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INTRODUCTION OF COMMUNITY-BASED MANAGEMENT IN THE SMALL-SCALE COASTAL FISHERIES OF LIBERIA

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ABSTRACT

Efforts to manage the fisheries of Liberia began in 1956 with the creation of the Bureau of National Fisheries (BNF). Management, however, has remained minimal with measures limited to licensing, heavily concentrated on the industrial fisheries sector, and leaving the coastal artisanal fisheries virtually unmanaged. This open access situation has subjected the coastal artisanal fisheries to the common property problem leading to overcapacity and overexploitation due to the race-to-fish.

This study provides a theoretical review of community fisheries management and describes a particular form of community-based co-management thought to be suitable for the coastal artisanal fisheries of Liberia. A preliminary implementation plan is devised, the associated costs estimated and the potential benefits, in terms of economically more efficient fisheries, assessed. A rudimentary cost-benefit analysis suggests that implementing community-based co-management in Liberia is likely to yield significant net economic benefits.

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AM	Accountability Measure
BNF	Bureau of National Fisheries
CBA	Cost-Benefit Analysis
CBCM	Community-Based Co-Management
CCMA	Community Co-Management Association
CCRF	Code of Conduct for Responsible Fisheries
CDC	County Development Committee
CFM	Community Fisheries Management
CFR	Community Fishing Rights
CIA	Central Intelligence Agency
CMA	Co-Management Area
CMC	Community Management Committee
DDC	District Development committee
EEZ	Exclusive Economic Zone
EMSY	Effort at Maximum Sustainable Yields
FAO	Food and Agriculture Organization of the United Nations
FCA	Fisheries Cooperative Association
FDF	Fisheries Development Fund
FFGC	Fundy Fixed Gear Council
FJS	Fisheries Judicial System
FMR	Fishery Management Regime
GDP	Gross Domestic Product
GMFMC	Gulf of Mexico fisheries Management Council
GoL	Government of Liberia
GRT	Gross Registered Tonnage
IFQ	Individual Fishing Quota
IQ	Individual Quota
ITQ	Individual Transferable Quota
IRR	Internal Rate of Returns
IVQ	Individual Vessel Quota
Kg	Kilogram
Km	Kilometre
LAP	Limited Access Privilege
LEITI	Liberia Extractive Industries Transparency Initiatives
LISGIS	Liberia Institute of Statistics and Geo-Information Services
m	Meter
MCS	Monitoring Control and Surveillance
Mm	millimetre
MOA	Ministry of Agriculture
MoU	Memorandum of Understanding
M&E	Monitoring and Evaluation
MRAG	Marine Resources Assessment Group
MRI	Marine Research Institute
MSY	Maximum Sustainable Yields
Mt	Metric tonnes
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
NPV	Net Present Value

OSY	Optimum Sustainable Yields
RFA	Regional Fisheries Association
RMP	Resource Management Plan
SAFMC	South Atlantic Fisheries management council
TAC	Total Allowable Catch
TURF	Territorial User Rights in Fisheries
UNCLOS	United Nations Convention on the Law of the Sea
US$	United States Dollars
USA	United States of America
USAID	United Stated Agency for International Development
VMS	Vessel Monitoring System

1 INTRODUCTION

The fisheries sector of Liberia has the potential to make substantial contribution to national socio-economic development, economic revitalisation and reduction of poverty in the short, medium and long term (MOA 2007). This potential cannot be effectively harnessed without financial, physical and human assets, and institutional and political environments required for managing fisheries on a sustainable basis (Kebe *et al.* 2009). Over 80% of the population depends on fish for animal protein and there is an urgent need to improve fish production, preservation and distribution.

As a result of the 14-year civil war (which ended in 2003), an already weak and centralized management regime with ineffective legal instruments and institutions has been further reduced to a symbolic presence. Human resources and enforcement capacity are almost non-existent.

There has been no government fisheries policy for decades, and the lame institutions and the Bureau of National Fisheries (BNF), which is inadequately staffed and under-funded, are not able to ensure effective resource conservation and management. This has created a common property situation, subjecting the fisheries to overcapacity by varying, unregulated methods of harvest and poaching, resulting to millions of dollars loss in fisheries revenues (MRAG 2005).

Therefore, implementing an efficient fisheries management regime, capable of ensuring resource sustainability, improving the livelihoods of fishers and generating overall benefits to the country from increased resource rent from the fisheries at minimum management cost, is the major focus of this paper.

1.1 Significance of the study

The small scale coastal fisheries of Liberia have some unique characteristics which suggest a participatory approach to ensure most effective management and sustainable development: fishing communities are situated along estuaries and mangrove wetlands which are unique ecosystems that support fish recruitment; these are increasingly subjected to abuse (used for dumping of waste and deforested for firewood); there is increasing use of illegal and damaging fishing methods by community members that are destroying fishing grounds and result in reduction in catch; most landing sites are in remote locations and inaccessible for most of the year, especially during the wet season; and there are conflicts with industrial vessels and with migrant fishers over fishing grounds.

These circumstances are compounded by the BNF's incapacity to enforce management regulations, due to inadequate budgetary support, and staffing, thus leaving the coastal fisheries in an opened access situation, with no effective management system.

Additionally, a recent livelihoods analysis of coastal fisheries communities in Liberia by Kebe *et al*. (2009) suggests that improvements in the human and social capital of fisher-folks and of the political and institutional environment to ensure better representation of fishing communities in the preparation and implementation of policies would greatly reduce their vulnerability to poverty.

The goal of this project is to study the possibility of greater participation of fishing communities in the effective management of fisheries resources in Liberia, through a system of community-based management, to increase resource sustainability for improved livelihoods and socio-economic benefits from the fish stock. Boosting artisanal fishing is likely to have the most immediate impact and, based on evidence from elsewhere in West Africa, will benefit the largest number of Liberians, particularly women, who dominate fish marketing.

1.2 Organisation of the study

This study is organised in six main chapters. Chapter one provides the general introduction of the study. General background information about Liberia and the fisheries is provided in Chapter two. Chapter three discusses the theory of community fisheries management, including empirical experiences for lessons learned. Chapter four, the principal section of this study, discusses the proposed community management system for Liberia, including estimated cost and implementation. In chapter five, a cost-benefit analysis is done to determine the feasibility of implementing community management in Liberia. The report ends with chapter six, in which conclusions are drawn and recommendations made for implementing community-based co-management in Liberia.

2 BACKGROUND INFORMATION

The objective of this chapter is to provide general background information on the geography, government, people and the economy of Liberia and its fisheries sector.

2.1 The country

Liberia is situated in the south-western sector of the great bulge of West Africa. It lies between 4°34' N and 6°56' N, and 7°32' W and 9°26' W. Liberia has a total area of about 111,370 km^2, of which 96,320 km^2 (86 percent) is dry land, drained by natural streams and rivers (figure 1). The remaining 14% (15,050 k m^2) consists of mainly rivers, lakes, lagoons, creeks and streams that drain to the Atlantic coast bringing nutrients which boost the primary production on the shelf (CIA 2010).

Apart from a narrow strip of flat coastal plains, Liberia consists of a series of plateaus of moderately high altitude with elevations rising from zero meters at the Atlantic Ocean up to heights of 1,380 meters. The country is densely forested with a series of derived savannah (grassland created as a result of farming) along the coast and in the northwest. The coastline (figure 1) is characterized by lagoons, mangrove swamps, and river-deposited sandbars (CIA 2010).

The climate is tropical, hot and humid, with one major extended rainy season between April and November (Welcomme 1979). The dry season, usually characterised by the harmattan wind (a dry and dusty West African trade wind which blows south from Sahara), lasts from November to April. There is very little variation in temperature, which averages about 30°C.

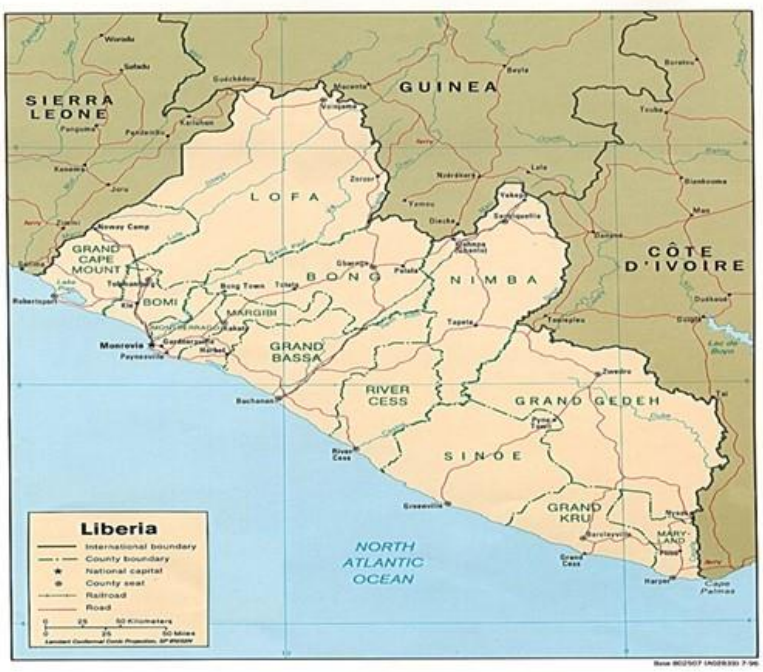

Figure 1: Map of Liberia showing Atlantic coastline, inland water bodies and neighbouring countries (FAO 2001).

2.2 The people

The name ‘Liberia’ comes from the English word "liberty" and refers to the nation's origin as a colony of free blacks repatriated to Africa from the United States in the early nineteenth century.

Although the settlers and their descendants, known as Americo-Liberians, defined the boundaries of the nation-state, made English the official language, and dominated the government and economy for almost one hundred fifty years, they constitute only 5% of the population (CIA 2010). The remaining people belong to sixteen broadly defined ethno-linguistic groups of the Niger-Congo family (The Mel, Mande and Kwa) (Advameg, Inc. 2009).

The population of Liberia is now estimated to be 3.48 million people, with an annual growth rate of 2.78%. Literacy rate is put at 57.5% and 60% of the population lives along the coast. The predominant religion in Liberia is Christianity (85.6%) but Islam and traditional religions are practiced and they constitute 12.2 % and 0.6% of the population, respectively (LISGIS 2009, CIA 2010).

2.3 The government

The constitution of 1847 was patterned on the American constitution and provided for a separation of powers among the executive, legislative, and judicial branches under a republic type of government.

The executive branch is headed by the President who is also the head of state and commander-in-chief of the armed forces of Liberia. The president is elected by popular vote for a six-year term (eligible for a second term). All cabinet ministers, the chief justice and justices of the Supreme Court are appointed by the president and confirmed by the Senate.

The legislature is bicameral with an upper house based on equal representation of the fifteen counties with two senators each (30 seats) and a lower house of representative (64 seat; members elected by popular vote to serve a six-year term). At the local level, each county is administered by a superintendent appointed by the president and further divided into districts, chiefdoms, and clans (Advameg, Inc. 2009). The system of "native" administration retains much of the older system of indirect rule in which local chiefs are empowered by the central government to collect taxes and judge minor court cases.

The judiciary branch is headed by the chief justice of the Supreme Court. The legal system is a dual system of statutory law based on common law for the modern sector and customary law based on unwritten tribal practices for indigenous sector.

2.4 The economy

Though Liberia is richly endowed with water, mineral resources and forests, and a climate and soil favourable to agriculture, its economy was heavily dependent on the production of a few primary products or raw materials prior to the civil war that engulfed the country in 1990. During this period, 75% of the value of exports came from iron ore alone. Iron ore, timber and rubber together amounted to over 80% (CIA 2010). The remaining key export commodities included: cocoa, coffee, palm oil and precious minerals (gold and diamonds). Local manufacturing, mainly foreign owned, has been small in scope.

The post-war economy is dominated by agriculture (including fisheries), accounting for 77% of GDP and employing 70% of the labour force. Industries and services account for 5% and 18% respectively. The GDP per capita was $500 in 2009 with GDP growth rate for the same period estimated at 4.6% (CIA 2010).

Faced with devastation from the civil war, the government has made significant strides to reconstruct damaged infrastructure, and to improve security and confidence to attract foreign investment. The embargos on timber and diamond exports have been lifted; new mining and agricultural concessions have been signed by the government to open new sources of revenue. Additionally, oil exploration contracts have also been signed with a number of companies to begin offshore oil exploration. The government of Liberia reports that in 2008 companies operating in the forestry, mining (iron ore, gold and diamond) and oil sectors contributed $29.5 million to government revenue, representing 15% of total revenue (GoL 2009).

The fisheries sector generated 3.2% of the GDP and 12% of agricultural GDP in 2002 (MOA 2007). Though the contribution of fisheries to the overall economy is not very high, the artisanal subsector is important in providing nutrition and employment for the population. The per capita supply of fish in 2007 was estimated at 4.4 kg/person per year (FAO 2004-2011). Total export from fisheries in 2007 was estimated at $ 0.6 million (FAO 2010).

2.5 Fisheries in Liberia

Liberia's fisheries sector includes an established marine fishery involving industrial and artisanal fishing activities, an inland fishery which is exclusively artisanal and aquaculture practiced in rural areas through fishpond culture (MOA 2007). Although not the key national industry, fisheries are locally important for communities with access to fisheries resources, providing employment for about 37,000 fishers and processors, and also has an important nutritional contribution in terms of protein intake (MOA 2007).

Liberia's coastline (of 570 km) and extensive continental shelf (averaging about 34 km in width), and an exclusive economic zone (EEZ) of 370 km, provide about 210,000 km^2 of fishing grounds. These hold considerable maritime fish resources, including; finfish species (Clupeids, Sciaenid, Thread fins, Carangids, Sparids, and Tuna); and crustaceans such as shrimps, crabs and lobsters which are less abundant but of much higher value. Seasonal populations of small pelagic including flying fish and herring also occur and are important to the artisanal fishery.
Estimates of maximum sustainable yield (MSY) of the continental shelf area compiled by Ssentongo (1988) from resource surveys produced and overall estimate of 180,000 mt/year. However, results from a resource survey in 2006 reported biomass estimates of 27,000 and 152,000 tons of demersal and pelagic resources respectively (BNF 2006). Clearly, biomass of this size can hardly sustain a MSY of 180,000 mt/year. This discrepancy is indicative of the lack of robust knowledge about the biological productivity of the Liberian marine waters.

Liberia also has approximately 3000 km of rivers and tributaries (Vanden Bossche & Bernacsek 1990) that traverse the country, and countless perennial swamps and inland water bodies with enormous potential for increased production from inland fisheries and aquaculture. The estimated MSY for the inland fishery is 40,000 mt/year (FAO 2004-2011).

The national fishery comprises three main sub-components:

- Marine fisheries, involving industrial shrimp trawl fishery, fish trawl fishery, and artisanal activities;
- Inland fishery, mainly artisanal; and
- Aquaculture, through fish farming.

The marine fishery resources of Liberia are exploited by two fisheries (Figure 2):

i. The artisanal canoe fishery operating in estuaries and shallow inshore waters and extending from the shoreline to a depth of 20–40 m;
ii. The industrial trawl fishery supposedly operating in open deeper waters, and targeting finfish or shrimp.

However, there is a need for a more elaborate characterisation of the fisheries and fishing fleets, under appropriate management systems to fully harness the potential benefits from the resource. Liberia has a fairly good potential for developing the different fisheries from which economic benefits could be maximised, including a deep sea fishery for tuna resources.

