Sustainable Livelihoods from Fluctuating Fisheries

ANNEX 4

Contributions to Malawi National Fisheries Symposium, 2001

DFID Fisheries Management Science Programme

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The full symposium proceedings are available on CD ROM from:

National Aquatic Resource Management Programme (NARMAP)
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1. Lake Malawi Fisheries Management Symposium – Programme & Participants.

TECHNICAL COOPERATION REPUBLIC OF MALAWI
FEDERAL REPUBLIC OF GERMANY

PROCEEDINGS OF THE LAKE MALAWI FISHERIES MANAGEMENT SYMPOSIUM

4TH – 9TH JUNE 2001 CAPITAL HOTEL, LILONGWE

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Department of Fisheries

NATIONAL AQUATIC RESOURCE MANAGEMENT PROGRAMME (NARMAP)

Deutsche Gesellschaft für Technische Zusammenarbeit

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* our emphasis added

2. Paper based on presentations given by project team members E.H. Allison, P.M. Mvula and F. Ellis

Fisheries management and uncertainty: the causes and consequences of variability in inland fisheries in Africa, with special reference to Malawi

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Summary

Uncertainty pervades the management of fisheries. Scientific fisheries management over the last 50 years has been based on the premise that there exists an equilibrium relationship between fish production and the level of harvest that can be taken without depleting the stocks. These equilibrium 'surplus-production' and 'yield-per-recruit' models have served to establish the principle that unregulated fishing will deplete fish stocks and dissipate economic rents from the fishery, but they have been of limited applicability for practical fisheries management when their equilibrium assumptions are violated. The influence of equilibrium models has extended beyond stock assessment into management, such that many fisheries management measures are based on a 'steady-state' view of fishery resources even when most stakeholders are aware that the assumptions are untenable.

This paper makes the case that fish production in many African inland waters is driven by climate variations. For fisheries where stocks fluctuate independently of fishing effort, management for traditional sustained-yield type objectives is inappropriate. While there have been many studies attempting to elucidate the mechanisms for environmentally-induced fishery fluctuations, there have been fewer studies of the consequences of such variability for fisherfolks' livelihoods, and for the design of appropriate fishery management regimes. A study of the livelihood strategies of fisherfolk involved in the important fisheries for small pelagic species in Lake Malawi is used to make the case for management that supports opportunistic exploitation of fluctuating resources by enabling geographical and occupational mobility. Livelihood sustainability and resource conservation are best served by support for such flexible strategies. The interdependence of fishing and other sectors of the rural economy suggests that policies and development interventions aimed at raising fishermen's incomes without addressing the wider context of rural poverty are unlikely to be successful or sustainable. Species-based fisheries management and development

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focused on the fishing enterprise would benefit from re-conceptualisation within a broader natural resource management and rural livelihoods framework.

1. INTRODUCTION

Many fisheries resources fluctuate dramatically from year to year due to climactic variability (e.g. Glantz, 1992; Bakun, 1998). There has long been widespread recognition that constant catch or constant effort approaches to management, based on the paradigm of an achievable optimum sustainable yield, are inappropriate for these types of fishery (e.g. Beddington & May, 1977; Larkin, 1977).

The problem of variability in fisheries, and consequent uncertainty in future stock size estimates can be dealt with in one of two ways. Variability can be regarded as random 'noise' that obscures underlying steady-state dynamics, or its causes and patterns can be investigated, and the results of these investigations incorporated into understanding the likely behaviour of future stock and harvest levels, without necessarily being able to predict them.

Although different fisheries are known to have very different patterns of catch series, there have been few attempts to classify fisheries according to extent and patterns of variability. Caddy & Gulland (1983) classified fisheries as steady, cyclical, irregular and occasional. This latter category denotes so called 'boom and bust' stocks that sustain important fisheries episodically before disappearing for decades or even for centuries. More recently, there have been attempts at formal statistical classifications of patterns of variation in catch or biomass time-series (Spencer & Collie, 1998) and to link patterns of variation with fish life-history parameters (Kawasaki, 1983). This work has interesting implications for fisheries management, as it suggests that different management targets may be appropriate for different fishery types.

Interpreting the different categories of fisheries in terms of the factors that could drive different patterns of variability (DeAngelis & Waterhouse, 1987) suggests that steady and cyclical fisheries are likely to be driven primarily by biotic interactions (e.g. stock-recruitment relationships and catch-effort relationships). Irregular and occasional stocks could be either chaotic systems driven by strong biotic interactions (feedbacks), or systems where biotic interactions are relatively unimportant, and abiotic factors are the main influence on stock dynamics. If the latter explanation for the dynamic behaviour of fluctuating stocks is accepted, management based on regulation of biotic interactions (e.g. the effect of harvesting effort on future stock size) is much less relevant.

This paper sets out to examine whether certain fisheries in Africa's Inland waters are strongly influenced by climatic fluctuations, such that the use of management based on standard equilibrium fishery models may be problematic. The paper then explores the fishery implications of climate-driven stock fluctuations, through analysis of fisherfolks' livelihood strategies in Malawi, derived from both primary fieldwork and published information. Finally, the paper draws out some preliminary policy and management implications of these observed livelihood strategies. These implications are framed against a context where fisheries policy and management in Malawi is undergoing a transition from centralised state-led management towards community-based or co-management (Sholtz *et al*., 1998; Allison *et al*, 2001).

2. AFRICA'S INLAND FISHERIES

Fish protein has made up approximately one fifth of the animal protein consumed in Africa since 1961 (FAO, 1996). However, the contribution from inland waters has risen from less than 25 per cent in 1951 to 41 per cent of domestic fish production in 1994. In absolute terms, inland fisheries production has soared from 250 000 tonnes in 1950 to almost 1 500 000 (FAO, 1996).

In recent years, Africa's inland fisheries have produced the majority of fish consumed in many African countries and almost all of that consumed in Mali, Chad and East Africa (Figure 1). Africa's inland fisheries are important not only as a source of food, but as a source of employment and income for resource poor families. They are exploited almost entirely by artisanal fishing communities in predominantly rural areas. In 1996 FAO estimated that the number of canoes operated by artisanal fishers in Africa's inland waters had increased by 40 per cent in the preceding decade and that most freshwater fisheries were intensively exploited.

" As fishing effort continues to respond to the growing demand for fish, proper inland fisheries management is becoming more and more urgent." (FAO, 1996: 10-36).

'Proper fisheries management' in this context has usually meant management for equilibrium production targets such as maximum sustainable yield, with measures to achieve these targets enforced by the State (e.g., for Lake Malawi, Tweddle & Magasa, 1989; FAO, 1993; GOM, 1999).

While fisheries management in Africa shows an increasing interest in community and co-management strategies (e.g. Normann, Nielsen & Sverdrup-Jensen, 1998), these approaches too, are often based on unjustified assumptions about static equilibria and livelihoods based entirely on fishing. These assumptions lead to uncritical promotion of territorial use rights in undifferentiated and idealised constructs of a 'community' united by fishing interests (Allison & Ellis, 2001). The assumption in both cases is that fish yields can be both optimised and stabilised by better management. This does not allow for the possibility that optimal strategies may be opportunistic and 'unstable' in the conventional sense.

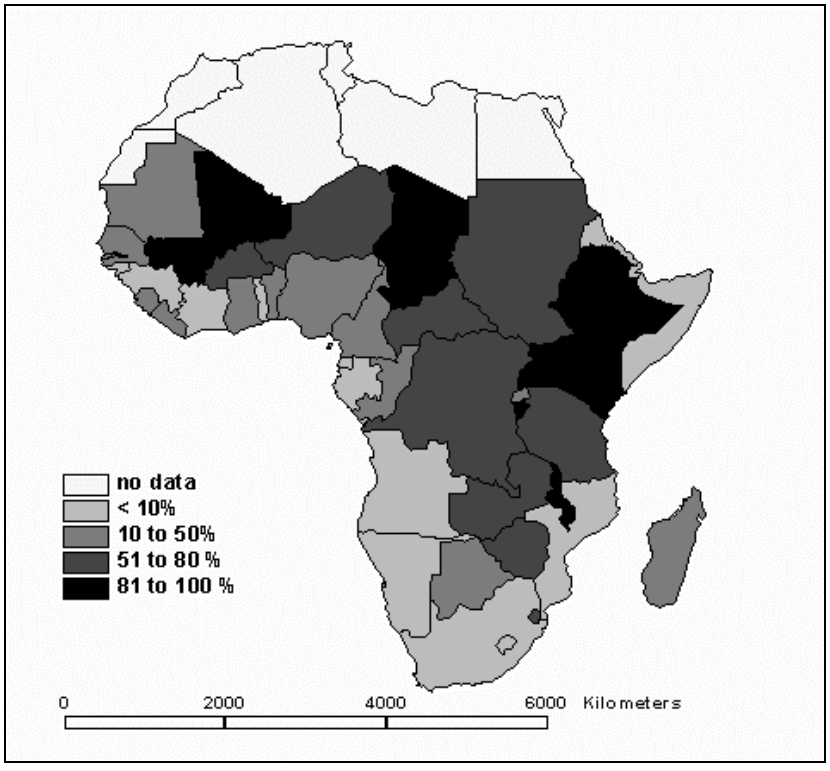


Figure 1: Inland fish production as a proportion of fish supply available per caput in sub-Saharan Africa, 1994 (Adapted from FAO, 1996).

