



Back to Basics

**Traditional Inland Fisheries
Management and Enhancement Systems
in Sub-Saharan Africa and their
Potential for Development**



Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

Natural Resource Management

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List of Abbreviations

ALCOM	Aquaculture for Local Community Development Programme, Harare, Zimbabwe
CBFM	Community-based fisheries management
CEMARE	Centre for Economics and Management of Aquatic Resources, Portsmouth University
CIFA	Committee for Inland Fisheries of Africa
COFAD	Consultants for Fishery, Aquaculture, and Rural Development (COFAD GmbH), Tutzing, Germany
DFID	Department for International Development, U.K.
FAD	Fish aggregating device
FAO	Food and Agriculture Organization of the United Nations, Rome, Italy
GOPA	GOPA Consultants, Bad Homburg, Germany
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn, Germany
IAC	International Agricultural Centre, Wageningen
ICLARM	International Center for Living Aquatic Resources Management, Penang, Malaysia
IDRC	International Development Research Centre, Ottawa, Canada
IDS	Institute of Development Studies, Sussex, UK

IFAD	International Fund for Agricultural Development, Rome, Italy
IFM	Institute for Fisheries Management and Coastal Community Development, Hirtshals, Denmark
IIRR	International Institute of Rural Reconstruction, Silang, Cavite, Philippines
IRD	Institut de Recherche pour le Développement (formerly: ORSTOM)
NARS	National Aquatic Research System
ODA	Overseas Development Administration (now DFID)
PFMP	Participatory Fish Stock Management Programme, Malawi
PRA	Participatory Rural Appraisal
SADC	Southern African Development Community
SFLP	Sustainable Fisheries Livelihoods Programme
SL	Sustainable livelihoods
SNV	SNV Netherlands Development Organisation
TMAF	Traditional Management of Artisanal Fisheries (Project)
UNCED	United Nations Conference on Environment and Development (Rio)
UNDP	United Nations Development Programme

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1. Introduction

Sub-Saharan Africa suffers from poverty and malnutrition: about 46% of its population were living below the poverty line in 1998 (World Bank 2000a), and 34% were described as undernourished in 1996-98 (FAO 2000b)—both the highest figures in the world. Of particular concern are rural areas, where 70% of Africa's poor are living (World Bank 2000).

Fisheries, as a major contributor to primary production in Africa, plays a significant role in combating these problems

- fish provides about 20% of the animal protein and 5% of the total protein supply (FAO 1996)
- fisheries provide employment, income, food and trading opportunities (especially to women) in many local and regional economies.

Total fish production in sub-Saharan Africa amounted to 4.5 million tonnes in 1998, of which inland fisheries, with 1.7 million tonnes or 39%, represented a remarkably high share.

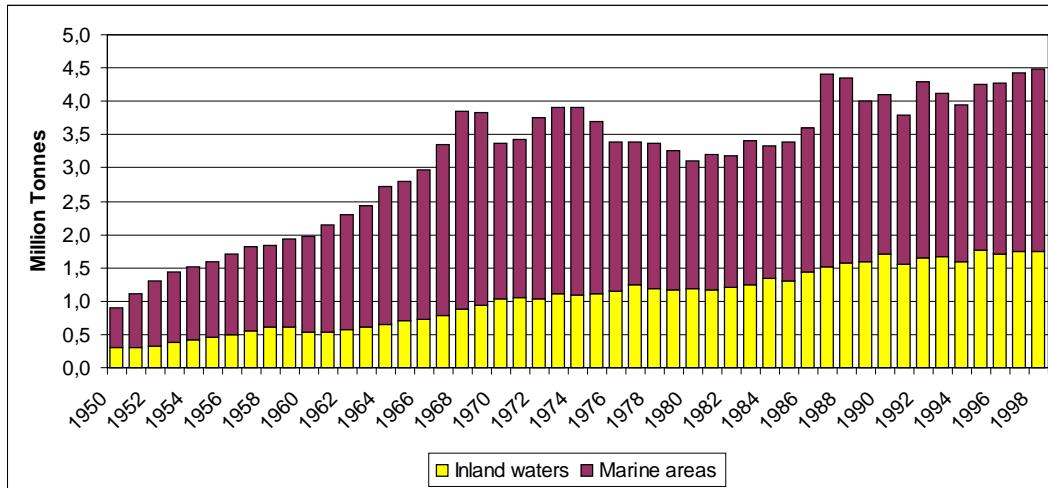
Figure 1 shows the development of fish production since 1950.

Even though these figures need to be treated with some caution, there is little doubt that they reflect the general trend: almost a stagnation, over the last decade, of both marine and inland fish production.

This static production, taken together with the population growth during the same period, has led to a declining *per caput* fish consumption. From a peak of 9.4 kg in 1982, consumption dropped to 6.8 kg in 1994 (FAO 1996) and has probably fallen even further since then.

Diminishing *per caput* availability of fish and fishery products undoubtedly affects the nutritional status of the sub-Saharan African population.

Figure 1: Fish production of sub-Saharan Africa: Marine and inland



(Source: FAO FishStat)

However, although highly appreciated as food, both the nutritional role of fish and its relevance with respect to food security in sub-Saharan Africa have frequently been misjudged in the past. On the one hand, fish is a particularly efficient source of protein, minerals and vitamins and is, in many areas of Africa, more readily available than other sources of high-quality animal protein. On the other hand, food shortages are generally the result of a lack of energy-rich foodstuffs rather than of fish, which is usually eaten as a condiment, to give taste to sauces and staple foods, or as a snack.

In addition, the fish available in the region is not necessarily consumed by those most in need of protein intake: the high purchasing power of the more affluent groups skews market demand and reduces the availability of fish to many of the poor of sub-Saharan Africa.

Where the global economy has created logistics which allow the marketing of goods and products from the furthest corners of the world to the affluent markets, this results, for

example, in the export of high-value marine species from Africa to European markets and low-value species being transformed into fish meal for First World agro-industries.

In contrast to the marine fisheries of sub-Saharan Africa, catches from inland fisheries are still mainly processed and consumed locally. The reasons for this disparity are manifold and include the following:

- inland fisheries do not generally produce fish in quantities which make collection and export profitable
- small-scale processing, handling and conservation techniques seldom yield a product which conforms to international quality standards
- the majority of the species caught are unknown to First World consumers
- the irregularity of produce, stemming from the seasonality of many inland fisheries, restricts the feasibility of permanent export-oriented marketing structures.

Therefore, inland fisheries are of particular relevance in the context of food security and development. Just to stabilise *per caput* fish availability from inland fisheries at the present level and safeguard the role of fish as a source of protein and income for an ever-growing population, would require a substantial increase in production in the near future.

But where can an increase in inland fish production come from; how can it be achieved? With 1.7 million tonnes, inland capture fisheries are approaching their maximum potential—which was estimated by FAO at 1.9 million tonnes for capture fisheries “as we now know them” (FAO 1996). About half of the landings come from the larger lake systems, and these, in particular, appear to offer few opportunities for increases in supply.

Inland aquaculture in 1998 contributed 33,000 tonnes, which is only 0.7% of the region’s total fish production or 0.1% of world aquaculture production (including marine

aquaculture, sub-Saharan Africa's share is about 0.14%, according to FAO figures).

The FAO sees development potentials in the following fields (*cf.* FAO 1996):

- strengthening of fisheries management systems
- fisheries enhancement in small and medium-sized water bodies
- development of aquaculture, in particular through integration with agriculture
- promotion of an appropriate economic and institutional framework.

Until now, however, development assistance to inland fisheries in Africa, and in particular to aquaculture, has not met with the same degree of success as it has in Asia and other parts of the world.

Efforts to develop pond culture and other 'imported' production systems as culture-based fisheries have had only limited success and did not achieve any self-sustained development on a larger scale. Development assistance to *inland capture fisheries* has rarely produced more than limited and often unsustainable improvements, or in some cases has even resulted in deterioration, for example when new fishing technologies brought about over-exploitation.

One of many reasons for these repeated failures has been and still is the frequently observed neglect of social and cultural aspects of inland fisheries and aquaculture on the part of modern African states as well as of development agencies. In recent years, and in line with Agenda 21 of the UNCED Conference of Rio, 1992, which advocates that any form of development intervention should address the complex inter-relationships between economic, social, and cultural determinants of resource use, there is growing acceptance of the importance and uniqueness of indigenous production systems and the value of traditional knowledge as a factor of production. However, practice is still lagging behind this insight.

In recognition of the above, the *Deutsche Gesellschaft für Technische Zusammenarbeit* (GTZ) commissioned COFAD GmbH to carry out this study, which argues that a better acknowledgement of traditional resource management and enhancement systems is an essential component of a more appropriate and effective approach to inland fisheries and aquaculture development.

The study aims to expand our knowledge base of existing traditional fisheries management and enhancement systems and to improve our understanding of the complexities of resource utilisation. To this end, the study presents an outline of *traditional fisheries management* and *traditional fisheries enhancement* systems as well as of *modern fisheries enhancement* and *aquaculture* systems. After analysing the potentials and constraints of these systems, conclusions are drawn and formulated into recommendations. Key concepts and definitions are explained and individual examples are presented in boxes within the main text. Two case studies, both undertaken in the context of this study, and a bibliography are provided as annexes.



Photo 1: Marketing of fish by bicycle is very common in Africa



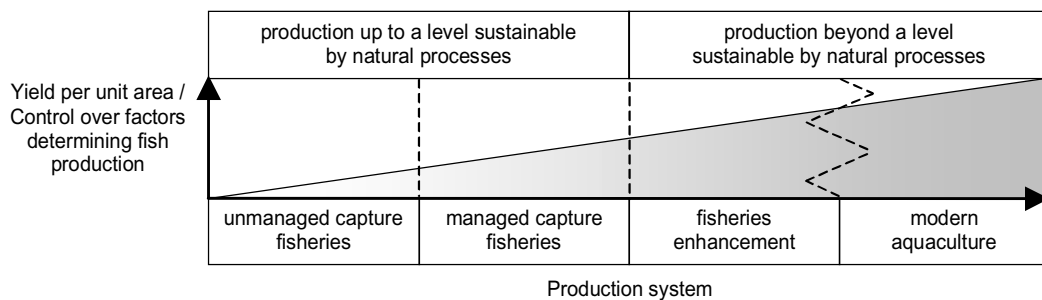
Photo 2: Boys with fish, Navrikpé, Burkina Faso

2. Inland Fisheries Management and Enhancement Systems in Africa

2.1 Inland Fish Production Systems

Inland fish production includes the wide range of activities involved in producing fish from or in inland waters, covering the spectrum from ‘capture fisheries’ to ‘aquaculture’. Figure 2 depicts this range of fish production systems:

Figure 2: Inland fish production systems



Capture fisheries refers to the removal of aquatic organisms from inland waters. The term refers to the process of extraction and applies to harvesting from both, unimproved ‘wild’ and enhanced fish stocks (FAO 1997a).

Aquaculture is “the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants with some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc.” (FAO Fisheries Glossary).

Fisheries management is, according to FAO Fisheries Glossary, “the integrated process of information gathering, analysis, planning, decision-making, allocation of resources and formulation and enforcement of fishery regulations by

which the fishery management authority controls the present and future behaviour of interested parties in the fisheries, in order to ensure the continued productivity of the living resources”.

While this definition implies that to “ensure the continued productivity” means to regulate the extraction of biomass to the extent that the resource remains sustained, most fisheries management policies explicitly aim at an increase in production while, at the same time, sustaining the resource, in its widest sense.

Fisheries enhancement refers to production systems beyond extractive, unmanaged ‘open access’ and/or managed capture fisheries.

The FAO defines ‘enhanced fisheries’ as “activities aimed at supplementing or sustaining the recruitment of one or more aquatic organisms and raising the total production or the production of selected elements of a fishery beyond a level which is sustainable by natural processes”. Included, among other things are, after Welcomme and Bartley (1998),

- introduction of new species to exploit underutilised parts of the food chain or habitat
- stocking of natural or man-made water bodies to improve recruitment, bias fish assemblage structure to favoured species or maintain productive species that would not breed naturally in such a system
- fertilisation of the water to raise levels of productivity
- engineering of the environment to improve fish reproduction and migration, and provide shelter and other vital habitat, food resources, etc.
- elimination of predators and other unwanted species
- moderate modification of water bodies to cut off bays and arms to serve the purpose of increasing control.

Aquaculture implies a degree of human intervention which exceeds that of enhanced fisheries and involves ownership

over the stocks. The FAO explicitly defines that aquaculture “implies individual or corporate ownership of the stock being cultivated” (FAO Fisheries Glossary) and uses this criterion as the dividing line between fisheries and aquaculture in its statistics. The term ‘*modern aquaculture*’, as used here, denotes aquaculture technologies of Asian and European origin.

2.2 Traditional Fisheries Management

2.2.1 Resources and Property Regimes

Inland fisheries utilise various natural resources, primarily water/water bodies and fish stocks, but also land, wood and other resources.

The traditional method of regulating resource use in African inland fisheries is based on a social consent which gives property rights over resources to individuals, groups or communities. Property regimes thus established determine the rights and responsibilities of the stakeholders and provide incentives to preserve the resource or even to invest into it. Property regimes, together with other prevailing norms and values, provide the framework within which management measures can be undertaken.

The most commonly found regime in African inland fisheries is based on common property, where the right to use a delimited resource is vested with a delimited social entity.

Box 1: Property rights and regimes

Schlager and Ostrom (1992, *cf.* Ostrom 2000) subdivide property rights into

- *use rights* (the right of access to a defined physical area; the right to withdraw resource units, e.g. catch fish)
- *control rights* (the right to manage a resource, i.e. to regulate internal use patterns and transform the resource by making improvements; the right of exclusion, i.e. to determine who has access to the resource, who has the right to withdraw resource units, and how those rights may be transferred; the right of alienation, i.e. to sell or lease management and exclusion rights).

A person or organisation can hold one or more of these rights; an owner, for instance, usually holds all of them.

For a natural resource, the following situations (or property regimes) may exist (*cf.* Bromley 1999):

- *No property rights have been defined ('non-property')*. Everybody has a right to access a resource and withdraw from it ('*open-access*'), nobody has a right to exclude others from using it.
- *Property rights have been defined*. Depending on who holds these rights, there is
 - *private property*: Individuals, families or legal entities have the right to undertake socially acceptable uses and exclude others from using the resource.
 - *common property*: 'Private' property of a group, which jointly uses the resource and has the right to exclude non-members. Management is usually undertaken by all group members or their representatives. Different from individual private property, more than one basic economic unit (e.g. a nucleus family) are involved.
 - *state property*: Property over which the state exercises management rights and defines access rules. State property is in most cases used by the citizens, within the given legal framework.

Whether or not and which property rights are established over a natural resource depends on the nature of the resource

and external factors. Among the attributes of a resource, two are of importance in this respect:

- *excludability*, i.e. the question of whether potential users can be excluded at a reasonable cost, and
- *subtractability*, i.e. the question of whether withdrawal of resource units by one user reduces the benefits available for others, or, in other words, if there is rivalry concerning the benefits between users.

The higher the excludability of a resource, the greater the opportunities for restricting its utilisation; the higher the subtractability, the greater is the reason to do so. Both attributes are influenced by technical, social and other factors and are subject to change.

A particular combination of high or low excludability and subtractability narrows the choice of property regimes. Nevertheless, the attributes of a resource do not absolutely determine one form of property regime, but in most cases leave scope for decision-making. This decision can take into account social, economic, cultural, political and other factors and needs a certain social consensus. Where this agreement is lacking, the enforcement of a property right becomes increasingly expensive, if not impossible.

Common property regimes typically govern resource use and management of smaller or medium-sized water bodies with defined boundaries. Larger lakes and rivers are sometimes also managed as common property, not in their entirety, but sub-divided along the territorial boundaries of traditional rule.

‘Commonly owned’ water bodies and the aquatic resources they contain are regarded as part of the resource base of a village, a clan or a similar entity or ethnic group. In many ethnic groups, however, to the living only usufructuary rights are allocated, while gods, spirits, or ancestors and unborn generations are seen as the true owners of the water bodies.

Control rights over common property resources are usually exercised by the local traditional authorities, who act as *trustees* for the 'true owners'.¹

Use rights are typically granted to all members of the group which owns the resource, or to specific sub-groups such as males or part- or full-time fishers. Occasional fishing for home consumption is usually conceded to all group members. In some cases non-members (e.g. migrant fishermen) are also allowed to fish under certain conditions, e.g. against payment of fees or reciprocal granting of access rights to their fishing grounds. Members generally share resource use rights as well as related duties as co-equals.

The resources under common property are usually marked by a high degree of subtractability: fishing by one individual will noticeably diminish the fish remaining for others.

It is not practicable to share such resources within the user group by allocating individual property rights over individual resource units (sections of a water body or fish), and to exclude others from using that particular resource unit. Reasons are that

- a water body can hardly—at least not at reasonable costs—be divided up into small plots (different e.g. from agricultural land, which can easily be fenced off or demarcated in some other way)
- in capture fisheries, a particular fish cannot, for obvious reason, be made property of a particular fisher before it

¹ To leave control rights with the traditional authorities of the own (ethnic) group and not to concede them to any other groups or organisations is a distinctive feature of traditional African inland fisheries management. Cases where professional or other voluntary associations which exist independently of the overall traditional socio-political structures would be in charge of management (for example fishing co-operatives) do not exist in traditional African inland fisheries. Equally, a sovereign management by the users themselves does not appear to exist: users can express their interests and influence decisions only in the framework of traditional authority and the mechanisms of participation they foresee.

is caught (different from cattle or other tended animals, which are privately owned even when kept on a communal pasture).

To treat these resources as one pool and share them under a common property regime accordingly corresponds well to their nature.

Common property regimes provide a suitable framework for the joint utilisation of such resources, as they can prevent unauthorised extraction by outsiders and 'free riding' by group members (i.e. a disproportionate extraction of benefits or failure to contribute to necessary investments). In this way, legitimate users, withdrawing from the resource in a permissible way, can have a reasonable hope to participate in future benefits and therefore have an incentive to conserve the resource.

Where excludability is very low, resources are usually not subject to common property regimes. In fact, no cases of functioning common property regimes in African inland fisheries are reported where the possibility to exclude potential users (at least non-members of the group the resource belongs to) does not exist to a significant extent. For example, traditionally, fisheries on many of the larger lakes of Africa appear to have been subject to common property regimes, with traditional authorities allocating use rights within their rule. Due to social, economic, political and technological changes, which have severely limited excludability, many of these regimes have not endured (e.g. Owino 1999, Njaya 2000).

Where no property rights have been established or where a property regime has become inefficient or has collapsed altogether, an *open access* situation exists.

Open access situations can be found mostly where fish stocks are regarded as unlikely to be depleted (low subtractability), or where the low value of the harvestable resource does not justify management efforts. Examples are large lakes, some rivers, and floodplains during the flood season, when no definable boundaries exist and fish are

harder to catch: during the floods, fish resources can be utilised by everybody, but become common property when the floods recede (*cf.* Neiland *et al* 1994, Thomas 1996, Williams 1998).

The frequency of true open access situations in African inland fisheries is difficult to determine and appears to have been overestimated in the past (*cf.* Ostrom 2000). Some examples given as open access situations, e.g. where all members of the group owning the resource are allowed to fish, but outsiders are not, would be better described as common property regimes. In other situations, as in some floodplain fisheries, open access does indeed exist, but is granted only temporarily.

All modern states of postcolonial Africa lay claim to fisheries resources as their property. *State property* being superimposed on common property and traditional management has often resulted in unclear and contradictory competences, mutual undermining of authority and absence of effective management.

Private property of inland fisheries resources is uncommon in African traditional rural societies. Water bodies and aquatic resources are regarded as the property of the community or of higher beings, but can in some cases be allocated to a person or family for exclusive use. Exclusive use rights usually concern resources with a high subtractability and excludability, such as very small water bodies or sites for installing specific catching devices. Where private property, in the Western sense, of capture fisheries resources does exist, this is the result of recent developments.

To sum up, the following factors appear to determine the choice of property regimes in traditional African societies:

- excludability and subtractability of the resources
- the costs and benefits of making a resource more exclusive, determined among other things by the value of the resource (*cf.* Thomas 1996)

- social objectives, with the effect that use rights are preferentially allocated to many or all members of the community rather than to individuals (unlike in Western societies, where resources tend to be allocated as private property wherever circumstances allow).

Box 2: *Traditional management of fisheries in eastern Caprivi*

The management of fisheries in the eastern Caprivi is based largely on tenure, either by community, household or individual. In this way, access to fishing grounds is preferentially given according to how the user is associated with the owner. Tenure takes different forms according to the waterbody. Thus, in larger lakes and the perennial rivers (such as the Zambezi), tenure is held by the community for the use of its members, with sections of the river demarcated as being under the jurisdiction of the senior headman (*silalo induna*). Within these zones, each village has a subzone where its inhabitants usually fish, although in principle they are free to fish throughout the zone. If someone from outside the community wishes to fish, they are expected to first ask the senior headman for access. The general rule regarding permission is that individuals from adjacent wards are given preference, followed by members of the same ethno-linguistic group.

In the floodplain, small ponds, known as *mulapos*, form in depressions. These *mulapos* are under the direct control of either an individual or household and are inherited along the male line. Permission must again be sought to either fish or plough (when the pond dries up to reveal rich soil). In the floodplain proper, everyone in the community is allowed to fish. This includes those who spend most of their time outside of the community, and only return to take advantage of the greater availability of fish as the flood recedes.

Some other traditional management measures did exist in the past, although they are not practiced today. Intentional measures included a restriction on fishing until the *mulena* (chief) opened the season with a ritual called the *mubingo*.

Following the *mubingo*, the whole community fished in a combined effort. Part of the catch would then go to the *induna*. Further measures included the prohibition of fishing in areas reserved in honour of chiefs and a taboo against certain fish species.

The extent to which traditional tenure-based management still exists in eastern Caprivi seems to be related to the state of fish stocks, commercialisation, the influx of outsiders to the area and the park status of certain river areas, where management control was taken away from traditional authorities. Enforcement is initiated in different ways. If someone uses fishing grounds without asking, the aggrieved party can take them to court. More general offences, such as fishing by outsiders in community areas, or the use of dragnets can be reported by anyone from the community.

(Source: Abbott 2000, COFAD case study, see Annex 1)

2.2.2 General Features and Objectives

As one of the oldest rural economic activities, fishing, particularly in inland waters, has typically been governed by traditional rules and customs. Traditional fisheries management is still the predominant form of fisheries management in sub-Saharan Africa, particularly in situations where water areas are delimited, such as small lakes, some floodplains, lagoons and reservoirs, but also in riverine fisheries and larger lakes.

Traditional fisheries management systems are most effective in areas of low population density, and where internal and external pressures on the resource are low. They are usually tightly tailored to conform with, and derive maximum benefits from, the seasonal environment in which they have evolved.

Access to resources, harvesting and consumption of fish are subject to socially determined regulations and form part of an overall resource management and allocation concept. In the framework of such a concept, fishing rights are allocated similarly to usage rights over agricultural land.

Box 3: *Traditional fisheries management in north-east Nigeria*

Perhaps one of the most recent and in-depth studies of a traditional fishery has been the DFID-financed Traditional Management of Artisanal Fisheries (TMAF) research project, undertaken by the Centre for Economics and Management of Aquatic Resources (CEMARE), Portsmouth University. The project aims to determine whether traditional systems, and a greater community involvement, have a role in modern fisheries development policy (Sarch 2000, Sarch, 1994a/b, Sarch and Lewins 1994).

In a survey of 3 fishery systems, notably Upper River Benue, Lake Chad and Nguru-Gashua Wetlands, Sarch (1994b) identified that 75% of villages in each study area have exclusive access to certain fishing grounds and that in all cases some aspects of fishing came under the jurisdiction of a traditional master fisherman. The right to fish certain water bodies is restricted at certain times of the year, often during the receding flood. The dry-season pools and *fadama* (seasonally-flooded low-lying areas) are under community-based traditional management. Key institutions are involved in the management of traditional fisheries and impose restrictions which vary widely in each village.

Neiland *et al* (1994) describe the fisheries management systems according to particular aspects, among these:

Jurisdiction: The types of jurisdiction (i.e. the right and power to exercise authority and control over a defined range) could be classified as:

- traditional: fisheries management authority lies with traditional rulers, and has evolved over centuries, based on indigenous knowledge and culture. Although management objectives have changed over the years and recently seem to be revenue-orientated, they are resilient, deep-rooted and serve to protect the best interests of the community.
- non-traditional: authority and control lies with state, local and federal governments. The objective is sustainable exploitation or revenue generation.

Ownership: the Federal Government controls the natural resources in Nigeria with State and local governments having

mandates to enforce licensing, catch and gear regulations, designation of fish sanctuaries, closed seasons and other management measures. Traditional jurisdiction over fisheries resources retain some power within this framework.

Regulations: Regulations concerned

- fishermen numbers: traditional authorities controlled who could enter the fishing grounds but did not have a way to set limits on the number of fishers except during festival fishing
- fishing time: seasonal regulations were set by traditional and non-traditional authority; closed seasons exist in Benue and Nguru-Gashua wetlands but not Lake Chad; in *fadama* even daily time regulations were set
- gear: most regulations were set at community level and Government enforced rules applied in some areas; mesh sizes, use of cast nets, fish fences, fish dams, poison and explosives were all regulated in some form or other
- licensing: traditional authorities had no licence system and only Nguru-Gashua wetlands had government licensing
- catch: there did not appear to be any regulation of catch size and quantity.

Fisheries management regulations often have their roots in the social concept of resource-sharing, which is a collective value of most rural societies in Africa. It allows every member of the community to benefit from available resources, at least to the extent of securing household subsistence. Strategies of equitable resource use include reciprocal exchange and mediation within the community, and the maintenance of ceremonial and cultural values which support the concept.

The establishment and enforcement of regulations within the territorial boundaries of their rule is the responsibility of traditional authorities, usually village heads and/or councils of elders, or similar institutions. In West Africa, for example, there is often an earth priest (*chef de terre*), legitimised by (supposedly) being a direct descendent of the founder of

the village, or a specific water priest (or ‘water master’, *chef des eaux*), who decides on most issues and performs the rites connected with the water and its use (e.g. Oualbaded *et al* 1996). In Muslim societies, religious leaders, who also decide on secular issues, are often those responsible for fisheries management.

Below this level, other persons can be charged with specific tasks and responsibilities in fisheries management, e.g. ‘shore masters’, ‘fish watchers’ or ‘chief fisherman’. Finally, the whole traditional community is involved in observing and enforcing compliance to traditional rules, which are usually effective because of the high degree of acceptability and legitimacy they entail. According to one author (Olomola 1993), everyone accepts the responsibility of “being his brother’s keeper”.

Sanctions are often fines or confiscation of gear, but also social sanctions—some of them very subtle—are applied, such as public shaming or, less subtly, bodily punishment. Also ‘supernatural’ beings are believed to set rules for resource utilisation and enforce them, sometimes by killing the violator (e.g. Dangbégnon 2000).

Box 4: *Spiritual protection of lagoons in Ghana*

According to local belief, all lagoons along the Ghanaian coast are protected by gods or goddesses and have fetish priests acting as custodians who serve as a link between the spiritual and corporeal worlds. These traditional practices serve to regulate the harvesting of fish, preserve the water quality and conserve the mangrove forests (Entsua-Mensah and Dankwa 1997). Despite the existence of these customary beliefs, the lagoons are often too heavily exploited. This has been blamed on the advent of Christianity, western influence and education, and the intrusion of groups who do not share the same beliefs (Ntiamoah-Baidu 1991).

Most traditional fisheries management systems contain objectives similar to those found in modern fisheries management. The objective of sustainable resource use and resource conservation, for example, appears to be a feature common to both traditional and modern fisheries management. Based on local knowledge and interlinked with traditional beliefs, customs and rules, traditional management systems may entail more than one objective, however.

Equally common are objectives which reflect economic and social postulates: while aiming at optimising resource utilisation, they still contain elements of resource sharing. Under most traditional regimes, for example, fishing for subsistence is open to all members of a group, a concession often made use of by women and children.



Photo 3: Boy at Lake Mwange, Zambia, presenting his rich catch of Nile tilapia

Box 5: Tradition and knowledge systems

The term 'traditional' as used here refers to a cultural continuity among a group of people, transmitted in the form of social attitudes, beliefs, principles and conventions of behaviour (*cf.* Berkes and Farvar 1989, Berkes 1999). It does not imply that practices characterised as 'traditional' have been transmitted unchanged from pre-colonial or any other time when outside influence was supposedly low or non-existent. Nor does it imply that a practice takes place in an overall 'traditional' context, such as in the absence of a money economy.

