No. 1

Japan International Cooperation Agency

Republic of Malawi
Ministry of Mines, Natural Resources and Environment
Department of Fisheries

The Master Plan Study on Aquaculture Development in Malawi

Main Report

National Aquaculture Strategic Plan (NASP) 2006-2015

July 2005

SSC System Science Consultants Inc.

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Master Plan Study Outputs

The outputs of “the Master Plan Study on Aquaculture Development in Malawi” consists of the following,

1. Summary (Japanese version)
2. Main Report -National Aquaculture Strategic Plan (NASP) 2006-2015-
3. ADiM Working papers
4. Aquaculture database (CD1 and 2)
5. NASP profile
6. Photograph collection

Preface

In response to a request from the Government of Malawi, the Government of Japan decided to conduct the Master Plan Study on Aquaculture Development in Malawi and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. YAMAMOTO Sachio of System Science Consultants Inc. and consists of System Science Consultants Inc. between January 2003 and June 2005.

The team held discussions with the officials concerned of the Government of Malawi and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Malawi for their close cooperation extended to the study.

July 2005

KITAHARA Etsuo
Vice President
Japan International Cooperation Agency

July 2005

Ms. Sadako OGATA
The President of
Japan International Cooperation Agency
Tokyo, JAPAN

Letter of Transmittal

Dear Madam,

We are pleased to submit to you the report for "The Master Plan Study on Aquaculture Development in Malawi". This report presents the result of all work performed in both Malawi and Japan over 32 month period from January 2003 to August 2005.

In Malawi, over 60 percent of the peoples are living under the poverty lines and most of them are rural farmers. The aquaculture sector has large potential to contribute to the life of these peoples through diversifying farm production and generating incomes. Regarding to food security, production from fish farming a still small but significant importance in supply of animal protein to the people complementing capture fisheries that can not satisfy the fish demands near future. This Plan provided aquaculture development strategies and action plan as a road map of the sector. Implementation of the Action Plan will contribute to reduce the poverty and hunger through the improvement of the food security and livelihood of rural community.

We wish to express our deep appreciation and sincere gratitude to the officials concerned of your Agency, the Ministry of Foreign Affairs, and the Ministry of Agriculture, Forestry and Fisheries of the Government of Japan for the courtesies and cooperation kindly extended to our team. We additionally inform you that we had sincere cooperation from our counterparts of the Department of Fisheries, the Ministry of Mines, Natural Resources and Environment of the Government of Malawi. The opportunity to work with farmers and dedicated efforts of all concerned, particularly Bunda College of University of Malawi, World Vision Malawi, who were our important partner, are also gratefully acknowledged. We also express our hearty gratitude to the officials concerned from JICA Malawi Office, the Embassy of Japan in Zambia for the close cooperation and various form of assistance extended to our team during field investigations and studies in Malawi.

Very truly yours,

YAMAMOTO Sachio
Project Manager
Master Plan Study on Aquaculture Development in Malawi
System Science Consultants Inc.

MAP OF MALAWI

Photographs 1 - Fishes of Malawi -

Cultured Fish Species 1

Two indigenous tilapiine species, *O. shiranus* (left) and *T.rendalli* (right) are the predominant aquaculture species in Malawi. The species are well adapted for pond conditions. Because of inadequate nutrition their growth is slow and productivity remains low.

Oreochromis shiranus

Tilapia rendalli

Cultured Fish Species 2

O. karongae (left) and *Clarias* catfish (right) are common on the market but presently they are peripheral aquaculture species. These species grow bigger than *O. shiranus* and *T. rendalli*. Farmers are keen to culture both species but fingerlings are in short supply.

Oreochromis karongae

Clarias gariepinus

Exotic Fish Species

To protect the biodiversity of Lake Malawi, the farming of exotic fish species is prohibited. Common carp (left) was introduced in the 1970s and still remains in the country, mainly for research purpose. Nile tilapia (right) are is farmed in neighbouring countries.

Cyprinus carpio

Oreochromis niloticus

Lake Fish

The Lake Malawi fish fauna is unique and provides the bulk of animal protein consumed in Malawi. The government has initiated a programme to develop the farming technologies for indigenous species, but success has eluded the attempts so far.

***Barbus* species**

Mbuna cichlids of the Lake

Photographs 2 - The aquaculture scene -

Rural aquaculture

It is estimated that there are about 4,000 small-scale fish farmers in Malawi. A typical farmer has one or two small pond and harvests about 13 kg of fish per annum. Ponds are normally constructed by family members and sometimes with help of hired labour.

The majority of farmers use maize bran as feed and green compost for pond manuring. Partial harvesting is the norm and many farmers do not harvest their ponds on an annual basis. Only 3 % of fish farmers owned a seine net.

Nevertheless, the current outputs from fish farming form an important part of household livelihoods and provide an additional option for spreading risk and increasing the overall value of the farming system.

Fish pond

Pond-farm irrigation

Pond Construction

Fish farmer and fish

Commercial aquaculture

Two carefully planned middle/large-scale fish farms have started in 2004, viz. Chambo cage culture in Lake Malawi (MALDECO Fish Farm) and semi-intensive pond culture in the Lower Shire valley (G.K. Aquafarm). MALDECO Fish Farm used *O. karongae* and G.K. Aquafarm use common carp and *O. mossambicus*.

Though still in the nascent phase, these farms are making excellent progress and at full-scale production will produce over 3,000 mt per annum.

Cage culture -MALDECO-

Large scale pond -Kasinthula-

Concrete fish tanks -MALDECO-

Harvesting of fish -Kasinthula-

Photographs 3 - Capture Fisheries and Marketing -

Capture Fisheries

Since 1976, the total fish supply has fluctuated between 40,000 and 76,000 mt with no definite trend. Lake Malawi is the most important contributor (57%) to the annual fish supply. Fish supply from capture fisheries was estimated at 56,000 mt in 2000. Total fish yield has remained fairly static since then and despite fish imports (1,630 mt in 2000) and a limited contribution from aquaculture sub-sector, per capita supply fell from 12.8 kg during the early 1970s to 5.8 kg in 2000.

Artisanal fisherman

Midwater trawling in the lake

Fish being dried by the Lake

Trawl vessel

Fish marketing

Processing of fish by small-sale fishers is rudimentary. Distribution and marketing of fish is complex but appears to be efficient. The bulk of the fish landed by small-scale fishermen is smoked or sun dried while the remainder is sold in fresh style. Tilapias are the most valuable fish species in Malawi and its price is sharply increasing with more than 30% growing rate. Fresh tilapia currently fetches up to MK 200 / kg (USD 2/kg) in the city market. While, small dried fishes, such as Matemba are most popular in the villages and its prices are about one-ten of tilapia

Processed fish sold at the market

Dried fish shop in a village

Smoked tilapia sold at market

Fresh tilapia at city market

Photographs 4 - Pilot Projects -

Innovative farmers approach

During the pilot project, capacity building of two different farmer groups was examined. Innovative farmers are successful farmers with innovative ideas and an entrepreneurial spirit. 25 farmers were identified for the pilot project. They were provided with intensive training, including study tours to Egypt and Zambia. After training, farmers started their own small projects on their farms. Some of these farmers are now teaching other farmers in fish farming and farm integration. The group has been formalised into the "Innovative Fish Farmers Network Trust" and this is the first officially registered fish producers' association in Malawi.

Farmer to farmer extension

Farmer's project – poultry

Study tour Worldfish Center, Egypt

Training at Bunda College

Farmers' club approach

Innovative farmers are relatively better-off, while farmer club members are resource poor. Farmer Clubs have following advantages, i) collective resources, ii) rapid dissemination of information among club members, iii) encourage one another within the club. The project identified two model farmer clubs "Mawila" and "Limbikani" in the Zomba and attempts were made to replicate them in adjacent communities. Farmers were encouraged to communicate their knowledge of composting, pond construction and management, fish feeding and manuring and irrigation techniques to other communities.

Collective club fish pond

Horticulture at club land

Club members

Water bridge built by club

Photographs 5 - The Master Plan Study Process -

Participatory planning

The NASP was drafted through a consultative process with a wide range of stakeholders and key strategic partners, including private fish farmers, academic institutions, NGOs and the Department of Fisheries. Several workshops were held at both community and national level. These workshops contributed towards the development of an understanding of the planning process, the exchange of information among different stakeholders, capacity building of farmers such that they could express their opinion to government, creating unity of the stakeholders to promote aquaculture development, etc.

Year	Month	Events
2003	January	Project started
		Situation analysis of aquaculture in Malawi
	April	1st National aquaculture workshop (Kick-off workshop)
	May-June	National socio-economic survey
	August	DoF high level planning meeting
	October	1st Counter part training in Japan
	December	2nd National aquaculture workshop
2004	January	Pilot project started
		Innovative Fish Farmers Network Trust (IFFNT) established
	June	Innovative farmer study tours: Egypt & Zambia
	August	Regional aquaculture workshop (Zambia, Tanzania, Mozambique)
	October	2nd Counterpart training
2005	February	3rd National aquaculture workshop
		Pilot project completed
	May	Draft final report submitted
		4th National aquaculture workshop with international participation
	July	3rd Counterpart training in Japan
	August	Final report submitted

EXECUTIVE SUMMARY

PART 1 BACKGROUND

1. STRATEGIC CONTEXT

Project Genesis

In January 2003, the Department of Fisheries (DoF) of the Ministry of Mines, Natural Resources and Environment of the Government of Malawi launched the "Master Plan Study on Aquaculture Development in Malawi (ADiM)" under the financial and technical support of the Japan International Cooperation Agency (JICA). The aim of the project was to develop a strategic sector plan and a "Road Map" for future aquaculture development in Malawi. This strategy presented here is the result of a comprehensive participatory consultative process with and among a wide range of stakeholders in various sectors that impinge on aquaculture. By early 2005, the project had produced all the required interim reports and the final National Aquaculture Strategic Plan (hereafter called the NASP) was submitted in July 2005.

Malawi's National Development Goals

Poverty reduction and economic development are the overall national goals of Malawi. The NASP complements Malawi's Poverty Reduction Strategy Paper (PRSP), under the guideline of Malawi Fisheries and Aquaculture Policy, through sustainable aquaculture development.

Why is Aquaculture Important?

Aquaculture is important to Malawi's economic and social development goals for three main reasons. Firstly, ***capture fishery can no longer meet the country's demand for fish***. Since the 1970s food supply, in terms of animal protein, has decreased by 40%. This decline is largely and directly related to the fully utilised capture fisheries and population increase, such that the yield cannot meet the demand. Aquaculture is the key to providing the future basic protein requirements of the people of Malawi. Secondly, rural farmers need alternative livelihoods strategies. The majority of Malawian farmers largely rely on maize production for their livelihood and this is simply not enough to alleviate rural poverty. ***Aquaculture provides an alternative opportunity for income generation by rural farmers***. Thirdly, the price of fish in the country has increased dramatically and this, coupled with the high demand for fish, provides significant opportunities for commercial aquaculture in Malawi. ***Commercial aquaculture has the ability to significantly improve the cash economy in certain areas of the country and to contribute towards economic growth and job creation***.

2. OVERVIEW OF AQUACULTURE IN MALAWI

History of Aquaculture

Concerted efforts to develop present tilapia aquaculture in Malawi were initiated during the 1960s with substantial support from external donors. Malawi has the best human capital in the region and now also has 13 aquaculture stations with more than 200 experimental ponds. These investments, in addition to the tertiary aquaculture training provided by the University of Malawi, through the Bunda College of Agriculture, have established Malawi as one of the foremost exponents of inland aquaculture in central Africa.

Currently, Malawi's aquaculture is dominated by rural aquaculture. At the start of the project in 2003 there were no middle or large-scale commercial aquaculture activities in Malawi.

Rural Aquaculture

Aquaculture production and marketing

Total aquaculture production in Malawi in 2002 was estimated by the National Aquaculture Centre (NAC) at 800 metric tonnes, comprised mostly of indigenous tilapiine species and catfish. There is disparity between these estimates and the approximations of the Project, which calculated total current small-holder fish production to be between 40 and 200 metric tons per annum. In relation to capture fisheries the proportion produced by aquaculture was insignificant and did not exceed 1.4%.

Malawian aquaculture systems are typically "low-input – low output" operations. Estimated yields of small-holder farmer ponds are in the region of 700-1,200 kg/ha/yr. Ponds are built mainly by family members and sometimes by hired labour. Fish farming practices consist mainly of some form of polyculture, though *Oreochromis shiranus* is normally the dominant species. Other species, in order of priority, include *Tilapia rendalli, Oreochromis karongae, Clarias gariepinus* and *Cyprinus carpio.* Mixed sex culture is practised and reproduction is not controlled. Farmers still rely heavily on Government stations for fingerlings, though latterly more are produced and sold by farmers. Farmers have a fair knowledge of appropriate pond inputs. However, the majority of farmers only provide their fish with maize bran and use green compost as a source of nitrogen. Partial harvesting is the most common practice and production is not scheduled. Only 3% of fish farmers owned a seine net.

There has been a significant increase in the number of fish farmers in Malawi over the last five years. The NAC estimated that there were approximately 2,000 small-holder fish farmers in 1995 and that the numbers had increased to 4,050 farmers with 9,500 ponds in 2002. Fish farmers were relatively evenly distributed across the country. Household level factors such as access to labour, availability of pond inputs and the level of agricultural diversification had a stronger influence on farm production than geographic, climatic, political and other variables.

Malawian Fish-Farmers

The ADiM socio-economic survey (2003) covered 563 farmers in 13 districts in all regions in Malawi and provided the basic information with which to characterise the small-holder fish farming sector. The small-holder fish farming sector has the following characteristics;

Aquaculture is integrally linked to crop farming A typical small-holder fish farmer has one or two small ponds (about 200 m^2 or less) usually located in close proximity to a seasonal wet-land (Dambo). The majority of farmers are resource limited with consequent low levels of production. Over 80 % of farmers produced less than 19kg/yr, which contributed between 1% and 17% to overall household income. The majority of fish farmers rely on crop farming for their main source of income (70%). Fish farming therefore is one of a variety of activities that are combined to maximize income and food security at the household level. This suggests that fish farming needs to be viewed as part of the overall agricultural system and should not be seen as a stand-alone activity.

Better producers have greater access to resources and are more experienced More productive farmers tend to be older, have larger families (= more labour), larger land holdings, higher education levels, and more skilled employment experience. They also have access to and cultivate more land of all types, have better access to water, produce a more diverse range of agricultural produce, have more diverse livelihood strategies and are less food insecure.

Fish farmers need support to improve production Approximately 70% of fish farmers were not satisfied with their current fish farming activities. The main reasons for this dissatisfaction was slow growth of fish in their ponds (35%), which indicates a clear lack of knowledge and the lack of

technical support (8%). Small pond size was also cited (25%) as a problem among those farmers producing less than 60 kg/yr. Of interest is the fact that very few farmers indicated that marketing of fish was a problem. Approximately 8% of farmers had abandoned fish farming in recent years because of lack of water and predation.

Commercial Aquaculture

In 70s and 80s, the private sector initiated fish farming on several sugarcane and tea estates. Their main objective was to produce fish for their labour force and not to sell product. The DoF categorized the estate farms as commercial aquaculture. However, none of the estate fish farms really operated on business principles and little if any effort was made to employ technically skilled management, or to invest in appropriate technologies. At its peak, the "commercial" sector produced a maximum of around 100 mt per annum and from the mid 1990s to around 2001/02 the sector virtually collapsed.

Two meticulously planned commercial aquaculture operations were established in 2003/2004. One is a large-scale cage culture operation that is geared to produce between 2,000 and 3,000 mt of *Oreochromis karongae* in circular floating cages in Lake Malawi. The operation consists of a cage unit and a pond based fingerling production unit. The other is a medium scale pond culture operation in the Lower Shire valley at Kasinthula and consists of 10 ponds with a total surface area of 8 ha. The main species farmed include *Oreochromis mossambicus* and *Cyprinus carpio*. The only other "small to medium" scale commercial fish farm in Malawi is the recently (2001/2) privatised trout farm on the Zomba plateau. In addition, and as a direct consequence of the ADiM pilot project, several small-holder farmers have also taken the first steps towards the commercialisation of their fish farming activities. The success of these ventures will provide the impetus for the development of the sector in Malawi.

Aquaculture Institutions

The Department of Fisheries (DoF) has the primary responsibility for fisheries administration, management and providing professional services to ensure sustainable fisheries utilisation and enhanced aquaculture production at national and district level. The National Aquaculture Centre (NAC) at Domasi plays a leading role in aquaculture development, research, fingerling supply and training in the country. The DoF has 13 aquaculture stations and 41 aquaculture extension staff in the country. Bunda College of Agriculture and Chancellor College (University of Malawi) offer a BSc and a Masters degree in Aquaculture and related disciplines.

In Malawi, non-governmental organisations (NGOs) are important players in aquaculture extension. Most notably amongst these are World Vision Malawi, Action Aid, Care International, OXFAM etc. In many cases, they have actively promoted aquaculture as a component of rural development projects, combining credit schemes, irrigation systems, and other integrated services. Since the mid 1990s donor assistance for aquaculture has decreased.

3. CONSTRAINTS TO AQUACULTURE DEVELOPMENT

Constraints to Rural Aquaculture

Rural aquaculture is characterised by low productivity. Current productivity of about 700kg/ha/yr, this means about 14kg harvest from typical one fishpond, remains contribution of aquaculture at minimum level. Limited access to resources is fundamental challenges and constraints of the current rural aquaculture in Malawi. Especially these are;

Poor access to the land and water: Farmers who possess small land are often difficult to access to the land which is suitable for aquaculture nor water source.

Scarcity of input commodities: Most farmers either do not have access to the necessary resources or cannot afford the risk of acquiring the necessary inputs, such as feed, fertiliser and fish net, etc. Another problems of small-holder aquaculture derive in part from the poor accessibility to and the high price of fingerlings. Fingerling production from DoF rarely meets the demand in terms of quantity and quality, and then in most cases, farmers have to source fingerlings by themselves.

Poor human and social capitals: Weak human and social capital is also constraints of small-holders. Without basic ability in learning new technologies such as literacy and arithmetic, effective extensions are not expected. In addition, institutional capacity and negotiation skill in order to access for extension service and credits are still weak.

Poor understanding of small-holder fish farmers' livelihoods: In most instances fish farming is an add-on activity of small-holder farmers. The development of aquaculture should be promoted within the overall context of rural, and in particular, agricultural development. Although to realise a greater degree of synergy in rural development initiatives requires a better understanding of the linkages between aquaculture and agriculture, poverty and rural development, it's poorly known.

Constraints to Commercial Aquaculture

"Our fish do not grow" is the most common complaint by Malawian fish farmers. This is not unique to Malawian cichlids, it simply illustrates the phenotypic plasticity of tilapias in general. The success of tilapia farming world-wide is a consequence of certain management and genetic interventions. Most important amongst these are controlling reproduction in ponds, providing appropriate and adequate quantities of feed and appropriate fertilisation, selection of appropriate species, hybridisation and development of faster growing strains and mono-sex (all male) farming. If the target is to produce large fish at the end of the grow-out cycle then either one, or a combination of the above, must be applied in conjunction with appropriate and adequate nutrition and fertilisation. To realise significant increases in fish production in Malawi requires the DoF to address following issues as a matter of priority.

Antiquated technologies and poor dissemination of research results: Most Malawian fish farmers are subsistence farmers, who for various reasons cannot afford the risk of improved feeding, fertilisation and management of their fish ponds and are forced to adopt a "low input – low return" farming strategy. To change this approach, it is necessary to demonstrate the profitability of advanced higher yield technologies. However, these technologies are in most instances not available to the farmers. The lack of focus on applicable commercial aquaculture research has in the past also been one of the major reasons for investor hesitancy and the absence of any substantial and well-planned investments in this sector.

Inability to access credit and institutional support: The scale of production, non-scheduled cash flow, lack of collateral, and high transaction costs of small loans has meant that the majority of Malawian fish farmers are not creditworthy and therefore find it difficult, if not impossible, to access credit. Medium to large-scale commercial investors in aquaculture are similarly constrained by the high interest rates and uncompetitive investment incentives, such as tax breaks as well as the high import duties on raw materials and machinery.