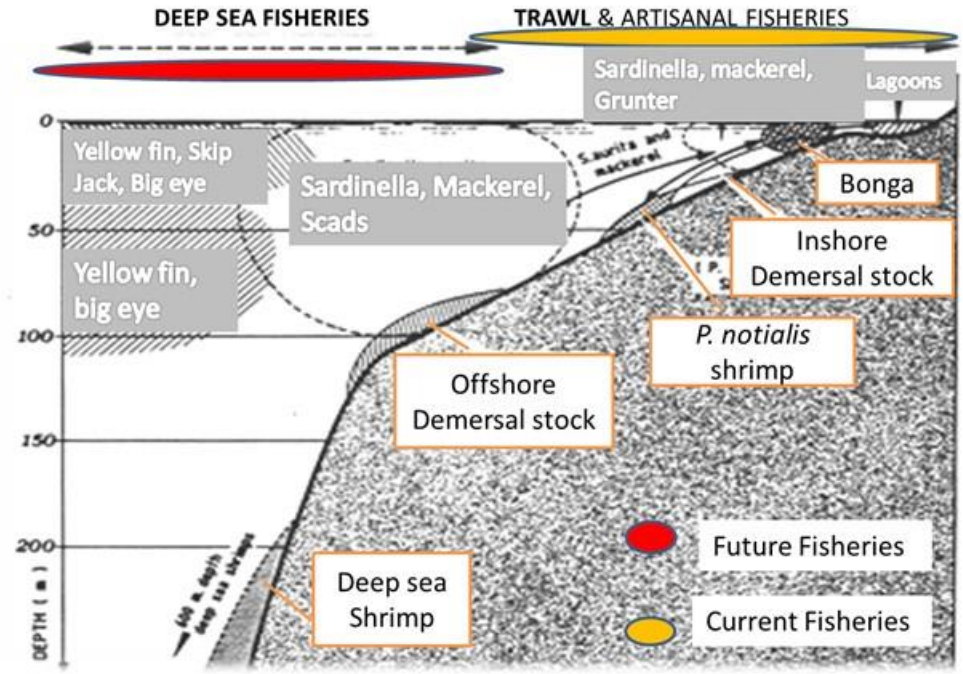

Figure 2: Location of current and future fisheries on the Liberian shelf (modified from Ssentongo 1988).

A deep sea fishery targeting tuna, shrimp and offshore demersal resources presents a potential source of fisheries revenue. This could be developed by means of licensing foreign vessels for the fishery. This potential source of revenue is currently being lost to illegal fishing by foreign vessels. USAID (2008) reports that fish valued at about $ 0.2 million were exported from Liberian waters. At the moment there are no legal landings of industrial shrimp or tuna catch. All the catch that is exported are transhipments carried out at sea by both licensed and unlicensed vessels.

Fish production has been relatively low compared to estimated potential yields. Average annual fish production has shown a fairly stable trend, though fluctuating between 8000 and 15000 tons (Figure 3). Total fish landed in 2008 was 7890 tons (FAO 2010), with the industrial sector contributing 70%. The high points in figure 3 correlate with periods of improving political stability in the country, and increased monitoring by the BNF. Generally, the low production is as a result of inadequate catch data from vessels and landing sites.

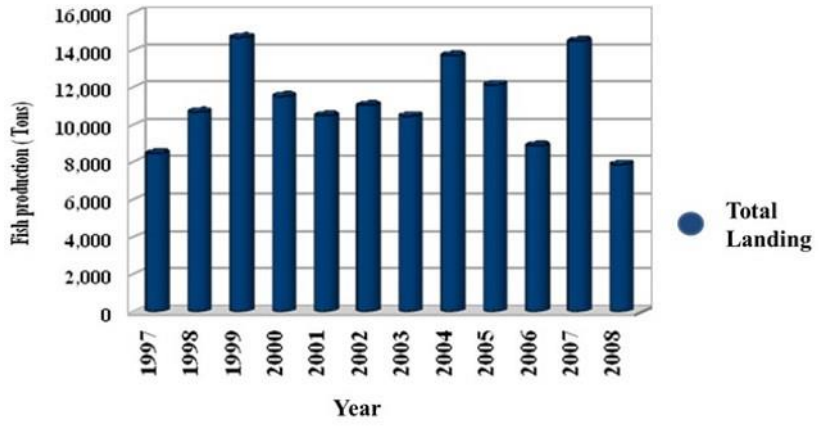

Figure 3: Total Fishery Production in Liberia from 1997-2008 (FAO 2010).

Artisanal Fisheries (including inland fisheries) are known to land more than 50% of the fish catch, even though there is a fluctuating and declining trend between 2004 and 2008 from all sub-sectors as is indicated in Figure 4. Inland fisheries show a steady decline in reported landings, which can be attributed to the lack of current and reliable data from the subsector.

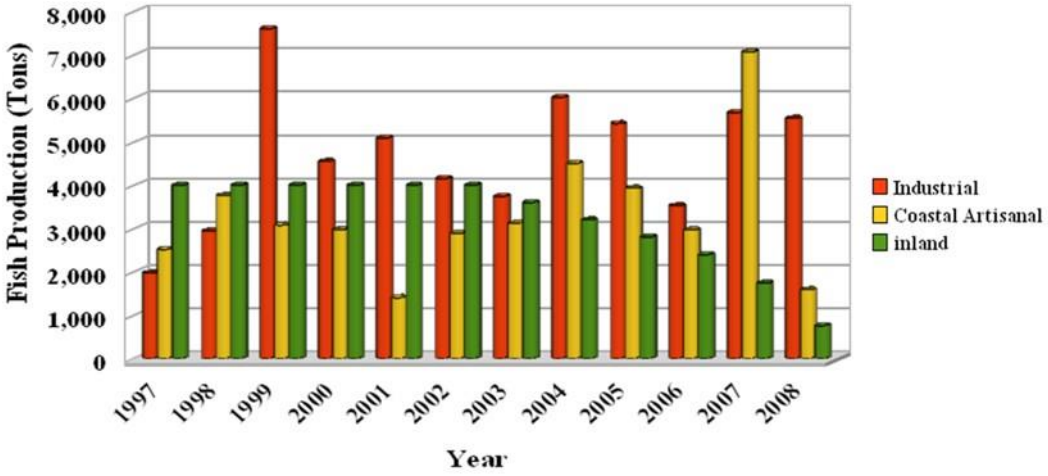

Figure 4: Fish production from sub-sectors of the fishery in Liberia (FAO 2010).

2.5.1 The industrial fishery

The first attempt at commercial fishing in Liberia was in 1848 when the then President of the country, Joseph Jenkins Roberts, converted his yacht into a fishing boat. The first fishing trawler to operate in Liberian coastal waters belonged to Woerman Company, a German company that operated in the country between 1938 and 1939. In 1952 the Government of Liberia requested the Food and Agriculture Organization (FAO) and the United States Government to help develop its fisheries subsector, starting with an assessment of the fisheries potential of the country. The study found that a medium-scale fishing industry could be established in the country (MOA 2007).

An industrial fishery began soon thereafter, targeting mainly the shrimp resources within the Sherbro fishing grounds, off the coast of Grand Cape Mount County, which extend into Sierra Leone. Currently, the industrial trawl fisheries may be divided into two segments; (i) a demersal trawl fishery which targets mainly shrimp and (ii) a mid-water to pelagic trawl fishery which targets mainly finfish. The industrial sub-sector is restricted to operating outside 6 nautical miles offshore. However, this restriction is not effectively enforced.

In 2009 there were eight industrial fishing companies, mainly foreign owned, operating 35 rigged side and stern trawlers registered in both fishing and shrimping operations. The industrial fleet is quite heterogeneous in size and level of mechanization. The vessels ranged in size from 60 GRT Chinese pair trawlers (ice carriers) to 251 GRT trawlers with on-board freezing, processing and storage facilities. The number of registered vessels has remained between 29 and 43 since 1999 (Table 1). However, there are reports of large numbers of vessels poaching the Liberian waters resulting to the loss of millions of dollars in fisheries revenue (MRAG 2005).

These vessels land their catches at the old iron ore pier in the Free Port of Monrovia. The industry currently employs about 4,200 persons, 75% of whom are Liberians, making up about 11% of the total employment in the fisheries sub-sector (MOA 2007).

Table 1: Number of licensed industrial vessels in Liberia since 1999 (BNF 2009, MOA 2007)

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
# of Vessels	32	30	35	43	41	29	31	29	27	37	35

2.5.2 Coastal artisanal fishery

The coastal artisanal fisheries are exploited by four different groups of fishers: the Kru, the Fanti (Ghanaians), the Pohops and migrant fisheries from Senegal and Gambia.

The Kru fishermen usually fish alone, but their small dugout canoe can carry a crew of up to three men. The Kru canoes are propelled by sails or paddles. They fish during the day, departing in the morning with an offshore wind and returning in the afternoon with the onshore wind. The Kru fishermen have therefore a limited fishing range along the coast.

The Fanti fishermen (Ghanaians) employ more developed fishing methods than the Kru, such as larger vessels with outboard engine and larger nets that are operated by a crew, which allows them to fish deeper in sea and catch much more fish than the Kru. The Fanti are more organised and operate in small groups of up to 20 men, living under one enclosure. The Fanti fishermen are settled at various fishing locations along the Liberian coast, e.g., Buchanan, Cape Palmas, Robertsport, Marshall and Greenville.

The Pohops operate beach seines (200–800 m long) using dugout canoes, usually with a 1- or 2-person crew to deploy the net which is pulled to shore by a team of up to 20 men.

The recently arrived migrant fishers dominated by Senegalese and Gambians using much larger fishing canoes (more than 20 m long) fish further in deeper sea. They have settled in communities in Sinoe, Rivercess, Grand Kru and Grand Bassa Counties.

Artisanal fish landings (both marine and inland) have shown a stable trend over the years, with an average annual landing of about 6000 Tons (Table 2). The sector, however, recorded a sharp drop

in catch in 2008, reporting only 26% of the landing from the previous year. This can be attributed to the lack of data from landing sites (Figure 4). The main species are Clupeids (*Ilisha africana, Ethmalosa fimbriata & Sardinella Spp.),* Sciaenids (Cassava Croakers), Threadfins, Carangids, and Sparids (Ssentongo 1988).

Grand Kru County with 35 landing sites and Sinoe County with 30 have the largest number of landing sites and are dominated by indigenous fishers, but they land substantially fewer fish annually than Grand Cape Mount County with 14 sites and Grand Bassa County with 18 sites, a reflection of the smaller boats used by indigenous fishers (MOA 2007). The major fishing centres for the artisanal fishery are Monrovia, Marshall, Buchanan, River Cess, Greenville, Robertsport and Harper.

The artisanal fishery is estimated to provide a means of livelihood for about 33,000 full-time fishers and processors in both marine and inland waters, about 61% of whom are Liberians with 60% female participation (MOA 2007). The females are mainly involved in processing and trading of fish products, though there are female boat-owners.

Table 2: Annual artisanal landings from 1997 – 2008 (FAO 2010).

Year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2003**	**2005**	**2006**	**2007**	**2008**
Coastal Artisanal	2519	3757	3078	2973	1409	2890	3121	4500	3929	2971	7071	1588
Inland Fishery	4,000	4,000	4,000	4,000	4,000	4,000	3,600	3,200	2,800	2,400	1,743	763
Total Landing (Tons)	**6519**	**7757**	**7078**	**6973**	**5409**	**6890**	**6721**	**7700**	**6729**	**5371**	**8814**	**2351**

There are four types of artisanal fishing vessels:

a. the Kru dug-out canoe (Figure 5 A);
b. the standard canoe (medium-sized);
c. the large Ghana-type canoe (Figure 5B) (dug-out hull and planked) and,
d. the newly arrived Senegalese Canoe (20 m or more in length).

a. Kru Canoe b. Fanti Canoe

Figure 5: Artisanal vessels at beach landing sites in (a) Monrovia showing Kru canoe, and (b) Robertsport showing Fanti canoe.

According to the Bureau of National Fisheries (BNF), there are 3,473 canoes operating in the inland and marine fisheries, only 8% of which are motorized. Canoe sizes range from the one to three man Kru canoes, 5–7 m long, to 10-15 m long Fanti canoes. Most of the Kru canoes are hand-paddled or operated by sail with a few powered by 7-15 horsepower outboard engines. These are small dugout canoes deploying mainly hook and long lines and gillnets. The fifteen to eighteen man (10–15 m long) Fanti canoes are powered by 25-45 horsepower outboard engines.

The multispecies artisanal fisheries are exploited with a variety of gear including: ring nets and purse nets used for small pelagic species, with larger gillnets specifically adapted for different species and seasons, and cast-nets (Table 3). These account for about 40% of the artisanal landings (Ssentongo 1988). The newly arrived Senegalese and Gambian fishers operating in Grand Cape Mount County use set gillnets and long-lines. The average annual catch per canoe was estimates to be 2.2 tons in 2004 (BNF, 2006).

Table 3: Fishing gear characteristics and the target species for artisanal fishers (Source: BNF 2006, FAO 1988).

Fishing gear	Mesh size (mm)	Gear dimensions (Meter)		Target Species caught	Area fished	Fishing season
		Length	Depth			
Cast net	25.4–50.8	1–5		Bonga, mullet, *Sardinella*, Grunters,	Lagoons and estuaries up to 1 mile from shore	all year
Floating gillnet Number I Number II	152.4–228.6 76.2–101.6	65–70 30–60	2–3 2–3	Sharks, Tuna, rays, Croakers Mackerels, sharks, tunas	Approx. 4 miles from shore 1–5 miles from shore	all year all year
Bottom gillnet	76.2–101.6	30–60	2–3	*Dentex Spp*., Threadfins, Croakers, crabs, Grappers	Approx. 100 fathoms from shore	all year
Purse seine	38.1–44.5	200	20	*Sardinella*. *spp*., flying fish	Inshore	dry season
Beach seine	25.4 – 50.8	200–800	9–18	*Sardinella*, Croakers, Bonga	Beach area	all year
Hand lines		15 - 20		Barracudas, *Epinephelus*, *Sparidae*	Approx. 1–3 miles from shore	all year
Set hook and line		50 - 100	100–200 hooks	*Sphyraena spp*., Sparids, *Epinephelus*	Approx. 1–3 miles from shore	all year

2.5.3 The inland fishery

Liberia's inland waters provide an estimated 800 km^2 of water surface area. These comprise: coastal lagoons, rivers, floodplains, swamps, reservoirs and dams. These water bodies harbour rich fish fauna that supports major inland fisheries resources.

There are about 3000 km of rivers and tributaries (Vanden Bossche & Bernacsek 1990; Welcomme 1979) that traverse the country. Six main rivers flow across the country from the Fouta Djallon Mountains of Guinea. These are the rivers Lofa, Saint Paul, Saint John and Cestos (which have their lower courses entirely within the country); the Mano River (which forms the frontier with Sierra Leone); and the Cavalla (Cavally) River (which forms the frontier with Côte d'Ivoire).

There are also several smaller streams such as the Grand Cess River, the Sino River, Via River, River Gbe, River Sehkwehn and the Farmington River and countless perennial swamps and inland water bodies with enormous potential for increased production from inland fisheries and aquaculture. In addition to Lake Piso and major coastal lagoons and reservoirs there are several man-made lakes and dams around the mining towns of Bong Mines, and Tubmanburg which now support major inland fishing activities (personal observation).
The inland fishery sub-sector of the national fisheries of Liberia is poorly developed and largely traditional and subsistence-based, but is believed to contribute 25% of the fish consumed by rural dwellers. Even though data and information on inland fisheries is lacking, its development is of great economic and development importance (MOA 2007). The estimated MSY for the inland fishery is 40,000 Mt/year (Vanden Bossche & Bernacsek 1990). The sector was reported to have

landed 4000 tons of fish in 1987 (Vanden Bossche & Bernacsek 1990). FAO (2010) reported a total landing of 1743 tons and 763 tons from the inland sector for 2007 and 2008 respectively, showing a decline in fish landing. This trend is however due to lack of monitoring and availability of data from the inland sector.

The number of vessels and fishers operating inland is unknown but, there is at least one fisher in every rural household in riverine communities who are engaging in subsistence fishing. There are seasonal migrant fishers who come in from Guinea during the dry season to do commercial fishing inland (personal observation).

The inland waters support two major fisheries: a prawn fishery which targets the giant freshwater prawns, *Macrobrachium sp*., and is dominated by women, and finfish fisheries also dominated by women, exploiting mainly the smaller water bodies and the major rivers during the dry season.

Major species of finfish exploited by the inland fisheries include *Heterobranchus sp., Clarias sp., Barbus sp.* and *Tilapia spp*.. The exact number of freshwater species in Liberia is not yet known, but Asur (2006) identified 26 species belonging to 25 families in an assessment of water bodies in Bong County, Liberia, and Vanden Bossche and Bernacsek (1990) report 28 species for the Cavalla River.

