Review of River Fisheries Valuation in West and Central Africa

by

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ABSTRACT

This paper provides a review of the valuation of river fisheries in West and Central Africa. It is the general perception that compared to the biological and ecological aspects of river fisheries, this particular subject area has received comparatively little attention. Economic valuation is concerned with finding expression for what is important in life for human society. It should therefore be a central and integral part of government decision-making and policy. The paper starts with a review of concepts and methods for valuation. Three main types of valuation techniques are identified: conventional economic valuations, economic impact assessments and socio-economic investigations and livelihood analysis. On the basis of a literature review, valuation information was then synthesised for the major regional river basins and large lakes, and also used to develop a series of national fisheries profiles. To supplement this broad perspective, a series of case-studies are also presented, which focus in particular on the impact of changes in water management regime. Finally, the paper presents an assessment of the three main types of valuation methodology and a set of conclusions and recommendations for future valuation studies.

Keywords:

River Fisheries; Valuation; Economic valuation; West Africa; Central Africa; Future research

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1 INTRODUCTION

The role of inland fisheries in providing a wide range of economic and social benefits for developing countries (DCs) throughout the world is increasingly recognised by governments and international development agencies. In particular, river and floodplain fisheries have been observed to underpin the livelihoods of many millions of people in major river basins such as the Amazon, Congo, Ganges, Mekong, Niger and others.

However, it is also widely acknowledged that there is increasing demand on the use of inland water resources for a wide range of activities including hydro-electric power, irrigation, navigation, industrial uses, as well as fisheries. The problems for fisheries management which this multi-sectoral context creates are often very serious and difficult to resolve. The UN FAO Technical Guidelines for Responsible Fisheries (Inland Fisheries) (1997) provides some guidance for the development of an appropriate response, stating that

'*Management should be conducted in a climate of compromise with other users and depends as much on regulations governing their activities as those governing the fishery itself. In other words inland fishery managers are rarely in control of the resource they manage. Because of this the code (Code of Conduct for Responsible Fisheries) must be interpreted to inform and involve sectors other than fisheries*' (p.3)

The development of policies for the world's river basins requires decisions to be taken concerning the alternative usage of water resources. For example, should a river system and associated floodplains be conserved for wildlife and tourism uses, or should the river and floodplains be managed and drained for industrial and urban uses? Under ideal circumstances, these types of decisions should be based on a sound methodological approach which incorporate the views and desires of all stakeholders involved, and should also be underpinned by a wide-range of information (hydrological, biological, ecological, economic, social and institutional dimensions).

Unfortunately, in most DCs, the circumstances for decision-making are far from the ideal described above. The basis for sound decision-making is constrained by a range of factors, and in particular, the nature of the weak state and weak governance (which limits stakeholder participation and cooperation) and limited institutional capacity (which limits information flows).

In the following review, we will examine one important dimension of the information base required for effective decision-making in inland fisheries – economic value. It is the general perception that, compared to the biological and ecological aspects of river fisheries, this particular subject-area has received comparatively little attention. In order to address this deficiency, a review of the status of knowledge is an important starting point. The paper will focus exclusively on West and Central Africa, with the primary objective of producing a review of river fisheries valuation in this region.

The paper is structured in five sections following this Introduction. Section 2 provides a description of the methodology used for the review. Section 3 identifies and examines the economic value of river fisheries in West and Central Africa.

Section 4 identifies and describes the economic impact on fisheries of changes in river basin management. Section 5 provides an assessment of the methodologies used for economic valuation in West and Central Africa. Section 6 presents a series of conclusions and recommendations for future valuation studies.

2 METHODOLOGY

2.1 Geographical focus

For the purposes of this review, West and Central Africa was defined to include all of the Sub-Saharan region stretching from Senegal in the West to Congo and Gabon in the East. These regions cover 7 major river basin systems (**Fig.1**.), as follows:

1. Senegal-Gambia river basin;
2. Volta river basin
3. Niger-Benue river basin
4. Lake Chad basin
5. Congo-Zaire river basin
6. Atlantic coastal basins (I)
7. Atlantic coastal basins (II)

2.2. Economic valuation study approaches in fisheries

It is important to recognise that economic valuation in fisheries can be approached in a number of different and yet complementary ways.

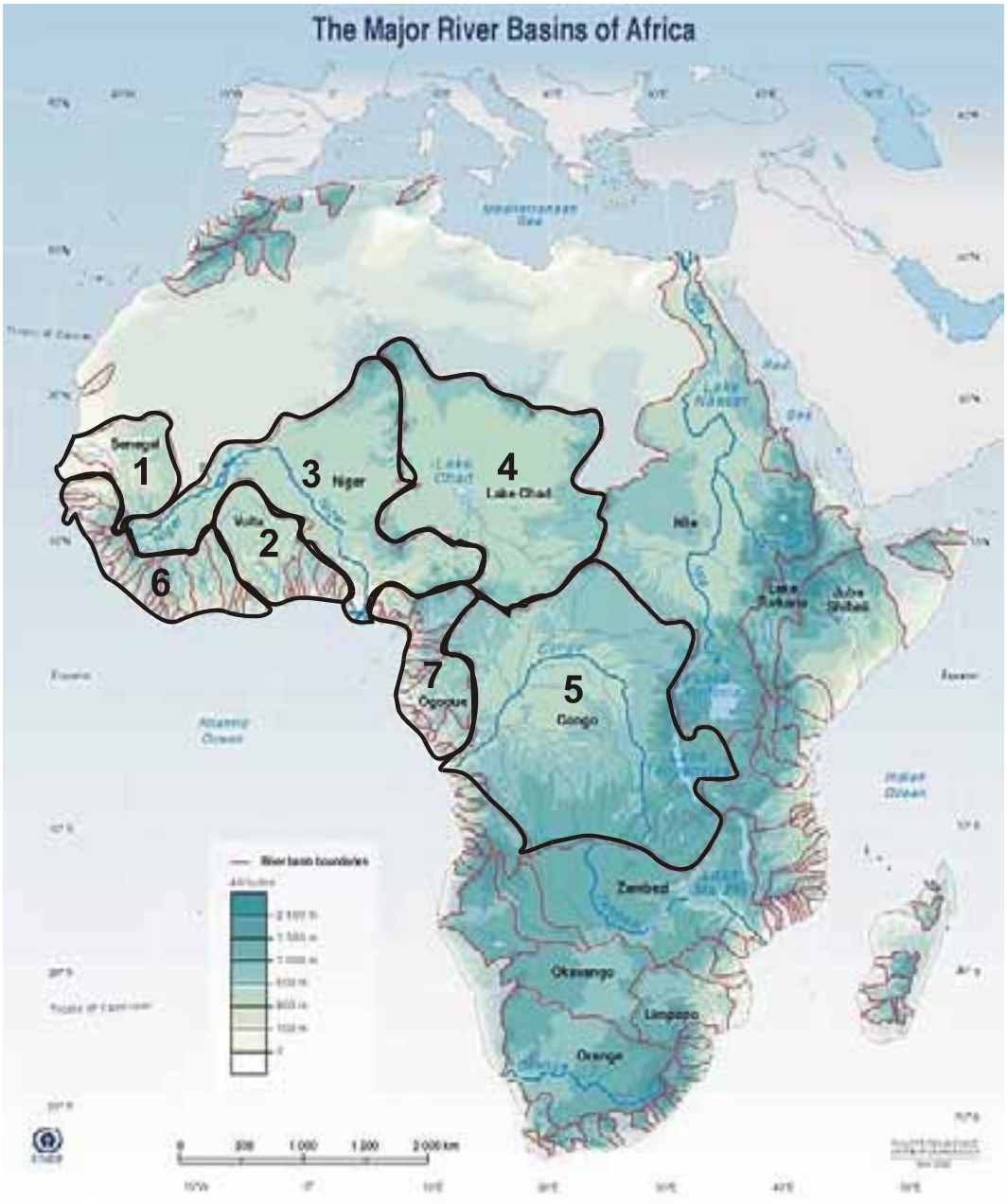
In general terms, values can be defined as '*beliefs, either individual or social, about what is important in life and thus about the ends or objectives which should govern or shape public policies*' (Royal Commission on Environmental Pollution, 1998).

Economic valuation tends to have a particular meaning to economists in general, as explained below, but it is appropriate to consider how this also relates to other approaches. Three broad categories of economic valuation study approaches can be identified as follows: (1) Conventional Economic Valuation; (2) Economic Impact Analysis; and (3) Socio-economic Analysis.

2.2.1. Conventional economic valuation

The conventional approach in economics to environmental valuation is to look for some way of measuring human preferences for or against changes in the state of the environment (improvement or deterioration). Where such preferences are expressed as willingness to pay – for example, to raise water quality on a certain stretch of river – value will be expressed in monetary terms. This can then provide a rational basis for policy decision-making over the use or management of environmental assets.

Fig.1. The major river basins in Africa. The numbers indicated the 7 basins included in this review.



Source: Aaron T. Wolf et al., 1999; Revenga et al., *Watersheds of the World*. World Resources Institute (WRI), Washington DC, 1998; Philippe Rekacewicz, *Atlas de poche*, Livre de poche, Librairie générale française, Paris, 1996 (revised in 2001).

2.2.1.1. Economic values as social values

It can also be argued that economic values are social values, since the concept of value is anthropocentric: it is the people who value the environment, and accordingly the estimated value resides in the individuals themselves rather than in the objects of their assessment. The arithmetic of conventional economic valuation is underpinned by *economic efficiency analysis (EEA)* which has the maximisation of social welfare

(defined in terms of the optimal allocation of resources) as its goal. There are two ways in which EEA is commonly applied, that is cost-effectiveness analysis and cost benefit analysis. With cost-effectiveness analysis there is a presumption in favour of the least-cost option for achieving a given objective; with cost-benefit analysis, the presumption is in favour of the option which produces the highest ratio of monetary benefits to costs. In short, there is an implicit value judgment underlying efficiency analysis (i.e. that improvements in economic efficiency are desirable). In a policy planning context, this presumption in favour of efficiency is the basis of a number of decision criteria that can be used to select and prioritise project options (or other interventions) in terms of their economic value to society (Whitmarsh & Premachandra, pers. comm).

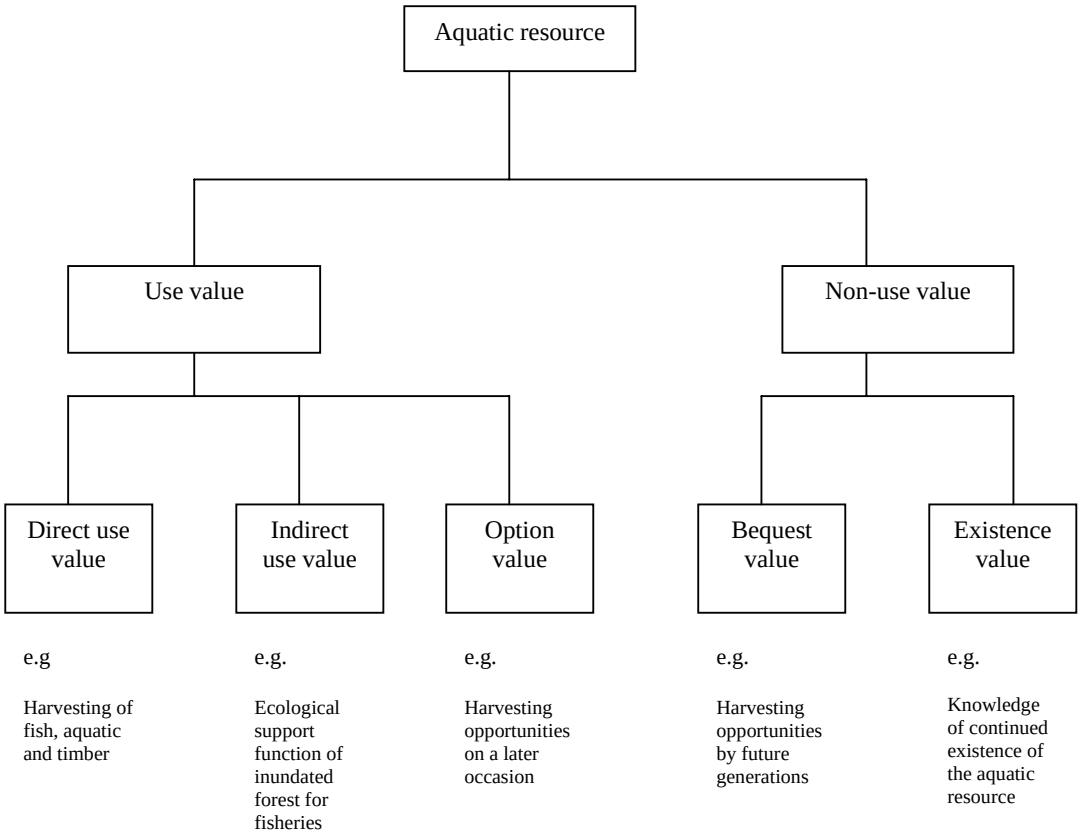
2.2.1.2. Total economic value

It is nowadays recognised that a natural resource may provide a range of benefits according to the particular use or function it fulfills, and this forms the basis of the concept of total economic value (TEV). The components of TEV in respect of an aquatic resource, such as a river system and its adjacent floodplains, are shown in **Fig.2**. The obvious and tangible benefits would be those derived from *direct use* of the resource, and these may materialise in the form of commodities (e.g. fish, aquatic plants, fuelwood) or services (e.g. recreation and amenity). The aquatic resource may also have an additional indirect use, such as coastal protection and providing a habitat for juvenile fish. Individuals may also derive a benefit from being able to postpone their personal use of the resource to a later date; they attach an option value to using the resource. There are also another set of benefits, which are quite distinct, termed *non-use* (or 'passive' use value). This might include the value associated with the desire to maintain a river fishery intact for future descendents (bequest value) or simply the satisfaction from knowing that a particular aquatic habitat has been preserved in perpetuity (existence value).

2.2.1.3. Valuation in practice

Valuation is always a comparative exercise, and it is appropriate to consider how such comparisons might be undertaken. At its crudest this might involve comparing the economic benefits provided by a natural resource in its current state with the absence of benefits if the resource were to be removed or completely destroyed. However, in reality, policy decisions tend to involve incremental (or marginal) changes from current conditions. For example, in the case of fisheries policy, we might wish to know how economic benefit might change if harvesting activity on a certain river were regulated using a different set of management measures; the comparison would thus be between the existing policy (i.e. the base case) and proposed regime. Within the framework of cost-benefit analysis, the comparative estimates of economic value could then be used to decide whether the proposed policy change was worthwhile or whether it would be preferable to keep the status quo. Another way in which economic values may be compared is over time, an exercise that may prove necessary in situations where, in particular, there is concern about environmental degradation and the aim is to measure the social cost of this change. An especially important application of this type of retrospective comparison is natural resource damage assessment, an ex-post form of cost-benefit analysis used to assess the social cost of particular incidents (e.g. oil spills) or interventions (e.g. major infrastructure projects).

Fig.2. The components of TEV in respect of an aquatic resource.



2.2.1.4. Valuation techniques

There are two broad classes of valuation techniques, direct and indirect. *Direct techniques* involve descriptions of situations to individuals and assessment of their valuations through direct questions. Contingent valuation method (CVM) and stated preference are examples of direct techniques. CVM has the advantage of being able to measure use and non-use (passive) values. Stated preference analysis, or the experimental analysis of choice, has its roots in conjoint analysis (CA). CA is a form of analysis used to represent individual judgements of multi-attribute stimuli. *Indirect techniques* (also known as revealed preference techniques) use information on actual behaviour to build economic models of choice. These models are then used to determine the value of environmental change. Indirect techniques are based on traditional economic theory, which provides several decades of experience in empirical modelling. Examples of revealed preference techniques include travel cost models and hedonic price models.