Constraints to Service Providers

Weak extension and support services: One of the critical constraints to aquaculture development in Malawi is the weakness of the aquaculture support services, brought about by inadequate government resources. Thirteen aquaculture demonstration stations and 41 aquaculture extension officers are insufficient to meet the most basic operational requirements to assist the widely dispersed fish farmers. Furthermore, the DoF cannot afford to send extension staff on refresher courses, resulting in antiquated extension messages. Moreover, the lack of communication between extension staff at remote stations and regional offices and or the NAC, and their low level of

remuneration (one third of similar staff at NGOs) has de-motivated the staff. Given the small size of the sector it is highly improbable that the DoF would be able to justify or afford an increase in budget allocation to the aquaculture sector in the short term. Clearly, this has and will continue to impact negatively on the development of the rural small-scale aquaculture sector.

Weak capacity of local government and private service providers in aquaculture extension: To overcome above constraint and to enhance aquaculture production it is necessary for local government, NGOs and other private organisations to play an increasingly leading role in providing support services to small-holder fish farmers. However, collaborative mechanisms between the private sector, NGOs, local government and the DoF in the delivery of effective services are not well established and in many instances, there is a need to build the fish farming capacity of the partners. These are challenges that need to be addressed in the short term.

Unreliable statistics : Reliable aquaculture statistics are essential for policy making, evaluation of the service delivery by the DoF, and decision making for allocating resources to the sector. The limited operational budget and human resources of the DoF makes it impossible to collect adequate and accurate aquaculture statistics. Current information clearly suggests that the annual surveys undertaken in the past were inefficient and have led to contradictory results.

4. DEVELOPMENT OPPORTUNITIES

Development Opportunities to Rural Aquaculture

Existing models of integrated approaches to enhance the resources of small-holders: Successful formation of a group can they not only utilise limited resources collectively, but also access to services. Two farmers club, Mawila and Limbikani farmers' clubs in Zomba District, give us a good example. These club obtained new club land and water that makes them integrated agriculture and aquaculture, attract supporter outside by their group power, enable to access to loan scheme and increased cash incomes.

Progress of the technology that economize nitrogen inputs: Recent study by ARTDMIS (JICA) at NAC suggests that fish grew to a larger size in deep ponds in comparison to shallow ponds under the same input condition. Through organising themselves into a group, poor farmers are able to strengthen their resources, in addition to inclusion of such technology which economises the limited resources, and consequently, increases their income.

Developing Opportunities to Commercial Aquaculture

Accumulation of Knowledge on Fast Growing Technologies: Stunting of tilapia species is the most fundamental issues for production of commercial sized fish. Currently, some approaches are on examination at NAC and these results show the some opportunities to improve the growth of the culture tilapias in Malawi. These are;

- Introduction of alternative species such as *O. karongae* (Chambo)
- Mono-sex (all male) tilapia technology
- Developing improved strains of indigenous tilapia

Accumulation of Economic Information: Weak capacity of fish farmers in business planning is one of the constraints for commercial aquaculture. One of the reasons for such situation is inadequate information service regarding to aquaculture economy currently available in Malawi. Though not much study in this field has been done by the DoF, some existing information and knowledge may suggest a direction for future study.

- Price information
- Cost information

Opportunities to Improve Support Services Factors

Government has recognised the problems and has adopted several remedial actions including, (i) selection and intensification such that services are geared towards specific target zones and or target groups, (ii) devolution of the extension services as part of the Decentralisation Policy, and (iii) possible participation of the private sector in service provision.

Selection and intensification of the Government Services: Priority areas for rural aquaculture include certain areas in Zomba, Thyolo , Nkhata Bay and Rumphi, followed by Mulanje and Mwanza. For commercial aquaculture, Southern part of Lake Malawi and the lower Shire valley were also have been identified as high priority areas, principally because of the favourable temperature conditions for intensive warm water fish culture. Other potential areas are specific localities within the Nkhotakota, Mchinji and Dowa Districts (along the Bua River), because of water availability and the proximity to the Lilongwe market.

Devolution of extension services: Devolution of the Government extension services to the District level is regarded as a basic instrument for more efficient service delivery. It provides the mechanism to place the service at the most appropriate point to reach the greatest number of beneficiaries.

Possible participation of the private sector in service provision: One of the opportunities for private participation is privatisation of government fish farm. Leasing Kasinthula fish farm is a good example that firm has renovated the station and provided job opportunities for local people. Another opportunities is participatory research and extension of fish farmers. 7 innovative farmers and two farmers' clubs in country receive over 100 visitors annually and this suggested high potentials as the extension centres within the area.

Lessons Learned from the Pilot Project

Fish farmers in Malawi largely depend on other fish farmers for aquaculture related information and purchase of fingerlings. There observed a number of leading farmers in each geological area during the national survey. Promoting farmer-to-farmer extension through strengthening capacities of such farmers can largely contribute to efficient as well as effective aquaculture extension in Malawi. The farmer-to-farmer extension does not only subside the existing government extension system, but also has its own merit. Being handled by farmers by themselves, advises and information exchanged through the farmer-to-farmer extension will be more farmer-centred. The Pilot Project, through two approaches, 'innovative farmers approach' and 'farmers' club approach,' aims to promote active interaction among members of each group and verify quality of information exchanged through providing technical training. The most efficient and effective forms of farmer-to-farmer extension is identified and reflected to the NASP.

Innovative Farmers Approach

Innovative farmers recognise following three positive aspects in networking themselves.

① Enhancement of information exchange among farmers

② Building capacity on negotiating skills against the government

③ Building up new partnership with universities, NGO, and donors

The network, the Innovative Fish Farmers Network Trust (hereafter called IFFNT), has been legally registered to the government during the Pilot Project as an organisation that represents fish farmers in Malawi. At the same time, the members had various opportunities to discuss and integrate with other stakeholders of the sector. Through such opportunities, the DoF has announced to provide some assistance from their HIPC funds. Other organisations, such as Worldfish Center and USAID are now inviting IFFNT for their workshops.

Farmers' Club Approach

The 'farmers' club approach' seeks an effectiveness of targeting small-scale farmers in the clubs for development and extension on small-scale aquaculture system. The Pilot Project studies two existing farmers' clubs, Mawila and Limbikani farmers' clubs on their collective pond management as well as their activities as clubs. Through providing trainings, the Project aims to build further capacity of those two successful or 'model' clubs and such clubs to influence on and be duplicated to other newly established clubs. The Project also identifies the role of an NGO, the World Vision Malawi (WVM) as an effective intermediary.

PART 2 THE STRATEGY

Part 1 of this report provided the background information to contextualize the aquaculture sector in Malawi. This information has been used as the basis to develop the NASP that is presented in detail in Part 2. The broad issues presented in the background document are narrowed down considerably in Part 2 to focus on the strategies and actions that are needed to advance aquaculture development in Malawi.

Structure of the NASP

The National Aquaculture Strategic Plan (NASP), for the period 2006 to 2015, is composed of the following components

Mission **Value**	**Mission** explains the purpose of the Plan, and its reason for existence: **Value** defines the expected manner in which DoF staff conduct their duties
Vision	**Vision** describes the image of the ideal DoF required to fulfil the mission statement
Principle	**Principle** is the concept guiding the NASP
Strategy	**Strategy** identifies priority areas (strategic themes) and means (strategies) to accomplish the mission. Strategy is also supported by expected output, benchmark 2005 and actions
Action Plan (Complementary Projects)	**Action plan** describes the matrix composed of Output, Activities, Indicators, Partners, Implementers and Timeframes Action Plan includes two complementary projects. Since various elements of the strategies are crosscutting, complementary projects combine these crosscutting elements under project-type actions for efficient and effective implementation of the strategies
Implementation	**Implementation** explains an implementation arrangement and timeframe
Monitoring & Evaluation	**Monitoring & Evaluation** explains the mechanism that provides feedback to the relevant person to review and improve the plan on a regular basis

Mission

"Fostering a profitable and sustainable aquaculture sector"

Additionally, this mission is supported by the following: To increase the economic and social benefits for fish producers and citizens in general, while contributing to sustainable fish supply, food security and economic growth. National poverty reduction and improved livelihoods will be achieved through the promotion of excellence and best practices of DoF services.

Vision

The vision of the NASP is to create a practical DoF that is dedicated to improving technological innovation and extension for aquaculture development by the best possible use of available resources. It is anticipated that development in the aquaculture sector will continue along a dual pathway, comprising the small-holder and commercially-orientated sub-sectors. Taking this into consideration, and providing quality services, the DoF will strive to move the sector towards such that:

- Rural aquaculture forms a planned part of the on-farm production system and is integrated into the overall business activities of the farmer and moves towards a more scheduled and better-managed production system, which will increase cash income and improve the livelihoods of small-holder farmers.
- Small and large-scale commercial fish farming operations are competitive and are able to contribute significantly to the declining supply of tilapia from natural waters in Malawi, and support the rural economy through providing job opportunities for local people.
- The private sector is increasingly involved in service provision, through the provision of an enabling environment, thereby increasing the quality and efficiency of interventions.

Overall objective of the NASP

Given the current status of the sector, it is acknowledged that attaining the desired scenarios outlined in the Vision is a long-term process, spanning several decades. However, the NASP only encompasses a 10-year period, and its focus will therefore be on laying the foundation for this transformation process. Given this emphasis, the overall objective of the NASP is to facilitate the necessary institutional, legal, and administrative changes in the sector, and to increase the capacity of stakeholders to enable:

- Improved livelihoods among rural small-holder fish farmers
- A successful commercial aquaculture sector
- The provision of quality aquaculture services at a national and local level

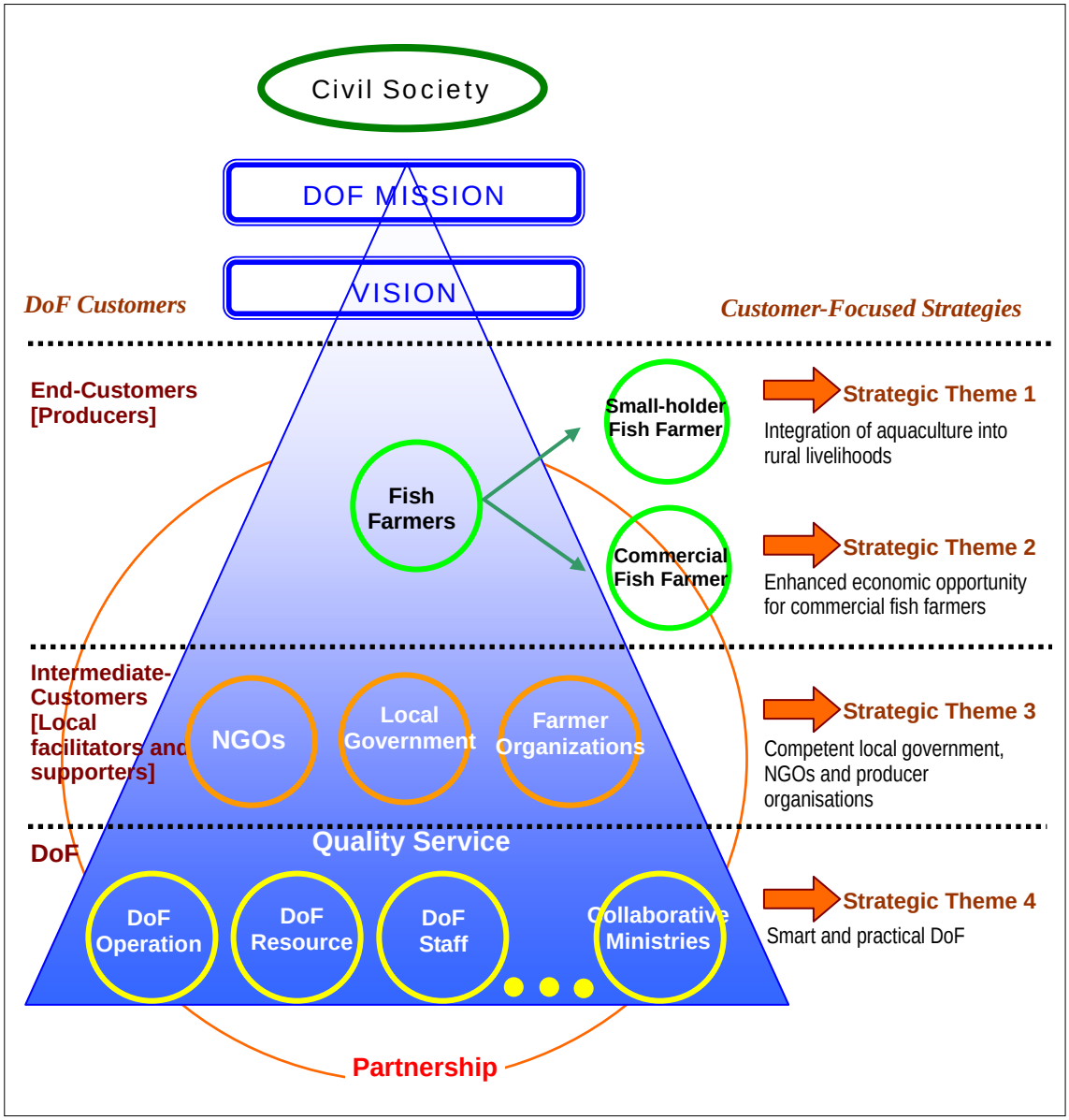
Guiding Principle

The following five principles will be the pillars of the NASP:

A. The NASP should contribute to the national goal of eradicating poverty and hunger
B. The NASP should be a "customer-focused" initiative
C. The NASP should be responsive to the needs and capacity of stakeholders
D. The NASP should be an instrument to promote wider partnerships
E. The NASP needs to encourage and facilitate a process of building the knowledge base

Conceptual Framework

The conceptual framework of the NASP is shown in the figure below. The NASP emphasises a 'people-centred approach.' Three strata formed by different actors in the aquaculture sector comprise the spine of the framework. The first stratum includes the end-customers who are the producers and other people directly benefiting from the aquaculture industry. The second stratum includes local government, NGOs and farmer organizations. They are considered as intermediate service providers between the producers and the DoF. The DoF forms the base of the NASP (3rd stratum) and supports the groups in the upper strata. Under the NASP, strategic themes are set up taking into account concepts of how the DoF should act and provide services according to these strata, in order to achieve its mission.



NASP Framework

The Strategy

Four strategic themes and 12 strategies are proposed under the NASP. These should guide the focus of the DoF for the next 10 years in order to achieve their mission and vision. These themes and strategies are summarized in the table below:

Strategic theme 1 Integration of Aquaculture into Rural Livelihoods

Outcome Improved livelihoods among rural small-holder fish farmers

The integrated livelihoods approach as it relates to aquaculture development is a key tool for poverty reduction among small-holder fish farmers. Although many Government and NGO extension workers recognize the importance of a holistic and integrated approach to aquaculture extension and research, they often do not have the opportunity to further their understanding of these approaches to facilitate effective implementation. The strategy presents some considerations on this relatively new approach in the sector and indicates the means by which capacity will be built to allow its adoption into the Malawian aquaculture development process.

Strategy 1 Providing the opportunity for all stakeholders to develop their capacity to enhance the integrated livelihoods approach, which includes aquaculture

Output 1.1 Projects that adopt the integrated livelihoods approach that includes aquaculture, and an institutional model that supports this process

1.2 Broader understanding of the context between aquaculture and the socio-economic, institutional and political status of poor farmers

1.3 Increased capacity of DoF, local government and NGO staff to utilise tools and methods necessary to support the integrated livelihoods approach

Strategic theme 2 Enhanced Economic Opportunities for Commercial Fish Farmers

Outcome Fish producers that are financially independent through income generated by aquaculture

This strategic theme deals with small to large-scale commercial aquaculture. The entrepreneurial abilities of many farmers have been suppressed through inadequate commercially orientated DoF services and institutional support mechanisms. The strategies under this theme are intended to guide the DoF and other stakeholders in establishing enabling conditions which provide incentives to encourage entrepreneurial farmers.

Strategy 2 Enhancing institutional capacity of NAC to develop medium to large-scale commercial fish farming technologies

Output 2.1 Enabling environment and framework for commercially orientated aquaculture research at NAC established

2.2 Scientific capacity in commercially orientated aquaculture enhanced

Strategy 3 Providing an appropriate credit, business training and technology package for small to medium-scale commercial fish farmers

Output 3.1 Aquaculture credit scheme for small commercial fish farmers introduced

3.2 Business planning and management capacity of small and medium-scale fish farmers improved

Strategy 4 ***Creating a regionally competitive and investor friendly environment through sound policy, clear procedure and legal framework***

Output 4.1 One-stop-shop for all aquaculture business application procedures established

4.2 Competitive investment environment for commercial aquaculture established

Strategy 5 ***Ensuring aquaculture activities are environmentally responsible and sustainable***

Output 5.1 Fisheries Policy and Act with respect to environmental threats revised and amended

5.2 Early warning system to monitor potential threats caused by aquaculture to biodiversity and environment established

5.3 Knowledge of the link between aquaculture practices and environmental issues increased

Strategy 6 ***Establishing links and information flows between producers and fish traders to enhance access to markets***

Output 6.1 Shared information between fish producers and fish traders

Strategic theme 3 Competent Local Government, NGOs and Producer Organizations

Outcome Quality aquaculture services become available at grass-roots level

Needs based service delivery requires decentralised functions, and should adopt a bottom-up and participatory approach to ensure stakeholder involvement. Local government, NGOs and producer organizations have an important role to play in this approach. Strategies under this theme provide a framework for collaboration among these partners and the DoF, and also the mechanisms for capacity building of all stakeholders.

Strategy 7 ***Sensitising and building capacity of local government on their primary responsibilities in aquaculture development***

Output 7.1 Capacity of District Assemblies to formulate plans and strategies to guide aquaculture development enhanced

7.2 Existing agriculture extension services utilised in promotion of fish farming

Strategy 8 ***Developing alliances between DoF and NGOs to promote unified approaches in aquaculture extension***

Output 8.1 Aquaculture guidelines for NGOs which facilitate partnership agreements with the DoF developed

8.2 Knowledge and technical skills in aquaculture extension among NGO field staff improved

Strategy 9 ***Fostering fish producer's organizations that assist farmers to increase production, access to finance, markets and other services***

Output 9.1 Fish farmer networks strengthened and expanded

Strategic theme 4 Smart and Practical DoF

Outcome High performing DoF and staff

Providing the best possible service to DoF customers (described previously under Strategic Themes 1-3) depends on strong institutional capacity of the DoF. Importantly, the NASP cannot be successful without a practical and efficient DoF. Challenges to be addressed in order to revitalise the DoF are explained under this Theme.

Strategy 10 Building healthy DoF financial resources

Output 10.1 Sustainable donor support for the aquaculture sector secured

Strategy 11 Realizing efficient DoF operation

Output 11.1 Communication and partnerships between the DoF and stakeholders enhanced
11.2 Under-utilised DoF facilities restructured

Strategy 12 Promoting quality DoF staff and information

Output 12.1 High quality capacity building secured
12.2 Reliable aquaculture statistical and economic analysis system for DoF staff and other stakeholders instituted

PART 3 ACTION PLAN AND IMPLEMENTATION

1. ACTION PLAN

Action Plan

The NASP details the outputs of the 12 strategies, the required actions, and by whom and when these should be performed, as well as indicators to evaluate each output. The Action Plan will provide the basis for the DoF to develop annual work plans for the NASP. For the swift and integrated implementation of the strategies, two complementary projects are proposed. The complementary projects aim at an integrated approach, and as such incorporate a range of the strategies and actions required to achieve the expected outputs of the NASP.