The continuity referred to by the term may relate to

- an individual practice and its appearance
- the institutions² governing and carrying out a practice as well as their legitimacy, or
- the general cognitive background—the knowledge system—on which the practice is based.

As opposed to 'traditional', 'modern' relates to practices and institutions introduced only in recent times under the influence of outside cultures, such as colonial administrations or external assistance agencies.

Traditional customs and practices, such as traditional fisheries systems, do not stand alone, but are linked to a specific cognitive background or knowledge system. Scholars have suggested various adjectives to describe these knowledge systems, with 'traditional', 'indigenous' and 'local' being the most often used. Each of these adjectives highlights certain features:

- *traditional* emphasises the continuity. Some scientists, however, want to avoid possible negative connotations of the term, such as primitive, savage or static.
- *indigenous* emphasises that the knowledge has been developed by the people themselves and is often linked to ethnic groups (even though not all members of the ethnic

² The term 'institutions' is used here in the sense proposed by D.C. North: "Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social, or economic." (North 1990)

group share the knowledge in total; there is always specialist knowledge in various fields).

- *local* finally puts the focus on the fact that knowledge has been developed under and for local conditions, with limited outside influence, and entails information on a local situation. This term will be applied in the further course of this study.

Local knowledge is seen as a system, because it has a complex structure and includes individual facts, nomenclatures and categories, information on processes (e.g. biological processes, social processes such as rites), cosmologies, world views, religious beliefs and moral tenets. These components are closely interlinked and integrated.

The antonym of 'local knowledge' is 'scientific' or 'formal knowledge': knowledge which is generated by the global scientific community. It is, however, difficult to discern a clear dichotomy between local and scientific knowledge (*cf.* Agrawal 1995), as scientific knowledge is also characterised by the cultures that had a dominant influence on its development. 'Western knowledge', a term also frequently used as an antonym to local knowledge, does not describe the true opposite, but rather local knowledge of other parts of the world.

There is a frequent exchange of elements of knowledge between knowledge systems. Scientists, for instance, systematically screen local knowledge of medical plants, and rural Africans usually have no problem in understanding and accepting the basic mode of operation of a television or aeroplane. Indeed, the two knowledge systems are not mutually exclusive, and local knowledge has generally been innovative and open for new insights.

However, individuals as well as social organisations tend to filter information and absorb and accept only those elements of outside knowledge that are compatible with their own knowledge system. This process—described as “self-reference” in systems theory—limits the flexibility of traditional knowledge (as it limits the ability of scientific or western knowledge to understand traditional knowledge systems).

Transfer between knowledge systems is generally easier for practical and factual knowledge, while more complex constructs such as cosmologies are difficult, and total knowledge systems virtually impossible, to communicate.

This does not mean that traditional patterns of resource allocation would always be equitable: in some cases, they favour privileged subgroups or keep benefits from others.

Political and institutional objectives, for example may pursue aims such as the preservation of the power status of traditional rulers or the allocation of economic benefits to specific individuals and groups within the community. If, for example, fees, tributes, or shares of the yield are demanded to access a fishery, their payment may serve to stabilise the institutions in charge of fisheries management or serve social purposes; for example, if they are used to support the needy.

Similarly, traditional management approaches accommodate spiritual, religious and related objectives, often interwoven with the objectives previously mentioned.

Box 6: *Fisheries management measures in south-west Nigeria*

Olomola (1993) describes nine principal management measures—rules or regulatory mechanisms—which he found in place in his study area in south-west Nigeria.

1. Prohibition of immature catches
2. Restriction of the use of particular fishing gear (permanently or temporarily)
3. Prohibition of fishing in some creeks (sacred grounds)
4. Prohibition of fishing on the days of festivals
5. Prohibition of the use of chemicals as a means of catching fish
6. Prohibition of the use of magical power in fish harvesting
7. Ritualism for the replenishment of fish stocks (sacrifices, prayers, other rituals and ceremonies)
8. Taboos against eating certain fish species
9. Closed seasons.

(Source: Olomola 1993)

2.2.3 Management Measures

Traditional fisheries management systems in sub-Saharan Africa employ a variety of management measures. Many of these measures can also be found in other fisheries of the world, whereas others are quite specific to Africa.

The rationale of many management measures may be obscured by the socio-cultural and religious context in which they take place; their effect on the resource may sometimes appear to be a side-effect rather than intentional. Often, for example, rituals and magic are interwoven with fisheries management measures. They are in some cases “considered an integral part of fishing technologies rather than ‘additions’, and should be treated as such by external institutions” (Tvedten and Hersoug 1992). Means which are justified on primarily metaphysical grounds may, in the knowledge system of African inland fishers, be part of goal-oriented and intentional resource management, however.



Photo 4: Young fishermen, Lanke Mwange, Zambia

Box 7: *Intentional and inadvertent fisheries management measures*

Traditional fisheries management systems and measures have been classified along different lines. A common example is the division into intentional and inadvertent approaches, with intentional measures explicitly aiming at resource-related objectives (especially resource conservation), and inadvertent measures primarily pursuing other objectives, e.g. religious or health-related ones (Klee 1980, Scudder and Conelly 1985). However, even authors using this classification acknowledge that it is difficult to decide whether individual practices conserve a resource intentionally or inadvertently (Beyer 1980). The problems involved can be illustrated with the help of an example described by Olomola (1993).

In his study area in Nigeria, traditional management includes a ban of fishing in certain creeks. These creeks are regarded as sacred grounds and are reserved only for sacrifices to deities which are believed to protect the lives of the inhabitants of the local communities. It is believed that if sacrifices are carried out in a proper manner, the deities will release large quantities of fish from sacred grounds to areas where people are permitted to fish.

Olomola calls the prohibition “inadvertently” protective of the fish stocks. However, as the management measure aims at the maintenance or even an enhancement of fish stocks, it could also be classified as intentional. Moreover, modern fisheries biology may find that the creeks concerned are important breeding grounds and therefore support the traditional management measure. It is not unusual that management measures put into force on the basis of traditional knowledge coincide with insights gained through scientific knowledge (*cf.* Price 1995, Owino 1999).

This is not to say that there are no inadvertent management measures or that the distinction is unfounded, but rather that it is difficult to make this distinction without an in-depth knowledge of the people and their cognitive background.

Some of the management measures frequently found in African inland fisheries are discussed in the following paragraphs.

- *Access control*

The most common traditional fisheries management measure is to restrict the right of withdrawal to a defined group of people in order to quantitatively limit fishing pressure. Access may also be granted as a territorial use right.

Box 8: *Marking of fishing gear, Sierra Leone*

The technological requirements for successfully exploiting the highly variable inland waters of the Pujehun district in Sierra Leone led to the development of many different kinds of indigenous fishing gear. In most cases the nets, traps, fences, snares, spears, etc., and the way they are used, has been developed to technological perfection over time.

Traditional gear is produced from natural materials and operated by almost all people of the fishing villages, including children and the old. The number and types in actual use vary with their specific purpose, the hydrological and biological conditions of the fishing ground and their fish populations, and the personal productivity of the manufacturer. Of the different traps alone, a single fisher may use more than 50 at one time, and thousands may be found in the same stretch of water.

When used on common fishing grounds, the fishing gear therefore needs to be marked by the owner so as to be identifiable. The individual marks are distinctly different and recognisable to all fishers. Apart from establishing ownership, the marks also allow better control of fishing as intruders, as well as violators of spatial and/or seasonal fishing regulations, become more easily detectable.

(Source: Beck 1985)

- *Closed areas*

Traditional fisheries management authorities may declare specific parts of a water body off limits for fishing. Prohibition may cover all fishing activities or the use of specific gear, the fishing of certain species, or fishing during certain time periods.

Box 9: *Examples of closed areas*

During dry season, the Red Volta, like other arid rivers, breaks up into a series of stagnant pools in which river biota concentrate. Especially the larger, perennial pools are critical for survival of aquatic animals, including hippopotami, crocodiles, and fish. Fishing is forbidden in certain pools by traditional regulation and rituals, such as prayers and sacrifices, are carried out in order to seek the favour of river deities. In this way, reproductive stocks are maintained through the dry season and re-colonise the river as the waters return with the onset of the rains. Examples similar to this observed by Beck (COFAD) near today's Lake Bagré in Burkina Faso, are reported by Price (1995) for the Niger River.



Photo 5: Pool at the Red Volta declared sanctuary, site for sacrifices in the foreground, marked by sticks

In many cases, these restrictions are again associated with religious beliefs, for instance when the respective water is seen as the home of a spirit.

- *Closed seasons*

Closed seasons exist particularly at times when fish stocks are most vulnerable, such as during spawning or at the end of the dry season, when fish gather in residual waters and can be harvested almost completely.

Box 10: Examples of closed seasons

An example of a closed season can be found in Zambia, where the Luvale impose a form of closed season in the main river channels of the floodplains during the dry season (Beck 1986).

Often, fisheries are closed almost all year round, and are opened only for short periods. Olomola (1993) reports on some lakes in Nigeria, where fishing is only permitted twice a year. The first fishing season corresponds with the onset of the rainy season, while the second coincides with the receding flood waters. These fishing events only last for one day, and are announced by a 'town crier' with the authority of the community leader.

Where fishing takes place only for few days each year, it is often carried out as a 'fishing festival', with almost all members of a community taking part in it. Examples can be found amongst the Nyakyusa fishermen, Tanzania (Wilson 1951) and in West African lagoons. One reason for these festivals may be that they ensure an equal distribution of the benefits within the community.

Many such traditions seem to have arisen from the proper identification of spawning and breeding seasons (and grounds) and the recognition that fishing during certain periods could have detrimental effects on the fish stocks (e.g. Owino 1999), although social and metaphysical reasons are often given for the prohibitions.

- *Gear restrictions and restriction of particular fishing methods*

Gear restrictions either concern the use of specific gear in general or, in the case of nets, the regulation of mesh sizes. Mesh size regulations are reported in recent times only and are applicable only to modern nets. They can be seen as an answer of traditional management systems to technical innovations or even as an incorporation of Western or scientific knowledge into traditional knowledge systems.

Box 11: Examples of gear restrictions

Fortes (1937) and Braimah (1991) discuss the restriction of various types of fishing gear in the communal fishing of ponds in Ghana. Pond owners, who are often community leaders, encourage community participation in the annual week-long fishing event. Gear restrictions are imposed in order to prolong the fishing of the ponds and enable the fish to get into the hands of as many as possible. The purpose of these events is thought to maintain the social status and prestige of village leaders.

Olomola (1993) reports the recognition of the over-exploitation of certain fish species as being the rationale for imposing gear restrictions. Restrictions were placed, for example, on the use of cast nets for catching *Gymnarchus niloticus*, and on pole-and-line fishing for *Ophiocephalus obscurus*. Since 1988, the mesh size of cast nets has also been restricted to a minimum of 5 cm in the region he investigated.

Beck (1986) observed *luvale* fishermen (see Box 14) at Lake Mwange, Zambia, operating cross-river fences (*lugando*) to catch mature catfish on their annual spawning runs. When yields diminished, they modified the fences by slightly increasing stick inter space, i.e. reducing screening efficiency. In this way, the traps were transformed into selective fishing gear, allowing mature fish below a certain size to pass through the fence unaffected.



Photo 6: Lugando fences at Lake Mwange, Zambia

- *Prohibition of capture of certain species or of under-sized specimens*

The capture of certain fish species is prohibited, either totally or only in certain waters, and this has possibly evolved from the recognition that the collection of juveniles in one fishing season led to low catches in the next. Prohibitions can also be religious, for instance where fish are regarded as sacred, or result from a taboo to eat fish, which exists for a small number of ethnic groups in sub-Saharan Africa (*cf.* Simoons 1974). Also, clans or families which have a particular fish species as their totem are not allowed to eat or to catch that particular species.

Box 12: Traditional fisheries management in Sierra Leone

In the Bo-Pujehun region of Sierra Leone, a complex form of traditional resource management occurs which involves closed fishing areas and seasons, gear restrictions and the licensing of canoes. Traditional regulation is aimed primarily at sustaining fishery yields within the tilapia fishing grounds of Lake Mabesi and in the common property fishing grounds of the main river systems. The management systems are controlled by the paramount chiefs of local communities.

The most striking feature of these resource management systems is the role of the *nyeilomui* (fish watchers), who are directly responsible for the enforcement of local fishing rules. Every village has such an authority who is assisted by an apprentice. Fish watchers are generally highly respected and the lifetime office is passed on to the assistant after the death of the holder. For their service to the community, the fish watchers receive in-kind or monetary payments, given on a voluntary basis. Violations of fishing rules are brought before the village chiefs and normally result in the confiscation of gear and/or imposition of fines.

In the northern section of Lake Mabesi lie three densely wooded, flat islands. During the rainy season they are completely submerged and attract fish by offering shelter, food and spawning grounds. During this time the area is closed for fishing and the fish watchers anchor their canoes over the islands which at this point lie 3-4 metres below the water surface. The arrival of tilapia is indicated by the high turbidity of the water caused by nest-digging activities. Nest construction is in its final stages when capillary roots of the trees cut off during construction of the nests float to the surface. From then on it takes only a few days for the majority of fish to spawn.

The opening of the fishery is dependent on the decision of the fish watchers, after which large-scale fishing takes place. Determining the optimal opening day is not easy. If not properly estimated, fish might either still be spawning or they may have already left the area. Both factors can lead to short- or long-term fishery losses.

In parts of the floodplain river systems, the fishery is effectively closed all year round except for 1-2 days at low flood when the community virtually empties the residual water bodies of all fish of catchable size.



Photo 7: Nesting sites of tilapia at Lake Mabesi, Sierra Leone during low water

If properly managed, these forms of fishing achieve the following objectives:

- sustainability of future yields
- efficient fishing through which high catches are achieved with little effort.

These regulations are dynamic and continuously adapted, for example, a decrease in yield would result in the tightening of regulations. All fishermen are involved in the decision-making process governing their resources at the village or group level. Violations of rules result in sometimes severe sanctions.

(Source: Beck 1985)

- *Limitation of individual fishing effort*

The strong influence of egalitarian philosophy in traditional African societies finds expression in prohibitions of disproportionate extraction by individuals.

Olomola (1993) mentions the prohibition of using magic power as an indirect management measure leading to this effect, particularly because extraordinarily high catches alone are regarded as circumstantial evidence for the use of witchcraft.

- *Sacrifices or payment of fees*

According to many traditional beliefs, waters are often the home of spirits or deities. In the view of the fishers, to keep them in a favourable mood requires sacrifices. Often, sacrifices are seen as an absolute prerequisite for fishing and an integral part of the activity. Traditional fisheries management systems therefore frequently force the individual fisher to make an adequate contribution to this 'investment'. (The practice of making sacrifices could even represent an attempt of fisheries enhancement, aiming at an increase of production *beyond* a level which is sustainable by 'natural' processes.)

Such obligatory sacrifices, in the same way as fees or shares of the harvest to be paid to traditional rulers or to communities owning a resource, act as a threshold for entering fisheries. Intentionally or not, they may limit fishing effort to a certain extent, depending on the size of the 'entrance fee'.

2.3 Traditional Fisheries Enhancement

Systems or measures of fisheries enhancement are found in many countries and regions of sub-Saharan Africa. Some presumably evolved over centuries, others have emerged fairly recently. Traditional fisheries enhancement systems and measures are implemented within frameworks of traditional resource management. As such, they are linked to a variety of objectives but, compared with capture fisheries management, economic objectives (i.e. to increase physical and economic yields) have a much higher relevance. All systems and measures have in common:

- a degree of management and intervention which goes beyond that of traditional capture fisheries
- property rights which are defined more narrowly than in capture fisheries.

Traditional fisheries enhancement usually includes one or more of the following areas of intervention: movement of fish stocks, extent of water retention, water quality (fertility) and/or availability of fish feed. Often enhancement techniques are rooted in and combined with methods of fish catching, as for example the attraction or confinement of fish.

Fisheries enhancement systems largely rely on the same resources as capture fisheries. They usually involve smaller water bodies, because such habitats can be guarded and harvested more easily than larger rivers and lakes and are thus characterised by a high excludability and subtractability. Unlike in capture fisheries, exclusive use rights over the (enhanced) resources are frequent, and enhancement facilities are usually private property.

Almost invariably, fisheries enhancement systems or measures are in competition with other forms of resource use, in particular capture fisheries.

Traditional fisheries enhancement systems are based on local knowledge and are subject to traditional rules and regulations applicable to resource utilisation. Larger

enhancement systems these days are regulated by modern laws and institutions to at least the same extent as they are subject to traditional regulations and the attention of local authorities, especially where there is a risk of conflict.

The traditional fisheries enhancement systems that were investigated in the course of this study were based on one of two principal strategies:

- to modify a habitat by introducing structures which not only attract fish (such as fish aggregating devices (FADs) in capture fisheries) but additionally provide periodic shelter, thereby improving stock recruitment, survival rates of juvenile fish and/or natural food supply. Such systems are here referred to as *shelter fisheries systems*
- to retain water and fish with the help of physical structures. These systems are referred to as *retention systems*.

The two different types of systems are described and discussed in some detail below, mostly regarding their technical and economic aspects. Unfortunately, only little information on their social implications is available to date.

2.3.1 Shelter Fisheries Systems

Fishers have long since known and taken advantage of the fact that many fish species associate themselves with floating or drifting objects which provide shelter and protection against predators. Exploiting this behaviour pattern, communities in many parts of sub-Saharan Africa have devised semi-permanent structures known as fish aggregating systems in order to attract fish and thus increase catches. Many of these systems also improve fish habitats or provide additional feed, thus enhancing the resource.

Brush parks

Brush parks are submerged structures made up of wooden materials such as brushes and branches which are usually fixed to the bottom of a shallow water body. Brush parks are

found in several African countries, and particularly in West Africa. They are mostly located in brackish water lagoons, but are also found in freshwater lakes and rivers (for example in the Ouémé River, Benin). They cover water areas ranging from a few square metres up to several hectares and are labour-intensive to construct and operate.

The functions of brush parks are

- to offer certain fish species a relatively protected environment for breeding, spawning and feeding
- to provide additional fish food in the form of *aufwuchs* (aquatic organisms attached to underwater substrates) and associated fauna which colonise the structures
- to attract fish.

While the first two functions enhance fish production, attraction only subtracts fish from stocks that are otherwise available to capture fisheries. Depending on the design and operation of a brush park, either enhancement or aggregation dominates in the overall set of functions.

Brush parks mimic certain shore or shallow water habitats. The species composition within them is therefore narrower than outside their confines. In most brush parks of West Africa, for instance, tilapia species (e.g. *Sarotherodon melanotheron*) dominate the catches.

Yields from brush parks evidently increase exponentially with the time lapse between harvests. By harvesting at 3-month intervals, fish yields may easily come close to the amounts which are otherwise attainable only by extensive aquaculture. Many brush park owners, however, are forced by cash flow problems to harvest at shorter intervals, which will decrease overall yields.

Pockrandt (1993) points out that the frequency of harvest generally increases with decreasing size of the specific shelter. In some cases brush parks are being raided every couple of days, thus acting entirely as fish aggregating devices. Examples of this type of fishing are reported from Madagascar (Kiener 1960, Kapetsky 1981). The so-called

vovomora, consisting of a circle of compressed ferns surrounded by vertical sticks (about 0.5 m diameter), are placed in coastal lagoons in order to attract, in particular, cichlids and some species of freshwater prawn. In addition, floating grass is often taken as a fish aggregating device, making use of the fact that fish approach it in search of food or shelter (Gordon 1989: Ghana; Williamson 1972: Lake Chilwa, Malawi; Beck 1985: Sierra Leone).

Brush parks are mostly privately owned, built under some kind of use right obtained for the section of the water in which the operation takes place. Individual ownership prevails but Weigel (1985) reports on a case in Benin in which 17 co-operatives representing 300 fishers have successfully operated an area of 80 ha of *acadjas*.

Box 13: Brush parks of sub-Saharan Africa

The brush parks of Benin, known as *acadja*, have existed for at least two centuries and are by far the most well-documented of all the brush parks in sub-Saharan Africa (*cf.* Welcomme 1971, 1972, 1979, Hem 1987, Dankwa and Mensah 1996). An *acadja* can extend over an area of a few square metres to several hectares. Generally, their structure follows four basic designs, which vary according to social and economic needs:

- *Aula*: a small circular structure of floating vegetation and branches which is positioned in rivers as water levels recede after the rainy season. *Aula* are often set in clusters of four to six units, each with a diameter of approximately 20 m. These clusters are usually fished every 20 days, either in rotation or simultaneously.
- *Ahlos*: similar to the *aula*, but rectangular. They are usually put in place towards the end of the rainy season, attached to river banks or at the mouths of river channels on floodplains. They are fished every 3 months during the flood.
- *Acadjavi*: rectangular structures, comprising a matrix of branches, which extend up to 40 m². One type, the

amedjerotin, is constructed entirely of palm leaves. Being small in size, they require less capital than larger *acadjas* and are therefore often owned by poorer community members. They are usually fished more frequently than the larger brush parks, and yield over 2 tonnes per hectare per year. *Acadjavi* are common in Lake Nokoué, where they are associated with reed beds.

- *Ava*: large rectangular structures, similar to but larger than *acadjavi*, known to reach up to 7 ha in size. They are particularly prevalent in Porto Novo Lagoon, Lake Nokoué and Lake Ahémé where *ava* of 0.25 ha in size are densely grouped.

Ava and *acadjavi* also exists in combination, where a central *ava* is surrounded by several *acadjavi*. The central *ava* is rarely fished but serves as a reserve for recruitment to the smaller associated *acadjavi*. These are generally fished once every 2 months.

Acadjas are in most cases private property, the section of water containing an *acadja* is passed on within families (Kirk and Adokpo-Migan 1994). While *acadja* operation is a male affair, women in the hinterland are involved in collecting the branches.



Photo 8: Acadjas in Benin

2.3.2 Retention Systems

The fish retention systems found in Africa are the traditional enhancement technique closest to modern aquaculture. Most systems comprise the retention of water by weirs and/or flood depressions and ponds, water management and a certain control over fish stocks. Fish may either be stocked or naturally present in the retained water and their production aided by feeding and/or fertilisation.

Box 14: Fisheries of the Luvale, Zambia

The Westbank floodplains of the Upper Zambezi, north-west Zambia, which stretch over about 8,000 km², are the main fishing grounds of the local ethnic group, the Luvale. The Luvale have fished their waters since time immemorial and their knowledge of fish is said to be exceptional among African fishers. In their language they differentiate between more than 50 species of fish, and have extensive knowledge on the ecology of their fishery.

The fishers of the Luvale have traditionally lengthened and enhanced their fishing cycle through a series of retention structures, traps and enclosures. The fishing cycle begins in December when the rivers break their banks and fish concentrate in the flooded channels during their migration to the spawning grounds. At strategic points, cross-channel traps (*lugando*) are erected, thereby obstructing the migratory route particularly of catfish. This method of fishing is known as *musuza* and is followed by a period of little fishing due to the height of the flood.

As the flood waters recede, fish weirs (*walilo*), constructed from reeds or mud, built across drainage streams and large depressions, are put into use. *Walilo*, which often stretch for hundreds of kilometres and are recognisable from satellite images, can be very old and remain the property of the original builders' descendants. With the aid of these barriers and fences, the water is literally screened for migrating fish, most of which are juveniles. This method is not thought to threaten the sustainability of the fishery as the amount caught represents only a fraction of the total production.

In some cases, depending on the physical propensities of the underlying ground, *walilo* also retain water, nutrients and fish for up to several months, thus creating retention ponds.



Photo 9: Permanent walilo structure on Zambezi Westbank floodplain, Zambia, during dry season

From July until the beginning of the next flood a variety of fishing activities concentrate on the fish which congregate in the residual waters of the floodplain. The ponds are either bailed out or fished using poison. The main river channels, in which the larger mature fish and a large proportion of the young fish survive the dry season, are hardly fished. Approximately 2,000 tonnes of fish are harvested from the *walilo* each year, representing a yield which is up to five times higher than that from capture fisheries in open waters.

(Source: Beck 1986)

Permanent or semi-permanent barriers

Barriers and dams are commonly constructed of reeds, grass, mud and more solid materials, and are built across small channels or used to raise natural embankments. The dams more or less control the inflow and outflow of water

and retain fish. The ponds thus created are fished either with the help of traps, baskets or nets while the water is still in them, or by breaching the dam and releasing the water through nets or traps and collecting the remaining fish when the bottom becomes dry. This traditional activity has similarities to extensive forms of aquaculture and is widely practised throughout sub-Saharan Africa (*cf.* Neiland *et al* 1994: north-east Nigeria; Vallet 1993: Cameroon; ICLARM/GTZ 1991: Malawi; Scudder 1960: Zimbabwe and Democratic Republic of Congo).

Fences and traps

A combination of fences and traps constructed from bamboo or palm fronds are often used to exploit fish migration patterns. These structures, which are usually arranged in a complex labyrinth-like formation, can reach considerable lengths. In the Barotse floodplain (Zambia), for instance, earthen embankments guide fish through the channels and lead them to traps.

While fences and traps are closer to fish-catching devices than to enhancement systems, when not involving additional management measures, there are cases where they are part of rudimentary enhancement techniques.

Hatsi, for example, are barriers built from sticks, shrubs or reeds, and commonly used in Denu and Keta Lagoons in Ghana. These structures can attain a length of several hundred metres. Baskets are fitted at regular intervals along the length of a *hatsi*, with their entrances positioned against the current in order to trap fish. They are privately owned, and their installation requires the intervention of authorities to establish usufruct rights in order to avoid resource conflicts. *Hatsi* are erected towards the end of the dry season, frequently on the edges of swampy areas which open into deeper water. The main operating period for *hatsi* is between May and September.

Primarily constructed as fish-catching devices, *hatsi* are also associated with small brush parks in Ghana where they are

constructed in a semi-circle around the brush parks to retain fish (Stegemann 1998). Hornell (1950) observed a similar system in Benin, where fishers enclosed brush parks within a semi-circle of branches. Feeds were thrown into these enclosed areas for a period of 2 months, after which the fish were poisoned and harvested using cast nets. The branches were later replaced by a wall of netting which encircled the brush parks, held in place by stakes and resembling the cages and pens used in modern aquaculture. At harvesting time, the brush parks were dismantled and the net drawn together, thereby trapping the fish.

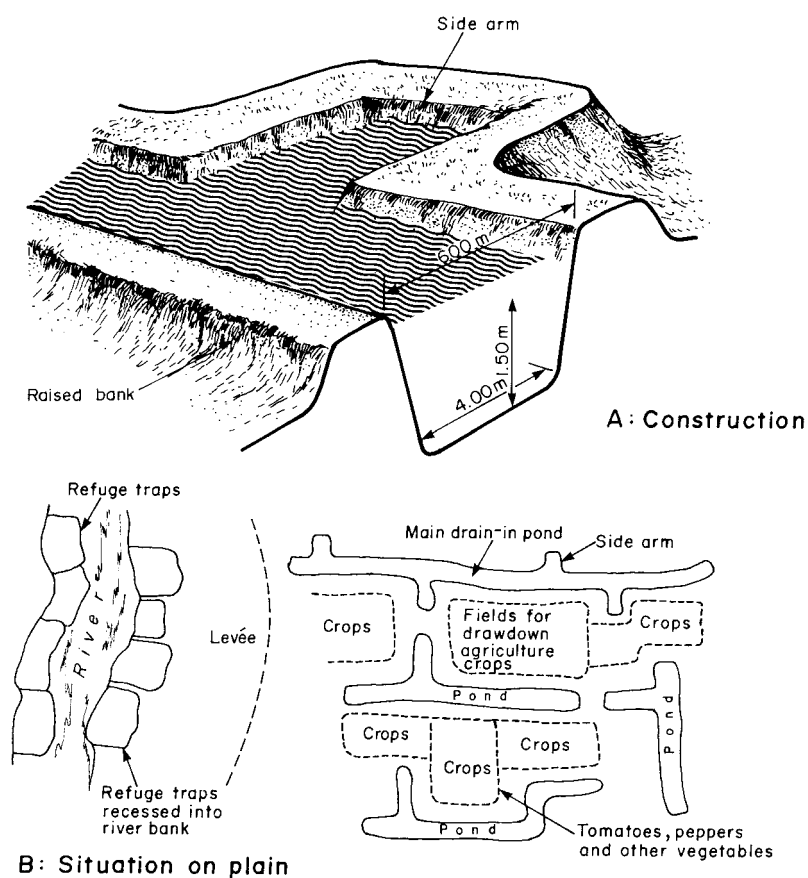


Photo 10: Men with small fish harvested from a traditional pond, D.R. of Congo

Drain-in ponds

In floodplains and other seasonally inundated areas, naturally occurring depressions are deepened or ponds are dug in order to prolong the retention of water and lengthen the fish-harvesting season. These structures are known as *drain-in ponds* or *fish holes* (*whedos* in Benin and parts of Ghana, *ebe* in other parts of Ghana). Fish enter these ponds during the floods and are naturally trapped as the waters recede. Along the Ouémé river system in Benin, approximately 3% of the surface area is occupied by drain-in ponds, some of which are several kilometres in length.