Vessels used in inland artisanal fishers are small dug-out canoes (1-3 man capacity), operated with oar/paddle and rafts made from floating cock wood and often operated with long poles or attached to a rope tied across the river with which it is pulled back and forth.

A variety of gear is used to exploit inland waters. These include basket traps, water fences and fence traps, fixed gillnets, cast nets, hooks and line, hook and handline, pole and line and circular scoop nets of varying depths and diameters (personal observation).

2.5.4 Aquaculture

Aquaculture development begun at Suakoko, Bong County, in the 1970s, establishing 55 fishponds with technical support from donor projects to conduct research on *Oreochromis niloticus*. By 1985 this had increased to 200 family-type fish ponds and one fish breeding center (Vanden Bossche & Bernacsek 1990). Since then, this has reverted to a subsistence activity, with production estimated at 39 mt in 2004 (MOA 2007)**.**

Fish farming practices are mainly pond-based, in inland valley swamps with gravity flow irrigation systems. Though aquaculture development has been largely driven by donor support, it has remained largely a subsistence activity, with no major fish production and distribution taking place. Not much research has been done on developing local species for culture, as imported exotic species of Tilapia and Carp have been used (MOA 2007). At its peak in the 1990s there were about 3,600 fish farmers nationwide using 450 ponds of various sizes with a total area of about 17.5 ha, distributed in 159 communities around the country. However, because of the civil war, most of the ponds have not been used since the early 1990s. Some are now being rehabilitated, and BNF have estimated that the rehabilitation works in the early 2000s provided employment for about 700 women and youths.

The main culture species are Nile tilapia (*Oreochromis niloticus*) and Africa catfish (*Clarias gariepinus*), imported from Ivory Coast, and local species of Tilapia and catfish especially *Heterobranchus spp*. The Nile tilapia accounts for about 90% of total production (35 tons). African

catfish also imported in 2003, accounts for 1.3% (0.505 tons), while *Heterobranchus spp*. and local species of Tilapia account for less than 10%. The common Carp, *Cyprinus carpio*, was introduced in the 70s at the Central Agriculture Research Institute (CARI) from India but was not sustained due to the civil war. There have been very little attempts to identify local species of interest for aquaculture, or to improve them genetically (MOA 2007).

2.5.5 Current fisheries management system

Management of the fisheries in Liberia is mainly through input controls and technical measures. The objective is to regulate fishing effort and mesh sizes through registration of vessels and the monitoring of fishing activities. Regular inspection of gear and the deployment of inspectors onboard vessels and at fish landing sites are conducted to ensure compliance with rules and regulations governing the fishery sector.

The legal framework for managing the fisheries is provided under section 105 of Chapter 4, Subchapter C of Title 24 of the Natural Resources Law of The Republic of Liberia (1956), and by the "Penal law of 1956, Chapter 13, part I, Liberia code of Laws revised, 1999". The Natural Resources Law of 1956 empowers the Ministry of Agriculture, through the Bureau of National Fisheries, to manage and develop the fisheries sector, including making regulations from time to time, and licensing of vessels and gear.
Subsequent to this legislation, the 'Revised Fisheries Rules and Regulations of 1973' was drafted and in 2010, a new 'Marine Fisheries Regulations' was approved and gazetted for improving fisheries management by elaborating the powers of the coordinator and fisheries inspectors, and introducing new management regimes. Part II section 4(2a) of the new marine fisheries regulations of 2010 empowers the Minister of Agriculture to determine and enforce appropriate management measures for all sub-sector of the fisheries, including the allocation of access rights (TAC or Quota) to groups, including artisanal fishers. The fisheries regulation outlines various offenses and penalties, and also empowers fisheries observers and inspectors to inspect vessels, gears and premises of fishing entities to ensure compliance with regulations and to impose sanctions on violators.
The Ministry of Agriculture through the Bureau of National Fisheries is charged with responsibility to manage and coordinate all fisheries activities including:

1. Licensing and registration of fishery vessels
2. Development of aquaculture and inland fisheries
3. Conduct fishery research and fish stock assessment and management
4. Establish manpower development programs through collaboration with local and foreign partners (Bureau of National Fisheries)

2.5.5.1 Actual fisheries management practices

Fisheries management in Liberia is centralized and operates a licensing system for both industrial and artisanal fisheries, but also recognizes informal management practices that are consistent with rules that promote resource conservation and sustainability.

The management regime enforces licensing of all vessel (industrial & artisanal) fishing in the marine and inland waters of Liberia, mesh size regulations and fish size limitation on certain species landed even though it recognizes the right of all citizens to engage in subsistence fishing.

The actual management practice is to license all vessels, which meet a certain licensing condition, to fish in Liberian waters and to assign fisheries inspectors to all registered industrial vessel to monitor fishing activities at sea (on-board-observers). Records of catch and landings are taken by fisheries inspectors onboard vessels and at the Freeport of Monrovia. Artisanal landings are recorded at selected landing sites.

The licensing requirements are seldom met by vessels as it is common practice to prioritize revenue collection. Compliance levels are very low for mesh size regulation, fish size limits, endangered species protection, and fishing zones restrictions by both artisanal and industrial vessels. Even though these are finable offenses under the law, weak enforcement capacity of the BNF and a weak and frustrating judicial system allows violators to go unnoticed and/or unpunished.

2.5.5.2 Traditional fisheries management practices

Fisheries management in the rural communities of Liberia is largely based on cultural and traditional beliefs and practices, and is 'community-based'. Even though the government of Liberia owns all natural resources including land, water, forest and mineral resources, this is with respect to their traditional and customary ownership by tribal clans and chiefdoms. Therefore communities who have traditional ownership of land containing water bodies (including rivers, lakes, lagoons and estuaries) are found to exercise management control over them.

The description of traditional fisheries management practices in Liberia, outlined in this report, are exclusively based on those observed by the author in Liberia, especially in parts of Bong and Lofa counties.
The management of fisheries in inland and community-owned water bodies is guided largely by traditional rights and ownership, and administered through traditional beliefs, customs and practices that are handed down from one generation to the next. Observed management practices include closed seasons, closed areas, restrictions on fishing method and gear, and the amount of catch.

Closed seasons are observed during the rainy season (June to December) when the rivers flood their banks and are considered dangerous for fishing by females due to high water levels and current. This also coincides with a period of the farming seasons when women, who are the major fishers, are engaged in planting and weeding of rice farms. During this period the men, who have finished their share of the farming work, are allowed to do hook and line fishing and to lay baskets and traps. The closed season ends when the water levels are low and considered safe. During this time the women have finished harvesting the rice farms and are allowed to go fishing in small organised groups up to the day of the fishing festival which takes place between February and May each year. It is cultural in most rural communities to hold a 'fishing festival' once a year on major water bodies that are often shared by different clan communities. These are the times women from all communities within a clan who 'own' segments of the river converge to a common starting point (usually up stream) and fish down to the boundary with an adjoining clan.

Closed areas are often imposed on segments of rivers, creeks and streams to honor traditional beliefs and customs. These protected areas (PA) serve as a sanctuary for many valuable fish species. Traditional PAs are used for ancestral spirit worship and are non-fishing areas. A number of these PA are found along the Via river, in Zorzor district of Lofa County, Liberia. Traditional PAs are also established to protect species believed to have ancestral significance. One of such PA is found at Bawota in Bong County, where the capture and eating of *Heterobranchus sp.* in a certain segment

of creek is forbidden. Consequences of death or other mysterious happenings are said to await persons who violate these local taboos.

Restrictions on fishing methods and gear types are also imposed by traditional authorities based on common beliefs and practices. For example, it is against tradition to erect a water fence across the width of a river or creek. There must be openings to allow free movement of organisms up and down stream. Additionally, for fences constructed along river tributaries for the African catfish (*Heterobranchus spp*.) during their spawning migration, open-ended baskets are used. This allows the species free passage upstream where they will spawn before being captured on their return journey.

Though it is not known how communities in other parts of Liberia react to the presence of migrant commercial fishermen on their waters, those in Lofa tend to frown and often stop them from fishing because they are said to be 'catching too much fish and will deplete the fish stock'. Communities here favor moderate, subsistent utilisation of the resource aimed at ensuring a sustainable daily supply of fish to community households (personal observation).

3 THEORY OF COMMUNITY- AND RIGHTS-BASED FISHERIES MANAGEMENT

Global marine capture fisheries have seen stagnation in capture production for the past 10 – 15 years. FAO (2009) reports that 80% of the world fish stocks for which assessment information is available are fully or overexploited and, thus, requiring effective and precautionary management. Fisheries management experts have attributed fisheries resource overexploitation and degradation of coastal environment to either lack of fisheries management or misguided management regimes heavily centralised under agencies of government, with no recognition of the capability of fishers to contribute to effective management of coastal resources (Hannesson 1994; Pomeroy, 1996). The centralisation of many fisheries administration and management regimes around the world and their limited capacity to monitor and enforce fishing in fishing grounds that are often remote, have resulted to management failures and the overexploitation of many fisheries. Therefore, there is a need for an alternative approach to management that will lead to more effective and sustainable management of fisheries resources.

It is well known that the common property management regime is the fundamental reason for fish stock overexploitation (Harding 1968, Arnason 2007a). Various management options involving the participations of resource users (fishers, communities and groups involved in the direct harvest of fish stock) have been proposed for solving the "problem of the commons" which plagues open-access fisheries making them difficult to manage since no one conserves a resource that belongs to everyone (Arnason 2001).

3.1 The fundamental fisheries problem

The biomass of many fish stocks is big enough during the early development phase of the fishery to generate good catches and allow the fishermen earn a high return on their investment and effort. According to Arnason (1993), under a common property management regime this encourages more investment and increased fishing effort as new fishermen are attracted to the fishery. This reduces the fish stock and consequently the net profits gained by fishermen. But while profits remain positive fishermen will continue to invest in the fishery. As fishing effort rises, stock biomass further

declines, resulting in a corresponding decline in catch per unit effort and, inevitably, a reduction in economic benefits from the fishery (Arnason 1993).

Fishing capacity continues to increase as long as the fishermen get a positive rate of return from the fishery. As a result, fish stock biomass is reduced far below the maximum sustainable yield (from point A toward point B in Figure 6a and from point E toward F in Figure 6). At any point of biomass along the adjustment path (Figure 6b), if revenues exceed cost of fishing they provide an incentive for fishers to increase fishing effort until an equilibrium point is reached at point F or, equivalently, point B in the sustainable diagram (6a) (Arnason 1993). At these points, expansion stops, as revenues equal the cost of fishing, thus providing no further incentive for investments in the fishery.

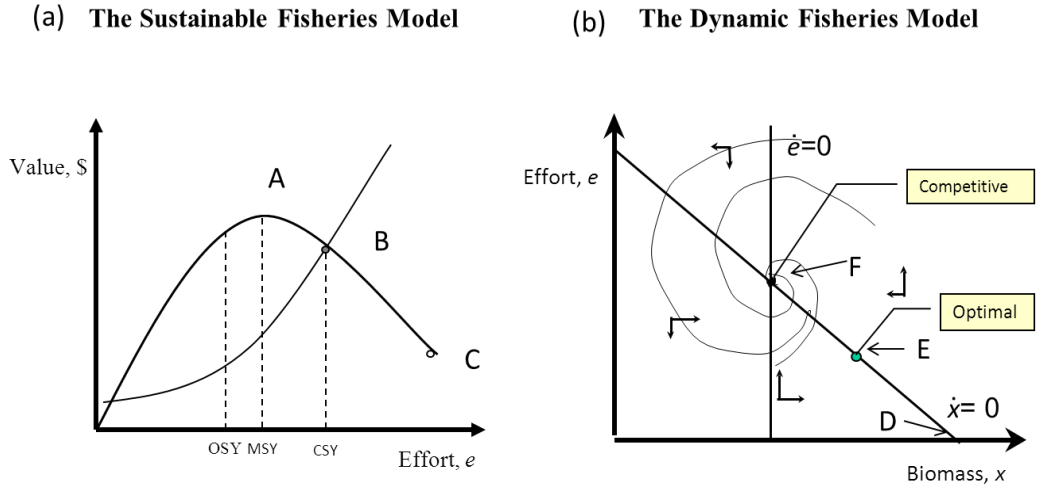

Figure 6: The sustainable and dynamic fisheries models showing revenue and cost functions, and the adjustment path of biomass towards equilibrium (Adopted from Arnason 2008).

3.2 Theoretical considerations of fisheries management regimes

Because of the fundamental fisheries problem discussed above, fisheries management is necessary (Arnason 2007). A fisheries management regime (FMR) is the institutional framework — explicitly set by law or implicitly by social customs and traditions — under which fishing activities operate. The FMR consists of three key components: (i) the Fisheries Management System (FMS) (ii) Monitoring Control & Surveillances (MCS) and (iii) the Fisheries Judicial System (FJS) (Arnason 2007b). The FMS is basically a set of rules that the fishing activity has to obey. The MCS is essentially the enforcement of these rules – policing. The FJS assesses guilt and innocence and issues sanctions to those found guilty of violating the rules.

All three of these components are necessary for fisheries management to work. If any of them fails, the fisheries management as a whole fails. Therefore, any effective fisheries management regime must include all three components and maintain them in good order.

Fisheries management regimes have evolved, over the centuries, to address the problem of common property in fisheries. These range from the traditional management systems in coastal and inland fisheries in Asia (Pomeroy 1996), and the tenure system in the Japanese fisheries (Oliva & Yamao

2006) to rights-based Individual Transferable Quota (ITQ) system based on total allowable catch (TAC) in Iceland (Arnason 2001; Runolfsson & Arnason 2001).

3.2.1 Fisheries management systems

There are a very large number of possible fisheries management systems (Arnason 2007a). However, Arnason (1993, 2007a) has argued that they can conveniently be grouped into two broad classes: (1) biological fisheries management, and (2) economic fisheries management which can be further divided into (a) direct restrictions and (b) indirect economic management (Figure 7).

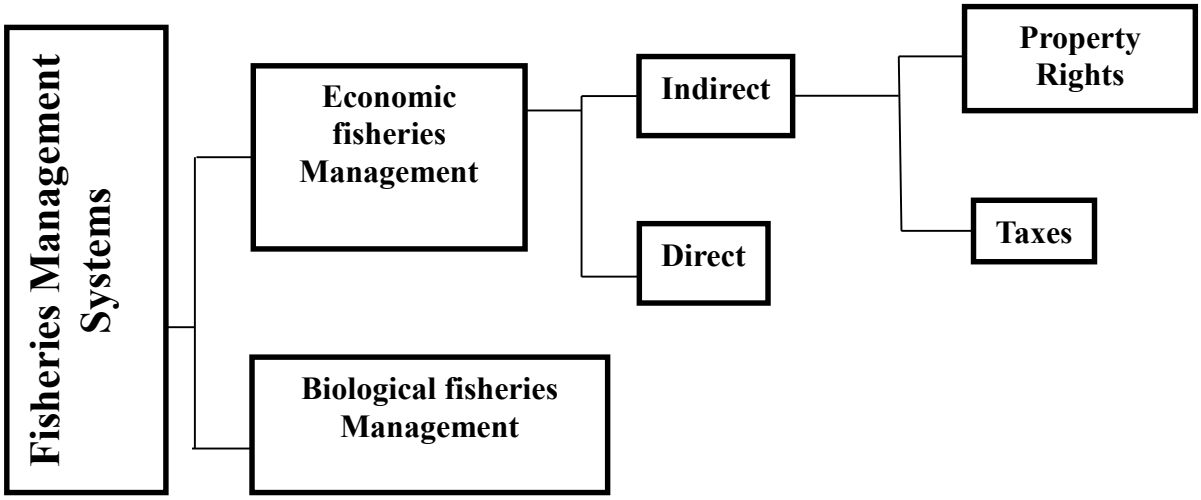

Figure 7: Classification of Fisheries Management Systems (Arnason, Per. Com.)

3.2.1.1 Biological fisheries management

The objectives of biological fisheries management, such as closed area, closed seasons, gear restrictions, and total allowable catch, are to conserve fish stock and to promote stock enhancement (Arnason 2001). However, the enforcement of biological restrictions is costly (Arnason 2002, 2003) and the benefits small and transient because these methods do not remove the common property problem. Therefore, fisheries management based on this approach tend to generate negative economic gains Arnason (1993).