Cost Estimation

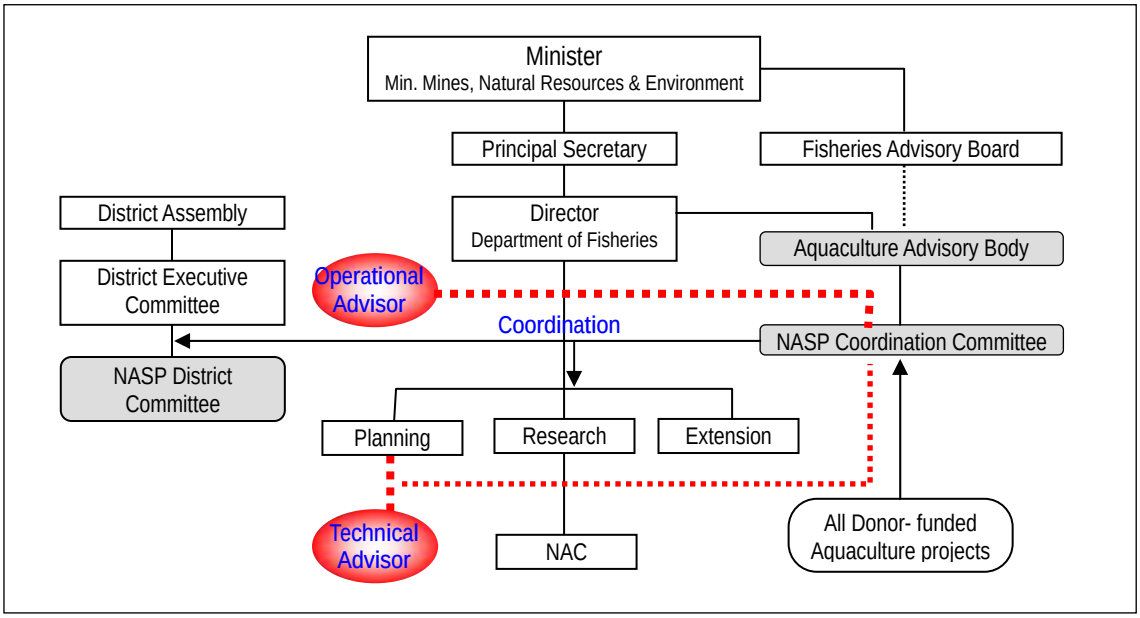
The total cost for implementing the Action Plan (including the complementary projects and fees for technical assistance), based on 2005 prices and not considering escalations due to inflation, is estimated at USD 3,199,795.

2. IMPLEMENTATION

Institutional Arrangement

The implementing agency of the NASP is the Ministry of Mines, Natural Resources and Environment, through the Department of Fisheries (DoF), which will be responsible for budgeting and implementation.

Efficient implementation of the NASP will be achieved through establishing an **Aquaculture Advisory Body** that will function as the executive body and which, will be responsible for supervising the implementation. In addition, a **NASP Coordination Committee** will be responsible for the day-to-day implementation of the scheduled activities at a national level. At District level, **District Committees** will be established in at least the three priority areas and be responsible for coordinating local level NASP activities, especially the Complementary Projects, and also for ensuring that these projects fit into the overall development plans for the District. There will be two foreign experts allocated, operational and technical advisors, to facilitate the implementation of the NASP.



Organizational chart of the NASP implementing bodies

Implementation Schedule

An annual work plan will be prepared by the DoF/NASP Coordination Committee and participating donors. Currently, no international donor has committed itself to assisting with the implementation of the NASP. Therefore, at the early stages the annual work plans must be flexible enough to respond quickly and effectively to potential changes in budget allocations and the needs of beneficiaries. The Action Plan will be closely monitored and adapted according to the available budget for a particular year.

Monitoring and Evaluation Plan

The internal mechanisms for project monitoring and evaluation (M&E) that are currently in place in the DoF need to be strengthened to be effective in tracking progress in the implementation of the NASP. The NASP therefore incorporates an M&E plan to assist the DoF in this process. The NASP is designed to be “results-orientated” and clear targets and indicators of change are included to ensure that the NASP impacts effectively on the development of the aquaculture sector.

These indicators will be measured using various data sources, including regular DoF reporting, specific surveys and participatory evaluation processes at community level. The NASP Coordination Committee will bear the responsibility for facilitating the M&E process.

Below figure summarises the functions of responsible implementation persons and committees within the NASP implementing bodies.

	Aquaculture Advisory Body	NASP Coordination Committee	NASP District Committees	DoF each sections	Operational Advisor (Foreign expert)	Technical Advisors (Foreign experts)
Planning and preparation for implementation						
Continuous sensitisation of key stakeholders in the NASP		●		○	●	
Set up the NASP as the official aquaculture development plan of the Ministry		●		○	●	
Preparation of an annual work plan		●		○	●	○
Budgeting for the annual work plan		●		○	●	
Approval of the implementation plan	●				●	
Implementation				●		●
Implementation of the annual plan			○	●		●
Implementation of complementary project 1			●	●		●
Implementation of complementary project 2			○	●		●
Coordination of activities		●	●		●	○
Monitoring & Evaluation						
Monitoring /preparing monitoring report		●		○	●	○
Organising annual evaluation meeting	○	●	●	○	●	○
Review of outputs	●				●	○

Remarks ●: Responsible body ○: Participation or collaborative body

Summary for functions of responsible implementation persons and committees

PART 4 EVALUATION AND RECOMMENDATIONS

1. EVALUATION

Consistency of NASP with Existing Policy and Plans

The NASP was conceived to recognise and address the most pertinent international and national development frameworks and these are;

- Millennium Development Goals (MDG)
- Malawi Poverty Reduction Strategic Paper (MPRSP)
- The National Fisheries and Aquaculture Policy 2002
- FAO Code of Conduct for responsible fisheries
- National Environmental Action Plan 2002 (Revised Draft Feb 2003)
- Agenda 21

Equity, Efficiency and Sustainability

If the NASP is implemented as proposed, it will contribute to the sector through increased equity (in terms of improving the living standard of poor fish farmers), efficiency, and sustainability (in terms of aquaculture service provision). The approaches adopted by the NASP are "people-centered" and focused on livelihood enhancement of resource-poor farmers. The NASP also includes as target groups the most vulnerable people such as households with AIDS orphans and women-headed households, thereby ensuring equity in its implementation.

Successful implementation of the NASP will provide for greater participation of the private sector in the aquaculture sector through increasing private investment, privatization of selected government facilities, and facilitating participatory research and farmer-to-farmer extension. This will result in increased efficiency and sustainability of aquaculture development in Malawi.

Regional impact

Networking with international research institutions to address common regional problems in rural aquaculture and production technology development are important elements of Strategies 1 and 2, and will contribute to the development of aquaculture in Malawi and in the region as a whole.

Fish Production

The NASP focuses on increasing fish production in the short-term and places great emphasis on building the capacity of stakeholders at all levels. If the NASP is successfully implemented, it is highly probable that increased resources will be attracted to the sector, resulting in more rapid development. Assuming that the supportive conditions are established for aquaculture development as a result of the implementation of the NASP, estimates regarding future aquaculture production may be in the order of between 3,000 and 5,000 tons of fish/annum by 2015.

Environmental Impact

The NASP strongly advocates and includes actions that will ensure the sustainable and responsible development of the medium to large-scale commercial aquaculture sector. Of particular concern is the need to reduce potential risks to the biodiversity of the Lake, and other water resources. Strengthening the capacity of the DoF will have a positive impact on their regulatory functions, especially with regard to managing the risks associated with large-scale pond culture, cage culture and the translocation of exotic species.

2. RECOMMENDATIONS

A. Fostering a long-term vision to the integrated livelihoods approach among farmers

It is probable that the majority of small-holder farmers will continue to rely on a number of on-farm activities, rather than risk focusing on aquaculture alone as a livelihood option. Hence, there is a need to investigate options for maximizing the potential of the integrated livelihoods approach. This will be achieved by motivating farmers to move from a subsistence, high risk livelihood, to a more robust and diversified strategy by incorporating aquaculture into the farming system. A more holistic view towards development needs to be encouraged, which would greatly facilitate the successful integration of aquaculture into the farming system.

B. Effective farmer participation in the aquaculture development

Participation of commercial fish farmers in the promotion and development of aquaculture in general needs to be encouraged. These farmers have the capacity to make a significant contribution to satisfying the demand for fish in the country, participate in relevant on-farm research, as well as acting as agents for aquaculture development. The last point is particularly relevant with regard to development of small-scale commercial operations in rural areas, where progressive farmers are in

daily contact with their fellow farmers and who can provide valuable extension support in areas that are inaccessible to the DoF.

C. International cooperation in aquaculture development

International research cooperation is vital in developing knowledge and technologies, as well as in promoting responsible research practices. This cooperation will synchronize national efforts with global initiatives in tilapia culture. In supporting international cooperation, it is recommended that the DoF and donors seek to strengthen communication and networking among existing partners in line with the NASP framework.

D. Midterm reviews

Flexibility in project implementation will be encouraged to account for risks and uncertainties in the design and implementation phases. Periodic review of the progress made in implementation of the Action Plan will be necessary, to enable appropriate changes to be incorporated as required.

E. Effective donor coordination

Inadequate donor coordination could lead to a duplication of effort, and contradictory policy advice, which will further erode the productivity and efficiency of existing institutions. To avoid these risks, the NASP recommends to establish two bodies (the Aquaculture Advisory Board and the NASP Coordination Committee), which will coordinate all aquaculture projects in the country and allow the DoF to effectively control and harmonize policies.

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Currency

Malawi Kwacha = MK

Currency Equivalent

USD 1.00 = MK 113.00 (April, 2005)

MK 1.00 = USD 0.00885 (April, 2005)

Remarks: Currency equivalents during the last 10 years are shown in Attached Table A1
Source: OANDA (2005)

Fiscal Year of Malawi

July 1 - June 30

Abbreviations and Acronyms

ADB	African Development Bank
ADiM	Master Plan Study on Aquaculture Development in Malawi
ARTDMIS	Project on Aquaculture Research and Technical Development of Malawian Indigenous Species (JICA)
CAS	Catch Assessment Survey
CNRFFP	Central and Northern Region Fish Farming Project
CPUE	Catch Per Effort Unit
DA	District Assembly
DANIDA	Danish International Development Agency
DEC	District Executive Committee
DFID	Department for International Development, U.K.
DoF	Department of Fisheries
EIA	Environmental Impact Assessment
EPA	Extension Planning Area
EU	European Union
FAO	United Nation Food and Agriculture Organization
FCR	Food Conversion Ratio
FRU	Fisheries Research Unit
GDP	Gross Domestic Product
GNI	Gross National Income
GTZ	Gesellschaft für Technische Zusammenarbeit
HIPC	Highly Indebted Poor Countries
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
ICEDA	Icelandic International Development Agency
ICLARM	International Centre for Living Aquatic Resource Management (WorldFish Center)
IFAD	International Fund for Agricultural Development
IFFNT	Innovative Fish Farmer Network Trust
JICA	Japan International Cooperation Agency
MAGFAD	Malawi-German Fisheries and Aquaculture Development Project
MASAF	Malawi Social Action Fund
MAIFS	Ministry of Agriculture, Irrigation, and Food Security
MMNRE	Ministry of Mines, Natural Resources and Environment
MSY	Maximum Sustainable Yield
mt	metric tonnes
MTF	Malawi Traditional Fisheries
MPRSP	Malawi Poverty Reduction Strategy Paper
NAC	National Aquaculture Centre
NARMAP	National Aquatic Resource Management Programme
NASP	National Aquaculture Strategic Plan
NGO	Non-governmental Organization
NORAD	Norwegian Agency for Development Cooperation
NSO	National Statistics Office
ODA	Official Development Aid / Assistance
ODA (UK)	Overseas Development Agency, U.K.
SIDA	Swedish International Development Agency
S/W	Scope of Work
TOR	Terms of Reference
UNDP	United Nations Development Programme

General outline of the NASP

National development goal	Poverty alleviation and food security

Background for aquaculture development

Why is aquaculture important?	Aquaculture can be one of the economic activities for rural farmers which diversify source of income and contributes to the enhancement of the livelihood.	Increase in aquaculture production results in a sufficient supply of animal protein for Malawian citizens and contributes their health.	Development of commercial aquaculture provides job opportunities and active economy in rural area.	-	-
Constraints to aquaculture development	"Poor resources" ・Aquaculture alone cannot improve farmer's livelihood. ・The relation between aquaculture and rural farmer's livelihood is not well understood.	"Lack of policy and technologies that promote commercial aquaculture" ・There is not technology that maximises productivity and profit. ・The policy and the banking system which support commercial investors are weak.		"Poor service" ・DoF lacks human and financial resources. ・There lacks reliable information.	
Development opportunities **Lessons learned from the pilot project**	・Some NGO has know-how on integrated livelihood approach. ・Due to decentralisation, it becomes easier to support cross-sectoral activities.	・Through past research on aquaculture development, there has been information/ data being accumulated. ・With an initiative of the private sector, experimental trial on commercial aquaculture has been initiated.		・Through decentralisation, producer-oriented services can be further achieved. ・There are producers all around Malawi with high technologies and leadership. ・The producers' organisations are being organised at both central and district levels. ・NGO are actively involved in aquaculture sector.	

Strategies

Customers (target group)	Small-holder farmers	Commercial fish farmers	District Assembly, NGO & Producers' organisation	Department of Fisheries (DoF)
Strategic themes	Integration of Aquaculture into Rural Livelihoods	Enhanced Economic Opportunities for Commercial Fish Farmers	Competent Local Government, NGOs and Producer's Organizations	Smart and Practical DoF

Strategy	The strategy proposes the introduction of multi-sectoral livelihood approaches. It includes utilisation of limited resources (e.g. land, water, and labour) through organising farmers into a group, training at farmers' school, research on poverty and aquaculture, etc.	The strategy aims to promote aquaculture technologies development which maximise its profit, and improve the investment environment. These include promotion of: research and technology development for commercial aquaculture; better accessibility for funds; business training; one-stop-shop for aquaculture permit; introduction of tax exemption; marketing; and environment conservation scheme. Such activities are to be carried out in collaboration with the private sector and other stakeholders.	The strategy promotes aquaculture enlightenment among district officers with appropriate information. Strengthening the relationship between NGO and DoF, and the capacity building of NGO staff on aquaculture planning and implementation are some of activities to be carried out.	The strategy promotes the establishment of the aquaculture advisory body, privatisation of underutilised government facilities, establishment of a statistical and economic analysis system.

Effects of the NASP on the national development goal

	Economic growth for poverty alleviation	Human capacity development	Relief for vulnerable groups	Good governance
Short-term	・Increase in cash income for rural farmers and improved livelihoods ・Improved investment environment for commercial aquaculture	Improved nutrition status among fish farmers	Aquaculture to be a part of social safety net for women-headed families, families with orphans, and ultra-poor families	Through planning and implementing aquaculture activities, the capacity of officers at district level will further be strengthened.
Medium/ Long-term	Activated rural economy through fish sales, improved job opportunities, & development of related industries	Aquaculture to be a supplement to capture fisheries, so that enough animal protein is provided to all citizens in Malawi		

PART 1 BACKGROUND

Table 1.1 Summary of Malawi's Fisheries and Aquaculture Sectors

Country	Total area	118,900 km^2
	Population	11 millions
Main water bodies	Lake Malawi *	29,000 km^2, average depth 292 m, maximum depth 785 m, shoreline 1,500 km
	Lake Malombe	420 km^2
	Lake Chirwa	700 km^2
	Lake Chiuta **	199 km^2
	Lower Shire River	402 km
Fisheries Industry	Share of fisheries sector in GDP	n.a.
	Number of fishermen	48,000 persons
	Number of people in related business	230,000 persons
Fish production (Capture fisheries) Year 2000	Total	55,900 mt
	Lake Malawi	31,644 mt (56.6%)
	Lake Malombe	4,490 mt (8.0%)
	Lake Chirwa	-
	Lake Chiuta	-
	Lower Shire River	1,602 mt (2.9%)
Fisheries trade	Export (2000) Import (2000)	nil 1,630 mt (2,808 mt in 1999)
Fish consumption	Per capita fish supply (2000)	5.8kg
	Animal protein intake (2001) ***	3.7g
	Share of fish in animal protein (2001) ***	1.1g (29.7 %)
Prices (2000)	Tilapia (*O. karongae*)	Wholesale: USD1.8 (MK199.0) Retail: USD2.2 (MK244.9)
Aquaculture	Introduction of aquaculture	1906 (Rainbow trout) 1950s (Tilapia)
	Number of fish farmer (2002) ****	4,050 persons
	Number of fish pond (2002) ****	9,500 ponds
	Production (2002) ****	800 mt
	Productivity (2003) *****	700kg/ha/yr.
Aquaculture institutions	Number of government fisheries staff engaged in aquaculture sector	60 person (officer + technical staff)
	Number of government fish farm	13 demonstration fish farms
	Tertiary educational institution	Bunda College (BSc & MSc in aquaculture & fisheries science)
	Major NGO involved in the sector (2005)	World Vision Malawi, CARE, Oxfam, Action Aid, CARD, Concern Universal, etc.
	Major donor in the sector (2005)	JICA (Japan), ADB

Source: *Ribbink (2001); **Nyasulu (2002); ***FAO food balance sheet; ****NAC; *****ADiM National socio-economic survey (2003)

CHAPTER I STRATEGIC CONTEXT

1. Project Genesis

In 2002, the Government of Japan agreed to conduct and support the Master Plan Study on Aquaculture Development in Malawi (ADiM). The aim of the project was to develop a national strategic sector plan as a "Road Map" for future aquaculture development in Malawi. Recently, Malawian government has adopted the revised National Fisheries and Aquaculture Policy (NFAP, 2002). This aquaculture sector plan is expected as a document that promotes the implementation of the NFAP. Following the preparatory study mission (Scope of Work mission, from 9 to 17 September 2002) the Japan International Cooperation Agency (JICA), responsible for the implementation of technical cooperation programmes for the Government of Japan, selected and contracted with System Science Consultants Inc. to implement the Master Plan Study. System Science Consultants Inc. sub-contracted Enviro-Fish Africa (Pty) Ltd. to participate in the development of the Strategic Plan. The project was launched in January 2003 and a Project Coordination Committee was established within the Department of Fisheries (DoF) of the Ministry of Mines, Natural Resources and Environment. The duration of the project was 32 months.

The Project was undertaken in four stages (the planning process is described in Annex 1). Stage 1 included an analysis of present and historical data and information and undertaking a national socio-economic survey of fish farmers in the country. This provided the background to develop the NASP on the basis of past experiences, lessons and challenges. Interim strategies for aquaculture development were built during the second stage. The third stage consisted of testing the interim strategies through the pilot projects. The fourth and final stage was the development of the NASP through a consultative process with a wide range of stakeholders and key strategic partners, including private fish farmers, academic institutions, NGOs and the DoF.

This document is the Final Report, which presents the NASP and examines the “best” approaches and actions to be taken by the DoF to ensure the sustainable development and growth of small-holder and commercial aquaculture in Malawi during the next 10 years.

The Final Report consists of four parts: Part I provides the background on the importance of the aquaculture sector in Malawi and describes its salient features and considers the opportunities and challenges that face the sector. Part II presents the strategies for the future development of the sector. Parts III and IV present the proposed actions and arrangements for the implementation of the strategies.

2. Malawi’s National Development Goals

Aquaculture in MPRSP

Malawi is a small, land locked country with a total area of approximately 118,900 km^2 and is one of the world’s poorest countries. The lakes of Malawi comprise a total surface area of 23,900 km^2. Poverty is widespread and deep, and this is reflected by poor social and economic indicators. In 2003, the per capita GNI (Gross National Income) was USD 160 per year, which is approximately half of the regional average, and 65% of Malawians live below the poverty line (NSO, 2002). Although infant and under-five mortality rates have declined since 1980, it is still higher than the averages for other Sub-Saharan African countries. Similarly, the HIV/AIDS epidemic is serious and 14.2% of the 15-49 age group is infected with HIV. Life expectancy has declined from 44 years in 1980 to 37.5 in 2003 and food insecurity remains widespread (World Bank, 2005). 70% of the population are subsistence farmers. However, their food sufficiency is approximately 70%. Malawi experiences

chronic seasonal food shortages and is a net importer of food. In 2004, Malawi was ranked 165th out of 177 countries with a Human Development Index value of 0.388 (UNDP, 2004).

