



REPUBLIC OF GHANA

Ministry of Fisheries and Aquaculture Development
Fisheries Commission

FISHERIES MANAGEMENT PLAN OF GHANA

A National Policy for the Management of
the Marine Fisheries Sector
2015-2019





The Ghana Government is fully committed to implementing a robust Fisheries Management Plan to ensure long term conservation of its fish stocks whilst at the same time contributing to improved food and nutritional safety at a national level.

Citation: Ministry of Fisheries and Aquaculture Development (2015).
National Fisheries Management Plan, Government of Ghana pp48

Text in this document is based on the officially gazetted
Fisheries Management Plan of Ghana, published on October 2015

Cover Photo: Fish Landing Site in Sekondi, Western Region - Ghana

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Definitions

Maximum Economic Yield (MEY): The sustainable catch or effort level for a commercial fishery that allows net economic returns to be maximized. Note that for most practical discount rates and fishing costs, MEY will imply that the equilibrium stock of fish is larger than that associated with MSY. In this sense MEY is more environmentally conservative than MSY and should in principle help protect the fishery from unfavourable environmental impacts that may diminish the fish population.

Maximum Sustainable Yield (MSY): The maximum average annual catch that can be removed from a stock over an indefinite period without having any negative effect on resource potential under prevailing environmental conditions.

Overfished: A stock with a biomass below the biomass limit reference point.

Overfishing: A stock is experiencing too much fishing and the removal rate from the stock is unsustainable.

Stock: A functionally discrete population of species that is largely distinct from other populations of the same species. Such a population may be regarded as a separate entity for management or assessment purposes.

Sustainable Yield: The average catch that can be removed from a stock over an indefinite period without causing a further reduction in the biomass of the stock. This could be either a constant yield from year to year, or a yield that fluctuates in response to the changes in abundance.

Abbreviations

BET	Bigeye Tuna
CCRF	Code of Conduct for Responsible Fisheries
CPUE	Catch Per Unit Effort
EEZ	Exclusive Economic Zone
EY	Equilibrium Yield
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organisation of the United Nations
FMP	Fisheries Management Plan
FSSD	Fisheries Scientific Survey Division
GDP	Gross Domestic Product
FC	Fisheries Commission
GRT	Gross Registered Tonnage
ICCAT	International Commission for the Conservation of Atlantic Tunas
IEZ	Inshore Exclusive Zone
IFMD	Inland Fisheries Management Division
IUU	Illegal, Unreported and Unregulated
LOA	Length Overall
MEY	Maximum Economic Yield
MOFAD	Ministry of Fisheries and Aquaculture Development
MSY	Maximum Sustainable Yield
NHS	National Harvest Strategy
QA	Quality Assurance
RFMO	Regional Fisheries Management Organisation
UNCED	United Nations Conference on Environment and Development
VMS	Vessel Monitoring System

Executive Summary

The fisheries resources of Ghana have long been a pillar of the national economy, contributing significantly to her socio-economic development. The fisheries sector generates over US\$1 billion in revenue each year and accounts for at least 4.5% of Ghana's Gross Domestic Product (GDP). The sector also provides livelihood for an estimated 10% of the population representing about 2.5 million people who are employed directly or indirectly including their dependents. Significantly, fish constitutes 60% of the animal protein consumed in Ghana.

Available scientific evidence indicates a gradual decrease in the stocks of fish within Ghana's fisheries waters due to increasing fishing effort. There has also been weak enforcement and noncompliance with the current fishery management measures. Reversing the trend of stock depletion to support the socio-economic development and food security for present and future generations of Ghanaians requires bold and immediate policy and management actions.

It is therefore, imperative to develop a national strategic framework to halt further decline and rebuild the fish stocks through a Fisheries Management Plan, the purpose of which is:

- i. to reduce the excessive pressure on fish stocks;
- ii. to ensure that fish stocks within the fisheries waters of Ghana are exploited within biologically acceptable levels;
- iii. to ensure that the fisheries legislation is implemented to protect the nation's fish resources;
- iv. to protect marine habitats and bio-diversity;
- v. to contribute to enhancing export opportunities and strengthening value addition;
- vi. to strengthen participatory decision making in fisheries management (co-management); and
- vii. to meet Ghana's regional and international fisheries management obligations.

Accordingly, the Fisheries Management Plan sets out a formal harvest strategy for the fishery and provides direction for the formulation of management actions within the context of the Fisheries Act, 2002 (Act 625), Fisheries (Amendment) Act, 2014 (Act 880) Fisheries Regulations, 2010 (L.I. 1968) and Fisheries (Amendment) Regulations, 2015 (L.I. 2217)

1

Introduction

Managing fisheries depends on the sound knowledge of the biological potentials of the said resources. This scientific knowledge informs and guides any management strategies to allow sustainable exploitation based on defined objectives. Accordingly, section 42 (1) of the Fisheries Act, 2002 (Act 625) mandates the Fisheries Commission to prepare management plans for the sector.

Goal

The goal of the Management Plan is to rebuild fish stocks to enhance the socio-economic conditions of fishing communities, create employment within national and international frameworks and standards and improve food security as well as contribute to GDP and foreign exchange earnings.

Purpose

The purpose of the Management Plan is to provide a strategic framework for reversing the declining trend of fish resources and establish a sound management regime to ensure that fish stocks are exploited sustainably in an enhanced environment.

Key Objectives

The Management Plan has been developed to meet the following key objectives:

- i. to reduce the excessive pressure on the fish stocks;
- ii. to ensure that fish stocks within the marine waters of Ghana are exploited within biologically acceptable levels;
- iii. to ensure that effective fisheries legislation is implemented to protect the nation's fish resources;
- iv. to protect marine habitats and bio-diversity;
- v. to contribute to enhancing export opportunities and strengthening value addition;
- vi. to strengthen participatory decision making in fisheries management (co-management); and
- vii. to meet regional and international obligations in fisheries management.

Scope

This Management Plan applies to capture fisheries in the marine waters of Ghana. It also covers all fishing vessels fishing in the marine waters of Ghana and Ghanaian flagged vessels wherever they fish.

The scope of the Management Plan can be summarized as follows:

Species

- All highly migratory tuna and tuna-like species;
- All pelagic species;
- All demersal species; and
- Other non-target, associated or dependent species caught in the course of fishing.

Fishing Activities

- Industrial fishing (semi-industrial, industrial trawlers and tuna vessel);
- Artisanal fishing.

Operation of the Management Plan

This management Plan will operate for a five year period from 2015 to 2019. There will be an annual Operational Plan developed from the Management Plan's priorities that will designate the actions to be taken in every calendar year. The Fisheries Commission will use the Management Plan to advise the Minister as well as prepare an annual report on the performance of the fisheries resources against all performance indicators in accordance with the implementation time frame specified in the Management Plan.

Review of the Management Plan

This Management Plan is a working document that reflects current understanding of the fisheries resources of Ghana and, as such, is expected to change over time. Accordingly, the Management Plan will be periodically reviewed and improved as advancements in knowledge and management are made. However, no major departure from the stated management arrangements will occur unless the Fisheries Commission is otherwise directed by the Minister during the implementation phase of the Management Plan.

2

Policy Framework

The current overall Government policy intent for the fisheries sector in Ghana is guided by:

- i. Ghana Shared Growth Development Agenda (GSGDA II).
- ii. Fisheries Act, 2002 (Act 625) Fisheries (Amendment) Act, 2014 (Act 880) Fisheries Regulations, 2010 (L.I. 1968) and Fisheries (Amendment) Regulations, 2015 (L.I. 2217).
- iii. The Republic of Ghana Fisheries and Aquaculture Policy (2008).
- iv. The Ghana Fisheries and Aquaculture Sector Development Plan 2011-2016.

These provide a broad statutory and policy framework to ensure the ecologically sustainable management of Ghana's marine, estuarine and freshwater fisheries resources. Section 42(I) of the Fisheries Act, 2002 (Act 625) in particular, mandates the Fisheries Commission to prepare management plans to sustainably manage the fisheries resources.

Section 42- Fishery plans

(I) A fishery plan prepared by the Commission for the management and development of fisheries shall:

- a. Be based on the best scientific information available;
- b. Ensure the optimum utilization of the fishery resources; and
- c. Be consistent with good management principles.

Section 43 of the Act 625 specifies the content of the fisheries management plan pursuant to section 42 of the Act 625.