Figure 3: Construction of a typical *whedo* in Ouémé valley of Benin



Source: ICLARM/GTZ (1991), based on Welcome (1983)

Box 15: The ebe system of Ghana

Ebe are a type of drain-in pond widely used in some Ghanaian lagoons. They originated from water bodies created in irrigation perimeters, particularly those established for sugar cane, where fishing was carried out on a temporary basis. In Denu Lagoon, a seasonal floodplain depression in East Ghana, the use of *ebe* developed into a full-time activity in the 1960s when an alleged tidal wave swamped the area and inundated the soils with saline water. The contamination of agricultural soils has since continued, probably compounded by natural salination through overuse of irrigation.

Ebe are prepared or maintained towards the end of the dry season (January-February) by digging shallow ponds to a depth of approximately 60 cm. It is common to find *ebe* situated close together, separated by earthen dams of about 0.5 metres in height. Generally they adopt a rectangular shape with a surface area of about 150 m², but have been known to extend to 400 m². *Ebe* are private property and are constructed by family members or hired labour.



Photo 11: Ebe being harvested

In Denu Lagoon, *ebe* occupy over 1,500 ha of the lagoon area, owned between approximately 3,500 people. At the

height of the seasonal floods (July) these *ebe* are no longer visible under a water depth of up to 2 m. At this stage, the lagoon is under a common property regime and capture fishing using gill nets, cast nets and hand lines is widely practised.

As the flood waters recede (from September) the dams of the *ebe* become visible and are reinforced using mud. The dams are allowed to dry before the fishing of the *ebe* commences, to prevent them from being damaged. Fish are caught using dragnets or by bailing the water out. The latter technique is less damaging to juvenile fish and involves the construction of a mud chamber of about 10 m² in the corner of the *ebe*. A trap or wicker basket is built into the wall of this chamber with its opening towards the larger part of the *ebe*. As the water in the chamber is bailed out, the fish are drawn into the trap along with the receding water. The fish are hauled out in the basket as it fills. Tilapia are the main species caught. Once all the large fish have been harvested, the adjoining dam to a neighbouring *ebe* is broken to allow water to enter and refill the *ebe* and so forth. The remaining fingerlings are then allowed to grow before the next harvest takes place. There are usually two harvests per dry season. *Ebe* yield approximately 500 kg per hectare per year (Balarin 1997).

Occasionally, owners of *ebe* will fertilise their ponds and provide feed in the form of maize husks and rice bran. There is a recognition amongst *ebe* owners that additional feeding enhances yields. In some cases merchants will contract the harvesting of *ebe* from the owners and will apply fertiliser and feed to the ponds in the weeks or months prior to harvesting.

The owners of *ebe* in Ghana are protected by a traditional management system which forbids the use of devices such as fences (*hatsi*) that could divert fish resources away from the *ebe*.

(Source: Stegemann 1998, COFAD case study, see Annex 2)

Drain-in ponds exploit the annual cycle of flooding and desiccation that many river systems and floodplains in sub-Saharan Africa are subject to. Floodplains are highly productive aquatic and terrestrial environments which provide their human inhabitants with a variety of products

throughout the wet and dry seasons. During the wet season, when the rivers overflow their banks and flood waters extend across the plains, the nutrients from terrestrial sources, for example from rotting vegetation and animal dung, enter the aquatic food chain. Fish are able to move freely within flooded areas to take advantage of the rise in primary productivity. As a result, there is a seasonal increase in fish biomass in floodplain areas. The timing and extent of flooding, however, is uncertain, making the size of the catch unpredictable.

Box 16: *Traditional management of drain-in ponds*

The Libinza people of the Ngiri River floodplain, D.R. of Congo, have developed a particular type of drain-in pond. Natural terraces within the floodplain are modified to form ponds, and water from nearby channels is allowed to enter and fill the ponds. Once the ponds are filled, they are closed off with wicker fences and mud. The fish within the pools are often so concentrated that it is necessary to feed them. A few decades ago, these traditional fisheries enhancement systems were operated as private ventures, and outsiders wishing to fish the ponds were subjected to user fees. Since 1960, the Government has granted free access to the ponds and as a result only a few ponds are in use today (Goffin 1909, Leynseele 1979, Baluyut 1989).

In northern Ghana, shallow seasonal ponds of less than 5 ha in size are traditionally used for the retention of fish as a method of fisheries enhancement. During and immediately after colonial rule, the ponds were not managed effectively by government authorities. Since then, some of these ponds have come under the responsibility of local chiefs and have been operated on a sharecropping basis by community members. This approach proved very successful and some chiefs handled the matter with such good judgement that the upkeep of the local authorities depended on the management of the fish ponds (Denyoh 1982, Braimah 1991).

Through drain-in ponds, people living in floodplains make use of the increased biomass, on the one hand, and on the other hand reduce the uncertainty of production by making fish available over a longer time and on a more reliable basis. Drain-in ponds, however, easily become congested with vegetation during the dry season to the point of becoming anoxic, particularly when water temperatures are high. Therefore, although drain-in ponds are originally colonised by a variety of species during the earlier part of the receding floods, only the most hardy fish survive towards the end of the dry season.

The management of some drain-in ponds and other retention systems includes feeding of retained fish, mostly with agricultural wastes and by-products, uneaten food or inedible parts of it having fertilising effects. In a few cases observed, retention ponds were stocked with juvenile fish collected from open waters and restocked in the smaller, more manageable water bodies.

Box 17: *The use of floodplain ponds of the Niger-Benue drainage system*

Awachie (1975) describes the use of seasonal as well as perennial lakes, pools and swamps along the floodplains (*fadamas*) of the Niger-Benue drainage system as fish ponds. The level of management depends on the ownership conditions and on their distance from settlements or villages: privately owned lakes and ponds near settlements are fed and fertilised with household and agricultural wastes, as there is a recognition that this improves fish yields. As opposed to this, communal lakes and ponds and those privately owned but at a greater distance remain unfed. Larger ponds are harvested annually, usually at the height of the dry season when catches from the main river channel are poor. Smaller family ponds are subject to continuous cropping. The partially managed ponds yield approximately 70% of total inland fish harvests of the area. Migrant fishermen are able to purchase the right to fish privately owned ponds under agreed terms.

Frequently, drain-in ponds are used to supplement income during the lean season for agriculture. In Benin, maize and vegetables are often cultivated on the banks of drain-in ponds and the flats between ponds, irrigated with the water retained in the depressions. Drain-in ponds are also used in conjunction with rice cultivation as part of an integrated farming system (Welcomme 1985).

While drain-in ponds usually are operated as private undertakings, *wbedo* fishing is sometimes a group activity under the control of the chief fishermen of a village.

2.4 Modern Fisheries Enhancement and Aquaculture

Modern fisheries enhancement and aquaculture operations, using technologies of Asian and European origin, play only a marginal role in sub-Saharan Africa today.

The most frequent measure of *modern fisheries enhancement* is the introduction of non-native species into natural or man-made waterbodies. Examples are the introduction of the Nile perch (*Lates niloticus*) in Lake Victoria and the stocking of some larger lakes (Kariba, Kivu) with the Lake Tanganyika sardine (*Limnothrissa miodon*). These measures, most of which date back to pre-independence times, aimed at enhancing artisanal capture fisheries, but also led to the establishment of semi-industrial fisheries.

Furthermore, some carp, bass and trout species have been introduced in African countries, mostly to enhance sport fishing. Other species, as for example tilapias, have been introduced into areas where they were not endemic for pond culture or in the context of culture-based fisheries.

Culture-based fisheries—the regular stocking of small and medium-sized water bodies with juveniles originating from aquaculture—has never had the success in Africa that it had in other regions, notably Asia. It was practiced in only few African countries, among them Burkina Faso (in the context of a GTZ project), mainly in man-made lakes. In Zimbabwe,

dams were restocked after a drought (Sugunan 1997, FAO 1999).

Box 18: Culture-based fisheries, Burkina Faso

The question of how and to what extent capture fisheries can be enhanced under sub-Saharan conditions was, among others, the subject of a project which carried out extensive field trials in Burkina Faso between 1987 and 1994. The project was supported by German technical assistance and implemented by GOPA/COFAD. It aimed specifically to increase fish yields of small to medium-sized barrages in the south-west of the country. The technological approach involved stocking and management of stocks at various levels of intensity. The following selected results may help to illustrate, from a technical point of view, the potentials of culture-based fisheries:

By restocking and controlled fishing, fish production of Tounoura Lake, a reservoir of 6-12 ha surface area, rose from less than 2 tonnes in 1987 to about 9 tonnes in 1995. Management rested with a local group of fishers, who had obtained exclusive use rights from government. The main fish species were redbelly and Nile tilapia of which the latter was continuously replenished from a breeding and nursing pond that was located just below the dam and operated on intensive scale (feeding, fertilisation). The introduction of the native *Heterotis niloticus* proved very successful: a single stocking of 800 fingerlings led within only 3 years to an annual harvest of 1.5 tonnes.

In other examples of culture-based tilapia fisheries, peak yields topped 4 tonnes per hectare and year.

Initial stocking in 1991 of the then newly completed 600 ha impoundment at Comoe with 337 kg of artificially reproduced fry and fingerlings of the native barbel *Labeo coubie* resulted, within 3 years, in the recapture of almost 7 tonnes of table fish. As the stocking was not repeated and the fish were unable to reproduce naturally, the yields plunged to zero shortly afterwards.

(Source: Beck 1995)

Modern aquaculture technologies were first brought to sub-Saharan Africa by colonial powers, in particular the German and Belgian administrations. They involved freshwater pond culture only, to produce protein-rich food for the labour force. However, after the breakdown of colonial rule, most ponds were abandoned and pond culture retained the stigma of colonialism for some time.

Only in the 1960s and 1970s were the first attempts made by external aid agencies to revive pond culture as a component of rural production. To date, and despite an international donor investment of over US\$ 400 million into aquaculture development in Africa between 1975 and 1990 (CIFA 1990) and more than 300 externally financed projects between 1970 and 1993 (Harrison *et al* 1994), production has remained marginal and largely unsustainable. With the exception of Southern Africa, where modern aquaculture is mainly practiced by members of the white minorities, and a few commercial ventures in other parts of the continent, most aquaculture activities today still take place under the auspices of development assistance projects.



Photo 12: 'Modern' fish ponds, Liberia

Where aquaculture was introduced within the framework of development projects, target groups were—and in most cases still are—rural smallholders and their families. Specific objectives were usually one or more of the following:

- increasing household food supply
- increasing household resilience through diversification of income and food sources
- strengthening marginal economies, increasing employment and reducing food prices
- improving water resource and nutrient management at household or community levels
- preserving aquatic biodiversity through re-stocking
- reducing pressure on fisheries resources.

Box 19: *Women in inland fish production*

In the traditional households of rural Africa, women are generally responsible for 'reproductive tasks' such as raising children, housework, and production of food for household consumption. Women typically have a higher workload than men, and the number of different tasks prevents them from concentrating their efforts on one or two activities. Also, their homestead tasks limit their geographical mobility.

Use rights for land today rest mostly with the male head of a rural household. There are other traditional land allocation systems which allow both men and women to hold and exercise land use rights. Also, there are rural societies with a matrilineal organisation or matrilineal marital residence pattern, where control over land resources rests exclusively with women. Similarly, women's access to financial resources, education and information is generally more restricted than that of men, but here also, there are situations where women have equal or even better access than men.

Inland capture fisheries

In general, women are involved in capture fisheries for home consumption or small-scale marketing. Fishing is done

by comparatively simple means, inshore or in small waters. The amount of fish thus produced is considerable, however.



Photo 13: Woman with liyanga fishing basket at the Zambezi river, Zambia, during low water

Where fishing is the major source of (monetary) incomes, systems of division of labour have evolved where women predominantly engage in processing and selling the fish caught by mostly men. In large areas of West Africa, women (*fish mummies*) have not only monopolized fish trading, but also run fishing enterprises, with their husbands and male relatives as employees.

Little is known about the involvement of women in fisheries management; no examples of a prominent role of women in this area have been documented.

Traditional fisheries enhancement

In various regions of sub-Saharan Africa, women are involved in fisheries enhancement, but mostly on a smaller scale than their male counterparts, with smaller enhancement devices, near shore or in small water bodies. In West Africa, however, there are cases where women run larger enhancement facilities as *acadjas* and *whedos* or fish holes requiring considerable investment and management efforts.

In the Congo, the Gambia, Liberia and Ivory Coast, women are known to build fences and small dams, or dig holes, in seasonally flooded river beds. The women harvest fish from these ponds periodically, allowing them to grow, and sometimes also applying feeds (Trottier 1987).

In some parts of West Africa, women also stock fish in confined water bodies. In Liberia, for instance, small catfish, oysters and turtles are traditionally stocked in barrage ponds (by men and women) (Trottier 1987). In Gabon, women often stock fingerlings in the traditional ponds managed by their husbands (Vincke and Wijkström 1982).



Photo 14: Woman fish trader, Zambia

Modern aquaculture

Many of the earlier projects to develop aquaculture in Africa have focussed on men, regardless of the fact that their objective was subsistence production, i.e. production for home consumption which is the domain of women in rural Africa. Others selected men as their main target group, even where women controlled land and other assets. Even where gender aspects are made an issue, development agencies often face problems in tailoring their approach to aquaculture develop-

ment to local ideas of labour division between men and women (*cf.* ALCOM 1991, Harrison *et al* 1994).

In some areas where aquaculture became a sustainable component of rural production practices by mainly men on a commercial basis, women often constructed their own ponds, to both produce for their households and to earn cash.

3. Potentials for and Constraints on Development

3.1 Traditional Fisheries Management

Inland capture fisheries have considerable income and employment effects and provide most of the fish consumed in rural Africa, at prices (or opportunity costs) which make it affordable also to lower income groups. Since inland capture fisheries are mostly under common property or, in some cases, open access regimes, they are accessible to many, which results in a wide distribution of incomes and other benefits.

In spite of these facts, inland capture fisheries have received less development assistance than other sectors of production, whether from African governments or from aid agencies. The reasons are manifold, and include

- the dispersed settlement structure and their fragmented organisation have prevented effective socio-political representation of many inland fishers
- being mostly part of the informal sector of the economy, development planners have often failed to recognise the importance of the sector
- urban and sectoral biases have kept the sector out of the mainstream of development.

When subject to development support and assistance, approaches have often been insensitive to the complex organisation of inland fisheries. As pointed out by Tvedten and Hersoug (1992), (traditional) artisanal fisheries have survived in spite of government efforts rather than because of them. For example, the provision of improved technology has been the main, and sometimes the only, objective of assistance to the sector. The frequent rationale of such interventions was that the introduced technologies had produced good results in other regions, overlooking the fact that technological appropriateness is determined not only

by bio-technical, but also by human and environmental factors. Fishing technology not appropriate to the environmental and/or the socio-economic conditions of the target group can have adverse effects on their livelihoods.

Box 20: Technological change and dependence

The gear used in traditional fisheries comprises spears, fences, baskets and other tools made from local materials. They are still typically used for occasional fishing, in which most families having access to lakes and other water bodies engage. The fish caught by occasional fishers are mainly for home consumption.

More productive fishing methods are adopted for market-oriented production, both on a part-time and full-time basis. The *lusenga* (dipnet) fisheries of Lakes Victoria and Tanganyika, which have been rapidly modernised since the 1950s, are typical examples. The most important technological intervention was probably the introduction of nylon twine. Nylon twine increased catch per unit effort, as it is more transparent and has a higher tensile strength than natural fibres, which reinforced the trend towards commercial fishing. More people from around the lakes took up fishing on a full-time basis, to the extent that the entire labour potential of many families was absorbed in fish harvesting, processing, and sometimes marketing. As a consequence, agriculture diminished in importance to the household economy, and the fishing/farming production system was replaced by an artisanal, but predominantly commercial, fishery.

The switch from part-time to full-time fishing has decreased the self-reliant nature of traditional fishing/farming systems. Full-time fishermen have to produce a constant surplus which can be exchanged for consumables, and the goods and services they no longer produce themselves. In most cases it also implies the adoption of more sophisticated technology, and a dependence on imported production inputs, such as nylon twine, hooks, engines, spare parts and fuel. This technological dependence becomes particularly critical if input supplies are irregular or monopolised.

Being less self-reliant and more specialised, full-time fishers experience decreased geographical and professional mobility, which exposes them to more risks. The loss of a gill net, or a long stretch of bad weather which impedes fishing, can seriously endanger the household economy. The lack of formal credit mechanisms to counter losses in production can force them to sell assets, and join ranks with those who have no other means of production than their labour, and who tend to migrate to cities in search of work. The risks in the production sphere are further increased in some lakes, such as Victoria and Tanganyika, because of the existing and potential competition from industrial fishing fleets.

Also, being treated almost in isolation from other rural sectors, insufficient effort was exerted in order to understand the social and cultural determinants of inland fisheries; the wealth of information with respect to these dimensions available for other sectors of rural production was ignored.

Although the management of traditional inland fisheries has been subject of research for more than a century and has been discussed in the context development for two decades, the results were largely ignored by modern African states and many development agencies. Only since little more than a decade ago have some development projects recognised the importance of traditional management systems, and only a few of them have made consistent efforts to make traditional systems the basis of their approach to development (e.g. Price 1995). This re-orientation is probably due to a combination of

- a general recognition of the frequent failure of transfer-of-technology approaches
- an increased interest in local knowledge
- the shift towards community-based and participatory approaches
- the recognition of the importance of institutions in development.

3.1.1 Potentials

About 520,000 km² of sub-Saharan Africa, or some 2% of the landmass, is covered by larger water bodies, and main rivers amount to a length of some 35,000 km (FAO 1996). The extent of smaller water bodies is unknown.

The potential for the region's inland capture fisheries has been estimated by FAO (1996) at 1.9 million tonnes, which would be an increase of 12% over the total production of 1.7 million tonnes estimated for 1998 (FAO FishStat). The key factor for the realisation of this potential is seen in improved fisheries management, and, in this context, the increased recognition of traditional management. Traditional systems have several important potential virtues:

Sustainability of production

Most traditional African inland fisheries management systems tend to strive for sustainability of resource use. The objective of sustainability is inherent to these systems, because it corresponds with the underlying local philosophy: the systems are based on the concept that fishing effort has to be in balance with the resource, and fishing is seen as a matter of give-and-take in an interaction with nature and the forces, spirits and deities governing it. Similarly, the fact that resources are considered to belong to ancestors and unborn generations may support sustainability in resource utilisation.

In this sense, traditional approaches are in line with modern ecological concepts at least in so far as to exclude the unlimited extraction of resources.

However, their inherent tendency towards sustainability does not imply that traditional management systems promote, *per se* and under all conditions, ecological soundness and sustainability: where they are weakened or obstructed, or cannot cope with external changes, they may not be capable of preventing resource depletion.

Relevance and appropriateness of local knowledge

The fact that traditional fisheries management is based on local knowledge is of considerable benefit, because local knowledge

- is, in practice, the only knowledge available on the spot. While basic elements of scientific knowledge may be represented, e.g. by extension officers, they are often insufficient to generate a sound basis for fisheries management. Where additional scientific knowledge is provided through external assistance, it is costly, available only on a temporary basis, and not always appropriate, because the formulas and models of modern science do not always correspond to the specific situations of African environments.
- is the comprehensive and collective cognitive base of a traditional fishery. A management system based primarily on insights of modern fisheries biology would possibly not be accepted by the fishers, because they would not share its cognitive base (*cf.* Degnbol 1999). On the one hand, fishers wouldn't understand the formulas and complex biological models favoured by scientists to explain nature. On the other hand, state institutions (which mostly do not understand the models either) and many scientists have problems to understand and accept aspects which, in the eyes of African fishers, are essential and integral parts of the resource system, in particular its metaphysical and spiritual dimensions.
- adopts a multi-dimensional approach. Local knowledge regards the utilisation of fisheries resources as part of a multiple resource use system and considers ecological, social, economic and political aspects, as do modern approaches to resource management (e.g. the ecosystem approach). Many insights of local knowledge on fisheries and the measures taken on these grounds find support in modern fisheries biology (*cf.* e.g. Price 1995, Appiah-Opoku and Mulamoottil 1997, Owino 1999).

- well recognises the finiteness and subtractability of the resource; the notion that fisheries resources may be inexhaustible may exist in coastal fisheries, but is almost unknown in African inland fishing communities (Sverdrup-Jensen and Nielsen 1998). Stock fluctuations are identified and 'over-fishing' is frequently diagnosed by traditional fisheries managers as the reason for decreased availability of fish (e.g. Olomola 1993, Neiland *et al* 1997).

Structural stability and flexibility

Traditional fisheries management systems have existed for a long time. As institutions, they have a high degree of structural stability and constitute an accepted normative framework for sustainable resource use.

Nevertheless, empirical research has shown that traditional African fisheries management systems are also dynamic and able to adopt new measures under changing conditions (e.g. Beck 1986, Olomola 1993, Neiland and Ladu 1997, Neiland *et al* 1997) or to incorporate elements of scientific knowledge.

Decentralised decision-making

Being community-based and therefore decentralised, traditional fisheries management allows for direct reaction to a particular resource or social situation, contrary to management by the state, which almost always relies on rules made and decisions taken at central level.

High acceptance

The fact that traditional management systems have evolved from local traditions generally brings about a high degree of acceptance on the part of the communities, which facilitates the enforcement of rules and restrictions.

Back-up by other traditional institutions

Being a part of the overall traditional institutional framework, fisheries management can draw upon the whole range of other traditional institutions, e.g. those in charge of jurisdiction, mediation, religion, transfer of knowledge or enforcement of social norms.



Photo 15: Fishermen at Lake Mwange, Zambia

3.1.2 Constraints

The strengths and advantages highlighted above do not imply that traditional fisheries management should be considered the panacea to provide for improved resource utilisation in inland fisheries. In particular, social, economic and demographic changes in Africa have resulted in conditions where traditional resource management approaches reach their limits. Restrictions are, among others:

Limits to adapt to change

Although traditional fisheries management systems are not static as such, some of their inherent features oppose rapid

changes, or prevent them from keeping pace with a rapidly changing environment.

- Management measures or regulations not directly concerned with resource utilisation but involving metaphysical dimensions (for instance, those sometimes referred to as ‘inadvertent’) show a higher resistance to change: as they have an objective outside of the rationale of resource management, and, in addition, are usually fixed in rituals and ceremonies, a reason to adapt them to changes in the resource situation, e.g. declining fish stocks, appears less evident.
- There are limits to local knowledge. Local knowledge, the cognitive basis of traditional management, relies very much on experience. Where changes have emerged only recently, local knowledge may not command sufficient experience to accommodate the new situation. Examples are changes in the water regime of a river due to dam construction or the emergence of new resources, such as man-made lakes.

Limits of knowledge on biological and ecological processes

According to some authors, local knowledge lacks understanding of the biology and ecology of fish, especially regarding fish reproduction (e.g. Svendrup-Jensen and Nielsen 1988). In some cases, it is believed, for instance, that fish are released by deities or come with the rain. The latter assumption may come from the evident correlation of rain and fish reproduction. Whether such monocausal reflections are sufficient for the adoption of management measures in situations where stocks fluctuate for reasons not related to precipitation remains questionable.

Limitations of traditional authority

The dependence of traditional management on traditional authority also implies a number of limitations.

- Even though still prevailing in most rural parts of sub-Saharan Africa, the overall authority of traditional institutions is on the decline. Challenges are, among others, the general change from traditional to modern societies, where the young people, in particular, show less adherence to traditional rules, as well as the effects of urbanisation and/or migration. Migrant fishers, for example, or people coming from urban areas to fish as a last resort, often refuse to accept local regulations, especially when they pertain to different cultures and do not share the customs and beliefs of the communities *in situ* (Ntiamoa-Baidu 1991).
- Traditional authority over resources is limited to a defined territory. Where fishing grounds fall into more than one traditional territory, proper management would require co-ordination between the different authorities. Instead, such a situation often leads to conflict.
- The overlapping and partly conflicting competencies of traditional and modern institutions have often severely undermined the functioning of the former (e.g. Olomola 1993, Price 1995, Svendrup-Jensen and Nielsen 1998, Williams 1998). Also, the taxation of fisheries by local or state governments—which in some cases appears to be the central objective of fisheries administrations—could reduce offerings to traditional authorities, thus further weakening their position. Where colonial powers have collected taxes through traditional institutions, these were on the one hand strengthened, but on the other hand their reputation and integrity was harmed (*cf.* Sarch 2000). Where holders of traditional authority became an integral part of modern administration and holders of office receive a government salary, their individual authority may be reduced (Thomas 1994).

Box 21: Traditional versus modern fisheries management

There are several cases where traditional rules lost their original coherence or became altered as a result of commercialisation, ecosystem changes, state intervention, and population pressure. Modern legislation and management, which were introduced to replace the traditional systems, often failed to regulate fisheries adequately.

Niger

During the 18th century, the Peulh Empire drew up comprehensive feudal land laws covering the 30,000 km² Central Delta of the Niger (Kone, 1985). Customary administration consisted of decentralised management with specific rules. Initially, the Bozo people were the only ethnic group granted exclusive fishing rights under the chief or *water master*. The *water master* performed sacrifices to the water spirit, set fishing seasons and protected user rights. Outsiders wishing to fish the waters were required to give over a third of their catch as payment.

The colonial period introduced new land registration which attempted to follow traditional systems, retain the power of the *water masters* and establish peace between communities. After independence, the 1963 proclamation of Mali declared sovereign right over all water, thereby ignoring the traditional ownership rights which had persisted for centuries. Access to waters is leased by the Government as required, and fishing gears are taxed. All customary laws have been cancelled and only subsistence fishers retained user rights, which has led to conflicts between modern and traditional management systems (Kassibo, 1991). Outsiders have been able to enter previously controlled fisheries areas, to the objection of local traditional user groups, and violent conflicts have ensued.

The inability of the modern management system to conserve fish resources and mitigate conflicts has advocated a return to traditional management (Jeay, 1989).

Middle Zambezi

Before the early 1960s, the 300 km stretch of the Zambezi from Victoria Falls to the Kafue River confluence was

exploited by the traditional fishers of the Gwembe Tonga, who used traditional fishing techniques (Scudder, 1960). Five years after the construction of the Kariba Dam, the fishery was commercialised and opened to outsiders. A closed season was introduced during the main agriculture season and government provided services, transport and credit facilities. The number of fishers grew from 400 in 1958 to over 2000 in 1962. By the mid-1960s, the fishery became severely over-exploited (Scudder and Connelly, 1985).

The Kafue River Fishery

Prior to 1917, fishing on the 11,240 km² Kafue River floodplain was for subsistence purposes and the local people (the Twa) claimed ownership of the fishing grounds. Each fishing group had a delimited fishing area which was defended against intruders, particularly the Lozi from Barotseland. Between 1917 and 1950, colonial administration opened the fishery, ignoring local rights to the extent that by 1959 the numbers of fishers had grown to 5000, and production was as high as 11,000 tonnes. In the 1950s, the introduction of cheap nylon gillnets led to rapid commercialisation, fuelled by growing markets in the Copperbelt and facilitated by an increasing number of fish traders. By 1981, fishermen numbered 6000 as unemployed youth began fishing. Marked overfishing became evident and social pressures were so great that gillnet theft became a major problem (Lehmann, 1977).

The ambiguous role of ethnicity

Traditional management relies on ethnic structures and is therefore inseparable from the overall role of ethnicity in African societies. Ethnicity is ambiguous: it has often been misused for political and economic purposes and can become a source of conflicts. There are situations where ethnicity is an obstacle to, rather than an advantage for, resource management, for instance in South Africa, where ethnicity has been misused by the Apartheid regime.

3.2 Traditional Fisheries Enhancement

3.2.1 Potentials

Although a significant proportion of sub-Saharan Africa's water bodies would be suitable for fisheries enhancement (especially the smaller water bodies and rivers), traditional enhancement systems are only found in some regions.

Unlike modern aquaculture, traditional fisheries enhancement systems have evolved in the African social context and are based on local knowledge. They are reported to be culturally and socially appropriate and can produce more than capture fisheries.

In spite of their potential advantages, and similarly to traditional inland fisheries management systems, traditional enhancement systems have received little attention from national development planners and international agencies. There are some exceptions, most of which concern research rather than diffusion or application on a wider scale, however. Examples are

- efforts to develop improved *acadjas* by ORSTOM/IRD and by IFAD, IDRC and the *Centre de Recherche Océanographique*, Ivory Coast
- a project in Benin concerned with *acadja* fisheries mentioned by Weigel (1985)
- a GTZ project which tried to transfer the traditional *trous à poisson (wbedos)* from the floodplains of the Ouémé to the fringes of the lagoons of Southern Benin.