3. CLIMATE AND FISHERY FLUCTUATIONS IN AFRICA'S INLAND WATERS

Conventional fisheries management in industrialised countries over the last 40 to 50 years has been based directly, or conceptually, on the Gordon-Shaefer bioeconomic equilibrium model and its derivatives (Figure 2). This model proposes an equilibrium between catch and fishing effort, so that fishing effort can be regulated to achieve a maximum sustainable yield (F_{MSY}), maximum economic yield (F_{MEY}) and related targets. Failure to regulate fishing effort is thought to lead to a situation where fishing effort tends towards the point where economic returns from the fishery equal the costs of exploiting the resource – the 'open access equilibrium' (F_{OAE}). If signals of resource scarcity are distorted or masked by subsidies to the fishing industry (in the forms of grants for modernising fishing technology, compensation for poor fishing seasons etc), then fishing effort can even exceed the open access equilibrium, possibly leading to stock extinction.

Although the Gordon-Shaefer model provides an elegant and persuasive overview of how a fishery bioeconomic system works, it has been extensively criticised for failing to provide the basis for successful fisheries management. There are many practical difficulties with the model: it is difficult to identify the target reference points until they have been exceeded; it is difficult to dis-aggregate the models in fisheries where one stock is fished by many fleets, or one fleet fishing many stocks; and it is based on catch and effort data that are often unreliable (Hilborn & Walters, 1992). There are also the theoretical difficulties with the equilibrium assumptions, outlined in Section 2, above. All these problems have led some to question whether the model itself, as well as the fishery management systems that are built on its basis, may not be appropriate to some fisheries - particularly those that fluctuate extensively (e.g. Sarch & Allison, 2000).

How applicable are bioeconomic equilibrium (or surplus-production) models to African Inland fisheries? Three of the most important aquatic production systems in inland Africa are shallow lakes, river floodplains, and the pelagic zones of large lakes. It is also the fisheries of these systems that undergo the most pronounced climate-induced fluctuations (Kalk, McLachlan & Howard-Williams, 1979; Plisnier, 1997; Sarch & Birkett, 2000). By contrast, fisheries based on longer-lived, larger sized fish in demersal ecosystems in many of the larger and deeper African lakes seem more likely to fit with prevailing notions of equilibrium dynamics and the conventional fish stock management approaches based on them. There is a reasonable body of evidence suggesting that fisheries are significantly impacting productivity in these latter systems (reviewed in Pitcher & Hart, 1995), which is not the case for the more variable fisheries we consider in this paper.

Malawi, and the African Lakes region more generally, contain important examples of all these types of fishery system, although river floodplain fisheries are poorly documented in the region. In this paper, we use Lake Chilwa and the pelagic fisheries of Lake Tanganyika to illustrate the possible influence of climate variability of fisheries in shallow lakes and the pelagic zones of the Great Lakes, respectively.

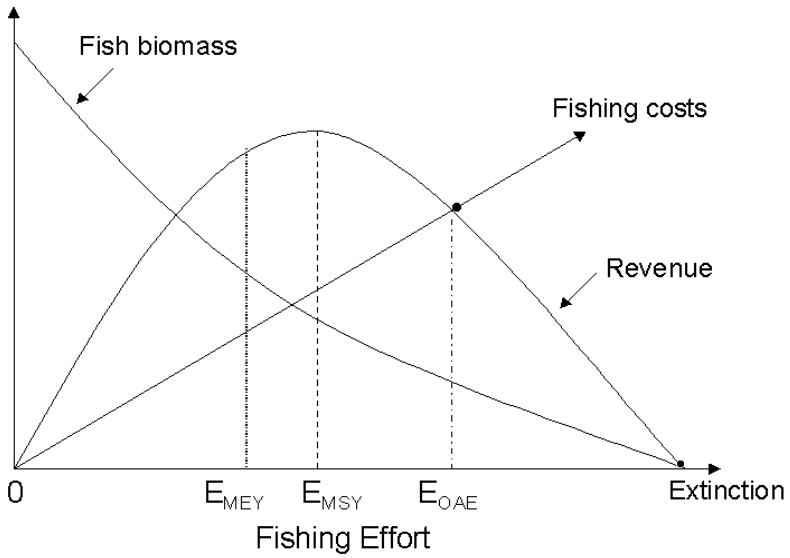


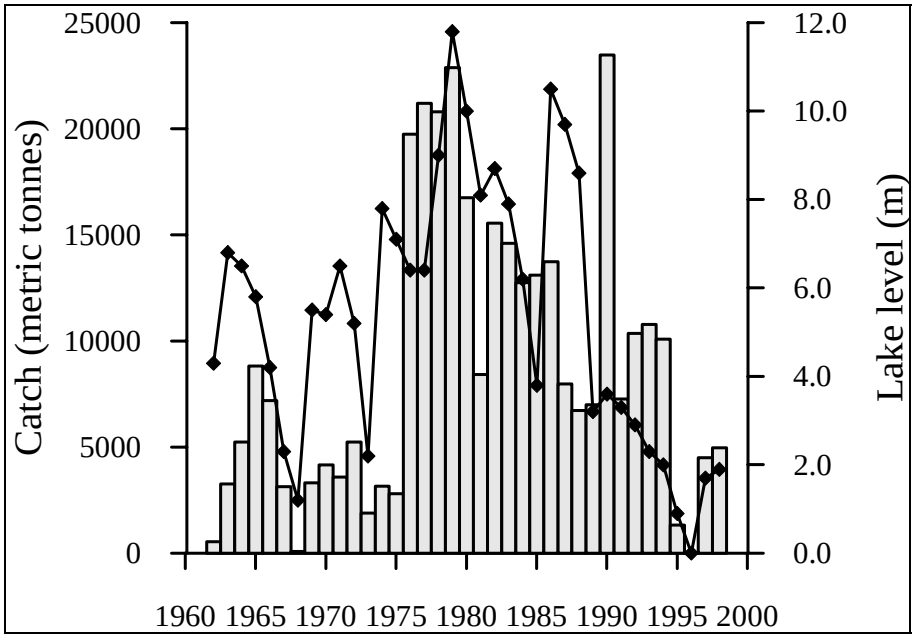
Figure 2: The Gordon-Shaefer bioeconomic equilibrium model (Gordon, 1954; Shaefer, 1954) as a basis for fisheries management.

3.1 Lake level fluctuations and fisheries at Lake Chilwa

Africa's shallow lakes are among the most productive fishery ecosystems in the tropics (Talling & Lemoalle, 1998). They are also prone to periodic lake level fluctuation, even to complete drying out in low-rainfall years. Most inland water ecosystems (with the exception of the African Great Lakes) are young, in geological and evolutionary terms, with an adaptable, resilient flora and fauna. They are, in a sense, pre-adapted to cope with a degree of human-induced change (Moss, 1992). This resilience is a feature not often emphasised in fisheries analyses, typically pre-occupied with stability as a management objective (Shepherd, 1991).

Lake Chilwa is in many ways typical of the shallower African Lakes. The Lake has recently fluctuated around 1850 km^2 including both open-water and wetland areas, is less than 3 m deep, and is subject to extreme fluctuations, including complete desiccation (Lancaster, 1979). In good years, fish catches can be as high as 25 000 tonnes (fishery statistics are rather uncertain and vary between sources) and more than 10 000 people are engaged in fishing activities. There was a major increase in fishing effort around the early 1970s, as the region became better integrated into the market economy. Minor recessions in lake level, sufficient to reduce fishing for one or two years, can be expected every six years or so (see Figure 3). Major recessions which will interfere with fishing in the open lake for 3-5 years can be expected every 60-70 years, with a possibility of an intermediate recession in 30-40 years (Lancaster, 1979). The last drying episode covered the period from late 1994 to 1996, when fishing ceased altogether. Fishing operations started again in April 1997 (GOM, 1999).

Figure 3: Catch fluctuations (shaded bars) and lake level variations in Lake Chilwa, Malawi 1962-1998. Note also that the lake gauging system was changed in 1989, and the lake level measurements from this period onwards may not be directly comparable with those in previous years (lower apparent amplitude of fluctuation) Fisheries data from Department of Fisheries, GOM (1999); Lake Level Data from Environmental Affairs Department (2000).