Section 43- Content of fishery plan

(I) A fishery plan shall:

- a. Identify the fishery resource and its characteristics, including its economic and social value and interrelationship with other species in the ecosystem;
- b. Assess the present state of exploitation of each resource and taking into account relevant biological, social, and economic factors, determine the potential average annual yields from the resource;
- c. Specify the measures to be taken to promote the development of the local fishing enterprises, both industrial and artisanal;
- d. Determine the amount of the fishery resource to be made available to licenced foreign fishing vessels;
- e. Specify the conservation measures to be enforced to protect the resources from over-exploitation;
- f. Indicate the research necessary to enhance management of the fishery resource;
- g. Specify the information and any other data required to be given or reported for the effective management and development of fisheries; and
- h. Take into account relevant artisanal fishing methods or principles.

This Management Plan sets out management strategies and key performance measures to allow for assessment of the degree to which these objectives are being achieved.

It also aims to achieve outcomes that are consistent with broader Government objectives for the management of marine resources.

The management Plan also takes into account Ghana's obligations and commitments under the following key International Instruments:

- The United Nations Convention on the Law of the Sea, 1982.
- The Convention establishing the International Commission for the Conservation of Atlantic Tunas (ICCAT) 1966 and its Recommendations.
- Agenda 21- The United Nations Conference on Environment and Development (UNCED).
- The FAO Code of Conduct for Responsible Fisheries, 1955.
- FAO Compliance Agreement on Flag States, 1993.
- The UN Fish Stock Agreement on Flag State Responsibilities and Port State Measures.
- FAO Guidelines on Flag State for Responsible Fisheries, 1997.

2.1 Guiding Principles

The following five key principles will provide guidance for the development of strategies for effective implementation of the Plan.

2.1.1 Equitable distribution of benefits

Ghana will develop sustainable, locally owned fisheries that can provide significant opportunities for delivering social benefits for the people.

2.1.2 Use of the precautionary approach in management

This is a fundamental component of an effective risk management strategy. In support of this approach, Ghana will ensure that in the absence of adequate scientific information, conservation and protection systems will be put in place and regularly reviewed to ensure that no irreversible damage is caused to the habitat and the fisheries resources.

2.1.3 Participation, public accountability and transparency

Shared responsibility is an important part of managing the fisheries resources of Ghana. This Management Plan will promote collaboration, participatory decision making and shared responsibility with all stakeholders. The Government will be accountable and transparent in the management of the fisheries resources of Ghana.

2.1.4 Limitation of adverse environmental impacts

The Government will ensure the conservation and protection of the fisheries resources and shall uphold and apply the polluter pays principle in protecting marine habitat

2.1.5 Eco-system Approach

This approach considers all components of the eco-system including, ethnic population, communities and habitat and their linkages as the basis for the conservation and sustainable use of the fisheries resources of Ghana.



Sekondi Fishing Harbour, Western Region - Ghana



Fishing canoes at Mumford, Central Region - Ghana

3

Institutional Framework

The institutions responsible for the management of the fisheries resources of Ghana include the following;

Ministry of Fisheries and Aquaculture Development (MOFAD)

MOFAD has oversight responsibility for the sustainable management of fisheries resources and development of the fishing industry.

In this regard, MOFAD will:

- i. Obtain Cabinet approval for the implementation of the Management Plan;
- ii. Provide financial resources for the implementation of the Management Plan;
- iii. Supervise implementing institutions and agencies; and
- iv. Promote collaboration between the Fisheries Commission and Sub Regional, Regional and International Fisheries Management Organisations in the implementation of the Management Plan.

The Fisheries Commission

The Fisheries Commission is responsible for the following:

- i. Implementation of the Management Plan through the establishment of a Fisheries Management Operational Committee;
- ii. Developing the capacity of staff of the Fisheries Commission for effective implementation of the Management Plan;
- iii. Periodically reviewing the Management Plan;
- iv. Collaborating with relevant authorities and major stakeholders in the implementation of Plan measures; and
- v. Coordinating the activities of all relevant stakeholders in the implementation of the Plan.

Inter-agency Collaboration

In accordance with Section 13 of the Fisheries Act, 2002 (Act 625), the Fisheries Commission shall collaborate with the following in the implementation of the Plan:

- Ministry of Environment, Science and Technology (Environmental Protection Agency);
- Ministry of Justice and Attorney-General's Department;

- Ministry of Transport, Ghana Maritime Authority (GMA) and Ghana Ports and Harbour Authority (GPHA);
- Ministry of Finance (MOF);
- Ministry Interior (Ghana Police Service);
- Ministry of Defence (Ghana Navy and Ghana Airforce);
- Ministry of Trade (Ghana Standards Authority and Ghana Export Promotion Authority);
- Ministry of Health (Food and Dugs Authority); and
- Research Institutions and Universities.

This collaboration will be principally in the following key areas:

- Monitoring, control and surveillance;
- National observer programme;
- Port sampling;
- Compliance and enforcement;
- Data collection and management;
- Control of fish Imports and Exports; and
- Designation of Maritime Protected Areas (MPAs).



Marine Police personnel on a field visit to Sekondi Fishing Harbour after a week's Training Workshop on Fisheries Laws and Regulation

4

Description of the Ghanaian Fisheries Sector

Ghana has a coastline of about 550km and maritime domain, including the territorial sea and the Exclusive Economic Zone (EEZ) of 228,000km². The productivity of Ghana's marine fisheries is driven by a coastal upwelling system, when cold water rich in nutrients are brought to the surface and stimulate the ecosystem. There are two upwelling seasons in Ghana; a major upwelling season from July through September, and a minor upwelling season, from late December to early February. These are also the high seasons for fishing.

Ghana's Marine Fishing Sector

Ghana's marine fisheries capture sector consist of three main types of fishing fleets.

- Artisanal canoes (made of wood, motorised and non-motorised);
- Semi-industrial boats (mainly wooden boats); and
- Industrial vessels (generally over 25m Length Overall (LOA) made of steel hull and with capacity to operate in areas beyond national jurisdiction).

Artisanal Fleet

Number of vessels

- Motorised - 8,458
- Non-motorised - 1,493
- Total - 9,951

- Fishing gear - gillnets, handlines, traps, pots
- Target species - sardinellas, anchovy and mackerels
- Annual catch - 254,000 mt



Semi-industrial (Inshore) Fleet

Number of vessels

- Purse seines - 363
- Trawlers - 40
- Total - 403

Fishing gears - purse seines and trawl gears

Target species - sardinellas and mackerels

Annual catch - 6,000 mt



Industrial Trawl Fleet

Number of vessels - 107

Fishing gear - bottom trawl

Target species - sparids, groupers, cuttlefish and snappers

Annual catch - 18,500 mt



Tuna bait-boat vessels

Number of vessels - 20

Fishing gear - pole and line

Target species - skipjack and yellowfin

Annual catch - 20,000 mt



Tuna Purse seine boat vessels

Number of vessels	- 17
Fishing gear	- purse seine
Target species	- yellowfin, bigeye and skipjack
Annual catch	- 45,000 mt



Source: Fisheries Commission Annual Report 2014

Ghanaian Fishing Vessels and Catch Data (2014)

The operational status and volumes of catch of Ghanaian fishing vessels areas specified below.

	Number of Vessels	Volume of catch (mt)	Percentage contribution	Catch per vessel (mt /vessel)
Marine				
Motorised canoes	8,458	172,300	50.12	20.37
Non-motorised canoes	1,493	81,900	22.82	54.86
Total canoes	9,951	254,200	73.93	75.23
Semi-industrial	403	6,100	1.77	15.13
Trawlers	107	18,500	5.38	172.89
Tuna Vessels	Bait boats: 20 Purse seine: 17	65,000	18.91	1756.75
Grand total		343,800		

4.1 Socio-economic importance of the fisheries sector

Fish constitutes more than sixty percent (60%) of animal protein intake by the Ghanaian population. Scientific evidence point to the fact that Ghana's marine fish landings has declined over the last decade. This has resulted in Ghana becoming a net importer of about forty percent (40%) of her fish requirements. This figure is likely to increase in the coming years due to the current population growth rate combined with the current dwindling trend in fish landings. This will have significant implications to the country's economy as a result of increased importation of fish. Studies have also shown that aquaculture production would not be able to narrow this gap anytime soon.

Given that a great share of the population relies upon fish and fish products as their main source of protein, it is important to prevent the over exploitation of the fisheries resources.

4.2 The Tuna Sub-Sector

Tuna fishing occurs mainly in Ghana's EEZ, and on the high seas. The targeted stocks are essentially those under the management of ICCAT. The tuna sub-sector has been benefitting from a relatively good stability with current landings estimated at around 65,000 mt per year. It is likely that Ghana will maintain its position as one of the important regional hubs for tuna landings.