Whether the acceptance and performance of traditional enhancement systems constitutes a potential for transfer and replication would need to be proved empirically. There appears, however, to be ample scope for their improvement and intensification.

Potentials of fish sheltering systems

- *Suitable sites*

Although most fish sheltering systems, in particular most brush parks, are found in West African lagoons, it can be assumed that these systems also function in other riverine and lacustrine environments.

- *Social and economic development potential*

The features which make up the social and economic development potential of these systems have been summarised by Pockrandt (1993). They include

- high productivity of a given water surface area as compared to open water capture fisheries
- decreased effort needed to harvest the fish
- improvement of the habitat in and around brush parks
- provision of seasonal employment for a large number of people,

while environmental impacts were assumed to be either positive or neutral.

- *Potential transferability*

Fish sheltering systems have evolved in Africa and, being compatible with African socio-economic and cultural frame conditions in general, it could be assumed that they may be replicated in areas where they are currently unknown. Examples exist: traditional traps made of brushes or grass are used to aggregate fish in a similar way to brush parks, but are not operated as enhancement systems. Whether, through the provision of know-how, these traps could be transformed to enhance production could be subject to trials.

- *Potential for intensification*

As far as other traditional fisheries enhancement systems are concerned, a certain potential for intensification exists, for instance through improved designs or increased control over factors which determine production. Several initiatives to design improved *acadjas* are reported and results support the assumption that, at least technically, there is potential for intensification.

Potential of fish retention systems

- *Suitable sites*

Suitable sites appear to be available in considerable numbers, in floodplains, but also in other areas with a suitable topography and water regime. Balarin (1988) estimates that if only 1% of Africa's 12 million hectares of floodplains (see figure 4) could be developed using the *wbedo* system, at 1 tonne per hectare per year, the potential would be as much as 120,000 tonnes per year.

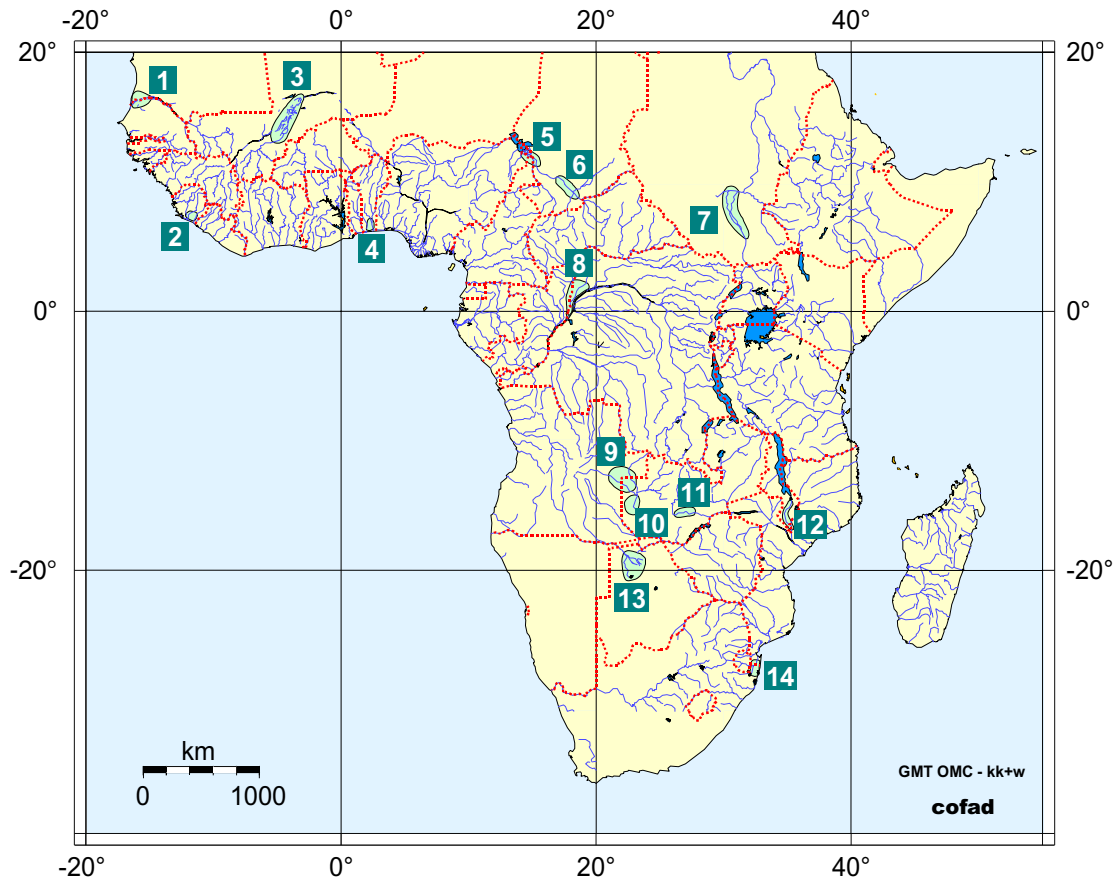
- *Social and economic development potentials*

The production of different retention systems has been estimated at between 200 kg/ha per year (unfed ponds, no stocking) and well above 2,000 kg/ha per year (drain-in ponds).

Some fish retention operations have been described as the traditional systems of fisheries enhancement closest to modern aquaculture. Thus, they may deliver levels of production similar to those produced by modern pond culture.

- *Potentials for integration with other farming activities*

One of the greatest potentials is the possibility of integrating retention systems with other farming activities, thereby not only augmenting agricultural productivity but also reducing risks through diversification.

Figure 4: Important floodplains of sub-Saharan Africa

- | | | |
|-------------------|-------------------|-----------------------|
| 1 Senegal | 2 Mabesi/Mape | 3 Niger central delta |
| 4 Oueme | 5 Logone, Yaeres | 6 Chari |
| 7 Nile, Sudd | 8 Congo, Mbandaka | 9 Zambezi Westbank |
| 10 Barotse | 11 Kafue | 12 Shire |
| 13 Okavango Delta | 14 Pongolo | |

Large floodplains are typically located in areas with distinct rainy seasons that border the perhumid equatorial zone, while fringing floodplains, which are not depicted on the map, are found along most African rivers.

(adapted from Welcomme 1983)

For example, fish retention systems accrue a considerable amount of wastes in their sediments, which are rich in nitrates. These bottom sediments could be used to fertilise soils and enhance crop production, thus also contributing to the production of staple foods, the main-

stay of smallholder production. Likewise, waste products from agriculture, for instance weeds and rotten leaves, can be fed directly to fish or composted within the pond.

- *Potential transferability*

In the areas where they are practised, retention systems are usually an accepted component of the production system, well integrated into the socio-economic context. Whether this fact is sufficient to assume that they could be replicated in parts of sub-Saharan Africa where they do not yet exist remains to be seen.

- *Potential for intensification*

There are reports of cases where fish in traditional retention systems were fed, where the retained waters were fertilised, or where fish were stocked (e.g. Di Palma 1969). Such operations could be starting points for development efforts towards modern fisheries enhancement or aquaculture.

3.2.2 Constraints

The feasibility of replicating and further developing traditional fisheries enhancement systems will, in most cases, depend on societal agreement to allow exclusive resource use, i.e. to allow individuals or small groups to operate the system for their exclusive benefit. As they are not a livelihood option accessible to all, but may subtract resources from the majority of users, this consent may be a stumbling block to further development.

Constraints on fish sheltering systems

- *Financial and labour investment*

Construction and maintenance of large fish sheltering systems such as brush parks imply an initial investment

well beyond the reach of most people, and there are cases where the investment could not be amortised.

In Benin, the high capital and labour investments required to construct brush parks have led to negative net incomes (Buffe 1958, Bourgoignie 1972). For many, the cost of importing construction materials became so prohibitive that they were forced to emigrate to other water bodies. In the 1970s, these problems became so extreme that at least one-third of the brush park owners emigrated to Nigeria where they re-established their operations (Welcomme 1972).

Box 22: Conflicts over brush parks

Large brush parks, as found in the coastal lagoons of Benin, have been subject of controversy with respect to the water surface they occupy. Although they are assumed to increase the overall productivity of the water body, they physically impede fishing in the waters they occupy and, as they attract fish from a wider area, they also reduce the stocks available to capture fisheries to some extent.

In socio-economic terms, a brush park polarises revenues, because a relatively large area of a water body is used for the exclusive benefit of individuals through privately owned structures. The owners of brush parks, by virtue of their possession of assets and collateral, generally enjoy a more influential status in society than fishers, and are often outsiders to local communities. Therefore, while brush parks increase the benefit to their owners, in the form of more sustained and/or increased production, those relying on capture fisheries—already vulnerable and disadvantaged in terms of resource availability—are further deprived of opportunities to secure a livelihood.

In Lake Nokoué, Benin, socially powerful brush park owners have even been known to exclude fishers from the waters adjacent to their brush parks, particularly those using cast nets. The exclusion of cast net fishers from these waters has been a controversial issue for some time.

In Lake Ahemé, Benin, the absence of modern management and the breakdown of traditional systems governing artisanal lake fishing led to severe tensions between brush park owners and fishers. Between the late 1950s and the 1970s, the installation of brush parks had not been controlled by any form of regulation. Consequently, the brush park fishery expanded to the extent that brush parks covered 30% of the lake surface but engaged only 20% of local community members in employment. Those engaged in the capture fisheries, i.e. those without the financial resources and social status to invest in brush parks, were disadvantaged by the loss in fishing area and diminishing resources available to them. The brush parks also damaged their fishing nets, and were a hazard to navigation. These conflicts and inequalities eventually led to a moratorium on the brush park fishery in 1970 and the military were employed to dismantle the structures (Weigel 1985, Dangbégnon 2000). Kapetsky (1981) described a similar situation in the brush park fishery of Togo.

The conflict over large brush parks in Lake Ahemé is a frequently cited example of enhancement systems which, even having evolved without outside intervention and based on local (or regional) knowledge, eventually encountered the resistance of the majority of the small-scale users of a common pool resource.

- *Market constraints*

The harvesting of larger sheltering systems often leads to bulk supplies with consequent low market prices. Because of the high capital requirement of maintaining large-scale operations like brush parks, the resulting low returns may well lead to financial collapse.

- *Environmental problems*

Brush parks are usually constructed from locally gathered branches. In many areas, large-scale construction and subsequent deforestation means that the wood has to be purchased from further afield. This sometimes

results in conflicts with local communities, because diminishing forest resources will negatively effect especially the poorer groups who rely heavily on them for firewood and construction material.

Constraints on fish retention systems

- *Resource use conflicts*

Fish retention systems, especially the larger ones, require established usufruct rights, secured over a long period, in order to make the effort invested in their construction and operation worthwhile. Where such rights are granted by the governing authority, conflicts over territorial and resource use rights tend to be less problematic than where the enhancement systems have been established without social consent, as a result of individual power and influence. A number of disputes concerning the implications of water or fish retention have been reported, especially where suitable sites for water retention are limited, excluding most people from the benefits accrued through fish retention.

In Benin, for example, conflicts between fishers and the owners of drain-in ponds induced the government to clarify resource use rights. As a consequence, drain-in ponds were only allowed to be set in areas which was not allocated to any kinship group, i.e. open-access areas, and the owner was not allowed to impede the flow of waters or to drain water from any contiguous plot. Passage through the ponds and water drawing rights had to be conceded (Weigel 1985).

The frequent poaching of fish from retention systems is another indication that these systems are seen by many local people as a breach of the tradition of equitable resource access: poachers consider themselves entitled to participate in the accruing benefits, even by theft.

Poaching commonly affects the production of *ebe* drain-in ponds in Ghana. Not only do poachers directly

diminish harvest yields, but the detrimental impact often deters *ebe* owners from fertilising their ponds (Stegemann 1998).

- *Poor water management*

In riverbeds and floodplains, the productivity of traditional retention systems suffers from poor water management. Generally, these systems are feasible only in limited areas where evaporation and seepage of water are reduced. Furthermore, fish production in confined water bodies, such as drain-in ponds, is reduced through low levels of oxygen, high concentrations of wastes and little water exchange.

3.3 Modern Fisheries Enhancement and Aquaculture

3.3.1 Potentials

There are few limits to modern fisheries enhancement and aquaculture development as far as its physical potential is concerned. FAO estimates that in terms of suitable sites and water availability, less than 5% of the potential for aquaculture development has been utilised to date (FAO 1996). There are several options to better utilise this potential:

Increased integration with other agricultural activities

One potential for increasing the production and viability of aquaculture in Africa lies in integrating it into existing farming systems. In Europe and Asia, the regions from which the technology was 'imported', aquaculture is almost always only one branch of production in small-scale farming. In Africa, however, development programmes have often presented aquaculture to farmers as an alternative to, and not a diversifying element of, established production patterns.

Box 23: Traditional versus modern enhancement systems

The difficulties associated with introducing technology-led aquaculture were encountered by an externally funded aquaculture development project in the Kwango-Kwilu region, Democratic Republic of Congo. The project aimed to improve rural livelihoods and nutrition through the introduction of small-scale rural pond culture.

The main economic activity of the area is small-scale agriculture, but since pre-colonial times the farmers of the Kwango-Kwilu region have enhanced their production pattern through a form of integrated traditional enhancement. The system comprises a series of retention ponds, each averaging around 1000-2000 m² in size, dug along the length of a narrow spring-fed river and separated by dams which extend across the river's width. It is common to find over 30 ponds in a row.



Photo 16: Traditional barrage pond in one of the numerous valleys of the Kwango-Kwilu, D.R. of Congo

The fish migrating along the stream tend to remain and spawn within the ponds, between which they are able to move freely during the rainy season when the dams are overtopped. The population of fish remaining in the ponds after the waters recede grows through natural reproduction. The pond

owners, usually those who have constructed or inherited the embankments, sometimes provide feed in the form of rice husks and other waste products. The ponds are never drained and the fish are harvested on an irregular and need-oriented basis with hooks and lines and baskets. Annual yields are around 100-500 kg per hectare, which is 10 to 30 times higher than the local capture fishery yield.

Instead of attempting to enhance these existing systems through improved management, the project introduced a new form of aquaculture based on trials carried out elsewhere. The new ponds were situated in the vicinity of the traditional ponds, but different from these, they were not placed to take advantage of the topography and hydrology of the area. Small-scale farmers, sometimes the same ones who operated the traditional retention systems, were encouraged to operate them on a semi-intensive basis, with one to two crops of one species (tilapia) per year.

Whereas the traditional ponds serve as a type of bank account which can literally be dipped into as and when needed, and which need little input, the newly introduced system required a high level of effort. In particular, the labour required to manage the project ponds forced the farmers to abandon the tasks necessary for the upkeep of their farming systems. The annual harvest provided only one or two income peaks during the year which, without other sources of income, would have required the farmer to exercise a strict and long-term management of his funds. Even if the yearly income had been sufficient to guarantee the livelihood of the participant farmer's family, the level of financial management required to make it stretch over the year would have been beyond his reach.

Furthermore, the local market was unable to absorb the quantities of fish generated from the annual harvest. This dramatically decreased incomes and profits to the extent that the farmers rapidly lost interest. Therefore, as soon as the funds dried up, so did the project's ponds.

Interestingly, a group of commercial peri-urban farmers, who had been excluded from the target group, copied and invested in the new methodology with considerable success.



Photo 17: Modern ponds at the outskirts of the town of Kikwit, D.R. of Congo

(Source: Beck and Walter-Dehnert 1986)

Only in recent years, some projects have developed promising approaches to integrate aquaculture into farming systems in sub-Saharan Africa (e.g. ICLARM/GTZ in Malawi, ALCOM in the SADC region).

Better utilisation of marketing potential

Being less dependent on specific physical conditions than most traditional enhancement methods, modern fisheries enhancement and aquaculture have a considerable potential to follow demand geographically, with aquaculture facilities set up in peri-urban areas or in places with good marketing infrastructure. Also, aquaculture can more readily adapt production to demand by producing preferred species or fish of a certain size.

Alternative target groups

Target groups of aquaculture development have, in the past, mostly been the rural, resource-poor households. There are, however, other groups with a much higher capability to successfully practice modern aquaculture: people with sufficient financial assets and entrepreneurship to finance and manage aquaculture as a commercial venture. There are a number of cases in sub-Saharan Africa where commercial investors have taken up aquaculture on their own initiative.

Modern enhancement as an option to improve production from small natural and artificial water bodies

The physical potential to develop modern fisheries enhancement are difficult to quantify, but it can be assumed that the fisheries of most smaller standing waters, including wetlands and swamps, and especially man-made reservoirs, could be successfully enhanced, often with relatively little effort. Small, often multi-purpose village tanks and barrages are suitable for all forms of modern enhancement, including fertilisation and feeding, and enhancement may even facilitate the growing of fish in non-perennial waters by seasonal stocking of suitable fish species.

A distinct advantage of small water bodies lies not only in their productivity and relatively easy management; as they are widely scattered and frequently situated in marginal farming areas, enhancing their production would attain a particular importance in the context of rural employment and nutrition.

The fisheries of larger lakes may also be improved: The introduction of small pelagic fish species from Lake Tanganyika into Lake Kariba and Lake Kivu in the 1960s led to better utilisation of the vast pelagic zones of the lakes, which had been largely devoid of fish, and to the establishment of important fisheries.

Box 24: Potentials for modern fisheries enhancement

The present and future availability of small water bodies and their potential for fisheries enhancement has, among others, recently been discussed by Kapetsky (1998). His assessment, on a global scale and from a purely resources-based point of view, confirms

- that small water bodies offer the highest enhancement potentials
- that in Africa conditions for fisheries enhancement are comparatively favourable in terms of climatic growth conditions for the Nile tilapia (the reference species in his work), and the availability of perennial small water bodies and natural fertiliser resources (as an important production input)
- but that, although seemingly unlimited, the present developing potentials are being restricted by an array of social, economic and technical factors.

The latter constraints to the development of fisheries enhancement are not restricted to African or any other developing countries, but are rather universal. Barthelmes (1981), for example, showed that increasing scientific knowledge of the parameters of inland fisheries production did not lead to subsequent development of the sector in Europe, and that the methods applied to raise yields beyond natural production were primarily based on experience, not science. When in the early 1970s research on aquatic energy flows indicated that most inland waters, especially lakes, provide a tangible potential for increasing fish production—more than ten times the actual fish yields—fisheries enhancement techniques based on these scientific insights were developed. These techniques, however, were applied almost exclusively in Eastern Europe, with its specific economic, political and social conditions of that time, not in Western Europe's market economies. Empirical and/or scientific knowledge, therefore, can lead to increased production only where the overall economic, political, social and cultural conditions are conducive to development.

3.3.2 Constraints

Constraints to the development of modern fisheries enhancement and aquaculture vary according to the approach chosen and to the political, social, economic and cultural context into which the innovation is introduced. For decades, the prevailing approach was the transfer of (foreign) aquaculture technologies to mainly small-scale farmers, in order to improve subsistence production.

The underlying rationale was that

- the majority of the produce would be for home consumption, and increased home consumption of fish would provide sufficient incentives for the farmer to take ownership of the technology
- inputs, in terms of feed, fertiliser, and labour, would be available in abundance and at low, or no, financial or opportunity costs.

After three decades of almost entirely externally-financed efforts to introduce modern fish farming into rural sub-Saharan Africa, these assumptions have been proved wrong and, despite the enormous investments of the past, aquaculture development in sub-Saharan Africa had only limited success and did not achieve any self-sustained development on larger scale.

A main reason for past failure, i.e. the choice of a target group not fully able to make use of the technologies, may constrain the present and future development of modern fisheries enhancement and aquaculture. Two basic dimensions are concerned:

- priorities and felt needs of the target group
- means and resources of the target group.

Priorities and felt needs of the target group

To promote the farming of fish for home consumption may not be sufficient to motivate farmers to take up aquaculture. Fish, unless caught occasionally and in non-marketable

quantities, is almost always considered a cash crop in the African context. While food security is an integral part of the coping strategy of rural households, fish production, in particular through the high effort implied in pond culture, was rejected as part of this strategy. Fish was always seen, first and foremost, as a way to earn cash. If the effort involved in taking up pond culture was not rewarded with a sustained income, compensating for neglecting other components of a farming system, it constituted a risk and was, therefore, often discontinued.

Means/resources of the target group

The second dimension concerns misconceptions with respect to resource availability to small-scale farmers, e.g.

- *Labour*

Fish farming requires considerable labour input, even if practised on a small scale. With labour availability being the single most important factor limiting rural production in Africa, farmers could not be persuaded to tend to their ponds regularly, thus diverting efforts from other farming activities and, potentially, risking their livelihood.

The failure to recognise labour as the most critical factor might have been prevented if aquaculture development had been planned in collaboration with target groups and experts in integrated rural development, rather than in isolation.

- *Production inputs*

In the past, development planners often assumed that the inputs required for aquaculture production would be readily available, at little or no opportunity costs. This assumption was, and is, incorrect: in Africa, agricultural land and water, although not as critical a factor of production as labour, always have opportunity costs.

Box 25: Patterns of rural food production

In terms of their socio-economic and cultural characteristics, inland fisheries and fisheries enhancement are, with few exceptions, predominantly traditionally organised and based in the rural sector.

Traditional systems of food production in Africa are characterised by two strategies:

- to provide subsistence to the producer through extensive production and limited surplus marketing
- to share resources in order to provide for all the members of a given social entity.

Resource-sharing is a collective value of most rural societies; accumulation/concentration of wealth on a significant scale appeared only where feudal systems emerged, or in transhumance in the form of large herds. Resource-sharing was achieved in the first place by systems of resource allocation providing every member of the traditional society with means to guarantee their survival. Social measures to discourage overachieving are still common in many rural societies.

Today, the production systems in rural Africa are still predominantly extensive, with comparatively low input levels and correspondingly low returns. Animal husbandry, for example, is based on grazing and scavenging. Keeping animals in pens and providing feed is the exception rather than the rule.

For those who fish as a mainstay of their household economy, fish is usually a commodity, a means of exchange rather than for home consumption, and it is traded or sold in order to acquire other essential food items and goods.

A study in Zambia found that although the rationale of the agencies promoting the development of aquaculture was increased food security, in the areas where it took off, the motivation of the operators was to earn cash income (Van der Mheen-Sluijer 1990). An example where cash and home consumption targets are combined was reported from a remote area of Luapula province, Zambia: in order to rear fish for household consumption, women in that province often

construct ponds alongside their husbands' ponds, which are solely for the purpose of raising fish for cash.

Economic self-sufficiency based exclusively on fisheries has never existed in the traditional African context. Where it does exist today, it is usually the outcome of recent interventions in habitats and of externalities, for example in the case of the Nile perch fisheries of Lake Victoria, where the species has been introduced. The Nile perch established itself so successfully that it now supports a commercial fishery which satisfies a large market demand from Europe.

Fish producers rely on other production systems to meet their needs in the same way that the great majority of rural and urban dwellers rely on the production of fish as a major and accessible source of animal protein. This interdependence between fish producers, agriculturists and herders is the base of the integrated food production web that can be observed in most rural economies. Exceptions exist where rural societies live in geographical isolation and where largely self-sufficient integrated rural production systems are practised.

In order to better analyse the livelihoods of the poor, *Sustainable Livelihoods* (SL) approaches have been developed by DFID, IDS (Sussex), UNDP and others. SL approaches are people-centred, focus on people's strengths, opportunities, coping strategies and local initiatives, and put an emphasis on the vulnerability context of livelihoods. The SL framework incorporates many tools and methods that exist independent of it, especially participatory ones.

In West Africa, the *Sustainable Fisheries Livelihoods Programme* (SFLP), a partnership between FAO, DFID and 25 African countries, seeks to apply SL approaches in the fisheries sector.

The availability and regular supply of fingerlings is another constraint to the long-term sustainability of fish farming in sub-Saharan Africa. Because, in many countries, there are no private producers of juvenile fish, aquaculture development relies on the supply of fingerlings from government-run hatcheries, operated by

extension services. Unfortunately these services have frequently not been able to provide fingerlings. Unreliable supplies of fingerlings and low juvenile survival rates, as a result of stressful transport conditions, have forced many participants in aquaculture development schemes to abandon their ponds.

Similarly, feed and fertilisers for fish farming usually have tangible opportunity costs in sub-Saharan Africa. Even when operating on a low-input basis, it is difficult to convince small-scale farmers to invest in inputs for an unfamiliar production system. In a recent fish-farming project in Malawi, Dickson and Brooks (1997) describe the lack of feeds and fertilisers as the largest constraint to production success. Despite high levels of extension assistance and support, farmers were reluctant or unable to apply fertilisers and feed, and consequent harvests were lower than expected. In cases where feeds and fertilisers have been applied, this has often been to please the extension agent or his foreign counterpart. Without this type of secondary motivation, feeding and fertilising is often readily discontinued.

Incompatibility with local knowledge systems and lack of know-how

The specific skills and know-how required for aquaculture are not part of traditional African knowledge systems. Examples are:

- Fish farming was considered a technology to be easily within the technological grasp of small-scale farmers. However, the technological know-how required for economically successful pond culture is far more demanding than what is the norm in extensive farming, the mainstay of small-scale farmers.

The skills required in water management, for example, at least to the extent of keeping the fish alive, are not needed in rain-fed agriculture, and are therefore rarely

available. This constraint is not only a limiting factor for the adoption of aquaculture in sub-Saharan Africa, but also for the development of small-scale irrigation, where insufficient know-how, on the part of the participating farmers, contributed to widespread failure of projects.

- Another constraint lies in the fact that comprehensive interventions in the rearing process of aquatic organisms and their environment, as practiced in modern aquaculture, have no tradition in Africa.

Human interventions into the lifecycle of fish, such as the bio-technical reproduction techniques, have no parallel in the local knowledge systems. Such practices are unknown for livestock and even more so for wild animals (which fish are presumed to be). It seems that according to local knowledge and experience, reproduction of fish is taken care of by nature or by deities, and interventions other than putting these forces in a favourable mood (e.g. through sacrifices) are not recognised.

Feeding and fertilising methods are unfamiliar to the rural small-scale producer in Africa and, in traditional animal husbandry, animals are rarely fed, but rather left to scavenge. Fertilisation of plots, if done at all, is only carried out irregularly in small-scale traditional agriculture. Fertilisation of water (thereby possibly making it unsuitable for drinking and some other purposes) is apparently even less comprehensible to the target groups. Harrison (1994) describes a case in Malawi where farmers associated with a development project did not want to fertilise their ponds with manure as it turned the ponds an unattractive brown colour.

Incompatibility with traditional institutions

Other constraints to the development of modern fisheries enhancement and aquaculture concern traditional institutions. African traditional institutions, in various respects, do

not provide a context conducive to modern fisheries enhancement and aquaculture, for the following reasons:

- Modern fisheries enhancement and aquaculture imply considerable investments and therefore are viable only if the accruing benefits can be realised by those bearing the costs. The hierarchical structure of many African societies and/or the postulate to share resources often force the producer into sharing a substantial part of these benefits. 'Overachievers' are sometimes punished through socially accepted poaching as a means of redistribution.

In Luapula province, Zambia, for example, several hundred small-scale farmers abandoned their fish ponds after a few years because of theft by people as well as predation by otters (P. van der Heijden, personal communication).

Thus, as a result of their idiosyncrasies, traditional institutions do not encourage investment in modern forms of production.

- Similarly, traditional land and water use rights are not always secure enough to justify investments in facilities such as fish ponds. In some societies, for instance, land use rights may be allocated anew every season.

Modern fisheries enhancement as culture-based fisheries in open waters is feasible only if exclusive use rights are granted to those who made the investment, such as, for example, the acquisition and stocking of juvenile fish. This is often in contravention of traditional use and access rights, and even if granted, exclusive use rights may not be supported and enforced by traditional institutions.

These and other constraints, which originate from conflicts of development efforts with local knowledge systems and traditional institutions, can seriously affect the development of modern aquaculture and fisheries enhancement, and even where projects have tried to take account of local

knowledge and institutions, overcoming these obstacles has proved to be extremely difficult (e.g. Thomas 1994)

Inefficient modern institutional context

The successful introduction of modern fisheries enhancement and aquaculture into sub-Saharan Africa requires an enabling institutional environment, not only on the traditional, but also on the modern side. Especially required are appropriate policies, legislation, technical support and infrastructure as well as financial and marketing institutions.