3.2.1.2 Economic fisheries management

Direct restrictions

Economic fisheries management is concerned with ensuring that fishing effort is kept at the optimal level (E) as shown in Figure 5b, by restricting number of vessels and vessel size, engine capacity (sizes), number of traps and nets, fishing time etc. These restrictions, however, are ineffective in eliminating the common property problem of the fisheries resources (Arnason 1993), as fishers tend to invest in improved and more efficient methods of harvest which are within the limits of the law. At the same time setting and enforcing these restrictions is costly. Therefore, just as in the case of biological fisheries management, fisheries management based on direct restrictions tends to generate negative economic gains Arnason (1993).

Indirect management

Indirect economic fisheries management methods work by altering the incentives of fishers. These methods can be shown to be capable of achieving economic efficiency of the fishery on a sustainable basis (Arnason 2003, 2007a). The indirect methods include taxes and property rights-based fisheries management systems such as access rights and individual quotas.

(a) Taxes

Taxes as a fisheries management tool can be used to adjust the economic condition of fishing firms so as to induce a more socially optimal behaviour (Arnason 1993, 2003, 2006). Taxes on the volume or value of catch are the most effective and will lead to reduction in fishing effort to more economically sustainable levels. Taxes as a fisheries management tool are, however, subject to socio-political constraints and are often not politically feasible.

(b) Property rights-based fisheries management systems

Fisheries management systems based on property rights are seen as the most effective approach for eliminating the common property problem. This they do by establishing private property rights in harvests which creates indirect rights in the fish stock (Charles 2006). Property rights-based management systems limit the scope of the open access externality (Arnason 2000; Ostrom 1990). The development of property rights-based management regimes has significantly improved the socio-economic benefits and sustainability in many fisheries around the world (Arnason 2003; Ward and Keithly 2000).

Property rights are productive in the sense that they minimise conflicts over access to resources and provide incentives for owners of the resources to make them as productive as possible. Since the source of the economic problem in fisheries is the absence of property rights, property rights management systems should, in principle, be successful in securing maximum economic gains from the fishery (Arnason 1993, 2006).

There are many types of property rights systems. According to Arnason (2001), Sutinen (2003), Willmann (2000), numerous forms of property rights have been employed to solve the common property fisheries problem. But the most commonly used of these are access licenses, territorial user rights (TURFs), individual quotas (IQ), individual transferable quotas (ITQ) and group or community fishing rights (Arnason 2006). Sole ownership is a form of property right that is seldom used in fisheries.

(i) Licences

In practice, fishing or access licences do not eliminate the problem of common property among the licence holders. It may alleviate the problem especially in the situation when the number of licence holders is low and held for some years (Arnason 2001).

(ii) Sole ownership

According to Scott (1955), sole ownership is not monopoly but merely complete appropriation of natural resources in a particular location. Putting a resource into sole ownership is sometimes called making a resource "specific" to one owner. A sole owner could either plan to economise on the use of fishing effort by adopting labour-saving techniques. However, if a sole owner expected to have permanent tenure, then in short time the fishery would probably be quite different from a

competitive fishery. The sole ownership keeps the future return from the fishery as high as possible while maximising current income (Scott 1955). This is true only if the other enterprises in the economy are run by a purely free market economy. However, most of socio-political policies in many countries do not support sole ownership of the fisheries resources.

(iii) Individual quotas

The Individual Quota system (IQs), especially Individual Transferable Quotas (ITQs) offer in many respects the most effective general approach to managing fisheries resources to alleviate the common property problem, and for generating resource rent and increased profits (Arnason 2000, 2001; Sutinen 2003). A quota allows a firm to manage its fishing in an efficient way, but not in competition with other firms. The IQ system seems to be more economically efficient than other systems, even though it poses a challenge for adequate monitoring and enforcement, and for determining total allowable catch (TAC) for allocating quotas to fishing entities (Arnason 2001).

IQs have been introduced by several fishing nations around the world and has proved an effective fisheries management system (Arnason 2001; Sutinen 2003). Countries which have implemented Individual Transferable Quota (ITQ) in most of their fisheries include Iceland, New Zealand, Australia, Canada, Holland, Greenland, Namibia, Peru and Chile. Others which use ITQs in their fisheries include USA, Portugal, Mexico, Mozambique, Norway, Denmark and Poland (Arnason 2001; Sutinen 2003).

(iv) Territorial user rights

Territorial User Rights in Fisheries (TURFs) is the exclusive right to engage in fishing within a certain specified geographical location (Charles 2006). It is a system most applicable for sedentary species and inland water bodies and lakes. The system gives the TURF holders the motivation to control and conserve the environment. TURFs have been employed in the lobster fishery in the northeastern USA and coastal fisheries of Japan (Arnason 2001), and are quite widely used in Asia and other parts of the developing world. TURFs have also been used in traditional and small-scale fisheries to preserve social organization and reduce conflicts (Panayotou 2000).

(v) Community rights

Community or group rights is another form of property rights-based fisheries management system where communities or groups of fishermen are given exclusive rights to use or manage a fishery resource. According to Arnason (2006) and Willmann (2000), interest in community fishing rights has increased as an alternative in situations where other rights-based approaches such as ITQs cannot be implemented for socio-political reasons or because of enforcement problems. The theory on the economic efficiency of community-based rights is poorly established, but preliminary results are promising (Arnason 2001). According to Charles (2006), community rights in fisheries come in two forms: the right to utilize the resource in the form of a communal quota allocation or within a defined territory (as in a TURF) and the right to manage or share in the responsibility for managing the resource. Though some types of community fishing rights go a long way towards solving the problems of enforcement and socio-political opposition often associated with ITQs and other property rights regimes, according to Arnason (2006), it does not constitute a fisheries management regime and therefore, the community is still faced with the problem of resolving the common property problem in the fisheries.
Traditional or local community-based management has a long history of existence in many countries in the world. Pomeroy (1996) attributed the weakness or failure of the majority of these

traditional fisheries management systems to their restructuring by governments, the evolution of centralized administrations coupled with technological development and modernisation.

A number of long enduring community-based fisheries management still exist in some countries in Asia, Africa, and the developing world. Many fishing communities still maintain some level of informal or traditional fisheries management rights as is evident by the tenure system of community fishing rights in the inshore fisheries of Japan (Oliva & Yamao 2006). Empirical evidence has shown that community fisheries rights can provide an efficient and equitable system for extracting and distributing resource rents (Arnason 2006; Charles 2006; and Sutinen 2003). Arnason (2003) pointed out that if community fishing rights are to produce an economically efficient outcome, they must be of very high quality. Also it has been argued that the size of the area that will be managed by a community should be defined in relation to the costs and benefits involved (Pomeroy 1996). However, community management of fisheries is normally tricky. One reason is that the community must impose an effective fisheries management system. Another is that most fisheries resources are migratory. It is therefore the obligation of governments to provide a legal basis to manage the fish stocks under appropriate management regimes depending on socio-political situation of the individual countries which share transboundary stocks.

3.3 Monitoring, Control & Surveillance (MCS)

A successful FMR is characterized by an effective monitoring and enforcement program (MCS) and an effective and expeditious judicial system to ensure compliance with rules and regulations governing the fisheries and to adjudicate cases of infraction in keeping with laws.

Monitoring Control & Surveillance (MCS) is to observe the activities of the fishing industry, and to enforce its adherence to the rules of the FMS (Flewwelling *et al.* 2002). It is to collect data about the fishery that can be used to improve the fisheries management and judicial systems, and the MCS system itself (for example, patrols, violations, and recording landings, all of which may help refine the efficiency of MCS procedures).

- **Monitoring** is the continuous measurement of fishing effort characteristics and resource yields. It includes measurements of catch, species composition, fishing effort, bycatch, and area of operation (Flewwelling *et al*. 2002).

- **Control** are the regulatory conditions under which the resource may be exploited, and usually consist of legislation, regulations, and international agreements, each of which should describe the management measures required and the requirements to be enforced. The management measures may include establishing designated fishing areas (fishing zone demarcation), restrictions on type of fishing gear, catch and quota controls (by species or total take), vessel movement controls, on-board observers, licensing, and vessel inspection.

- **Surveillance** refers to the extent and types of observations required to maintain compliance with regulatory controls imposed on fishing activities. Surveillance provides the means through which the activities of both legal and illegal vessels can be detected, and may involve the use of radar, airborne, and spaceborne systems, and vessel monitoring systems (VMS) to provide information to fisheries management.

Activities under MCS can generally be divided into two categories: **Data Monitoring** (gather data on the fishery and fishery operations for the purpose of management, including biological and

economic data), and **Enforcement Monitoring** (to establish regulatory framework and to detect and report violations of established fishery rules.

3.3.1 Fisheries Judicial System (FJS)

The **Fisheries Judicial System (FJS)** is an integral part of the FMR, and is intended to process alleged infractions for the application of appropriate sanctions upon conviction. The FJS should be designed with respect to the criminal laws and judicial system of the state, but must ensure the following:

- A clear legal basis and well defined violations with clear stipulations of the burden of proof,
- The speedy processing of alleged violations, through administrative fines or special courts, and with lawyers who are knowledgeable in both fisheries and maritime issues,
- A high probability of a fine or penalty for violations, and
- High penalty for violations, to serve as a disincentive to fishers who will want to violate for benefit.

The legal bases for most FJS are domestic law and, as regards foreign fishing, the United Nations Convention on the Law of the Sea (UNCLOS), which gives coastal nations jurisdiction to exploit and manage fisheries resources within 200 nautical miles of their coastline, and the FAO Code of Conduct for Responsible Fishing (CCRF) (Flewwelling *et al*. 2002).

3.4 Who does the fisheries management? Power sharing

The fisheries management regime is one thing; another thing is who runs it. This is the question of how fisheries management power is shared between social groups. Traditionally, under the unmanaged, common property or common pool arrangement, the fisheries management regime, for what it was worth, was operated by the fishermen and possibly the social groups to which they belonged (Ostrom 1990). Nowadays, in most countries, formal governments, often the national government, have assumed much of the power for fisheries management. This power is exercised by setting fisheries management rules (i.e., the fisheries management system) and enforcing them by setting up formal MCS-system and submitting cases to the courts (FJS). Nevertheless, in spite of the almost universal rule of government sovereignty, a degree of power sharing between the government, fishermen and fishing community is almost invariably in place. This is typically referred to as co-management (Figure 7). To what extent the fisheries management power resides with the government and to what extent with the fishers and their communities varies from one country and one fishery to another.

The form of community-based management varies and will depend on the degree of delegation of management responsibility and authority between local community and government. As illustrated in Figure 8, it can vary from different degrees of partnership arrangements between government and fishers or local community (**co-Management**) to a 100% community management **(self-management)**. To the right of the diagram communities have more power and responsibilities in making management decisions. Depending on the strength and capability of the community it can result in self-management, as the government will devolve management authorities and responsibilities of the fisheries completely to the community. In the middle is co-management, with responsibilities shared between the government and local community, though in different degrees.

The question of power sharing or degree of co-management is not only a question of power. It is also a question of the most effective way of running the fisheries management regime. In many

cases, decentralisation, i.e. a high degree of self-management in fisheries, has great advantages in terms of the effectiveness of the fisheries management regime.

Managing fisheries resources with the involvement or participation of resource users (fishermen, fishing entities, fishing communities and groups) constitutes a community fisheries management (CFM) system. The success of community fisheries management initiatives depends on the strength of the local organisation and its ability to ensure compliance from its members and to enforce agreed rules and regulations, and on government policy to establish the legal bases granting the necessary rights and authority to manage the fisheries (Pomeroy 1996).

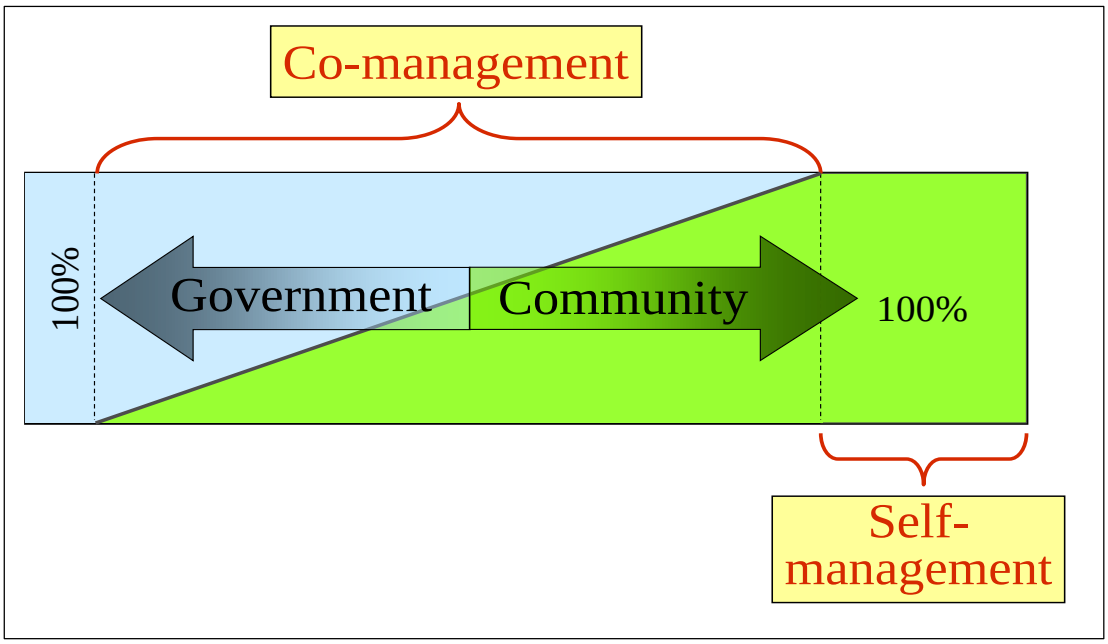

Figure 8: The sharing of responsibilities between government and community in natural resource management (Arnason, per. com.)

According to Arnason (2003), CFM exhibits several attractive properties. It (i) may lead to economically efficient fisheries, (ii) may reduce enforcement cost, (iii) will decentralise fisheries management, and devolve power and authority to communities thus giving them greater control over resource exploitation and management. Arnason, however, pointed out that the efficiency of CFM depends on the quality of the community rights and the overall set-up of the community organisation.

3.5 Why Community Fisheries Management (CFM)

The failure of centralised fisheries management regimes in many parts of the world, including Liberia, to achieve resource sustainability and economic efficiency suggests that community –based fisheries management (CFM) may be a preferable arrangement. The management of small-scale coastal fisheries by centralised administration is often challenging due to the extent of their spread along the coast, the poor state of essential infrastructures and institutions and more fundamentally the difficulties of enforcement. Additionally, central administration is often too overwhelmed by budgetary, logistical, technical and manpower constraints to be any significant presence to enforce management measures within fishing communities. Moreover, CFM is a participatory management system that will devolve local ownership and enforcement responsibility to fishers, and has been recommended by the "Draft Marine Fisheries Law of 2010" and the "New Marine Fisheries Regulations of 2010" (GoL 2010) for management of small-scale artisanal fisheries in Liberia.

CFM, therefore, may be the most appropriate management option for the small-scale artisanal fisheries in Liberia, as it provides low-cost and more efficient means for monitoring the activities of artisan fishers, and for accessing relevant information and local knowledge for sustainable management of the coastal artisanal fisheries. CFM, thus, may greatly reduce the socio-political problems associated with fisheries, and improve the socio-economic welfare of fishers. CFM has the following advantages over centralised management: (i) information gathering and processing (ii) incentives (iii) responsibilities.

Information gathering and processing

The availability of data and information (biological, economic and social) is the basis for effective fisheries management. It is known that fishers and their local communities possess the most complete information concerning their fisheries and their fishing operations and a great deal of information about the available fish stock and the prevailing biological and environmental conditions. Therefore the fishers' involvement in the management process would provide valuable wealth of local or indigenous knowledge to supplement research-based scientific knowledge to improve fisheries management decisions (Pomeroy 1996, Arnason 2003). Moreover, in the communities, this information is at hand and, often, common knowledge. Therefore, it can be accessed and processed cheaply.