The Government will continue to maintain and create incentives to improve the level of development of this industry. Ghana will also continue to participate in the meetings of ICCAT and implement its recommendations and resolutions.

4.3 The Industrial Sector

In this category the main players are the bottom trawlers, generally up to 30 m LOA. In the last ten (10) years a significant increase in fishing capacity was observed, mainly due to the importation of additional vessels. Presently, this sector comprises around one hundred and seven (107) active vessels, contributing to an estimated annual catch of nearly 20,000 mt. Some of the vessels currently operating are in very poor state of maintenance. It is anticipated that the vessels in a very poor state will be removed from the fisheries register which will result in substantial reduction in fishing effort with the implementation of this Management Plan.

4.4 The Semi-Industrial Sector

The semi-industrial vessels are of two types: (a) larger ones which generally range between 20 and 30 meters LOA using primarily bottom trawl and (b) smaller vessels, typically wooden vessels, between 8 to 10 meters LOA using primarily small purse seines. The semi-industrial sector comprises of approximately 403 boats. The total numbers more than doubled in the last ten (10) years, yet the catches have halved and are currently estimated at under 10,000 mt. Profitability of fishing operations by the semi-industrial sector is the lowest that have been observed for decades. It is anticipated that a substantial reduction in the total number of vessels will occur in the coming years as a result of the implementation of this Management Plan.

4.5 The Artisanal Sector

This sector comprises 9,951 (motorised and non-motorised) canoes. The size of these canoes ranges from 3 meters to almost 20 meters LOA and are made out of single wawa (*Triplochiton spp.*). The canoes use a variety of fishing gears but ring-nets are probably the most commonly used.

Catches from this sector are estimated to be in 254,000 mt. Survey indicates that catches per canoe have declined substantially in recent years affecting their profitability. It is anticipated that this Management Plan will include measures that will make provisions for reducing fishing effort.

5

Status of Exploitation of Fish Stocks (Fishing Effort and Maximum Sustainable Yield (MSY))

Despite increased fishing effort by all fleets over the last decade, total annual fish landings has exceeded 350,000 mt. With the exception of the tuna fleet, catch per unit of effort (CPUE) of all fleets has been decreasing. In addition, the sizes of fish being landed are much smaller. This is a clear case of growth overfishing. To exacerbate the situation fishing fleets except the tuna fleet all operate within the inshore exclusive zone (IEZ) which is invariably the spawning and nursery grounds for most fish species.

5.1 Fishing Effort and Maximum Sustainable Yield

Figure 1 shows the catch volume (harvest) of the various fleets operating in Ghanaian waters. This figure portrays a consistent rise in catch till the mid-1990s then a significant fall since then.

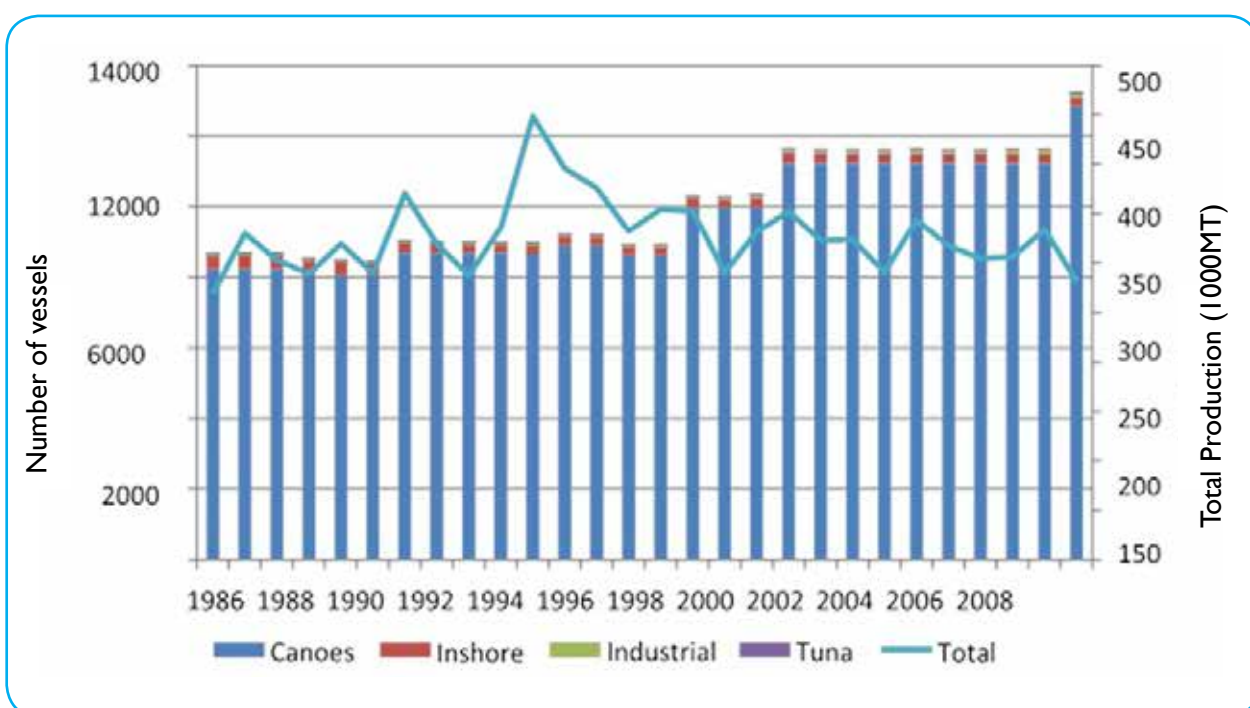


Figure 1: Evolution of the Ghanaian fleet and catches. (See annex for individual fleets)

5.2 Key Issues

According to the available scientific information the Ghanaian fisheries management is confronted with the following issues:

Key Issues	Description of problem
Excessive fishing effort exerted in all fisheries	Excessive fishing capacity - too many vessels exploiting the current resources, especially in the trawl sector - requires effort reduction to more sustainable levels. The exact extent of overcapacity translates into levels of fishing effort above MSY level of effort representing both economic and biological overfishing. Urgent reduction of fishing effort by management action is required.
Inadequate information on fisheries biology and stocks	Inadequate scientific information on the biology and current biomass levels of the main commercial species making it difficult to align stocks with current effort. Available information suggests demersal fish stocks are overexploited and require rebuilding strategies.
Inadequate regulations and weak enforcement of existing regulations	Penalties for infractions within current regulations are not deterrent enough. There is also weak enforcement of the fisheries laws and regulations due to inadequate resources (both human and financial) and inadequate conflict resolution mechanisms. More strategic use of existing resources and amendment of regulations in support of new conservation actions are however being enacted and progress in enforcement since 2011 are being applied.
Low levels of protection of marine biodiversity	There is inadequate protection of specific marine ecosystems impacting adversely on recruitment patterns of most fish species. Better protection of sensitive ecosystems is required to ensure replenishment of biomass, particularly of coastal areas which are known nursery grounds of various commercial species. Closure of known spawning and nursery areas is required.
Inappropriate procedures in certifying fish for export	Catch monitoring and catch certification are key processes to ensure informed management decisions. There are no clear guidelines on verification of fish and fishery products for export with adverse implications for access into the export market.

6

Addressing Key Issues

There are five key issues which require major strategic responses under the Management Plan:

1. Reducing the current levels of fishing effort and fishing capacity.
2. Improving information on fisheries biology and stock assessment to support a stock.
3. Effective enforcement of fisheries legislation.
4. Protecting marine habitat to conserve biodiversity.
5. Product certification and reducing post-harvest losses.

These challenges will be addressed with strategic actions which are measurable by key performance indices (KPIs). In the following tables the strategies to address the challenges are proposed and those that are major policies and requiring immediate implementation in 2015 are asterisked (*).