The present-day exploitation of the continent's inland aquatic resources predominantly forms part of the informal economy, and is not subject to specific policies and legislation. Therefore, the establishment of institutional frameworks for fisheries enhancement and aquaculture is generally afforded a low priority. This is reflected by the fact that within sub-Saharan Africa, only Namibia and South Africa have specific aquaculture development policies (Coche *et al* 1994). Mozambique recently identified aquaculture as a development priority, but it still lacks policy and legislation to ensure its sustainable development.

A very critical issue concerns extension services: the introduction of aquaculture technology to sub-Saharan Africa has invariably been dependent on the development and support of such services. They generally have two aims: to produce and supply fingerlings and other inputs, and to provide advice and support to fish farmers. However, extension services have proven to be neither very effective nor self-sustaining. One of the reasons why extension services are ineffective is that extension workers generally receive little training, despite the existence of aquaculture training facilities in sub-Saharan Africa. The training which is provided is usually restricted to the technical aspects of aquaculture production, ignoring the socio-economic context of fish farmers and modern methods of target group work, such as participatory planning. A further constraint has been the separation of aquaculture from other rural

extension services in most sub-Saharan African countries. The potential of integrating aquaculture with other farming systems has thus been overlooked.

There are also various informal institutions of African societies and administrations which have acted as constraints to aquaculture development, sometimes involving the illegal extraction of fees for services provided in the context of development projects or the appropriation of harvests, for instance by military.

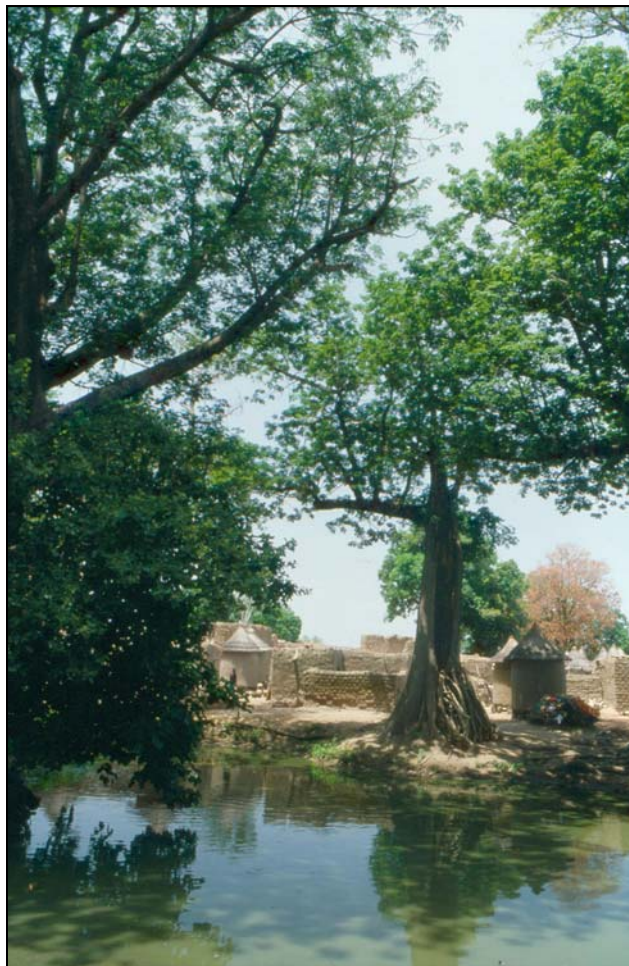


Photo 18: Village pond (Burkina Faso) where culture-based fisheries is practiced.

4. Conclusions and Recommendations

4.1 General

The preceding chapters have described and discussed traditional inland fisheries management and enhancement systems and their potential for more appropriate and effective approaches to the development of inland fisheries, fisheries enhancement and aquaculture. Two main conclusions are suggested:

- Better approaches to the management of inland fish resources could ensure sustainable supplies of fish protein for a growing African population but, above all, contribute to integrated rural development by providing income and employment as well as increasing internal market demand
- Traditional fisheries management and enhancement systems can, if understood, acknowledged and turned to account adequately, facilitate improved and sustained utilisation of inland fisheries resources, because they have evolved empirically, have been tried and tested, and reflect a profound knowledge of the human environment of resource utilisation.

Although being essentially associated with common property regimes, traditional fisheries management can also function in open access situations. Traditional fisheries enhancement systems, however, usually imply varying degrees of exclusiveness of resource use. Their effectiveness under different resources allocation systems results from a locally evolved and collectively owned cognitive base (local knowledge) and established, accepted and functioning local (traditional) institutions.

Unfortunately, the advantages of traditional resource management and enhancement systems have, more often than not, been ignored by government planners and decision makers as well as by many development assistance

agencies. Parallel administrative structures and legal frameworks were set up, often superimposed upon traditional institutions, sometimes weakening or even eroding them.

However, African governments, as well as international agencies, can also play a positive role and support fisheries management based on traditional systems. For many traditional inland fisheries management and enhancement systems, a certain degree of government support could be of advantage (e.g. where conflicts and problems exceed the powers of traditional authorities to enforce rules, as in cases of encroachment of fishing grounds by armed poachers, or where the pursuit of offenders outside a traditional territory is warranted). Also, state institutions can contribute modern (scientific) knowledge and facilitate the extension and dissemination of such knowledge.

The essential condition required for traditional and 'modern' resource utilisation and management systems to work in synergy is the acknowledgement and understanding of the former by development planners and decision-makers. In the past, a lack of experience in understanding traditional management and the considerable efforts needed have often prevented this. Also, existing legal frameworks often prevented government institutions from officially acknowledging traditional institutions.

Recommendations

Interventions into existing resource allocation patterns and property regimes, whether by government, development assistance and/or other agencies should exert the effort necessary to understand the dimensions and the rationale of traditional resource management systems and the institutions on which they are based. Dimensions to be considered would include:

- the nature and state of the resource, present and past allocation patterns and the actors and stakeholders involved.

- performance, potentials and shortcomings of traditional management systems. As these do not disclose themselves easily to outsiders, specialised (e.g. anthropological) expertise may be warranted. Participatory methods are recommended for this analysis to involve all stakeholders and to make them owners of the development process which may follow.
- modern institutions, their rationale, performance and impact on resource allocation and management systems *in situ* and their interaction with existing traditional institutions.
- potentials to improve synergy and co-operation of traditional and modern institutions and to set up management systems where both systems can exert their respective strengths.

Interventions designed to change and strengthen existing institutional arrangements have to consider the following aspects:

- Any change of existing institutional frameworks can bring about improvement only if accepted by all or the majority of the stakeholders. Often, such acceptance can only be achieved in the mid- or long term, and with the active involvement of all parties concerned.
- If possible, existing traditional institutions should be the starting point of change. However, traditional institutions cannot be changed or re-designed by external agents at their own discretion, in a process of 'social engineering'. Instead, it is the people themselves who have to decide on whether and how to integrate traditional and modern systems.

Efforts to manage inland fisheries resources by central government have, in general, been unable to address the individuality of many local fisheries, and even where regulations were adapted to local conditions and traditional management systems were acknowledged, the joint

management of resources by modern and traditional institutions—co-management—has, in the past, been the exception rather than the rule.

Co-management is a ‘middle course’ between pure state and pure community management. The term covers a wide spectrum of arrangements with different degrees of state and community rights and responsibilities. The approach has been elaborated upon and tested in fisheries, also in African inland fisheries, during the past decade, with varying degrees of success.

Box 26: Co-management and tradition in African inland fisheries: Experience and lessons learned

A possible framework for the co-operation of stakeholders as local communities and other social groups and modern administrations in resource management are co-management arrangements.

While being more widespread in the management of forest or rangeland resources, co-management has also been applied in fisheries (*cf.* GTZ 1998, Jentoft 1989, Nielsen 1996, Pinkerton 1989, Pomeroy/Berkes 1997, Svendrup-Jensen and Nielsen 1998; a good source of information on the Internet is www.co-management.org).

Examples of co-management in African inland and lagoon fisheries include

- the fisheries of Aby Lagoon, Ivory Coast, supported by ICLARM/IFM/NARS (Konan 1999)
- the fisheries of Lake Malombe and the Upper Shire River, of Lake Chiuta, Lake Chilwa and, to a certain extent, Lake Malawi, under the Participatory Fish Stock Management Programme (PFMP), supported by GTZ, ODA, UNDP, and the World Bank (Bell 1998, Hara 2000, Hara *et al* 1999, Njaya 2000, Njaya *et al* 1999, Mohamed 2000/2000a, Scholtz *et al* 1998)
- the inshore fishery of Lake Kariba in Zambia and Zimbabwe (Hanna 1998, Malasha 1999, Nyikahadzoi and Songore 1999, Syampaku 1998)

- the Mweru-Luapula fishery (Aarnink 1999) and the Bangweulu fishery in the north-east of Zambia, with support from the Netherlands Development Organisation (SNV) and IFAD.

By and large, these co-management arrangements are described as promising or successful. Their relatively short period of existence (most arrangements started in the mid-1990s) does not allow for final evaluation, however.

It is frequently reported that the relationship between traditional and co-management institutions and bodies is a problematic issue. For example, where co-management bodies take over competencies, they weaken traditional authority, just as state organisations do in the same situation. Traditional authorities are therefore reluctant to give away competencies unconditionally.

On the other hand, there is some evidence that traditional authorities and institutions have a considerable potential to strengthen co-management arrangements, where they are successfully integrated. They can in particular improve communication between co-management bodies and the people, increase the legitimacy of such arrangements and facilitated the enforcement of rules. In this way, traditional institutions have helped to increase effectiveness and to reduce the costs of co-management—a very critical factor for their sustainability.

Altogether, it seems that in most cases of co-management of fisheries resources, traditional resource management systems have not been investigated adequately, the relevance of traditional authorities has been underestimated and they have not been sufficiently involved in the new arrangements. Even where co-management bodies have successfully involved traditional authorities, it seems uncertain whether such an arrangement will be sustainable. As Konan (1999) noted for the Aby Lagoon in Ivory Coast, the situation remained “very ambivalent because of the duality of the local decision-making structures. In fact, upon the traditional authority is superimposed the administration and ‘modern’ organisation”.

Problems encountered with co-management are manifold and involve, for example:

- different levels of decision-making and the lack of reciprocal transparency and adaptation. Traditional resource use systems are limited to communities, ethnic and kinship groups, and so on, whereas governments establish norms valid for a national territory made up of a multitude of such entities.
- the preference of government (and, often, development assistance) agencies for top-down approaches: co-management cannot be imposed from above, but needs to be negotiated between the stakeholders. It is often difficult for the stakeholders to invest the time and financial resources necessary.
- both government staff and development workers often have problems in understanding the functioning of traditional institutions.
- traditional systems may have inherent weaknesses, because they have been compromised by the internal or external effects of change and are thus ill equipped to complement government efforts to manage resources.
- the difficulties in balancing the interests of all stakeholders, in particular to achieve mutuality of interests between government and user groups. In principle, co-management arrangements strive to arrive at a situation where every participant is better off when co-operating ('win-win situation'). Where different interests clash, however, the more powerful participants may either influence the arrangement for their own benefit or leave the arrangement and assert their interests independently. In this way, existing power structures are reflected in co-management arrangements and could prevent the achievement of solutions which are acceptable to all.

To achieve synergy or, at least, to avoid conflicts between traditional and 'modern' resource use and management systems, the alternative to co-management is community-

based fisheries management (CBFM). Under CBFM arrangements, the authority to manage given resources is devolved to local communities. The communities then would exercise their authority within the existing normative framework. Therefore, both, co-management and community-based management requires a legal framework which acknowledges and accommodates traditional institutions and devolves management functions to local traditional and government authorities.

Both scenarios would benefit from development assistance and participatory methods. Given the lack of financial and human resources of many African governments, in many cases this would imply the involvement of external assistance.

Box 27: Co-management versus community-based management of inland fisheries resources

In Africa, as in other regions of the world, reality has shown that central government is usually not capable of taking adequate management decisions for a specific water body and enforcing management measures on the ground. The involvement of stakeholders, in particular local institutions and traditional authorities, appears to be the only way to manage not only inland fisheries, but also other natural resources such as forests and wildlife (*cf.* Onibon 2000).

Options for doing so are community-based management or co-management of resources. The concepts of community-based fisheries management and co-management have many similarities, as both entail the involvement of communities in fisheries management. They differ insofar as community-based fisheries management gives full responsibility to a community, while co-management creates a partnership arrangement between government and one or more communities (*cf.* Berkes *et al* 2001). As the degree of government involvement in co-management varies, community-based management can also be seen as a form of co-management with (almost) no direct government participation.

Co-management appears to be the most suitable option where large water bodies are concerned, where a sizeable number of stakeholders have access to a resource, where different ethnic groups or nations are involved in resource utilisation, or where the state has a particular interest in a resource (e.g. biodiversity conservation).

Where resources are delimited and utilised by only one or very few stakeholder groups, community-based management appears to be the better option.

In African inland capture fisheries, it is usually the traditional communities that represent most stakeholders. To devolve management functions to these communities has several advantages:

- institutions exist and can be 'utilised' with little or no cost
- their acceptance is generally high
- they have appropriate methods to mediate in case of conflicts
- they have effective mechanisms of enforcement.

However, to rely solely on traditional communities for resource management is, in most cases, neither viable nor realistic. Successful community management as co-management requires government support, in particular by providing an appropriate legal framework and officially acknowledging traditional institutions. Also, community management could require the adaptation of existing or the creation of new institutions and/or management bodies. If traditional authorities and institutions are fully integrated into such structures, the advantage of traditional management could be maintained.

4.2 Management of Inland Capture Fisheries

The following conclusions can be drawn with regard to inland capture fisheries in sub-Saharan Africa:

- The sub-sector's present and potential contribution to regional development in terms of income, employment and nutrition is of a magnitude similar to that of other sub-sectors of primary production (e.g. animal

husbandry). Enhancement systems, whether traditional or modern, are not likely to contribute to integrated development on a comparable scale.

- Traditional management is still the predominant method of managing inland fisheries in sub-Saharan Africa. Traditional fisheries management systems are specific to the fishing activities they regulate and exert a degree of control and enforcement over resource exploitation, which government services are often unable to provide. Highly diversified, they are based on local (traditional) knowledge and traditional institutions and their underlying rationale generally aims at sustainability of resource utilisation.

Inland capture fisheries have received less development assistance than other sectors of primary production, whether from African governments or from aid agencies. Reasons why the sector has been kept out of the mainstream of development include the low degree of socio-political representation of the fishers as well as the fact that inland fisheries are mostly part of the informal sector of the economy.

Box 28: Viewing inland fisheries as part of rural development

Efforts to support inland fisheries development should put into use the available knowledge on the rural sector in sub-Saharan Africa. Unlike inland fisheries, other sub-sectors of primary production of sub-Saharan Africa such as agriculture and animal husbandry have been subject to intensive and long-term studies and investigations. As a result, a wealth of information on the socio-economic and cultural aspects which determine rural livelihoods is available.

For example, the usufruct rights to resources used by smallholder agriculture and husbandry have been investigated for decades. The information available could be a point of reference for a better understanding of the use and access rights which traditional management applies to the utilisation

of aquatic resources: the use of terrestrial and aquatic resources is governed by the same values, customs and beliefs, but information on the socio-cultural determinants of land use is rarely taken into account in the context of managing inland fisheries.

Using the knowledge available on rural production for inland fisheries development would help avoiding mistakes and/or preventing duplication of research efforts, and could facilitate the integration of inland fisheries within an overall rural development approach.

Where inland capture fisheries have received development assistance, interventions have frequently failed because development planners did not understand the traditional institutions and local (traditional) knowledge of existing resource management arrangements.

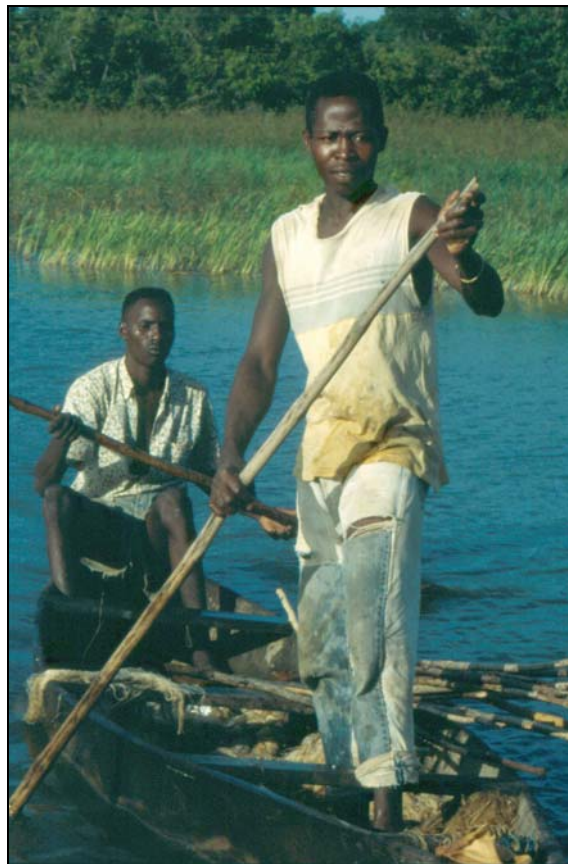


Photo 19: Fishermen at Toussiana Lake, Burkina Faso

Box 29: The relevance of local knowledge

Local knowledge is the cognitive base of traditional management systems. Of relevance are

- local *technical* knowledge, i.e. the knowledge regarding, for example, the interaction of biological and ecological aspects which determine fish population dynamics or the impact of specific gear on fish stocks
- knowledge, reflection and acceptance of values, beliefs, norms and sanctions as well as decision-making and implementation processes which govern individual and community livelihoods and determine resource utilisation.

The metaphysical and cosmological dimensions of local knowledge systems are particularly difficult to understand. Reluctance to openly address these aspects of local knowledge often exists on both sides: local people deem it inappropriate to expound their knowledge and beliefs in front of outsiders, either because they fear to be looked down upon, or because there are restrictions (e.g. secrecy) to doing so. Development workers and members of the administration, in turn, are often reluctant to discuss indigenous views and beliefs, because they do not believe in them, feel that they are difficult to understand or fear to violate taboos and the dignity of the people.

Understanding and accepting local knowledge as a major factor of traditional management should not prevent the use of modern ('scientific') knowledge, especially under co-management arrangements. The relevant elements of scientific knowledge could be made available to stakeholders through presentations appropriate to their cognitive background.

Understanding of both the institutional and the cognitive basis of traditional management is essential for improved management of inland capture fisheries. Furthermore, management arrangements, whether community-based or co-management, need to be

- specific with regard to the given resource
- capable of preventing over-exploitation
- in line with the economic, social and cultural objectives of the people involved.

Successful arrangements need to have sufficient knowledge and suitable institutions at their disposal in order to define and enforce regulations and to solve conflicts.

Recommendations

Where new resource management arrangements are needed, either because overall frameworks have been formulated and local regulations have to be adapted or because changing overall conditions require new regulations, traditional institutions and local (traditional) knowledge should be the starting point. Only knowing how and why (or why not) existing resource management systems function will allow the design of locally appropriate management arrangements and the integration of both existing institutions and local knowledge. Two scenarios can be imagined:

- existing traditional management is functioning. In this case, the overall legal and institutional framework should acknowledge and strengthen traditional institutions, devolve functions to them and adapt regulations to fit local customs, values and beliefs. State institutions could assist further by offering modern knowledge and co-operating in enforcing regulations.
- traditional management is weakened or eroded: in this case, past (successful) institutional structures should be considered and, in particular, local (traditional) knowledge should be incorporated when designing new management regimes.

Box 30: Participatory methods as a way to understand traditional institutions and local knowledge

Nowadays, a large number of participatory approaches are available in development co-operation, e.g. *Participatory Rural Appraisal* (PRA). Participatory approaches are used in analysing a given situation as well as in planning development interventions.

PRA and related approaches make use of a vast number of methods or tools, some of which have been in existence for some time in the social sciences (e.g. semi-structured interviews), while others have been newly created.

Specific to participatory approaches are not only some methods and tools, but also the ways of applying them. Participatory approaches imply that information is not only 'extracted' from target groups and stored in documents often not even accessible to them, but elaborated, evaluated and applied jointly by target groups and development workers.

In the context of fisheries and aquaculture development, participatory methods have been successfully applied and adapted (*cf.* Townsley 1996, GTZ 1998).

Due to their particular propensities, participatory approaches are also suitable for the generation of information on local knowledge and for the application of local knowledge in fisheries management and enhancement. While no specific participatory approach exists for this purpose, many of the common PRA methods and tools can be applied.

In the recent past, several publications describe how to investigate and utilise local knowledge in the development context with the use of participatory methods. Examples are: Emery (2000), Greiner (1998), IIRR (1996) and World Bank (1998).

4.3 Traditional Fisheries Enhancement

Traditional fisheries enhancement systems go beyond the management of wild stocks. Their relevance and potential for development stem from the fact that they have evolved without outside assistance. Enhancement systems in general and traditional enhancement practices as well, are different from traditional capture fisheries management systems in at least two ways:

- Although they have evolved from local knowledge systems, they are not necessarily accessible to all. In particular the more efficient and complex systems are often based on specialised technical knowledge, similar to other artisanal production systems.
- Unlike the common property regimes usually governing inland capture fisheries, many traditional enhancement systems imply, to varying degrees, exclusive use or property rights.

Their potential for development is based on two assumptions:

- The different systems are found only in some countries or areas, but suitable conditions for their development exist in many other areas. Therefore, there is scope for replicating them through intra-regional transfer of technology.
- Their efficiency could be augmented by the gradual, step-by-step infusion of elements of European and Asian aquaculture, such as feeding/fertilising and improved water management, while their indigenous roots would still foster acceptance.

Where traditional fisheries enhancement systems are an accepted practice, they are usually part of the overall resource allocation and management concept. They may represent a higher conflict potential than does capture fisheries management, e.g. by limiting access, but are generally accepted in the social context in which they have evolved.

Recommendations

Traditional fisheries enhancement systems should be seen as starting point for development in terms of their potential for

- intensification, e.g. by improving input-output ratios
- replication in other parts of Africa.

Before development efforts to 'transplant' enhancement systems are implemented, not only the bio-technical feasibility of traditional enhancement systems should be examined, but also the potential for their successful replication in terms of their compatibility with existing resource utilisation patterns. Depending on the degree to which they subtract resources from a common pool, they would rely on (apart from an overall acceptance by the community) the presence of effective (traditional and/or modern) institutions to ensure excludability and thus provide the *conditio sine qua non* for the investments they require.

Because of their private venture character, which implies a certain degree of entrepreneurship, community-based management of traditional fisheries enhancement systems are unlikely to be viable where collective production has no tradition. Nevertheless, if transplanted into a traditional rural environment, they would have to be in line with existing resource management systems and the overall framework of (traditional) resource allocation.

However, while the potential for transfer of traditional enhancement systems appears promising, data on their micro-economic performance are sketchy, and the social and economic implications of 'modernising' them can only be speculated upon.

Hence, there is a need to generate information on traditional enhancement systems if future developments are to be built on existing practices and indigenous knowledge. Without substantially improved information, development efforts in this direction would, even if implemented on a

pilot scale, be hazardous, with the hazards ultimately borne by the fishers and farmers involved. Since most African nations are facing increasingly problematic budgetary constraints, the financing of such studies would have to come from the outside, through development assistance.

4.4 Modern Fisheries Enhancement and Aquaculture

The performance of aquaculture and other enhancement systems of European and Asian origin, introduced with massive support from external development assistance agencies, is to date contributing only fractionally (less than 1%) to inland fish production in sub-Saharan Africa. One conclusion which can be drawn from this assessment is that building on existing enhancement systems, or merging them with modern know-how and technology, could be an alternative to the bio-technical, production-oriented, and often top-down approach to fisheries and aquaculture development practised in the past.

From the discussion of the factors which have contributed to the poor performance of many aquaculture development projects, several conclusions and recommendations regarding future effort to develop 'modern' fisheries enhancement and aquaculture can be derived.

Recommendations

Fish as a cash-crop

When promoting rural fish farming, development planners should take into account that only sustained monetary incomes can provide sufficient incentives for the adoption of the technology. In marginal smallholder households, fish is not part of the staple food intake but is consumed as a relish or side dish. In ensuring household food security, absolute priority is given to staple crops. This implies that cash-crop production in marginal household economies is only allocated those resources not necessary for the production

of the amount of staples necessary to provide for the energy consumption of the family. This again means that fish farming, if adopted, will substitute existing cash-crop production and will, in terms of the allocation of resources, be in competition with them.

Target groups

The common target groups of small-scale rural aquaculture development projects have been the rural poor, i.e. smallholder farming families. Marginal farmers are, however, the least suited to take up a new and demanding technology. Their priorities are subsistence, survival and security. They are vulnerable, in terms of risk taking, and their resources are limited to the extent of marginality.

It is therefore recommended that the viability of targeting small-scale farmers as the priority group in rural fish farming development programmes is reconsidered. By targeting this group, it is likely that the impacts achieved will not justify the innovative effort.

Integrated aquaculture

In Africa most attempts towards integrated aquaculture have ignored existing farming systems and have instead promoted the integration of fish farming with other, equally demanding and non-familiar systems of animal husbandry, such as pigs and chickens raised intensively in pens.

It is therefore recommended that opportunities to integrate fish farming into existing farming systems should be investigated. If fish farming could be adapted to fit with other farming activities, preferably those of high priority within the coping strategy of farmers, fish farming would further diversify the farming system instead of increasing the existential risk of rural homesteads by diverting resources.

Commercial aquaculture

While the social and natural environment of small-scale farming provides more constraints than opportunities for economically feasible and sustainable aquaculture

production, there is a considerable potential for the commercial, market-oriented uptake of the technology. Commercial aquaculture on a semi-intensive scale in peri-urban areas has not been considered an option by many foreign aid agencies, in spite of its obvious advantages:

- being in the vicinity of centres of demand, marketing would be facilitated
- availability of labour would be no constraint because of the large number of un- or under-employed people concentrated in urban centres
- recycling of waste products from urban-based food industries would provide economically attractive inputs
- capital and entrepreneurial capacities are more readily available than in rural areas.

It is therefore recommended that future aquaculture development efforts, which are not exclusively focused on poverty alleviation, but instead are aimed at food production, should consider the option of promoting aquaculture in an enabling environment and on a commercial scale.

Culture-based fisheries

Water development projects almost always have a strong bearing on fish and fisheries, often in a negative fashion. Culture-based fisheries may help to alleviate negative impacts on the fisheries and to better utilise new fisheries potentials created e.g. by artificial water bodies. Although man-made lakes, especially in connection with agricultural irrigation, usually offer intrinsic possibilities to combine modern aquaculture with capture fisheries, this still remains an exception. It is therefore suggested that the appraisal of culture based fisheries—as well as fisheries rehabilitation in general—should become an integral part of any water development planning. It is further proposed that culture based fisheries, perhaps combined with habitat improvement, should primarily aim at

- maintaining indigenous fish species and aquatic biodiversity
- filling ecological niches which cannot be colonized by native fish
- using species for stocking that reproduce naturally in the new environment
- securing/enhancing fish production of non-perennial water bodies.

The introduction of exotic fish must be regarded with great reservations, because it could endanger indigenous species and their habitat. Also, schemes that require continuous restocking with cultured species may be problematic because they imply organisational, managerial, and technological effort comparatively demanding and difficult to sustain in rural Africa. As water development projects frequently disturb or even disrupt traditional production patterns, culture based fisheries may be a way to create alternative incomes for affected population groups.

In general, it appears that modern fisheries enhancement and aquaculture could benefit from the careful consideration of strengths and weaknesses of traditional enhancement and resource allocation and management systems. Traditional enhancement operations may, possibly, produce less from the resources they use, but could probably be better adapted and more appropriate to their social and cultural environment, accepted by most members of the community and still produce sufficient return to be considered viable by operators.

If these advantages could be merged with technological and managerial elements of modern aquaculture, the resulting 'hybrid' could, maybe, show a way to increase fish production in sub-Saharan Africa on a sustainable basis.

Overall Recommendations

It is recommended that African governments, development agencies, and research institutions both in Africa and in the industrialised countries join forces in order to promote and develop a new approach to increase sustainable inland fish production along the lines suggested here, together with stakeholders and target groups. In particular, it is recommended

- to improve knowledge of traditional fish production systems, in particular with regards to traditional knowledge and institutions
- to implement, on pilot scale, and in a participatory fashion projects following the approach suggested here and to monitor and evaluate them
- to systematically exchange relevant experience and initiate a joint learning process.

Such an approach would not only be in line with the Chapter 26 of the Agenda 21, but also of with para 8(j) of the Bio-Diversity Convention of the UNCED Conference of Rio (1992):

“Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices”.

