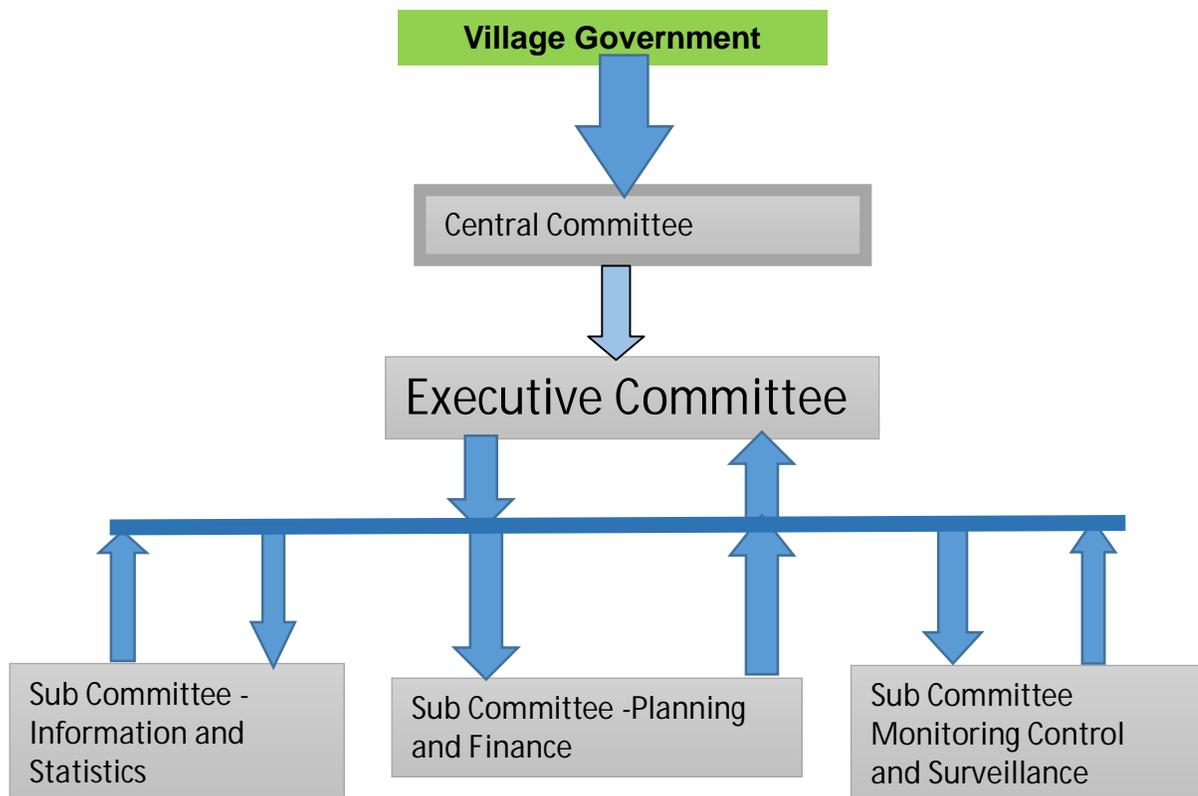


Figure 2: BMU Structure

Tanzania BMU guidelines, elaborated how data collection activity conducted by BMU. Principally, there is data and information committees (Fig. 2) of five members whose main function is information and data gathering. In marine waters of Tanzania, due to lack of data enumerators, 222 members of Beach Management Units from 13 coastal districts in 23 sampling landing sites (Table 2) were trained on data collection and given mandate to collect fisheries data as part of their BMU's roles and responsibilities. This was seen as the first step in preparing them to take up their roles in a community-based approach in the management of fisheries resources.

The use of BMU as data collectors makes random selection of sampling sites to be biased due to the fact that the selection of landing sites depends on the location of BMU and other criteria including how busy is the landing sites. CAS data collection forms are user friendly and easily understandable by BMU's, because the form was translated to local language (Swahili) and species name are locally named up to family level to make BMU understand what they are doing. CAS sampling days have been reduced from 16 to 10 days per month to give BMU's ample time to do their other income generating activities during the month.