Fish landing site at Half Assini, west coast of Ghana

Industrial Trawl fishery

REDUCING FISHING EFFORT AND CAPACITY

Key Issue 1: Reducing the current levels of fishing effort and fishing capacity

Strategic actions applied to: TRAWLERS (T)	Actions to implement strategy	KPI
*T1.1 Achieve a 50% reduction in fishing days over the next 3 years (scaled annually).¹	<ol style="list-style-type: none"> 1. Impose licence conditions to reduce the number of days per vessel available. 2. Establish new licence scheme. 3. Penalise vessel operators who do not meet the conditions captured in their sanitary certificates with a penalty of further reduction of 10 days from their 150 day allocation. These lost days can be reinstated if the vessel's rights are transferred to a vessel with a sanitary certificate. 4. Delete boats inactive for one year from the allocation. These lost days can be reinstated if the vessel's rights are transferred to a vessel with a sanitary certificate. 5. Delete boats inactive for one year from fisheries registry and revoke the licence (see technical note). 6. Closed season for 2 months, up to 4 months by year 3 (May-June or November-December to be determined). This condition of licence will be reviewed on an annual basis and closed days increased accordingly to meet the current capacity of the resource. 7. Education programme to encourage vessel owners to transfer rights in days from two vessels to a single vessel for a total of 300 days. 	<ol style="list-style-type: none"> 1. Monitoring of days fished per vessel to ensure compliance with total days cap. Monitoring the number of days transferred to complying vessels. 2. Monitor new scheme to ensure its compliance as to days fished. 3. Number of vessels penalized. 4. Number of inactive boats deleted and number of licences revoked. 5. Number of imposed closed days; Number of reports and fines for violators against closed seasons. Number of beneficiaries of alternative livelihood schemes. 6. Number of rights successfully transferred. 7. Number of licences cancelled.

¹ The allocation of these rights in days will be limited to minimum period of one trimester (no monthly licences). Fishing days authorization will be based on calendar days without derogations for days not spent fishing due to weather or vessel repairs. This would be graduated over the next 3 years with a reduction of 20% in the 1st year, 20% in the second.

Strategic actions applied to: TRAWLERS (T)	Actions to implement strategy	KPI
*T1.1 Achieve a 50% reduction in fishing days over the next 3 years (scaled annually).¹	8. Cancel licence of repeat IUU offenders without an option to replace that vessel. The vessel will be declared IUU. The sanctioning scheme will be as follows: US\$2million fine for 1st time offenders, US\$2-4 million fine for 2nd time offenders and 3rd time offenders will have to pay US\$4 million followed by automatic cancellation of vessel licence.	8. Amount of fines imposed on offenders.
*T1.2 Control the number and capacity of vessels.	1. Reduce the fleet size under strategy T1.1 over a transitional period of 3 years. 2. Implementation of replacement scheme for registered vessels, allowing the replacement of two (2) old vessels for one (1) new vessel not exceeding 300 GRT.	1. Number of vessels reduced over the period. 2. Number of old vessels replaced.
*T1.3 Reduce fishing effort through strict implementation of sanctions scheme under the Fisheries (Amendment) Act 2014 (Act 880).	1. Cancel licence repeat IUU offenders without an option to replace that vessel.	1. Number of licences cancelled; Number of fines imposed;

¹ The allocation of these rights in days will be limited to minimum period of one trimester (no monthly licences). Fishing days authorization will be based on calendar days without derogations for days not spent fishing due to weather or vessel repairs. This would be graduated over the next 3 years with a reduction of 20% in the 1st year, 20% in the second.

Semi-Industrial fishery

REDUCING FISHING EFFORT AND CAPACITY

Key Issue 1: Reducing the current levels of fishing effort and fishing capacity

Strategic actions applied to: SEMI-INDUSTRIAL TRAWLERS (SI)	Actions to implement strategy	KPI
*SI 1.1 Achieve a 50% reduction in fishing days over the next 3 years (scaled annually).²	<ol style="list-style-type: none"> 1. Impose licence conditions to reduce the number of days per vessel available. 2. Establish new licence scheme. 3. Penalise vessel operators who do not meet the conditions captured in their sanitary certificates with a penalty of further reduction of 10 days from their 150 day allocation. These lost days can be reinstated if the vessel's rights are transferred to a vessel with a sanitary certified. 4. Delete boats inactive for one year from the fisheries register and then revoke licence. 	<ol style="list-style-type: none"> 1. Monitoring of days fished per vessel to ensure compliance with total days. Monitoring the number of days transferred to complying vessels. 2. Monitor new scheme to ensure its compliance as to days fished. 3. Number of vessels penalized. 4. Number of inactive vessels deleted and number of licences revoked.

- 2 *The allocation of these rights in days will be limited to minimum period of one trimester (no monthly licences). Fishing days authorization will be based on calendar days without derogations for days not spent fishing due to weather or vessel repairs. This would be graduated over the next 3 years with a reduction of 20% in the 1st year, 20% in the second.*

Canoe fishery

Key issue 1: Reducing the current levels of fishing effort and fishing capacity

Strategic actions applied to: CANOES (C)	Actions to implement strategy.	KPI
*CI.1 Survey and registration of active canoes.	Complete survey, register and emboss	Number of registered and embossed canoes.
*CI.2 Increase the traditional one day per week fishing holiday to 2 days per week.	Educate fishers in collaboration with traditional authorities and local assemblies.	No. of infractions and sanctions observed imposed on non-compliance.
*CI.3 Control of new entrants to the fishery.	Educate fishers on alternative employment options. Providing financial and technical incentives to fishers to go into aquaculture production and other alternative livelihoods.	Number of beneficiaries of alternative livelihoods schemes.
CI.5 Implementation of co-management for the artisanal sector.	Facilitation of co-management systems in communities with other institutions. Revise fisheries legislation to incorporate co management requirements. Development of a robust co-management policy and implementation plan.	Number of communities practicing co-management.
CI.7 Modernization of the fleet by using innovative materials (fiberglass, steel, etc.) to control increasing effort (number of canoes).	Establishment of pilot schemes under WARFP.	Number of new types of vessel replacing old canoes.

Tuna and other large pelagic migratory species

MANAGING THE EFFORT AND CAPACITY IN THE TUNA INDUSTRY

Key issue 1: Managing effort and capacity in the tuna industry.

Strategic actions applied to: TUNA FLEET (TF)	Actions to implement strategy	KPI
*TFI.2: Strict adherence to the ICCAT purse seine capacity limit allocated to Ghana under ICCAT Rec 14-01 and vessel limits under 14-01.	Ensure compliance with ICCAT. Recommendations and resolutions by MOFAD. Improved data collection. Strictly adhere to licencing and monitoring of vessels.	Rate of compliance by vessels with ICCAT recommendations.
TFI.3 Development of FAD Management Plan and logbook in conformity with ICCAT 13-01.	Ensure compliance with ICCAT. Recommendations and resolutions by MOFAD. Conduct data collection on FADs. Active participation in Adhoc Working Group on FADs.	FAD logbooks developed and used in conformity with ICCAT recommendations.
*TFI.4 Strict adherence to the ICCAT BET quota under Recommendation; 14-01 (limits Ghana's quota to 4722 mt).	Monitor catches through logbook inspection. Impose technical restrictions, e.g. limitations on the use of FADs to reduce Bigeye catches. Close fishery for all vessels when quota is exhausted. Develop and implement Bigeye transferable quota for each of the purse seine fleet by 2017.	100% logbook coverage. FAD management plan implemented. Closure of fishery. ITQ developed and implemented. No ICCAT letter of concern or identification issued.
*TFI.4a Strict adherence to the ICCAT swordfish quota under Recommendation 13-03 (Limits Ghana's quota to 100 mt).	Ensure compliance with ICCAT. Recommendations and Resolutions by MOFAD. Improve data collection from artisanal fleet.	No ICCAT letter of concern or identification.

Tuna and other large pelagic migratory species

MANAGING THE EFFORT AND CAPACITY IN THE TUNA INDUSTRY

Key issue 1: Managing effort and capacity in the tuna industry.

Strategic actions applied to: TUNA FLEET (TF)	Actions to implement strategy	KPI
TFI.5 Improved reporting system for timely delivery to ICCAT deadlines.	Ensure compliance with ICCAT. Recommendations and Resolutions by MOFAD. Improve data collection and submission to ICCAT. Submission of improve data.	No ICCAT letter of concern or identification issued.
TFI.6 Bycatch mitigation measures regarding the catches of shark and sea birds.	MOFAD to ensure compliance with ICCAT Recommendations and Resolutions. Improve data collection from artisanal fleet Modified gears to avoid or reduce bycatch Improve public awareness education.	No ICCAT letter of concern or identification issued.
TFI.7 Prohibition of transshipment at sea under ICCAT Recommendation 12-06	Restrict carriers to port to port operations. 100% observer coverage of purse seiners. 24/7 VMS monitoring of all Tuna vessels including carriers. Strict enforcement of Fisheries (Amendment) Act, 2014 (Act 880).	Nil transshipment at sea.