Annex 1: Traditional Fisheries Management in the Eastern Caprivi Region of Namibia

by James Abbott

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Abstract

The eastern Caprivi, located in the extreme northeast of Namibia, has an active fishery in the rivers and floodplains of the area. Communities in this area are heavily dependent on this fishery. A traditional tenure-based system has evolved to manage the fisheries, although this system may be compromised due to several factors, including the advent of modern gear and the erosion of traditional culture. In this paper, the fisheries of the area are considered along with the traditional and modern measures which exist to manage them. Following this, the role of traditional authorities in present and emerging Namibian legislation and policy will be considered and recommendations made for effective integration of traditional management of fisheries into national policy.

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1. Introduction

1.1 Background

This study examines traditional management practices that evolved to manage the fisheries of the upper Zambezi River between Zambia and Namibia, in the eastern part of the administrative region known as the Caprivi (see figure 2.1). It was undertaken in April and May 2000. Consideration focused on what role the customary laws and the authority structures which enforce them play in present and possibly future fisheries management.

Fish stocks, fishing and the traditional management practices that evolved around them are essentially dictated by the flow of the Zambezi River, both in terms of its annual flood cycle and longer scale climatic trends. Different species and habitats exist in the Zambezi River channel and adjacent floodplains, varying according to the stage of the flood cycle. Longer scale flood trends, such as the peak height, duration and degree of flooding will in turn affect the habitat, diversity and biomass of fish stocks. As a result, fishing methods have developed to reflect the cyclical nature of fish availability. Traditional management in turn is focused largely on the tenure of fishing grounds which are only accessible during certain times in the flood cycle.

At present, the fish stocks of this area, and the communities they support may be at risk due to overexploitation and destructive fishing practices. There is uncertainty regarding the actual state of fish stocks, due to the complexity of the system and the limited biological surveys carried out in this region (C. Hay, personal communication). A reduction in the biomass or biodiversity of fish would be a serious issue as fish are an important source of both protein and cash to this relatively poor region with a growing population (Tvedten *et al.* 1994). Moreover, the Zambezi River forms a boundary for no less than four countries, which creates a potential climate for conflict if fishers compete for a

resource which knows no boundaries. Therefore, it is important to not only consider appropriate modern management methods, but also to make use of existing traditional management practices and authorities. In this way, modern management initiatives can be made more effective and suitable for the communities where they are implemented.

As in many freshwater fisheries, it is impractical to consider management practices, traditional or otherwise, merely from how these practices affect fish stocks. Hence, this study will demonstrate how fishing in the eastern Caprivi and its ability to be managed is also affected by national boundaries, culture and the choices that communities and individuals make regarding whether to fish or farm and if they do fish, whether to eat or sell their catch.

1.2 Defining Traditional Fisheries Management

It is important at the outset to define how both 'traditional management', and 'customary law', are perceived for the purposes of this study. Various definitions exist in the literature, mostly differing in terms of relation to pre-colonial authority structures, gear use and economies. Most studies accept that the most narrow of definitions for traditional management (i.e., purely indigenous structure managing traditional gear use, based on biological and cultural parameters, with non-cash compensation and penalties) are unworkable and do not allow the examination of situations where modern and traditional management can be integrated. Ruddle (1998), in his discussion of traditional management of fisheries in the South Pacific points out the fact that traditional management "is the end product a long process of change and adaptation to external pressures and constraints". This is certainly the case in eastern Caprivi, where traditional management has changed in response to colonialism and new fishing methods.

Indeed, traditional fisheries management can often 'blend' with modern practices, such as the codified recognition of

traditional tenure in legislation (e.g. King and Faasili 1999) or the enforcement of modern regulations by traditional authorities (e.g. Neiland and Ladu 1997). The ambiguity surrounding the definition of traditional management is especially evident in the difficulty which often occurs when addressing these concepts in policy and legislation. Attempts to integrate traditional authorities in resource management in the Caprivi as well as Namibia as a whole have been hampered by the many grey areas regarding tenureship and enforcement on communal lands.

Despite the ambiguity of the term traditional management, there are some common features that can be identified in most systems. Tenure is often a prominent element (Hviding and Jul-Larsen 1995) where access to certain fishing areas can be limited according to the season, ethnic or familial status of the user, or gear used. Decisions regarding allocation of tenure or conflict resolution are made by traditional authorities, and enforcement is carried out by the users of the resource. Management based on tenure can often adapt to a certain degree to the use of modern gear and cash economies, as access and compensation adjust accordingly. However, the adaptation depends to a large part on the resilience of the whole traditional authority structure in the face of change. If traditional tenure is not recognized, then the practices of control and compensation are similarly ignored¹.

Hinz (unpublished), in his treatise on traditional law in Namibia, defines several different 'states' of customary law which can occur simultaneously. 'Official customary law', which is codified and potentially subject to the bias of researchers and historical accounts; 'customary law of traditionalists', which may be too idealistic and the 'living

¹ Tenure in this context does not usually imply ownership, but rather a right to use a resource. This right can be at the family or community level. The seasonal inundation of the Zambezi floodplains affects tenure, as the streams and pools used by certain groups become contiguous with the main channel and become open to all.

law of the people' which may differ from official customary law. A similar approach is offered by Neiland *et al.* (1994), distinguishing how management practices function in theory (*de jure*) and in practice (*de facto*). Several different states of customary law appear to operate in Caprivi, resulting most notably in a divergence of opinion between the paramount traditional authority and traditional authorities at the community level regarding certain management measures. In this way, fishing directives regarding minimum mesh size issued by the paramount tribal authority have sometimes been resisted at the community level for being impractical or impossible to implement (Tvedten *et al.* 1994).

Equally important in the discussion of traditional management is the rationale behind management practices based on customary law. Once again, tenure is an important element. Tvedten *et al.*, (1994) state that traditional management practices in Namibia are "more as a way of securing fish for certain groups than preserving stocks on an ecosystem basis". Scudder and Conelly (1984) distinguish between *intentional* and *inadvertent* practices, with the former pertaining largely to gear restrictions or access and the latter to avoidance of taboo species or sanctuaries established in the honour of chiefs or ancestors. In eastern Caprivi, intentional practices such as the establishment of tenure have become dominant, while inadvertent practices based on traditional beliefs have largely vanished due to an erosion of culture.

Regardless of the rationale behind practices, traditional management can be limited in its ability to actually conserve fish stocks. Hinz (unpublished), refers to Dye (1998), who states that traditional measures "only conserve what they can envisage being depleted", implying that the more complex the aquatic system, the more difficult it is to determine cause and effect. This in turn can make traditional management less able to conserve vulnerable fish stocks in the face of increased pressure and/or new fishing methods. In a dynamic and non-discrete system such as the

Zambezi floodplains, with its wide variety of aquatic habitats, the link between fishing pressure and effect on fish stocks is all the more complex. However, where fishing is such an important element of daily life such as in the Caprivi, most fishers are aware of changes in fish numbers, diversity and distribution due to natural and human factors.

Other factors can also limit the application of traditional authority structures and practices outside of a strictly traditional society. These include the breakdown of extended family and traditional authority structures, including a break in the transfer of management knowledge between generations as occupations become more diverse (Hinz, unpublished), the onset of a cash economy and commercialisation, urbanisation, (where fishing becomes disjointed from other resource uses) (Tvedten *et al.* 1994), jurisdictional conflicts (where traditional and modern boundaries do not correspond)(Hinz, unpublished), the introduction of recreational fisheries and new environmental pressures such as eutrophication and the introduction of exotic species.

Experience has demonstrated that the flexible nature of traditional management can often adjust to these new realities, as mentioned in the discussion of “blended” management practices. Certainly this appears to be the case in the eastern Caprivi region, where traditional authorities have often recognized the merit in banning certain types of modern gear such as dragnets, as well as cooperating with other enforcement agencies. However, the problem of “what they can envisage being depleted” is also an issue in this area, as it is commonly thought that the high floods act as a annual sanctuary of sorts, as most gear becomes ineffective.

1.3 Objectives

This study of traditional management of fisheries in the eastern Caprivi seeks to address the following question: What role do traditional authorities in the eastern Caprivi

play in fisheries management at present and what potential role can they have in the future? In doing so, this study will suggest that while traditional fisheries management practices in this area are largely limited to tenure, traditional authorities possess the necessary local involvement, consultation and adaptability to be suitable for modern community level management. However, for community management to be effective, the relationship between government, traditional authorities and communities must be re-evaluated.

In *Section Two*, the eastern Caprivi will be described, highlighting the natural, political and socio-economic features which affect fishing activities and management structures. *Section Three* focuses on fishing activities along the Namibian and Zambian sides of the Zambezi River, giving an overall view of the fishing methods used, the division of labour between fishing and other activities, and the cash and non-cash characteristics of these activities. *Section Four* discusses management practices which exist in the area, in terms of traditional authorities, government legislation and emerging national policy. *Section Five* considers the institutional and legal options for the management of fisheries including the integration of traditional practices and makes recommendation for future policy and research priorities.

1.4 Research Methodology

Much of the information for this study was derived from previous studies, as well as existing and emerging government policy and legislation. In order to collect information on the present state of traditional management and exploitation patterns, visits were made to the paramount chief and traditional government of the region, which is comprised of traditional authorities of all parts of the eastern Caprivi. Information collection on Impalila Island involved field visits, discussions with traditional authorities, fishermen and other community members as

well as Participatory Rural Appraisal (PRA) methods such as resource mapping and use calendars.

1.5 Selection of the Study Site

While the whole of eastern Caprivi was taken into consideration, focus was especially given to the fishing communities on Impalila Island (see map). This site was chosen for several reasons: It has a variety of aquatic and terrestrial conditions, an active traditional authority structure, a high level of both fishing and agriculture and a proximity to riverine borders with other countries, allowing a two way access for fishers and markets. A limitation of this study is that conditions, both natural (Mendelsohn and Roberts 1997) and socio-economic (Tvedten *et al.* 1994) vary within the region. Therefore it is not the intention of this study to infer that findings from Impalila Island are directly applicable to other areas. The situation on Impalila Island nevertheless has merit when considering the eastern Caprivi in general, as it is affected by the most critical issues to the area, namely: cross-border fishing, destructive and overexploitive fishing methods, commercialisation and competition with recreational fishing.

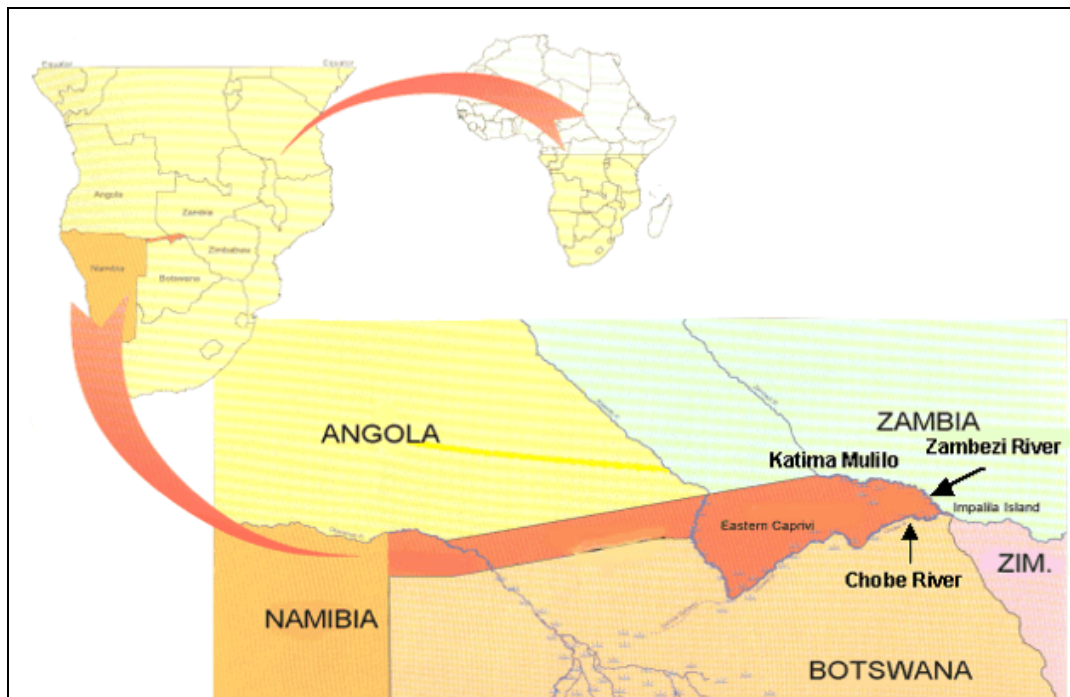
2. The Study Site

2.1 Introduction

As stated in Section One, activities in the eastern Caprivi, such as fishing and agriculture are significantly influenced by the flood cycle of the Zambezi River. The annual inundation of the floodplains determines which fish can be caught and where, as well as options for agriculture and markets. Other activities, such as cattle grazing are also at the whim of flood waters, and thus, whole communities oscillate between homes on the floodplain and solid ground. This section will also describe the other related physical, economic and historical factors of the eastern Caprivi which influence fisheries in the region. The specific study site of Impalila Island will also be described.

2.2 The Physical Environment

For the purposes of this study, the eastern Caprivi is delineated by the Zambezi River to the north and the Chobe/Linyanti Rivers in the south. At the height of flooding the rivers and floodplains become largely contiguous. Impalila Island is located at the easternmost tip of the Caprivi region, where the Chobe and Zambezi Rivers meet. To its north is Zambia and to its south is Botswana, with a broad expanse of floodplains stretching to the east.



*Figure 2.1: Map of the study site
(adapted from Mendelsohn and Roberts 1997)*

2.2.1 The Aquatic Environment

The Zambezi River is fed by tributaries in the Angolan and Zambian highlands. The extremely slight gradient leads the river to the Kalahari basin, where it fans out over a broad sand filled floodplain (Van der Waal 1990). Flood waters in the region peak between February and May, raising the depth of the main channel and filling a network of channels as well as seasonal depressions (*mulapos*). The habitat of coarse perennial grasses, sedges and papyrus becomes inundated, leaving very little high ground.

The flood typically lasts 4-6 weeks during March-April, before subsiding back into side channels and the main stream of the Chobe and Zambezi (Schlettwein *et al.* 1991).

In addition to the annual flood cycle, the flood regime also shows longer scale trends. The most dramatic example is the disappearance of Lake Liambezi, which was fed by all three river systems. The water level in the lake rose in the early 1970's, followed by a drop in levels due to dry

conditions (Van der Waal 1990). Flow to the lake stopped completely in 1982, causing the lake to eventually disappear in 1985, also ending a significant subsistence and commercial fishery (Tvedten *et al.* 1994).



*Fig 2.1.1: Floodplain habitat on the Zambezi river.
Note inundated huts.*

Fish species found in eastern Caprivi have different feeding and reproductive strategies, with the distribution and numbers of fish being dictated by the degree and duration of floods. The seasonal inundation of the grasslands provides habitat for adult fish to spawn, as well as a temporary refuge from most fishing methods.

High water levels in the main channels makes fishing by gill and drag nets less effective. Thus, the longer and greater the flood, the more fish are able to reproduce and are less vulnerable to fishing. Conversely, if flood levels are low, spawning and feeding habitats are limited and more accessible to fishers. If floodplains remain dry over several seasons they are grazed and compacted by cattle, which may have an adverse affect on their ability to provide fish habitat when inundation finally does occur. An equal but opposite effect can occur in seasonal channels, where lack of flow

causes the channels to become choked with vegetation, further limiting the breadth of inundation.²



Fig 2.1.2: Rapids on the Chobe River, with Botswana in the background

The upper Zambezi River and adjacent wetlands support the highest level of fish diversity in any perennial Namibian river, with Hay *et al.* (1999) citing 90 species. The high number of fish species found here reflects the diverse aquatic habitats, with several species of clariids, machokids (squeakers), cichlids and cyprinids, as well as top predator fish, the latter group being especially important for recreational fisheries. Surveys done by van der Waal (1990) in 1975, 1976 and 1980 indicated a significant drop in catch per unit effort over time, but he points out that this also coincided with a dry period. The actual status of fish stocks

² Residents of eastern Caprivi claim that the reduction in the number of hippos, which previously kept channels clear of vegetation, has limited the potential of Lake Liambezi to ever reflow, despite the record floods experienced in 2000. Van der Waal (1990) also cites the effect of the decimation of the *lechwe*, a marsh-dwelling antelope on floodplain habitat and nutrient recycling.

is difficult to determine for several reasons. The annual flood cycle imparts a natural variability both in fish numbers and the fishing pressure upon them, making it difficult to establish fish population and exploitation trends. Moreover, limited research capacity as well the low priority given to freshwater fisheries by the government make the present data collection limited in scope and applicability. The transboundary nature of the Zambezi is also a factor in the scope of data, where at best data collection only represents one half of the river and does not take into account exploitation patterns on the other shore.



Fig. 2.1.3: Village on Zambezi floodplains. During especially high flood events, villages and crops become inundated, and residents move to higher ground.

While there may be a lack of solid indicators regarding the status of fish stocks in the eastern Caprivi, factors which may cause fish populations to be at risk are evident. Most significant of these factors is the extended dry period which

affected the levels of the Zambezi river throughout the 1980s and 1990s. A longer term effect is the increase in use of more effective (and often destructive) modern gear (van der Waal 1990), as well as an increasing population (Mendelsohn and Roberts 1997) and an uncontrolled recreational fishery. Another contributing factor, which will be discussed in more detail in Section Four, is the complete absence of government management of fisheries in the region. This administrative vacuum, while an impediment, also offers an opportunity to understand how traditional authorities address management issues in its absence.

As fishing is such a significant activity in the region, it is worthwhile to consider anecdotal evidence gathered from residents regarding change in fish stocks. Tvedten *et al.* (1994) asked 18 Namibian fishermen along the Zambezi River about perceived changes in fish catches over the last 10 years. According to 78% of the respondents, the numbers of fish had declined, with the remaining responses equally divided between no change or increase in fish stocks. This trend was generally reflected by individuals throughout the associated rivers and floodplains surveyed by Tvedten *et al.* (1994). By contrast, in the fieldwork conducted for the present study, opinion varied more significantly regarding the state of fish stocks. Most responded that it was difficult to say due to the variability that came with the floods, however, those that did say that catches had declined thought that it was not so much due to less fish being available overall. Rather they thought that the issue was with more people now fishing the same resource. Individuals involved in recreational fishing reported that fishing was still good, although some areas had been “fished out” and that there had to be some effect due to dragnetting and small mesh sizes, especially on the Zambian side of the river.

2.3 The Political Environment

2.3.1 Present Day Structure

Namibia is divided into 13 administrative regions including the Caprivi. It is a declared policy of the national government that certain powers regarding planning and use of infrastructure and natural resources will be devolved to the regions, although this has yet to occur. As a result, administration of the region is largely by the national government, either from the regional capital and only town, Katima Mulilo, or the national capital, Windhoek. The Caprivi region is further divided into constituencies, with the eastern Caprivi almost entirely in the Kabe constituency. All land in the Caprivi region is either owned by the state or classified as communal land, with all of the Kabe constituency consisting of communal land. No individual has specific title in communal lands, however tenureship is granted by traditional authorities for agricultural and domestic use³.

2.3.2 Pre-Independence Structure

The political landscape of eastern Caprivi prior to the independence of Namibia in 1990 reflects a history full of changes in authority and degree of control. The principal ethnic group of eastern Caprivi, the Basubia, are thought to have arrived in the 1700s from present day Angola and Zambia (Tvedten *et al.* 1994) and the area of southern Zambia, Caprivi and north-western Botswana became a single kingdom. In 1890, the German colony of South West Africa (Namibia) was granted the Caprivi as a corridor to the Zambezi River.

³ At present, the status of communal lands is under review by the Government. A new Communal Lands Bill, which would have given some latitude for leasing land on a large scale to businesses on communal land in certain cases was rejected by the National Council (the Lower House) as leaving residents open to exploitation.

The German presence in the Caprivi remained limited and peripheral control was exercised through traditional authorities, whose positions were strengthened and consolidated by colonial administrators (Tvedten *et al.* 1994). After 1917, the whole of South West Africa/Namibia fell under British control, although the Caprivi was administered as part of present-day Botswana until 1929, when it was administered from Windhoek by South Africa as part of the South West Africa/Namibia Protectorate, under a League of Nations mandate. From 1940 to 1980 the Caprivi region was administered directly from South Africa as a separate apartheid “homeland”. Political reform then reincorporated the Caprivi back into the South West Africa administration where ethnic homelands were given administrative capacity and control over certain activities, such as natural resource management, although activities were strongly controlled and dependent on the central government in Windhoek.

The foregoing synopsis demonstrates that the history of the Caprivi is certainly complicated. However, a few themes emerge: the Caprivi region has often been perceived as a distinct geographical entity, and has been under control by several administrations of varying distance. Even at present, the area is less prominent in national government activities, due to the political and geographical distances involved⁴. This has recently led to discontent in the area, to the extent of a succession movement attacking the main town of Katima Mulilo in August 1999.

Another prominent theme is the profound effect that the occupying South African regime had in the area. First, traditional authorities in the area were used as a means of controlling residents, with the indigenous administration being provided with sufficient manpower and material to enforce laws and leaders being paid relatively large salaries. Second, military bases, schools and hospitals were

⁴ Due to the extreme eastern placing of the Caprivi, South African time is unofficially observed.

constructed in the area, especially during the 1970s and 1980s, providing employment and amplifying the market economy (Tvedten *et al.* 1994). Thus, traditional authorities had the capacity to enforce fisheries management measures, but at the same time, the emerging commercialisation of the fisheries heightened the pressure on the resource.

2.3.3 Traditional Authorities in Eastern Caprivi

The traditional authority in the eastern Caprivi is based on a paramount hereditary Chief/King (*mulena*), who presides over a parliament (*kuta*) in Bukalo (known as the *Bukalo kuta*), located roughly in the centre of the eastern Caprivi. The *kuta* is composed of the senior headmen (*silalo induna*) of the eastern Caprivi, who represent several villages. Decisions made by the *kuta* are facilitated by the deputy chief/Prime Minister (*ngambela*) who is appointed by the *mulena*. Each *silalo induna* in turn communicates the decisions to their respective communities, via the village headmen (*munzi induna*). The offices of the *kuta* at Bukalo are well organised, with a secretary and assembly/courtroom.

At the community level, the *silalo induna*, also a hereditary position, presides over a *kuta* made up of headmen from each village. A *kuta* will be convened if there is important news or decisions to communicate, or if a conflict needs to be settled. In this instance, the community at large, both men and women, attend. This latter function of conflict resolution is especially interesting, as the cases heard can range from property disputes to theft or assault. The two parties, after paying a nominal fee to the *silalo induna*, present their cases before the *kuta*. Community members are allowed to ask either party questions. Following this, the *silalo induna*, after consultation with the *indunas*, renders a decision. The guilty party is required to pay money or cattle or both, with a portion once again going to the *silalo induna*. In the case of illegal fishing gear, such as drag nets, the gear is also confiscated. If cases are still

unresolved, or are of a more serious nature, they are referred to the Bukalo *kuta*. Serious cases such as murder are normally referred directly to the Police.

The reasoning used to reach decisions in the *kuta* is based largely on precedent, especially where property dispute is concerned. Thus the community presence at the *kuta* plays a vital role in serving as a collective memory of boundaries and owners. There are a few examples of written policies, imposed during the colonial era, as in the case of the hunting of certain species of game or using drag nets (Tvedten *et al.* 1994).

The ability to enforce decisions made in the *kuta* lies in the fact that the whole community has participated in the judgement process and thus is aware of the requirements placed on the guilty party. Considering the distance of the Bukalo *kuta* and the limited telephone communications, it may be expected that decisions would not easily make their way to the individual communities. However, the tightly knit social structure means that messages quickly reach their destinations, and the group as a whole is aware of the decisions and resulting obligations on individuals.

The effectiveness of traditional law towards within the community is nevertheless contrasted by a limited usefulness towards individuals outside of the community. As expected, traditional enforcement has less effect near areas which have a high proportion of migrants, such as Katima Mulilo. However, traditional authorities in rural communities can also have limited effect if the accused is not Namibian. While communities along the Zambian side of the Zambezi share the same language and culture, there is apparently little cooperation between traditional authorities. In this instance, orders to pay cattle or money to the *kuta* and the injured party are difficult to enforce and offenders are usually delivered to the Police.

Impalila Island has a well established and respected *kuta*. The influence the *kuta* has is evidenced by the fact that a community meeting is normally held each week and is

normally well attended, especially if there is an interesting conflict to be heard. Moreover, as the ward extends over both solid land and floodplain, it is significant to note that fishermen based in camps in the floodplain manage to attend meetings. Meetings which address important issues or interesting cases are especially well attended. However, some conflicts which seem to be beyond the scope of the *kuta* are emerging, such as infractions by Zambians and the efforts of one of the island's lodges to prevent access to certain traditional areas.

2.4 The Socio-economic Environment

In addition to fishing, residents of the eastern Caprivi depend to a large degree on subsistence farming and the use of other natural products, such as trees, papyrus and sedge. Other sources of income include government salaries and pensions, as well as the sale of fish, beef and traditional beer (Tvedten *et al.* 1994). Tourism was until recently a significant contributor to the economy, however unrest in the region due to a secessionists movement and the Angolan war has caused visits to drop to very low levels.



Figure 2.4.1: Freshly cut reeds from floodplain being unloaded from the community boat at Implalila Island, with woven mats in foreground.

Households in the eastern Caprivi often have several income generating activities, carried out by different family members at different times of the year. This is an effective strategy as the work required for and benefits gained from farming, fishing and related activities varies over the year, as illustrated by an example from Impalila Island in table 2.4.1:

Table 2.4.1: Seasonal division of labour on Impalila Island as determined by PRA exercise.

Activities	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Land clearing						2	3					
Burning								2	4	3		
Ploughing	7	2								2	3	4
Weeding	3	4	3									
Bird scaring	3	3	3									
Harvesting				2	4	2						
Threshing							3	4				
Reed cutting							2	3	4			
Sedge cutting										3	4	
Grass cutting					4	4						
Plastering				2	3	4						
Mat weaving	3	3	4								2	
Basket weaving								2	3			
Pole cutting	1	1	1	1	1	1	1	1	1	1	1	1
Fence building	2	1	1	1	1	1	1	1	1	2	2	2
Fishing	1	1	1	1	3	4	4	2	1	1	1	1

Looking at the table, it is evident that fishing takes place throughout the year, however the most activity is in the months during the retreat of flood waters. Each activity ideally occurs when resource collection/use is optimal. However, Table 2.4.1 indicates that individuals often have to divide their time between activities, especially fishing and farming.

The importance of fishing for households in the Caprivi was detailed by Tvedten *et al.* (1994), as illustrated in table 2.4.2 below:

Table 2.4.2: Proportion of full time, part time and occasional fishermen in the eastern Caprivi (adapted from Tvedten *et al.* 1994).

Fishing Activity	Zambezi	Chobe / Floodplains
	%	%
Full-time	22	56
Part-time	39	36
Occasionally	39	7
Stopped temporarily	0	0
Total (n)	18	55

Tvedten *et al.*, (1994), in assembling the data shown in Table 2.4.2, defined a part time fisherman as someone who fishes throughout the year but divides time between other activities, especially farming, whereas occasional fishermen tend to only fish during the flooding season.

Hence, fishing activity, while dictated to a large degree by the natural flooding cycle, can be influenced by factors beyond the actual catch value or potential. Table 2.4.3 below illustrates some of the factors which can cause individuals to increase or decrease fishing activity, regardless of season.

Table 2.4.3: Examples of how fishing activity is affected by non-biological factors

Fishing activity	Rationale
Increase	<ul style="list-style-type: none"> • To gain revenue in order to pay for school fees • To hire labour to work on fields
Decrease	<ul style="list-style-type: none"> • Tending crops in a good growing season, where the planting area has increased and more weeding is necessary • Offer of extra labour in government project

On Impalila Island, daily commercial activity is mostly focused on the sale of fish. Vegetables are grown on the island but are consumed locally. Two factors explain why fish is the key market item: First, the crops grown on the island are a long term investment which is prone to drought and disease, with the market being affected by the lack of milling facilities. Similarly, markets for cattle in Namibia are distant and the quarantine controls in Botswana are very strict. Fish, by contrast, are an easily caught and transportable good which can be sold at nearby Botswana in exchange for the stronger Botswanan currency. No data exists on how much fish is sold by Namibians in Botswana, however there is a constant flow of residents of Impalila Island and the surrounding floodplains to Botswana to sell fish.