Poverty reduction and economic development are the overall national goals of Malawi. In 2001 the Government adopted the Malawi Poverty Reduction Strategy Paper (MPRSP). The MPRSP provides the broad guidelines to achieve the national strategic goals of economic and social development. The strategy is built around four pillars: (i) sustainable pro-poor growth, (ii) human capital development, (iii) improving the quality of life of the most vulnerable, and (iv) good governance. HIV/AIDS, gender as well as science and technology are cross-cutting issues of all strategies outlined in the MPRSP. The opportunities of aquaculture sector are spell out in this MPRSP as a part of strategies that aim at increasing sustainable utilisation of fisheries resources.

Table 1.2 Malawi basic data

	Figure (year)		Others
Population			
Population (millions)	11.0	(2003)**	
Population growth (annual, %)	2.0	(2003)**	May decline to 1.7% by 2010 because of HIV/AIDS
Rural Population (% of total population)	84.9	(2001)	
Population density (people / km^2)	105	(1998)*	
Economy and Finance			
GDP growth rate (constant, %)	0.7	(2001-03)	MPRSP target 3.0%
GNI per capita, Atlas method (current USD)	160	(2003)**	
Real interest rate (%)	23.9	(2001)	
Agriculture, value added (% of GDP)	38.4	(2003)**	
Industry, value added (% of GDP)	14.9	(2003)**	
Services, value added (% of GDP)	46.7	(2003)**	
Imports of goods and services (% of GDP)	40.6	(2003)**	
Export of goods and services (% of GDP)	27.5	(2003)**	
Total debt service (% of export good & services)	7.7	(2003)**	
Net ODA (USD, 2001-03 average)	426.3		Bilateral share (gross ODA): 55%
Aid per capita (current USD)	45.4	(2003)**	
Net ODA per GNI (%, 2001-03 average)	24.7		
Health and Education			
Life expectancy at birth (years)	37.5	(2003)**	Decreased from 44 in1992
Under 5 mortality (/'000)	178	(2003)**	220 (1992)
Fertility rate (births per woman)	6.0	(2003)**	
Malnutrition children (low height at age, %)	49.0	(2000)	No improvement from 48.7 (1992)
HIV infection (% of population aged 15-49)	14.2	(2003)**	Sub-Saharan Africa: 8.6%
Illiteracy rate, adult total (% of age 15 & above)	46	(2000)	40 (1992)

Source: World Bank, 2003; *National Statistics Office report, 2004; **World Development Indicators database, 2005

Aquaculture in National Fisheries Policy

Reflecting MPRSP, the National Fisheries and Aquaculture Policy has adopted vision and mission statement for the DoF as well as its new objectives for aquaculture sub-sector as follows;

Vision: To be a dynamic, high performance, consultative and client focused that promotes, builds

and ensures sustainable development, utilization and management of the fisheries resources of Malawi.

Mission: To provide framework condition and excellent services for maximization of socio-economic benefit through sustainable utilization and management of capture fisheries and increased aquaculture production.

Objectives of Aquaculture: The overall policy goal of fish farming is to improve fish supply in Malawi. To achieve this goal, the policy guides specific objectives as follows;

- To solve problems related to fish farming and management of small water bodies through biological research,
- To develop adoptive/appropriate recommendations for fish farming, and
- To encourage farmers to adopt fish farming as a source of subsistence and income.

3. Why is Aquaculture Important?

Despite the progress made in economic reforms under the MPRSP, the levels of poverty have largely remained unchanged. Agriculture has been stagnant, and poor farmers continue to generate insufficient income and their nutritional status has continued to decline since the 1970s. The current conditions lack the decisive means for economic growth in traditional production systems. Consequently, the need for diversification of economic activities at household, and indeed the national level, has become pivotal for economic growth. Small-holder fish farming can play an important complementary role to improve income generation and food security and the commercial aquaculture sector can contribute towards economic growth and the creation of wealth.

Aquaculture- an alternative production opportunity for the poor

In Malawi, 65 % of the population live below the poverty line and 85% of the poor live in rural areas and depend on agriculture for their livelihood (NSO, 2002). **Improving farm income levels of the rural population is a precondition for poverty reduction in Malawi.**

Malawi has focussed on four main pro-poor development strategies (Ellis *et al*., 2002); (i) Increased maize production through modernisation (e.g. hybrid maize, fertiliser, irrigation), (ii) Improved food security by diversifying food crops, especially drought resistant crops such as cassava, sweet potatoes, beans and ground nuts, (iii) Increased reliance on cash crops for income generation to improve food security and (iv) Increased emphasis on non-farm activities to diversify options and sources of income. Adoption of these strategies varies regionally and within the socio-economic context of the farmers. For example, hybrid maize production cannot solve the food supply problem of small-holders with less than 0.5ha of land; at best it can provide food for an additional 2-3 months in comparison to traditional varieties (World Bank, 1995). Food security gaps persist at the household level and must be addressed through alternative measures. There have been notable increases in the production of cassava, sweet potatoes and other alternative food crops. However, these are low-value products and cannot act as an engine to drive the rural economy. **Farmers need alternative opportunities for income generation.**

There are several reasons why aquaculture can contribute towards income generation and food security at household level.

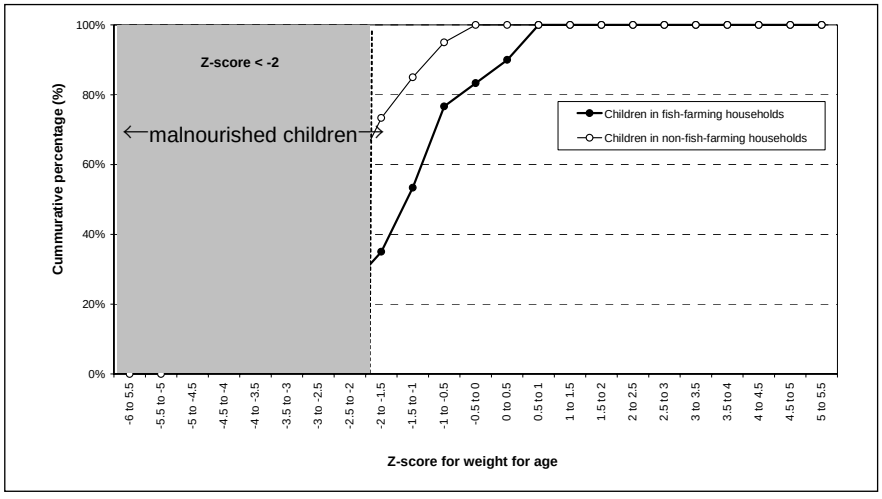
Fish has several major advantages over other cash crops. Fish is a high value product (USD1.5 to USD2/kg), there is a ready market for fish in rural, peri-urban and urban areas, there is an increasing

demand for fish, production can be scheduled to provide fish all year round (refer to Attached Table A2). The majority of small-holder farmers are net purchasers of food. Moreover, the price of cash crops fluctuates widely because of the highly seasonal nature of supply and demand. This has a serious impact on disposable income and food security during the year. Because fish production can be scheduled, aquaculture provides an opportunity for improved household food security and income generation.

Aquaculture promotes better utilisation of available land. Many fish ponds are constructed around, or in close proximity to seasonal wetlands ("Dambos") on under-utilised land. For many land-limited farmers, intensification of land use could be the most important strategy to increase production. A total of 35,000 ha of underutilised Dambo land has been identified in Malawi for small-scale irrigation (World Bank, 2004). The integration of aquaculture and irrigation can lead to significantly higher levels of production.

Aquaculture is a good entry-point for diversification of income generating activities. In the context of the rural poor, aquaculture is capital intensive. Nevertheless, depending on the investment capacity of the farmer some quantity of fish can be produced, once a pond has been constructed, and this may be less risky than other activities. Small-holder aquaculture in Malawi is almost entirely integrated into the agricultural system, and is more closely related to farming (seed/ fingerling production, fertilisation, disease and pest/ predator control, etc. in a managed environment) than to fishing. The synergies between farming and aquaculture provides opportunity for entrepreneurial farmers to adopt fish farming as an additional income generating activity.

Aquaculture stabilizes the livelihood of poor and improves their nutritional status. Many of fish farmers benefit from the direct contribution of fish through having food for home consumption in addition to cash income from the sales of fish. In the Pilot Project baseline survey, average annual cash income for fish farming was MK 1,706 (9.7% of total annual cash income) for those who are engaged in aquaculture (Attached Table A3). Figure 1.1 shows the comparison of nutritional status between two groups of children in rural area. One is from the households having fishponds and another from ordinary households. In this study, it clearly indicates that children of fish farming household have better nutritional status compare to others. Incidence of stunting (children more than two standard deviations below the median height for age of referenced population) among children under five year old is 30% in fish farming households and 70% in non-fish farming households.



Data: Data were obtained from 60 randomly chosen children (under 5 years old) from farmers' household in Zomba District

Source: JICA Study Team (2003-2005)

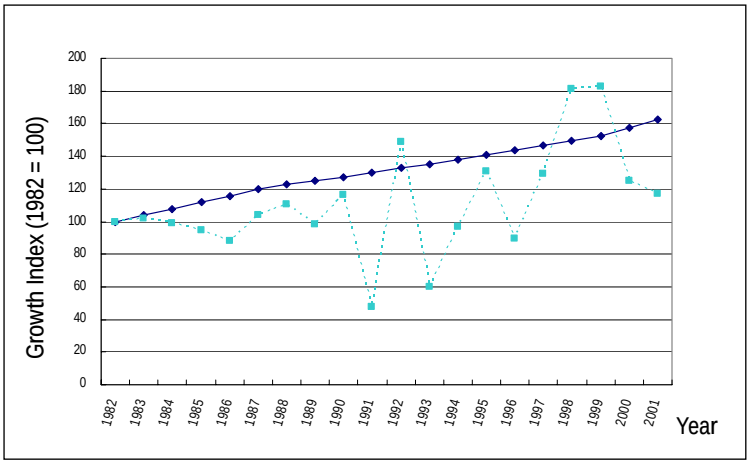
Figure 1.1 Comparison on nutrition status between children in fish farming households and children from non-fish farming households

If fish farmer is poor, fishponds may play more variety of roles in their livelihood. These are, apart from the roles as cash incomes and food source as already mentioned above, as kind of bank in other words "living-stock", or the fish distributed fro the harvest to neighbours and relatives may strengthen their social relationships, and these are all very important to resist the external shocks for the poor.

Box 1 The Main Features of Agriculture in Malawi

Agriculture is the most important economic sector in Malawi and accounts for over 36% of GDP, and a large proportion of the population is directly or indirectly dependent on agriculture for their livelihoods. Thus, agriculture-led development is a pivotal part of the national poverty reduction strategy and the growth of agri-businesses in Malawi. However, growth in agricultural output over the past 30 years has been disappointing. Agricultural production indicators demonstrate that per capita production has fallen from 290.9kg/year to 141.5kg/year between 1971 and 2002 (FAO, 2005).

Small-holder farmers dominate the agricultural sector, occupy 76% of land area and account for 68% of the agriculture workforce. The small-holder farming system can typically be described as "low input - low output". The principal farming implement is a hoe and there is limited use of fertiliser. There is a very high dependency on maize with a limited measure of intercropping or crop rotation. Rainfall is relatively high but is concentrated over a four-month period (Attached Figure A1). Yields vary according to rainfall and there have been several severe droughts and floods in the last decade, which have severely impacted agriculture production. Over 70% of farmers cannot produce enough food for home consumption and are net purchasers of food (World Bank, 2004). Severe food shortages often occur in January and February, just before the harvest season (refer to Attached Figure A2). Livestock ownership is generally low with a small minority of farmers owning large or medium stock units. 23.8% farmers own some kinds of livestock and chickens are most popular, yet not all households own them (44.7%). Overall livestock rearing generates annual cash income of USD8.46 in 1998 which is lower than the cash income generated by fish farming (Attached Table A3 and A4). Moreover, the increase in national maize production (dotted line) in most years during the period 1982 to 2001 was lower than population growth (solid line in the figure below). Poverty in Malawi may therefore have worsened over the past two decades largely on account of poor agricultural yields.



Source: MAIFS statistics (2003)

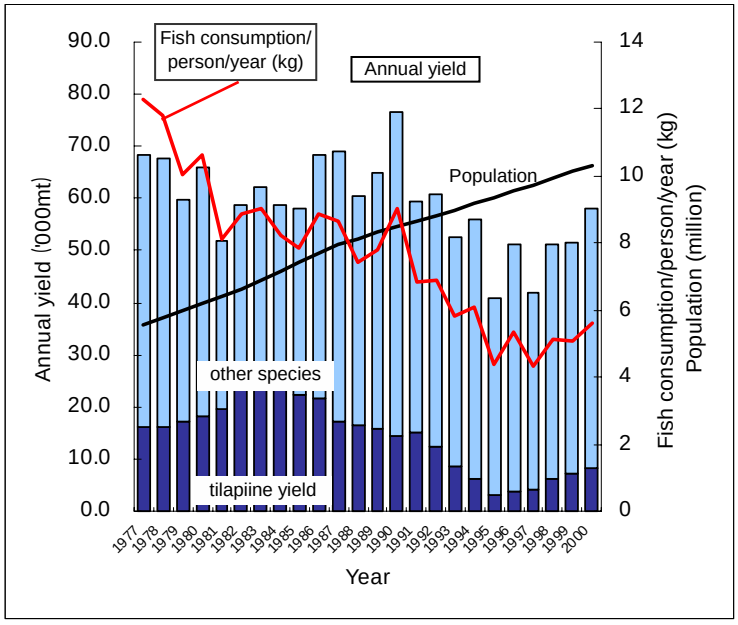
Population growth and maize production 1982-2001

Capture fishery cannot meet future demand

Adequate nutrition strengthens the ability of an individual to become more productive. In Malawi, the nutritional status of the population has been deteriorating since the 1970s. Food intake has declined by 10% from 2,417 calories in 1971 to 2,168 calories in 2001 and animal protein intake has fallen by 40%, from 6.6g per day in 1971 to 3.7g in 2001 (FAO, 2005) (Attached Table A5). As a consequence, approximately 25% of children under the age of 5 years presently suffer from chronic malnutrition. Improving the nutritional status of its people is a fundamental challenge facing the Government of Malawi.

The decline in animal protein intake is directly related to fish supply, which cannot match the population growth rate. Traditionally, fish has been the main source of animal protein, accounting for approximately 60% of total supply. Per capita supply has declined from 12.8 kg during the early 1970s to 5.8 kg at present (ADiM Working Paper No. 1). In poorer family, the dependence on fish for the animal protein is higher than that of wealthier family. At the same time, the poorer family share higher percentage of their income for fish than the wealthier family (Attached Table A6). This fact suggests the important role that fish plays especially in poor family households. **Unless adequately managed the current fisheries are unsustainable and fish intake will decline further.**

Under the present population growth rate of 2% per annum, the fisheries, even if managed on a sustainable basis, will not be able to supply future demand. The decline of CPUE is observed at various fishing grounds (Attached Figure A3). The decline is especially prominent in tilapiine stocks (Attached Table A7). The total potential yield from the capture fisheries in Malawi is estimated at 78,000 mt (Attached Table A8). This leaves a deficit of 17,000 mt, to maintain the per capita fish supply of 5.8 kg of 2000 in 2025. The demand gap would have to be met by importation or by other means (ADiM Working Paper No. 1). However, access to imported fish may struggle in future as diminishing world fish supplies may elevate market prices above Malawi's purchasing power. **This deficit clearly illustrates the need to strongly support and aggressively promote the development of the aquaculture sector in Malawi in an appropriate manner.**

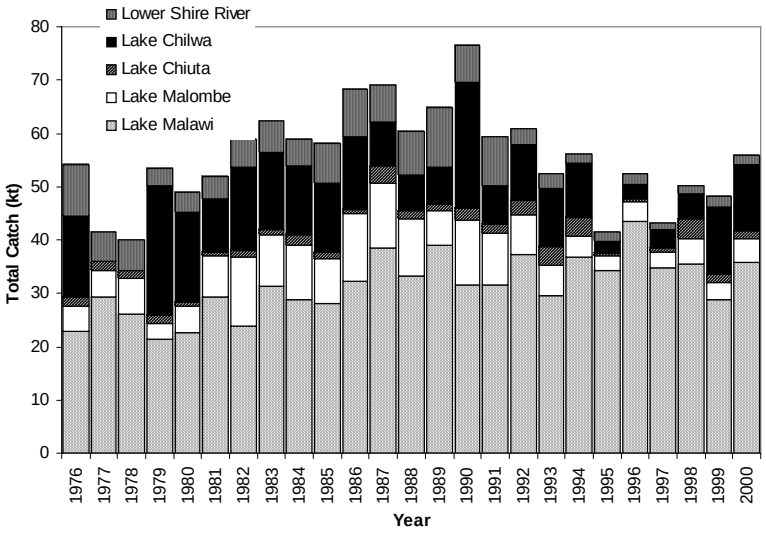


Source: Compiled by JICA Study Team (2003-2005)

Figure 1.2 Total annual fish yield in Malawi 1977-2000 and per capita fish consumption

Box 2 The Main Features of Malawi's Capture Fisheries Sector

The water bodies of Malawi, which cover 20% of the surface area, are vital resources. The main water bodies are lakes Malawi, Malombe, Chilwa and Chiuta, the upper Shire river and the lower Shire Floodplain. The overall national fish supply from these water bodies is illustrated in the figure below. Since 1976, the total fish supply has fluctuated between 40,000 mt and 76,000 mt with no definite trend. Lake Malawi is the most important contributor (57%) to the annual fish supply. Fish supply from these waters was estimated at 56,000 metric tonnes in 2000 (Attached Table A9). Total fish yield has remained fairly static since then and despite fish imports (1,630 mt in 2000) and a limited contribution from aquaculture, per capita supply fell from 12.8kg during the early 1970s to 5.8kg in 2000.



Source: ADiM Working Paper No. 1

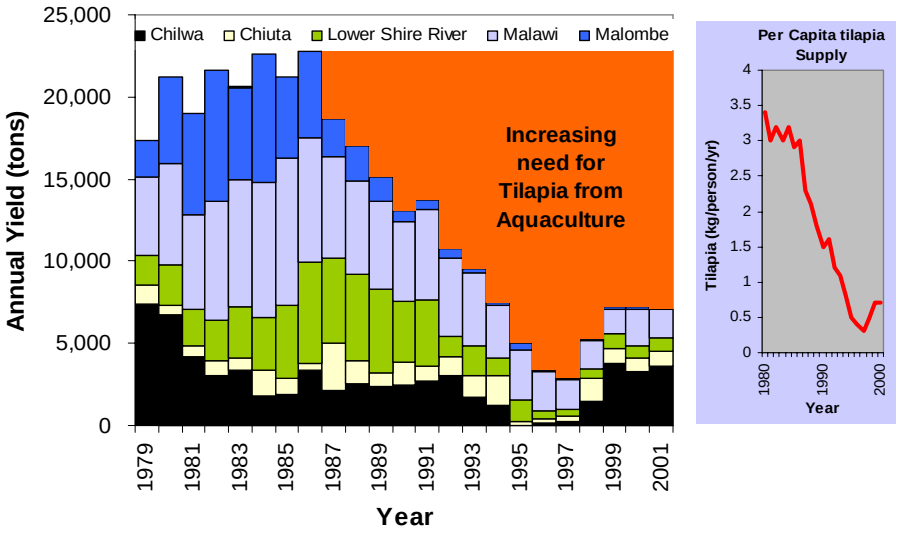
Fish yield by water body 1976 to 2000

The fisheries provide a source of direct (48,000 people) and indirect (230,000 people) employment. The sector is highly diverse ranging from large stern trawlers to hook and line fishing from the shore. Small-scale commercial fishers, who are either self employed or employed by boat owners, dominate the fisheries. Small-scale commercial fisheries contribute approximately 87% to the total fish landings and uses a highly diverse assemblage of gear including beach and open water seines, gill-nets, fish traps and hooks.