Tuna Fish

BIOLOGY/STOCK ASSESSMENT

Key issue 2: Improving information on fisheries biology and stock assessment to support rebuilding harvest strategy:

Strategic actions applied to: ALL FLEETS	Actions to implement strategy	KPI
*2.1 Develop a Data Collection regime aimed at gathering fisheries data³.	<p>Develop new data collection systems and methodology.</p> <p>Deploy skilled personnel over the course of the next 5 years.</p> <p>Implement a continuous capacity building programme for all technical and scientific staff directly involved in fisheries data collection.</p> <p>Organize at least one annual meeting to promote the sharing of experiences among stakeholders.</p> <p>Provide logistic support for technical teams: (i) means of transport, (ii) access to information technology (IT) facilities, (iii) specific IT training sessions.</p> <p>Implement a quality assurance system for collected data. Carry out periodic meetings to analyze the overall quality and sampling biases across the various regions.</p>	<p>New regime adopted.</p> <p>40 new staff recruited.</p> <p>60 personnel deployed over the period.</p> <p>Number of staff trained in data collection.</p> <p>No. of meetings organized;</p> <p>Number of personnel trained in IT skills.</p> <p>Number of meetings held to discuss QA matters.</p> <p>Number of biases detected in data analysis beyond the threshold relative error of 5%.</p>
2.2 Undertake new stock assessment survey to update the 2006 survey.	<p>Develop research plan to assess the key commercial fish stocks.</p> <p>Secure funding for the new scientific work. (See strategy 2.1 for other actions)</p>	<p>Number of commercially important species assessed.</p> <p>Amount of funds secured for scientific work.</p> <p>Reports of research cruises carried out.</p>

3 Fisheries data include catches, landings, effort, discards and specific fish biological data which will form the basis for stock assessment information for the National Harvest (NHS) by 2019.

BIOLOGY/STOCK ASSESSMENT

Key issue 2: Improving information on fisheries biology and stock assessment to support rebuilding harvest strategy:

Strategic actions applied to: ALL FLEETS	Actions to implement strategy	KPI
2.3 Improve the implementation and use of data collection schemes for all fisheries including fishing logbooks for inshore, trawl and tuna fisheries.	<p>Improve data collection systems for the inshore and artisanal fisheries.</p> <p>Evaluate the data requirements for the tuna fishery log book.</p> <p>Revise and update log book information consistency with regional data needs. e.g. ICCAT or other trawl fisheries in the region.</p> <p>Test and implement logbook for tuna and trawl sector.</p>	<p>Number of simplified and robust collection schemes established.</p> <p>Number of vessels filling out logbooks correctly.</p> <p>Number of vessels applying updated logbook requirements revised.</p>
2.4 Collaboration with Universities and Research Institutions.	<p>Establish training programmes on specific areas (e.g. Benthic Ecology).</p>	<p>Number of collaborative training programmes undertaken.</p>
3.3 Increasing the effectiveness, efficiency and sustainability of fishery enforcement detection and penalty processes thus enhancing Port State Management Agreement (PSMA).	<p>Maintaining the integrity of the vessel monitoring system (VMS) through systems upgrades and updates (software and hardware), training officers in VMS technology, subscription of more airtime, VMS data and track analysis to improve the detection rate.</p> <p>Imposition of dissuasive sanctions including provision for repeat offenders and cancelation of registration and licence suspension.</p> <p>Full implementation of inspection as per PSMA).</p> <p>Promote regional approach to MCS strategies to combat IUU fishing through the Regional Fisheries Management Organisation (RFMOs).</p> <p>Eliminating financial incentives for IUU fishing by strictly enforcing the sanctions provided under the Fisheries Laws and Regulations.</p>	<p>Number of upgrades made to the VMS system and training provided.</p> <p>Number of sanctions and fines imposed on IUU vessels.*</p> <p>Degree of compliance with PSMA requirements.</p> <p>Number of IUU infractions reported through RFMO.</p>

BIOLOGY/STOCK ASSESSMENT

Key issue 2: Improving information on fisheries biology and stock assessment to support rebuilding harvest strategy:

Strategic actions applied to: ALL FLEETS	Actions to implement strategy	KPI
*3.4 To verify the information in catch certificates validated by the Ghanaian authorities⁴.	Develop guidelines on verification procedures for catch certification.	Number of certificates duly verified and compliant with national regulations

PROTECTING MARINE HABITAT & BIODIVERSITY

Key issue 4: Protecting marine habitat to conserve biodiversity

Strategic actions applied to: ALL FLEETS	Actions to implement strategy	KPI
*4.1 Creation of marine habitat protection areas to protect nursery areas and spawning grounds, mainly in estuaries and mangrove areas.	Draft designation of different types of marine habitat considered essential for protection. Create designated Marine Protected Security Areas (MPSA). Liaise with relevant agencies to ensure enforcement of buffer breeding grounds around oil installations.	Number and size of habitat protection areas established. Number of protected areas created and monitored.
*4.2 Implement closed seasons according to oceanographic data (mainly from May and June between two upwelling periods when adult fish come close to shore to spawn).	1-2 months closure (all fisheries) and to be revised yearly. Up to 4 months in year 5 (*with the exception of artisanal canoes).	Degree of compliance with closures. Number of warnings or prosecutions for non-compliance with closed seasons.

- 4** *The adoption of a reliable Catch Certification Scheme is of paramount importance for Ghana's compliance with international obligations as flag, port, coastal and market State to assist in attaining this goal, the European Commission offers to provide advice in terms of auditing and analyzing samples of Catch Certificates.*

PRODUCT CERTIFICATION MANAGEMENT

Key issue 5: Reducing post-harvest losses

Strategic actions applied to: ALL FLEETS	Actions to implement strategy	KPI
*5.1 Actively seek solutions to mitigate post-harvest losses in the fishing process and in the supply chain process.	<p>Focusing on minimizing the damage to fish at sea through education.</p> <p>Improving landing facilities to increase food safety and hygiene, and reduce post-harvest losses.</p> <p>Improving the value chain and value addition of seafood products.</p>	<p>Number of awareness campaigns undertaken.</p> <p>Number of fishermen sensitized.</p> <p>Number of food safety and hygiene facilities provided.</p>

IMPROVING SOCIAL INTERVENTIONS AND LINKAGES WITH INTER-AGENCIES

Key issue 6: Creating facilities for enhanced fish production.

Strategic actions applied to: ALL FLEETS	Actions to implement strategy	KPI
6.0. Promoting community group involvement in post-harvest and facilitating business opportunities.	<p>Facilitate the creation of women fish processors and traders associations to access micro-credit financial schemes.</p> <p>Provide government support to the creation of micro-credit facilities.</p>	<p>Establishment of Associations at the national, regional and district levels.</p> <p>Amount of credit made available to micro-credit from Government sources.</p>
6.1 Improved social intervention through the implementation of an insurance and pension scheme for fishermen.	Implement government policy to provide insurance and pension schemes for fishers.	Number of fishers signed unto the insurance and pension schemes.
6.2 Collaboration with agencies and institutions related to the environment.	<p>Institutionalise regular meetings, interactions, training and co-ordination programmes on specific areas (e.g. education, sensitization, studies, etc.).</p> <p>Set up inter-linkages with lead agencies such as EPA, Local Government and Oil Companies, to combat any negative trends in the ecosystem.</p>	<p>Number of collaborative programmes undertaken.</p> <p>Number of joint initiatives developed and implemented.</p>



Migrant Fishing Community in Half Assini, western coast - Ghana



Fishermen mending nets in Axim, Western Region - Ghana



Implementation and Financing of the Management Plan

An annual Operation Plan (OP) will be developed to implement the strategic actions required to address the key issues identified in the Fisheries Management Plan covering the period 2015-2019 as shown in Table 1. **In Table 1 the strategic action steps with asterisk (*) are ranked as having a High Priority (*HP). Other strategies are either medium priority (MP), or low priority (LP).** The rankings in Table 1 reflects the importance of the strategy in response to the challenges identified and the need for fishery reform means we need to address the HP issues in 2015. Other strategy actions have lower priorities, MP or LP in the initial part of the FMP (2016-2020).

The need to prioritise changes in key areas in 2015 means that the energies of the implementing government agency and managers would be significantly different in the early years of reform (2015 and 2016) than towards 2019, when the benefits of initial effort and capacity adjustment will lead to a more secure underpinning for the fishery resources.

The Operational Plan for 2015 is specified in some detail in Table 2, The 2015 Operational Plan is for the key strategies that have to be undertaken in 2015 to implement the fishery reform process. In Table 2, means of implementation and mode of enforcement of a selected number of the most highly ranked major strategic actions (asterisked*) under each challenge are presented. This will guide the prompt implementation of these key strategies commencing in early 2015 and continuing through the year and to 2019 where applicable. Within each year a practical operational plan will be prepared with time frames according to Tables 1 and 2 with a budget. In the latter part of 2015 the Operational Plan for 2016 will be drafted.