Incentives

In a CFM, where fishers basically take many or most of the management decisions, there are great incentives for all fishermen to adopt the most effective fisheries management system and for drawing accurate conclusions from the available data, or they risk losing their own money. This is in contrast to the centralised authority (Arnason 2003) where it is difficult to collect data, and remunerations are not directly affected by the quality of fisheries management.

Responsibilities

Under a CFM arrangement, communities have the primary responsibility to ensure that the fisheries are efficiently and sustainably managed (Arnason 2003). It is less likely that in case of mismanagement social safety nets will be as easily forthcoming as when the central authority fails in its fisheries management function. The communities, in effect, own the fishery and will be the beneficiaries of good management and pay the price of management mistakes.

3.6 Design principles for an efficient Community Fisheries Management

The success of community fisheries management is dependent on certain features of the communities and the rights they are given (Arnason 2003; Ostrom 1990). These may be referred to as the CFM 'design principles'.

Ostrom (1990) outlines her design principles for successful management of common pool natural resources as: clear boundaries and membership, congruent rules, collective choice arenas, monitoring, graduated sanctions, conflict resolution mechanisms, recognized rights to organize and nested units. She associates community management failures with non-adherence with three or more of the design elements.

On the other hand, the Arnason design principles attempts to increase the likelihood that the community fisheries management game will lead to an efficient outcome. These principles may be regarded as design principles for setting up the community fishing rights (CFR) and they will be referred to as follows:

i. The community fishing rights (property rights) should be as high quality as possible.
ii. Communities should consist of as homogeneous a group as possible.
iii. Community decision-making rules should be clear and effective.
iv. Communities should, if possible, be set up so that each member's pay-off is an increasing function of the aggregate pay-off. (Arnason 2003)

CFM only devolves the right to manage the fishery to a group of people, the community, but does not constitute a fisheries management system (Arnason 2003). Within a CFM system the members of the fishing community find themselves in a co-operative game situation in which everyone playing can be better off depending on the collective decisions made. In the game members can communicate and, we will assume, form binding agreements. However, it is known that the outcome of this kind of a game can be far from optimal.

3.6.1 Property rights

Property rights are the major requirements for economic progress (Arnason, 2006). In fisheries, property rights have proved to solve the fisheries problems of common property (Sutinen 2003; Scott 1988; Arnason 2000). Property rights bring about privileges for resource use and the rules and conditions under which those privileges are exercised (Arnason 2006; Charles 2006). Thus, by giving communities the rights to their fisheries, communities will be in a position to maximise the benefits therefrom and, accordingly, improve the overall management of the fisheries.

The arrangement of assigning collective rights can be referred to as community fishing rights (Arnason 2003; Charles 2006). Contrary to individual rights in fisheries, community property right is a collective right allocated to a group of resource users.

According to Arnason (2003) allocating community fishing rights is likely to improve the efficiency of the fisheries compared to management by the central authority. This notion is based on three fundamental reasons. First, given that the communities own and derive substantial benefits from the resources, the communities will tend to manage the fisheries better than the centralised authority. Secondly, since communities choose their own fisheries management policies it is likely that the communities will be able to enforce these management policies more effectively and less expensively than the centralised government. Lastly, allocating community fishing rights is decentralising the fisheries management responsibilities. By so doing, the government is

streamlining its responsibilities. Thus the effort that is usually allocated to managing the particular fisheries could be allocated to promoting other economic activities which would contribute to the overall economic efficiency of the country (Arnason 2003; Raubani 2006).

To ensure efficient CFM, the allocated property rights should be of high quality, meaning the rights must be secure, exclusive, permanent, and be transferable (Arnason 2003, 2006). The higher the quality of the property rights, the higher the efficiency of the CFM. On the other hand, if the property rights are of low quality, achieving efficient CFM is difficult and usually leads to low efficiency (Scott 1988).

The quality of the property rights has the following characteristics:

- Security
- Exclusivity
- Permanence
- Transferability

Security

Security means that the rights cannot be taken away. If they are challenged, the rights holder must have the ability to withstand the challenges to maintain his property. It can be thought of as the probability of the rights holder to maintain his property. The probability can be measured from 0 to 1. A measure of 0 means that there is no security and the rights holder will certainly lose his property. Alternatively, a measure of 1 means security is very high and the rights holder will certainly maintain his property (Arnason 2000 and 2003).

Exclusivity

Exclusivity means that others cannot infringe on the rights of the holder. It also means that the rights holders are free to utilise the rights in any way they wish. Thus exclusivity is the ability of the rights holder to keep others away and utilise the rights without being infringed upon. It is important to note that enforcement plays a critical part in exclusivity. This means that for total exclusivity, the rights holder must ensure effective enforcement (Arnason 2000 and 2003).

Permanence

Permanence means the rights holder has permanency to the property right. It refers to the time span that the rights holder can hold onto the rights. This duration ranges from zero to infinite. Zero means the rights are worth nothing. If possible, the rights should be protected by law. If the rights are withdrawn or transferred, the rights holder has to be compensated (Arnason 2000 and 2003).

Transferability

Transferability simply means the ability of the rights holder to transfer the rights to other communities or anyone they wish. This is vital to ensure higher economic efficiency. For instance, if the rights holder is less efficient than someone else in utilising the right, he should be able to transfer the rights to the more efficient entity (Arnason 2000 and 2003).
According to (Scott 1988), it's easy to visualise the perfect characteristics of property rights measured along a four dimensional axes (Figure 8). Property rights can exhibit all four characteristics to a greater or lesser extent. They can be measured on a scale of 0 to 1. A measure

of zero means that the property rights do not have all four characteristics. Alternatively, a measure of 1 means that the property rights are perfect along each dimension.

The following diagram illustrates a perfect property right, an ideal impossible to attain in the real world, and an imperfect property right which is totally circumscribed by the perfect property right.

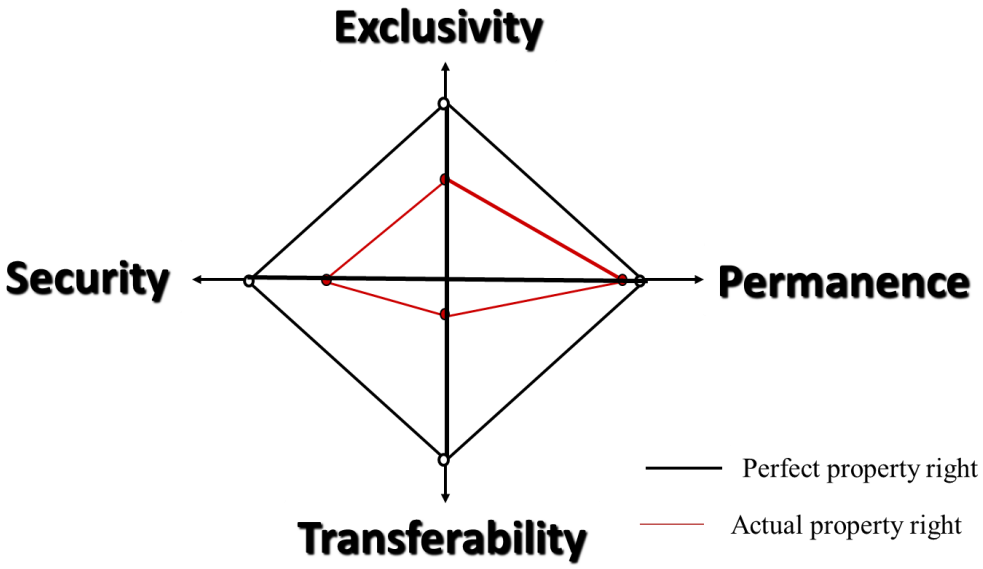

Figure 9: A four dimensional axes diagram mapping a foot print of the characteristics of property rights (Arnason 2000).

3.6.2 Communities should consist of as homogeneous a group as possible

To maximise the likelihood of efficient fisheries management, communities should consist of as homogenous a group as possible. Preferably, it should only contain those who share a common interest in fisheries, e.g. the fishermen. It does not of course necessarily mean all members of the community, but those who are responsible for making the decisions. This is important for bargaining towards an efficient fisheries policy. Consider for example if the community is homogeneous consisting only of fishermen, they would want to see a fisheries policy that maximises their profits. Therefore the bargaining game will result in a fisheries policy that would converge to a point that ensures maximum profits, most certainly at the optimum sustainable yield (Arnason 2003).

3.6.3 Communities' decision-making rules should be clear and effective

Another important aspect of ensuring an efficient CFM is that communities should be set up according to certain pre-assigned rules for decision making within the communities. Under this condition, transaction costs will be reduced as the process of accomplishing a path towards negotiating equilibrium is facilitated (Arnason 2003).

3.6.4 Communities should, if possible, be set up so that each member's pay-off is an increasing function of the aggregate pay-off

For an effective CFM, it is extremely helpful that the communities be set up so that each member's pay-off is a cumulative function of the total payoff. This can for instance be achieved by first

allocating individual quotas (ITQs) to community members to ensure that they all have a share of the property rights. Another way is to have the community organized as a limited liability company with members as shareholders (Arnason 2003).

3.7 Empirical experiences

The outcomes of community-based management of common pool resources vary. Some work well. Others work badly. Even more tellingly, those who worked the worst have probably disappeared already. It appears that the outcomes of CFM depend to a large extent on the resource involved and the design of the community management unit, its design principle (Arnason 2003; Ostrom 1990; Cox *et al*. 2010), and, in addition, leadership, social capital and incentives (Gutierrez *et al*. 2011). This section outlines a number of empirical examples of common pool natural resources, especially fisheries, which have been successfully or unsuccessfully managed, and the factors leading to their management successes or failures.

Cases in fisheries in which community management has been unsuccessful

Two Turkish inshore fisheries at Bodrum and the Bay of Izmir on the Aegean Sea were characterised by the problem of lack of exclusivity of rights and heterogeneity of membership which led to their failure. The fishery at Bodrum was characterized by overcapacity due to non-restrictions on new vessel entry and limits on the sizes of vessels lured into the fishery as a result of the financial success of trawlers already operating, leading to a sharp decline in catch per unit effort (cpue), and in revenues, rendering the fishery not profitable (Ostrom 1990). A new fishery (charter fishing) developed alongside a booming tourist trade encouraging more new entrants into the fishery. There emerged conflicts among the new entrants, small-boat fishers, and the trawlers, with no conflict resolution mechanism in place. There were also several heterogeneous groups with distinct interests competing for the resource (Ostrom 1990).

At Izmir, high demand for fresh fish resulted to overcapitalisation of the fishery, with too many small boats chasing after too few fish (Ostrom 1990). There was also heterogeneity in the groups involved at Izmir as there was in Bodrum. Ostrom (1990, p. 145) attributes the failure of the fisheries in Turkey to the following:

> "…the opportunities for quick economic gain, the large number of fishers, the internal division of the fishers into distinct subgroups with conflicting interests, and the lack of an overarching institutional mechanism in which local rules and conflict-resolution mechanisms could be designed."

In the village of Mawelle, in Sri Lanka, the inability of government officials to enforce additional rules to prevent new entry into an inshore fishery resulted in its failure. In Mawelle fishers were engaged in three types of fishing technologies: large beach seines used to catch shoals of anchovies and similar species, small traditional craft that use "bible" nets and fishing lines to obtain anchovies, squids and rockfish, and deep-sea fishing for tuna off the continental shelf (Ostrom 1990). There was a problem of overcapitalisation, with 100 beach seines being used on a beach which had room for the simultaneous use of only two nets.

Even though the fishers at Mawelle had devised elaborate rules regulating access to the beach and the use of the beach seines they were not able to enforce an entry rule to limit the number of nets to be used. National officials failed to enforce entry rules limiting the number of nets for political reasons, undermining the rotational system which the villagers had arranged, and encouraged 'free-

riders'. There were no opportunities under the governance system for local discussion or local decision making at a constitutional or collective-choice level. The external regime did not allow local rule determination and enforcement (Ostrom 1990).

In Eastern Canada, particularly in villages in Nova Scotia and Newfoundland, fishers have developed their own rules to govern the use of the nearby fisheries. In the village of Port Lameron, there are two fisheries: an inshore fisheries operated by 42 smaller boats (average crew size of 1.8) and an offshore fishery operated by 10 small boats (average crew size of 2.5). There are differences in value, size, and technologies between the inshore and offshore fishing boats and they operate in different zones of the fishing ground which is subdivided based on the type of fishing technology.

The claims of the fishers to their fishing ground was based on tenure, and its division according to technology greatly reduced the externalities that the use of one technology may impose on others, and constituted a low-cost system for distribution of the resource to all stakeholders, and for monitoring (Ostrom 1990). The fishers policed their fishing zones as they saw the problem of enforcement as theirs, and has a system through which complaints and conflicts were resolved.

The community rule system was not recognized by the Federal government which has jurisdiction by law for the conservation of fisheries resources and for its distribution among competing users. An attempt to regulate inshore fisheries through licensing of vessels and gear (net) types and to seize illegal nets without prior notice resulted to a two-fold increase in the number of licenses granted as to the number of fishers actually fishing, and an ensuing conflict in the community. The scale of protest which followed led federal officials to halt enforcement of the new measure. The failure of government to recognise and strengthen locally developed rules to access and use of an inshore fishery proved counterproductive and resulted to their failure to gain control of some inshore fisheries in Eastern Canada (Ostrom 1990).

Cases in which fishers have sustainably managed their resources

In Japan a number of inshore fisheries have traditional community rights and are considered to have one of the most successful marine community based fishery management regimes. The success of the Japanese rights-based fisheries management regime is based on centuries-old institutions and mechanisms to ensure stakeholder participation, and to provide an arena for collective decision-making and conflict resolution. As has been discussed by Oliva and Yamao (2006), community management of coastal fisheries in Hiroshima Prefecture is further strengthened by government policies and laws, giving Fisheries Cooperative Associations (FCA) or Fisheries Management Organizations the power to negotiate agreements among fishers for the purpose of conducting resource management, which are then confirmed by government as laws. FCAs, prefectural and national governments are involved in a variety of complementary measures to manage the fisheries. The primary objective of fisheries management in Japan is to maintain social equity in fishing communities through consensus-based decision making practices in FCAs (Oliva and Yamao 2006).

The growing interest in community desire to take on fishery rights in Canada can be traced to a number of factors including the negative impacts of growing concentration of control in Atlantic fisheries and a lack of governmental enforcement of policies (Charles 2006). This led to a series of protests and strategy meetings in the mid-1990s, which produced several new improvements in the fishery management system. There was a change from a TAC system based on gear and vessel size, to a new 'community' arrangement based on subdividing the groundfish TACs geographically, into community quotas to be utilized jointly by fishers within the specific area (Charles 2006).

Community Management Boards, such as the Fundy Fixed Gear Council (FFGC), were established in each geographical area, which further divides the quota among gear sectors, and sets operational management plans and regulations for each sector. Each Community Management Board managed and maintained its own Infractions Committee for local enforcement of the agreed-upon regulations, resolving allocation conflicts, maintaining livelihoods through an equitable allocation of fishing opportunities, and handling compliance (Charles 2006).

Additionally, the Canadian Supreme Court's "Marshall Decision" in 1999 recognized the historic rights of native communities to participate in commercial fisheries. This resulted to the expansion of Mi'kmaq fishing through the exclusion of non-natives by the federal government which bought licenses from non-natives, transferring them to the aboriginal communities of Lennox Island and Abegweit in the province of Prince Edward Island in the Gulf of St. Lawrence. A decision-making system was established to allocate quotas, set up operational rules and regulations, which involved the full community, through a local band council and through community meetings. Enforcement of the locally-set rules was done through traditional aboriginal community methods (Charles 2006).

The management of the various marine fisheries in the United States is through management councils, such as, the **Gulf of Mexico Fishery Management Council (GMFMC)** and **the South Atlantic Fisheries Management Council (SAFMC),** both of which manage federal fisheries, and work with state and community management groups to ensure sustainable fisheries management (GMFMC 2010; SAFMC 2010). Fisheries management in the USA has developed from open access through input control (requirements to procure permits, limits to the number of permits issued to output control (Total Allowable catch, TAC, IFQ & ITQ). Currently, the councils implement Limited Access Privilege (LAP) programs and Accountability Measures (AM), which gives federal access permits to individuals, communities or groups by allocating a percentage of the TAC through IFQ, ITQ, Community Quota, or Regional Quota to Regional Fishery Associations (RFA).