2.2.2. Economic impact analysis (EIA)

In contrast to the EEA described above, economic impact analysis (EIA) does not set out to determine whether a particular policy intervention or project is either beneficial

or detrimental in terms of economic worth to society. While EIA will consider the level of benefits generated by an intervention, it does not consider costs of implementation (i.e. there is no benefit-cost framework). Instead, EIA aims to establish what effect a particular policy intervention or project has on specific variables. This might involve using *revenue analysis* to see whether a new fisheries management system is likely to raise fishermen's gross earnings or revenue. The analysis would typically require the estimation of a demand function for the harvested product in order to determine the impact of changes in supply on market price (and hence total sales revenue). More ambitiously, EIA might involve the application of *multiplier analysis* to measure the total economic activity generated by a new fisheries management system (e.g. on output, income or employment) as a consequence of the interdependence between fishing and other sectors comprising the regional economy. The total economic impact will be made up of direct and secondary (i.e. indirect and induced) effects.

2.2.3. Socio-economic analysis

Finally, it is important to re-iterate the point made above, that conventional economic valuation is concerned with the analysis of whether particular interventions or projects improves the net wealth of society. It might be the case that this outcome also involves the creation of 'winners' and 'losers' in society. For example, the building of a dam across a river for hydro-electric power involves a wide diversity of effects including major changes in environmental quality and aquatic resource use. Conventional cost-benefit analysis side-steps the issue by invoking the principle of 'potential compensation' (i.e. that the intervention represents a net gain to society if the winners could compensate the losers and still be better off), but since this principle does not insist that compensation actually be paid it starts to become rather unsatisfactory where the losers also happen to be the poorest of the society/community.

In summary, the arithmetic of economic valuation may well ajudge a project such as dam construction to be worth undertaking insofar as it improves the net wealth of society, but it is unclear whether the social impact of the project is unlikely to be neutral. In such situations (especially where there is poor governance within the weak state context) something more than economic valuation is warranted, specifically a *distributional analysis* to examine how the net costs and benefits are apportioned across different groups affected by the change. Socio-economic analyses which uses participatory rural appraise techniques (PRA) such as group discussions and wealth-ranking can often provide an important starting point in identifying and characterising the socio-economic strata in a community or region. Once the social strata are known, further in-depth economic studies (e.g. income-expenditure surveys) can provide a better understanding of benefit flows (or the lack of them) in relation to specific policy interventions.

2.2.4. Livelihood analysis

In recent years, socio-economic analysis has been further extended with the development of techniques for livelihood analysis (LA). When underpinned by frameworks such as the sustainable livelihoods approach (SLA) (after Scoones, 1995), they can help to provide a better understanding of the relationship between human

society and natural resources. In this respect, LA can be used to complement economic valuation and socio-economic analysis.

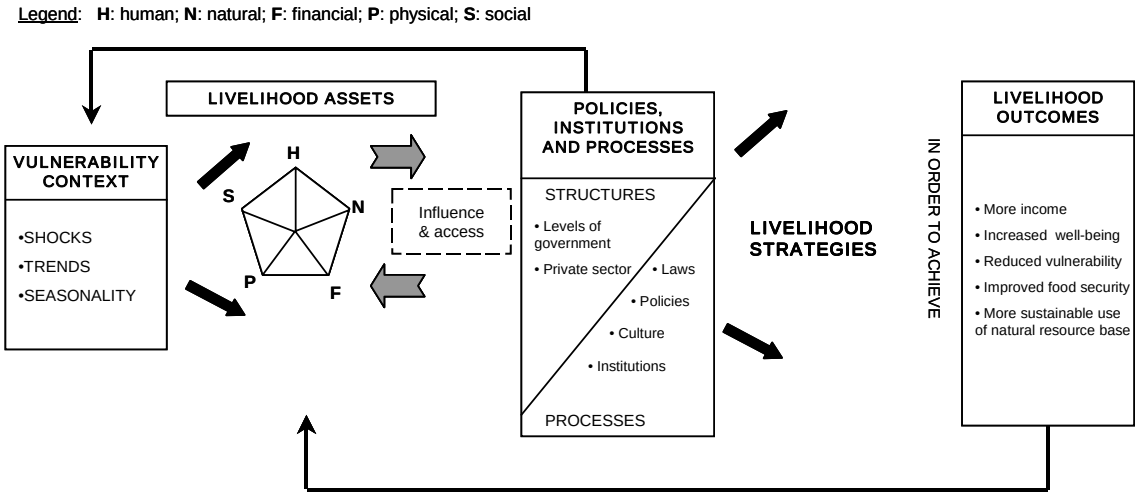
But why do we need to employ an additional set of LA techniques? Well, it can be argued that the objective of the economic valuation of the natural environment is to attach economic values to environmental resources or natural assets, and that by definition, these economic valuations represent *resource-centred approaches*. It can also be argued that adequate policies and effective management of natural resources needs information about the people involved, and the ways in which people use natural resources to sustain livelihoods. In other words, to make an appropriate decision regarding the management of a natural resource, one not only needs the economic value (albeit through the most comprehensive evaluation framework possible, such as the TEV), one also needs to know the contribution which this resource makes to livelihoods: who uses the resources? when? how?

More fundamentally, economic valuation techniques do not permit the identification of the factors which influence or affect people's access to these resources. However, very often the key issue is not the availability of the resource (or symmetrically its scarcity, to which its economic, or even social value is related), but the access to this resource. Extending Sen's main conclusion, which was initially framed in the specific context of famine (Sen, 1981), to the wider domain of natural resources, it should be recalled that poor people are usually those who lack access to these resources. In this context, determining the value of the resource is irrelevant, if people cannot access it. A key question is therefore: what are the factors that influence people's access to, and control over, natural resources?

The Sustainable Livelihoods Approach (SLA) is a holistic and people-centred approach that attempts to capture and provide a means of understanding people's livelihoods, and in particular the factors and processes which affect these livelihoods. The framework **(Fig.3.)** consists of five components: (1) the vulnerability context of the environment in which the communities under consideration operate; (2) the livelihood assets of these communities; (3) the policies, institutions and processes (PIPs) which affect their lives and in particular their access to livelihood assets; (4) the livelihood strategies which the communities adopt; and (5) the outcomes they achieve or aspire to. An important aspect of the SLA is its use in helping to understand the role of institutions (e.g. rules which affect resource access).

When combined with more conventional economic and socio-economic techniques (e.g. economic valuation and household income-expenditure surveys), LA is a powerful tool, which can provide:

Fig.3. The Sustainable Livelihood Approach SLA framework



- an analysis of the causes of vulnerability – shocks and stresses in the economic, social and political context, trends, seasonality, fragility of natural resources, etc – which affect the communities;
- an assessment of the assets, at the individual, household or community levels, comprising human, social, economic, physical and natural resource assets;
- a description of the context within which livelihoods evolve – policies at both micro- and macro-levels; civil, economic and cultural institutions, both formal and informal; the nature of governance and its processes at all levels in society;
- an identification of people's livelihood strategies, including, but not restricted to, consumption, production and exchange activities; and
- an evaluation of the resulting livelihood outcome, assessed multi-dimensionally in terms of food and other basic needs security, greater sustainability of the natural resource base, reduced vulnerability and increased income.

The value of such a framework is to encourage analysts to take a broader and systematic view of the factors that affect people's livelihoods – whether these are shocks and adverse trends, poorly functioning institutions and policies, or a lack of assets – and to investigate the relations between them. It does not take a sectoral view, but tries to recognise the contribution made by all the sectors to building up the stocks of assets upon which people draw to sustain their livelihoods.

2.3. Information sources, collation and synthesis

In order to establish an appropriate basis for the Review of River Fisheries Valuation in West and Central Africa, an extensive literature search was undertaken, mainly

through on-line searches of the international literature and information databases. Other grey literature was provided by current regional programmes (e.g. DFID/FAO Sustainable Fisheries Livelihoods Programme [SFLP]) or in the case of past regional programmes or projects, literature was accessed through various libraries, and collections (e.g. CEMARE Library, University of Portsmouth).

The review process consisted of four steps:
Step 1: the literature search aimed to undertake an inventory of all the valuation studies which had been undertaken in West Africa in recent times (since 1980). Initially, the outputs were collated according to the three broad methodological approaches:

- Conventional economic valuations (CEV);
- Economic Impact Assessments (EcIA);
- Socio-economic investigations and livelihood analysis (SE-LA);

Step 2: the resultant information was also synthesised (**Appendix 1** and **Appendix 2**) according to the 7 major regional river basins, and according to the three largest lakes/reservoirs (Lake Volta, Lake Chad, Lake Kainji), to highlight the following characteristics:

- Identification of all riparian countries;
- Identification of major rivers and floodplains;
- Length of river and floodplain area;
- Number fishers by river/floodplain;
- Total annual catch by river/floodplain/river basin;
- Identification of economic impact or value of fisheries

Step 3: a number of important and well-studied case-studies of economic valuation in West and Central Africa were identified (including the Chad Basin, the Hadejia-Nguru-Gashua Wetlands and the Central Delta of the River Niger in Mali). The important elements which were highlighted for each included:

- Key methodologies employed and resultant values;
- Impact of changes in water management regime (where available);
- Contribution to understanding the role of fisheries in livelihoods;

Step 4: Finally, a series of National Fisheries Profiles for countries in West/Central Africa were developed, based on the following criteria for inclusion: (a) the share of inland fisheries production is >10% total domestic catches and (b) the potential annual catches is estimated in the literature to be >5,000t (**Appendix 3**).

3. THE ECONOMIC VALUE OF RIVER FISHERIES IN WEST AND CENTRAL AFRICA

3.1. Overview

The results of the literature review have confirmed that information and statistics on the economic value of river fisheries in West and Central Africa are very sparse and limited, compared to information on other subjects (e.g. fisheries biology and ecology). This will not come as a major revelation for most fisheries administrators

and scientists connected with African inland fisheries. It is well-known that the majority of countries concerned do not have effective statistical collection or reporting systems, mainly due to a lack of institutional capacity. While most countries provide an annual estimation of fisheries production to the UN FAO Statistical System, economic data on fisheries are not regularly reported. However, despite all of this, it may come as a surprise to many, that there is sufficient contemporary information and data to say something interesting and significant about the value of river fisheries in the region. Furthermore, the limited amount of economic valuation work which has been carried out successfully so far, if anything, points the way to the potential for more work of this kind in the future. Using the three broad methodological approaches (above), the following results can be reported:

3.2. Conventional economic valuation

There have been very few studies of West and Central African fisheries which have attempted to apply a conventional economic valuation approach. Only two sets of studies appear in the formal literature. These are summarized below.

(a) Economic valuation of the wetland benefits: The Hadejia-Jam'are Floodplain, Nigeria (Barbier *et al*., 1991; 1993);

This study assessed the economic importance of the Hadejia-Jam'are wetlands and thus the opportunity cost to Nigeria of its loss, by estimating some of the key economic benefits it provides to local populations (over 2 million people) through crop production, fuelwood and fishing. However, the wetlands are threatened by drought and upstream water developments, which are taking place without consideration of their impacts downstream.

Based on a series of field surveys, the net benefits from the direct use of the floodplain for agriculture, fuelwood and fishing were calculated by Barbier and his co-authors, as shown in **Table 1.** Where appropriate, actual prices were adjusted to economic values using shadow prices. The terms financial and economic were used to express the values of commodities based on actual or market prices, and the values of commodities based on adjusted or shadow prices respectively.

Fishing was shown to yield N18 million (or US$9 million) of annual net economic benefits (or N179 or US$90 per ha) in the Hadejia-Jam'are wetlands. This exceeded the economic contribution from fuelwood, but was less than the contribution from agriculture.

Table 1: Hadejia-Jam'are Wetlands, Nigeria: Summary of annual net economic benefits/ha, 1989-90 (Barbier *et al*. 1991)

Sector	Total output (tons)	Net economic benefits (N'000)	Total area exploited (ha)	Net economic benefits/ha (N/ha)
Agriculture	281,955	54,970	230,000	239
Fishing	6,264	17,877	100,000	179
Fuelwood	115,100	8,265	400,000	21
Total	-	81,112	-	439

The analysis of the Hadejia-Jam'are wetlands was then extended using a cost-benefit analysis of the net economic benefits over time from agriculture, fishing and fuelwood. The analysis assumed that the benefits provided by the floodplain do not

arise just in a single year but that the wetlands, if properly managed, are capable of yielding a continuous stream of such benefits over a number of years. The sum of the stream of benefits discounted into present values indicated the present value of the wetlands in terms of agriculture, fishing and fuelwood **(Table 2)**. This represented the present worth of the wetlands and was the benchmark for comparing the returns to development projects that might have threatened the floodplain system. The results of this analysis will be examined in Section 4 (below), when we will examine the economic impact of changes in river basin management.

Table 2: Hadejia-Jam'are Wetlands: Present value net economic benefits (i) per hectare; (ii) per river inflow; (iii) per controlled water release.

(i) Present value net economic benefits per hectare (N/ha) a/				
Base case	(8%, 50 years)	(8%, 30 years)	(12%, 50 years)	(12%, 30 years)
Agriculture	921	848	625	607
Fishing	300	276	203	197
Fuelwood	139	127	94	91
Total	1359	1251	923	895
Adjusted agriculture b/	838	773	574	558
Adjusted total	1276	1176	872	846

Notes: a/ economic benefits averaged over the total production area of 730,000ha (400,000ha for fuelwood, 230,000ha for cropland and 100,000ha for fishing); b/NPV of agriculture adjusted for unsustainability of wheat production. Approx. 56% of wheat hectarage assumed unsustainable.

(ii) Present value net economic benefits per river inflow (N/'000 m^3) d/				
Agriculture	264	243	179	174
Fishing	86	79	58	57
Fuelwood	40	37	27	26
Total	389	358	264	256
Adjusted agriculture e/	240	221	164	160
Adjusted total	366	337	250	242

Notes: d/ based on the average annual river flow into Hadejia-Jam'are floodplain of 2549 Mm^3 over 1985-87; e/ NPV of agriculture adjusted for unsustainability of wheat production. Approx. 56% of current wheat hectarage assumed unsustainable.

(iii) Present value net economic benefits per controlled water release (N/'000 m^3) f/				
Agriculture	408	375	277	269
Fishing	133	122	90	87
Fuelwood	61	56	42	40
Total	602	554	409	396
Adjusted agriculture g/	371	342	254	247
Adjusted total	565	521	386	375

Notes: f/ assumes a total controlled water release of 1648 Mm^3 per annum from upstream water development projects on the Hadejia and Jam'are rivers; g/ NPV of agriculture adjusted for unsustainability of wheat production. Approximately 56% of current wheat hectarage assumed unsustainable.

Exchange rate: N7.5 = US$1, 1989/90
Source: Barbier *et al*. 1991

(b) Fishing Income, Poverty and Fisheries Management in N.E. Nigeria (Neiland *et al.*,1998)

As part of a DFID-funded research project 'Traditional Management of Artisanal Fisheries in N.E. Nigeria', Neiland *et al* (1998) undertook an investigation of the profitability of fishing operations in three major fisheries: the Upper River Benue, the western shores of the Lake Chad and the Nguru-Gashua Wetlands. The objective was to evaluate whether the fisheries were generating net economic benefits, or in other words to see whether the resource exploitation and management systems were achieving a positive level of economic efficiency. It was assumed that economic efficiency and wealth generation from the fisheries were desirable from a societal

point of view, and that this could have a positive effect on fisheries incomes and poverty alleviation (assuming that fishing communities could access the benefits). Clearly, if the fisheries were efficient and generating net economic benefits, society would probably chose to maintain their operation as a valuable contribution to the economy. If not, then steps would have to be taken to improve economic performance (e.g. through better fisheries management), or to switch the inputs (labour, capital, technology) to other more productive uses.