7.1 Sources of Funds

Implementation also requires the provision of the adequate financial, technical and human resources. Both MOFAD and Fisheries Commission are committed to provide the funding of the Plan, through the following actions:

1. Undertaking a review and prioritization of allocation of funds from the Fisheries Development Fund, particularly to support research and enforcement.
2. Undertake a review and upward adjustment of the licence and permit fees and also introduce new levies for other services provided.
3. Initiate bilateral cooperation and technical assistance to support the implementation of the Plan.

Table 1: The timetable for implementing Strategic Actions under the Fisheries Management Plan (2015-2019)

Strategic Action areas (2015-2019)	2015		2016		2017		2018		2019	
	m1-6	m7-12	m1-6	m7-12	m1-6	m7-12	m1-6	m7-12	m1-6	m7-12
1.Reducing the current levels of fishing effort and fishing capacity; HP *T1.1, 1.2, 1.3, *C1.1, 1.2, 1.3 and *TF1.1, 1.2, IS1.1	*HP	*HP	*HP	*HP	*HP	*HP				
MP C1.4, 1.5, 1.6, 1.7	LP	LP	MP	MP	MP	MP	MP	MP	MP	MP
2.Improving information on fisheries biology and stock assessment to support a stock rebuilding harvest strategy; *2.1	*HP	*HP	*HP	*HP	MP	MP	MP	MP	MP	MP
2.2 and 2.3 Improve the implementation and use of fishing logbooks for tuna and trawl sectors.	LP	LP	MP	MP	MP	MP	MP	MP	MP	MP
3. Effective enforcement of fish legislation; *3.1	*HP	*HP	*HP	*HP	*HP	*HP	MP	MP	MP	MP
3.2 Increasing the effectiveness, efficiency and sustainability of fishery enforcement. 3.3	LP	*HP	*HP	MP	MP	MP	MP	MP	MP	MP

HP - High Priority; MP - Medium Priority; and LP - Low Priority

Table 1: The timetable for implementing Strategic Actions under the Fisheries Management Plan (2015-2019)

Strategic Action areas (2015-2019)	2015		2016		2017		2018		2019	
	m1-6	m7-12	m1-6	m7-12	m1-6	m7-12	m1-6	m7-12	m1-6	m7-12
4. Protecting marine habitat to conserve biodiversity; and *4.1, *4.2	*HP	*HP	*HP	*HP	MP	MP	MP	MP	MP	MP
5. Product certification and reducing post-harvest losses. *5.1, 5.2	*HP	*HP	MP	MP	MP	MP	MP	MP	MP	MP
6.2 Collaboration with inter-agencies and institutions related to the environment	LP	LP	MP	MP	MP	MP	MP	MP	MP	MP

HP - High Priority; MP - Medium Priority; and LP - Low Priority

Table 2: The Operational Plan 2015. This illustrates the means of implementing strategic actions under Fisheries Management Plan (2015-2019) and the mode of enforcement.

Strategic Actions	Means of implementation	Mode of implementation and enforcement
<p>*T1.1 Reduce the level of fishing effort by 50% with each vessel fishing 150 days per annum⁵.</p> <p>*T1.2 Reducing the number of vessels in the fishery.</p> <p>*T1.3 Remove IUU fishing to reduce fishing effort and capacity.</p>	<p>Revise conditions of licence through implementation of (s76) of the Fisheries Act.</p> <p>Increase cost of licences by 50% from current levels. Facilitate voluntary exit.</p> <p>Suspension for fishing offences</p> <p>Cancellation of registration and licences for repeat IUU offences.</p> <p>No new vessels admitted.</p>	<p>VMS monitoring.</p> <p>Log books.</p> <p>At sea enforcement.</p> <p>Port state measures.</p>
<p>*CI.1 Survey and registration of active vessels.</p> <p>*CI.2 Increase the traditional one day per week fishing holiday to 2 days per week.</p> <p>*CI.5 Moratorium on new entrants to the fishery.</p>	<p>Through engagement with stakeholder groups, Chief Fishermen and District Assemblies.</p>	<p>Log books.</p> <p>At sea enforcement.</p> <p>Port state measures.</p>
<p>*2.1 Develop a Data collection Regulation aimed at gathering fisheries data, namely catches, discards, landings and specific biological data which will form the basis for stock assessment information for the National Harvest Strategy (NHS) by 2020.</p>	<p>Licence conditions to provide catch data.</p>	<p>Logbook regulations.</p>
<p>*3.1. Active public awareness programme through various media to sensitize fishermen to the regulations, including traditional communication mechanisms.</p>	<p>Publicity of Management Plan changes through fishing sector operator meetings, community announcements.</p>	<p>Encourage co-management initiatives.</p>

5 The allocation of these rights in days will be limited to a minimum period of one trimester (no monthly licences). Fishing days authorization will be based on calendar days without derogations for days not spent fishing due to weather or vessel repairs.

Table 2: The Operational Plan 2015. This illustrates the means of implementing strategic actions under Fisheries Management Plan (2015-2019) and the mode of enforcement.

Strategic Actions	Means of implementation	Mode of implementation and enforcement
<p>*4.1 Creation of marine habitat protection areas, actively protect nursery areas and spawning grounds, mainly in estuaries and mangrove areas.</p> <p>*4.2 Implement VMS monitoring at sea and enact closed seasons between two upwelling periods (ie to be determined).</p>	<p>Through licence conditions.</p> <p>Cancellation of licences for repeated area infringements e.g. treat as IUU fishing offences.</p>	<p>At sea warnings and enforcement.</p>
<p>*5.1 Actively seek solutions to mitigate post-harvest losses focusing on minimizing the damage of fish whilst fishing vessels are out at sea.</p>	<p>Education leaflets on improving fish handling and reducing fish spoilage,</p>	<p>Observation of catch quality standards.</p>
<p>*5.2 The importance of data, including that from VMS, logbooks, landing declarations and catch returns forms, to cross check and verify the information in catch certificates validated by the Ghanaian authorities in underlined. The adoption of a reliable Catch Certification Scheme is of paramount importance for Ghana's compliance with international obligations as flag, port, coastal and market State.</p>	<p>Measuring the effectiveness of:</p> <p>VMS monitoring; Log books; Landing declarations and catch certificate completion processes using at sea enforcement.</p> <p>Port State measures.</p>	<p>Measuring the effectiveness of:</p> <p>VMS monitoring. Log books. At sea enforcement. Port State measures.</p>

Table 3. Financial plan for the year I (2015) (USD 1,600,000)

Strategic Actions	Mode of implementation and enforcement	Indicated amount
<p>*T1.1 Reduce the level of fishing effort by 50% with each vessel fishing 150 days per annum⁶.</p> <p>*T1.2 Reducing the number of vessels in the fishery.</p> <p>*T1.3 Remove IUU fishing to reduce fishing effort and capacity.</p>	<p>Port State measures.</p> <p>Align fishing capacity to stocks through surveys, interviews questionnaires, observations, reports.</p>	USD200,000
<p>*C1.1 Survey and registration of active vessels.</p> <p>*C1.2 Increase the traditional one day per week fishing holiday to 2 days per week.</p> <p>*C1.5 Moratorium on new entrants to the fishery.</p>	<p>Survey of fishery (baseline information).</p> <p>Provision of Log books.</p> <p>Enforcement of Regulations.</p> <p>Enact Port State measures.</p> <p>Educational campaigns and awareness creation.</p>	USD50,000
<p>*2.1 Develop a Data Collection Regulation aimed at gathering fisheries data, namely catches, discards, landings and specific fish biological data which will form the basis for stock assessment information for the National Harvest Strategy (NHS) by 2020.</p>	<p>Recruit 20 staff by September 2015 for data collection along 40 stations.</p> <p>Deploy 20 skilled staff by September 2015 for data verification and analysis.</p> <p>Build capacity of 100 staff by December in IT skills.</p> <p>Initiate 1 stakeholder meeting for 200 people.</p> <p>Provide logistics(working tools) for staff.</p> <p>Conduct a stock assessment of marine resources.</p>	<p>USD240,000</p> <p>USD360,000</p> <p>USD100,000</p> <p>USD20,000</p> <p>USD10,000</p> <p>USD250,000</p>

- 6 The allocation of these rights in days will be limited to a minimum period of one trimester (no monthly licences). Fishing days authorization will be based on calendar days without derogations for days not spent fishing due to weather or vessel repairs.**

Table 3. Financial plan for the year 1 (2015) (USD 1,600,000)