The LAP gives the flexibility to fishermen to fish at any time of the year when they can optimise their benefit, thus eliminating the "race to fish", and holding them responsible to account for catch landings and to monitor the activities of others in the industry to prevent overfishing. The success of fisheries management in the USA is due to cooperative actions between federal, state, communities and fishers to implement and enforce scientific and biological recommendations from NOAA and other research bodies, and enactment of the Magnuson-Stevens Act requiring Councils to set annual catch limits for fish stocks (populations) managed under fishery management plans (GMFMC 2010). There has also been a series of amendments to the shrimp fishery management plans of 1991. Between 1995 and 2008, amendments 1 to 7 were passed to address issues related to bycatch, permits, research, enforcement, and conservation of the shrimp resources which are the most economically important fisheries resource (SAFMC 2010).

Enforcement is done by the Coast Guard in collaboration with the different management councils. The Councils thoroughly assess potential costs and benefits of proposed management changes to fishermen and fishing communities before making a final decision, and they greatly rely on scientific data, research information and local knowledge from communities and fishers.

The program has been very successful to date; fishing capacity has been reduced, the race to catch fish has ended, and fishermen are operating more efficiently. The management councils were mandated by law to implement access limits for all fisheries by 2010.

3.8 Summary: What do we know?

A review of theoretical knowledge and empirical experiences in community-based fisheries management has revealed the following:

- Community-based management is not applicable to all fisheries, as it will sometimes work and sometimes not. The successful application of community-based management to different fisheries will have to take specific conditions into account including location, tradition and the socio-economic interest of the community.

- The success of a community fisheries management system depends on a set of design principles, similar to Ragnar Arnason's Design Principles. It should clearly define the rights of the community, consider the homogeneity of community members, have clear decision-making rules, and to the extent possible make each member's benefits positively dependent on the total benefits of the community.

- Rights-based fisheries management, especially when it incorporates individual fishing quota (IFQ), has proved the most economically and socially efficient in solving the problems of overcapacity, gear conflicts, the race-to-fish, and in providing benefits to both producers and consumers from resource rents at reduced management cost.

4 FORM AND BASES OF COMMUNITY FISHERIES MANAGEMENT FOR LIBERIA

In this section of the study, the system of community-based fisheries management for the coastal artisanal fisheries in Liberia is discussed. The discussion considers a number of factors including the current management situation of the coastal artisanal fisheries, the proposed design for community-based fisheries management (CBFM), the institutional arrangements and mechanism, including the respective assignment of responsibilities and obligations of the parties involved.

4.1 Current situation in management of coastal artisanal fisheries

The management of coastal artisanal fisheries in Liberia is centralised and operated by the government which has the sole authority to manage and administer all aspects of Liberia's fisheries including data and information gathering, research and enforcement of rules and regulations.

The Ministry of Agriculture (MOA), through its Bureau of National Fisheries (BNF), is responsible for all fisheries management activities such as the formulation of national fisheries policy and legislations, and establishing regulations and rules to realise policy goals for the conservation and sustainable management and development of fisheries resources.

Fisheries management activities are performed by fisheries inspectors who are assigned to selected fishing communities and landing sites around the country. Under the current management system, fisheries inspectors report to the Director of BNF, and to the County agriculture coordinators who represent the MOA in the counties. It is important to realise that due to the shortage of staff and other constrains associated with the present system, the impact of fisheries management has not generally been felt, especially not in coastal communities outside of Monrovia.

However, in fisheries communities there exist certain local governance structures that are recognised by government and allowed to persist according to customary law under the national legal and judicial system. Fishing communities are headed by a chief (town- or village-) who is supported by two tribal chiefs, one each for the Fanti and the Kru communities, who are selected by their tribesmen. There are also two fishing chiefs, selected by the fishers as the head fishermen, for each group who are directly responsible for all matters affecting the fishers. In communities with one tribal group of fishers, there would be only one set of chiefs. Even though the fishing communities are not officially engaged in enforcing fisheries rules and regulations, the chiefs provide a mechanism for resolving conflicts among fishers to ensure peaceful coexistence of the different groups living in the communities. They also coordinate search and rescue, and enforce customary rules including non-allowable fishing days and closed areas, and they impose sanctions or fines on violators. The extent to which they actually set and enforce fisheries rules is unclear, but may vary between communities.

All conflicts among fishers are first handled by the chiefs (fishing chief, tribal chief or town/village chief). Aggrieved parties can, however, make an appeal to the local magistrate (Justice of the Peace) for further hearing. Cases beyond the jurisdiction of the Justice of the Peace are moved through the higher courts (Probate Court & Circuit Court) and then the Supreme Court.

4.2 Proposed design for Community-Based Co-Management (CBCM) of fisheries in Liberia

It is recommended that local communities participate in the management of coastal resources through a system of Community-Based Co-Management (CBCM). Based on TURFs, CBCM is the sharing of management powers and responsibilities between the government and coastal fishing communities. The arguments for this arrangement were provided in chapter above. The basic arguments are in terms of proper incentives, information processing and cost of enforcement in all of which local communities are better placed than the government.

Fundamentally, the proposed community-based co-management system involves two key partners: the government (through the MOA) and the fishing communities. The government provides the required support to enable the effective functioning of the community-based co-management system including legal, infrastructure and rights allocation. The fishing communities will be given rights to make certain fisheries management decisions within designated areas including local rules and guidelines.

Fishing communities along the coast will be allocated demarcated TURFs or Community Management Areas (CMA) which will be administered by organised community management units known as Community Co-Management Associations (CCMA). The CCMAs will participate in the planning, organisation and implementation of fisheries management activities within their respective CMAs. They will be given adequate powers and authority to manage fisheries resources with the CMA, subject to the national fisheries regulations and rules.

The CMAs will cover a 5 to 10 mile stretch of coastline and extend 6 miles into sea (inshore zone) and 3 miles inland to includes all lagoons, estuaries and other water bodies within the defined limits of the coast (45 to 90 square miles). The suggested size of CMAs will allow for the establishment of 35 TURFs along the coastline. This will result in a closed coastal fishery, with all territories being managed by CCMAs. The proposed characterisation of the CMA is, however, subject to modification based on the prevailing local situation, such as population density of fishers and remoteness or paucity of communities.

The reason for employing TURFs rather than community catch quotas is that TURFs are easier to allocate and monitor at this stage. Later, as information on the status of key species becomes available, TACs may be set and allocated to CCMAs.

The membership of CCMAs would consist of all fishers resident within the CMA (fishing chiefs, fishers, fishermen and boat owners) at the time of the CCMA establishment. However, associate membership may be granted to other stakeholders (fish processors, fish traders, fish transporters), who will not have voting rights. The reason for this restriction is to ensure that voting interests are aligned toward maximising the benefits from the fishery.

A general assembly of the CCMA may assemble at least once every quarter during which major decisions are made by consensus, and the results circulated to all partners of the co-management arrangement.

With the assistance of government and other partners, the CCMA will develop a resource management plan (RMP), which will be regarded as a guideline for management of fisheries resources by the CMA. The RMP will define strategies for implementation of fisheries management activities, and will specify the type of information and data required for managing the resource.

Due to the limited human resources, state of infrastructure and community organisation in Liberia, it is proposed that CBCM be introduced gradually over a 10 year period, beginning with a five year

pilot in two communities, and gradually expanding to other communities, based on level of success. This will allow for adequate building of capacity in the CMAs. The government should gradually devolve management responsibilities to the communities as the necessary awareness and capacities accumulate, thus moving to self-management of the resource by the communities.

4.3 Institutional mechanism for Community-Based Co-management in Liberia

The proposed institutional arrangement for implementing the co-management system is illustrated in figure 10. This structure is in accordance with the current decentralisation strategy of the Ministry of Agriculture (MOA 2009) regarding county, district and community management committees.

A community management committee (CMC), an executive committee, will be constituted by the CCMA to run the day-to-day operations of the association including implementing the resource management plan and enforcement of rules, and would report to the CCMA and the BNF.

The CCMA is the decision making body of the CMA. It would elect members of the CMC and other committees in the CMA, and be responsible for developing RMPs and reaching agreements with the BNF and other interest groups on behalf of the CMA. It would report directly to the BNF and inform the District Development Committee (DDC), and other stakeholders.

The District Development Committee is a development committee constituted by the government to oversee all development projects within the districts, and it reports to the county development committee (CDC) which is chaired by the superintendent of the county.

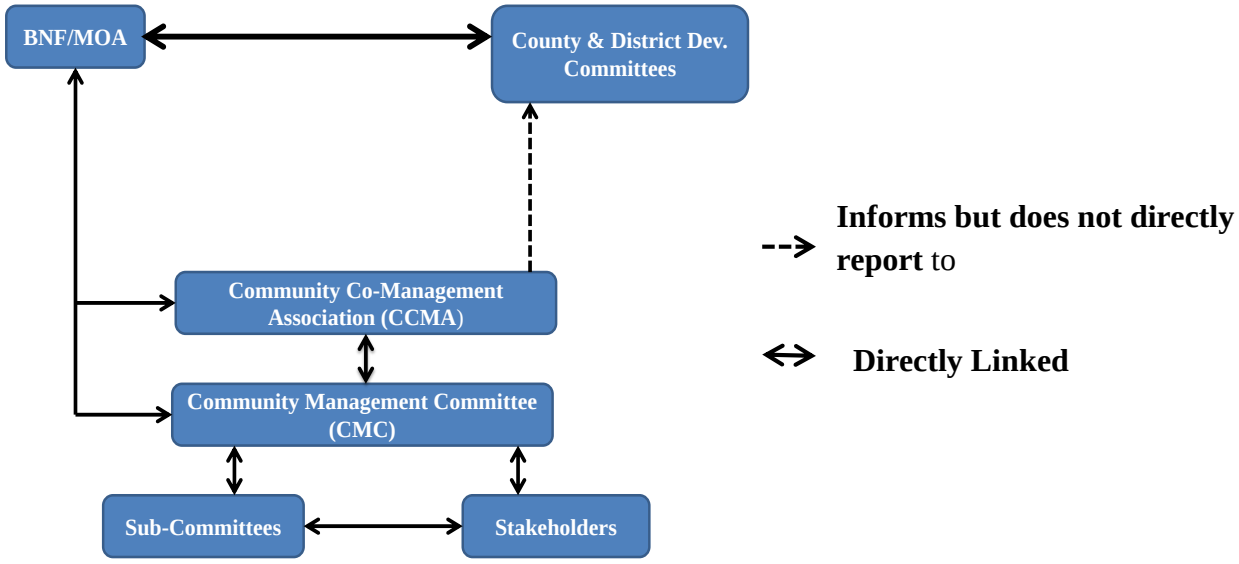

Figure 10: Proposed institutional arrangement for Community Co-management Associations in Liberia.

The CDC directs all development programs within the county and reports to the president and informs all development partners, including line ministries with activities in the counties. It would also be informed by the DDC and BNF.

The BNF will coordinate information among the various stakeholders and partners, including the CDC and other development agencies, and with the CCMA and CMC.

To ensure effectiveness in their functions, and overall efficiency in implementing co-management activities, all committees could appoint working sub-committees, as may be necessary, with specific mandates and tenure.

4.4 Delegation of responsibilities under Community-based Co-management in Liberia

Co-management requires a clear identification of the fisheries management activities to be performed by the fishing communities, and those which should be retained by the government through its Bureau of National Fisheries. The following lists the most essential allocation of responsibilities between the two parties according to this proposal.

4.4.1 Responsibilities of the government:

- **Establish legal and regulatory framework for community co-management of inshore fisheries.** The government (BNF) will facilitate the formulation of national policies, and enactment of appropriate laws and regulations to control fishing activities. These laws will include appropriate provisions for the allocation and security of community rights, and authority to manage and utilise the fisheries resources through legalised community co-management organizations.

  The BNF will in particular ensure the creation of community management units (CCMAs) by implementing Part II, section 4(2) of the Marine fisheries Regulations of 2010, which calls for the allocation of fishing rights to artisanal fishers.

  The BNF will facilitate the development of co-management agreements or Memoranda of Understanding (MoU) with the CCMAs, detailing operational procedures to ensure effective collaboration in fisheries management activities between the government and fishing communities, and giving due recognition to the exclusive fishing rights of the CCMAs to regulate the use of the resource.

- **Scientific Research**. A key responsibility of the BNF would be to conduct scientific research and disseminate information to the CCMAs. Biological, as well as socio-economic information on the resource are important requirements for effective fisheries management systems. Research information on stock biomass will be obtained from results of stock assessment surveys. Socio-economic and other information with respect to the CCMAs will be obtained from collaborative surveys involving the local communities.

  The BNF will in due course set total allowable catches (TACs) and allocate group quota rights to fishing communities through their respective CCMAs. These rights would give CCMAs added authority of ownership and responsibility for management of the fisheries.

- **Monitoring, control and surveillance (MCS).** The BNF will primarily enforce fishing communities, i.e., CCMAs, to ensure that it is in compliance with the fisheries law and regulations. Thus, if the BNF determines that the community as a whole has transgressed it will sanction the CCMA as a whole.

- **Resolution of Conflicts**. The BNF will adjudicate 'inter-communal' conflicts which may arise between adjacent CCMAs, or 'inter-sectorial' conflicts which may occur between resource users in different fisheries (as between industrial & artisanal, or aquaculture & capture fisheries) a result of non-recognition of boundaries and rights of others in the use of

a common resource. The same applies to conflicts which arise from encroachment by industrial vessels into CMAs, destruction of artisanal gear and vessels by industrial vessels, and from transboundary incursions by migrant fishers and from non-recognition of boundaries by other CCMAs.

- **Support to capacity building and training**. The BNF will support capacity building of fishers and stakeholders and strengthen knowledge of fisheries management, environment and socio-economic issues in the communities. Facilities for training can be provided to fishing communities either directly, through special levies on fish and fisheries product or indirectly through other partners (donors and NGOs).

4.4.2 Responsibilities of the fishing communities:

- **Fisheries management**. With guidance from the BNF, the CCMAs are responsible for adopting fisheries management within their own boundaries. This includes allocating fishing rights to their members, controlling fishing gear, closing areas and conducting other fisheries management actions in the fishery. The CCMAs will restrict entry into their fishery and will have the authority to negotiate and set conditions for entry by outsiders.

  The CCMAs will, in compliance with national laws and the Fisheries Regulations of 2010, make and agree on local rules to regulate fishing activities, and monitor fishing activities and landings, to ensure that total catch should not exceed the given TAC.

- **Data and information collection**. Fishing communities will be responsible for collecting and submitting data such as catch record, fishing effort (number of fishing vessels, number of fishermen), number and type of fishing gear, number of fish species, and other data related to fishing activities. The community in collaboration with the BNF and other development partners (NGOs) will collect and process information on livelihood, socio-economics and local market situation. The BNF will take action to verify that the information provided is accurate and if not impose the appropriate sanctions on the community.

  The BNF will support training and local capacity developments to enable communities contribute to this activity as well as resource management, development of alternative economic strategies, conservation, and environmental assessment and biological and ecological research.

- **Collection of levies, fees and charges**. Under the current centralised management system, the collection of charges or license fees from the artisanal sector is a particularly daunting task. Recognizing that a successful fisheries management system is not without a cost, which is dependent on the payment of rents and levies from the fisheries, communities will be endowed with the right to impose reasonable charges on its members to pay for fisheries management costs. These fees would be subject to revision by the BNF.
  The fishing communities under co-management arrangement will take the responsibility to collect all fisheries levies, fees and charges. Each CCMA will be responsible to collect and remit into government revenue, all license fees and other charges as are stipulated in the fisheries regulations and in accordance with the revenue and finance law of Liberia. License fees would be collected as are specified for the different categories of gear and vessels/or canoe in the Revised Fisheries Fees of 2011. Fees that could be collected and retained by CCMAs on behalf of fishing communities include membership fees and other fees which will be specified in the co-management agreement (MoU) between the communities and the government.