Data for the study was obtained by a large-scale stratified sample survey of over 700 fishing households in the region, in order to obtain information on the costs and returns of fishing operations (both financial and economic values). An earlier survey (Neiland *et al*. 1993) provided additional essential socio-economic information on the fishing households themselves. The results of the surveys are summarised in **Table 3**.

The results indicated that all three fisheries were yielding substantial net economic benefits (N415 million or US$6 million), albeit to different levels for each fishery. The contribution of fisheries to the local economy of NE Nigeria, and especially in the Chad Basin, is therefore important, and needs to be taken into account in decisions which might affect the benefit stream. In the worse-case scenario, whereby the fisheries were mismanaged or impacted by environmental changes (either natural or man-made), the opportunity cost to Nigeria would be N415 million (or US$6 million). Interestingly, the majority of the fisheries within NE Nigeria are operated under traditional management systems.

Table 3: Fisheries of NE Nigeria: Net economic benefits, 1993-96 (Neiland *et al*., 1998)

Fishery	**Total no. households**	**Annual catch/household (kg)**	**Net economic profit/household (N)**	**Total net economic profit (N'000)**
Upper River Benue	5,660	877	917	5,190
Lake Chad	9,850	5,339	27,009	266,039
Nguru-Gashua Wetlands	6,026	3,077	24,002	144,636
Total	21,536	-	-	415,865

3.3. Economic impact analysis

Economic impact analysis can be disaggregated into two categories:

(a) The seven major river basins in West and Central Africa (**Table 4** and **Appendix 2**) provide 'economic indicators' for employment (no. fishers), total annual fisheries production (tonnes), potential annual fisheries production (tonnes), financial value of total annual fisheries production, financial value of potential total annual fisheries production.

The fisheries of the river basins in West and Central Africa provide employment for a great number of households, with the largest numbers found in the Niger-Benue system (64,700) and in the Congo-Zaire (62,000).

The total annual fisheries production for all the river basins in this region was 569,100 tonnes and this was valued at US$295 million (gross financial value). The highest production level for any single basin was found in the Niger-Benue River Basin (236,500 tonnes) valued at US$95 million (gross financial value).

The total potential annual fisheries production for all the river basins in West and Central Africa is 1.34 million tonnes, with a potential annual value of US$749 million (gross financial value).

Table 4: Fisheries of the major river basins and lakes in West Africa: economic indicators

	Employment (fishers)	Fisheries production (t/yr)	Value of production (million $/yr)	Potential fisheries production (t/yr)	Value of potential production (million $/yr)
River basins					
Senegal-Gambia	25,500	30,500	16.78	112,000	61.60
Volta (rivers)	7,000	13,700	7.12	16,000	8.32
Niger-Benue	64,700	236,500	94.60	205,610	82.24
Chad (rivers)	6,800	32,200	17.71	130,250	71.64
Congo-Zaire	62,000	119,500	47.80	520,000	208.00
Atlantic coastal	6,000	30,700	46.66	118,000	179.30
Major lakes					
Volta	20,000	40,000	28.40	62,000	44.02
Chad	15,000	60,000	33.00	165,000	90.75
Kainji	20,000	6,000	3.30	6,000	3.30
TOTAL	227,000	569,100	295.17	1,334,860	749.17

(b) The twelve major countries with significant inland fisheries in West and Central Africa (**Table 5** and **Appendix 3)** also provide 'economic indicators' on total annual catch (tonnes), financial value of total annual catch (US$), fish consumption per capita (kg/capita), fisheries employment and %contribution of fisheries to GDP.

The total annual fisheries production for the twelve countries with major inland fisheries in West and Central Africa is 597,500 tonnes. Nigeria (130,000t/year), Chad (100,000t/year) and Mali (100,000t/year) have the largest annual fisheries production. The total value (gross financial) of the annual inland fisheries production in the region is US$ 1416 millions. The countries with the largest values for national production are Mali, Chad, Senegal and Nigeria.

The average annual fish supply per capita in West and Central Africa is 11.10 kg/capita/year. The highest national values are for Senegal (29.9kg/capita/yr), Ghana (26.1kg/capita/yr) and Gambia (23.7kg/capita/yr). The lowest national values for fish supply are for Burkina Faso (1.4kg/capita/yr) and Nigeria (5.8kg/capita/yr).

The total employment provided by fisheries in the twelve leading fisheries nations in West and Central Africa is 667,560 and Chad (170,000) has the largest number of people working in the fisheries sector.

The contribution of fisheries to Agricultural GDP is generally low for the leading fishing nations in West and Central Africa. Fisheries in Chad (5% Agricultural GDP) makes the largest contribution to the national economy of any nation in the region.

Table 5: West African countries with major inland fisheries: economic indicators

	Fisheries production (t/yr)	Value fish production (US$million /yr)	Fish supply (kg/capita)	Employment (fishers & on-shore)	Fisheries % Agricultural GDP
Benin	34,000	29.30	9.1	75,000	Low
Burkina Faso	5,000	5.80	1.4	7,000	Low
Cameroon	50,000	36.40	9.3	65,000	Low
Chad	100,000	n.a.	6.5	170,000	High
Gambia	3,500	4.40	23.7	5,000	Medium
Ghana	53,000	380	26.1	110,000	5%
Ivory Coast	36,000	50	11.1	30,000	Medium
Mali	100,000	350	8.5	73,000	0.94
Niger	16,000	n.a.	0.47	2,000	1%
Nigeria	130,000	180	5.8	70,000	<2%
Senegal	60,000	350	29.9	60,400	5% ?
Sierra Leone	10,000	30	12.3	160,00	1%?
TOTAL	597,500	1415.9	11.09	667,560	-

3.4. Socio-economic and Livelihood Analysis information

The objective of this section is to "broaden" the perspective of the term 'valuation assessment', in contrast to the narrow economic sense with which it has been used so far. If we recognize that the value of an activity/resource may go beyond the purely quantitative economic estimation of the wealth generated by that activity or resource, then the term 'value' should be considered and dealt with in a much broader way, in the sense of 'contribution', and the underpinning question becomes: What is (are) the *contribution(s)* (i.e. no longer simply, *values*) of the activity/resource for the households, community, or society?

In the rest of this section, a series of projects or programmes are reviewed which have espoused this broader definition of the concepts of 'value' and 'valuation process'. The review of some of the research carried out within these projects reveals that this broadening uncovers a whole set of new issues, questions and mechanisms that had been totally missed out or neglected by the economic approaches presented above.

3.4.1 The experience of the Traditional Management of Artisanal Fisheries Project (TMAF)

In this first example we use again some of the research undertaken as part of the DFID-funded ‘Traditional Management of Artisanal Fisheries (TMAF)' Project. One major element of this research was the implementation of a poverty analysis of the fishing communities living in the three regions included in the project (Upper River Benue, western shores of the lake Chad, Nguru Gashua wetland). Because of the methodological challenge presented by poverty assessment in an African rural environment (due, e.g. to the partially non-commercialised economy and the multiple activity portfolios adopted by the households) a series of inter-related methods were used to provide as wide a range of perspectives on this issue as possible, including: estimation of annual income by household (quantitative method) and participative wealth-ranking exercises within fishing communities (qualitative).

Interestingly the wealth-ranking results showed that the fishing communities were highly heterogeneous in terms of income and wealth, ranging from "very rich" to "very poor". It was also shown that 40% or more of households in 12 case-study villages were impoverished. This state of "impoverishment" was defined by the communities themselves as having insufficient food for the year, low cash income and a reliance on other members of the community for help in time of need. They also tended to have no access to the inputs or resources (good land and fishing areas) to allow them to undertake the most valuable occupations, defined by the communities as farming and fishing.

A second important element of the project was an in-depth analysis of the local institutional arrangements (also called traditional management systems or TMS) and their potential role in the control of access to the resources and redistribution of the wealth generated by the fishing activity.

The analysis of the TMS reveals interesting results (Neiland, 2000). Although TMS are widespread in the fisheries of NE Nigeria and appear to provide a basis for the sustainable livelihoods of the fishermens' families, there is also evidence that many TMS simply re-enforce the exploitative positions of the local elites (and prevent some groups achieving sustainable livelihoods). The analysis suggests therefore that it is important to distinguish between the two outcomes and the type of TMS which produce them. For instance, in the case of the *Bade* system (an example where the village-level traditional management system still persists), it seems that there is still a high level of equitability, with the profits of the fishery flowing back to the community. In contrast, in the *Dumba* system (an example of a neo-traditional management system associated with Islamic traditions), the results suggest that the local elite are enriching themselves at the expense of the local fishermen (a form of rent-seeking activity).

In other words, a major paradox seems to exist with regards to the (potential) role of TMS in promoting sustainable livelihoods and poverty alleviation. On the one hand, TMS can be seen as the only socially and environmentally sound response by people in order to adapt to the risks and threats which this severe and unpredictable arid zone region have always produced. In that sense, and in absence of any tangible support by the authorities of the state, it can be seen as a central element which ensures the sustainability of the livelihoods of these rural populations. On the other hand, it is also possible to make a case that TMS encourage impoverishment of certain vulnerable members of fishing communities through denying access to resources and promoting exploitative social relationships.

Within the framework of the present section, this conclusion illustrates the extent to which a "pure" economic approach would have 'missed the point'. None of these issues, mechanisms and dynamics relating to power-relationships, distribution, socio-economic stratification, etc. would have appeared, using a conventional economic approach.

3.4.2 Lake Chad Basin Fishery Project

The research undertaken under the EU-INCO project "Sustainable development of African continental fisheries: a regional study of policy options and policy formation

mechanisms for the Lake Chad Basin (1998-2001)" is another illustration of what the term "valuation assessment" might mean when used in a broad, multi-sectoral and multi-dimensional sense.

The main objective of this 3-year European Commission funded project was to carry out a multi-disciplinary research programme to address some of the major fisheries planning and policy constraints faced in this part of Sub-Saharan Africa, in particular (1) poorly established policy-formation mechanisms, (2) lack of relevant data and information, and (3) limited institutional capacity (Neiland and Béné, 2002). As part of this project, a livelihood analysis was carried out throughout the Lake Chad Basin region. The main objective was to expand the knowledge of the so far very poorly understood livelihoods of the rural communities living in the region and, in particular, to assess the exact contribution of the fishing activities to their livelihoods.

For this, a combination of participatory activity and wealth ranking exercises were carried out in 64 villages across the three main fishing areas of the Basin (Western shores of the Lake, Chari delta, and Yaere floodplain). These ranking exercises were complemented by a series of comparative analyses of the ethnic composition, level of food security, and accessibility to fishing grounds across the different socio-economic strata (wealth groups) of the populations.

The livelihood strategy analysis, as it was designed, did not permit a quantification (in terms of overall household income) of the contribution of the different activities undertaken by the households. But it offered an in-depth qualitative analysis of household livelihood strategies and in particular permitted a significant improvement in our understanding of the specific role of the fisheries in the multiple activity portfolios of the households. It showed in particular that for the entire area, households, irrespective of their wealth levels, still rely to a very large extent on a subsistence-based economy where the three major activities (fishing, farming and herding) are closely integrated. With respect to fishing activity the survey demonstrates the central role of this activity (in terms of income, labour and food supply) for all wealth groups.

However, more importantly, the analysis revealed that there is not a one-to-one relationship between the contribution of fishing activity and the wealth (or poverty) level of the households. In the Yaere, the role of fishing activities increases with poverty: the poorer the people, the more they rely on fishing. In the Yaere, therefore, the fisheries seem to be the “activity of last resort”. In the Chari delta and along the Western shores of the Lake, however, the situation is totally different. It is the richest who derive most of their income from the commercialisation of their catches, while the poorest are only marginally involved the fishing activities and must rely on alternative activities (such as wood cutting or daily wage labour) to sustain their livelihoods.

One of the most interesting results derived from this livelihood analysis is that the conclusions revealed through the activity ranking exercise were corroborated by the comparative analysis of accessibility to the fishing grounds. More specifically, it is the issue of access to the resource which is the key-element which conditions the degree to which a fishery can (or cannot) fully play its role of a safety-net activity and act as potential entry point for poverty reduction. This conclusion is in line with the

recent progress made in the understanding of the complex relation between poverty and natural resources (Leach et al. 1999). It could not have been achieved if conventional economic evaluation techniques (which do not contain any analysis of (re-)distribution) had been used.

3.4.3. The Sustainable Fisheries Livelihood Programme

In 1999, the Sustainable Fisheries Livelihoods Programme (SFLP) financed by the UK Department for International Development (DFID) and implemented by FAO was launched in 25 West-African countries with the explicit objective of eliminating poverty in fishing communities. Within this programme, research is currently carried out on how the Sustainable Livelihood Approach (SLA) developed amongst others by Scoones (1998) at the Institute of Development Studies (University of Sussex), and later adopted by DFID, may be used as a tool for assessing and addressing poverty in the specific context of fisheries.

(a) The Sustainable Livelihood Approach

The holistic principle of the SLA shows that the vital policies, institutions and processes are not only fisheries based. They are also linked to education, health, administrative reforms like decentralisation, environment, etc., all of which exert an impact on the livelihoods of artisanal fisheries communities.

However, the Sustainable Livelihood framework itself does not define what poverty is and cannot identify all the elements which would need to be taken into account to eliminate poverty or reduce vulnerability to poverty. Other tools such as poverty profiling are therefore needed to operationalize the approach.

(b) Poverty profiling

Poverty profiles are analytical instruments directly linked to action, and are designed to provide information that may help in the formulation of actions to reduce poverty.
The basic structure of information contained in a poverty profile reflects the factors that influence livelihoods and the poverty situation of those being profiled. Such factors include:

- the variety of assets controlled by the household or to which the household has access;
- mediating factors such as laws, policies, and regulations directly affecting the household, development programmes and projects operating in the area, and local attitudes and beliefs;
- external factors, such as demographic trends, the conditions of the natural resource base, and macroeconomic data;
- the probability of shocks, such as falling commodity prices, drought, conflict, or large-scale illnesses.

By looking at the synergies between these factors and at the processes in which the communities are embedded, a poverty profile allows us to understand the poverty context at large, describe the specific traits that characterize poor artisanal fishers' households, and identify the major factors generating or aggravating their poverty. By using census data and other sources of quantitative or qualitative data, it also provides

information on the distribution of poor artisanal fishers across a given space (community, water body, or country).

Poverty profiles are currently being tested within the Sustainable Fisheries Livelihoods Programme (SFLP) in West and Central Africa (Pittaluga *et al.* forthcoming).

4. ECONOMIC IMPACT ON FISHERIES OF CHANGES IN RIVER BASIN MANAGEMENT

In this section, we will consider the economic impact on fisheries of changes in river basin management from the perspective provided by each type of valuation technique. From the start, it must be recognised that there have been relatively few studies of such impacts undertaken in West and Central Africa. However, those that have been completed, particularly when viewed together, provide a range of interesting and often complementary findings.

4.1 Conventional Economic Valuation (CEV)

4.1.1 Economic valuation of the wetlands benefits: The Hadejia-Jam'are Floodplain, Nigeria; and the impact of the Kano River Project (Barbier et al, 1991; 1993). The Kano River Project lies to the south of Kano city and along the Hadejia River. It was begun in 1976 with the building of Tiga Dam to store water for irrigated small-holder (1-2 ha) farming, which was commenced in 1981. By 1985/86, the Project was fully operational with over 7,000 ha of dry season crops (wheat and tomatoes) and 12,000 ha of wet season crops (rice, maize, cow peas and millet). Water use is high, estimated at 15,000 m^3 per ha annually.