Future yields from the capture fisheries can only be increased if current fisheries are managed on a sustainable basis and by harvesting underexploited or unexploited deepwater pelagic and demersal stocks in Lake Malawi. The total future potential yield has been estimated at 78,000 mt, of which some 58,000 mt would be from Lake Malawi. The total potential yield from deepwater stocks in Lake Malawi has been estimated at 43,000 mt. Malawi is however only one of the riparian states and would have to share the resources with Mozambique. Malawi is currently planning a project (supported by the African Development Bank) to increase production from the pelagic zone of Lake Malawi by 11,000 mt. While technologies exist for the harvesting of deepwater fishes, the exploitation of these stocks in Malawi is however constrained by a number of physical, technical and economic factors and it is highly unlikely that these resources would be fully exploited in the medium term. At best, it should be considered as a long-term objective (ADiM Working Paper No. 1).

Commercial aquaculture – an opportunity for the creation of wealth and enhancing the rural cash economy

The species composition of Malawi's capture fisheries has changed with major declines in the catches of the more valuable tilapiine species. The per kg beach price of tilapiine fishes is up to 400% higher than for other species. The decline of the tilapiine fishery has therefore resulted in highly significant economic losses (ADiM Working Paper No. 1). Figure 1.3 illustrates the decline in the tilappiine catch from 23,000 mt in 1984 to 7,000 mt in 2001 and the extreme decline in the per capita supply. **This leaves a deficit of 16,000 mt, and illustrates a major market opportunity for tilapiine aquaculture.**

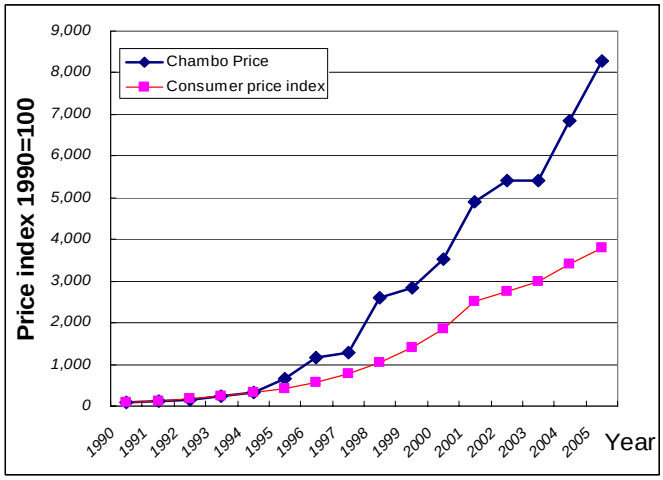


Source: Compiled by JICA ADiM Study Team (2003-2005)

Figure 1.3 Total tilapiine yield from major fisheries in Malawi 1979-2001 and per capita tilapia supply showing the increasing need for tilapia produced by aquaculture

The rapidly escalating price of fish is another factor that improve the climate for investment in medium to large-scale commercial fish farming in Malawi (Figure 1.4). Up to the end of 2002 the calculated return on investment was too low for investors to show any real interest in aquaculture. Since then the situation has changed dramatically and this is reflected by the current surge in interest by both small, medium and large-scale investors.

In environmentally suitable areas and districts, aquaculture has the potential to become an important contributor to the local cash economy. The establishment of a nucleus of successful fish farms will unquestionably unlock the entrepreneurial capacity of many farmers, which in turn would lead to greater earning and spending power, employment opportunities and the creation of wealth.



Source: Fish =MALDECO retail price;
Consumer price inflation =World Bank (2004) and EIU (2004)

Figure 1.4 Price trend of tilapia 1990-2005 (retail price)

CHAPTER II OVERVIEW OF AQUACULTURE IN MALAWI

1. History of Aquaculture

According to Meecham (1976), aquaculture in Malawi began in 1906, when rainbow trout (*Onchorhynchus mykiss*) was first introduced into the Mulunguzi Stream on the Zomba Plateau. Tilapia culture started in the mid 20th century with the building of several "coarse fish" ponds at Tipwiri, Nchenanchena, which where stocked with *Oreochromis shiranus* and *Tilapia rendalli* from Lake Malawi. By 1958, there were 52 ponds with a combined area of 5.9 ha and a total production of around 1,000kg.

Since the late 1960s, Malawi has made a concerted effort to develop small-holder and commercial aquaculture. During the period 1970 to 2002, Malawi has received substantial support through the FAO, ODA (UK), Malawi-German Fisheries and Aquaculture Development Project: MAGFAD (GTZ/ICLARM), the National Aquatic Resource Management Programme: NARMAP (GTZ), the Central and Northern Regions Fish Farming Project: CNRFFP (EU), the Border Zone Development Programme: BZDP (GTZ) and the Project on Aquaculture Research and Technical Development of Malawian Indigenous Species: ARTDMIS (JICA), amongst others (refer to Attached Table A10).

Overall, there has been a substantial investment in the establishment of aquaculture stations. Today, there are 13 aquaculture demonstration stations with more than 200 experimental ponds. These investments, in addition to the tertiary training provided by the University of Malawi at Bunda College (Kaunda, 2003) have established Malawi as one of the foremost exponents of inland aquaculture in central and southern Africa.

Commercial aquaculture in Malawi has a chequered history in Malawi. The first attempt to demonstrate the feasibility of commercial aquaculture was made in the early and mid 1970s at Kasinthula. Though some successes were achieved, an assessment of the potential for commercial scale aquaculture in 1990 (Balarin & Hecht, 1991) showed that the price of fish at that stage was too low to justify any substantial scale of investment. Though several attempts were made to establish commercial aquaculture operations during the 1990s, they all failed for various reasons. Contributing factors included under-capitalisation, high interest rates, inadequate management expertise, inappropriate site selection, an investor unfriendly environment and a lack of institutional support (ADiM Working Paper No. 2 and 6). Because of the declining yield from capture fisheries and increasing demand, the price of fish has increased significantly since 2001. As a direct consequence, two carefully planned large-scale fish farms were started in 2003 viz. Chambo cage culture in Lake Malawi and pond culture in the Lower Shire valley at Kasinthula. Though still in the nascent phase, these farms are making excellent progress and at full-scale production will collectively produce over 3,000 mt per annum. The trout farm on the Zomba plateau was privatised in 2002 and produces a small quantity of fish for the local hotel and restaurant trade.

Cognisance also has to be taken of the fact that Malawi is a signatory to the Convention on Biological Diversity, which was ratified in 1993. Conceived as a practical tool for translating the principles of Agenda 21 into reality, the Convention promotes to improve the conservation of biological diversity and sustainable use of biological resources (CBD, 2005). To reflect the Convention, the DoF has banned translocation and introduction of exotic species in Malawi, as articulated in the 'Fisheries Conservation and Management Act 1997' (refer to Annex 2 for further detail).

2. Rural Aquaculture

Aquaculture in Malawi now consists of two sub-sectors, namely a long established "low input - low output" rural aquaculture and a nascent commercial sector. Currently, rural aquaculture predominates the sector.

Edwards and Demaine (1997) define rural aquaculture as an activity that,

- is undertaken by small-scale farming households or communities;
- uses extensive or semi-intensive low cost production technology;
- may use off-farm agricultural inputs such as inorganic fertilizers to intensify production;
- avoids the use of formulated feeds;
- produces a commodity which must be of low-market value affordable to poor consumers.

Most small-holder rural Malawian fish farmers are adequately described by this definition. Some additional characteristics of African rural fish farmers however include,

- small-scale rural aquaculture complements the farmer's livelihood as a part of their subsistence coping strategy (fish as food, gifts, prestige and limited cash income).
- small-scale rural aquaculture is partially or totally integrated into the farming system and is not a stand-alone activity.
- small-scale rural aquaculture is a "low input - low return" system.

2.1 Distribution, Number of Fish Farms

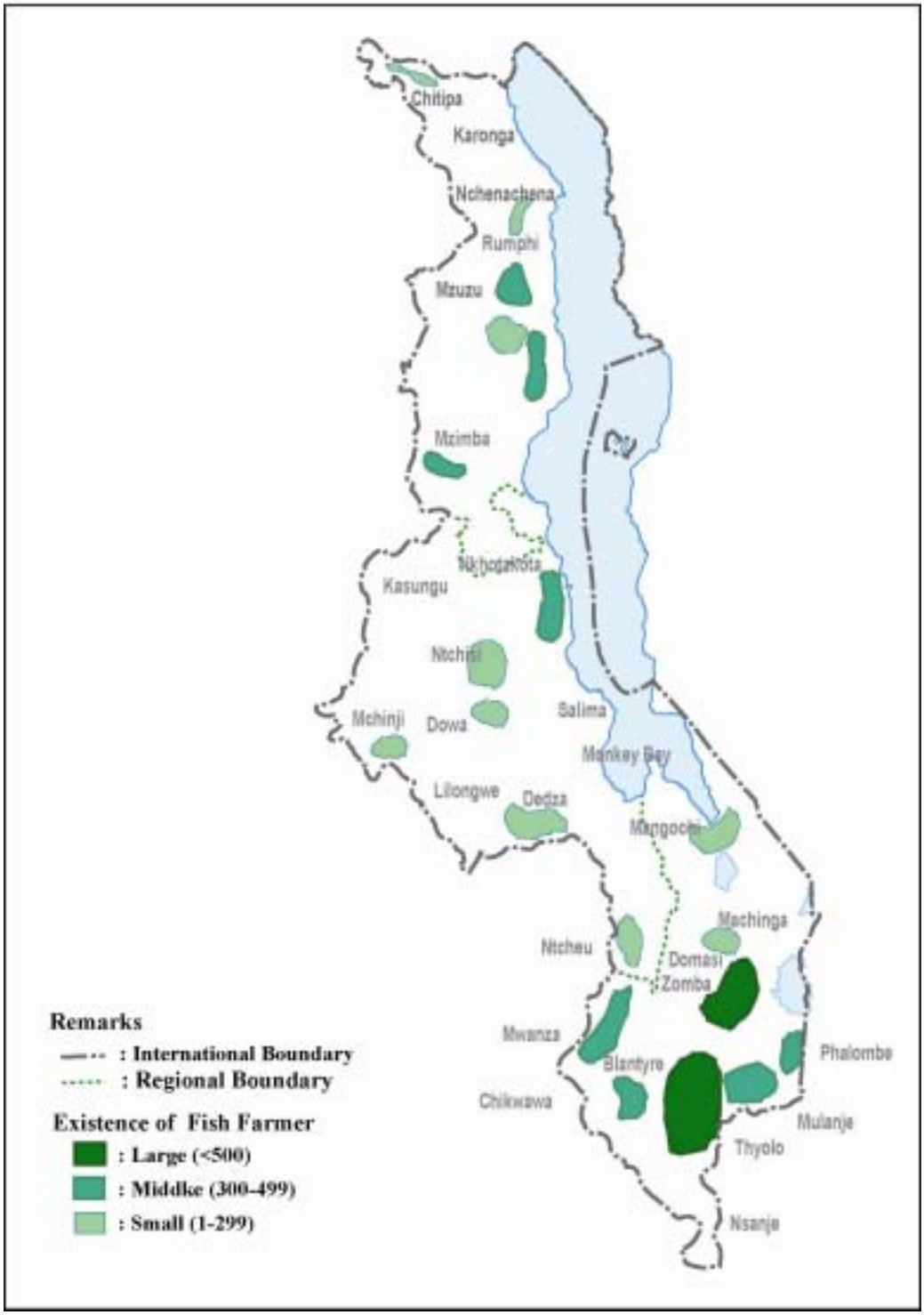
A typical small-holder fish farmer has one or two small ponds (about 200 m^2 or less) usually located in close proximity to a seasonal wet-land (Dambo). These fish farmers are widely distributed in rural area and practically, it is difficult for the government to capture the number of these farmers. Despite incongruent sources of information, it is clear that the number of ponds and fish farmers has increased significantly during the last 15 years. The National Aquaculture Centre (NAC) at Domasi estimated that there were approximately 2,000 small-holder fish farms in 1995 and that their number had increased to 4,050 farmers with 9,500 ponds in 2002 (Table 1.3 and Attached Table A11). Unfortunately, there is very little information on the proportion of active small-holder farmers or of ponds that are in production. Field observation suggests that many of existing ponds have been abandoned, yet exact figure is not known. Without this information, it is not possible to accurately estimate current levels of fish production in the country. Nevertheless, it is clear that there has been a significant increase in the number of fish farmers in Malawi over the last five years (ADiM Working Paper No. 2 and 3).

Table 1.3 Total number of small-holder farmers and ponds by region in 2001-2003

Region	No. of farmers			No. of ponds		
	2001	2002	2003	2001	2002	2003
South	1,500	1,500	1,972	3,278	3,500	n.a.
Central	990	1,200	922	2,056	2,900	n.a.
Northern	1,320	1,350	1,517	3,100	3,100	n.a.
Total	**3,810**	**4,050**	**4,411**	**8,434**	**9,500**	**n.a.**

Source: NAC, 2001 and 2002 and Chimangeni, 2002

Though there are distinct, regional biophysical, political and economic differences the two categories of farmers were distributed relatively evenly across the country. It was apparent that household level factors such as access to labour, availability of pond inputs and the level of agricultural diversification had a stronger influence than the geographic, political other variables on their distribution. The major fish farming areas in Malawi are illustrated in Figure 1.5.



Source: Updated by JICA ADiM Study Team (2003-2005) based on DoF information and Brooks. 1992

Figure 1.5 Distribution of fish farmers in Malawi

2.2 Production and Future Projections

Rural aquaculture production and productivity

Aquaculture production in Malawi in 2002 was estimated by the National Aquaculture Centre (NAC) at 800 metric tonnes, comprised of 93% tilapia (*O. shiranus, T. rendalli, O. mossambicus and O. karongae*), 5% catfish and 2% exotic species such as common carp and rainbow trout. This is in contrast to the estimates of the ADiM National socio-economic survey (ADiM Working Paper No. 3) and the ADiM situation analysis of aquaculture in Malawi (ADiM Working Paper No. 2), which estimated total current small-holder fish production to be between 40 and 200 mt per annum. In 2003, there were no medium or large-scale commercial aquaculture activities in Malawi. In relation to capture fisheries, the proportion produced by aquaculture (even if the NAC total country production estimate is correct) is insignificant and does not exceed 1.4%.

All small-holder agricultural enterprises in Malawi are resource limited (ICLARM & GTZ, 1991). Higher levels of production from small-holder fish ponds is limited by the affordability, availability and access to better quality inputs (feed, manure and fertiliser). Brummett (1994) estimated that only 27% of nitrogen requirements are met in integrated pond aquaculture systems in Southern Malawi. Some projects have reported maximum yields of 5,000 kg/ha/yr. However, given that most of the production figures quoted in the literature are based on small target groups a more realistic estimate of overall production in Malawian small-holder fish ponds is probably in the region of 700 – 1,200 kg/ha/yr (ADiM Working Paper No. 2 and 3).

Table 1.4 Malawi aquaculture production statistics 1995 – 2001

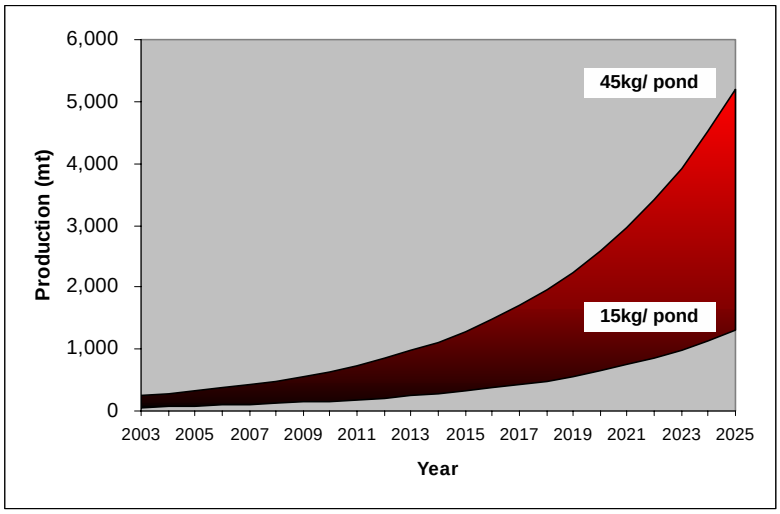
Unit: mt

Year	Production
1995	200
1996	210
1997	250
1998	340
1999	550
2000	640
2001	750
2002	800

Source: DoF, 2002

Projection

Future projections of the growth of the rural aquaculture sector were made on the basis of historical trends. During the period 1965 to 2002, the number of ponds has increased at an annual rate of 15% (ADiM Working Paper No. 3). The most dramatic increase occurred from 1999 to the present. If this rate of annual increase is projected, starting at an estimated current national pond count of 4,000, then up to 80,000 ponds may be constructed by 2025. This assumes that it will be possible to maintain a 15% growth rate per annum and that there is a adequate infrastructural and institutional support. However, on a national level there are sufficient new suitable pond sites to allow this increase to occur. Using two conservative levels of production (15kg/200m^2 pond and 45kg/200m^2 pond per year) the potential range of total production from small-holder fish farms is shown in Figure 1.6.



Source: ADiM Working Paper No. 3

Figure 1.6 The potential range of total production from small-holder fish farms under two of production scenarios of 15 and 45kg/200m^2 pond per annum (Attached Table A12)

Fingerling production

The number of fingerlings distributed during the 2000 / 2001 season in the South and Central Regions is shown in Table 3. No figures are available for the Northern Region as the CNRFFC was flooded during the rainy season and the Centre did not have any operational funds. *Clarias gariepinus* fingerlings are produced at NAC on demand, so only 16,905 fingerlings were sold in 2001.

The price of fingerlings (MK 5, 5 and 10 for *O. shiranus, T. rendalli* and *O. karongae,* respectively in September, 2004) is remarkably high. Theoretically, the high fingerling price makes small-holder fish farming uneconomical if the farmer has to purchase fingerlings. For example, if a farmer sells fish at an average weight of 40g then the fingerling cost can be as high as 90% of the selling price. Similarly, for a 150g fish the attributable fingerling cost would be 18%. In comparison to Asian countries, the cost of fingerlings is exorbitant.

However, it would appear that existing fish farmers produce their own fingerlings for on-growing and that new entrants buy their initial stock of juveniles from fingerling producers. Thus, the high cost of fingerlings may be a constraint for many new entrants to take up fish farming as a diversification strategy. Established fish farmers who produce their own fingerlings are not constrained by price.

Ideally, in the long term, fingerlings must be supplied by producers at a reasonable and appropriate price, such that fish farmers can concentrate on producing marketable size fish. Dual purpose ponds (fish and fingerling production) are uneconomical. Reduction of the cost of fingerlings by dedicated fingerling producers obviously requires a certain economy of scale. Development efforts should therefore focus on cost effective, mass-production and supply of high quality fingerlings. By high quality fingerlings we refer to young fish and not, as has often been the case in the past, the supply of small old fish as fingerlings. In the short term, this may only be possible through the NAC but once the technologies have been perfected they should be transferred to entrepreneurial farmers who wish to specialise in fingerling production or to dedicated farmer club hatcheries.

Table 1.5 Number of fingerlings distributed by the government in 2004

Unit: fish

Name of Station	Number of fingerlings produced
Nkhata Bay	1,960
Mzuzu	3,140
Chisitu	1,200
NAC	350,000

Source: DoF (2005)

2.3 Marketing of Cultured Fish

Most of cultured fish are sold at pond-side and are purchased by the people in same community. It is rare that fish farmer takes fish to the market and it counts only 5% of total harvest. Therefore, the market price of cultured fish is not available in the country. Table 1.6 shows the prices of natural fishes sold by MALDECO. MALDECO is the biggest fish supplier in the country and their prices will well represent real market prices. According to their records, tilapia is always most expensive fish at the market with MK245 (USD2.2)/kg in 2005. While Utaka and Ndunduma belong same family of tilapia, its small size and large amount supply make them reasonable in price and very popular to Malawians. Current small size of cultured tilapia might be given the same status as these Utaka and Ndunduma. Although price of cultured tilapia (*O. shiranus*), around 100g per piece, sold in the villages fluctuates largely by occasions, usually its price is around MK100-120/kg. Price of large cultured Tilapia (150g or above) is not known as fish with such size are rarely produced in the pond. Beach price of *O. shiranus* has 40% less price compared to Chambo with same size (ADiM Working Paper No. 1).