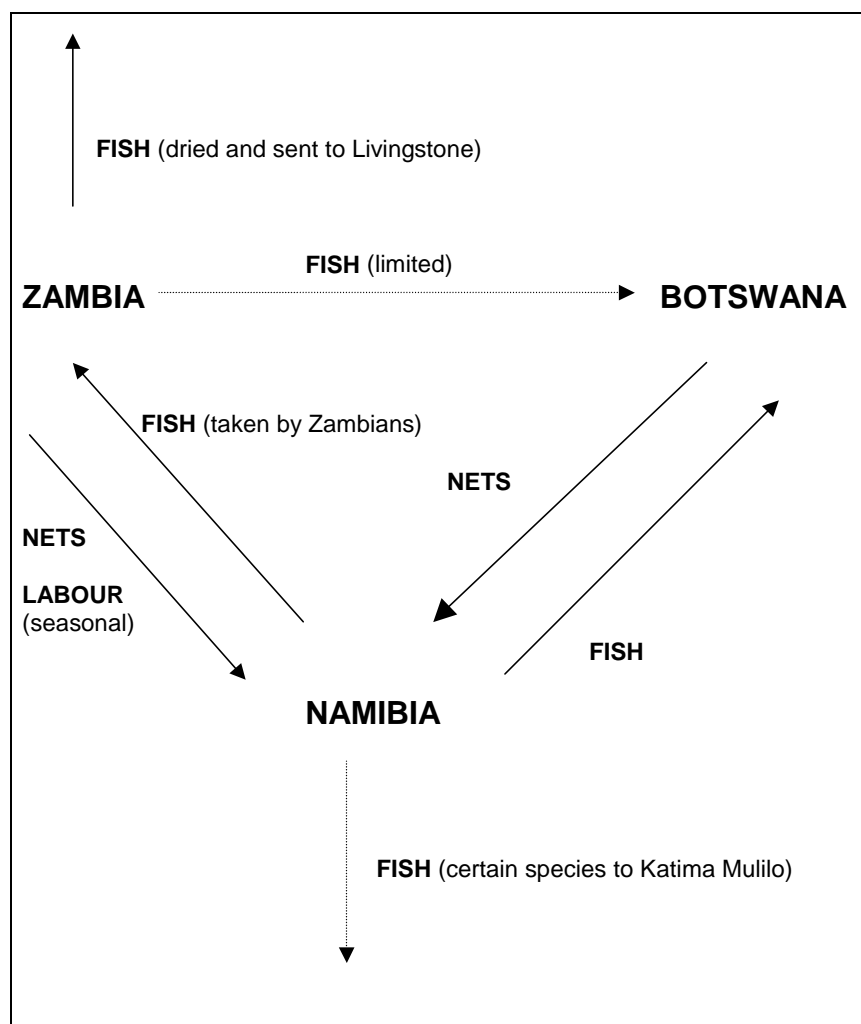
There is only one established fish market in east Caprivi, situated in the regional capital, Katima Mulilo. Fish taken to market is either fresh or preserved by salt, smoke or sun. Drying reduces the value of the fish, although individuals often do not have a choice as ice production facilities are limited. Relative prices for fish in Namibia, Botswana and Zambia appear to be similar, although selling in Botswana is preferred, due to the stronger and more stable currency.

On Impalila Island, the flow of goods and services between the three countries reflects the different socio-economic and cultural characteristics of each area. Both Zambia and the Caprivi have a long tradition of fishing and fish consumption, while in Botswana this is less so. However, most fish caught by Namibians is sold in Botswana, due to the established market and strong currency. The exception to this rule is during the Bulldog fish run in May-June, where fish is largely sent to Katima Mulilo fish market or even further east. Most Zambians by contrast do not sell their fish directly to Botswana, due to the need for a passport, which is very difficult to obtain in Zambia and instead send fish to Livingstone.

Namibians often purchase their nets in Zambia, as they are cheaper there, although of poor quality. Higher quality and

more expensive nets can also be purchased in Botswana. Namibians along the Zambezi apparently hire Zambians to increase their fishing effort during the high season (Tvedten *et al.* 1994). Zambians are often used as a source of cheap labour, due to high unemployment. Typically, payment is in the form of a portion of the catch, although payment in Namibian dollars is also common.

Figure 2.4.2: Simple schematic of the flow of goods and services related to fishing on Impalila Island.



3. Fishing in the Eastern Caprivi

As stated earlier in this paper, traditional gear use is no longer prevalent in eastern Caprivi. A comprehensive discussion of the different types of traditional gear which were used to exploit various habitats and species can be found in Tvedten *et al.* (1994). Several factors are thought to have brought about the change to modern gear. First, commercialisation of the fisheries, especially in the once productive Lake Liambezi, along with general growth in the cash economy took place in the 1960's (Tvedten *et al.* 1994). The introduction of modern gear and the commercialisation of the activity moved fishing away from the multi-method community activity it had been towards a more market directed operation. Gear modernisation initiatives were also started by the Zambian government at the same time (Tvedten *et al.* 1994), increasing the availability of nets throughout the region. Not only were these nets used, but nets were also made out of locally available materials, such as nylon fibres from tyres (MFMR 1996).

Hence, fishing methods were influenced not only by the introduction of more effective modern gear but also the development of a cash economy in the region. Fishing is now seen more as way to augment income in a short amount of time rather than as a supplement to diet. Fishing has also become almost exclusively a male-dominated activity, although the cleaning and sale of fish is largely done by women. Along the Zambezi River close to Katima Mulilo, large gillnet operations are often undertaken by businessmen who themselves do not usually fish. Rather, capital is invested in several nets and individuals, often Zambians, are hired to work the nets. Fishing activity at this scale becomes removed from the community and is thus less prone to community controls.



Figure 3.1: Woman cleaning fish in a mokoro, Impalila Island, with floodplains in background.

Gill nets, as described in Section 2.4, are either bought in Zambia or Botswana. Botswanan nets are of significantly higher quality than Zambian nets, being both stronger and less visible underwater. Zambian nets, being cheaper are usually the only option for most fishermen. This means that there is often a high rate of net turnover, due to damage from hippos and crocodiles. This situation may be exacerbated as the skill to repair nets becomes uncommon, as is claimed by older fishermen.

Gill netting involves at least two people, usually family members, operating out of dugout canoes called *mokoros*. Nets are left in for at least 24 hours, although Tvedten *et al.*, (1994) reported that they can be left out longer. Fishing is largely restricted to the river and main channels, with the greatest activity occurring as the flood subsides. During the high floods, fish are largely restricted to the inundated grasslands, where they are difficult to catch. The special fishery for the small Bulldog fish (*Marcusenius macrolepidotus*) occurs between May and June, when this species migrates along the Zambezi River. For this fishery, small meshed nets are set at natural spillways which are in

the rapids of the upper Zambezi. It is interesting to note that these spillways are also under the tenure of specific individuals.

After the catch is brought in, it is divided up by species as well as suitability for market. The fish selected to be sold is either taken directly by a member of the household or sold to a middleman. The latter situation is especially prevalent in areas close to Katima Mulilo, where middlemen use vehicles to buy fish at landing points along the river and then transport them to vendors at the Katima Mulilo fish market. The middlemen interviewed at the Katima Mulilo fish market stated that they buy from a diverse range of fishermen, both Zambian and Namibian, who use both gill nets and drag nets. The price paid for fish varies according to supply.

The effect of middlemen on how fisheries can be managed in the eastern Caprivi is significant. Middlemen provide a service to fishermen, transporting their catch to market. However, middlemen do not distinguish between fish caught with allowed or banned methods, which means that fishermen will receive the same benefit whether or not they are fishing sustainably. Moreover, middlemen can distort the real value of the fish by paying the fishermen much less than the market value. This in turn can cause fishermen to overexploit the resource. Thus, the normal community-based controls which can prevent destructive fishing practices can be compromised by the relative anonymity of fish being sold via a middleman, regardless of method.

4. Fisheries Management Practices in the Eastern Caprivi

4.1 Introduction

The policies and legislation which exists to manage freshwater fisheries in the eastern Caprivi and elsewhere in Namibia is very limited. There are at least two reasons why this is so:

- The responsibility for freshwater fisheries has been shifted from the Ministry of Agriculture, Water and Rural Development to the Ministry of Environment and Tourism before the Ministry of Fisheries and Marine Resources was ultimately assigned responsibility. As a result, no legislation empowering freshwater fisheries management has emerged since Independence and there is still a level of confusion amongst resource users and even within government over who is responsible for freshwater fisheries.
- Although the Ministry of Fisheries and Marine Resources is relatively well funded and staffed, it is more focused on the lucrative but also highly variable marine fisheries, which is the third largest contributor to the economy. At present, the Ministry lacks the capacity to properly address the research and management priorities required for freshwater fisheries in Namibia, as well as the significant extension services which may be required. There is currently only one fisheries biologist and a staff of technicians to serve all of the freshwater regions of Namibia. Moreover, the Freshwater Fisheries Institute is based in the arid southern part of the country, several hundred kilometres away from the most active regions of freshwater fishing.

As a result, freshwater fisheries exist in a legal and administrative vacuum. While a comprehensive policy exists

for the management of freshwater fisheries, there is neither the capacity nor the political will to implement it.

This section will examine the institutional arrangements, both existing and planned, which are relevant to freshwater fisheries in Namibia in the context of the situation in Eastern Caprivi. In doing so, it will suggest that implementing a top-down management infrastructure, especially in a complex fishery such as the eastern Caprivi, is costly and often prone to failure. The emerging policies and legislation discussed in this section will illustrate the potential for management measures which compliment existing traditional authority structures as well as activities of other government agencies active in the area, such as the Ministry of Environment and Tourism and the Ministry of Agriculture, Water and Rural Development.

4.2 Policies Relevant to Freshwater Fisheries Management

4.2.1 The White Paper on Responsible Management of Inland Fisheries of Namibia

The Constitution of the Republic of Namibia describes the role of government in the sustainable use and conservation of natural resources by stating in Article 95:

The State shall actively promote and maintain the welfare of the people by adopting ... policies aimed at ... maintenance of ecosystems, essential ecological processes and biological diversity of Namibian and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future ...

Following this general principle, in 1996 the Ministry of Fisheries and Marine Resources released the *White Paper on Responsible Management of Inland Fisheries of Namibia*. This document outlines the policy which the Ministry should follow regarding research and management of freshwater fisheries, with particular reference to the creation

of an Inland Fisheries Act. The *White Paper on Responsible Management of Inland Fisheries of Namibia* also makes several recommendations relevant to the management of freshwater fisheries by traditional authorities:

- the focus should be on gear restriction, and measures should favour passive over active gear and traditional over modern gear, including nets
- communal users, through local community leaders, should be consulted as to how the fishery resource should be used by recreational fishermen
- enforcement of regulations should be done by police and personnel from other ministries with the assistance of traditional authorities
- management of the communal fishery resource should exist at a local level.

These recommendations have several potential implications for management of fisheries in the eastern Caprivi. The *White Paper* places emphasis on the importance of traditional fishing methods, while in the Caprivi, gill nets are clearly the dominant fishing method. Underlining the importance of managing fishing as a subsistence activity is important, however the reference to commercialisation needs clarification, as most households in the region sell their catch, although not in quantities (or returns) which approach commercial levels. The *White Paper* also leaves the potential open for participation by traditional authorities in fisheries management, but merely implies a general involvement, rather than a lead role. The manner in which these recommendations have been implemented in the draft *Inland Fisheries Act* will be addressed in the next section.

4.3 Existing Legislation

4.3.1 The Nature Conservation Ordinance

At present, the only codified legislation in Namibia relevant to the management of freshwater fisheries is a single chapter in the *Nature Conservation Ordinance (Act #4 of 1975)*. In the Ordinance, fishing is generally restricted to hooks or lures, and must be done with a permit, except for “*any member of a population group ... situated on the communal land of the population group concerned ...*” In this latter case, which applies to communal areas described in Section Two of this paper, any fishing method is allowed, as long as poisons or explosives are not used. The Ordinance is silent on the role traditional authorities could play in enforcing even these limited regulations. The Ministry of Environment and Tourism, which is responsible for this legislation, does not at present enforce it, assumably due to the fact that the Ministry of Fisheries and Marine Resources now has responsibility in this area. Tvedten *et al.* reported in 1994 that most recreational fishermen did not obtain permits anyway and this appears to be the case today.

The limited scope of existing legislation is nevertheless accompanied by several measures that were implemented by the apartheid Homeland Administration and traditional authorities in the Caprivi prior to Independence. These included a prohibition on drag nets and the use of poison (MFMR 1996). In addition, *silalo indunas* occasionally implemented measures in their communities, particularly regarding minimum mesh sizes. It is evident that even up to this day, both the Bukalo *kuta* and *silalo indunas*, as well as most of those who fish in the eastern Caprivi still consider these measures to be in force. What is unclear is how effectively these measures were enforced by pre-independence tribal authorities. However, the general impression is that park rangers and police were well equipped to enforce measures, however the oppressive nature of the regime probably did not encourage voluntary compliance.

4.3.2 Related and Emerging Legislation

The Ministry of Environment and Tourism has recently enacted the *Nature Conservation Amendment Act (#5 of 1996)*. This Act enables residents of communal areas to establish Conservancies and Wildlife Councils in order to manage and benefit from terrestrial wildlife through activities such as tourism and trophy hunting. Conservancies have more control over the resources than Wildlife Councils, however in both cases revenue generated is returned to the community.

The conservancy initiative represents a first step in an attempt to devolve to the management of natural resources to the residents of communal land where they occur. While, in principle, conservancies have a relevant role for traditional authorities, the Act states that the management committee of a conservancy should be “representative of the community”, without explicitly stating the role of the traditional authority. However, it appears to be accepted by those involved in conservancies in the eastern Caprivi that traditional authorities will be involved, as all activities within the community have to be approved by the *kuta*.

Regarding enforcement of management measures, the Act implies that responsibility rests with the Ministry of Environment and Tourism. However, several conservancies have established game guards, although their duties are largely restricted to guiding and surveillance, with suspected infringements being reported to the police and/or the Ministry. While the goals of conservancies are only directed to terrestrial wildlife, there is evidence that game guards in the eastern Caprivi also survey fisheries. On Impalila Island, which is itself an emerging conservancy, the *silalo induna* stated that since the establishment of the conservancy, access by Zambians and drag netting has reduced, with game guards also checking mesh sizes.

4.3.3 The Draft Inland Fisheries Act

One of the recommendations of the *White Paper on Responsible Management of Inland Fisheries of Namibia* was to establish freshwater fisheries legislation to replace the outdated and inadequate provisions in the *Nature Conservation Ordinance (Act #4 of 1975)*. The Ministry of Fisheries and Marine Resources has drafted an *Inland Fisheries Act*, although the process has taken longer than expected, due in part to the factors cited in the introduction of this Section.

Several features of the draft Act acknowledge a potential role for traditional authorities, including determining general policy, the establishment of fishery reserves and the appointment of honorary inland fishery inspectors. Traditional authorities may even propose regulations to be enforced within their area. While the draft Act shows a wide scope for the consultation of traditional authorities, and indeed allows for the consideration of initiatives suggested by traditional authorities, the final decision to implement provisions rests with the Minister of Fisheries and Marine Resources.

4.4 Traditional Management of Fisheries in Eastern Caprivi

As stated earlier, the management of fisheries in the eastern Caprivi is based largely on tenure, either by community, household or individual. In this way, access to fishing grounds is preferentially given according to how the user is associated with the owner. Tenure takes different forms according to the waterbody. Thus, in larger lakes and the perennial rivers (such as the Zambezi), tenure is held by the community for the use of its members, with sections of the river demarcated as being under the jurisdiction of each *silalo induna* (MFMR 1996). Within these zones, each village has a subzone where its inhabitants usually fish, although in principle they are free to fish throughout the zone (MFMR 1996). If someone from outside the

community wishes to fish, they are expected to first ask the *silalo induna* for access. The general rule regarding permission is that individuals from adjacent wards are given preference, followed by members of the same ethno-linguistic group (MFMR 1996).⁵

In the floodplain, small ponds, known as *mulapos*, form in depressions. These *mulapos* are under the direct control of either an individual or household and are inherited along the male line. Permission must again be sought to either fish or plough (when the pond dries up to reveal rich soil).⁶ In the floodplain proper, everyone in the community is allowed to fish. This includes those who spend most their time outside of the community, and only return to take advantage of the greater availability of fish as the flood recedes (MFMR 1996).

Some other traditional management measures did exist in the past, although they are not practiced today. Intentional measures included a restriction on fishing until the *mulena* (chief) opened the season with a ritual called the *mubingo* (MFMR 1996). Following the *mubingo*, the whole community fished in a combined effort. Part of the catch would then go to the *induna* (Tvedten *et al.* 1994). Some inadvertent measures included the prohibition of fishing in areas reserved in honour of chiefs and a taboo against certain fish species (MFMR 1996).

The extent to which traditional tenure-based management still exists in eastern Caprivi seems to be related to the state

⁵ An exception does exist regarding ethno-linguistic preference, at least on Impalila Island. Fishermen from the Zambian side of the river with exactly the same Bausbia tribal background are not welcome to fish on the Namibian side. This ban is apparently due to their use of dragnets.

⁶ The same access principle exists with ephemeral ponds which form during the rainy season in north-western Namibia, where they are called *osbanas*. In this case, the MFMR has decided that future management should be based on ensuring equitable access to the resource, using fishing methods that gain maximum benefit.

of fish stocks, commercialisation, the influx of outsiders to the area and the park status of certain river areas, where management control was taken away from traditional authorities. Enforcement of the tenure-based system takes two forms. If someone uses fishing grounds without asking, the aggrieved party can take them to court. More general offences, such as fishing by outsiders in community areas, or the use of dragnets can be reported by anyone from the community.

5. Recommendations for Future Policy and Research

5.1 Introduction

This paper has illustrated the biological and social factors which have shaped the current state of use and management of fisheries in the eastern Caprivi. The most pertinent management issues can be identified as the following:

- commercialisation of the fisheries, especially large scale operations
- destructive fishing methods, such as drag netting and small mesh sizes
- lack of government sector definition and involvement in fisheries
- lack of knowledge regarding the state of fish stocks and exploitation rates
- transboundary issues, including the influx of Zambian fishermen in Namibia, the significant flow of fish to markets outside of Namibia and the lack of co-ordinated management between countries.

Many of these issues are related. For instance, the lack of government involvement in freshwater fisheries has resulted in a severe lack of baseline data on the status of fish stocks. Similarly, it is apparent that a large amount of destructive fishing is being carried out by non-Namibians, or at least with non-Namibian labour, making it a transboundary issue.

Fisheries management by either government or traditional authorities alone is impractical, as both parties do not possess the necessary capacity. A survey conducted by Tvedten *et al.* (1994) indicated that there was a difference amongst those asked about who should regulate fishing, both within and between areas, as indicated in Table 5.1 below:

Table 5.1: Preferred Institution to Regulate Fishing (after Tvedten *et al.* 1994)

Regulating Institution	Zambezi	Chobe/Floodplains
	%	%
No one	0	0
Ministry of Environment and Tourism	0	11
Ministry of Fisheries and Marine Resources	38	42
Local Community	19	8
Traditional Authorities	6	39
Police	38	0
TOTAL (n)	16	36

The results in Table 5.1 do indicate some support for the Ministry of Fisheries and Marine Resources. However, the small sample size and variation in responses prevents the conclusion that the Ministry alone should take responsibility for management. Traditional authorities in the east Caprivi are well suited to address the issues of tenure and conflict resolution in fisheries management, while the government has experience in the areas of research, co-ordinated enforcement and transboundary issues. In this section, possible roles for the government and traditional authorities will be outlined and potential areas for integration identified.

5.2 Integrated Management Options under Present Legislation and Policy

Although the Ministry of Fisheries and Marine Resources has confirmed its responsibility for freshwater fisheries in theory, in practice research activities are very limited, with extension and enforcement activities non-existent. The inaction in the latter two activities is understandable, due to the fact that the legislation that defines the Ministry's role is still in draft form. However, it is apparent that the present

priorities in the Ministry would probably not result in significant progress in extension and enforcement even after the promulgation of the *Inland Fisheries Act*.

In light of this limited capacity, the Ministry of Fisheries and Marine Resources would benefit by integrating its efforts within already existing or emerging structures and activities. Moreover, the complicated nature of the river/floodplain habitats and the communities which use them, as well as the linkages between different resource uses means that it would be almost impossible to separate fisheries management from other resource use activities. In Table 5.2, possible roles for parallel ministries and traditional authorities are listed:

Table 5.2: Management activities and roles for other ministries and traditional authorities within present Namibian policy and legislation

Activity	Role of other ministries	Role of traditional authorities
Research	<ul style="list-style-type: none"> Integrate data collection so findings can be interpreted in a wider context 	<ul style="list-style-type: none"> Involve in consultations to ensure that research questions are appropriate Assist in community-based research, such as catch monitoring
Extension	<ul style="list-style-type: none"> Develop activities through already existing projects, such as agricultural monitoring / improvement 	<ul style="list-style-type: none"> Involve in consultation to ensure extension activities are appropriate and that there is community participation
Enforcement	<ul style="list-style-type: none"> Use existing enforcement agencies, such as wildlife rangers and police 	<ul style="list-style-type: none"> Use community network for reporting of infractions and the appointment of honorary fishery inspectors Tribal court for conflict resolution and addressing minor infractions

As Table 5.2 illustrates, there is a high potential for integrated management. However, the present policy and legislation only allows a limited role for traditional authorities and communities in actual management, as decision making and responsibility for the resource skewed towards the Ministry of Fisheries and Marine Resources. The key element for effective community management is for the community to have primary responsibility to manage the resource. At present, this responsibility rests with the government, and consultation exercises run the risk of merely being a way of briefing traditional authorities on measures that have already been implemented. Another important element is ensuring that consultation is as broad as possible. Simply consulting with a single tier of traditional authority runs the risk of bypassing the community level authorities, as well as excluding individuals such as fishmongers and middlemen, who may be outside of the community but nevertheless affect the success of a management measure.

5.3 Recommended Management Options

5.3.1 Devolution of Resource Ownership

As stated previously, the key element for community management is ownership of the resource. Most discussions of community tenure and management deal with discrete bodies of water such as reefs or lakes (e.g. King and Faasili 1999; Scholtz *et al.* 1998), while the Zambezi/Chobe Rivers and floodplains are essentially an open system, with one half jurisdictionally out of reach. However, this paper has demonstrated that traditional authorities have established definite demarcations on an individual and community level for wide sections of the eastern Caprivi fishery. From a management context, this becomes an issue of particular importance in the eastern Caprivi, as fishermen from the Zambian side cross to fish on the Namibian side, as the habitat is undamaged by drag nets, thereby demonstrating that proper management can have

benefits even in an open aquatic system. Recognition of tenure could also allow communities to get returns from non-community users of the resource, especially recreational fishers.

5.3.2 Consultation

The role of two-way consultation with traditional authorities not only makes measures more appropriate but also more effective. However, the Ministry of Fisheries and Marine Resources should ensure that the intended function of traditional authorities as a means of community representation acting in the best interests of the whole community, is actually the case. Hence, extension and research should also take into account non-community members, such as middlemen and lodge owners, as well as less influential community members, such as women and the poor.

5.3.3 Capacity Building

This paper has demonstrated that traditional authorities have often extended their fisheries management scope beyond simply maintaining tenure to also include gear restrictions. However, it is important that if traditional authorities are given the mandate to implement measures, the ecological rationales must be valid. Basic training in fisheries ecology would complement the existing knowledge of the fishing communities and would allow for the effective implementation of non tenure-based measures such as closed seasons and the rehabilitation of riparian habitat.

5.3.4 Legislative Reform

The effectiveness of traditional authorities in eastern Caprivi is directly related to the nature of the community in which they exist. The more connected the community is, the more chance that the measures implemented by the traditional

authorities will be accepted and that the community itself will act to ensure that the measures are enforced. However, the external factors of outsiders, borders, commercialisation and recreational fishing can impair the effect of traditional authorities. Therefore the specific definition of how traditional authorities and the measures they enact are perceived in the context of law must be determined. This would include the degree to which outsiders are bound by decisions of the *kuta* and guidelines regarding appropriate sanctions for infractions should be defined.

Another important reform needed is to clarify the relationship between the paramount chief and the regional headmen, as this is a potential source of conflicting measures. Experience from community-level fisheries management in Malawi described by Scholtz *et al.* (1997), illustrated that the measures implemented varied between communities in both nature and effectiveness. Therefore, the issues of devolution of resource ownership and consultation in the context of traditional authorities must be approached very carefully, to avoid the potential benefits of appropriate management being overshadowed by political acrimony.

5.4 The role of traditional management for conservation and enhancement of fish stocks in the eastern Caprivi

To consider potential conservation and enhancement of fish stocks in the eastern Caprivi must take into account two elements of traditional fisheries management in this area:

- The tenure-based nature of traditional fisheries management in the eastern Caprivi acts primarily to restrict access to certain fishing grounds. However, users may also be restricted in terms of the methods they use, e.g., dragnets and mosquito nets.
- These fishing grounds are by and large restricted to small creeks, ponds and areas adjacent to the riverbank.

Moreover, high water levels tend to 'erase' a large portion of the demarcations on an annual basis during the flood. Each community has areas within the main channel of the Zambezi and Chobe Rivers which they in theory have first right of access, although enforcement is less effective. In addition, this part of the resource is more open to use from Zambian fishermen.

By inference, it can be assumed that within the context of traditional management, the main channel is largely outside of effective control. Therefore, the feasibility of traditional management is largely limited to ponds, creeks and areas adjacent to the riverbank. To determine just how effective traditional management of access and effort could be in this area, the following questions have to be addressed:

1. What is the seasonal and daily habitat of the most desirable fish species?
2. What is the habitat preference of each life stage of fish species?

Previous research has demonstrated that individuals who have fished the main channel and floodplains have some knowledge of both migration patterns and habitat preference amongst fish. Indeed, one of the most frequent comments recorded in this study was that Zambians had destroyed their side of the river with dragnets, driving the fish to the Namibian side.

Traditional management practices in the eastern Caprivi have proven to be effective in controlling access, and more recently, controlling gear type. Enforcing the provisions for gear or effort restrictions, as well as seasonal or absolute restrictions in certain areas would be more complicated, as it requires that no one can fish. However, if it can be demonstrated that this restriction benefits the community as a whole, then it can be more easily implemented by the traditional authorities which represent them.

In answering both questions 1 and 2, the local fishers would be a valuable source of information by relating their

experience as a basis in forming research hypotheses as well as coordinating on the collection and analysis of data. However, government would play a role in providing capacity for research and monitoring.

The role of government in conjunction with traditional authorities would be especially vital in efforts to enhance fish stocks, as this management measure apparently does not exist within the traditional context. Thus, if it could be demonstrated that rehabilitation of riparian habitat improves fish yields, then the government could provide extension services to promote rehabilitation projects and monitoring and the traditional authorities could in turn implement measures to prevent degradation of habitat.

Annex 2: The *Ebe* and *Hatsi* Fishery in Coastal Lagoons of Ghana

by
Hannes Stegemann

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Summary

The purpose of the study was the appraisal of the potential for improvement and enhanced production of a fishery system called *ewe* or *batsi* being used in the lagoons of eastern Ghana.

It was found that the '*ewe*' is correctly spelled and pronounced 'ebe', and that the *ebe* and *batsi* are two different systems.

The *ebe* is a water/fish retention system being widely used within the Denu Lagoon. Holes serving as drain-in ponds are dug into the lagoon depression. With receding waters at the onset of the dry season, the remaining biomass gets entrapped in these holes and will subsequently be harvested to 100%. The yield seems to be very high, an average of 4,500 kg/ha/year. Natural restocking takes place during the floods of the following rainy season with a breeding stock coming from the adjacent floodplain.

The *ebe* system developed out of former irrigation and/or swamp drain channels being used in the context of local agricultural activities. With the breakdown of these agricultural activities due to major environmental changes (salinisation, 1966), people adapted to the situation and further developed the *ebe* in order to maximize their income from this system.

Private ownership, managerial experience and maybe technological possibilities for developing these seasonal ponds into permanent ponds are a good base for envisaging further improvements. A precondition for any type of concrete recommendation should nevertheless be more research on the overall ecosystem with special reference to the state of the regional fish stocks.

The *batsi* are fishing devices made of sticks, shrubs and weed fitted with weir baskets, in order to entrap migrating fish.