Although a complete cost-benefit analysis of the Project has not been conducted, some information does exist on the costs and value of production when the project became fully-operational over 1984-86. Calculations of the current net economic benefits of the project are shown in **Table 6**.

Table 6. Net economic benefits, Kano River Project Phase 1, N.Nigeria (N7.5=US$1)

	Net economic benefits (N'000)
Tradeable Crops	4,714
Non-Tradeable Crops	11,839
Total	16,533
Net economic crop benefits per ha (N/ha)	865
Less net operating costs (N/ha)	846
Net economic project benefits per ha (N/ha)	19
Net economic crop benefits per water input (N/'000m^3)	1.10
Net economic project benefits per water input (N/'000m^3)	0.02

Source: Barbier 1991, 1993

The net economic crop benefits per ha of the Kano River Project appear extremely high (N865/ha). They easily exceed the net economic benefits per ha of floodplain agriculture (N239/ha, Table 1 above), and are virtually double the total net benefits from floodplain agriculture, fishing and fuelwood (N439/ha, Table 1). However, as in the case of most irrigation projects, the Kano River Project also had high net operating costs. Over 1984-86, these ranged from a low of 7.7% to as much as 37% of the total

value of crop production. As shown in Table 6, when the net operating costs are deducted from the net economic crop benefits, the resulting net economic project benefits are reduced to just N19/ha. Thus the current returns per ha to the fully operational Kano River Project do not compare favourably with those of the floodplain agriculture, fishing and fuelwood. It was also shown that the returns per water input were also higher economically for the floodplain agriculture system compared to the Kano River Project.

Based on the current net crop and project benefits in Table 6, a cost-benefit analysis was conducted for the Kano River Project (Phase I). Adjustments to the time horizon and discount rate were included in a sensitivity analysis, as shown in **Table 7** below. In comparison with the present value net benefits of the Hadejia-Jam'are Floodplain (Table 2), it is clear that the present worth of the Kano River Project is much lower. Only the present value of net crop benefits per ha are substantially higher for the Project compared to the floodplain. However, to exclude current operating costs gives a misleading indication of the net economic returns to the Project. In addition, the present value of net crop benefits per 10^3m^3 of water use for the Project is substantially lower than for floodplain recession agriculture, let alone for total net floodplain benefits.

Table 7: Present value net economic benefits, Kano River Project Phase I, Nigeria (N7.5=US$1, 1989/90)

Per hectare	**(8%, 50 years)**	**(8%, 30 years)**	**(12%, 50 years)**	**(12%, 30 years)**
Crop (N/ha)	10,586	9741	7186	6970
Project (N/ha)	233	214	158	153
Per water Use				
Crop (N/103/m3)	13	12	9	9
Project (N/103m3)	0.3	0.3	0.2	0.2

Source : Barbier *et al*. 1991, 1993

4.1.2. Economic impact of changes in river basin management on fisheries in N.E. Nigeria.

The findings of the DFID-funded 'Traditional Management of Artisanal Fisheries in N.E. Nigeria Project' (Neiland, 1998) allow some conclusions to be drawn about the impact of changing hydrological patterns on river basin fisheries. It should be pointed out, however, that the research involved here was not originally aimed at producing a CEV analysis. In addition, there is the difficulty of trying to separate out the impacts of man-made impacts (e.g. river basin modifications through dam construction and irrigation), as opposed to natural environmental fluctuations (a characteristic of African arid zone fisheries).

There are two facts that are known for certain about the fisheries of N.E. Nigeria – first, they currently yield a significant economic profit of at least N415 million/year (or US$ 6 million/year), and second, the fisheries have been impacted by environmental change, mainly as a result of natural (e.g. Sahel drought) and man-made (e.g. dam construction). The impact of change has in all cases led to a reduction in the aquatic environment – rivers and floodplains have been reduced in size, Lake Chad has shrunk and been replaced by a large swamp – and by and large, as a consequence, fish stocks have been reduced in size, diversity and distribution.

The question is, therefore, whether it is possible to estimate the change in value of the fisheries in N.E. Nigeria as a result of these environmental changes? A simple methodology has been used to produce some indicative figures, as shown in **Table 8**. The difficulty in estimating these values lies in making appropriate assumptions about the dynamics of the fishery system overall (biological-economic-social parameters and how they interact).

It has been assumed that in a well-functioning arid zone African floodplain fishery (Lake Chad fishery is assumed to have these characteristics – high stock level, good catch returns, economically efficient) small-scale fishers will be able to catch about 5 tonnes of fish per year and produce a net economic yield of at least US$1/day (or N27,000). Using this baseline, the potential total net economic profit was calculated for each of the other fisheries. These values were then compared to the actual values at present.

Table 8: Economic impact on fisheries of hydrological changes in the river basins of N.E. Nigeria (Neiland, 1998)

River basin fishery	**Major hydrological modifications over past 30 years**	**Impacts on fishery**	**Current economic value of fishery landings** (Total net economic profit, N'000s) (1)	**Estimated change in value of fishery** (+/- total net economic profit, N'000s or % change) (2)
Upper River Benue	(i)Construction of Lagdo dam; (ii) Construction of Gongola River dam; (iii) Sahel drought (70s/80s)	Reduction of riverine discharge, size of annual flood, less inundation of floodplains, reduction of fish biodiversity and stock size; falling catch rates; prices stable; stable local demand.	5,190	- 146,010 (-96%)
Lake Chad Basin	(i) Construction of dams in northern Cameroon; (ii) Sahel drought (70s/80s);	Reduction of riverine discharge and floodplain; major reduction in size of Lake Chad, but creation of fringing floodplain; change in species diversity; change in fish migrations & distribution; catch rates stable; increased demand/ prices from non-local markets.	266,039	266,039 (0%)
Nguru-Gashua Wetlands	(i) Construction of dams on headwaters; (ii) smaller irrigation dams elsewhere; (iii) Sahel drought (70s/80s)	Reduction of riverine discharge and floodplain; reduction of fish stock size abundance and diversity; falling catch rates; increased regional demand and prices.	144,636	-18,066 (-11%)
TOTAL			**415,865**	**364,076**

Notes:1) As shown in Table 3 above, based on research findings of TMF project (Neiland, 1998); (2) It is assumed that in a well-functioning fishery, such as the Lake Chad fishery (above), that households will achieve a net economic profit of N27,009/year (or $1 per day); based on the number of fishing households per fishery the potential total net economic profit was calculated for Upper River Benue and Nguru-Gashua Wetlands; the current total was deducted from this value to give an indication of the change in the value of the fishery.

The results show that the Lake Chad fishery has not experienced a change in terms of economic returns (0% change) (the major assumption of the analysis). The fishery of the Nguru-Gashua Wetlands has experienced a decline of 11% in economic returns. The Upper River Benue has experienced a massive 96% decline in economic returns.

The changes in economic value for each fishery are purely indicative, and should be treated with caution. However, it is possible to consider whether the changes could be explained using knowledge derived from recent research (e.g. other elements of the TMAF Project; Neiland, 1998). In the case of the Lake Chad Basin fishery, which has been taken as the base-line, the impact of environmental change has been widely characterized in the literature as a drastic decline of the fishery. However, an alternative narrative might view the situation as an evolution of the fishery from a lacustrine/riverine fishery into a swampland fishery. It may be the case, as suggested here, that while the nature of the fishery has changed, the total economic value has remained relatively stable. Of course, this would need to be tested, but it is not necessarily the case that a larger Lake Chad would produce higher economic returns (compared to a more inaccessible swamp system). Three factors which have facilitated the operation and resilience of the fishery are the existence of alternative livelihood options (farming), un-fished remote fishing areas (which act as fish refuges) and the well-developed fish marketing system.

In the case of the Nguru-Gashua Wetlands fishery, it can be hypothesized that the relatively low reduction in economic value of the fishery (11%), in the face of drastic reduction in the aquatic environment, is only a temporary phase. The relatively high household catches and economic profit are probably due to an increased level of fishing effort (with few income alternatives), and a high demand for fish products (and prices) from nearby Kano and other urban areas (supported by a good marketing network). It is anticipated that the fishery in the Nguru-Gashua Wetlands will not be able to sustain the present level of activity, and that it will become overexploited (biologically and economically) in the near future. The situation will be exacerbated by the inability of local authorities to manage water releases from the major headwater dams.

In case of the Upper River Benue, the impact of the reduction of the aquatic environment has been devastating on the local fisheries, and their economic value. The current economic value is a meager N5 million/year (or US71, 428) compared to the Lake Chad and Nguru-Gashua Wetlands fisheries. The reduction in the size of the River Benue and its floodplain over 20 years since the construction of the Lagdo Dam upstream in Cameroon, coupled with low and only local demand for the available fish, has produced a fishery of low value to the local economy overall.

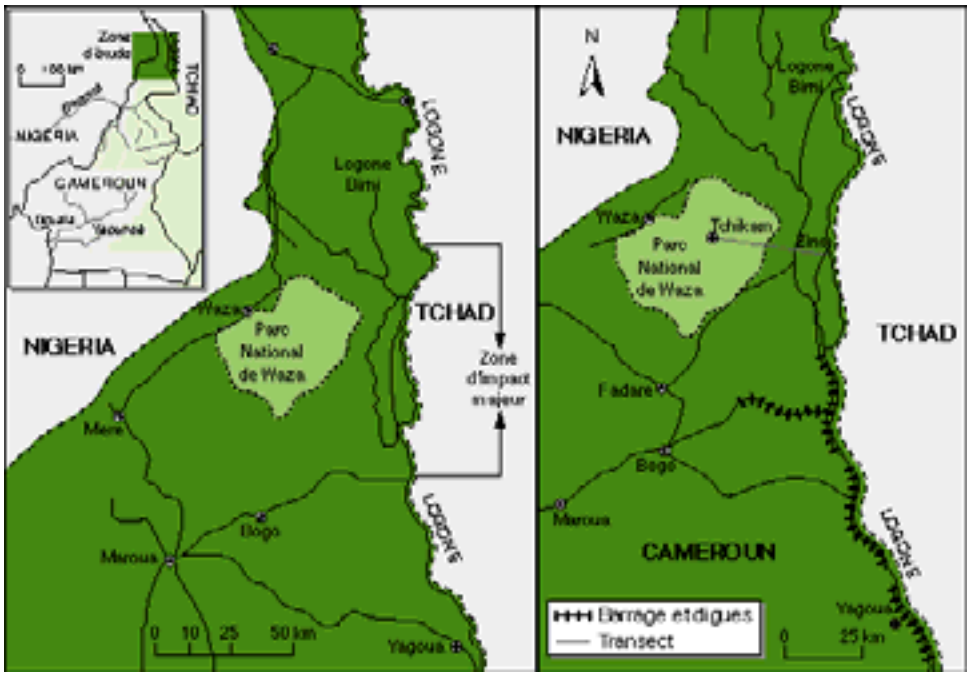
4.2 Economic Impact Assessment (EcIA)

4.2.1 Maga reservoir and the Yaere floodplain (Cameroon)

There are many examples of Economic Impact Assessments available in the literature, most which concentrate on the impacts of dams on the river flood. One relatively well-documented (and classical) case is the Maga dam on the Logone River, located in the Far-North Province of Cameroon at the border with Chad. In the pre-dam situation, the Logone river used to flood the fringing plain (called the Yaere floodplain). However, in 1979 a national irrigated rice growing project was constructed under the management of the state-controlled company SEMRY (Rice Culture Expansion and Modernisation Authority). The hydrological component of the project consisted of 28 km of embankments which created the Maga reservoir, plus some 80 km of dykes along the Logone River to control the flooding of adjoining floodplains (see **Fig.4**) and to allow the culture of irrigated rice.

The SEMRY project has however never attained its expected rice production level. But more importantly, these schemes seriously modified the floodplain regime leading to an acceleration of the degradation of the environment caused by drought (including the disappearance of many plant species). These modifications are also thought to have eliminated the flooding of some 59,000 ha of floodplain and seriously reduced another 150,000 ha which were important breeding and nursery areas for fishes. As a consequence, IUCN has worked with local partners to start a rehabilitation project in 1993. The main objective was the restoration of the flooding area to return to a level close to the pre-dam conditions. This was to be achieved by the opening of the dyke at two different locations close to the Maga reservoir.

Fig.4. The 28 km dam and 80 km dikes along the River Logone SEMRY project.



Although a more comprehensive estimate (valuation) of the total economic benefits and costs of the SEMRY scheme is now possible – especially based on the various very detailed economic, social and ecological studies carried out by IUCN during the first phases of the rehabilitation project (1993-1997), the only type of evaluation of the economic impacts of the SEMRY scheme on the fishery that it was possible to carry out prior to the IUCN studies consisted of costing the lost of direct catches induced by the reduction of the floodplain area. Taking into consideration the catch losses induced by the 590 km^2 flood reduction and assuming a 50% reduction of productivity for the other 1,500 km^2 affected by the flood disruption (i.e. assuming a productivity of 2.5t/ km^2/yr instead of the "normal" 5t/km^2/yr), the total catch reduction would be an estimated 6,700 t/yr. At the current average local price of US$ 0.85/kg (Jolley *et al*. 2002), this represents a total direct lost of 120 US$ million (first sale value) over the 21 years during which the flooding pattern has been significantly affected (1979-2000).

4.2.2. The Niger River Mali

The production of the Central Delta was estimated to be around 100,000 t in the 1960s (Daget 1973). However, in 1973 severe drought conditions affected the entire Sahelian region, which substantially modified the flood of the Niger River and impacted on the fisheries activities. By 1990-91, the production of the fisheries operating in the Central Delta had decreased to 50,000 t – a 50% decline with respect to the pre-drought period. Adopting a similar approach than the one above, the economic impact induced by the drought on the Niger River can be estimated to be US$20 million (first sale value) per year.

4.3 Socio-economic-Livelihood Analysis (SE-LA)

The literature review has not revealed any specific SE-LA studies which have investigated the impact of changes in river basin management on fisheries. The detailed research findings of many of the projects mentioned above certainly provide some evidence that impacts have been felt by fishing communities. In the case of NE Nigeria, a survey of village heads revealed the major changes which had affected the fisheries over the past 30 years, as shown in **Table 9**. These included deterioration of the aquatic environment, which was undoubtedly linked to the impact of dams, irrigation schemes and a series of Sahel droughts.

Table 9. Major changes detected in the fisheries of N.E. Nigeria over the last 30-50 years by village heads (Neiland, 1998)

Major changes	**% Total responses from village heads**		
	Upper River Benue	**Lake Chad**	**Nguru-Gashua Wetlands**
Catching less/smaller fish	18	17	3
Smaller catch, higher unit value	14	0	8
Deterioration in fishing environment	4	22	18
Deterioration in aquatic environment	4	22	23
Traditional gears now ineffective	0	0	3
New gears introduced	36	17	10
Decline of fisheries management	0	0	3
More fishermen now	7	11	0
Less fishermen now	7	6	5
Increased fishing costs	4	6	23
No changes	7	0	0
Village does not fish	0	0	5
Total	100%	100%	100%

There is a need for both cross-sectoral and time-series studies of this kind to examine the changes which are taking place in the fisheries of West and Central Africa. The newly-emerging LA approaches offer considerable potential for further work in this area throughout the region.