The involvement of BMU as data enumerators makes them to feel the sense of ownership among the community members and motivate them to implement conservation measures since they are participating in one of the management activity of the fishery resources.

5. Costs incurred to have fishery dependent-data through BMU

The process of collecting meaningful fishery data is based upon structuring a feasible system of data - gathering procedures. It includes sampling frame, sampling protocol, data enumerators, kind of data collected, training and the cost incurred in data collection.

The effective and timely management of Catch Assessment Survey in Tanzania requires the collection of sampling catch and effort data from the sampled landing sites. To provide such data, the Fisheries-dependent monitoring was established through Beach Management Units in marine waters of Tanzania. The Fisheries dependent monitoring program initiated sampling in 2012 by training 25 participants in marine waters of Tanzania. Sampling surveys are currently conducted in five coastal districts: Rufiji, Mafia, Kilwa, Pangani and Mtwara.

The program uses stratified-random sampling designed, where by districts used as strata in which two landing sites were sampled in each district makes a total of 10 sampled landing sites. In each landing sites two BMU members were selected to collect catch data in 10 sampling days per month. The days are selected randomly, and in each sampling day, arriving gears from fishing were recorded by make use of National data collection form designed from FAO sampling framework. In this program, data analysis use a minimum of 31 records per Gear type strata of any given landing sites per unit sample which is needed for 90% confidence level in the lowest level analysis. These records will be allocated to the BMUs in proportion to the extent of the use of the gear type of the villages.

Enumerators (BMU's members) conducts monthly sampling at sampling landing sites randomly selected from the strata available in each district. In each sampling day, data enumerators working on voluntary basis as their involvement in fisheries management. It has been estimated that the cost of BMU member to collect data per month was 65,000/= which is equivalent to 32.5 US \$ by then. For the 10 enumerators it costs about 325 US \$ per month. That means per year it will come to 39,000 US \$ whereby the salary for two district data enumerators from District Authority will be 150 US \$ for one enumerator, with 10 enumerator it will be 1,500 US \$ in

which per year will cost 180,000 US \$. In simple comparison of the two you will see the difference is 141,000 US \$ which is very significant.

Many stakeholders believe that data collected by BMUs members are neither accurate nor complete. These misgivings are exacerbated by problems of timeliness and accessibility and by perceived conflicts of interest; BMU's members do not collect data only, but also enforces fishery regulations, in their respective landing sites and fishing grounds too. They were also involved in making policy recommendations to local government authorities, and makes judgments about the policy recommendations and fishery management plans prepared by the district councils. For many fishermen these multiple responsibilities create a sense of ownership to the fishery resources and they feel themselves as part of the decision makers.

6. Implication of unreliable fisheries data

Assessment and evaluation of any fishery, depends on fisheries data especially catch per unit effort (CPUE) and catch trend (Fig. 3). This is the index of relative abundance although in isolation, provides limited information for management advice or about the effect of fishing. In addition, unreliable fisheries data gives inaccurate CPUE data which cannot provide information needed to assess and manage any fishery or ecosystems. As a matter of fact, accurate CPUE data and some other related catch information used to assess and provide management advice about fish populations that can help overcome these fisheries problems, including integrated stock assessment models, management strategy evaluation, and adaptive management.