Table 1.6 Price of major fish species in 2005

Unit: USD (MK)

	Fresh		Frozen		Smoked		Sun Dried	
	W/sale	Retail	W/sale	Retail	W/sale	Retail	W/sale	Retail
Oreochromis Karongae (Chambo/Tilapia)	1.8 (199.0)	2.2 (244.9)	2.3 (255.4)	2.6 (293.9)	3.1 (352.0)	3.5 (400.0)	-	-
Clarius gariepinus (Mlamba/African catfish)	1.0 (108.2)	1.1 (126.5)	-	-	-	-	-	-
Copadichromis species (Utaka/Mbaba)	1.0 (111.1)	1.2 (132.0)	-	-	-	-	-	-
Diplotaxodon limnothrissa (Ndunduma)	0.8 (93.5)	1.0 (110.4)	1.1 (126.6)	1.5 (166.0)	-	-	1.6 (178.3)	1.8 (207.0)

Remarks *: Wholesale price at MALDECO (Mangochi) and retail price at city (e.g. Blantyre and Lilongwe)
Source: MALDECO official price (2005)

2.4 Fish Farmers

The ADiM National socio-economic survey (ADiM Working Paper No. 3) provided the nation-wide information with which to characterize this sector in Malawi. The survey covered 563 farmers in 13 districts in all regions in Malawi. The baseline information on farmer clubs within the Chingale area in the Zomba District was also obtained (122 households) through the ADiM Pilot Project baseline survey (ADiM Working Paper No. 4). These two surveys and other documents provided the background with which to portray the rural aquaculture sector.

Outline of the farmers

The ADiM National socio-economic survey found that the average size of ponds throughout the country was 180m^2 and that farmers had an average of 1.5 ponds with a total surface area of 280m^2. The national average production was 706 $\pm$ 131 (SE) kg/ ha / year, which is equivalent to 12.3 $\pm$ 3 (SE) kg / fish farmer / annum. This is slightly higher than the sub-Saharan regional average of 500 kg/ha/yr (Machena and Moel, 2000). Harvesting is not scheduled and fish are often left in the ponds for prolonged periods. For example, 18% of farmers interviewed during the socio-economic survey had not harvested their ponds for over a year. Table 1.7 shows the use of harvested fish. In comparison to fish farmers in Asian countries, Malawian fish farmers share less percentage for sales, which suggests them being less market-orientated. In the other words, Malawian fish farmers are not professional fish farmers.

Among farmers whom harvest fish, only 4 % produced more than 60kg/yr, 10 % produced between 20 and 59kg/yr, and 55 % less than 19kg/yr (refer to Attached Figure A4), suggesting that there are two broad categories of small-holder fish farmers in Malawi;

(i) those who harvest a small quantity of fish that contributes to household food security. Over 90% of the fish farmers in Malawi fall into this category, and

(ii) those who harvest larger quantities of fish and in addition to contributing to household food security also obtain a tangible income from the activity.

Ponds are normally constructed by family members and sometimes with the help of hired labour. The most common species farmed are *O. shiranus* and *T. rendalli* and these are generally farmed under mixed sex, monoculture conditions. Reproduction is not controlled and few farmers have dedicated fingerling production ponds. Many farmers are still dependent on the NAC and its satellite stations for fingerlings, though latterly more farmers produce their own fingerlings or purchase them from other fish farmers. The ADiM National socio-economic survey (ADiM Working Paper No. 3) indicated that farmers generally have adequate knowledge regarding pond inputs but very few practised what they knew. The majority of farmers use maize bran as feed and green compost for pond manuring. Partial harvesting is the norm and many farmers had not harvested their ponds for over a year. Only 3% of fish farmers owned a seine net.

Nevertheless, it became evident that the current outputs form an important part of household livelihoods and provide an additional option for spreading risk and increasing the overall value of the farming system.

Table 1.7 Utilization of harvested fish (pond) cultured in Malawi and that of some Asian countries

Unit: %

	Malawi	Bangladesh	China	Philippine	Thailand	Vietnam
Home consumption	47.3	55.0	5.0	1.0	5.0	9.0
Sold	40.0	18.0	95.0	97.0	95.0	90.0
Given away	12.0	26.0	0.0	0.0	0.0	1.0

Source: * ADiM National socio-economic survey (2003), others R. D. Guerrero III *et al.* (2002)

Aquaculture is integrally linked to crop farming

The ADiM National socio-economic survey results suggest that fish farming contributed between 1% and 17% to overall household income. This is not much different from various other studies conducted in Malawi and Africa, which suggest that farmed fish contribute between 6% and 30% to

total farm production (Lazard, 2002; Woldfish Center, 2004). The Pilot Project has also shown that fish farming contributes more or less 10% of total annual cash income among farmers who practise aquaculture in the Chingale area, Zomba District (refer to Attached Tables A13).

Fish farming, therefore, is one of a variety of activities that are combined to maximize income and food security of small-holder farmers. This suggests that fish farming must be seen as part of the overall agricultural system and should not be considered as a stand-alone activity. In general, the more productive fish farmers also generally tend to be the more progressive farmers.

Better producers have greater access to resources and are more experienced

The more productive farmers tend to be older, have larger families (= more labour), larger land holdings, higher education levels, and more skilled employment experience. They also have access to and cultivate more land of all types, have better access to water, produce a more diverse range of agricultural produce, have more diverse livelihood strategies and are less food insecure. The constraints facing small-holder fish farmers are similar to those facing small-holder agriculture in general.

Category 2 fish farmers (see above) have larger and / or more ponds, feed their fish and manure their ponds more appropriately than the Category 1 farmers. Fish production per farm was found to be related both to the intensity of fish farming activities and available pond surface area.

Table 1.8 Characteristics of fish farmers in different categories

Category	Fish Yield (kg/ha/yr)	Household size	Age of household head	Land holdings (ha)	Skilled job experience (%)	Food secure (%)
Non fish farmer	-	7.3	39.7	2.58	21	47
Small producer*	538	8.3	43.2	3.14	25	57
Larger producer**	2,316	11.3	50.2	5.92	50	75

Remarks: *Small producer – fish production between 0 and 19kg per year
**Larger producer – fish production >60 kg per year
Source: ADiM Working Paper No. 3

Another observation is that fish farmer household tend to be male-headed households. Female-headed households often have less resources, human as well as financial resources, to initiate fish farming (Attached Table A14).

Fish farmers need support to improve production

The majority of fish farmers recognize that fish farming provides an opportunity for farm diversification and improved income. However, most were dissatisfied with their performance. The main reasons for the dissatisfaction in all groups currently engaged in fish farming was the slow growth rate of fish (35%), small pond size (25%) and the lack of technical support (8%), though all farmers were satisfied with the market and the price of fish. The survey result showed that 8% of farmers had abandoned fish farming in recent years. The main reason for abandoning the activity was lack of water. All of these reasons indicate a poor understanding of the critical requirements for successful fish farming. This clearly suggests the need for capacity building, education, improved extension and the need for access to small loans for the more progressive farmers and a greater supporting framework (extension) for those farmers at the lower end of the spectrum.

Table 1.9 Summary of socio-economic indicators of Malawian fish farmers

Descriptor/Indicator	Value	Comment
Mean household size	8.2 people	More productive farmers tend to have more people to assist with labour on the farm
Mean age of fish farmers	42 years	Better fish farmers are normally older and have greater ability to manage their fish ponds Mean age of farmers producing in excess of 60kg/yr is 50.2 years
Greater degree of food security	64.4%	Most fish farmers are better-off than small-holders without fish ponds
Mean size of land	3.32 ha	Fish farmers have significantly larger land holdings than the average small-holder farmer in Malawi
Mean number of ponds per household	1.6 ponds	Farmers generally see the number of ponds as a constraint to increased production
Mean pond size	178 m^2 (Total Pond Area 284m^2)	Larger pond size may improve production and this may therefore be a constraint to development
Mean fish production per farm	12.26 kg per annum	In most instances benefits only accrue through improved home fish consumption
Mean fish production/ pond	7.69 kg per annum	Indicates low level of management and lack of resources
Main supply of fingerlings (% of respondents)	DoF : 55.0% Other farmers: 32.8%	DoF and farmers provide most fingerlings
Use of manure (% of respondents)	85.6%	Although a high % of farmers use manure, the quantities applied are too low to satisfy the nitrogen requirements
Harvest methods (% of respondents)	Partial harvest: 94.3%	The high % of partial harvest shows the importance of the pond as a food store for home consumption
Use of fish (% of respondents)	Sold at pond or market: 47.0% Home consumption: 31.6% Distribution: 15.0%	Current quantities of fish produced are easily sold directly from the pond with little need for transport to the market
Mean contribution of fish to household income	17.0%	Although this is low, the contribution of fish farming to increased integration is of great importance to households
Average number of income generating activities per household	6.78	Small-holder farmers rely on a wide variety of income sources. More productive farmers are more diverse
Sources of income (% of respondents)	Food crops : 83.0%; Fruit & vegetables : 74.0%; Off-farm activities : 49.0%; Livestock : 26.0%; Fish : 19.0%*	A reliance on agricultural income can be expected, but the importance of off-farm sources is significant as it increases diversification
Priority expenditure items (% of income)	Food & basic necessities: 61%; Agricultural inputs : 19%; Education: 9%; Other: 11%	Small-holder farmers are not often able to produce enough food themselves and have to buy in food during certain times of the year.
Mean number of livestock per household	Large Livestock Unit: 1.58** Poultry : 10.66	The low levels of livestock are a constraint to pond nitrogen inputs
Households engaged in Ganyu (temporary employment)	26.5%	Ganyu can be used as an emergency strategy for survival, or as a means of increasing diversity of income sources

Remarks: *Respondents could provide multiple answers; therefore, the total percentage can be over 100%
**One large livestock unit = 1 head of cattle, or 2 head of sheep or goats
Source: ADiM Working Paper No. 3

3. Commercial Aquaculture

The FAO, Committee for Inland Fisheries of Africa (CIFA, 2000) defines commercial aquaculture as the rearing of aquatic organisms with the goal of maximizing profit where profits are revenues minus costs. Commercial aquaculture can include small to large-scale operations, and range from extensive to intensive systems. Commercial fish farms actively participate in the market by purchasing inputs (including capital and labour) and engage in off-farm sales of the fish produced. Normally aquaculture is the principal economic activity of farmers in this category.

Malawi started to develop aquaculture technologies through research and development. Major efforts were made in the late 1980s, which emphasised the development and transfer of technologies appropriate for small-scale aquaculture and in particular focused on the poorest of the poor. On the other hand, while the government was assisting and developing small-scale fish farmers, the private sector initiated fish farming on several sugarcane and tea estates. Their main objective was to produce fish for their labour force and not to sell product. The estate farms had the necessary resources and existing infrastructure (e.g., roads, machinery, irrigation systems, and adequate water supply) to begin fish farming and their ponds were stocked with fingerlings purchased from government stations. The DoF categorized the estate farms as commercial aquaculture. However, none of the estate fish farms really operated on business principles and little if any effort was made to employ technically skilled management, or to invest in appropriate technologies. At its peak, the "commercial" sector produced a maximum of around 100 mt per annum and from the mid 1990s to around 2001/02 the sector virtually collapsed.

The reasons for the failure of these farms are many and include the lack of proper financial planning, lack of commercial fish farming expertise, absence of commercial aquaculture expertise at government stations, inadequate fingerling production capacity (quality and quantity), and most importantly the fact that fish farming was not the core business of the estate. The failure of the estate fish farms and the absence of focus on commercial fish farming by government stations also sent a signal to prospective investors that fish farming was not commercially viable and this led to increased investor hesitancy. These factors certainly affected the development of the sector in Malawi, though many potential investors realised the futility of commercial aquaculture at the time because of the low price of fish (Balarin & Hecht 1991, Brooks 1992, Balarin 1997). The price of fish over the last 5 years has increased by over 350% and "chambo" now sells for up to USD 2 / kg.

This dramatic change is the main reason for the re-emergence of the commercial aquaculture sector in Malawi. Two meticulously planned commercial aquaculture operations were established in 2003/2004. One is a large-scale cage culture operation that is geared to produce between 2,000 and 3,000 mt of *Oreochromis karongae* in circular floating cages in Lake Malawi. The operation consists of a cage unit and a pond based fingerling production unit. The other is a medium scale pond culture operation in the Lower Shire valley at Kasinthula and consists of 10 ponds with a total surface area of 8 ha. The main species farmed include *Oreochromis mossambicus* and *Cyprinus carpio*. The only other "small to medium" scale commercial fish farm in Malawi is the recently (2001/2) privatised trout farm on the Zomba plateau. In addition, and as a direct consequence of the ADiM Pilot Project, several small-holder farmers have also taken the first steps towards the commercialisation of their fish farming activities. The success of these ventures will provide the impetus for the development of the sector in Malawi. Table 1.10 profiles the past and present commercial aquaculture ventures in Malawi.

Table 1.10 List of past and present commercial aquaculture ventures in Malawi

PAST	
1. SUCOMA farm (Sugar Corporation of Malawi)	
Location	Nchalo in Chikwawa district, Southern Region
Pond area	Total 17.2 ha consisting of 28 ponds ranging in size from 0.1 to 1.0 ha.
Fish production	49 mt at peak production.
Current status	SUCOMA fish farm was the largest commercial farm; the species farmed were *O .mossambicus, T .rendalli, Clarias gariepinus,* and *Cyprinus carpio* with an average production ranging from 3.1 to 3.6 mt/ha/year. The farm supplied fish to plantation workers on the sugar estate. Currently, the farm is operating at minimum capacity and production is inconsequential.
2. Dwangwa Sugar Estate Fish Farm	
Location	Nkhotakota District, Central Region
Pond area	3.2 ha
Fish production	94 mt in 1990.
Current status	This estate had a crocodile farm and produce fish mainly to feed the crocodiles. Crocodiles skins were exported. The farm has now ceased production and has closed down.
3. Liwonde fish farm (Nu-Line Foods Fish Farm)	
Location	Liwonde, Southern Region
Pond area	more than 10 hectares
Fish production	No records
Current status	The farm was planned to produce fish for sale to schools and other institutions of higher learning. The farm has closed down.
4. Benthos fish farm	
Location	Mangochi District, Southern Region
Pond area	No accurate data
Fish production	Currently no production.
Current status	The farm is owned by Club Makokola. The farm originally planned to supply *O. karongae* to the Club Makokola and other restaurants, but has now stopped production. Some fingerlings were supplied to MALDECO. Theft was one of the major problems.
PRESENT	
5. MALDECO fish farm	
Location	Mangochi District, Southern Region
Year established	2003
Pond area & cages	2 ha earthern ponds and concrete tanks for fingerling production, and 4 x 16m diameter cages
Fish production	Not yet harvested (target production = 3,000 mt)
Current status	This is Malawi's first major commercial fish farm. Currently, the farm produces *O. karongae* fingerlings for stocking into production cages.
6. G.K. Aquafarm	
Location	Kasinthula, Chikwawa District, Southern Region
Year established	2004
Pond area	10 ha (leased from DoF) and hatchery facility.
Fish production	Geared to produce 12 mt /ha /year.
Current status	The ponds have been renovated and produces *Cyprinus carpio* and *O. mossambicus*. Farm made feeds are used for fish production.

Source: Compiled by JICA ADiM Study Team (2003-2005)

4. Aquaculture Institutions

4.1 Department of Fisheries

The Department of Fisheries (DoF) within the Ministry of Mines, Natural Resources and Environment, has the primary responsibility for fisheries administration and providing professional services to ensure sustainable fisheries utilisation and enhanced aquaculture production at national and district level (refer to Attached Figures A5 and A6 for the structure of the Ministry and the DoF). It currently has about 500 staff with 80 professional officers (Qualifications of such DoF staff are shown in Attached Table A15). The DoF is composed of six divisions, viz. (i) Management and Administration, (ii) Planning, Monitoring and Evaluation, (iii) Research, (iv) Extension and Development, (v) Aquaculture, and (vi) Training. The aquaculture division with its headquarters at Domasi is known as the National Aquaculture Centre (NAC). Domasi was established in 1959 as an experimental fish farm. The main objective of the NAC is *to increase and sustain fish production from small-holder and large fish farming operations in order to improve fish supply in Malawi*. The DoF has 37 stations in the country. Of these, 30 are engaged in aquaculture and 13 are aquaculture demonstration stations with fish ponds (Figure 1.7 and Attached Table A16). The DoF has 60 staff members who are involved with aquaculture and of which 41 are dedicated aquaculture extensionists. SWOT analysis of the DOF is shown in Annex 5)

4.2 District Assembly

Once the on-going devolution plan is achieved, the aquaculture extension will be replaced under the authority of the District Assembly. As of February 2005, the fisheries officers in the Districts are located under the District Assembly, yet their salaries are being paid by the central government. Through devolution, the District Assembly will take an initiative in providing direct services to beneficiaries, whereas the central government will more concentrate on policy as well as research and education planning at the national level.

4.3 University of Malawi (Bunda College of Agriculture and Chancellor College)

Bunda College of Agriculture has been offering a BSc degree in Agriculture with an Aquaculture major since 1997 and a Masters degree in Aquaculture or Fisheries Science since 2002. By 2004, 51 BSc and 7 MSc holders have graduated (Attached Table A17). Chancellor College offers a Masters degree in Environmental Sciences in aquaculture related areas.

4.4 NGOs and Other Organisations

Various non-governmental organisations (NGOs) have for many years actively promoted aquaculture in Malawi. Most notable amongst these are World Vision Malawi, Action Aid, OXFAM, US Peace Corps, and various religious denominations, amongst others (refer to Attached Figure A7 for major NGOs' activities in respective sectors and Districts). There are some fish farmers groups which are often organized by NGOs. One of these groups, "Chingale Fish Farmers Association (Zomba District)" is the largest group that composed of 19 clubs with 329 member households. These groups are supported by World Vision Malawi in training and fingerling supply, yet not officially registered to the government. "Innovative Fish Farmers Network Trust" is an only officially registered national organisation. This new group is composed of 25 fish farmers who are expected as leaders of aquaculture development in their areas and aims at mainly sharing their experiences and knowledge among the members.

WorldFish Center (WFC), an autonomous non-profit international scientific and technical centre, unlike other NGOs, the WFC specialises in fisheries and aquaculture sector. The WFC has a

branch office at Domasi adjacent to NAC since 1987. The Center implements various researches and studies in fisheries and aquaculture in collaboration with the DoF. Such researches and studies include integrated aquaculture-agriculture technologies.

4.5 Donor Organisations and Support

Malawi is heavily dependent on foreign aid. External aid flow to Malawi accounts for almost 12% of GDP. 32.75% of total government revenue comes from loans and grants. Consequently, development policy and programmes are significantly influenced by donor policies.

Donors provide aid on a selective basis and carefully choose (or select) specific areas for official assistance. This process clearly influences the scale of assistance to the fisheries sector. Consultation with major donors has revealed that their support for the fisheries sector, particularly aquaculture, has decreased substantially. Currently, fishery or aquaculture components are often integrated into projects that enhance social development as a whole (Major donor's policy on fisheries assistance is shown in Attached Figure A8). For example, GTZ in Malawi has recently decided to refocus on capacity building in three major sectors, viz. 1) Health, 2) Education, and 3) Democratisation, instead of natural resources and natural resource management. The change in focus is largely a consequence of the perceived failure of individual sector assistance. Other major donors are similarly focussing on capacity building to assist integrated rural development. For example, DFID, one of the major donors in Malawi, has shifted support towards the integration of sectors (including aquaculture and fisheries).