5. ASSESSMENT OF VALUATION METHODOLOGIES

The range of valuation methodologies which have been applied to the river fisheries of West and Central Africa, as revealed by the literature review, have been grouped into three categories in this paper – conventional economic valuation (e.g. household surveys as a basis for undertaken economic cost benefit analysis), economic impact assessment (e.g. monitoring of fish markets to estimate output volume and value based on financial prices) and socio-economic and livelihood analysis (e.g. participatory rural appraisal techniques such as wealth-ranking of fishing households).

In this brief section, we will compare the three types of methods to answer three simple questions within the context of undertaking valuations studies in West and Central Africa:

- Which methods are most easily used and applied?
- Which methods produce information outputs with the greatest utility?
- Which methods are most cost-effective?

In order to make the comparison and answer the key questions, twelve assessment criteria were used and each type of method was scored for each (1 = low or unfavourable to 3 = high or favourable). The results are shown in **Table 10** below.

Table 10: Comparison of valuation methods using criteria scoring

Criteria	**CEV methods** e.g. CBA using household surveys	**EcIA methods** e.g. monitoring of fish markets for volume and value	**SE-LA** e.g. PRA wealth-ranking of fishing households
Quantity of data required	1	3	2
Formal sampling required	1	3	3
Representativeness/scaling-up potential	3	2	1
Time-series capacity	1	3	3
Replicability of methods	3	2	2
Potential for errors	1	3	2
Data processing difficulty & time needed	1	2	2
Potential for causality analysis	3	2	2
Capacity needed	1	3	2
Ease of local training in short-term	1	3	2
Cost	1	3	2
Potential for local sustainability	1	3	2
Total	**18**	**32**	**25**

Table 10 reveals that Economic Impact Assessment methods produced the highest score (32) followed by socio-economic and livelihood analysis (25) and conventional economic methods (18). In other words, in terms of a global assessment of the ease of usage, utility and cost, methods such as market monitoring are better than methods such as PRA wealth-ranking or cost-benefit analysis using household surveys.

This comparative analysis has of course been undertaken using relatively few (12) assessment criteria and is directed specifically to take account of conditions on the ground in West and Central Africa based on personal experience. In other words, on the basis of our experience, valuation techniques such as market monitoring is most likely to be successful.

A brief examination of the criteria scores for each of the three methods reveals why this is the case overall. Economic impact assessment methods do not need a large quantity of data and formal sampling is not a requirement. At the same time, there is good potential for scaling-up and generating representative statistics or indicators. The methods have high potential for time-series data collection, replicability of operation and low potential for errors (compared to more complex approaches). The time required for data processing and information outputs is comparatively low, and the results may be used in the analysis of causality between a limited number of

parameters. The methods may be implemented even in cases of low local capacity, and this expertise may be increased quickly through relatively simple training courses. The overall cost of the methods is low and the sustainability of the methods by local staff over time is high.

From our personal experience of implementing a range of valuation methodology in West and Central Africa, the most successful, in terms of the assessment criteria used here (ease, utility, cost), is the fish market monitoring system in the Lake Chad Basin (Neiland, Jolley and Béné, 2003), compared to the socio-economic and livelihood analysis approaches (Béné *et al*. 2001) and the very detailed economic analysis conducted in NE Nigeria (Neiland, 1998). For more information on each of the approaches please refer to the references cited.

6. CONCLUSIONS AND RECOMMENDATIONS

There are three main conclusions and matching recommendations which can be derived from the Review of River Fisheries Valuation in West and Central Africa.

Valuation information and the policy process

First, there is relatively little information on the value of river (or inland) fisheries in West and Central Africa. For most river basins and countries, it is possible to derive some estimates of gross financial values of fisheries production based on landings data and local prices. For the major river basins of West and Central Africa the total potential value of fisheries production is US$749 million/year, and the value of current production is US$295 million. For the countries with major inland fisheries, the actual value of all inland fisheries is US$1415 million (cf Table 5). In addition, a number of case-studies have revealed that inland fisheries make a positive economic contribution to regional economies, and also provide important livelihood benefits including employment. At the same time, other studies have shown that changes in river management regimes can deleteriously impact on this flow of benefits. As a result of these findings, it is ***recommended*** that valuation studies need to be undertaken more widely in the region, in order to avoid the situation whereby the role of river fisheries is overlooked or underestimated within the policy process.

Toolbox of valuation methods and opportunities for application

Second, there are a wide variety of valuation methods, which produce a range of information types. There is important scope to combine different methods in different situations to provide a powerful mechanism for information generation and analysis. In the context provided by many countries of West and Central Africa, the application and use of valuation techniques is constrained by a variety of factors (e.g. weak institutional capacity). At the same time, there are also opportunities to utilise valuation methods to develop sustainable and robust information systems. On the basis of past experience revealed by this literature review, it is ***recommended*** that investigations should be undertaken to understand how valuation techniques should be developed and applied under particular conditions within West and Central Africa. It would be useful to develop ‘A manual for valuing river fisheries in Africa’ on this basis. One central element to be considered very seriously is the relationship between policy-makers (information users) and the information generation process (involving a range of stakeholders) – the sustainability of the system will depend upon this.

Increased capacity for valuation studies

Third, one of the major constraints to the development of information systems and policy processes which incorporate valuation information in West and Central Africa is limited capacity at all levels of government fisheries and development organisations. There are many possibilities for increased capacity through in-country training courses, particularly short-courses. Once again, it is important to match the demand for such capacity-building with the need for valuation information within the policy process of a particular country. It is ***recommended***, therefore, that a generic approach to capacity-building in fisheries valuation should be developed for West and Central Africa taking into account the needs of the policy process, and the full range of opportunities and constraints.

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APPENDIX 1 major river basins of West and Central Africa

The major river basins considered in this study are: (1) the Senegal-Gambia rivers basin, (2) the Volta river basin, (3) the Niger-Benue rivers basin, (4) the Lake Chad river system, (5) the Congo-Zaire river basin, (6-7) the Atlantic coastal basins. Are also included in the table the three largest lakes/reservoirs of West and Central Africa: (8) the Volta Lake (man made), (9) the Lake Chad (open waters) and (10) the Kandji Lake (man made).

River Basins	Characteristics
1. Senegal-Gambia rivers basin	Countries: Senegal, South Mauritania, South-West Mali, North-East Guinea, Gambia Gambia river Total length: 1120 km Gambia: +480 km Annual catches: 1500-3500 t (1977-82) Potential yield: 2000 - 8000 t (Welcome 1979) Guinea: 200 km Annual catches: 1000-2000 t (1987) Potential yield: 5000 t (Welcome 1979) Senegal river Total length: 1640 km Length (in Senegal): 1400 km No. fishermen (Senegal): 14000 (1977) Fringing floodplain: + 5000 km^2 River delta: 7000 km^2 Main tributaries (Mali) Faleme river: 300 km Bakoye river: 300km Baoule river: 350 km Total annual catches: 2000 t Other rivers Sine-Saloum river (Senegal) Length: 100 km No. fishermen: 4000 – 6000 (1988) Total annual catches: 6000 – 8000 t (1988) Casamance river (Senegal) Length: 325 km No. fishermen: 5500 (Frenoux 1988) Total annual catches: 12000 – 15000 t (1987)
2. Volta river basin	Countries: Burkina Faso, Ghana, Togo, Benin Volta river (cum. Red, White, Black Volta) Total Length: Benin: 380 km Burkina Faso: 1250 km Ghana: 650 km No. fishermen: (Burkina Faso): 7000 (1995) Total annual catches (Burkina Faso): 8,000 t (including reservoirs and Lake) (1997) Estimated annual productivity: 50-100 kg/ha

2. Volta river basin (cont)	Oueme river and floodplain Length: 700 km (Benin) Floodplain: 2000 km^2 (Benin) Annual catches: 5700 t (1976) (Welcomme 1979) Volta tributaries Oti, Koumongou, Kara, Mono rivers Togo: Length: 700 km Potential annual yield: 2000 – 6000 t (Patasse 1982) Benin: 360 km Potential annual yield: 500 t
3. Niger-Benue river basin	Countries: Guinea, Mali, Niger, Nigeria, Benin, Cameroon Floodplain: Central delta (Mali): Surface: 16,123 km^2 Annual catches Nigeria: 19000 t (1980) Benin: 1000 t (1971) Mali: 90000 t Fringing plains: Niger: 637 km^2 Benin: 242 km^2 Nigeria: 3000 km^2 Niger river Total length: 4183 km Nigeria: 1300 km Benin: 120 km Niger: 600 km Mali: 3000 km Guinea: 580 km (3400 km with tributaries) Total annual catches (excluding Niger delta): 114000 t (1966) Niger: 4000 – 7000 t (Welcome 1972) Benin: 1000 t Mali: 90,000 t Nigeria : 13000 t No. fishermen: Benin (Niger river): 3000 Mali (Niger delta and river): 40000 – 54000 (1975) Niger (Niger river): 2600 (1981) Benue river Nigeria: 1440 km Cameroon: 550 km (including Mayo Kebi) Annual catch: Cameroon: 3000 t (estimation 1966) Nigeria: 6500 t (Barbier et al. 1991) No. fishermen: 5100 (Nigeria) (Welcomme 1985)

4. Lake Chad river system	Countries: Niger, Chad, Central African Republic, Nigeria, North Cameroon Main rivers Logone (Cameroon): 280 km Chari (Chad): 1300 km Potential productivity Logone-Chari: 20000 – 30000 t/yr Floodplains Yaéré (Cameroon-Chad) Surface: 4600 km^2 Potential annual yield: 20000-30000 t/yr Annual catches: 2272 t (Logone river only) (Bobo and Boukar 1997) No. fishermen: 6800 (1997) Salamat river and floodplain (Chad) Salamat river: 950 km Fringing floodplain: 4000 km^2 Total annual catches: 22000 t (Deceuninck 1985) Bahr Aouk river and floodplain (CAR) Bahr Aouk river: 620 km Fringing floodplain: 8000 km^2 Total annual catches: 6000 t (Deceuninck 1985)
5. Congo-Zaire river basin	Countries: Congo-Brazzaville, Democratic Republic of Congo (DRC), Central African Republic (CAR), Rwanda, Burundi, Uganda Main rivers: Lualaba river becoming Congo-Zaire River: Total length: 4140 km Tributaries' floodplains: 17000 km^2 No. fishermen: 40000 – 50000 (Corsi, 1984) Total annual catches: 70,000 – 75,000 t Potential annual yield: 150000 t (including tributaries) Luapula River (DRC): Total length: 560 km Floodplains: 1500 km^2 No. fishermen: 2850 (Konare 1984) Total annual catches: 8800 t (1983) Ubangui and Uele (Congo, DRC, CAR): Total length: 2270 km Total annual Catches: 7520 t (1984) Floodplains: 1300 km^2 Sangha (Congo): 1000 km Floodplains (including Likouala river floodplain): 35,000 km^2 No. fishermen: 7000 –10000 (river and floodplain) Total annual catches: 10000 – 15000 t (1980) Potential Annual yield: 60000 – 100000 t

5. Congo-Zaire river basin (cont)	Tributaries and floodplains Cameroon: 1400 km DRC: 10000 km of tributaries 17000 km^2 of floodplain (not including Congo-Zaire floodplains) CAR floodplains: 15000 km^2 Congo: Annual catches: 10000 – 15000 t (floodplains and tributaries)
6. Atlantic coastal basin I	Countries: Gambia, Guinea Bissau, Sierra Leone, Liberia, Ivory Coast Ivory Coast rivers: Length (cum.): 1700 km Potential annual yield: 20000 t Total annual catches: 18500 (1997) No. fishermen: 6000 (FAO 2002) Sierra Leone rivers : Length (cum.) : 1280 km Total annual catches (1998): 10000 t Potential annual yield: 11000 – 14,000 t Fringing floodplains: 10,000 km^2
7. Atlantic coastal basins II	Countries: South Cameroon, Equatorial Guinea, Gabon Gabon: Ogooué river: 820 km No. fishermen: 1485 (1977) Total Annual Catches: 1800 t Equatorial Guinea: Rio Benito: 230 km No. fishermen: 400 (Matthes, 1980) Annual catches: 400t Potential annual yield: 1000 t (Matthes, 1980) Other rivers and tributaries: Cameroon: +500 km Productivity: 210 – 940 kg/km

8. Volta Lake	Country: Ghana Surface: 8270 km^2 Total annual catches: 40,000 t (1979) No. fishermen: 20,000 (1975) Potential annual yield: 40,000 – 50,000 t (Welcomme 1972)
9. Lake Chad (Open-waters and surrounding floodplains/swamps)	Countries: Nigeria, Cameroon, Chad, Niger Total surface (for "normal Chad"): 22,000 km^2 Nigeria: 5,500 km^2 (25% total) Niger: 4000 km^2 (17%) Cameroon: 1800 km^2 (8%) Chad: 11000 km^2 (50%) Total surface ("Little Chad"): 2000 km^2

	Chad: 1200 km^2 (60%) Cameroon: 800 km^2 (40%) Total Annual catches: 60,000 t (1997) (Neiland et al., 1998) Potential annual yield: 160,000 – 200,000 t (Lévêque 1987) No. fishermen: 10,000 – 15,000 (during "normal phase" Welcome 1972)
10. Lake Kaindji	Country: Nigeria Surface: 1270 km^2 Total annual catches: 4000 - 6000 t (1980s) No. fishermen: 20,000 (1975) Potential annual yield: 6000 t (Ita et al., 1984) Other smaller reservoirs in Nigeria Surface (cum.): 2750 km^2 Total annual catches: 20000 t (estimates)

Source: compiled from Welcomme 1972, 1979, and Van den Bossche and Bernacsek (1990), unless indicated otherwise.

Synthesis of continental fisheries catches in West and Central Africa

Country	Inland catches (t)	% of total catches	No. fishermen
Benin	32,000	76	3000
Burkina Faso	7,000	100	
Cameroon	20,000	24	
Central African Republic	9,000	100	
Chad	110,000	100	10,000 – 15,000 (LC)
Ivory Coast	27,500	27	6000[a]
Gambia	2,700	19	
Ghana	53,000	14	20,000
Mali	55,500	100	40,000 – 54,000
Niger	2,500	100	2600
Nigeria	103,000	44	5100 + 20,000 (LK)
Senegal	15,000	5	14,000 + 4000 – 6000 + 5500
Sierra Leone	16,000	30	

Source : Synthesised from Table above, except when mentioned otherwise.
[a] from FAO World Fisheries Statistics - Country profile, 2002.

APPENDIX 2 Potential Economic Value of Western and Central African Basins

Potential Economic Value of Western and Central African Basins estimated through the first sale values (US$/yr) of river and floodplain fisheries potential catches [a]. The number of fishermen and total annual catches actually recorded in the literature for these basins [b] are also indicated in this table. These records can be considered as very conservatives estimates of the real figures (see footnotes below).