Strategic Actions	Mode of implementation and enforcement	
*3.1. Active public awareness programme through various media to sensitize fishermen of the regulations, including traditional communication mechanism.	Co-management initiatives established through durbars, radio programmes TV adverts and print media etc.	USD20,000
*4.1 Creation of marine habitat protection areas, actively protect nursery areas and spawning grounds, mainly in estuaries and mangrove areas.	Survey conducted to establish areas.	USD50,000
*4.2 Implement closed seasons between two upwelling periods 1 month closure each June (all species) and 2 months demersal species).	Educational campaigns and awareness creation.	USD20,000
	Enforcement of Regulations.	USD30,000
*5.1 Actively seek solutions to mitigate post-harvest losses focusing on minimizing the damage of fish whilst fishing vessels are out at sea.	Ensure quality standards (HACCP) and proper conservation techniques onboard 50% of trawlers.	USD50,000
*5.3 The importance of data, including that from VMS, logbooks, landing declarations and catch returns forms, to cross check and verify the information in catch certificates validated by the Ghanaian authorities is underlined. The adoption of a reliable Catch Certification Scheme is of paramount importance for Ghana's compliance with international obligations as flag, port, coastal and market State.	Measuring the effectiveness of: VMS monitoring. Logbook inspection and verification At sea enforcement. (Traceability regimes established in all vessels).	USD200,000

References

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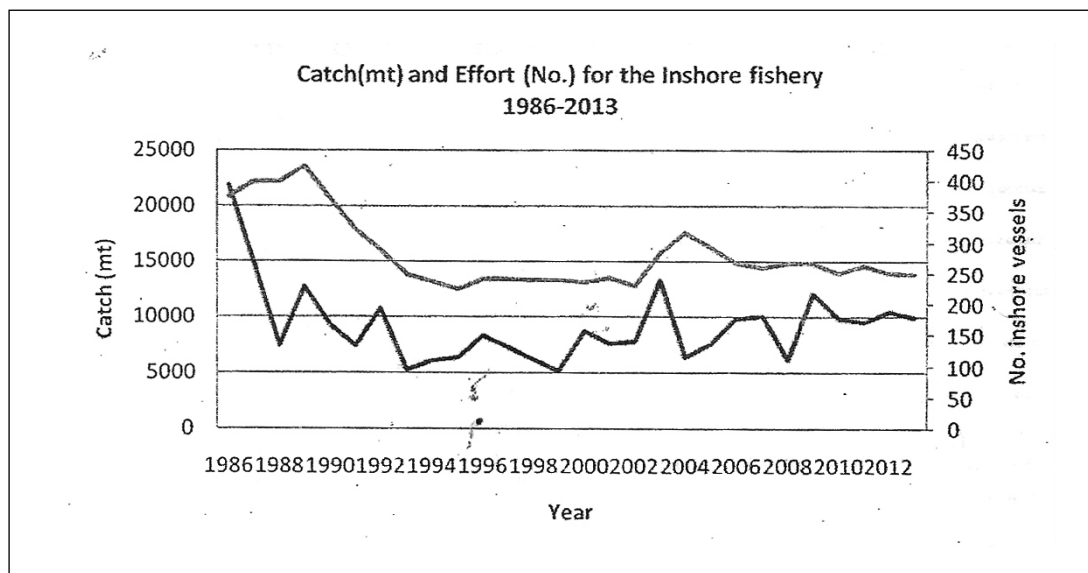
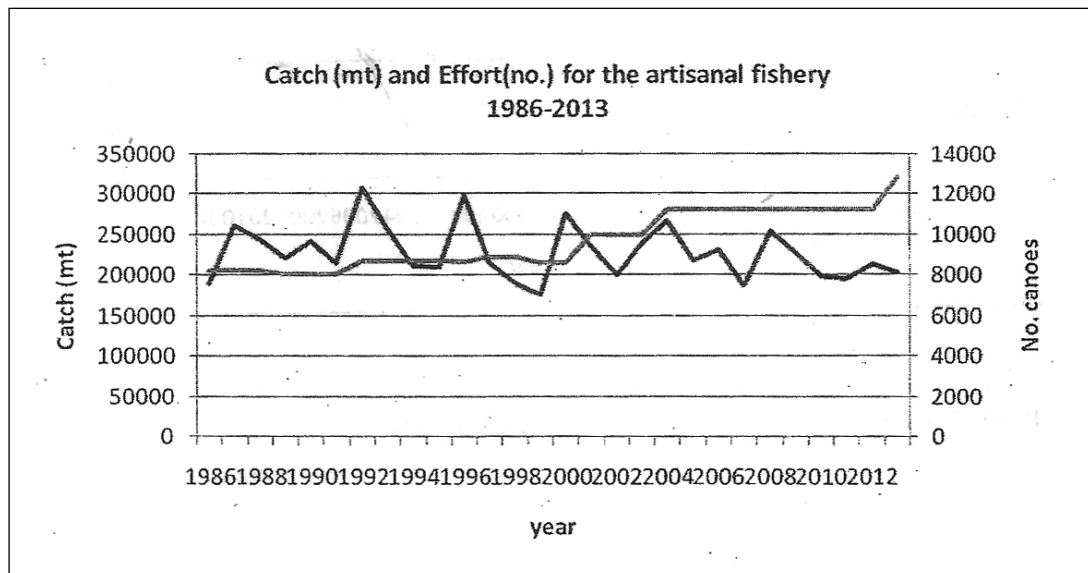
World Bank (2013) Annex 2: Time lines for strategic action plan implementation 2015-2020.

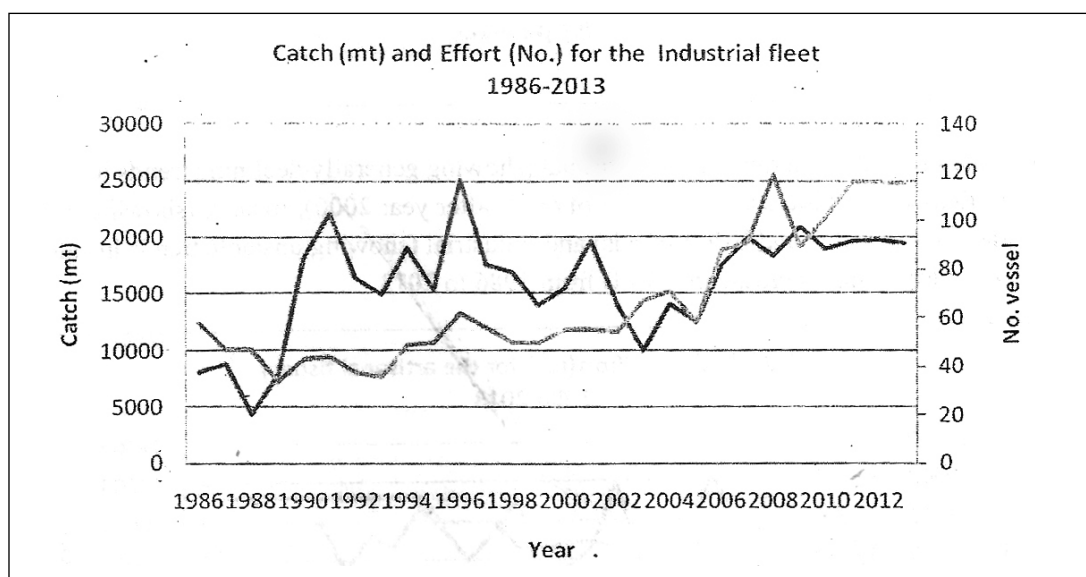
Anon (2013) 2013 Annual Report – Fisheries, Ministry of Fisheries and Aquaculture Development.

Fisheries Commission Annual Report 2014.

Appendix

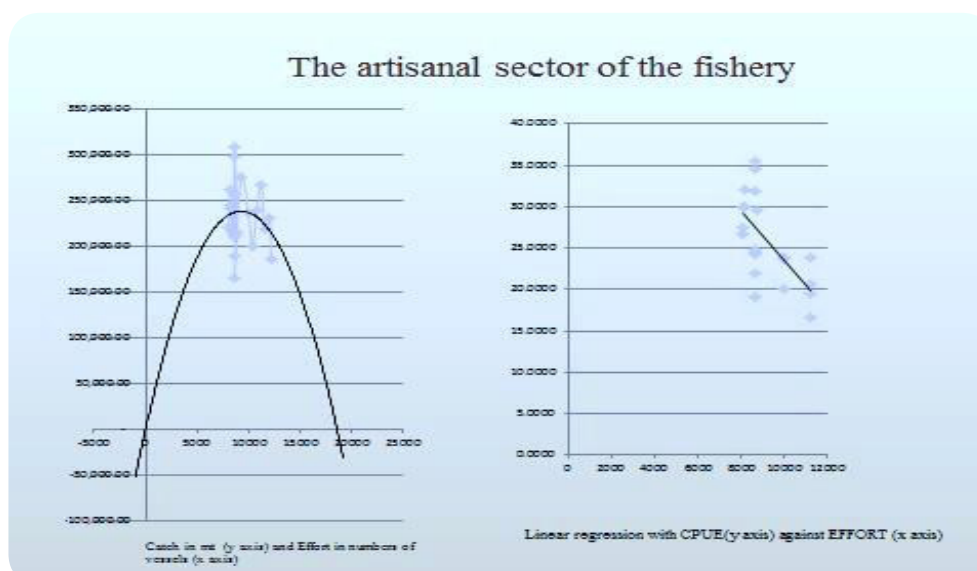
- a. Catch and Effort series for Artisanal (showing generally declining trends in catch with associated increase in number of crafts after 2000), Inshore (showing unstable trends in catch with a corresponding increase in Effort) from 1986 to 2013.