- **MCS activities and enforcement**. Under the co-management system the CCMAs will be responsible for the conduct of monitoring, control and surveillance activities through their respective CMCs. A community-based 'soft enforcement' process that involves the fishers in the formulation, rationalisation and imposition of the rules and regulations for their overall well-being, will focus on the social and cultural dynamics of compliance that can be used to sustained widespread compliance, and will encourage voluntary compliance, and achieve general deterrence (Pomeroy & Rivera-Guieb 2006). The CCMAs will, through the CMCs, formulate and enforce rules and regulations to control fishing activities within the CMAs, including the imposition fines and sanctions on members. There is a greater moral obligation on individuals to comply with rules and regulations with which they were involved.

- **Intra-communal conflict resolution**. The CCMAs will be responsible to resolve all conflicts arising within the CMAs between fishers on the one hand and between fishers and other stakeholders on the other hand. Conflicts in the CMAs may arise as a result of opportunistic behaviour by individuals to evade the rules and to gain disproportionate benefits at the expense of others (Ostrom 1990). These may include: (i) Free riding by individuals who will hold back their contribution so as to get the benefit while bearing less of the cost, (ii) Corruption by individuals receiving or providing illegal payment to change an existing rule in one's favour, and (iii) Rent seeking by individuals who use special advantages to gain excess profit from the resource.

- **Socio-economic responsibilities**. Considering the seasonality of the small scale fisheries, and the deplorable state of infrastructures and services in fishing communities, CCMAs would be well positioned to understand the priority needs of the CMAs and to incorporate them into their resource management plans (RMP).

  Fishing communities will need to engage other coastal stakeholders, especially tourism agencies, hotels, and the National Ports Authority or donor agencies and NGOs, to support investments in the CMAs which will contribute to improving the socio-economic welfare of community members, improve basic infrastructure and social services, and provide alternative livelihood opportunities for fishers.

Table 4: Summary of responsibilities and obligations of BNF and CCMAs under community-based co-management in Liberia

A. Responsibilities of fishing communities (CCMAs)
• Accept and reject new members • Develop RMPs • Set and enforce internal fisheries management rules accordingly • Enforce these rules and the general government rules • Do local research and data collection • Provide data to government

• Impose fees on members • Promote economic and social well-being in the community.
B. Responsibilities of Government (BNF)
• Sets general fisheries rules • Decides on community TURFs • Decides TAC for species and areas • Allocates community quotas (according to a pre-decided share) • Enforces community rights against others • Enforces restrictions on communities (TURFs, Quotas, adherence to management plans, adherence to fisheries management rules, payment of fees etc.) • Agrees on (or vetoes) Resource Management Plans • Provides expert advice and technical assistance • Supports in other ways

4.5 Implementation of co-management in Liberia

The establishment and operation of community-based co-management can be complex, time consuming and costly. It involves economic, biological, social and political considerations and, therefore, requires a multidisciplinary approach. Adequate funding is required to ensure its successful implementation and continuing operation.

It is useful to divide the implementation process into three phases; (i) preparatory phase, (ii) implementation phase and (iii) post-implementation phase, with activities broadly grouped as follows:

(i) Preparatory phase
   a. Informational campaign
   b. Consultation
   c. Planning

(ii) Implementation phase
   a. Project management and coordination
   b. Capacity building and community development
   c. Institutional construction and support
   d. Setting up of resource management and enforcement

(iii) Post-implementation phase
   a. Monitoring and evaluation

Pre-implementation information dissemination, consultation and planning may take a considerable amount of time but it is essential to facilitate smooth implementation of co-management. As a part of this process, the BNF will hold consultative meetings with community members and various stakeholders to identify and build consensus on the problems affecting the communities. At this point, linkages are established and strengthened between fishers, other stakeholders, NGOs and BNF so that a partnership for implementing co-management is developed. The process for identifying community boundaries to serve as the basis for demarcating CMAs, and for collecting baseline data will be initiated. A formal agreement for implementing co-management may be established. Strategic action plans may be developed and the required funding for actual implementation of the co-management arrangement sourced or identified.

During the actual implementation phase, management and coordination of project activities will be crucial to implementation success. The BNF will therefore ensure that activities and programs by the various CCMAs and their sub-units and fishing groups are adequately coordinated for proper service delivery. This will also ensure an effective conflict resolution mechanism.

Capacity building and community development are major requirements for implementing co-management in Liberia. Considering the current low literacy rate (57.5%) and the appalling state of physical infrastructure, and basic services, the BNF as a key partner will be responsible for fostering community awareness, sensitising community leaders and other political leaders to the concept of fisheries co-management, and for the training of CCMA and community leaders. The BNF will also engage other stakeholders such as training institutes, donor agencies and non-governmental organisations (NGOs) which could provide training, technical and financial support services to raise income and improve living standards by generating employment through alternative and supplemental livelihood development activities. Capacity development will also address community needs such as community social services and infrastructure development, enterprise development, and will involve empowerment and participation of individuals and organisations.

Institutional support will involve activities by the BNF to ensure effective mechanisms for decision making and conflict management, and to bring about interactive linkages amongst key partners (CCMAs, government institutions and NGOs). The BNF will also facilitate the required legal support (including policy development, development of a new fisheries law and amendments to existing laws and regulations), that will assure the implementation of the co-management arrangement. It will also include interventions towards community organization and strengthening.

Resource management and enforcement will consist of setting up systems and processes to manage, protect, conserve, rehabilitate, regulate and enhance the fisheries resources. The CCMAs with guidance and support from the BNF and /or other stakeholders will develop a resource management plan (RMP) for managing the fisheries in their CMAs, to be implemented by the CMCs. This will include activities for data and information gathering on the community, fisheries and environment, the enforcement of rules, and mitigation of conflicts among others.

Post implementation activities involve monitoring and evaluation. The purpose of this is to assess the outcomes of the implementation process and the operation of the community management unit to learn from mistakes and successes. This is a vital component in the overall process of setting up community management units country-wide allowing the BNF to modify and improve its implementation plans.

The preliminary implementation time frame for activities under community-based co-management in Liberia is 10 years, beginning with a five years pilot phase in two communities, Buchanan and Marshall, and followed by a five year expansion phase to cover the rest of the coastline. The summary implementation schedule with indicative estimates for key activities is presented in Table 5. It is proposed that a detailed implementation plan be developed and operationalised prior to actual implementation of project activities.

Table 5: Summary schedule for pilot implementation of community-based co-management in Buchanan and Marshall, Liberia

Phase	Component	Sub-Activities	Cost(US$)	Responsible	Implementation Time Table																			
Year					YR I				YR II				YR III				YR IV				YR V			
Quarter					1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	Project management & coordination		300,000	BNF																				
Sub-total			**300,000**																					
Preparatory	Pre-implementation consultations & Planning	Consultative meetings with communities & relevant institutions	20,000	BNF																				
		Develop detailed implementation Plan	15,000	BNF																				
		Collect baseline data & identify resource boundaries	30,000	BNF/CCMA																				
		Develop Co-management Agreement & Action plan with communities	15,000	BNF/CCMA																				
Sub-total			**80,000**																					
Implementation	Capacity building & Community Development	Training of CMC members & community leaders	40,000	BNF																				
		Community awareness & sensitization	30,000	BNF																				
		Development of Landing sites for the CCMA	250,000	BNF/CCMA																				
		Information & database development	30,000																					
	Sub-total		**350,000**																					
	Institutional Support	Community organization & Strengthening	100,000	BNF																				
		Legal & regulatory support for CMA	50,000	BNF																				
		Demarcation of CMA	50,000	BNF																				
	Sub-total		**200,000**																					
	Resource Management & Enforcement	Develop Resource management Plan	10,000	CMC/BNF																				
		Data & information collection	20,000	CMC/BNF																				
		Creation & Training of community enforcement unit	40,000	CMC/BNF																				
		Local implementation & coordination	10,000	CMC																				
		Registration & marking of vessels	20,000	CMC/BNF																				
Sub-total			**100,000**																					
Post-Implementation	Monitoring & Evaluation	Monitoring of project implementation	30,000	BNF/CMC																				
		Evaluation of project performance	20,000	All Parties																				
Sub-Total			**50,000**																					
Total			**1,080,000**																					

4.5.1 Estimated Cost

The estimated costs for implementing fisheries co-management in two pilot communities (Marshall and Buchanan) in Liberia over a five years period, and for expansion into 33 other CMAs are presented in Table 6 below. These estimates are based on official allowance rates for government employees, and current rates for consultants (local and from sub-region). The cost of logistics and materials considered current market prices. It is thought that the initial pilot projects will be most costly but subsequent additions as the co-management system is expanded to all 35 co-management areas would be less. The total cost is at US$**14,593,500.00** or $416,957.00 per each CMA.

Table 6: Estimated cost for implementing community-based co-management in the coastal fisheries of Liberia

Section A: Estimated cost for Pilot Implementation in Marshall and Buchanan communities								
Phase	**Program Activities**	**Time frame**	**Unit**	**Quantity**	**Unit cost (US$)**	**Cost (US$) At Community Level**	**Cost (US$) At BNF Level**	**Total cost (US$)**
Preparatory Phase	Pre-implementation consultations & Planning @ $40,000/CMA	2 years	CMA	2	40,000.00	30,000.00	50,000.00	80,000.00
	Project management & coordination	5 years	year	5	60,000.00	0	300,000.00	300,000.00
Implementation Phase	Capacity building & Community Development@ $175,000/CMA	5 years	CMA	2	175,000.00	350,000.00	0	350,000.00
	Institutional Support@$100,000/CMA	5 years	CMA	2	100,000.00	200,000.00	0	200,000.00
	Resource Management & Enforcement@$10,000/CMA/yr.	5 years	CMA	2	50,000	100, 000.00	0	100, 000.00
Post-implementation	Monitoring & Evaluation @ $10,000/yr.*5.	5 years	year	5	10,000	10,000.00	40, 000.00	50, 000.00
Total for Pilot	**For 2 pilot TURFS(CMA)**	**5 years**	**CMA**	**2**		**690,000.00**	**390,000**	**1,080,000.00**
Section B: Estimated cost for Expansion of Co-management to 33 other CMAs along the coast of Liberia								
For Expansion	**33 Additional TURFs (CMA)**	**5 years**	**CMA**	**33**	**390,000.00**	**12,870,000**		**12,870,000**
	Management & Coordination by BNF @ 5% of total cost	**5 years**					**643,500**	**643,500**
Total for expansion								**13,513,500**
Grand Total						**13,560,000**	**1,033,500**	**14,593,500**

5 COST-BENEFIT ANALYSIS FOR IMPLEMENTING CO-MANAGEMENT IN LIBERIA

In this chapter a rough cost-benefit analysis (CBA) of the proposed co-management project described in the previous chapters is presented. The purpose of this is to determine the economic feasibility of implementing the proposed community-based co-management in Liberia. CBA is an analytical and straightforward way of evaluating the economic potential of a proposed project to create net benefits (Layard and Glaister 1994). It is a measure of the expected economic efficiency of a project. The methodology for CBA use is outlined in Appendix 1a.

5.1 Data and information

The data used in this analysis were obtained from FAO data sources and the BNF statistical division. I wish to acknowledge the limitations of the landing data, as it may not represent landings from all landing sites. Liberia is still in a data-poor situation, and the landings figures may therefore be grossly under-reported. Information on the current market price per kilogram of fish and interest rates were obtained from Liberia.

5.2 Cost

The cost elements used in this CBA were determined based on the cost estimates in Table 6 and the implementation plan in table 5. There were two categories of cost identified: direct investment cost and management and coordination cost, amounting to $14.6 million. The costs are summarized in Table 7.

Table 7: Evaluation of cost for implementing co-management in Liberia

Year	Investment cost ($US)	Project management cost($US)	Total Implementation Cost ($US)
1	1.898	0.189	**2.087**
2	4.160	0.189	**4.349**
3	4.087	0.189	**4.276**
4	2.190	0.189	**2.379**
5	1.314	0.189	**1.503**
6 and later	0.00	0.095	
Total	**13.650**	**0.944**	**14.594**

5.3 Benefits

The co-management project is expected to yield benefits because of improved fisheries management. Essentially, the excesses of the problems of the commons are expected to be reduced. This will appear as (i) restored stocks, (ii) less fishing effort, (iii) higher catches per unit effort, (iv) better quality of landings, (v) improved processing and distribution, and (vi) higher price of fish. At the same time, enforcement of fisheries management rules is expected to be improved and its unit cost to be reduced. Taking all these factors into account, it is assumed that after two years of the co-management project the value of fish landings would increase by 10% each year for three years and then attain a stable state, and that the

management cost of the fisheries would be reduced by 50% at the end of fifth year and remain constant after that. The additional benefits are summarized in Table 8.

Table 8: Evaluation of benefits from the implementation of co-management in Liberia

Year	Revenues	Additional revenues	Reduced enforcement costs	Total benefits
1	3.96	0	0	0
2	3.96	0	0	0
3	4.356	0.41	0	0.41
4	4.752	0.792	0	0.792
5	5.148	1.188	0	1.188
6 and later	5.1480	1.1880	0.95	

The benefit was evaluated using the average annual landing of 3300 tonnes for coastal artisanal fishery in Table 2, and the current average fish price of $1.20 US per kilo from Liberia.

In addition to the above, implementing a successful fisheries management regime has various benefits of a more social value that are difficult to assign monetary values to. Among these one may mention:

- Increased community motivation from ownership of the fishery, and participation in the decision-making process regarding its management. This will result from increased awareness of the inherent benefits from a well-managed fishery.
- Improvements in social infrastructures and services resulting from increased business opportunities which will develop along the fishing communities.

5.4 Results of CBA

A time profile of the net benefits stemming from the above costs and benefits may be graphically illustrated as in figure 11. The first five years of the community management project require considerable net outlays of funds amounting to some US$12 m. This represents the approximate funding needs to embark on the project. However, from year six onwards, the benefits from the project are projected to exceed the costs by over a million US$ annually.

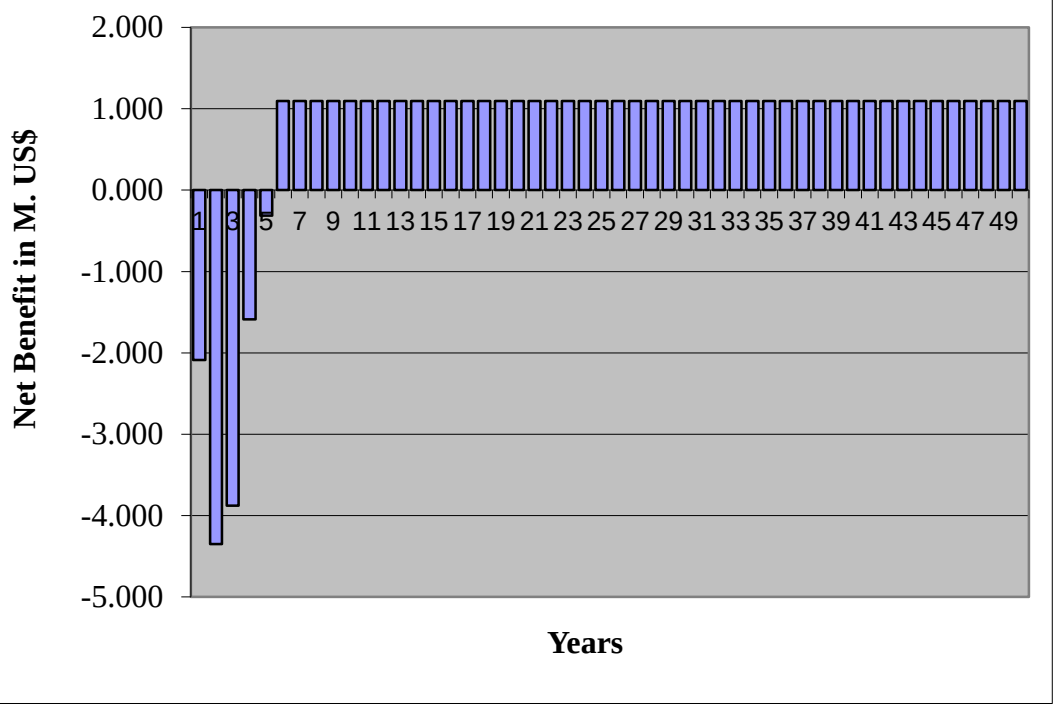

Figure 11: Net benefit time series of co-management in Liberia for 50 years.