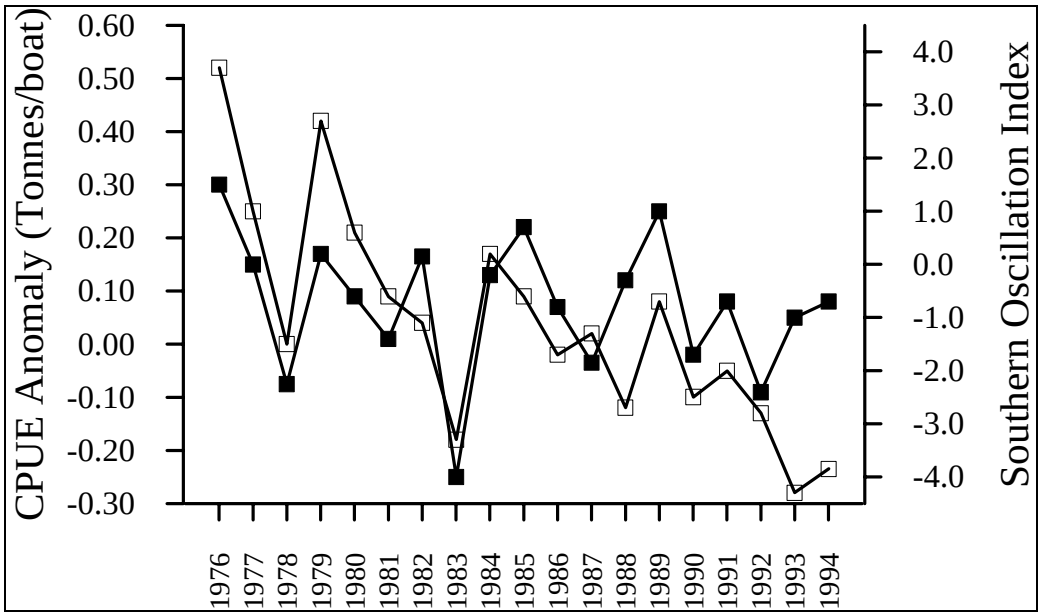
3.2 Climate and fisheries in the pelagic zones of the African Great Lakes

The fisheries for small pelagic fish in Africa's Great Lakes are among the most important on the continent, supplying dried fish (variously known as *kapenta, usipa, dagaa or omena* according to species and region) to markets throughout much of East and central/southern Africa. Anecdotal evidence, oral histories, ecosystem and environment studies and government fishery statistics all support the notion that of these small clupeids and cyprinids fluctuates extensively from year to year, in response to climate-driven variations in primary and secondary biological productivity (Tweddle & Lewis, 1990; Allison *et al.,* 1995; Plisnier, 1997).

An important study by Plisnier (1997) documents the relationship between fluctuations in stock size (measured by proxy as variations in commercial purse-seine CPUE) and the Southern Oscillation Index (Figure 4), demonstrating the important link between stock size and climate variations in pelagic fisheries. Evidence of climate-productivity links in Lake Malawi's pelagic fisheries are based on less extensive data, but imply a link between wind-stress, upwelling, and fish production (Tweddle & Lewis, 1990; Allison *et al*., 1995; Irvine *et al*., 2001).

Given the highly variable rainfall and wind regime in sub-Saharan Africa (Conway, in press) and the evidence for existence of strong climate-fish production relationships, there is case to made for fisheries research and management agencies to incorporate fish production-climate linkages in their programmes. These could provide more relevant scientific information than the current current efforts at estimating parameters for use in single-species steady-state fishery assessment models.

Figure 4: The relationship between stock abundance anomalies of small pelagic fish (clupeids) in Northern Lake Tanganyika (□), measured as the differences from the long-term average in Catch per unit of fishing effort by the Bujumbura-based industrial purse-seine fishery in Nov-Jan, and the Southern Oscillation Index or 'El Niño effect' (■) in the previous Feb-March. The correlation coefficient of 0.62 is highly significant. (Redrawn from Plisnier, 1997).



While there has been significant recent interest (if not formal research) in understanding the causes of variability in these fisheries, there has been little published work on the consequences of that variability for those involved in catching, processing, distribution, sale and consumption of fish. It is this gap in management-related research that we aim to address through work on the livelihood strategies of fisherfolk dependent on fluctuating resources.

4. THE LIVELIHOODS APPROACH AND RESEARCH METHODOLOGY

4.1 The origins of the livelihoods approach

The livelihoods approach has its origins partly in a literature concerned with understanding the differential capability of rural families to cope with crises such as droughts, floods, or plant and animal pests and diseases. This literature focuses attention on the assets of rural people, and how different patterns of asset holding (land, stock, food stores, savings etc.) can make big differences to the ability of families to withstand shocks (Swift, 1989). This set of concerns also links to the concept of vulnerability; defined as a high degree of exposure to risk, shocks and stress and proneness to food insecurity (Chambers, 1989; Davies, 1996). Vulnerability has the dual aspect of external threats to livelihood security due to risk factors such a climate, markets or sudden disaster; and internal coping capability determined by assets, food stores, support from kin or community, or government safety net policies.

The approach also borrows ideas from an ecological literature concerned with the sustainability of ecosystems or agroecological systems (Holling, 1973; Conway, 1987). Here, sustainability is defined as "the ability of a system to maintain productivity in spite of a major disturbance, such as is caused by intensive stress or a large perturbation" (Conway, 1985). The concepts of resilience and sensitivity as livelihood attributes also

originate in this context (Bayliss-Smith, 1991). Resilience refers to the ability of an ecological or livelihood system to "bounce back" from stress or shocks; while sensitivity refers to the magnitude of a system's response to an external disturbance. It follows from these ideas that the most robust livelihood system is one displaying high resilience and low sensitivity; while the most vulnerable displays low resilience and high sensitivity. These ideas are relevant to fishery-based livelihoods, as will become apparent in due course.

The concept of 'a livelihood' seeks to bring together the critical factors that affect the vulnerability or strength of individual or family survival strategies. These are thought to comprise, chiefly, the assets possessed by people, the activities in which they engage in order to generate an adequate standard of living and to satisfy other goals such as risk reduction, and the factors that facilitate or inhibit different people from gaining access to assets and activities. These considerations result in the following definition of a livelihood (Ellis, 2000, p.10):

"A livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household."

The livelihoods approach is typically set out in the form of a framework that brings together the principal components that are thought to comply with the livelihoods definition, as well as demonstrating the interactions between them. There are many different diagrammatic representations of this framework (e.g. Carney, 1998; Scoones, 1998; Reardon & Vosti, 1995). Here, the framework is summarised in tabular form (Table 1).

The reference social scope of this framework is typically considered to be the extended household, including members who are away from home but send remittances back to the resident homestead. The starting point of the framework are the assets owned, controlled, claimed, or in some other means accessed by the household (column A in Table 1). The livelihoods framework recognises five main asset categories, comprising physical capital (sometimes also called produced capital or economic capital); natural capital (land, trees, fish stocks etc); human capital (people, education and health); financial capital (savings, credit); and social capital (kinship networks, associations).

Access to both assets and activities is enabled or hindered by the policy and institutional context of livelihoods, including social relations, institutions and organisations (column B). It is also affected by external factors, sometimes referred to as the vulnerability context, comprising trends and shocks that are outside the control of the household (column C). Assets permit livelihood strategies to be constructed, and these are composed of a portfolio of activities, some of which may be natural resource based and others not so (column E). Finally, this framework points to outcomes of livelihood strategies, distinguished here between livelihood security effects and environmental sustainability effects (column F).

The livelihoods of artisanal fisherfolk are readily described by this type of framework. In this instance, key assets are fishing gears (boats and nets), although many artisanal fishers may also possess land and combine fishing with farming (Bailey & Pomeroy, 1996). The policy and institutional context of artisanal fishing includes, but is not limited to, the role of state regulations and 'community' based rules that affect access to resources. Social relations can also determine who has access to fishing opportunities (e.g. the ethnicity of fishing families may differ from other families in coastal communities, and roles within fishing activities are often strongly gender-differentiated). Fishing families are no less prone than other rural dwellers to adverse events and

trends, with natural fluctuations in fish stocks being especially critical for them. Finally, fishing families often engage in diverse activities in order to achieve livelihood security – an important attribute that we will return to in the context of fisheries management.

4.2 Fishing livelihoods research in Malawi

The livelihoods approach is utilised in many different ways, according to the goal of the study or programme. In development practice, it is being used as a 'process' tool to enable participants in development programmes to identify key constraints and opportunities for development intervention (Ashley & Carney, 1999). In this paper, we use the livelihoods approach as a conceptual tool to interpret published literature on Lake Chilwa fisheries, and as a primary research tool to understand the livelihoods of people engaged in small-scale fishing on the shores of Lake Malawi.

Livelihoods research utilises a range of existing methodologies in the social and economic sciences, and can essentially be regarded as a framework to organise these methodologies in such a way as to reduce sectoral and disciplinary biases. The research methods used for Lake Malawi include combination of qualitative and quantitative techniques.