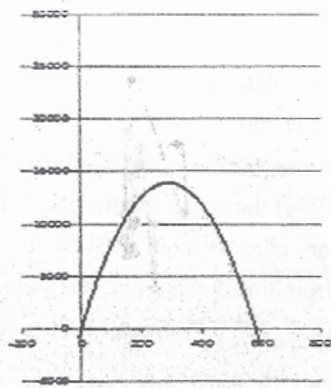


b. Parabolas and regression plots for MSY/ CPUE trends.

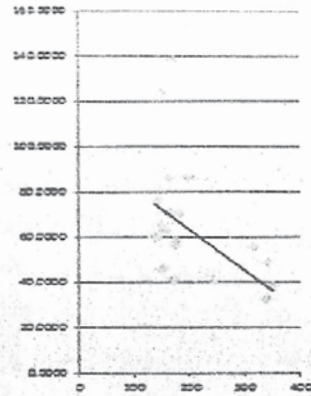
From the statistical inference based on catch, CPUE and effort data on commercial fishing operations, the



The inshore sector of the fishery

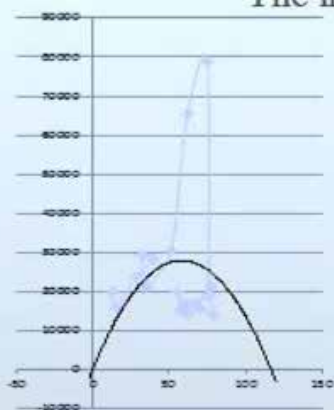


Catch in net (y axis) and Effort in numbers of vessels (x axis)



Linear regression with CPUE (y axis) against EFFORT (x axis)

The industrial sector of the fishery



Catch in net (y axis) and Effort in numbers of vessels (x axis)



Linear regression with CPUE (y axis) against EFFORT (x axis)

maximum sustainable yield (MSY) which is the biological reference point at which stocks can be harvested without any negative effect on resources was obtained using the Schaefer surplus production model. In this model (Schaeffer, 1954) the equilibrium yield (YE) is given by: $YE = a - bf^2$ where f is fishing effort and a and b are constants obtained by fitting a polynomial regression of YE (equilibrium catch) on f and f^2 . From this the maximum sustainable yield is calculated as:

$$MSY = -a^2/4b$$

The Fishing effort (in numbers of vessels) at the maximum sustainable limit is also calculated as:

$$F_{msy} = 0.5 a/b$$

The table below shows the regression equations and constants obtained, and the MSY and Fmsy for the various fleets. This indicates that catches in all the fleets exceed their MSY levels hence the need for conscious effort to reduce numbers.

CATCH	a	b	MSY= $a^2/4b$	$F_{msy} = 0.5 a/b$ (number of vessels required to sustain resources)	Current f (vessels in place as at 2013)
Artisanal	52.754	-0.0029	239,912	9,095	9,951
Inshore	100.6	-0.1845	13,713	272	403
Industrial	1268.2	-13.124	30,637	48	107

***See regression plots of various fleets.**

CATCH AND EFFORT DATA FOR THE GHANAIAN FISHERY 1986-2013

ARTISANAL				INSHORE				DISTANT - WATER				TUNA								
	EFFORT (TRIPS)	CPUE				CPUE				CPUE				CPUE			CPUE			
1986	190197	897500	8214	212	23155	21894	17060	375	1283	58384	8091	68	58	118985	34720	201	35	172736	992000	
1987	261451	3546324	8214	74	31830	14931	15880	399	940	37421	8768	98	47	89469	33465	209	36	160120	929583	
1988	244042	867841	8214	281	29710	7414	16086	399	461	18581	4344	54	47	80444	92426	221	36	160330	984250	
1989	220878	773203	8052	286	27431	12657	21574	425	587	29781	7851	129	34	60860	230912	212	36	152330	897056	
1990	242020	839811	8052	288	30057	9250	9681	371	955	24933	18060	235	43	76851	420000	243	36	167914	1133417	
1991	215847	1757136	8052	123	26807	7357	10063	323	731	22777	22078	171	44	129111	501773	207	36	182585	1049861	
1992	307931	860681	8688	358	35443	10765	11384	289	946	37249	16366	115	38	142313	430684	30776	36	171933	854889	
1993	257237	1009118	8688	255	29608	5230	8229	249	636	21004	14921	131	36	113901	414472	36856	36	210606	1023778	
1994	211747	813104	8688	260	24372	6032	9293	237	649	25451	19026	132	49	144136	388286	36973	36	216216	1027028	
1995	210659	1168906	8688	180	24247	6371	17219	225	370	28316	15298	153	50	99987	305960	33905	38	190478	892237	
1996	298249	1028128	8641	290	34516	8353	17823	241	469	34660	25104	157	62	159898	404903	37255	45	225788	827889	
1997	215125	674750	8895	319	24185	7294	15022	241	486	30266	17528	209	56	83866	313000	53625	43	286765	1247093	
1998	189459	1269328	8895	149	21299	6137	17466	239	351	25678	16847	173	50	97382	336940	65568	34	196311	1772108	
1999	176237	1418603	8610	124	20469	5149	17290	239	298	21544	13945	177	50	78785	278900	83552	353	40	236691	208880
2000	275965	2543765	8610	108	32052	8688	17571	239	494	36814	15455	111	55	139234	281000	53255	206	37	258519	1439324
2001	236355	1667745	9981	142	23680	7606	18660	244	408	31172	19644	109	55	180220	357164	88806	243	40	379513	2220150
2002	200824	839908	9981	239	20121	7785	26382	231	295	33701	13900	89	54	156180	257407	64046	302	41	212073	1562098
2003	238861	812435	9981	294	23932	13318	26575	283	501	47060	9943	79	67	125861	148403	65153	254	41	256508	1589098
2004	267910	1183412	11219	226	23880	6332	17493	316	362	20038	14010	178	71	78708	197324	62742	211	41	297355	1530293
2005	218871	1177471	11219	186	19509	7591	27143	293	280	25908	12494	111	58	112559	215414	82225	230	40	357500	2055625
2006	231681	1372753	11219	169	20651	9877	39934	267	247	36993	17419	120	88	145158	197943	63252	251	43	252000	1470977
2007	187088	9647289	11219	19	16676	10008	47070	259	213	38641	19892	167	91	119114	218593	72535	275	40	357500	1813375
2008	254133	1530843	11219	166	22652	6140	21757	267	283	22996	18289	203	119	90094	153689	64093	243	41	263757	1563244
2009	226755	850793	11219	267	20212	12047	36722	268	328	44951	20937	247	89	84360	234124	66470	214	43	310607	1545814
2010	198152	704710	11219	281	17662	9823	31489	250	312	39292	18859	236	101	79911	186723	77876	255	43	305396	1811070
2011	196200	196200	11219	1000	17488	9576	24003	263	399	36411	19597	234	116	83748	168940	80822	287	43	281610	1879581
2012	213451	2133451	11219	100	19026	10482	82666	251	127	41761	19763	250	116	79052	170371	75329	242	43	311277	1751837
2013	202602	202602	12847	1000	15770	9960	46052	249	216	40000	19406	201	115	96547	168748	82899	268	43	309325	1927884



Sardinella (Small pelagic fisheries; crucial to fisheries food security and nutrition in Ghana)



Fish Processors smoking sardinella in a Ghanaian fishing community

FISHERIES MANAGEMENT PLAN OF GHANA

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2015-2019

This publication was printed with support from the American People,
USAID Ghana Sustainable Fisheries Management Project
(Cooperative Agreement No. AID-641-A-15-00001)