4.6 Current and Planned Development Assistance

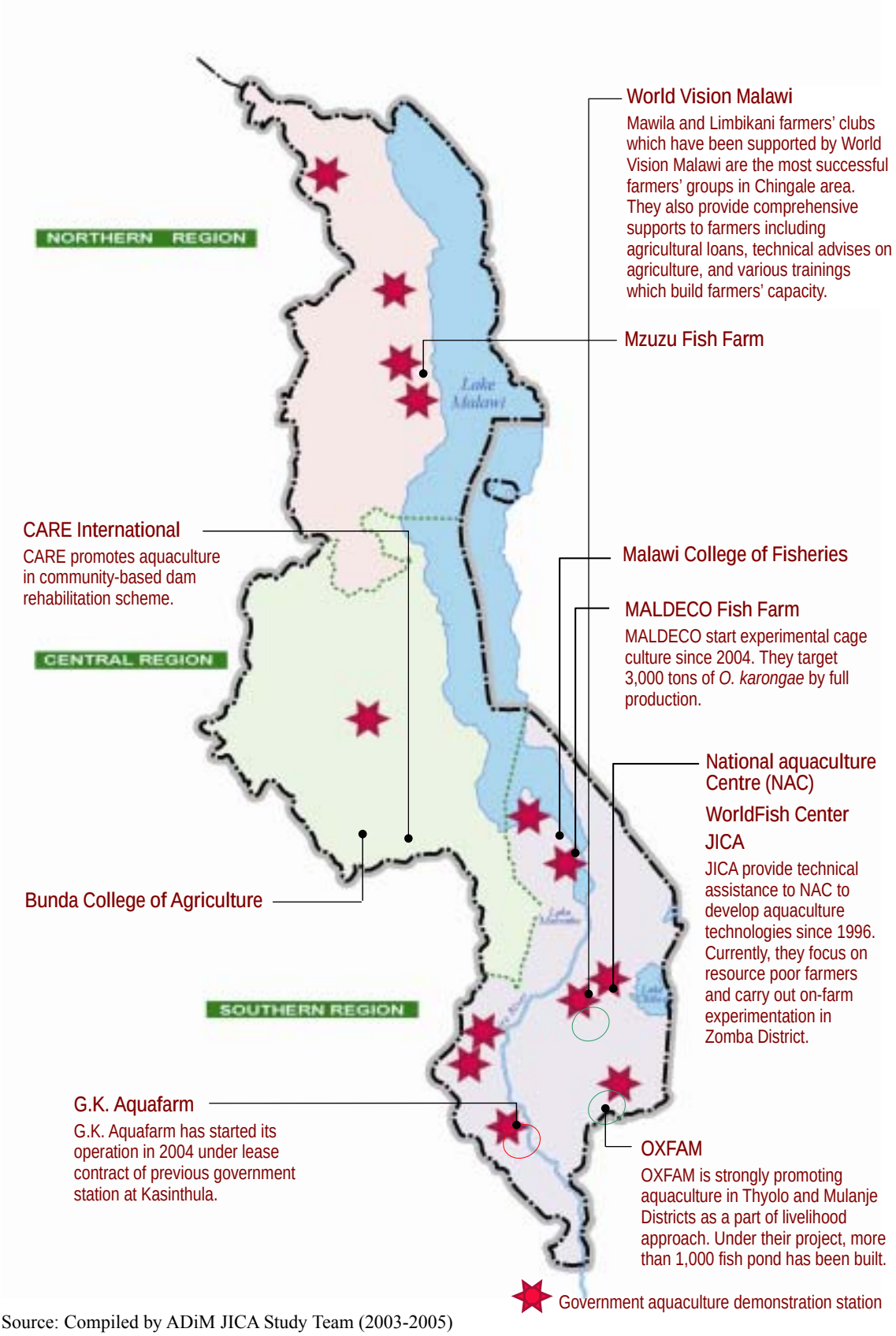
On-going and planned development assistances in the sector as of 2005 are listed below.

On-going assistances

- JICA: Project on Aquaculture Research and Technical Development of Malawian Indigenous Species (JICA) is being implemented in Zomba District
- WorldFish Center: WorldFish Center implements various researches and studies in fisheries and aquaculture in collaboration with the DoF.
- World Vision Malawi: Fisheries component is included in the Chingale Area Development Programme.
- Oxfam: Oxfam promotes fish farming in Thyolo and Mulanje Districts under the 'Shire Highlands Sustainable Livelihoods Programme.'
- African Development Bank (ADB): ADB currently implements the fisheries development project.

Planned assistances

- Malawi Investment Promotion Agency: The Malawi Development Corporation is currently seeking for a technical partner to initiate commercial aquaculture at Kasinthula.
- Canadian Marine Institute (MI): The Canadian MI collaborates with Bunda College in research and education in fisheries sector.
- Chambo Restoration Strategic Plan (2003-2015): The strategic plan was prepared with financial and technical support from USAID/COMPASS. It was initiated with 'Save the Chambo Campaign' in 2003.



Source: Compiled by ADiM JICA Study Team (2003-2005)

Figure 1.7 Location of aquaculture demonstration stations and major aquaculture activities

CHAPTER III CONSTRAINTS TO AQUACULTURE DEVELOPMENT

The current unfavourable macro-economic environment has cross cutting effects on all sectors, and this has also directly and indirectly affected the development of aquaculture. Malawi's economy holds inherent risk. The country is small and land locked, has an agricultural base, is heavily dependent on donor assistance and is prone to natural disasters such as drought. The inflation and interest rates are high and transport services are costly and unreliable (Table 1.11). Moreover, investment incentives are poor in comparison to other countries in the region. Collectively this creates a difficult business environment for commercial as well as small-holder aquaculture and also limits service delivery by the DoF in terms of extension and research.

Table 1.11 Some economic factors affecting fish farming operations

Factors	Figures	Comments
High interest rate	About 30%	It increases investment cost, erodes profit margins and seriously impacts availability of micro-finance for small-scale farmers.
High transport cost	2-3 times higher than rates in South Africa	It increases the cost of the most critical inputs for production, e.g. fertilizer, raw materials for fish feeds and manure. Fertilizer price in Malawi is three times higher than average world prices and 50% of this cost is attributable to transportation.
High inflation rate	27%	Discourages consumer spending and erodes purchasing power.
Slow land reform process	Over 80% of small-holder farmers have less than 1 ha and land is over used. A total of 800,000 ha of under utilised public land has been identified.	Many farmers claim that the size of their land is the main constraint to start fish farming.

Source: World Bank, 2004

There are several underlying reasons why aquaculture production in Malawi is erratic and why the sector as a whole is still under developed, except above macro-economic reasons.

1. Constraints to Rural Aquaculture

Rural aquaculture is characterised by low productivity and small quantity of the harvest. Current productivity of about 700kg/ha/year remains contribution of aquaculture at minimum level. Having limited resources are the major challenges. Such challenges and constraints of the current rural aquaculture in Malawi are described below.

Poor access to the land and water

Farmers who possess small land are often difficult to access to the land which is suitable for aquaculture nor water source. In Malawi, permanent water supply tends to be located only in Dambo area and such area is generally regarded as a common property by rural community. Many of fish farmers uses personal furrow (54%) and ground water (59%) for their aquaculture practices. Whereas only a few utilises communal or shared water (5%) for their fishponds. This suggests that unless farmers have their own water source within their land, it is difficult for one to start fish

farming. In other words, without any system to enhance using shared water, fish farming remains a business for limited farmers with specific geographical conditions.

Scarcity of input commodities

The findings of the ADiM National socio-economic survey (ADiM Working Paper No. 3) clearly showed that small-holder fish farming is practised on a low input basis. Fish are neither adequately fed nor are ponds adequately fertilised. The reasons for this are twofold. Most farmers either do not have access to the necessary resources or cannot afford the risk of acquiring the necessary inputs. Alternatively, those farmers that do have access to resources are either ignorant as to the nutritional requirements of the fish and the quantities of manure and or compost required for adequate pond fertilisation or are faced with problems of availability and supply. Manure collected from livestock is important to maintain fertility of the pond water. However, possession rate of livestock is not high in Malawi (Attached Table A4). Households that own cattle remain 5.2%. Poultry is the most popular livestock with its possession rate of 44.7% with average number of 8.4. Furthermore, there is also a demand for manure in other agricultural activities. Some amount of chicken manure is cheaply available in poultry factories. Yet, the factories are usually located adjacent to big cities and farmers who have access to those factories are limited due to the high transportation cost. If aquaculture is to make a meaningful contribution to fish supply in Malawi, then it is critical for farmers to be educated with respect to the requirements of their fish, and that the supply chain of manure and fertiliser in Malawi is vastly improved.

Another problem of small-holder aquaculture derives in part from the poor accessibility to and the high price of fingerlings. According to the ADiM National socio-economic survey (2003), fish farmers rely heavily on the purchase and distribution of fingerlings from the DoF (40%) and other fish farmers (41%). However, fingerling production from DoF rarely meets the demand in terms of quantity and quality. Moreover, most of the DoF stations (except the NAC) lack the physical and sometimes the technical capacity to ensure the efficient delivery of fingerlings to farmers. For example, during the period 2003 to 2005 there has been a dramatic increase in demand for *O. karongae* fingerlings, which the NAC and other producers could not satisfy. The market responded accordingly and the price of *O. karongae* fingerlings rose to more than MK 10 per fish. In September 2004, the price of *T. rendalli* and *O. shiranus* fingerlings (ex NAC) was MK 5 per piece. The current price of fingerlings is considered to be an obstacle for small-holder fish farmers. In addition, the supply network is weak and in most cases, farmers have to source fingerlings by themselves.

Poor human and social capitals

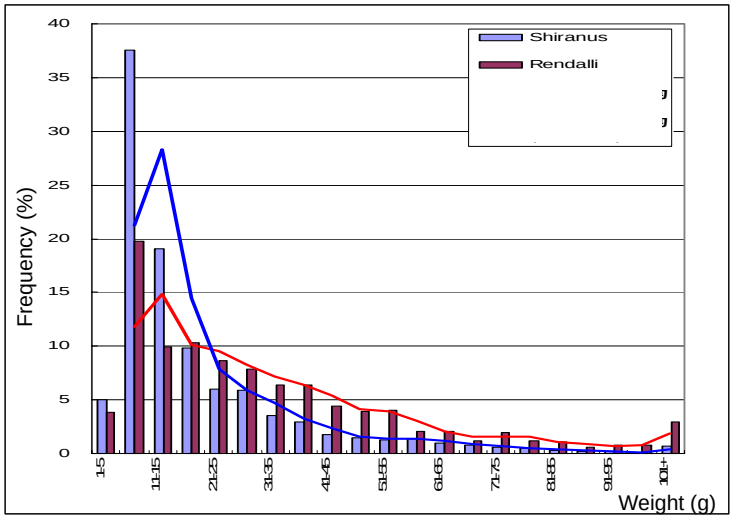
Weak human and social capital is also a constraint of small-holders. Without having basic ability in learning new technologies, effective extension will not be achieved. 40% of adult illiteracy rate becomes an obstacle in proper management of various fish farming activities. Institutional capacity and negotiation skill in order to access for extension service and credits are still weak. Such capacity can be brought by organising fish farmers into a group. However, most of farmers' lack in management skill to formulate cooperative works.

Poor understanding of small-holder fish farmers' livelihoods

In most instances fish farming is an add-on activity of small-holder farmers. The primary constraint facing small-holder farmers is access to resources and internal competition for water, land, feed, fertilizer, nets, and support services. This suggests that the development of aquaculture should be promoted within the overall context of rural, and in particular, agricultural development. To realise a greater degree of synergy in rural development initiatives requires a better understanding of the linkages between aquaculture and agriculture, poverty and rural development.

2. Constraints to Commercial Aquaculture

"Our fish do not grow" is the most common complaint by Malawian fish farmers. This is not unique to Malawian cichlids, it simply illustrates the phenotypic plasticity of tilapias in general. Figure 1.8 shows the size distribution of two species of Tilapia observed in 60 fishponds in the country. 63% of standing stock consists of fish that are less than 20g per piece. For *O. Shiranus*, the figure exceeds over 70%. The success of tilapia farming world-wide is a consequence of certain management and genetic interventions. Most important amongst these are controlling reproduction in ponds, providing appropriate and adequate quantities of feed and appropriate fertilisation, selection of appropriate species, hybridisation and development of faster growing strains and mono-sex (all male) farming. If the target is to produce large fish at the end of the grow-out cycle then either one, or a combination of the above, must be applied in conjunction with appropriate and adequate nutrition and fertilisation. To realise significant increases in fish production in Malawi requires the DoF to address these issues as a matter of priority.



Remarks: Data were based on 3,562 sample fish from 60 fishponds across 14 Districts.
Source: JICA ADiM Study Team (2003-2005)

Figure 1.8 Size distribution of two cultured Tilapia species

Antiquated technologies and poor dissemination of research results

Most Malawian fish farmers are subsistence farmers, who for various reasons cannot afford the risk of improved feeding, fertilisation and management of their fish ponds and are forced to adopt a "low input – low return" farming strategy. To change this approach, particularly in view of the high fish price, it is necessary to demonstrate the profitability of advanced higher yield technologies. However, these technologies are in most instances not available to the farmers.

It is inevitable that many will continue with current fish farming practices. The primary reasons why the current practices will persist include, amongst others, the widespread and high degree of poverty, an under-resourced and therefore inefficient extension service and antiquated extension material. The resources of the NAC are also not adequate to (i) establish a database of farmers who have the necessary resources to make the change from subsistence to commercial fish farming, (ii) to sustain a critical number of links between researchers and these farmers, (iii) to demonstrate the need for business planning and the profitability of alternative technologies that are perceived to be too risky. Moreover, several promising technologies have been developed at the NAC, but have not been disseminated to farmers. Past extension and external technical support approaches have been shown

to be unsustainable. The adoption of more participatory research and extension methods since the early 1990s will go a long way towards improving the rate at which new technologies are adopted by farmers.

The past mission of the NAC was largely geared towards the promotion, support and development of small-holder aquaculture. Consequently, much of the research has no application for medium to large-scale commercial aquaculture. The lack of focus on applicable commercial aquaculture research has in the past also been one of the major reasons for investor hesitancy and the absence of any substantial and well-planned investments in this sector.

Inability to access credit and institutional support

The scale of production, non-scheduled cash flow, lack of collateral, and high transaction costs of small loans has meant that the majority of fish farmers in Malawi are not creditworthy and therefore find it difficult, if not impossible, to access credit. It is unrealistic to expect that commercial banks would be significant providers of working capital for fish farmers. For small loans farmers are essentially restricted to organisations such as MASAF and various NGOs, though the terms for substantially meaningful loans are also highly restrictive. Farmers may have greater opportunities for collective access to finance if they approach lending institutions as producer groups, associations or clubs. It needs to be recognised, however, that this mechanism stifles individual entrepreneurial spirit. Resolving the mechanisms for access to capital is probably one of the most important challenges facing the development of small and medium-scale commercial aquaculture in Malawi.

Medium to large-scale commercial investors in aquaculture are similarly constrained by the high interest rates and uncompetitive investment incentives, such as tax breaks as well as the high import duties on raw materials and machinery. Furthermore, complicated procedure for obtaining rights for starting commercial aquaculture is an obstacle for aquaculture development in Malawi (Attached Table A18).

3. Constraints to Service Providers

Limited resources of the DoF

One of the critical constraints to aquaculture development in Malawi is the weakness of the aquaculture support services, brought about by inadequate government resources (The budget of the DoF is shown in Attached Table A19). Thirteen aquaculture demonstration stations and 41 aquaculture extension staff are insufficient to meet the most basic operational requirements to assist the widely dispersed fish farmers. Furthermore, the DoF cannot afford to send extension staff on refresher courses, resulting in antiquated extension messages. Moreover, the lack of communication between extension staff at remote stations and regional offices and or the NAC, and their low level of remuneration (one third of similar staff at NGOs) has de-motivated the staff. Given the small size of the sector it is highly improbable that the DoF would be able to justify or afford an increase in budget allocation to the aquaculture sector in the short term. Clearly, this has and will continue to impact negatively on the development of the rural small-scale aquaculture sector.

Weak capacity of local government and private service providers in aquaculture extension

To overcome above constraint and to enhance aquaculture production it is necessary for local government, NGOs and other private organisations to play an increasingly leading role in providing support services to small-holder fish farmers. Given their close proximity to the farmers and their participation in demand driven initiatives, their involvement in aquaculture would be more sustainable in the long-term. However, collaborative mechanisms between the private sector, NGOs, local government and the DoF in the delivery of effective services are not well established and in many instances, there is a need to build the fish farming capacity of the partners. These are

challenges that need to be addressed in the short term.

Unreliable statistics

Reliable aquaculture statistics are essential for policy making, evaluation of the service delivery by the DoF, and decision making for allocating resources to the sector. The limited operational budget and human resources of the DoF makes it impossible to collect adequate and accurate aquaculture statistics. Current information clearly suggests that the annual surveys undertaken in the past were inefficient and have led to contradictory results. This is one of the most basic challenges requiring attention.

CHAPTER IV DEVELOPMENT OPPORTUNITIES

1. Development Opportunities to Rural Aquaculture

Two opportunities are identified for the development of rural aquaculture. One is the approaches that strengthen resource base of small-holder farmers and the other is a potential technology that economises the limited pond inputs.

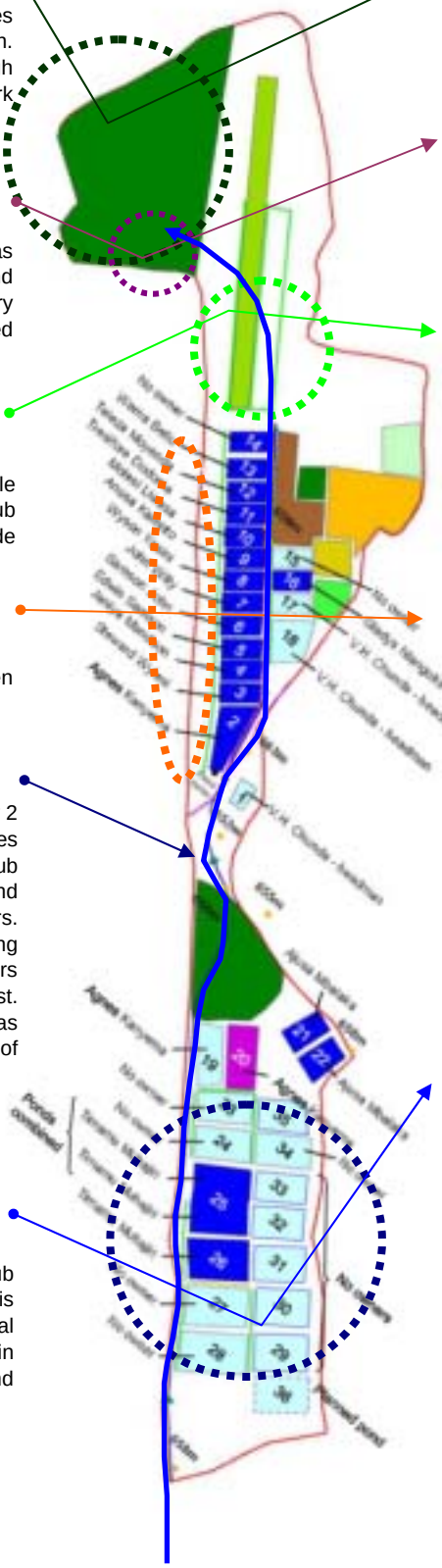
1.1 Existing Models of Integrated Approaches to Enhance the Resources of Small-holders

Table 1.12 explains a good example observed in two farmers' clubs in Chingale area, Zomba District on the utilisation of collective resources and opportunities of farmers by being members of farmers' clubs. For poor farmers, successful formation of a group can they not only utilise limited resources collectively, but also access to services. The average annual cash income for both clubs in 2004 was MK 13,506 which is more than a double of the average of other newly established clubs (MK 5,404). It also appears that the increase in the cash income from fish farming was possible by strengthening the service support. In Mawila farmers' club, after receiving various aquaculture related advises through the Pilot Project, their income from fish farming increased from MK1,736 in 2004 to MK3,470 in 2005 per member household. Figure 1.9 shows the integration of aquaculture with agriculture in the club land and its impacts. Such club acts as a potential model for supporting poor farmers through integrated agriculture with aquaculture component.