Assets were determined at household level by administration of questionnaires drawn from survey methods used in agricultural economics. Relatively small sample-sizes were used (typically 40 households per village) to ensure that data quality was maintained and good relationships between enumerators and respondents could be fostered. The small sample sizes also meant that each questionnaire could be verified by return visits to households if necessary. Sample selection was based on stratification following wealth ranking (based on people's self-defined criteria), to ensure that poorer households are included in the research. Based on people's own definition of wealth, three categories emerged, namely (a) the well to do (*wopeza bwino*), (b) the better off (*wopeza bwinno pang'ono*) and (c) the poor (*wosauka*). The criteria depend a lot on who has what and who does not have what. The well to do, were people that had some form of capital that enabled them to engage in some productive activities like fishing and small-scale businesses. They were said to have enough food, live in good houses, own some livestock and could afford to send their children to school. The poor were said to be lacking in most things and they did not have anything to enable them to engage in profitable productive activities. They often did not have enough food and had poor housing.

Three sites were purposely selected along the shores of Lake Malawi. The sites were Msaka in the Southern Region district of Mangochi, Lifuu in Salima (Central Region) and Tukombo in Nkhata Bay (Northern Region).

A range of qualitative tools drawn from Rapid and Participatory Rural Appraisal (RRA/PRA) and institutional analysis were used to investigate how access to assets is modified by social relations, institutions and organisations. These included wealth ranking, focus groups, key informant interviews, institutional mapping and ranking of organisations' effectiveness. Trends and shocks were analysed by documenting experiences described in focus group discussions, the use of relevant secondary social and economic data and the analysis of the political and macro-economic context (Allison et al., 2001).

Table 1: A framework for micro policy analysis of rural livelihoods (modified from Ellis, 2000, p 30).

A	B	C	D	E	F
Livelihood platform	Access modified by	In context of	Resulting in	Composed of	With effects on
assets natural capital physical capital human capital financial capital social capital	***social relations*** gender class age ethnicity ***institutions*** rules & customs land and sea tenure markets in practice ***organisations*** associations NGOs local admin state agencies	***trends*** population migration technological change relative prices macro policy national econ trends world econ trends ***shocks*** storms recruitment failures diseases civil war	**Livelihood Strategies**	***NR based activities*** fishing cultivation (food) cultivation (non-food) livestock nonfarm NR ***non-NR based*** rural trade other services rural manufacture remittances other transfers	***livelihood security*** income level income stability seasonality degrees of risk ***env. sustainability*** soils & land quality water fish stocks forests biodiversity

Resultant livelihood strategies were described through analysis of income sources (including gifts, remittances and exchanges) from household questionnaires, and the decision-making processes that lead to choice or adoption of these strategies were explored at both intra-household and village-level.

Although the household questionnaires can provide only a 'snapshot' of current livelihood strategies, this was complemented by qualitative investigation of dynamic change, pursued though semi-structured interviews and focus group sessions, and through documentation of individual life-stories.

Effects of chosen, or enforced, strategies on both livelihood security and environmental sustainability were investigated through existing monitoring systems, such as district and national production statistics and indicators of poverty or well-being.

The research aims to investigate institutional factors that block or enhance people's ability to pursue a sustainable livelihood so that policy and development intervention can address these constraints and opportunities.

5. LIVELIHOODS ANALYSIS IN MALAWI – RESULTS

5.1 Lake Chilwa livelihoods

Kalk *et al.* (1979) offer an interesting insight into livelihood responses to fishery fluctuation during the 1960s and 1970s at a time of gradual transition from quasi-subsistence to a partial cash economy in this area of Malawi. This insight does not appear to have been transferred to current fishery management initiatives. The fisheries of Lake Chilwa offer an economically unstable environment, determined by the seasonal and long-term fluctuations in lake level. Yet, at high production periods, the fisheries permitted readily earned cash, with "a substantial number of men gained an income five or more times greater than that prevailing for unskilled or agricultural labour" (Chipeta, 1972). In good years, Lake Chilwa supplies almost half the total fish production in Malawi, where fish is said to supply around 70% of animal protein in the diets of 12 million people (GOM, 1999).

Fishing in Malawi is largely a business, not a subsistence activity (Ferguson *et al*., 1993). Management that constrains access to fish in productive periods constrains income-generating opportunities, denies people access to much-needed protein and serves no conservation purpose in a lake where the sustainable yield concept is obviously untenable. And yet, despite wide-spread acceptance that fisheries management, in its traditional guise of stock conservation measures, is inappropriate, there have been recent measures to introduce fishery closures to allow recovery after drying periods (even though recovery in the past has been rapid). Various gear and mesh-size restrictions have also been introduced, apparently at the behest of fishing communities around the lake, who participate in an evolving co-management scheme with the Fisheries Department (Sholtz *et al.,* 1998).

Work reviewed by Agnew (1979) and Agnew & Chipeta (1979) provide a useful baseline from which to review the likely choices available to people in the latest drying episode, and how these might have been impacted by new management initiatives. These authors summarise the short-term choices of fishermen during the lake-drying period of 1967-68 as: 1) fishing on a very much reduced scale in the remaining swamps, streams and lagoons in the Chilwa catchment, 2) transfer to nearby Lakes Malombe, Malawi or Chiuta, 3) increasing the cultivation of rice, cotton, cassava and

vegetables 4) a switch over to commercial handicrafts such as plaiting carpets, 5) spending considerable time trapping birds and digging for rodents or 6) seeking employment elsewhere. These responses varied according to income status, asset profiles, ethnicity and time of residence in the area.

In the drying episode of 1968, around 200 fishermen migrated to nearby Lake Malombe, and others moved to Lake Malawi. These were among the richest fishermen, whose investment in fishing-related assets meant that they could not simply cease fishing, as could those with a lower stake in this source of livelihood. Since the introduction of community-based management in Lake Malombe and Southern Lake Malawi (Sholtz *et al,* 1998, Chirwa, 1998), the option to move fishing operations between lakes is constrained. That this may also prevent Malombe's fishermen from migrating to Chilwa in productive years, thereby relieving pressure on this intensely exploited lake, does not appear to have been explicitly considered.

The repercussions of recession in Lake Chilwa waters and consequent decline of fishing are much wider than on fishing alone. The whole of the Chilwa plains and lake must be seen as an economic network. Not only are there links between fishing and various ancillary services, but also complementary flows of income between fishing and farming. The successful fishermen had larger gardens and produced more cash crops than other fishermen (Phipps 1973). Recognition that there is an "integrated small-scale economy of farming, fishing and cattle-rearing" (Kalk, 1979; p15) does not seem to have led to any specific policy support for these diversified livelihoods. Instead, sectoral concerns for the sustainability of individual natural resource systems have prevailed, even when it is known that notions of resource sustainability are questionable. "The Chilwa fishes are clearly well fitted to persist in the unpredictable Chilwa ecosystem, provided the refugium of swamps and streams is maintained", according to Moss, (1979, p411), with Kalk (1979, p431) adding: "Man must remain as generalised in activity as the lake fauna in order to succeed in the Chilwa area".

Moss (1979) also cautions that more dangerous than overfishing in this resilient system were threats to the swamps through 'reclamation' for agriculture or perhaps as irrigation reservoirs, siltation through changes in catchment land-management, and pesticides. It is these threats that have led to recent interest in environmental management in the Chilwa wetland, and its designation as a Ramsar site. (Environmental Affairs Department, 2000).

The EAD report reiterates the perceived resilience of the system. However, in an analysis of fisheries issues (EAD, 2000, Table 5.2), the report highlights "Ignorance, Poverty, Corruption, Migratory fishermen and Lack of Resources" as barriers to sustainable utilisation of fishery resources, and recommends the implementation of "community-based natural resource management for the benefit of the local people". There is clearly some difficulty in accepting that migration may be a legitimate and sustainable strategy to maximise benefits from a fluctuating resource, a factor that needs to be taken into account in the design of any community-based management scheme.

The mobility and livelihood flexibility of the fishing families making their living on the shores of Lake Chilwa in the 1970s enabled them to respond to the extreme fluctuations observed. These were not mere 'coping strategies', but represent active opportunism – adaptations aimed at maximising the contribution of fishing to household incomes. It is not particularly useful to talk of the fish stocks as sustainable in the context of this level of 'natural' fluctuation. Around Lake Chilwa, there are large-scale shifts from fishing to farming, pastoralism and other occupations when the lake dries out (and back to fishing when it refills). Such strategies highlight the importance of enhancing

or maintaining the flexibility of lakeshore livelihoods rather than constraining it with fixed fisheries production quotas, seasons or areas.