River Basins [b]	Coefficients used for the calculation	Potential Economic Value
1. Senegal-Gambia rivers basin Recorded No. fishermen: = 23500 – 25500 [c] [1977-1988] [d] Recorded total annual catches: 22500 – 30500 [e] t/yr [1977-1988] Potential annual yield: Rivers: 52000 t/yr Floodplains: 60000 t/yr Total potential: 112000 t/yr	Potential river yield: 15 t/km/yr Potential floodplain yield: 5 t/km^2/yr Unit Price (first sale value) US$ 0.55 / kg (estimate)	US$ 61.6 million / yr
2. Volta river basin Recorded No. fishermen: 7000 [f] [1995] Recorded total annual catches: 13700 [g] t/yr [1976 -1997] Potential annual yield: Rivers: 6000 t/yr Floodplains: 10000 t/yr Total potential: 16000 t/yr	Potential river yield: 15 t/km/yr Potential floodplain yield: 5 t/km^2/yr Unit Price (first sale value) US$ 0.52 / kg (FAO, 2002)	US$ 8.32 million / yr
3. Niger-Benue river basin Recorded No. fishermen: 50,700 – 64,700 [h] [1975 – 1985] Recorded total annual catches: 236500 t/yr [1971-1991] Potential annual yield: Rivers: 105600 t/yr Floodplains: 100010 t/yr	Potential river yield: 15 t/km/yr Potential floodplain yield: 5 t/km^2/yr Unit Price (first sale value)	US$ 82.244 millions / yr

Total potential: 205610 t/yr	US$ 0.4 / kg [n]	

River Basins	Coefficients used for the calculation	Potential Economic Value
4. Lake Chad river system Recorded No. fishermen: 6800 [I] [1997] Recorded total annual catches: 32200 t/yr [1985-1997] Potential annual yield: Rivers : 47250 t /yr Floodplains : 83000 t/yr Total potential : 130250 t/yr	Potential river yield: 15 t/km/yr Potential floodplain yield: 5 t/km^2/yr Unit Price (first sale value): US$ 0.55 / kg [o]	US$ 71.637 million / yr
5. Congo-Zaire river basin Recorded No. fishermen: 50000 – 62000 [j] [1984 – 1989] Recorded total annual catches: 104500 – 119500 [k] [1980-1984] Potential annual yield: Rivers : 290500 t /yr Floodplains : 229500 t/yr Total potential : 520000 t/yr	Potential river yield: (“black” acid, low productivity water) 10 t/km/yr Potential floodplain yield (“black” acid, low productivity water): 2.5 t/km^2/yr Unit Price (first sale value) US$ 0.40 / kg (estimate)	US$ 208 million /yr
6 – 7. Atlantic coastal basins (I and II) Recorded No. fishermen: 6000 [l] [2002] Recorded total annual catches: 30700 t [m] [1997-1998] Potential annual yield: Rivers : 68000 t/ yr Floodplains : 50000t/yr Total potential: 118000 t/yr	Potential river yield: 15 t/km/yr Potential floodplain yield: 5 t/km^2/yr Unit Price (first sale value) US$ 1.52 / kg [p] (Vallet M., 1993)	US$ 179.3 million / yr

8. Volta Lake Recorded No. fishermen: 20000 [1975] Recorded total annual catches: 40,000 t/yr [1979] Potential annual yield: 62000t/yr	Potential river lake: 7.5 t/km^2/yr Unit Price (first sale value): US$ 0.71 / kg (1992) (Braimah, 1995)	US$ 44.02 million / yr
River Basins	Coefficients used for the calculation	Potential Economic Value
9. Lake Chad (Open-waters and surrounding floodplains/swamps) Recorded No. fishermen: 10000 – 15000 [1972] Recorded total annual catches: 60,000 (1997 = during "little Chad" period) Potential annual yield: 165000 t/yr (“normal Chad”)	Potential lake yield: 7.5 t/km^2/yr Unit Price (first sale value): US$ 0.55 / kg [0]	US$ 90.75 million / yr
10. Lake Kaindji Recorded No. fishermen: 20000 [1975] Recorded annual catches: 4000 - 6000 t [1980-1989] Potential annual yield: 6000 t	Potential river lake: 7.5 t/km^2/yr Unit Price (first sale value) US$ 0.55 / kg (estimate)	US$ 3.3 million / yr

[a] Lagoons, lakes and reservoirs are not included in this estimation.
[b] Note that the recorded total annual catches may differ from the potential annual yield. The closer the former is to the latter, the more likely the fisheries are at their maximal exploitation level.
[c] Not recorded: number of fishermen on the Gambia river.
[d] The periods between [ ] indicate the first and last year of estimation.
[e] Not recorded: total annual catches of the Senegal river.
[f] Only recorded fishermen in Burkina Faso operating on the Volta river; not recorded fishermen in Ghana, Togo, and Benin.
[g] Not recorded: total annual catches in Ghana, Togo, and Benin of the fishermen operating on the Volta river.
[h] Not recorded: number of fishermen operating on the Niger river in Nigeria.
[i] Not recorded: number of fishermen operating in the Logone-Chari system and in Chad.
[j] Not recorded: Ubangui fishermen.

[k] Not recorded: Total annual catches in Congo of the Ubangui river.
[l] Only recorded fishermen in Ivory Coast; not recorded fishermen in Gambia, Guinea Bissau, Sierra Leone, Liberia.
[m] Not recorded: annual inland catches in Gambia, Guinea Bissau and Liberia.
[n] Rough estimates from: Niger first sale value: US$ 0.15 – 0.50 / kg (Mamane N., 2000); Benue (Nigeria) first sale value: US$ 0.35 – 0.64 / kg (Jolley et al. 2002); and Niger central delta (Mali) first sale value: US$ 0.15 – 0.50 / kg (Weigel and Stomal 1994).
[o] Estimated for Nigeria, Cameroon, Chad first sale value, Table 1 in Jolley et al. (2002).
[p] This first sale value seems to be significantly higher than the values observed in other places. It needs to be cross-checked and should therefore be considered with caution.

APPENDIX 3 Country Fisheries Profiles

In this appendix the fishery profiles of the west and central African countries for which the share of inland fisheries exceeds 10% of the total catches and with a potential annual catch exceeding 5000 t are presented. This includes:

Benin, Burkina Faso, Cameroon, Chad, Ivory Coast, The Gambia, Ghana, Mali, Niger, Nigeria, Senegal, and Sierra Leone.

Cape Verde, Equatorial Guinea, Gabon, Guinea, and Liberia are not included in this list.

BENIN

General information *

Surface area:	112 622 km²
Populations (1997) :	5,720 millions
GNB (1995):	$EU 2,33 billions
GNB per capita (1995):	$EU 430
Gross Value of Agricultural Output (estimation 1995):	36%

* Economic and demographic data from UN and World Bank sources, fisheries data from FAO World fisheries statistics (2002)

Main rivers and floodplains

Niger Basin (Niger river and main tributaries):
- Surface area : 758,000 km^2
- Length (cum.) : 1118 km
- Floodplains: 275 km^2

Volta
- Length: 380 km

Inland fisheries **

Inland catches as % of total caches:
- 76% (1987) 69% (1999)*

Degree of exploitation (1987):
- inland catch range (t): 20,000 - 34,000[a]
- inland potential catch range : 28,000 – 33,000[a]

[a] including lakes, rivers, floodplain and lagoons.
* from FAO World fisheries statistics, 2002
** Source: Van den Boosche and Bernacsek (1990, Vol.2, Table 2, p.xii)

Fisheries data ***

	Production	Imports	Exports	Total supply	Supply per capita
	'000 t (fresh weight)				kg/yr
Fish for direct human consumption	43.771	8.5	0.321	51.95	9.1
Fish for animal consumption and other uses	-	-	-	-	-

Employment (1996):	
(i) full-time fishers (professional):	53000
(ii) Part-time and seasonal fishers:	22000
Fisheries first sale value (1995)	$EU 29,3 millions
Trade (1997, estimates):	
Import values:	$EU 6,7 millions
Export values:	$EU 1,4 millions

Inland fisheries ***

General overview

Two socio-economic categories are involved in continental fisheries activities (50 000 fishermen and 19 000 fish-mongers). In addition, the sector provides employment to about 300,000 people in various related fields, such as vessel and fishing gears reparations, fish distribution and marketing.

The majority of the fishermen (approx. 75%) are full-time professionals. They use different types of fishing techniques and gears. The remaining 25% include:

- Farmer-fishermen for whom fishing is a complementary or seasonal activity;
- The seasonal fishermen who fish only during specific period of the year;
- The occasional fishermen who fish only as a complementary subsistence activity;
- Households involved in traditional extensive aquaculture activities to complement their income derived from fisheries or farming activities.

Amongst the 33 000 tons of fish caught annually (1977) inland, 92.3% (i.e. 30,000 tons) come from lagoons and coastal lakes. Generally lagoon activity is performed on individual basis, from a non-motorised monoxyle pirogue. Fishing techniques and gears are diverse: driftnets, castnets, traps (for fish or shrimp), and hooklines.

Fish demand and catch uses

Fish constitutes the main source of animal protein for the population in particular in Southern (coastal) regions. In 1995, fish represented 5,5% of the total protein source and 31,9% of the total consumption in animal protein. About ¾ of the catches are consumed fresh; the rest (about 12,0000 t) is smoked, salt or dried before it is sold on the inland markets. In various fishing camps outside the fishing port, about 2 800 women are involved in processing and trading activities. The national production is not sufficient to cover the demand. Frozen and canned fish are therefore imported. In 1995, 14,200 tons of frozen fish were imported.

*** from FAO World fisheries statistics, 2002.

BURKINA FASO

General information *

Surface area:	274 200 km²
Inland water surface:	Approx. 122 000 ha (flooding season)
Population (1997):	10,5 millions
Gross Domestic Product (1996):	$EU 1 726 millions
GDP per caput (1996):	$EU 165
Gross Value of Agricultural Output (estimate 1995):	$EU 800 millions

* Economic and demographic data from UN and World Bank sources, fisheries data from FAO World fisheries statistics (2002)

Main rivers

Volta Basin (Black Volta, White Volta, and Red Volta):

Black Volta

Length: 650 km
Floodplain area : 570 km^2
Estimated annual productivity: 50-100 kg/ha

White Volta
Length: 255 km
Estimated annual productivity: 100 kg/ha

Red Volta
Length: 350 km
Estimated annual productivity: 100 kg/ha

Inland fisheries **

Inland catches as % of total caches: 100%
Degree of exploitation (1987):
inland catch range (t): 2,500 – 5,000
inland potential catch range : 15,000

** Source: Van den Boosche and Bernacsek (1990, Vol.2 Table 2, p.xii)

Fisheries data ***

	Production	Imports	Exports	Total supply	Per caput supply
	'000 tons liveweight				kg/year
Fish for direct human consumption	8	6.2	3	14.2	1.4
Fish for animal feed and other purposes	-	-	-	-	-

Estimated employment (1996):	
Primary sector:	Approx. 7 000 people
Secondary sector:	Approx. 3 000 people
Gross value of fishery (1992) (first sale value):	$EU 5,8 millions
Trade (1995):	
Value of imports:	$EU 3,5 millions
Value of exports (estimation):	$EU 2,0 millions

Inland fisheries ***

General overview

Inland fisheries have been producing annually between 6,000 and 8,0000 tons over the last few years in Burkina Faso. Despite sahelian conditions, Burkina Faso enjoys a relatively important hydrological network including three major basins: Comoé river basin in the western part of the country, the Volta river basin in the central part, and the Niger river basin in the eastern region. During the flooding period, the whole network extends over 122,000 ha, while during the receding season, it reduces to approximately 50,000 ha. This includes lakes and reservoirs for about 75% of the total surface, while the remaining 25% is made of rivers and associated floodplains. Fisheries activities take place mainly on the large permanent lakes and reservoirs.

About 7,000 people are directly involved in fisheries activities. Several socio-economic groups can be distinguished: the full-time professional fishermen (about 10% of the total number), who are mainly migrant fishermen from Mali (Bozo) or from Nigeria

(Haoussa); the national "semi-professional" fishermen who are also farmers (Mossi, Bobo, Marka); and the large number of occasional fishermen. During the 1980s, the semi-professional fishermen were generally organised in corporative groups in order to favour their "professionalization". The boats are usually 6-m long, non-motorised Malian pirogues. Fishing gears are not highly diversified but they are used specifically at different period in the season: gillnets are used all year rounds, hook-lines are used more specifically during the flooding season, while cast nets are preferred during the dry season.

Catch commercialization and trade

The majority of the catch is sold fresh, while the rest is dried or smoked using traditional techniques. The post-harvest losses are relatively low and rarely exceed 5%. Transport and commercialization of fresh fish caught from remote small and medium-sized reservoirs is made by a large number of traders who do not use ice. For water-bodies closer to the urban centres however, ice or even isothermal storage boxes are used to transport the fish. Most of the fresh fish is sent to the large cities such as Ouagadougou and Bobo Dioulasso. The largest commercial networks are organised by a fish-trader organisation located in Ouagadougou. Less-organised exports networks are also taking place from fishing camps located at the Malian border.

Approximately 6000 tons are imported every year (2/3 of frozen marine fish and 1/3 of dried or smoked product) for a total value of $EU 3.5-4 millions. Since 1989 however the volume of import is constantly decreasing due to the increase in inland production and the decrease in meat price which allow low-income households to substitute meat for fish.

State of the fisheries sector

Monitoring of fish landings is inefficient. It is based on voluntarily declaration by the fishermen. The official records do not exceed 1,500 while the total annual catch is thought to vary between 7,000-8,000 tons. Most of these catches are made by migrant fishermen. The fishing performances of the national "semi-professional" fishermen largely depend on their access to fishing gears and the degree of professionalisation.

Economic role of fisheries sector

Fisheries activities are not playing a central role in the economy of Burkina Faso. However, despite a relatively marginal contribution to the GNP and a decrease in the fish per capita consumption (1.4 kg / yr in 1995) fisheries appear to play a more important role in the rural economy. The sector employs about 10,000 people (full-time, part-time or seasonal fishermen and jobs in related activities). It also constitutes a complementary activity to agriculture, especially in areas close to small or medium-sized reservoirs.

Fisheries development

The annual potential yield is estimated around 10,000t, which suggests some perspectives for development. Field reports and observations seem to indicate however that the fisheries, especially those of large water-bodies, are already close to their maximum potential yield. The construction of the Bagre dam (20,000 ha) may however provide an additional development opportunity for the sector. Moreover, it is thought that the

domestic supply could further increase if the fish exported informally toward neighbouring countries was sold on domestic markets.

*** from FAO World fisheries statistics, 2002

CAMEROON

General information*

Surface area:	475.000 km²
Population (1996) :	13 560 000
GNP (1995):	US$ 8.840 millions
GNP per capita (1995):	US$ 680
Gross Value of Agricultural Output (estimate 1995):	US$ 2.213 millions

* Economic and demographic data from UN and World Bank sources, fisheries data from FAO World fisheries statistics (2002)

Main rivers and floodplains**

Lake Chad Basin rivers and floodplains (Logone, Chari and main tributaries):
- Length (Logone) : 280 km
- Floodplains (Yaéré): 250 – 7,000 km^2
- Potential productivity (rivers): 30,000 t/yr

Congo-Zaire tributaries
- Length (cum.) : 1390 km
- Potential productivity: 350 t /yr

Atlantic coastal basin tributaries
- Length (cum.) : >3800 km
- Potential productivity: 2173 t /yr

Niger-Benue
- Length Benue and tributaries (cum.): +550 km
- Potential productivity: 2125 t /yr

** Compiled from Van den Boosche and Bernacsek (1990)

Inland fisheries***

Inland catches as % of total catches:
- 24% (1987) 38% (1999)*

Degree of exploitation (1987):
- inland catch range (t): 20,000 - 50,000
- inland potential catch range : 45,000 – 80,000

* Source: FAO World fisheries statistics, 2002
*** Source: Van den Boosche and Bernacsek (1990, Vol.2, Table 2, p.xii)

Fisheries data (1997)*

	Production	Imports	Exports	Total supply	Per caput supply
	'000 tons liveweight				kg/year
Fish for direct human consumption	93	43	2	126	9.3
Fish for animal feed and other purposes	-	3.7	-	3.7	-

Estimated employment (1996):	
Primary sector:	65 000
Secondary sector:	180 000
Gross Value of Fisheries Output (at ex-vessel prices 1996)	US$ 36,4 millions
Trade (1998 estimated)	
Value of imports:	US$ 14.6 millions
Value of exports (shrimp):	US$ 1,4 millions

Inland fisheries[§]

General overview

Cameroon has a dense drainage network comprising rivers, floodplains, natural lakes and reservoirs which covers approximately 4 million hectares. The main traditional zones of continental fishing activities are the Lake Chad and the other water-bodies of the northern part of the country. However, since the 1980s, the production of these regions has decreased dramatically due to recurrent rainfall deficit. This decline is partially compensated by the catches from the reservoirs Bamendjin (25.000 ha), Lagdo (60.000 ha), Maga (24.000 ha), Mbakaou (50.000 ha), or Mayo-Oulo (80.000 ha).