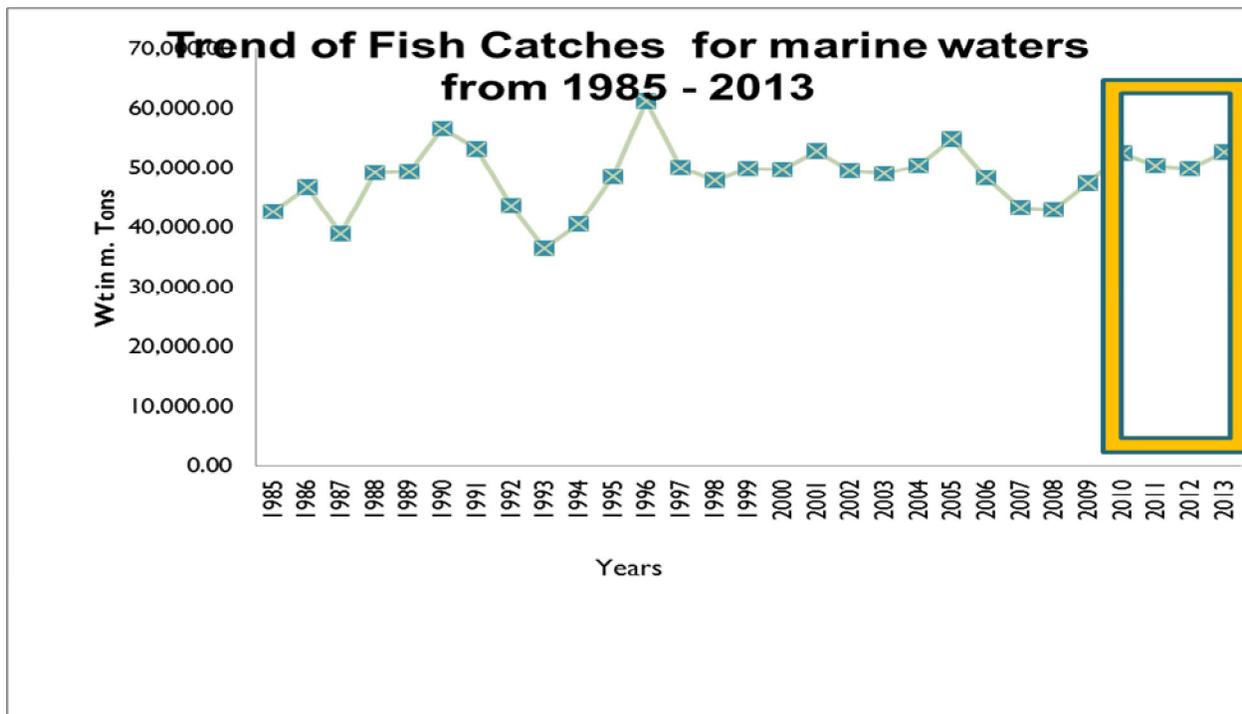


Figure 3: Catch trends from 1985 - 2013

It is important to have reliable and accurate fisheries data and catch trend to allow optimal management of a fishery resources (stock). Unfortunately, some management strategies actually

decrease the amount of information that is available to manage a stock. Reliable and up to data gives a way to management strategies. Many management regulations will break a continuous series of data. Therefore, the effect of management strategies on the information available to assess the stock should be taken into consideration.

Conclusion:

Stakeholders' involvement in data collection should be encouraged among fishery management institutions, independent scientists, researchers, representatives of industry and public interest groups. Not only would this build confidence among the different groups, but it would provide access to valuable and non-traditional sources of information.

Second, the Fisheries Development Division in Collaboration with WWF agreed on the use of BMU's members as data enumerators and consideration of economic effects of fisheries management on communities due to:

- Increase the involvement of stakeholders, its expertise, and its vessels in fishery research activities in order to expand the frequency and scope of National fisheries data collection efforts;
- Review data collection requirements placed on fishermen to use their indigenous knowledge of information to what is needed for conservation and management, regulation, and scientific purposes; and
- Review data collection procedures for fisheries whereby the community sector constitutes a major portion of the fish caught to minimize the cost of collecting data by their involvement.

The concept of community participation in fisheries activities such as data collection constitutes the core approach or key by which the government and other partners seeks to ensure sustainable resource use and livelihood development for fishing communities and other aquatic resource users. Basically, those districts which BMU are collecting data, the program if implemented properly, should be successful. However, the program will require constant monitoring, especially on species identification during these early stages and the Government can save some funds which will be used for other activities.

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