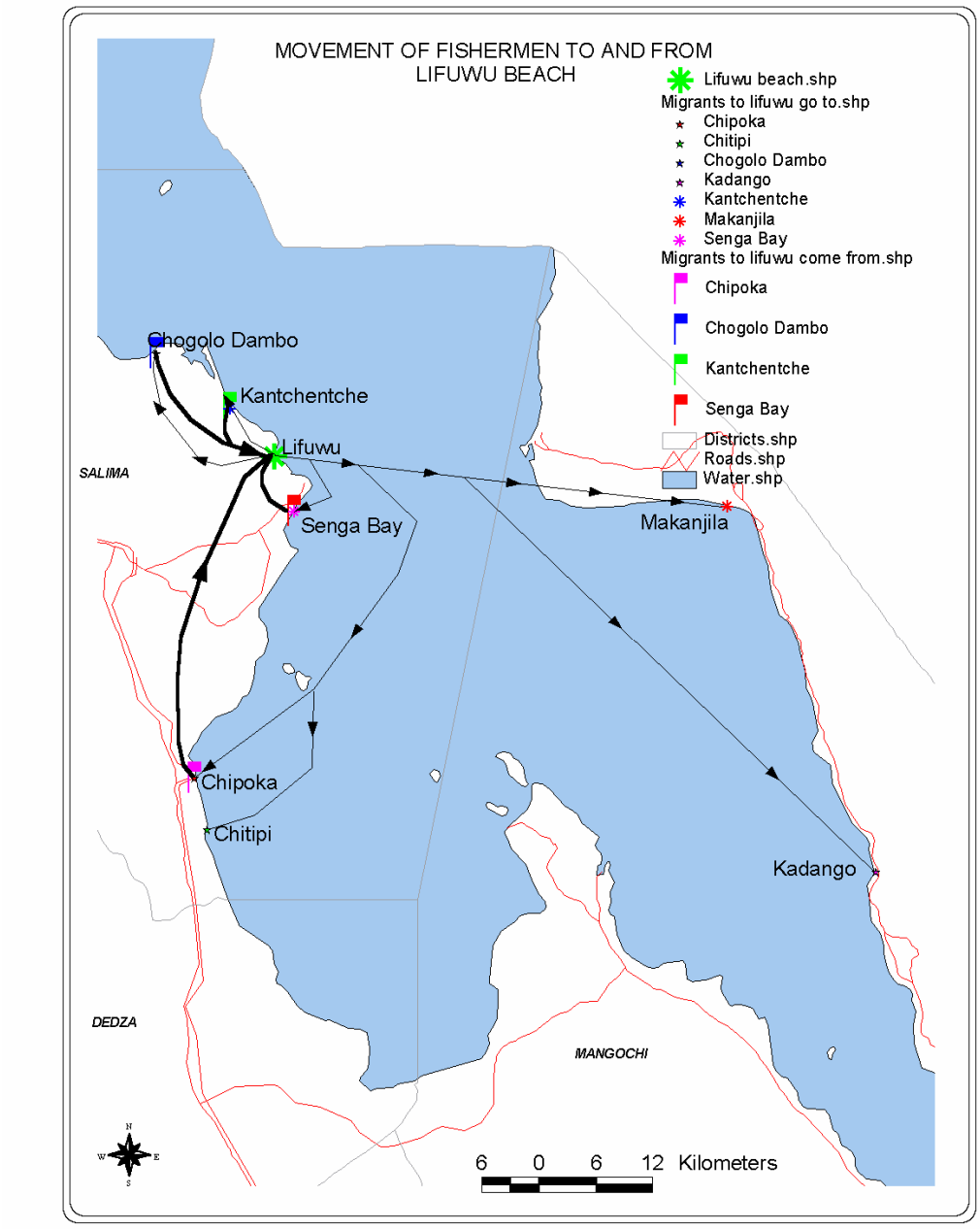
5.2. Livelihoods on the Lake Malawi shoreline

In Malawi, usipa (*Engraulicypris sardella*) is found throughout the lake, but only supports substantial fisheries in inshore areas (Thompson *et al.,* 1996; Thompson & Allison, 1997). These fisheries are mainly artisanal and carried out using chiromila seines set by two canoes or small 'plank boats'. The fishery takes place mainly at night with light attraction. There is also a substantial daytime beach-seine fishery, often for juveniles. Landings statistics are thought to be unreliable and to underestimate the true importance of the fishery, which may reach 50 000 tonnes in good years (Tweddle & Lewis, 1990). The fisheries are known to fluctuate extensively, with fishers able to identify and refer to 'good' and 'bad' years for usipa. These seem to be linked to interannual differences in productivity (Tweddle & Lewis, 1990) which in turn are generated by variations in the strength of upwelling caused by variations in wind stress (Allison *et al*., 1995).

Usipa are marketed largely in sun-dried form and, together with the small pelagic species of other African lakes, contribute significantly to dietary protein throughout Central and Southern Africa. The fishery is quite seasonal, and exploitation of 'usipa' is likely to form only part of the livelihoods of those catching it. Coupled with its interannual variability, this makes this species a useful case-study of a fluctuating fishery.

Results from the survey show that livelihood diversification and mobility are key factors enabling fishers to 'track' resource fluctuations in time and space. People along the Lake diversify in a number of activities including fishing, farming and different types of small-scale businesses.

This type of movement has been adapted for sometime by fishers tracking a 'fluctuating resource'. In the case of the usipa this has led to the establishment of special relations with people in different beaches. There are two types of movements on Lake Malawi, either long-term or short term. Long-term movement refers to fishers that have moved from their original homes and have established a permanent camp elsewhere. These often do not have access to land and thus rely solely on fish and to some extent small-scale business. With short-term movement fishers move in search of fish but operate from their original homes, only establishing temporary camps. Maintaining access to land, they are able to return to farming during poor fishing periods. The map below shows the movement of fishers around Lifuu beach in Salima District.



These strategies are well established and accepted around the Lake shore villages, where migrant fishers are seldom regarded as problematic, but are rather seen to bring benefits in the form of increased trade and economic activity in lake shore villages. Reciprocal access to fishing 'beaches' for landing catch and mending nets etc., may be more important to fishing-dependent communities than claims for territorial exclusivity of the type encouraged by efforts to promote community-based management (e.g. Sholtz *et al,* 1998). Such studies are urgently required around the other African Great Lakes, if the laudable move towards co-management is to develop models for fishery management that reinforce sustainable livelihood strategies. There is a danger that the idealised concepts of village-owned fishing grounds currently being promoted don't fit with the ecology of the fish or the livelihoods of the fishers.

6. DISCUSSION

The evidence for climate-induced fluctuations in the fisheries of shallow lakes, and for small pelagic fish in the African Great Lakes indicate that the management of these stocks needs to be informed by an understanding of how fishers, distribution chains and markets cope with fluctuating supplies. Most research on fluctuating stocks has been targeted at understanding in detail the mechanisms *causing* fluctuation in stock size. This is the study of fish recruitment processes and the environmental factors driving them (e.g. Cushing, 1996). There has been much less emphasis on the study of the *responses* of fishers to stock size fluctuations (Allison & Ellis, 2001).

Review of secondary data from the Lake Chilwa area, and preliminary analysis of primary fieldwork on the shores of Lake Malawi both reveal the importance of livelihood diversity and geographical mobility as livelihood strategies of artisanal fisherfolk. Mobility and diversity are required to sustain livelihoods when confronted with resource variability that is at least partially climate-induced. The Lake Chilwa case demonstrates that livelihood coping and optimisation strategies existed prior to introduction of both State-led and co- management systems. More recent information on the impact of fisheries management measures on livelihoods is lacking, but is currently being pursued by our research team.

The results of our research in Malawi are in accord with findings in other developing countries, where several studies have suggested that fishers cope with fluctuations through geographical and occupational mobility (Bailey, 1982; Haakonsen, 1992; Geheb & Binns, 1997; Sarch & Allison, 2000; Béné *et al*, 2000). Fisheries management strategies which focus on optimal catch rates ignore both the role which inland fisheries play in the livelihoods of many Africans and the inherent stock fluctuations which have shaped such livelihood strategies.

Proposals to manage fluctuating fisheries need to be based on a better understanding of fisherfolk's livelihood strategies. In fisheries where exploitation has little demonstrable impact on fish stocks, and productivity is closely linked with climate, it is not useful to talk about sustainable yields, or of fixed limits for fishing effort. Neither are community-based or co-managed territorial use rights, in the form of geographically fixed territories, useful for fisheries management in areas where lake or floodplain levels are highly variable, or where fishers have to track mobile pelagic resources to sustain their catch rates.

In Malawi, realisation of the importance of fisherfolk's mobility is leading to a move away from management based on beach village committees (Sholtz *et al*., 1998), towards larger spatial scales – lake management areas defined in terms of movements of range of operations of artisanal fishers, and on ecological criteria (Weyl, personal communication, 2001). The mechanisms for governance of these lake spaces are still being discussed.

It is relatively straightforward to outline what management approaches should not be taken, less easy to identify appropriate management support for sustainable livelihoods from fluctuating fisheries. While removing unnecessary impediments to sustainable opportunistic exploitation strategies is one important step, it may not be enough, given the increasing pressures on resources and livelihoods in Africa. Common property institutions that have evolved mechanisms, such as reciprocal access agreements between migrants, should be considered more appropriate than territory-based approaches as a way of implementing any effort-limitations deemed necessary. Even when embryonic and of limited functionality for resource conservation, such as in

Malawi, such institutions can be built upon, rather than replaced by externally-conceived 'perfect' ones.

Formal recognition, in national policy and legislation, of the legitimacy of opportunistic livelihood strategies, coupled with active removal of barriers to mobility and livelihood diversification would seem to be appropriate policy responses at national or district level. Active support for livelihood diversification (not the same as providing incentives for people to diversify out of fishing altogether) is another management option.