Catch commercialisation

In general the exact volumes or values of the catches are poor estimated. The majority of the inland fisheries catches is commercialised as dried or smoked fish. A large part of this production is exported, notably to Nigeria. The post-harvest losses are relatively important due to the lack of proper commercialisation and trade infrastructures. To satisfy the increasing demand (mainly in the southern urban centres), Cameroon now import about 43,000 t / yr of frozen fish.

State of the fisheries sector

For the past two decades, the development of the fisheries sector has been impacted negatively by various factors : (i) the drought which affects the inland fisheries; (ii) the over-exploitation of marine resources; (iii) high input costs and trade taxes induced by the CFA devaluation imposed in 1994 as part of the structural adjustment programme; (iv) the sector does not benefit from any government subsidies notably those which used to be available for fuel or fishing gear imports.

[§] from FAO World Fisheries Statistics - Country profile, 2002

CHAD

General information *

Surface area:	1,284,000 km²
Population (1995):	6,515,000
GDP (1995):	US$ 1.185 millions
GDP per capita (1995):	US$ 187
Gross Value of Agricultural Output (estimated 1995):	US$ 577 millions

* Economic and demographic data from UN and World Bank sources, fisheries data from FAO World fisheries statistics (2002)

Main rivers and floodplains

Lake Chad Basin rivers and floodplains

Chari-Logone system:

Length (cum.) : 1300 km

Floodplains (Yaéré): 4,000 km^2

Salamat river and floodplain (Chad)

Salamat river: 950 km

Fringing floodplain: 4000 km^2

Total annual catches: 22,000 t

Inland fisheries **

Inland catches as % of total caches: 100%

Degree of exploitation (1987):

inland catch range (t): 50,000 – 100,000

inland potential catch range : n.a.

** Source: Van den Boosche and Bernacsek (1990, Vol.3, Table 2, p.xii)

Fisheries data ***

	Production	Imports	Exports	Total supply	Supply per capita
	'000 t (fresh weight)				kg/yr
Fish for direct human consumption	90	0.7	n.a.	-	6.5
Fish for animal consumption and other uses	-	-	-	-	-

Employment (1996):	
Full-time professional fishermen:	20 000
Seasonal fishermen:	150 000
Gross Value of Fisheries Output (first sale value):	n.a.
Trade (1995):	
Value of imports:	US$ 0.9 million (estimation)
Value of exports (estimation):	n.a.

Inland fisheries ***

General overview

Until recently fisheries were ranked third in the national economy of Chad, after agriculture and livestock. Chad was then one of the five largest producers of inland fish in Subsaharan Africa with an annual production above 100,000 t. However severe drought and political instability have induced a relative decline in the production. It is estimated that the production in 1996 was probably close to 90,000 t with 30,000 t from the Lake Chad and the remaining 60,000 t from the Chari-Logone river system.

Economic contribution of fisheries activities

Nowadays the fisheries sector contributes approximately 10% of the GNP. A large number of farmers and herders are now involved in fisheries activities and numerous migrant (foreign) fishermen are operating from the Lake Chad and other water-bodies. The exact number of fishermen, however, is unknown. Three categories of fishermen can be distinguished:

- full-time professional fishermen;
- seasonal fishermen;
- occasional fishermen.

The first category consists mainly of foreign (from Mali, Nigeria, Ghana, Benin), well-equipped professional fishermen who operate from the Lake and the rivers. The fishermen of the second category are mainly Chadian households who fish on a seasonal basis essentially during the receding season (nov. - june). These are essentially farmers and herders who have been affected by the drought. Occasional fishermen use fishing activities as a complementary activity for subsistence.

Trade and commercialisation

Globally men are involved in the fishing activities while women are involved in fish processing and trading. Although the commercialisation is still relatively poorly organised, it is recognised that fishing can generate significant revenues and it is often observed that fishers are better-off than farmers.

There are numerous local (rural and urban) markets where catches are commercialised. Demand is globally higher than supply. The quality of the product sold in these markets is however particularly low, especially in comparison to these exported to the foreign markets in Nigeria, CAR, and Cameroon. Domestic consumers prefer fresh product. Unfortunately, expansion of commercialization is largely constrained by the scarcity of processing and transport infrastructure. The consumption per capita is still relatively low, at 6.5 kg / yr.

*** from FAO World Fisheries Statistics - Country profile, 2002

THE GAMBIA

General information*

Surface area:	10 600 km2
Population (1997):	1.189 million
GDP at purchaser's value (1998):	US$ 348 million
Gross Value of Agricultural Output (1998):	US$ 73 million
PCE per head (1998):	US$ 252
Water area (inland):	2 100 km2

* Economic and demographic data from UN and World Bank sources; fisheries data from FAO World fisheries statistics (2002)

Main river

The Gambia river

Length: +480 km
Annual catches: 1400-3500 t (1977-82)
Potential yield: 2000 - 8000 t (Welcome 1979)

Inland fisheries**

Inland catches as % of total caches:
19% (1987) 11% (1999)*
Degree of exploitation (1987):
inland catch range (t): 1400 – 3500t
inland potential catch range : 2000 – 8000t

* Source: FAO World fisheries statistics (2002)
** Source: Van den Boosche and Bernacsek (1990, Vol.2, Table 2, p.xii)

Fisheries data ***

	Production	Imports	Exports	Total supply	Per caput supply
	'000 tons liveweight				kg/year
Fish for direct human consumption	32.258	1.28	5.408	28.135	23.7
Fish for animal feed and other purposes	-	-	-	-	-

Estimated employment (1998):	
Primary sector:	5000
Secondary sector:	25000
Gross value of fisheries output (at ex-vessel prices):	US$ 4.4 million
Trade (1998):	
Value of imports:	US$ 135 000
Value of exports:	US$ 2.72 million

River fisheries ***

Gambia has considerable quantities of brackish- and freshwater fish. Some of the most abundant species are tilapia (*Oreochromis niloticus*), African bonytongue (*Heterotis niloticus*), upsidedown catfish (*Synodontis gambensis*), catfish (*Clarias lazera*), bagrid catfish (*Auchenoglanis occidentalis*), *Labeo senegalensis* and *Chrysichthus furcayus*. Artisanal fishing activities fall into three categories: marine, lower river and upper river. The lower portion of the River Gambia has a brackish-water regime and marine fish are caught in this area, particularly bonga, catfish, threadfins, barracuda, sole and shrimps. The shrimp (*Penaeus duorarum*) and tonguesole (*Cynoglossus senegalensis*) caught along the river are purchased by industrial fishing companies for processing and export to Europe.

*** Source: FAO World Fisheries Statistics - Country profile, 2002

GHANA

General information*

Area:	238,539 km²
Population (1997):	17,832 million
Gross Domestic Product (1996):	US$ 5.42 billion
GDP per caput (1996):	US$ 307

* Economic and demographic data from UN and World Bank sources; fisheries data from FAO World fisheries statistics (2002)

Main river and floodplains**

Volta river:

Length (Black Volta): 650 km

Annual catches (1960): 4000 t [a]

Oti river: Length: 900 km

Tano river: Length: 625 km

Pra river: Length: 445 km

** Compiled from Nerguaye-Tetteh et al., (1984) and Van den Boosche and Bernacsek, (1990).

[a] total catch of the river clam *Egeria radiata*

Inland fisheries ***

Inland catches as % of total catches:

14% (1987) 16% (1999)*

Degree of exploitation (1987):

inland catch range (t): 40,000 – 53,000[a]

inland potential catch range : 40,000 – 65,000[a]

[a] : including lakes, reservoirs, floodplain and rivers.

* Source: FAO World fisheries statistics (2002).

*** Source: Van den Boosche and Bernacsek (1990, Vol.2, Table 2, p.xii)

Fisheries data [§]

	Production	Imports	Exports	Total supply	Per caput supply
	'000 tons liveweight				kg/year
Fish for direct human consumption	477.2	14.6	32.2	465.6	26.1
Fish for animal feed and other purposes	-	9.0	-	9.0	-

Estimated employment (1996):	
Primary sector:	110,000
Secondary sector:	290,000
Gross value of fishery (1996):	US$ 380 million
Trade (1996):	
Value of imports:	US$ 19.5 million
Value of exports:	US$ 56 million

Inland fisheries§

General overview

The inland sources of fish comprise 50 lagoons with a total area of 40,000 ha, rivers about 6,000 km in length and lakes covering about one million hectares. The Volta Lake is the largest; it covers about 900,000 ha with a shoreline of 8,400 km. Fishing on the Volta Lake is done by about 15,000 small (3-7 m) planked canoes, mostly un-motorized, although outboard engines are becoming more common. The sector is wholly artisanal and employees about 85,000 fishermen and traders. The annual production is about 74,000 t which is 16% of the annual total domestic production. The most common fishing gears are handlines and gillnets for tilapia, lates and alestes.

Economic role of the fishing industry

The Ghanaian fisheries sub-sector accounts for about 5% of the agricultural GDP. Fish is the major source of animal protein for Ghanaians. Per caput consumption of fish is about 26 kg which represents 60% of all animal protein. In 1996, fish and fish products, including shrimps, tuna loins and canned tuna contributed US$ 56 million which is about 21% of the total non-traditional exports of Ghana. In total, the industry supports up to 1.5 million people, about 10% of the total population.

[§] Source: FAO World Fisheries Statistics - Country profile, 2002

IVORY COAST

General information*

Surface area:	322 455 km²
Population (1996) :	14.8 million
GNP (1996):	US$ 10.753 billion
GNP per capita (1996):	US$ 727,1
Gross Value of Agricultural Output (1996 estimates):	US$ 3.086 billion

* Economic and demographic data from UN and World Bank sources;
fisheries data from FAO World fisheries statistics (2002)

Main rivers (as part of the Atlantic coastal basin)

Sassandra river:

Length : 650 km

Bandama river

Length: 1050 km

Inland fisheries**

Inland catches as % of total catches:

27% (1987) 20% (1999)*

Degree of exploitation (1987):

inland catch range (t): 36,000

inland potential catch range (t) : 62,000

* Economic and demographic data from UN and World Bank sources; fisheries data from FAO World fisheries statistics (2002)

** Source: Van den Boosche and Bernacsek, (1990, Vol.2, Table 2, p.xii)

Fisheries data ***

	Production	Imports	Exports	Total supply	Per caput supply
	'000 tons live weight				kg /yr
Fish for direct human consumption	67.6	213.1	104.1	156.6	11.1
Fish for animal feed and other purposes	20.0	-	1.0	-	-

Estimated employment (1997):	
Primary sector:	30,000
Secondary sector:	Approx. 80,000
Gross Value of Fisheries Output (1995) (first sale value)	US$ 50 millions
Trade (1997 estimated):	
Import values:	US$ 167,7 millions
Export values:	US$ 200,4 millions

Inland fisheries ***

The exact inland fisheries production remains unknown. It is thought to be around 18,500 tons per year; essentially constituted by *Tilapia nilotica* (50- 70 %). Fishermen (estimated to be around 6000) fish from small, usually non-motorized boats. Fishing techniques and gears are diverse: including driftnets, castnets, traps and hooklines.

*** Source: FAO World Fisheries Statistics - Country profile, 2002.

NIGER

General information *

Surface area:	1,287,000 km²
Population (1996):	9,286,860
GDP at purchaser's value (1996):	US$ 1.533 billion
PCE per head (1996):	US$ 216
Gross Value of Agricultural Output (1997):	US$ 600.6 million

* Economic and demographic data from UN and World Bank sources; fisheries data from FAO World fisheries statistics (2002)

Main river and floodplain

Niger river

Length: 600 km (including 140 km of border shared with Benin)

Annual catches: 5000 – 7000 t

Niger floodplain:

Surface: 90,000 ha (of which 27,000 ha are permanent)

Inland fisheries **

Inland catches as % of total caches: 100%

Degree of exploitation (1987):

inland catch range (t): 2,500 – 16,000

inland potential catch range : 4,000 – 16,000

** Source: Van den Boosche and Bernacsek, 1990, Vol.3, Table 2, p.xii)

Fisheries data §

	Production	Imports	Exports	Total supply	Per caput supply
	'000 tons liveweight				kg/yr
Fish for direct human consumption	4 156	175,1	6,3	4 337,4	0,47
Fish for animal feed and other purposes	-	35	-	-	-

Estimated employment in fisheries (1996):	2000 household (approx.)
Primary sector:	73,000
Gross Value of Fisheries Output:	n.a.
Trade (1999):	
Value of imports:	US$ 168,427
Value of exports:	-

Inland fisheries §

Fisheries overview

Niger is a landlocked country. Its fish production comes from its inland water-bodies i.e. rivers (e.g. Niger et Komadougou Yobé rivers), lakes (Lake Chad et Lake Madarounfa),

permanent and seasonal ponds, and artificial reservoirs. The total area is about 70 000 ha (1993) while it was probably around 400 000 ha before 1974. This reduction is mainly due to the effects of the drought which has even induced in some cases the complete disappearance of water-bodies, as it is the case for the Niger part of the Lake Chad. This degradation, combined with the construction of dikes (for irrigation purposes) and the absence of coherent policies and regulations of water resources uses and fisheries management at the national level has resulted in the constant decline of fish production since 1981 (16 400 t in 1972; 8 000 t in 1980; 6 000 t en 1982; between 2,000 and 4,100 tons/yr since 1990).

The fishermen

The professional fishermen who exploit the various water-bodies come from 2,000 households. They use gillnets, hooklines, harpoons, castnets, traps, clapnets and seines. The low catches and the necessity to recover the high costs of the fishing gear force them to use prohibited gears and to fish during closed season with obvious negative effects on the resources. Some other fishermen practice farming and herding activities. These fish (for subsistence) mainly during the period of low activity on farms. Most of the boats are non-motorized pirogues (the few motorised boats being used for transportation).

Trade and commercialisation

Per capita fish consumption is extremely low. In 1996 the average consumption of fish was 0.47 kg/per capita/yr while that for meat was 14 kg/ per capita/yr. In urban centres, fish consumption can be slightly higher (0.8 to 1.2 kg/per capita/yr). This low consumption results from a combination of different cultural and socio-economic factors: the lack of infrastructure for the transport, commercialization and distribution of fish, diet habits, scarcity and high price of fish products. Imports from Mali, Burkina Faso and Nigeria and exports of dried fish to Nigeria or Benin have been both modest and stable over the last few years. Imports of marine fish stopped just after the CFA devaluation in 1994 and have not yet resumed.

State of the sector

Since 1994, the total annual production did not exceed 4500 tons. The annual variation simply reflect the flood volumes, the local rainfall levels, and the water level of Lake Chad. Some ponds do present significant potentials but are usually under-exploited. Most of them have no management plan, the activity being simply limited by the remoteness of the water-body and the distance from market or urban centres.

Economic role of the fisheries

The fishery sector contributes about 1% to the GNP (in "good" years). However it plays an important role in terms of food security for the fishermen households (the rate of self-consumption is estimated to be about 20 per cent) and the consumers. Fishing activities allow the generation of constant revenue for both producers (fishermen) and traders.