Present value and internal rate of return calculations were conducted for the net benefit time series in figure 11, i.e. for 50 years. The key results are summarized in table 9.

Table 9: Net present values of benefits and the internal rate of return (IRR) for the project

Discount rates (%)	0.05	0.035	0
NPV=	$4.395	$9.491	$37.00
IRR=	7.2%		

As indicated in Table 9, the present value of the project is positive for a rate of discount less than 7.2 %. At 5% rate of discount the present value of the project is about US$ 4 m. At 3.5% rate of discount it is about US$ 9.5 m. Thus, one may conclude that for costs and benefits as estimated above, the community-based co-management project is marginally beneficial. For

higher benefits or lower implementation costs than those assumed, the net present value would of course be higher.

6 CONCLUSIONS AND RECOMMENDATIONS

Community-based co-management will provide the BNF with a long-term management solution for the coastal artisanal fisheries, which it has not the capacity to enforce and regulate. It is an alternative to providing efficient, low-cost fisheries management to ensure long-term sustainability of the resource, and greater economic benefits for both fishers and the state.

Overall, community-based co-management is fundamentally a sustainable approach to small-scale fisheries management that would encourage both the employment of the appropriate fishing effort and enforcement of the fishery. This will lead to stock recovery, and improved social-economic benefits of the fishery.

Therefore, it is recommended that the government develop the necessary legal mechanisms to ensure the successful implementation of community-based co-management in the coastal fisheries of Liberia.

It is further recommended that studies be conducted to develop an appropriate management system for inland water bodies in Liberia.

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LIST OF REFERENCES

Advameg, Inc. 2009. *Countries and their culture: Liberia*. www.everyculture.com/Ja-Ma/Liberia (Accessed 18/12/2010).

Arnason R. 1993. Ocean fisheries management: recent international developments. *Marine policy*. Vol. 22, No.4-5 pp. 334.

Arnason, R. 2000. Property Rights as a Means of Economic Organization. In R. Shotton(ed.) Use of Property Rights in Fisheries Management[Electronic version]. *FAO Fisheries Technical Paper 404/1*. Food and Agriculture Organization of the United Nations. Rome. 2000.

Arnason R. 2001. Alternative Fisheries Management System: The Icelandic Experience. Paper presented at the seminar on The future of Commons Fishery Policy: The Voice of Europe´s Fishing Regions. European Centre for the Regions, santiago de Comostela, November 29-30, 2001.

Arnason R. 2002. Fisheries Management Costs: Some Theoretical Implications. In Schrank, W.E, Arnason, R. and Hanneson, R (eds.) Costs of fisheries Management. Asugate publishers.

Arnason, R. 2003. Community and Cooperative Fisheries Management: *possible application to Mediterranean fisheries.* In M. Spagnolo (ed.) Conference on Fisheries Management and Multi-Level Decision Systems: The Mediterranean Case. IREPA. Salerno 2003.

Arnason, R. 2006. Community Fishing Rights: Some Basic Principles. IIFET 2006 Portsmouth Proceedings. University of Iceland and European Commission Research Centre.

Arnason, R. 2007a. Advances in Property Rights Based Fisheries Management: An Introduction. *Marine Resource Economic*, Volume 22. pp. 335-346. http://www.ageconsearch.umn.edu (Accessed, 27/11/ 2010).

Arnason, R. 2007b. Economics of fisheries and Aquaculture. In *Fisheries and Aquaculture*, Ed. Patrick Safran], in *Encyclopedia of Life Support Systems (EOLSS).*

Arnason, R. 2008. *Basic Fisheries Economics*. A paper prepared for the workshop on Policy and Planning for coastal fisheries Resources. University of south Pacific, Suva, Fiji, January 28 to February 8, 2008.

Asur, Liberia, Inc. 2006. *Assessment Report of Water Bodies in Bong county, Liberia*. 6p.

Bureau of National Fisheries (BNF), 2006. *Annual Report*. 47p.

Bureau of National Fisheries (BNF), 2009. *Annual Report*. 17p.

Charles, A. 2006. COMMUNITY FISHERY RIGHTS: Issues, Approaches and Atlantic Canadian Case Studies. *IIFET 2006 Portsmouth Proceedings*. University of Iceland and European Commission Research Centre.

CIA-The World Factbook. 2010. https://www.cia.gov/library/publications/the-world-factbook/ (accessed 03/12/2010).

Cox, M., G. Arnold, and S. Villamayor Tomas. 2010. A Review of design principles for community-based natural resource management. *Ecology and Society* **15**(4): 38. [Electronic version] URL: [Accessed 3/2/11]. http//www.ecologyandsociety.org/vol15/iss4/art38/

FAO 1988. *Recent developments of the artisanal fisheries in Ghana*. By J. Haakonsen. Programme for Integrated Development of Artisanal Fisheries n West Africa (IDAF), Cotonou. Ref. IDAF/WP/21. Rome.

FAO 2001. Information on Fisheries Management in the Republic of Liberia. FAO November 2001. www.fao.org/fi/oldsite/FCP/en/LBR/zoom.htm. (Accessed 11/12/2010).

FAO 2004-2011. Fishery and Aquaculture Country profiles. Liberia. Fishery and Aquaculture Country Profiles. In: *FAO Fisheries and Aquaculture Department* [Electronic Version]. Rome. Updated 5 August 2004. [Cited 7 January 2011]. http://www.fao.org/fishery/countrysector/FI-CP_LR/en

FAO 2009. The State of World Fisheries and Aquaculture [Electronic version]. Rome. http://www.fao.org (Accessed 2/10/10).

FAO 2010. Country Stats. Liberia. www.fao.org (Accessed 10/2010).

Flewwelling, P.; Cullinan, C.; Balton, D.; Sautter, R. P.; Reynolds, J. E.. Recent Trends in Monitoring, Control and Surveillance Systems for Capture Fisheries (http://www.fao.org/DOCREP/005/Y4411E/y4411e03.htm), *FAO Fisheries Technical Paper*.No.415. Rome. FAO. 2002. 200p. (Accessed 22/1/11).

Government of Liberia (GoL). 2009. Liberia extractive Industries Transparency Initiatives (LEITI) First Report.

Government of Liberia (2010). *OFFICIAL GIZETTE* Vol. **IX**. No. 43. The new Fisheries Regulations-2010. November 24, 2010.

Gulf of Mexico Fisheries Management Council (GMFMC) 2010. *Opportunities and Challenges*. [Electronic version] www.gulfcouncil.org. (Accessed 10/1/11).

Gutierrez, N. L., R. Hilborn and O. Defeo. 2011. Leadership, social capital and incentives promote successful fisheries. *Nature*. Vol. 470. pp. 386 -389. Macmillan Publishers limited. [Electronic Version] www.nature.com/nature (Accessed 13/1/11).

Harding, G. 1968. The Tragedy of the commons. *Science.* Vol.162: pp 1243-47.

Hannesson, R. 1994. *Rights based Fishing: The role of property rights in the fisheries management*. Paper presented at the 82nd Statutory Meeting of ICES, St. John´s Newfoundland, Canada, September 22-30, 1994.

Kebe, M.; Jern, P.; Collins, R.; Kay, W.; Kekula, E. 2009. *A livelihoods analysis of coastal fisheries communities in Liberia*. FAO fisheries and Aquaculture Circular. No. 1043. Rome, FAO. 20p.

Layard, R. and S. Glaister 1994. *Cost-Benefit Analysis* (2nd ed.). New Year. Cambridge University Press. 508p.

LISGIS (2009) *2008. National Population and Housing Census Final Result*. Monrovia. 5p.[Electronic Version] www.emansion.gov.lr/doc/population_by_county. (Accessed 27/2/11).

Ministry of Agriculture (MoA) 2007. *Comprehensive Assessment of the Agriculture Sector of Liberia* (CAAS-Lib). Volume **1** - Synthesis Report**.** 151p**.**
Ministry of Agriculture (MoA) 2009. *Decentralization Issues and Strategy Process for Decentralizing the Ministry of Agriculture* 54p.

Marine Resources Assessment Group (MRAG) 2005. *Review of Impacts of Illegal, Unreported and Unregulated Fishing on Developing Countries: Synthesis Report*. 17p.

Oliva, L. and M. Yamao 2006. SUSTAINABILITY OF COASTAL FISHERIES IN HIROSHIMA PREFECTURE, JAPAN: Scope of Community-Based Management Approach to Achieve the Aims of Current Japanese Coastal Fishery Policy. *IIFET 2006 Portsmouth Proceedings.* University of Iceland and European Commission Research Centre.

Ostrom, E. 1990. *GOVERNING THE COMMONS: The Evolution of Institutions for Collective Action*. Cambridge University Press. NY. 280p.

Panayotou, T. 2000. Territorial Use Rights in Fisheries. In R. Shotton(ed.) Use of Property Rights in Fisheries Management[Electronic version]. *FAO Fisheries Technical Paper 404/2*. Food and Agriculture Organization of the United Nations. Rome. 2000

Pomeroy, R. S. 1996. Community-based and co-management institutions for sustainable coastal fisheries management in southeast Asia[Electronic version]. *Ocean & Coastal management*, Vol. 27, No. 3, pp. 143 – 162. http://www.worldfishcenter.org (Accessed, 27/11/2010)

Pomeroy, R. S. and R. Rivera-Guieb 2006. *FISHERY CO-MANAGEMENT: A Practical Handbook*. [electronic version] IDRC, Canada. http://www.idrc.ca//pub@idrc.ca (Accessed 12/01/2011)

Raubani, J. J. J. 2006. *Community Fisheries management (CFM): Future considerations for Vanuatu* [Electronic version]. Final Project. www.unuftp.is (Accessed 27/11/10). 47p.
Runolfsson, B. and Arnason, R. 2001. Initial Allocation of ITQs in the Icelandic Fisheries. In R. Shotton (ed.) Case studies on the allocation of transferable quota rights in fisheries. [Electronic version]. *FAO Fisheries Technical Paper*. No. 411. Food and Agriculture Organization of the United Nations. Rome. 2001. 373p.

Scott, A.D. 1955. "The Fishery: The Objectives of Sole Ownership." *Journal of Political Economy* 63: 116-124.
Scott, A.D. 1988. Conceptual Origins of Rights Based Fishing. In Neher *et al*. (eds.) *Rights Based Fishing*. Kluwer Academic Publishers, Dordrecht.

Shotton, R. (ed.). Use of Property Rights in Fisheries Management. FAO Fisheries Technical Paper 404/2. Food and Agriculture Organization of the United Nations. Rome. 2000

Ssentongo, G. W. 1988. Marine Fishery Resources of Liberia: A Review of Exploited Fish Stock [Electronic version]. CECAF/ECAF Series 87/45. FAO. Rome. www.fao.org (Accesses 4/2005)

South Atlantic Fishery Management Council (SAFMC) 2010. *Limited Access Privilege Program for the south Atlantic Snapper Fishery*. [Electronic Version]. www.safmc.net/socioEconomic/LimitedAccessPrivelege/ (Accessed 17/1/11)

Sutinen, J. G. 2003. Different Tools In Fisheries Management: *A comparative analysis in world fisheries.* In M. Spagnolo (ed.) Conference on Fisheries Management and Multi-Level Decision Systems: The Mediterranean Case. IREPA. Salerno 2003.

Ward, J. M. and Keithly, W. 2000. Determining the Impact of Adopting Property Rights as a Fishery Management Tool in Regulated Open Access Fisheries. In R. Shotton (ed.). Use of Property Rights in Fisheries Management. *FAO Fisheries Technical Paper 404/2*. Food and Agriculture Organization of the United Nations. Rome 2000.

Welcomme, R. L. 1979. The Inland Fisheries of Africa. [Electronic Version]. *CIFA Occasional Paper* (7) FAO, Rome .77.p www.fao.org (Accessed 15/12/2010).

Willmann, R. 2000. Group and Community-Based Fishing Rights. In R. Shotton(ed.) Use of Property Rights in Fisheries Management. *FAO Fisheries Technical Paper 404/1*. Food and Agriculture Organization of the United Nations. Rome 2000.

USAID 2008. *West African Fisheries Profiles. Liberia*. West African Trade Hub. Dakar

Vanden Bossche, J.-P.; Bernacsek, G.M. 1990. Source book for the inland fishery resources of Africa: 2.[Electronic Version]. *CIFA Technical Paper. No. 18.2*. FAO, Rome. 1990. 411p. www.fao.org (Accessed 11/12/2010).

APPENDICES

Appendix 1: Cost-Benefit Analysis for implementing Community-Based Co-management in Liberia

Appendix 1a: Methodology used for Cost-Benefit Analysis

The cost and benefit for implementing a community fisheries management regime (CFMR) were calculated to determine the present value or overall benefit of the management regime. The following mathematical functions/relationships were used:

Value of project (PV) = Benefits (B) – Costs(C)

$$B(t) = \sum_{i=1}^{I} p(i,t) \cdot q(i,t)$$

Where B = Benefit, q= quantity, P= price t = time

$$C(t) = \sum_{j=1}^{J} w(j,t) \cdot x(j,t)$$

Where C = cost, t = time, w = quantity, X= Price

$$PV = \sum_{t=0}^{T} \frac{B(t) - C(t)}{(1+r)^t}$$

$$= \sum_{t=0}^{T} \frac{\sum_{i=1}^{I} p(i,t) \cdot q(i,t) - \sum_{j=1}^{J} w(j,t) \cdot x(j,t)}{(1+r)^t}$$

Where PV= Present Value, r = interest/ discount rates, t= time

Appendix 1b: Evaluation of Costs and Benefits

Data					
Number of CMA	35				
Average Annual Landing (mt)	3.3				
Price (US$)	1.2				
Investment Cost (US$)	14.6				
Discount rate (%)	0.14				
Investment period (Yr)	5				
Rate of price & Landing increase (%)	1.1	1.2	1.3		
Reduction in management cost (%)	0.5				
Yearly Evaluation of Implementation Cost and Benefit in millions of US Dollars					
Year	Investment cost	Project management cost	Yearly total	Revenue	Benefit
1	1.898	0.189	**2.087**	3.96	1.87
2	4.160	0.189	**4.349**	3.96	- 0.39
3	4.087	0.189	**4.276**	4.356	0.08
4	2.190	0.189	**2.379**	4.752	2.37
5	1.314	0.189	**1.503**	5.148	3.64
6	0.00	0.095		0	0
Total	**13.650**	**0.944**	**14.594**	22.176	$7.58
				NPV	**$4.70**

Appendix 1c: Coast-benefit analysis

Assumptions

Fish price and landing are expected to increase by 10% after two years of management

Management and operations cost is expected to reduce by 50% after 5 years of implementation

Fisheries is in a stable, sustainable state after year 5

COST-BENEFIT ANALYSIS

	YEAR																								
Cost (US$)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Investment cost	1.90	4.16	4.09	2.19	1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Management & coordination	0.19	0.19	0.19	0.19	0.19	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Total Cost (US$)	2.09	4.35	4.28	2.38	1.50	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Total Revenue (US$)	3.96	3.96	4.36	4.75	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15
Net Revenue (US$)	1.87	-0.39	0.08	2.37	3.64	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05
Present Value	1.64	-0.30	0.05	1.40	1.89	2.30	2.02	1.77	1.55	1.36	1.20	1.05	0.92	0.81	0.71	0.62	0.54	0.48	0.42	0.37	0.32	0.28	0.25	0.22	0.19
NPV (US$)	23.39																								
All figures are srtated here in millions																									
Gains from project	0.00	0.00	0.40	0.79	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
Net gains	-2.09	-4.35	-3.88	-1.59	-0.32	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09

	YEAR																									
Cost (US$)	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
Investment cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Management & coordination	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	
Total Cost (US$)	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	
Total Revenue (US$)	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	
Net Revenue (US$)	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	5.05	234.989
Present Value	0.17	0.15	0.13	0.11	0.10	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	23.391
Gains from project	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	
Net gains	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	

PV= **4.391**

IRR= **7.2%**