The apparently greater importance of climate, relative to fishing, in driving the dynamics of fish stocks in many of Africa's shallower wetlands (Sarch & Allison, 2000) also suggests that effort could be redirected at protecting wetland functions and broader ecosystem integrity and away from trying to manage fish stocks for sustainability. Management needs to lose its preoccupation with stability and gain an increased appreciation of resilience.

'Modern' fisheries management has often consisted of setting stock conservation objectives, and then finding means of modifying fishers' behaviour or investment to fit these objectives (Mahon, 1997). This has usually meant imposing closed seasons, closed areas, size limits, gear restrictions, access or 'fishing effort' restrictions. While there has been concern for the effects of different regulatory options on fishing communities, there has usually been little systematic research on their effects on fishers livelihoods. Fisheries management is becoming more consultative, and fishing communities now have greater participation in management, sometimes through co-management arrangements (Pomeroy & Berkes, 1997). There is still little systematic discussion of the effects of different management options on livelihoods. There is a requirement for both participatory research to help to identify acceptable management solutions to fishery problems, and further studies of livelihoods to understand how fishers cope with and react to both inherent fluctuations and changing externalities.

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3. Draft Workshop Reports on fisheries research, management and development in Malawi

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LAKE MALAWI FISHERIES MANAGEMENT SYMPOSIUM

WORKSHOP REPORTS

LILONGWE

5TH – 9TH JUNE 2001

Department of Fisheries

NATIONAL AQUATIC RESOURCE MANAGEMENT PROGRAMME (NARMAP)

Deutsche Gesellschaft für Technische Zusammenarbeit

Improving co-operation, co-ordination and communication between research institutions in Malawi.
Workshop Session I (Tuesday 5 June 2001)

Pre-amble
The development of realistic and robust management procedures for Malawi's fisheries requires a knowledge of the biology and population dynamics of the resources harvested, an understanding of the fisheries that harvest the resource and the social and economic factors which drive the fishery. Research in all these fields was, is and will be undertaken in Malawi by a variety of players including government departments, academic institutions and visiting scientists. To ensure that research findings are applied in the management of Malawi's natural resources there is a need to improve co-ordination, co-ordination and communication between research institutions in Malawi.

Purpose of the workshop
Initiate a repertoire between different research institutions,
Define the responsibilities of the various institutions and researchers for the creation of a transparent system of initiating and performing fisheries related research in Malawi.
Develop a consensus among the different stakeholders on who should co-ordinate such research.

Outcomes
A brief summary of the co-ordination and co-operation problems within Malawi fisheries and aquatic research was presented to the workshop participants. These were discussed and it was unanimously agreed that there was a need to establish some sort of forum with the capacity to play a meaningful role to improve communication and co-operation between all stakeholders.

Two possible structures were presented to the workshop participants; a Government driven inter-institutional fisheries and aquatic research coordinating committee or a stakeholder driven forum. There was general consensus that a stakeholder driven initiative (in the form of a Forum) is preferable to one driven by Government.

Points raised during the discussion (summarised by Jacqueline Chisambo)

- A major advantage with the stakeholder initiative is that the stakeholders can contribute towards their membership hence the initiative can be assured of some sort of funding and sustainability as compared to the government initiative seeing that the FD sometimes works under severe constraints.
- It should be remembered that the Fisheries department (FD) of Malawi, Tanzania and Mozambique are as much a stakeholder as the others.
- For the list of stakeholders, the user group should also be included. It was agreed that representatives from the commercial as well as artisanal fisheries sectors should be included in the steering committee.
- The information gathered through this forum should be disseminated through a newsletter or news flash to keep all concerned parties updated.
- There needs to be a link established between research and extension. This forum should play a role in ensuring that scientific information is disseminated in a user-friendly format for the Manager and user. It will also need to look at the feedback from communities so that research is demand driven. This will also utilise local or indigenous knowledge.
- The view of the National Research Council of Malawi (NRCM) is that the FD should develop its own research appraisal and monitoring committee involving various stakeholders. The NRCM already has guidelines and procedures that should be taken as 'umbrella' guidelines. The Fisheries sector however is free to add some more guidelines if it wishes to do so as long as the guidelines do not deviate form the 'umbrella' guidelines of the NRCM.
- All stakeholders will be expected to contribute equal amounts of money irrespective of project size otherwise there would be the risk of some stakeholders contributing more than others thus having more influence in driving the forum than others.
- The emphasis of such a forum will be to co-ordinate research efforts which is entirely different from attempting to give it a mandate or legal authority to decide on management matters. This forum will not be taking over the role of the government but should be looked at as an informal group mainly dealing with dissemination of information as well as playing a role in assessing

various project proposals. This group can work hand in hand with the FD and the Fisheries advisory board (FAB).

Proposal for the establishment of Network for Fisheries and Aquatic Research
Malawi has a long and proud tradition of fisheries, aquatic and environmental research. This research has largely been in the form of joint ventures between the Government of Malawi and donor countries and or organisations, Universities and individual researchers. The diverse amalgam of specialist participants and stakeholders each with their own research agendas and restricted timeframes has resulted in a loss of co-ordination, communication and co-operation. The net effect of this has been:

- Uncoordinated research efforts
- Duplication of research effort
- Waste of scarce financial resources
- Poor management decision support

To address the problem it is proposed to establish a network of all stakeholders.

Proposed name
Network for Fisheries and Aquatic Research (NETFISHAR)

Aim of the Network
The overarching aim of the Network is the dissemination of information to its members and the general public. In other words the "currency" of the Network is information. This will be achieved through communication and co-operation between stakeholders, which will have the effect of improved co-ordination and co-operation between and among stakeholders, cost effective research, curtail duplication of research and enhanced management decision support. The network is apolitical and entirely stakeholder driven.

Structure of the NETFISHAR
The Network should consist of a Forum and a Steering Committee for which a constitution needs to be drawn up (A copy of a successful Research Network, which will have to be adapted for the Lake Malawi / Nyassa, Forum will be sent to Mr. Peter Jarchau of NARMAP). All stakeholders, including statutory departments, donor funded research and development projects, tertiary institutions and individuals, who are engaged in Fisheries and Aquatic research, development and management on Lake Malawi / Nyassa should be invited to become members of the Forum (see Appendix 1 for a list of potential stakeholders). The idea is to have the Network as inclusive as possible (but see section on Finances).

The Steering Committee of the Network is an elected body with a predetermined number of representatives. I would suggest that the steering committee consist of a maximum of nine (9) members, including a Chair, a deputy chair, secretary, treasurer and an elected body of five (5) members. All members are elected by the Forum. The Chair of the Steering Committee should not be a representative of a statutory body. The duration of tenure on the steering committee should e limited to a period of 2 years with overlap between the chair and other members. The Steering
Committee will be responsible for organising a two yearly fisheries and aquatic science symposium. The Steering Committee will be required to source donor funding and sponsorship for the symposium.

Operation of the Forum and the Steering Committee
The Forum is a body consisting of member organisations. The Forum should convene an annual meeting for one day, at which each stakeholder presents a summary of activities, new projects and progress in a collegial and casual, though professional, manner. The Forum meeting should be attended by as many employees / members of each stakeholder organisation as possible.
The Steering Committee should meet, at least, on a quarterly basis or whenever necessary. The Steering Committee should be responsible for the production of a biannual newsletter in which information is disseminated to all members (individual or institutional).

Legality of the Network
The proposed Network should be an independent body with its own constitution. Pivotal to its success is its apolitical nature, which should guarantee that the Network is not "hijacked" by any individual member, thus guaranteeing the free flow of information between member organisations. The end effect of this structure should be that no single member feels threatened in any way by other members. It would be

advisable to perhaps develop the constitution of the Network within the framework of the Code of Conduct developed by the National Research Council.

Relationship between the Network and the Departments of Fisheries (Malawi, Tanzania & Mozambique)
The Steering Committee of the Network must develop a good working relationship with the Departments of Fisheries of the 3 countries. The Departments (as members of the Forum) should commit to use the Network, through the Steering Committee, to act as a sounding board (if it so wishes) to assess the quality of research proposals and or projects, consider management proposals and the implementation thereof. Given that the Steering Committee will have an intimate working knowledge of all projects it can also advise the Department on duplication of research efforts and funding and in so doing contribute towards cost effective research and management of aquatic resources. Implicit in al this must be the understanding that the Network does not have any powers to force the Departments to accept any of its recommendations. Similarly, the Fisheries Advisory Board could use the Steering Committee of the NETFISHAR as a sounding board to consider management options, although the advisory board need not necessarily accept the suggestions of the Steering Committee.

Finances

The Network is to be financed by the stakeholder member institutions or individuals. It is suggested that a differential fee structure be developed, e.g. Institutional, company, community and individual membership. A budget will have to be drawn up to cater for quarterly meetings of the Steering Committee, secretarial costs such as production and mailing of a half-yearly newsletter. All other services to the Network should be on a voluntary basis, in return for which all members will be provided with information. The operation of the Network will incur costs and these have to be recovered. All members will therefore have to pay their fees, though as suggested above these could be staggered.