Market dynamics

The (small) Niamey market is the main commercial centre for fish products in Niger. Niger consumers prefer fresh fish rather than dried or smoked fish. Imports (175 tons en 1996) are essentially for foreign consumers. The supply of fresh fish varies depending on the fishing season. The flood recession season (Feb-July) is the period of greatest

abundance (and low price). In contrast during the flood season (Dec.-Feb) the supply is lower and prices higher. The prices are determined by market mechanisms despite an official price-regulation by the Ministry of Commerce. Globally the supply is insufficient (less than 0.5 kg/per capita/yr) but the demand is also low due to the low purchasing power of the consumers.

§ Source: FAO World Fisheries Statistics - Country profile, 2002

NIGERIA

General information *

Population (1997):	103.9 million
GDP at 1984 factor cost (1997):	US$ 1.36 billion
PCE per head (1997):	US$ 248
Gross Value of Agricultural Output (1997):	US$ 526 million

* Economic and demographic data from UN and World Bank sources; fisheries data from FAO World fisheries statistics (2002)

Main river and floodplains **

Niger river:
- Length (in Nigeria): 1300 km
- Floodplains: 3000 km^2
  - Annual catches: 13,450 t (1966)
- Niger outer delta
  - Annual catches: 19,000 t (1980)

Benue river
- Length: 1440 km
- Floodplains: 1810 km^2
- Annual catches 10,000 (1966)

Cross river
- Annual catches 4000 - 8000 (1975)

Other rivers and mangroves
- Annual catches: 13,000 t (1980)

Other floodplains: 300 km^2
- Oueme river floodplain (deltaic): 100 km^2

Annual catches: 5700 t (1976)

** Source: Compiled from Ita *et al*. (1985) and Van den Boosche and Bernacsek, (1990)

Inland fisheries ***

Inland catches as % of total caches:
- 44% (1987) 41% (1999)*

Degree of exploitation (1987):
- inland catch range (t): 110,000 – 130,000[a]
- inland potential catch range : 200,000 – 250,000[a]

[a] : including lakes, reservoirs, floodplain and rivers.

* Source: FAO World fisheries statistics, 2002
*** Source: Van den Boosche and Bernacsek, 1990, Vol.2, Table 2, p.xii)

Fisheries data §

	Production	Imports	Exports	Total supply	Per caput supply
	'000 tons liveweight				kg/year
Fish for direct human consumption	383.4	227.14	9.14	602.41	5.8
Fish for animal feed and other purposes	-	-	-	-	-

Estimated employment (1997):	
Primary sector:	70 000
Secondary sector:	n.a.
Gross Value of Fisheries Output (at ex-vessel prices):	US$ 180 million (estimated)
Trade (1997):	
Import values:	US$ 159 million
Export values:	US$ 8.4 million

Inland fisheries §

General overview

The inland capture fishery is basically artisanal, exploiting the major rivers, their tributaries, natural lakes and various reservoirs. The catch is dominated by *Lates* spp., *Gymnarchus* spp., *Synodontis* spp., *Clarias* spp. and *Chrisychthys* spp. The total surface area of freshwater bodies in Nigeria has been estimated at almost 15 million ha. This includes rivers, flood plains, wetlands and lakes (natural and artificial).

Utilization of the catch

There is a huge supply-demand gap for fish and fishery products in Nigeria: 400 000 t of supply against 800 000 t of demand (1997). This is in spite of its significance in the local diet and its favourable price compared to its substitutes. Fish alone contributes on average 20 to 25% of per caput animal protein intake, and could be as high as 80% in coastal and riverine communities. The total supply from all sources – artisanal coastal, brackish water, inland waters, aquaculture, industrial coastal, and imports – is therefore consumed locally, with the exception of high quality shrimps graded for export.

The predominant species in the landings of the coastal artisanal fishery – the pelagics – are preferred smoked. There is therefore a huge processing industry – dominated by women – along the entire coast. It is characterized by individual, small-scale enterprises, mostly home-based, but the products are aggregated in markets by wholesalers, also women, who take over the distribution to inland markets, up to the northern fringes of the country. There is an equally important and similar trade in the opposite direction, for processed fish from Lake Chad and some important rivers in the north. *Clarias* spp. from Lake Chad is also preferred smoked. The processing and packaging has been improved over the years, such that it has the highest shelf life among the local products and is available in the markets of the very densely populated cities of the southern region.

The major freshwater species – Tilapia, *Chrysichthys, Gymnarchus, Lates, Heterotis* – are preferred fresh, but are available fresh only at high cost. For reservoirs and lakes which

are within or close to major human settlements, markets develop around the landing sites and the product is usually disposed of within hours of landing, partly to direct consumers and partly to marketers who may preserve the fish for a few days. Most other landing sites in the inland water system are remote and facilities for preservation, other than smoking, are non-existent. The smoked product ends up in roadside markets where patronage is anything but guaranteed. The value of such smoked products vis-à-vis the fresh equivalent depends on the species and the quality of processing.

State of the inland fisheries resources

The inland fisheries resources are also highly depleted, especially the rivers, where illicit fishing practices are rife, and erosion and siltation recur annually. The reservoirs and lakes are in a better state, with various management measures being applied. Natural productivity is being enhanced by re-stocking with high quality, hatchery-produced fingerlings, and fishing effort is under some sort of control. An example here is the Nigerian-German (GTZ) Kainji Lake Fisheries Promotion Project, which has put in place a management plan for the sustainable exploitation of the fisheries resources of the lake.

Economic role of the fishing industry

For the entire artisanal coastal and inland sectors, fishing is the major source of livelihood. A total of 500,000 coastal and 200,000 inland fishers are recorded as primary producers. For such a well-integrated industry, total employment could well be five-fold. The industrial sector provides employment for about 100 000 Nigerians in various fields, such as management, engineering, vessel operation, distribution and marketing.

Output of the fishing industry is very important economically. Although less than 50% of total supply is produced locally, it accounted for 1.71% of the 38.7% contributed by Agriculture to GDP in 1997.

[§] Source: FAO World Fisheries Statistics - Country profile, 2002

MALI

General information *

Surface area:	1,240,278 km²
Population (1999):	11 039 000
GDP at purchaser's value (1999):	US$ 2.568 billion
Fisheries GDP (1999):	US$ 24.14 million
Fisheries GDP / GDP (1996):	0,94%
Water-bodies surface	20 000 km²

* Economic and demographic data from UN and World Bank sources; fisheries data from FAO World fisheries statistics (2002)

Main river and floodplains **

Niger river

Length: 3000 km

Annual catches: 5000 – 7000 t

Central delta of Niger river

Surface area: Annual permanent equivalent: 16,000 km^2
Annual catches: 55,000 – 75,000 t (1980s)
Potential yield: 75,000 – 150,000 t/yr

Senegal river
Length: 1400 km
Annual catches: 2000 t (1980s)
Main tributaries
Faleme river: 300 km
Bakoye river: 300km
Baoule river: 350 km

** Compiled from Van den Boosche and Bernacsek (1990)

Inland fisheries ***

Inland catches as % of total caches: 100%
Degree of exploitation (1987):
inland catch range : 55,000 – 100,000t
inland potential catch range : 100,000 – 200,000t
Number of fishermen: 55,000 (in 1975); 73,000 (in 1997) §

*** Source: Van den Boosche and Bernacsek (1990, Vol.2, Table 2, p.xii)
§ Source: FAO World Fisheries Statistics - Country profile, 2002

Fisheries data §

	Production	Imports	Exports	Total supply	Per caput supply
	'000 tons liveweight				kg/yr
Fish for direct human consumption	93056	900	661	93294	8.5
Fish for animal feed and other purposes	5710	-	-	1143	-

Estimated employment (1998):	
Primary sector:	73,000
Secondary sector:	260,000
Gross value of fisheries output (1999):	US$ 350 million
Trade (1999):	
Value of imports:	US$ 566 million
Value of exports:	US$ 535 million

Inland fisheries §

Fisheries overview

In Mali, the annual production is greatly dependent on the flood of the two main rivers: the Niger and the Senegal. For instance in 1969-70, where these two rivers were strongly affected by the severe Sahelian drought, the production was only 87,000 t, while in the period 1984-85 characterised by a large flood the production reached 350,000 t.

The Niger River (1700km in Mali) constitutes the main fishing zone, in particular thanks to the central delta and the numerous lakes and ponds which are flooded during the

flooding season. In good flooding years, the total flooded area may reach 30,000 km^2. Three main fishing grounds can be distinguished:

- The Niger river (and its main tributary: The Bani river) characterized by important variations in their volume of discharge between the receding and flooding periods.
- The delta floodplains which are flooded during the flooding seasons and dry out after the receding season.
- The seasonal ponds connected to the river during the flooding period.

The fishermen

The total number of fishermen is probably around 73,000 (1997). Three main categories of fishermen can be distinguished:

- The fishermen-farmers. They allocate a large part of their labour and income to agricultural activities and use fishing product to complement their subsistence economy.
- The non-migrant professional fishermen (Bozo, Somono). Fisheries activities represent an important element of their income but they are also involved in agricultural activities.
- The migrant professional fishermen who depend exclusively on fishing activities for their livelihoods.

Catches commercialization and trade

Due to the lack of infrastructure, a large part (75%) of the catches is commercialised as smoked, burned or dried fish. The production is then transported to Mopti. In 1999 the average price in Mopti was 1250 FCFA / kg (US$ 1.9 / kg). The production was used as follows :

- 3,760 tons for the domestic markets;
- 927 tons for export toward Ivory Coast (808 tons) and Burkina Faso (119 tons) for a total commercial value of 1,161,278,850 FCFA (US$ 1,772,945). The added-value is about CFA 30 billion;
- 1.143 tons for animal consumption.

At the same time, 1.891 tons of fresh fish were traded domestically and 2,6 tons were exported, at the average price of 676 FCFA/kg (US$1 /kg). The per capita consumption is still relatively low: 8.5 kg / yr.

Economic role of fisheries activities

Fishing is a very important economic activity in Mali, especially in rural areas. It concerns directly 260,000 persons, i.e. 3.6% of the rural population and it is estimated than overall more than 500,000 people are directly or indirectly dependent on this activity (including fishing gear repair or sales, fish traders, fish processors).

[§] Source: FAO World Fisheries Statistics - Country profile, 2002

SENEGAL

General information *

Surface area:	196 722 km²
Population (1996):	8,530,000
GDP at purchaser's value (1996):	US$ 4.795 billion
Gross Value of Agricultural Output (estimated 1996):	US$ 482 million
PCE per head (1996):	US$ 290

* Economic and demographic data from UN and World Bank sources; fisheries data from FAO World fisheries statistics (2002)

Main rivers

Senegal river
- Total length: 1640 km
- Length (in Senegal): 1400 km

Sine-Saloum river
- Length: 100 km
- Total annual catches: 6000 – 8000 t

Casamance river
- Length: 325 km
- Total annual catches: 12,000 – 15,000 t (1987)

Inland fisheries ***

Inland catches as % of total caches:
- 5% (1987); 23% (1999)*

Degree of exploitation (1987):
- inland catch range: 13,000 – 60,000t
- inland potential catch range: 100,000t

* Source FAO World fisheries statistics, 2002
*** Source: Van den Boosche and Bernacsek, (1990, Vol.2, Table 2, p.xii)

Fisheries data §

	Production	Imports	Exports	Total supply	Per caput supply
	'000 tons liveweight				kg/year
Fish for direct human consumption	383.2	17.0	145.0	252.0	29.9
Fish for animal feed and other purposes	53.0	-	53.0	-	-

Estimated employment (1998):	
Primary sector:	60,400 amongst whom 3,350 industrial fishermen
Secondary sector:	n.a.
Gross value of fisheries output (at ex-vessel prices):	US$ 350 million
Trade (1996):	
Value of imports:	US$ 11.3 million
Value of exports:	US$ 310.5 million

Inland fisheries §

In the 1950s, rainfall in Senegal was abundant and river floods regular. At that time, inland fisheries provided more than 80% of animal protein intake in the regions where fishery activities were taking place. During the 1970s and 1980s however, the drought and various dams built for purposes of flood control have dramatically affected the inland fisheries production. In 1996, inland fishery catches were 47,500 t.

In the inland regions far from the coast, most fish is consumed in dried and smoked form. Recently however, Dakar has become the first region for consumption of Kethiakh (smoked fish) distributed through the two main retailer markets of Thiaroye and Castor.

§ Source: FAO World Fisheries Statistics - Country profile, 2002

SIERRA LEONE

General information*

Surface area:	72 326 km²
Population (1998):	4 568 million
GDP at purchasers' value (1998):	US$ 699 million
GDP per caput (1998):	US$ 155

* Economic and demographic data from UN and World Bank sources; fisheries data from FAO World fisheries statistics (2002)

Main rivers and floodplains**

Rivers (Sewa, Jong, Little Scarcies, Rokel, and Moa rivers)

Total length (cum.): 1280 km

River floodplains

Surface (cum.): 10,000 km^2

Inland fisheries**

Inland catches as % of total catches:

30 (1987); 30 (1999)*

Degree of exploitation:

inland catch range : 16,000t (1987) - 10,000t (current)[a]

inland potential catch range : 11,000t - 14,000t[a]

[a] : including lakes, reservoirs, floodplain and rivers.

* from FAO World fisheries statistics, 2002

** Compiled from Balarin 1985 and Van den Boosche and Bernacsek (1990)

*** Source: Van den Boosche and Bernacsek (1990, Vol.2, Table 2, p.xii)

Fisheries data §

	Production	Imports	Exports	Total	Per caput

				supply	supply
	'000 tons liveweight				kg/year
Fish for direct human consumption	59 437	2 282	9 120	52 599	12.3
Fish for animal feed and other purposes	-	-	-	-	-

Estimated employment (1994):	
Primary sector:	About 80 000 - 100 000 full-time, plus additional 60 000 part time, middlemen and processors
Secondary sector:	n.a.
Gross Value of Fisheries Output (at ex-vessel prices 1998)	US$ 30 million
Trade (1998 estimated)	
Value of imports:	US$ 3.2 million
Value of exports:	US$ 13.6 million

Inland fisheries§

General overview

Sierra Leone has a dense drainage network comprising the main river systems, which empty into the Atlantic Ocean. Inland lakes also include Lake Sonfon, Lake Mape and Lake Mabesi. Species caught include mullets, catfish (*Clarias* spp.) tilapia, oysters and clams. None of these have been commercialized as the fishing methods have to be substantially improved. Everything is done at the subsistence level. Production estimates have not been worked out although a conservative estimate can be put at about 10 000 t. This sector has been severely disrupted as a result of the civil war in the country with many areas not under government control for the past five years. With the emergence of peace it can be considered a priority for development.

Utilization of the catch

In the industrial sector, the catch landed in Freetown is sold frozen, and it is also distributed frozen to consumers by traders; some of the frozen fish is thawed and processed by smoking and sold in local markets for immediate consumption, or is hard smoked and packed into baskets for transportation to the hinterland. The previous, well organized, trade in frozen fish in insulated trucks appears to be in abeyance for the time being. At the same time, the massive displacement of inhabitants has resulted in a big drop in the inland market for fish. The bulk of the catch is therefore utilized within the capital city Freetown and its environs. It is hoped that with the signing of the Lome peace accord, and with the maintenance of stability and security, the inland market will re-appear, which would kick-start fish trade once again.

State of the industry

The artisanal or small-scale fisheries sector, notwithstanding the various constraints, continues to contribute significantly to the protein intake of the population. From the limited figures available, there seems to have been a continuous drop in the gross value of the industrial fishery (export and locally-landed fish) from 1991 to 1996. Much as the artisanal fishery contributes significantly to feeding the people, the industrial fishery could contribute significantly to foreign exchange earnings.

§ Source: FAO World Fisheries Statistics - Country profile, 2002