Acknowledgements

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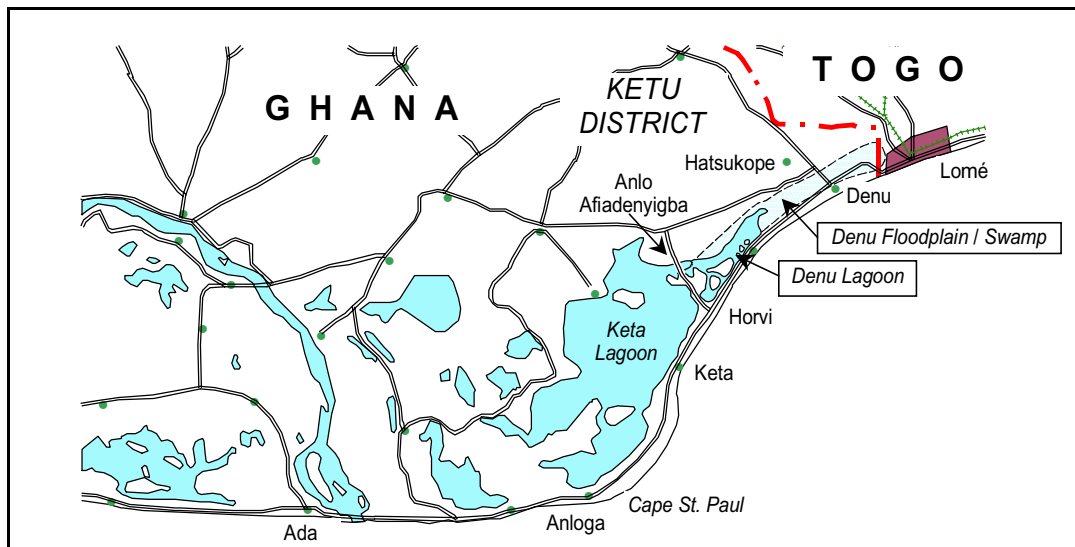
I am very grateful to Mr. Akoetey Gaglo, who has had the patience to tell me the history of his village and to answer my questions over several hours. Last but not least, Mr. Thomas Künzel was a good companion during part of the field study and gave me his valuable advise on the bio-technical features of the studied systems.

1. Background

This case study was carried out in the context of a wider study on traditional forms of inland fish production in Africa, commissioned by GTZ to COFAD GmbH, Tutzing. It was carried out from February 15th to February 20th, 1998. The whole area under consideration has been visited (from Ada to Denu, including both, Keta and Denu Lagoon. The *ebe* system has been observed in operation (harvest and marketing), interviews have been carried out with village elders, 'pond'-owners, harvesters, fish-mongers, salt producers, fishermen and government officials.

While concentrating on the main issue—*ebe* and *batsi*—time was as well allocated to a more holistic approach in order to get a better understanding of the local economic and social environment.

Prices and costs are stated in local currency, the Cedi. (Exchange rate as of February 1998: 1 \$ US = 2345 Cedi)



Map 1: Keta and Denu Lagoon, Ghana

2. Ebe

What is sometimes referred to as ‘ewe’-system should be spelled and pronounced ‘ebe’. ‘Ebe’ means ‘hole’ in the Ewe language. The system has been found all along the Denu Lagoon, but not within the Keta Lagoon.¹

The Denu Lagoon is within Ketu District² (most eastern area of Ghana, bordering district with Togo), about 26 km long (on the Ghana side, the lagoon continues on the Togo side) and in average 3.5 km wide, what gives a surface of about 91 km². The lagoon expands parallel to the coast-line, a narrow strip of sandy land between 500 m and 1.5 km wide separates the lagoon from the sea.

¹ Formerly the two lagoons were linked, but a road being built in 1992 connecting the villages of Horvi and Anlo Afiadenyigba serves today as a dam separating the two water systems.

² Ketu District:
 Surface: 1,130 km²
 Population: 234 000
 Popul. density: 207/km²
 Rainfall: 890 mm/coastal area
 1,270 mm/hinterland

The lagoon is fed by rainwater and numerous creeks (most of them seasonal) and belongs to the floodplains of the Aka River. There is no more direct link (see footnote 1) to tidal sea water, but brackish water infiltrates from the sea through the narrow sandy stripe into the lagoon depression during high tide.

The Ketu District's demographic statistics are not very precise, but it is estimated that about 38,500 people live directly around the Denu Lagoon. In the eastern part of the lagoon, towards the border with Togo, there are a number of very small villages (100-150 people/village) on small 'islands' within the lagoon (where the lagoon becomes very swampy).

The majority of the people live on the small strip between the lagoon and the sea, their economy is based on marine fishing (mostly beach-seining³), fish processing and marketing, coconuts⁴, salt production and handicrafts (weaving). They consider fish harvesting within the lagoons as 'amateur' fishing, but useful as additional occupation.

Inland from the lagoon, on red laterite soils alternating with sand, people live from agriculture. The main crops are maize and yams, other crops are cassava, pepper, beans, okra, groundnuts and cotton. Poultry has some tradition in the area, but people keep goats, sheep and pigs as well. Several handicraft activities supplement farming. The farmers appreciate the fish harvesting within the Denu Lagoon as additional resource of food and income.

Most of the people living around Denu Lagoon belong to the Ewe-speaking unit of the *Somme* or *Sume* (spelling not

³ The beach seine was introduced into the area end of the last century by European traders. Especially people (men) with little land for farming turned to fishing (Nukunya 1969).

⁴ Copra, coconut oil. Less important today than it used to be in the first half of the century. From the late 1940s the cape St Paul wilt started destroying huge numbers of trees, in addition thousands of coconut trees have been washed away by the coast erosion.

clear).⁵ They insist of not being part of the *Anlo* (Keta Lagoon), the largest and formerly dominating group in this area.

Fishing and fish harvesting within the Denu Lagoon is done with different techniques according to the seasons.

End of the dry season (January/February), the *ebe* are being prepared or maintained: shallow holes (approx. 60 cm deep) are dug into the floodplain, or, existing holes are being desilted. Often these holes are one beside the other, separated by earthen dams about 40 cm high. These holes can have different shapes. We have seen even more or less round ones with a diameter of about 20 m, but the standard shape is rectangular, about 30 m by 5 m. The largest holes are 80 m by 4-5 m. The whole surface of the lagoon is privately owned. Every owner of a plot organizes his labour force accordingly to his means. Either family members are preparing the holes, or hired labour is doing it.



Photo 1: Denu floodplain with ebe

⁵ Spieth (1906) enumerates 120 of these political units for the whole Ewe-speaking region.

We estimated that about 1/6 of the lagoon surface is covered with *ebe*, which would mean about 1,520 ha being used by this system. The highest density of *ebe* is within the eastern part of the lagoon up to the border with Togo (and beyond, but the Togo side was not studied). Most of the people own several holes, the poorer ones just 2-3, the richest up to 20 holes of a fairly large size. We would estimate the total number of *ebe* owners to be between 3,000 and 3,500 people.

The rains start in March/April and the lagoon fills with fresh water. The highest water level is reached in July. All the *ebe* are now under water, not any longer visible. The average water depth is now between 1.20 m and 1.60 m. At this time of the year people start fishing with gillnets, castnets, handlines and longlines, everybody is obliged to respect the limits of his property, but poaching exists. Fishing is mostly done from the shoreline and by foot, some people use little flat bottom canoes. Up to the end of July, people catch *Clarias* and *Heterotis niloticus*, with rapidly increasing salinity (salt deposits in the ground get dissolved) these species disappear afterwards. The standard species throughout the season are *Sarotherodon melanotheron* and *Tilapia zillii*. The tilapias being caught at this time of the year have the size of a palm and slightly bigger. It can be assumed that they come for spawning into the shallow floodplain.

With receding water, the *hatsi* comes in use, a reed fence used in combination with traps (see below). In the western part of the Denu Lagoon people also use *acadjas* which they call '*atsidza*' (see below).

Once the dams of the *ebe* become visible, they are reinforced and slightly highered with mud. Then the dams have to dry at least for one week before the first harvest in order to avoid breaking them. The first harvest of an *ebe* takes place the earliest in September. It is done either with a dragnet or by bailing-out. We have not seen the dragnet technique, but we have been told that the long and narrow shape of the standard *ebe* responds best to the use of this

type of net. During the case study period, all the people used the bailing-out technique:



Photo 2: Ebe being bailed out

Three to five young men, quite often still boys, construct inside an *ebe* a new mud wall (dam) thus separating a space of about 3 m by 4 m from the larger part of the hole. They fit a trap, a weir-basket, with its opening towards the larger part of the *ebe* into this wall (under water, down at the bottom). Then they bail out (with buckets) the water from this newly created chamber into the neighbouring pond. With this system they empty the complete *ebe* and all the fish gets entrapped when following the receding water within the weir-basket. During the bailing-out, the weir-basket has to be changed several times in order to get the fish out. Two traps are used: one is always in the water, built into the mud wall, the other is waiting on land to replace the one in use, once filled with fish. Once the *ebe* is emptied from basically all its water—just a few centimetres are left, full of very small fingerlings—the dam to the neighbouring pond will be opened, sometimes a weir-basket will be fitted, and the emptied pond will be flooded again with the water

from the neighbouring pond. We have been told several times by the harvesters, that it is important not to harm the remaining fingerling. Therefore they do not dry the harvested pond completely, they allow it to refill from the neighbouring pond as quickly as possible and they do not like the use of dragnets.



Photo 3: Work gang with weir-basket

It takes about 4 hours for 3 people to harvest a pond of 5 x 30 m, approximately 0.70 m deep (105 m³ of water to be bailed out). In the observed case (18.02.98) the harvest was 35 kg of 98% *Sarotherodon melanotheron* and 2% *Tilapia zillii*. The size of the fishes varied between 2 cm up to 5 cm, the weight varied between 10 grammes/fish up to 32 grammes/fish.

The observed *ebe* was only harvested the second time since the last rainy season (flood) and would not be harvested again before the next rains. People could not tell us the yield of the first harvest of this pond (November 1997), but if we assume a similar result, the annual yield would be 70 kg from 150 m² or about 4,650 kg per hectare.



Photo 4: Basket with harvest from one pond

The following day (19.02.98) we observed the harvest in an *ebe* of 4 x 80 m, approximately 0.60 m deep (about 1 km away from the site of the previous day). The harvest was 55 kg, average fish size/weight even smaller than the previous day, same species composition. This specific *ebe* was harvested the 5th time since last rainy season. According to the owner, this last harvest before the new rains was the weakest of all. He could not tell us the weight of the previous harvests, but the total cash revenue per harvest. As one little tin (takes about 250 grammes of fish) of fish was paid 500 Cedis by the buyer over the last season, we can make the following calculation:

Harvest	Proceeds	Quantity	
	(Cedis)	(tins)	(kg)
1. Harvest (August)	300,000	600	150
2. Harvest (September)	400,000	800	200
3. Harvest (October)	250,000	500	125
4. Harvest (November)	150,000	300	75
5. Harvest (February)	110,000	220	55
Annual total from 320 m ²	1,210,000		605

This would mean an annual yield of 18,900 kg/ha.

It sounds a lot, but it could be true, if we bear in mind that with receding waters from a flooded area of 91 km² from a given moment onwards 100% of the biomass gets entrapped within 1,520 ha and will be completely harvested over a period of 5-6 months.

The results of a little survey on the production of *ebe* ponds recently being done by the fisheries officer Yaw Atobrah seem to confirm the high yields:

<i>ebe</i> -Surface (m ²)	Harvest (kg)	Yield (kg/ha/year) (estim. 2 harvests/yr)
18	24	26,660
30	22	14,660
27	26	19,250
84	60	14,280
33	22	13,330
40	27	13,500

As I have had the pleasure to work for three days together with Yaw Atobrah, I would be tempted to say that he has the tendency to underestimate the surfaces of the *ebe* (to take exact measurements within a swampy area is not that easy!). Measures should not just take into account the effective

water surface, but as well the surrounding walls which can be quite large. Another error could come from the fact, that people never communicate the weight of the harvest of a specific pond, but the cash revenue of the day's operation. For instance, when refilling the emptied pond with the water from the neighbouring *ebe*, a few more kg of fish are caught in the weir-basket and added to the total income.

Therefore I would propose a conservative estimate of an *average* annual yield of about 4,500 kg/ha.

The owner (men *and* women can own) of an *ebe* seems to be completely free with regard to his management approach. He just has to respect the rules of individual land tenure. There seem to be no modern, neither traditional regulations imposing any restrictions, taxes etc. Apparently no clan chiefs neither fetish priests receive tribute or regulate gear and season.

The *ebe* ponds are stocked naturally with resources coming from a water system not controlled by the *ebe* owners community (certainly a danger and weakness of the system). Some people fertilize the water and feed the fish by throwing into the pond old maize husks or rice bran. For instance the owner of the *ebe* mentioned above (4 x 80 m, 18,900 kg/ha/year) is fertilizing all his ponds. He is quite aware that his production is much higher than the one of neighbours not fertilizing their ponds.

Once the *ebe* dams become visible and the fish remains entrapped in the ponds, the owners have to deal with the problem of poaching. Long branches of trees (see photo 1 here above) are thrown into the ponds to make it impossible to use a castnet or any other type of net without intensive, time consuming prior cleaning of the pond. A number of wealthy *ebe* owners employ watchmen during this season (August-January).

Whenever the owner feels a pond should be harvested, he organizes his labour force. Harvesting normally takes place on market days (every 5 days a given market place). Either family members or independent youngsters are recruited for

the operation. The labour gang comes with its own equipment (weir-baskets, buckets, sometimes a shovel) and gets 50% of the net cash income of the operation (after deduction of expenditure for food and drinks). Normally the word, where *ebe* will be harvested, gets around fast and fishmongers (generally women) turn up to buy the harvest. They pay slightly better for larger size fish, and when competition from other traders forces them to bid. A small tin containing about 250 grammes of fish pays 300 to 500 Cedis.

Every second year the owner needs to pay a labour force to repair the ponds and to desilt them. For a 4 x 80 m pond 5 man for one week are needed, and the fee would be 200,000 Cedis for the whole work gang (again they come with their own equipment). The labour force for harvest and maintenance/repairs consists normally of young men looking for every type of odd job being remunerated in cash.

The cost/benefit analysis for a one year operation of this size *ebe* would be the following:

Item	Expenditure (Cedis)	Income (Cedis)
Labour desilting/repairing (5 men/1 week, every 2 years)	100,000	
2 Watchmen for 5 month à 25.000 Cedis/month/10 ponds	25,000	
Food/drinks work gang for 5 harvests	50,000	
Fertilizing, anti-poaching branches (estimated)	25,000	
50 % of total cash revenue 5 harvests		605,000
Operating profit		405,000

The above analysis refers to a 'rich' man owning 10 ponds, who, theoretically, could have a net benefit of 4,050,000

Cedis/year. It is doubtful that he can get an average yield from all his 10 ponds as high as from in the case studied, but even if only 75% are realised, 3,037,500 Cedis/year are still not negligible compared with local salaries:

Occupation	Local Salary (Cedis/month)
Watchman	60,000
Fisheries officer (10 years service)	184,000
Truck driver for mining company	300,000

As we have seen, the fishmongers (women) pay an average of 2,000 Cedis/kg to the *ebe* owner for the fish harvested. Afterwards these women clean the fish, sell it fresh on the market, or smoke/fry excess quantities which would be difficult to sell the same day on the market or which are destined to buyers from more distant areas.

A small pile of 12 little fishes (about 150 grammes) sells 500 Cedis (ca. 3,350 Cedis/kg, = +68%) on the market in Denu, 6 little fishes (75 grammes) smoked are sold as well for 500 Cedis (ca. 6,700 Cedis/kg, = + 235%).

It seems that most of these women are professional traders and processors of marine fish, who have at least one *chorkor* (smoking kiln) at home, some have up to 4 *chorkors*. As the dry season corresponds to the off-season for sea fishing, the women (and the consumers as well!) are quite glad to have an alternative access to fish⁶.

All the fishmongers we spoke to expressed their concerns about decreasing seafish capture during the last years.

The *ebe* system is not leading to any conflict with local capture fisheries, as the whole surface of the lagoon is plotted and privately owned and any capture fisheries is

⁶ March – October: seafish on the markets, November-February lagoon/*ebe* fish on the markets

obliged to respect these property limitations. It seems that the common resource is managed by a communal agreement forbidding the use of devices which could 'drain' resources from the neighbour's plot into the own one (fish fences). Conflicts are only arising from fish poaching (even between neighbours). Some people told us, as long as there is no solution to poaching, they would not further invest into their ponds (fertilizing).

Today it seems that the Denu Lagoon depression is exclusively used for fish harvesting and salt winning. But not long ago, there have been agricultural activities within the depression: sugar cane plantations and vegetable growing.

The village chief Akoetey Gaglo told us the history of his village (Gagloko) and explained us the development of the *ebe* ponds. He himself used to be a farmer, he grew vegetables right beside his village which is located on a small island in the middle of the eastern lagoon swamps and he planted sugar cane within the lagoon. Sugar cane planting took place in January/February, the harvest was in July/August. Then, after harvest, *they used to fish within the sugar cane irrigation channels*, with castnets, dragnets and traps (*tilapia*, *beterotis* and *clarias*). Akoetey and his father were both born in Gagloko, his grandfather migrated from a village called Hatsuko situated about 4 km away on the northern fringe of the lagoon (where he used to be a maize, yams and cassava farmer) into the depression, because of the high potential for cash crop production and the good water supply and quality.

But the sugar cane production within the Denu depression came to a sudden end, when in 1966 a tidal wave came all the way up to the Denu Lagoon⁷. It took three years for the

⁷ As the big tidal wave threatened the villages close to the beach, especially the town of Keta, people decided to cut a channel into the stripe separating the sea from the lagoon in order to give way to the water pressure. Apparently this was initiated by an engineer called Aryee, who drowned during the works. It might be useful to search the literature on this event. Gill (1962, p.17) mentioned the channel being cut in 1963.

sea water to dry up. During that period people fished sea water species (sardines, anchovis, bonga, mullet, sea-breems, shrimps and crabs) within the lagoon. Afterwards, the high salinity of the soils and heavy salt deposits did not allow any longer the former agricultural activities. Wells with formerly good quality drinking water turned brackish. The people of his village (about 100) today have to go all the way to Denu (about 3 km) to get drinking water from a borehole. Due to the environmental changes, the location of Gaglokope today is an anachronism. Therefore, and as his family still has land rights in Hatsukope, some of his children moved back there to do traditional crop production.

After 1966 the former irrigation channel fisheries developed into the specialized *ebe* system. People dug channels all over the place within the limitations of their plots in order to retain water and fish. Akoetey, his brothers and sisters all own ponds and make basically there living out of this activity. Akoetey himself is a rich man, because in addition to his fish harvest income he has a regular pension as ex-serviceman. He works with his grandchildren and hires occasionally people for works within the ponds.

As the owner of ten ponds, he can do with them whatever he wants, selling, leasing. But no owner would do that, as you can get such a good income from them. He would like to get more ponds, but nobody sells.

His children are going to inherit his ponds.

People know that they harvest from the ponds all the young, immature fish (0-groupe) originating from the last rainy season's spawn. But under normal conditions the whole lagoon dries up towards the end of the dry season and the fish would not survive and just be eaten up by the birds.

Nevertheless, the *ebe* system and other devices like the *batsi* (being used early in the season, see below) reduce substantially the amount of fishes from the 0-groupe remaining within perennial waters and thus being able to grow to mature size and to reproduce themselves.

But according to the local fisheries officers no study has been done yet on this important question. Very little is known on the location and the stock situation within the perennial water systems feeding the Denu Lagoon. The use of these perennial water sources also affects the yearly volume of spawn within the Denu Lagoon.

People just tell you that the harvest today is less than it used to be. But for them it does not matter too much, as the loss in volume (weight) harvested is well compensated by the value increase over the last years.

People link this loss in productivity to the diminishing annual floods. They attribute this to a dam being built at Afife by a Chinese rice project in 1982 in order to irrigate the fields.

3. Hatsi

A *hatsi* is a barrier being built out of sticks, shrubs and reed. Every few meters these barriers have gaps with weir-baskets fitted into them.

We have seen them in the western part of the Denu Lagoon and especially in the Keta Lagoon⁸, where they are very common and have often a considerable size of several hundreds of meters length.

Hatsi are being built and repaired end of the dry season within major depressions within the lagoon in order to entrap the migrating fish, either coming up with the flood (for spawning) or going down with the receding water in order to remain in perennial waters (main *hatsi* use period is May to September). The weir basket entrances are faced against the current (to entrap fish going with the current).

⁸ Here they function with the tidal effect.



Photo 5: Hatsu at the end of dry season, before repairs for new season



Photo 6: Weir-basket fitted into Hatsu

As the case study took place end of the dry season, we could not see a *hatsu* in operation, but it seems to be clear that they are *not* necessarily associated with the *ebe* ponds. As a

matter of fact we saw only one relatively small *batsi* within the *ebe* area (eastern part of Denu Lagoon) placed in the middle of several ponds belonging to one owner. It seems that *batsi* within the *ebe* area are not wanted or tolerated, as their placement necessary leads to conflicts, because fish migration will be altered and fish can be channelled into the own ponds, thus depriving the neighbour.

The appearance of larger numbers of *batsi* coincides with the crossing of the border-line from *Sume* to *Anlo* territory, from swampy areas to more open areas (after the rainy season larger surfaces are under water, or, end of the dry season, sandy surfaces with no vegetation and important salt deposits).

The installation of a larger *batsi* requires communal management, chiefs and priests help defining the rules in order to avoid conflicts between different land/lagoon plot owners affected.

We could not obtain any catch data from *batsi* (except catch composition: *clarias* and *beterotis* in July, till the end of the season *Sarotherodon melanotheron*), nor figures allowing a reliable comparison with other systems, especially the *ebe*.

4. Atsidza

The *atsidza* is a brush park (*acadja*), a small circular structure with a diameter of about 4-6 m. The system is used in the western part of the Denu Lagoon (again from the border-line between *Sume* and *Anlo* people, within the *Anlo* territory) and the Keta Lagoon. We have seen as many as about ten *atsidza* being associated to each other within a surface of about 1 ha. They are privately owned and harvested by using an encirclement net (1 man/day including reconstruction of the device).

Quite often *batsi* are associated with *atsidza*: for instance we saw an open water area of about 10 ha partly encircled

with *hatsi* in order to channel and retain fish within the *atsidza* area.



Photo 7: Area being closed off by hatsi (foreground) used for atsidza (background)

Apparently *atsidza* are only used/allowed in areas with complete individual plot ownership within the Lagoon (Denu) and where there are not in competition with other type of fisheries (like capture fishery on Keta Lagoon).

Rules and regulations are set by the clan chiefs and religious leaders.

Because it was too late in the dry season and the lagoon more or less dried up, we could not assist in a harvest of an *atsidza* and therefore, we rely only on one verbally communicated production figure for the last harvest (end of January) of an *atsidza* with about 19.50 m² surface: composition mainly *Sarotherodon melanotheron*, harvest value 19,500 Cedis, estimated weight 9.75 kg (5 t/ha/harvest). This specific *atsidza* was reported to have been harvested once every month since August 1997 with

the highest yields (figures not memorized by the owner) in October.



Photo 8: Atsidza

The owner said that he operates 4 *atsidza*, and that he has no cash investment costs. When I asked how much he paid for the net, his answer was: "Nothing. It was a gift from my brother, who is a truck driver."

The yields of the *atsidza* are apparently high, but we do not dispose of enough information and reliable data to do a proper cost-benefit analysis.

5. Salt

Salt-making is an old tradition and an important industry in the coastal lagoon districts. Manoukian (1952) reports that "wide, flat-bottomed pits are dug by men in the dry bed of the lagoon, either before the rains begin or when the water is receding in September. Later on the deposited salt is collected in baskets by women."

During the field study we observed and interviewed women engaged in the salt production. It seems that the majority of these women originate from the villages close to the sea and that they are mostly engaged in fish processing and fish marketing. The salt production serves their own needs for the fish processing, but a fair amount is sold on the market.

When the Denu Lagoon starts to dry up, the women collect the raw salt from plots belonging to them or family members, but they buy as well raw salt from plots belonging to other people. The raw salt then will be refined in cemented evaporation pans (constructed by men).



Photo 9: Salt refining pan

The salt production period goes from December up to May, the salt destined for sale is stocked as long as possible in order to achieve a good price on the market (highest price end of the rainy season). It seems that the salt requirements of the whole hinterland are still largely met from the lagoon salt-pans.

A woman told us that she is buying the raw salt for 8,000 Cedis an enamel bowl containing 15-17 kg, after refining she

can sell the content of the bowl for 15,000 – 18,000 Cedis (+90%).

The raw salt comes from places just drying up, not prepared or worked in a special manner, it comes as well from artificially dug out pits and to a much lesser degree from *ebe* ponds. This seems to be logical, as one of the main ideas of the *ebe* ponds is to retain water and fish as long as possible into the dry season. Consequently most of the *ebe* ponds will not dry up sufficiently before the next rainy season to allow the collection of raw salt from them.



Photo 10: Semi-industrial salt pans

Recently the semi-industrial production of salt started at the far western end of the Denu Lagoon, just inside the road dam separating Keta Lagoon from Denu Lagoon. Two large cemented salt pans have been constructed (each about 75 x 150 m), saline water is pumped from Keta Lagoon over the dam into this pans.

6. Conclusions

A confusion in the literature led to the impression that the *batsi* and *ebe* systems are identical or correlated with each other. This is not the case, however; *ebe* and *batsi* are two distinct systems not linked to each other. An *ebe* is a water/fish retention system and drain-in pond, a *batsi* is a barrier/fish fence.

The *ebe* ponds developed from irrigation perimeters (sugar cane and vegetables since 1966), where fishing in drainage and irrigation channels was a side-activity. The currently widespread retention system involves only the rearing (for a limited period) and harvesting of fish. It has evolved due to environmental changes which destroyed most of the agricultural potential within the lagoon swamps and pushed people into economic alternatives. The system seems to be well managed, produces high yields, and, as demand is high, has ready access to markets.

People quite visibly care for their system, they try to use soft harvest techniques in order not to kill off the remaining juvenile fish, some people fertilize their ponds.

The *ebe* system seems to be very viable as it is now, if the frame conditions remain stable. Before we reflect on potential for further development, the main weakness of the system has to be addressed:

The *ebe* ponds are naturally stocked. Where does the fish come from, where does the fish go to? Very little is known of the functioning of the larger environment.

Harvesting devices prevent the offspring of last season's spawn to escape into open perennial waters. If almost 100% of the biomass is collected, growth over-fishing⁹ occurs.

⁹ Growth over-fishing exists whenever fish are captured at sizes below the optimum determined by their growth and natural mortality rates.

Whether this growth over-fishing could lead to the far more serious recruitment over-fishing¹⁰ is not known.

How is the resource being used in the perennial waters? Is there any likelihood that the frame conditions will change at the basis of the resource (irrigation schemes, growing fishing effort, pollution)? We do not know enough about the hydrological and biological functioning of the extended ecosystem to answer these questions.

The combination of declining catches from marine fishing, increasing market demand for fish with long term assured high producer prizes and an existing high human potential (local knowledge and experience) certainly leads to the suggestion to improve and further develop the *ebe* system.

But this should be done very carefully and certain methods should be excluded straight away:

- a) extending the surface used by *ebe* within the lagoon
- b) Improving the fish *retention* techniques and capacities.

Both approaches would incorporate the high risk of putting the breeding stock under too much stress and future fish stock levels may decline to the extent that the seasonal stocking of the *ebe* ponds will become insufficient and the harvesting will no longer be economic.

But it would certainly be interesting to investigate the possibilities to create ponds holding water on a permanent basis, or, at least for an extended period. This would allow fish to grow to a better size (the fishmongers and the consumers are asking for it!), yearly production could be enhanced. Eventually this could lead to proper fish farming with the owners being able to produce part of their breeding stock themselves.

A large number of current *ebe* owners have no or very little additional income from other economic activities. They

¹⁰ Recruitment over-fishing is defined as the over-exploitation of a fish stock to the extent that the breeding stock is no longer able to maintain a viable long-term population.

would be interested and free (with regard to their yearly occupation calendar) to work on their ponds all year long.

We learned that the current *ebe* system is a relatively recent development due to the breakdown of the agricultural potential within this area. We should not forget that this development could be reversed over the coming years: the Denu Lagoon is cut off from the Keta Lagoon, and thus from a direct link to saline water, since 1992. The existing salt deposits are intensively exploited. The seasonal flooding of the lagoon consists only of fresh water. All these factors may lead to an improvement of the soils over the coming years and the re-establishment of an agricultural potential within the lagoon depression. People now relying on *ebe* as main cash income could find in future other attractive alternatives.

The impact of 'traditional culture' on the potential for change has to be taken into account, but should not be over-emphasised. Human cultures are never static, they always have to, and do, reply to new challenges, constraints and potentials. The Sume and Anlo people have undergone a number of substantial changes within their environment and culture over the last 100 years, widening their 'local knowledge' and re-enforcing their adaptation capabilities.

There seems to be scope for further improvement and development of the *ebe* system, but more research is needed in order to understand

- a) the functioning of the wider lagoon ecosystem
- b) the range of options for regional economic and social development.

Only the findings of this research work will tell us whether, and how the *ebe* system should be altered, improved, extended and if it is suitable for introduction into other geographical areas.

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