Kick-off

To make the NETFISHAR work it is necessary for a champion to come forward and drive the initiative in a participatory manner. It is suggested that NARMAP plays a lead role in the establishment of the Network, by first gauging the interest of potential members by way of a survey and then to take the initiative in collaboration with enthusiastic partners to drive the process. The success of the NETFISHAR could be a major feather in the cap of NARMAP/GTZ as it will have provided the foundation upon which collaborative research can take place in Malawi for the first time.

Potential members of NETFISHAR

(The list of possible stakeholders is by no means complete and should be amended to be inclusive of all stakeholders)

Department of Fisheries (Malawi)
Department of Fisheries (Mozambique)
Department of Fisheries (Tanzania)
Tanzanian Fisheries Research Institute (TAFIRI)
Department of Parks and Wildlife (Malawi)
National Research Council Malawi
NARMAP
SADC / GEF Biodiversity project
DANIDA Coastal Zone Management Project
EU Fisheries Project
ICLARM
BZDP
Fishermen's Association of Malawi and all recognised user groups
JICA Fisheries and aquaculture project
The University of Malawi (Chancellor and Bunda College)
All Universities who have research interests in the Lake
All private individuals who have a research, management and development interest in the Lake.

The role of Livelihoods research in Malawi.

Workshop Session II (Wednesday 6th June)

Introduction

This workshop followed presentations by Dr Edward Allison, Professor Frank Ellis and Mr Peter Mvula on the livelihood strategies of people dependent of the fluctuating fishery resources of Lake Malawi[1]. The workshop was essentially a panel[2] discussion session based on the previous presentations.

The research examined how small-scale fisherfolk adapt to fluctuations in the natural resource base, and used an analysis of their household livelihood strategies to examine appropriate management and development interventions aimed at poverty reduction and resource conservation. While focused on fisheries, the research has wider applicability to the role of common property resources in sustaining rural livelihoods in Malawi and to problems of appropriate management of such resources.

The following report is a compilation of comments to the panel during the discussion session. Comments during the panel discussion fell in three categories, namely, Community based resource management, livelihoods and indigenous knowledge.

Community based resource management

- There is need to define community
- For effective resource management, there is need of an 'assemblage' of different stakeholders sharing a common resource.
- Land-based and lake-based communities need to be differentiated.
- It was noted that the implementation of community-based management departed from traditional management systems, which mainly deal with controlling access to a resource.
- For resource management, it is advisable to build upon systems already in place in the communities and work from there.
- Community based resource management should take into account various sectors within the fishery including small-scale business & Farming.
- There is positive interaction between migrant fishers and communities
- Different types of fisheries need different management.
- Should the Department of Fisheries privatise extension and/or enforcement?.

Livelihood issues

- Regarding diversification at household level - how do the different sources of livelihood boost each other?
- What alternatives are there?
- the division of labour at the household level needs to be taken into consideration when assessing livelihoods.
- The absence of rural financial services should be considered at policy level.
- Fishermen do not save even if they make lots of money

Indigenous knowledge

- Fishermen know where the fish are.
- There are information systems among fishermen.

[1]The paper entitled: "Fisheries management and uncertainty: the causes and consequences of variability in inland fisheries in Africa, with special reference to Malawi", is published in the proceedings of the Lake Malawi Fisheries Management Symposium.

[2] The panel consisted of Dr Edward Allison, Professor Frank Ellis and Mr Peter Mvula. The session was chaired by Dr W. Chirwa of the Center for Social Research., Zomba.

Management priorities for Lake Malawi/Malombe.
Workshop session III (Thursday 7June 2001)

Introduction
The aim of the workshop session was to determine Management priorities for Lake Malawi's and Malombe's fisheries and to attempt to identify key problem areas with the management of the Lake Malawi/Malombe system. The workshop was run in plenary discussion and information was captured on pin boards. This information was coallated into problem trees of causes and effects of ecosystem degradation and low fish catches, a flow diagram for Implementation Strategies and a list of opportunities in the fisheries sector. While the information gathered during the workshop is by no means comprehensive, the information presented here should serve as a point for future discussion and planning.

Causes and Effects-Problem trees
Major problems in fisheries in the Lake Malawi/Malombe system were seen as ecosystem degradation and low levels of some fish stocks, which lead to low catches and ultimately poverty and hunger. Two problem trees were developed with the workshop participants. The first problem tree (Figure 1) shows the causes and effects of Ecosystem degradation; and the second shows the causes and effects of low catches in the fishery (Figure 2).

Implementation strategies
A flow diagram for Implementation Strategies was also developed (Figure 3). The workshop proposed that the objectives for management of the Lake Malawi/Malombe complex should be:

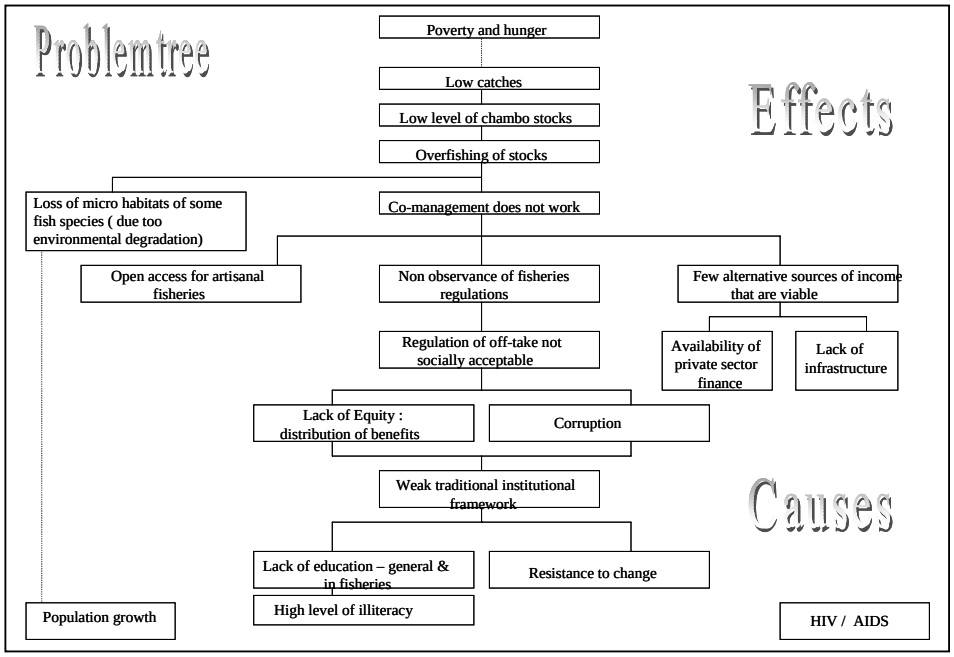
- To maximise social benefits, economic benefits and food production.

The guiding principles for Implementation Strategies were to be:

- The maintenance of biodiversity and ecosystem functions.
- The sustainable utilisation of the fisheries resources.

It was noted that past research programmes made little reference to future implementation of recommendations. The strategy for effort limitation was also seen as a high priority.

Opportunities
A number of opportunities within the fisheries sector were identified by the group. Theopportunities listed during the workshop are shown in Figure 3.



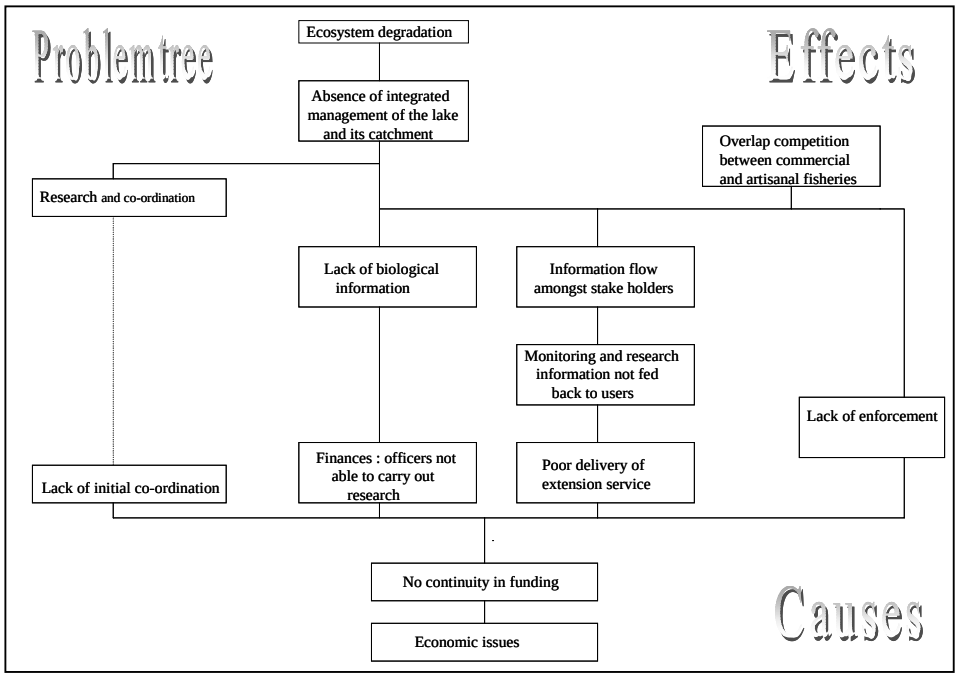


Figure 1. Causes and Effects of resource over utilisation as defined by a workshop session during the Lake Malawi Fisheries Management Symposium.

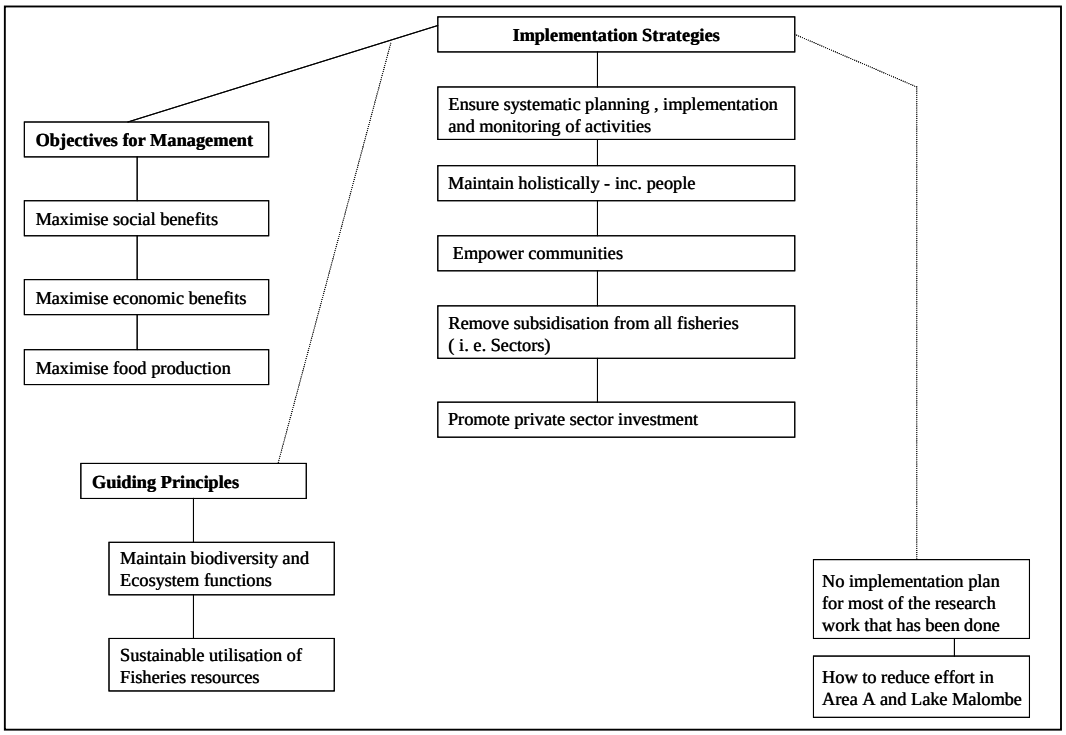


Figure 2. Considerations for Implementation Strategies for management measures in the fisheries sector in Lake Malawi/Malombe.

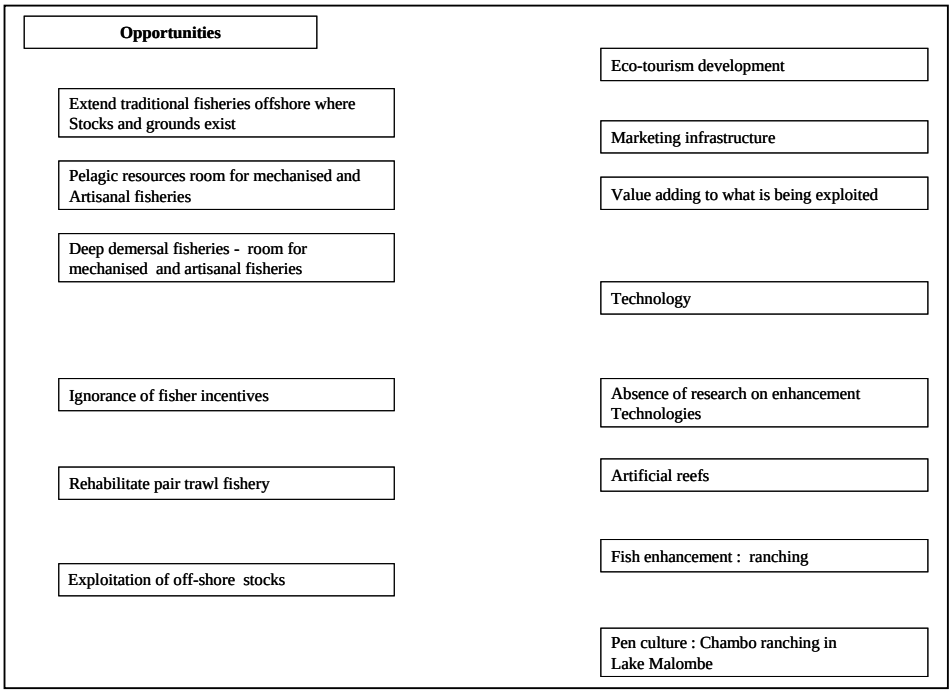


Figure 3. Opportunities listed for fisheries in Lakes Malawi and Malombe.

Identification of research gaps and research priorities for the formulation of management guidelines for the Lake Malawi/Malombe system
Workshop session IV, Friday 8th June 8th

Introduction
The purpose of this workshop session was to highlight research gaps that constrain the management of the fisheries in the Lake Malawi/Malombe complex. While it was not possible to fully describe and prioritise research activities during the workshop session, observations on lacking information and key questions were highlighted. The following list is by no means exhaustive and should serve as a guideline for future research.

Dissemination of Research
- The dissemination of research results to the fishing community can at best be described as weak if not non existent.
- The development of mechanisms and tools for the rapid dissemination of such results is seen as a high priority.

Social Research
The paucity of knowledge on the social aspects governing the behaviour of the fishing community was regarded as a severe 'bottleneck' in the implementation of management measures in the fishery. To facilitate the management of the fishery a number of key questions need to be addressed by social research in the near future. Key questions were:

- What factors control the behaviour of the fisher on lake Malawi (i.e. migration, resource shifting)?
- Whom is the fishing community utilising the various fish stocks (i.e. migrants vs. residents)?
- How can the acceptance of regulations be improved in the fishing community?
- How can management interventions best be implemented in the Malawian context?
- How should management advice be relayed to resource managers and communities?
- What are socially acceptable management interventions in Malawi (i.e. closed seasons, gear limitations, accesss limitations, sanctuary areas).
- What is the legal framework governing access rights to fishing resources?
- What is the community structure in lakeshore villages.
- What are the main sources of conflict between fishing sectors that constrain management?

Fisheries
The maintenance of regular monitoring activities by the DoF were seen as vital. These monitoring activities include:

- Monitoring of commercial trawl catches.
- Regular independent monitoring trawl surveys by the FRU.
- Catch and effort monitoring of the small-scale fisheries.
- Research on the exploitation strategies for under-exploited deepwater and pelagic stocks was considered a high priority. Key questions were:
- How can the deepwater and pelagic stocks be exploited by the small scale fisheries sector?
- Why are these stocks not exploited by the commercial/ small scale sector?
- What are the constraints towards developing fisheries for these stocks?
- The qualification of various stocks was seen as a high priority. Key questions were:
- What is a stock of fish in Lake Malawi, taking into account the highly diverse ichthyofauna?
- What species/groups of species form lake-wide single stocks and which form localised stocks?
- What is the state of these stocks in the lake and in localised areas?
- Is area specific management feasible?
- The characterisation of the various fishing sectors and the defionition of their utilisation patterns.
- The definition of resource utilisation by all sectors is vital (i.e. inshore and off shore fisheries).
- Sub-sectors within the small scale fisheries need to be clearly defined.
- What are the utilisation patterns of the various gears used in the fishery and were are the utilisation overlaps?

- The paucity of data on the biology and population structure of many of the target species in the fishery constrains the use of analytical fisheries management models.

Economics

- Information of the market system is lacking both on local and regional levels.
- The economics of the small scale and large scale fishery are not documented.
- The economic forces driving the small-scale fisheries are not understood.
- The use and flow of capital gained from fishing is not understood at community level.
- The economic benefits of fishing to the local non-fishing community is not understood.

Mbuna

- It was suggested that research on the Mbuna should not be a high priority of the FRU. Since there is a high level of independent research interest in this species group, work by independent researchers on stock assessments, biology, life history and evolution should be facilitated by the DoF.
- Mechanisms need to be developed for the dissemination of research findings from such independent research to the DoF for the formulation of management plans for this stock.

Taxonomy

- Taxonomic research was considered as a vital component of fisheries management.
- Taxonomic research should be supported by the DoF at both institutional and independent researcher level.
- The development of a standard identification/field guide for the fishes of Lake Malawi is seen as a high priority.