Table 1.12 Some examples in strengthening of resources for small-holder farmers by organising farmers' club in the case of Mawila and Limbikani farmers' clubs

Land and water	Both clubs have obtained new club land through negotiating with village headmen (Mawila: 3.6ha and Limbikani: 2.5ha). Constructing water cannel has provided members opportunities for establishing collective fishponds and starting aquaculture (60 HH in both Mawila and Limbikani farmers' clubs). Introduction of clubs as well as collective ponds have resulted in bigger bargaining power and efficient use of limited resources.
Feed, fertiliser, fingerlings, fish nets, etc.	Poor farmers are able to access to fish nets and wheelbarrows by joining the club. Members of the club can access to the loans for fertiliser as well as fingerlings provided by the NGO (67 % of households). Members are also able to allocate among themselves different roles in aquaculture such as broodstock rearing, fingerling production, and selected breeding, for effective aquaculture practice.
Human resources	Periodical meetings and collective club activities provide opportunities for members to share knowledge and technologies. When a representative of the club receives a training, the information will be transferred within the club through such opportunities.
Social capitals	As a collective entity, the club managed to collaborate in on-farm research with research institutes (e.g. Bunda College, Worldfish Center) and private firms (e.g. Monsanto company). Furthermore, farmers' clubs in the area have gathered together to form an association, called the 'Chingale Smallholders Farmers Association' for better access to services.

Source: Compiled by JICA ADiM Study Team (2003-2005)



Crop production (club land)

During dry season, the club produces maize seed for seed multiplication. Fertilisers were obtained through WVM's loan scheme. Members work together for 3 days a week.

On-farm trial on maize (club land)

On- farm trial on hybrid maize was entrusted from Bunda college and Monsanto through WVM. Necessary equipment and materials are provided and the club manage the farm.

Vegetable production (club land)

Using small-scale irrigation, vegetable are grown during dry season. The club buys seeds and members provide labours.

Fruit production (club land)

300 banana suckers have been planted along the pond side.

Water cannel

The cannel stretching approximately 2 km across the club land provides water which is essential to club activities. The cannel cuts across land owned by non-club members. Coordination and consensus building between the club and land owners over the water usage is the must. Construction of the cannel was achieved through collective labours of the club members.

Aquaculture production (club land)

There are 33 fishponds within the club land as of 2005. Each fishpond is owned and maintained by individual members. The club helps members in finding the market for fingerlings and providing opportunities for trainings.

Cash income from maize

Net profit from maize production in 2004 was MK56,000. Profit was shared among members and each received some MK750-1,750.

Knowledge obtained farm trial

Through participating in the on-farm research on improved maize, farmers can see the impact and learn a lesson from the experience.

Vegetable production

In 2004-2005, MK 9,795 was raised from sales of vegetables that was used for club activities. Vegetables were also shared among the members for their HH consumption.

Fruit production

Banana suckers were introduced to Mawila in Dec. 2005. By Feb. 2005, MK 2,000 was generated from sales of bananas. Once it is fully established, approx. MK10,000 is expected form its production. Cash sales was kept with in the club and used for its activities.

Fish sales

In 2005, the fish sales for average member HH was approx. MK3,470.

Mawila farmers' club

Year established	2001
N. of members	37 HH
Area of club land	36,045 m^2
No. of fishponds	33 ponds
Area of total fishponds	7,586 m^2
Pond possession rate among club members	64.9%

(2005)

Source: Compiled by JICA ADiM Study Team

Figure 1.9 The integration of aquaculture with agriculture in the club land and their impacts (in case of Mawila farmers' club)

1.2 Progress of the Technology that Economise Nitrogen Inputs

Many fish farmers, except the more progressive individuals, are increasing the number, size and depth of their ponds as a means to increase fish production, rather than improving feeding, fertilisation and pond management. Given that most resource poor farmers rely almost exclusively on their maize crop for food security, it is not surprising that they are averse to the financial risk of improved feeding, fertilisation and management of fish ponds. It is mainly for this reason that they prefer a simple strategy towards enhanced fish production. However, this strategy may for many ultra-poor farmers be thwarted by the availability of land and access to adequate water resources.

Recent study by ARTDMIS (JICA) at NAC suggests that fish grew to a larger size in deep ponds in comparison to shallow ponds. Production of *O. shiranus* (in polyculture with *Clarias gariepinus*) increased from 18g/m^2 in 60cm deep ponds to 143g/m^2 in 150cm deep ponds. Similarly, survival rate also improved from 43% to 84% and the average body weight of fish was heavier in the deeper ponds (Figure 1.10). The reasons provided for enhanced fish growth in deeper ponds where that the increased water volume held more nutrients thus increasing feeding opportunities for the fish and that deeper ponds reduced the rate of predation and delayed sexual maturation. The shallowness of farmer ponds is either because they do not dig them deep enough at the outset or alternatively a consequence of a high seepage rate, suggesting that greater care has to be taken in selecting suitable sites for ponds.

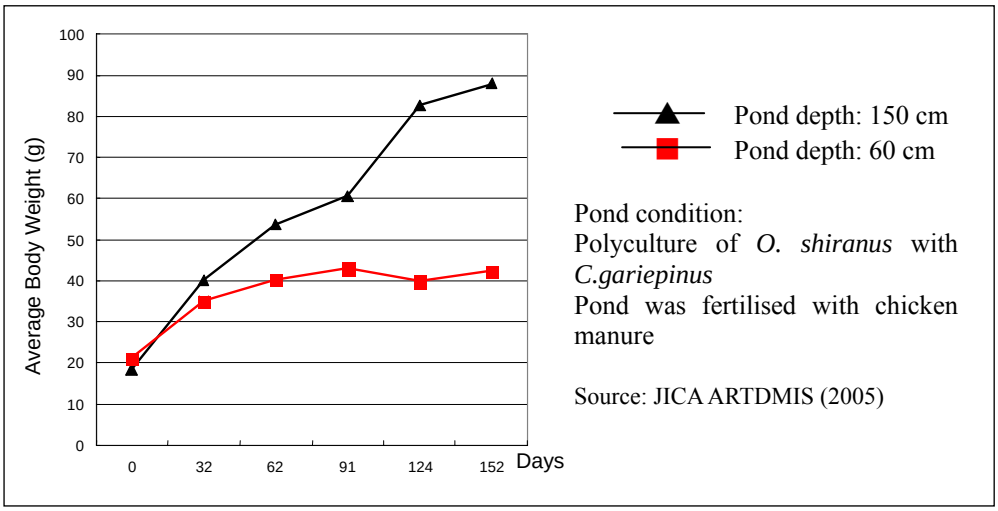


Figure 1.10 Growth performance of *O. shiranus* at different pond depths

Deeper ponds may therefore be one of the "best-practice" technologies that could be applied by especially resource poor farmers. Of course, production would be even further enhanced through managed feeding schedules, improved fish feeds, enhanced fertilisation regimens, higher stocking densities and species selection.

Through organising themselves into a group, poor farmers are able to strengthen their resources, in addition to inclusion of such technology which economises the limited resources, and consequently, increases their income.

2. Developing Opportunities to Commercial Aquaculture

The primary interest of Malawian fish farmers, as elsewhere, is directed towards "profit-maximisation" or cash income. This is true even among resource poor farmers, despite the fact that

their behaviour and farming practices are often not geared towards this objective. The profitability (Y) of fish farming, whether undertaken on a small, medium or large-scale is basically affected by production quantity (Q), fish price (P), and production cost (C), as shown by Y = (Q x P) – C. Profit is therefore dependent on the farmers' capacity to increase production, reduce production costs and to secure a good market. Currently, in Malawi, there are some accumulation of knowledge in these factors and these knowledge is good opportunities for commercial aquaculture.

2.1 Accumulation of Knowledge on Fast Growing Technologies

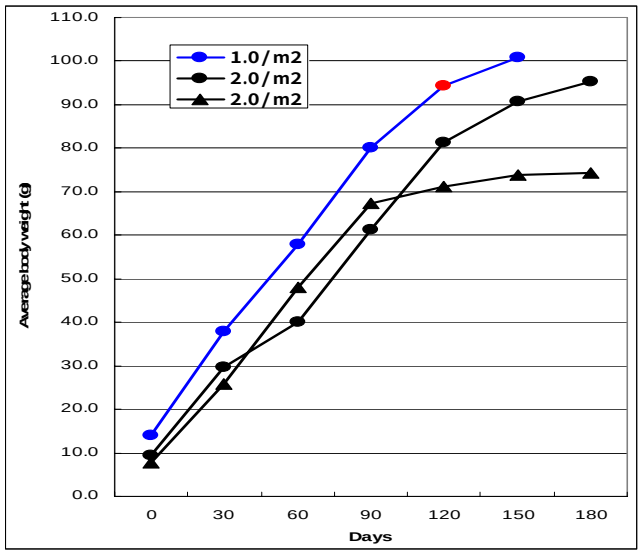
Stunting of tilapia species is the most fundamental issues for production of commercial sized fish. Currently, following three approaches are on examination and these results show the some opportunities to improve the growth of the culture tilapias in Malawi.

Introduction of alternative species

Currently, *O. shiranus* is the dominant aquaculture species in Malawi. It was selected mainly because of the ease with which it breeds in ponds. However, the species is phenotypically highly plastic such that it is able to adapt its reproductive strategies to the sub-optimal nutritional conditions in the ponds by maturing at a smaller size (<10g) and earlier age. It is not uncommon that fish <20g account for over 40% of the total harvest from farm ponds and this reduces the value of the harvest significantly (Omizo *et al.*, 2004). For these reasons farmers have expressed a desire to switch to *O. karongae* and *T. rendalli* (see Attached Figure A9; ADiM National socio-economic survey (2003); and Working paper No. 5). Considerable and valuable research on *O. karongae* was carried out during the CNRFFP during the early 1990s, which showed the superior growth performance of these species (CNRFFP, 1997). Currently there is a renewed research effort to assist farmers to switch from *O. shiranus* to *O. karongae* or *T. rendalli*, and to develop appropriate on-farm fingerling production techniques for *C. gariepinus*. *O. karongae* has also been selected as the species of choice by MALDECO for their cage culture operation and several farmers are now actively producing fingerlings of this species for grow-out.

The success of Asian tilapia farming also came about as a consequence of a shift in species, from *O. mossambicus* to *O. niloticus.* This shift occurred during the late 1970s and 1980s. However, during the early stages Asian farmers also experienced the problem of stunting in *O. niloticus*, which had a serious impact on the market since consumers demanded large fish. This provided the impetus for researchers to focus on selective breeding, as well as hormonal and genetic sex manipulation and ultimately to mono-sex all male farming of *O. niloticus*. The species is now generally regarded as the international tilapia species of choice. *O. niloticus* is also popular in countries where the market welcomes smaller fish. For example, in Egypt the market prefers fish in the 100-150g size class precluding the need for sex change. The inclusion of the above example is not to be seen to promote the introduction of *O. niloticus* into Malawi. It was merely included to illustrate the importance of applying appropriate technologies and disseminating the information to farmers. There are many valid and important reasons why *O. niloticus* must not be introduced into Malawi and these are dealt with elsewhere in the NASP.

It is important to note, however, that farmers are largely ignorant regarding the food and feeding requirements of fish and, as a consequence, may very well also be disappointed by the growth of *O. karongae* and *T. rendalli*. First and foremost, farmers need to be educated on the nutritional requirements of fish in ponds. Moreover, there is a need to aggressively promote *O. shiranus* polyculture with *C. gariepinus*. The ADiM Pilot Project results have shown that this practice leads to larger *O. shiranus* as a consequence of reduced competition for food and an increase in production of *C. gariepinus*, which feed on juvenile *O. shiranus* and the possible inhibition of spawing in *O.shiranus*.



Source: JICA ARTDMIS (2005)

Figure 1.11 Growth of *O. karongae* at different stocking density

Box 3 Use of Exotic Species in Malawi

The choice between endemic or exotic species for commercial aquaculture is largely guided by four principal factors. These are 1) the acceptability of the species on the market, 2) price, 3) growth rate and 4) available technologies. If an indigenous species cannot meet these requirements then the most common alternatives are Nile tilapia or common carp. The keen interest in these fish throughout Africa stems from the successful commercial farming of these species in Africa, Asia and elsewhere. The DoF is, however, well aware that the species are farmed in neighbouring countries.

Common and Chinese carp (grass and silver carp) were introduced into Malawi during the 1980s for experimental trials, but banned in 1991. The Fisheries Conservation and Management Act of 1997 prohibits the introduction of exotic species into Malawi. Hybrid red tilapia were brought into Malawi in 2002 from Malaysia. The fish were confiscated and not allowed for use in aquaculture.

Introducing an alien species is a two-edged sword; it can either contribute towards the national fish supply or can devastate environment and cause irreparable damage to natural fish populations and community structure (e.g. the introduction of *Lates niloticus* into Lake Victoria). Alien species are recognized as one of the most significant threats to natural aquatic ecosystems. Although introductions of alien species have usually resulted in ecosystem disruption everywhere it has been tried, these species do provide opportunity to increase fish production and gaining economic benefit from aquaculture. A balance must be struck between the possible and likely ecological dangers and potential benefits. Therefore, policy makers must weigh the costs of ecosystem disruption against the possible benefits of species introductions. This requires a comprehensive risk assessment according to internationally accepted and recognised protocols (Attached Figure A10)

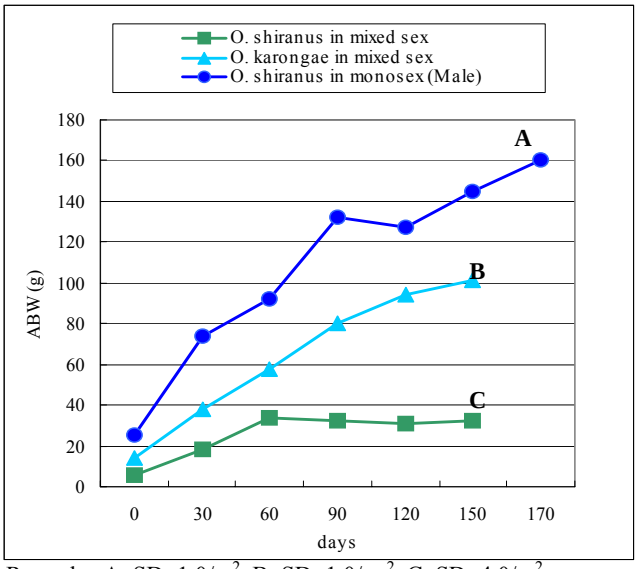
Mono-sex (all male) tilapia

All male, mono-sex culture is the most effective means to control reproduction of tilapia in fishponds and is widely applied throughout the world. There are four common methods to produce all male tilapia; (i) manual sexing, (ii) sex reversal using androgen hormones, (iii) hybridisation, and (iv) production of YY super-males. The only technique that has been tested in Malawi is hand sexing (ARTDMIS at NAC). However, the benefits of all male culture need to be carefully explored in

relation to availability of fingerlings, associated production costs and the optimum price / size ratio, all of which may be variable depending on the location of the farm. These options need to be considered both from a small and large-scale perspective. From a small-holder perspective it is highly unlikely that hand sexing would be a sustainable option for many farmers as they would not be able to afford discarding 50% (on the assumption of a 1:1 sex ratio) of the fingerlings they produce and few have the available pond space to produce an adequate number of fingerlings to practice hand sexing. Hormonal sex change is costly and would not be sustainable by small-holder fish farmers, unless supported by donor intervention. Opportunity exists in the Lower Shire to hybridise *O. mossambicus* with *O. placidus*, however, this would have to undertaken under controlled conditions and would require evaluation before hybrid fingerlings are made freely available to farmers. Production of YY males also requires extremely controlled conditions and should be considered as a medium term option, though the cost of the fingerlings may be prohibitive.

The most appropriate options for large-scale commercial producers are hormonal sex change (though this could have an impact on the marketability, if the fish are intended for export) and production of YY supermales. Hybridisation of *O. mossambicus* with *O. placidus* could also be an avenue though under the same pre-conditions as mentioned above.

The figure below compares the growth rate among different tilapia species with different fish rearing techniques. All male, mono-sex culture of *O. shiranus* with low stocking density shows high growth rate (A). *O. karongae* shows relatively high growth rate with mixed sex culture (B). On the other hand, *O. shiranus* shows relatively low growth rate when they are stocked in high density without sexing (C).



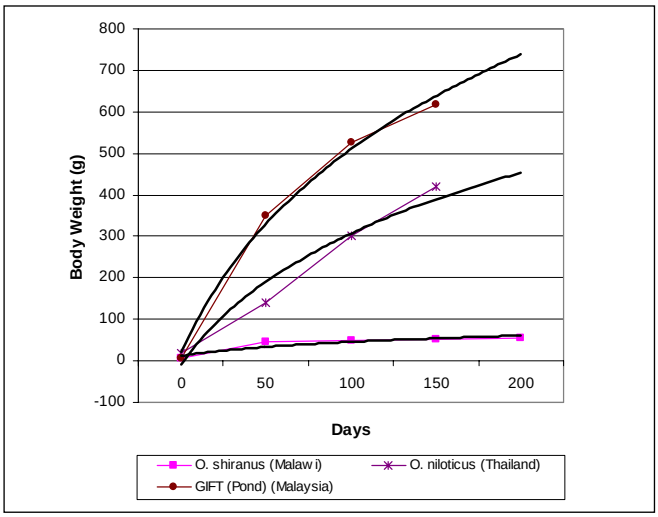
Remarks: A: SD=1.0/m^2, B: SD=1.0/ m^2, C: SD=4.0/m^2
Source: JICA ARTDMIS (2005)

Figure 1.12 Comparison of the growth rate among different tilapia species with different fish rearing techniques

Improved strains of indigenous tilapia

The GIFT tilapia (Genetically Improved Farmed Tilapia) is the most famous of the improved strains. Figure 1.13 shows the growth performance of the GIFT tilapia and *O. niloticus* in comparison to *O. shiranus*. The comparison is highly tenuous as the growth trials of the three species were undertaken under widely different environmental and feeding regimes. Nevertheless, it does illustrate the comparatively poor performance of *O. shiranus*. Many varieties are continuously being improved and show 20-80% faster growth rates than the original strain. The methods for strain selection are

well developed and training is available at the WorldFish Center in Abassa, Egypt. Currently, three DoF staff, including the head of the NAC are studying genetic improvement technologies. In South Africa, research on the genetic improvement of *O. mossambicus* is ongoing at the University of Stellenbosch. The DoF should make use of these opportunities on the African continent to seek technical and financial assistance from donors to develop strains of fish with superior growth traits. Clearly, this requires a dedicated, long-term and highly controlled R&D environment and this has to be established at the NAC.



Source: Diana *et al.* 2004; Ponzoni *et al.* 2004; Bolivar *et al.* 2000; and Brummett *et al.* 1995

Figure 1.13 Growth performance of genetically improved tilapia

Stocking density

The entry point of large-scale commercial aquaculture is when a farmer sets certain production targets per unit volume of water or pond surface area. To attain a pre-determined production target requires that the pond be stocked with the correct number of fingerlings. Under-stocking may result in under utilisation of feed, high food conversion ratios culminating in higher production costs, while over-stocking may result in a decline in fish growth rate, though overall yield may increase. For example, growth of *O. shiranus* stocked at densities of 2, 4 and 8 fish/m^2 resulted in daily growth rates of 0.37g, 0.24g, and 0.13g, respectively, during a 112 day experimental period (CNRFFP, 1997), though higher yields per unit area of water were obtained under the highest stocking density. Selling smaller fish (20-40g) in villages in Malawi is not difficult and are often preferred by consumers. Thus, a greater yield of smaller fish may result in higher profits per pond, particularly in view of the observation that farmers realise a higher price per kg by selling individual fish than selling fish on a unit weight basis in urban or peri-urban markets.

An approximation of the number of fingerlings required per pond with surface area of A can be estimated by:

X = [(A x Y) / (W2-W1)] / H, where

A = Surface of pond (ha)
Y = Expected yield per ha (kg)
W1 = Average weight of initial seed (kg)
W2 = Expected average weight (kg)
H = Survival rate (%)

For example, if a farmer plans a yield of 40kg of 150g fish from a 200m^2 pond with 80% survival, he needs 357 fingerlings of 10g (1.79 fish/m^2) for stocking. The determination of appropriate stocking density is determined by target (and most profitable) fish size, and the availability of technology and inputs to realise the target.

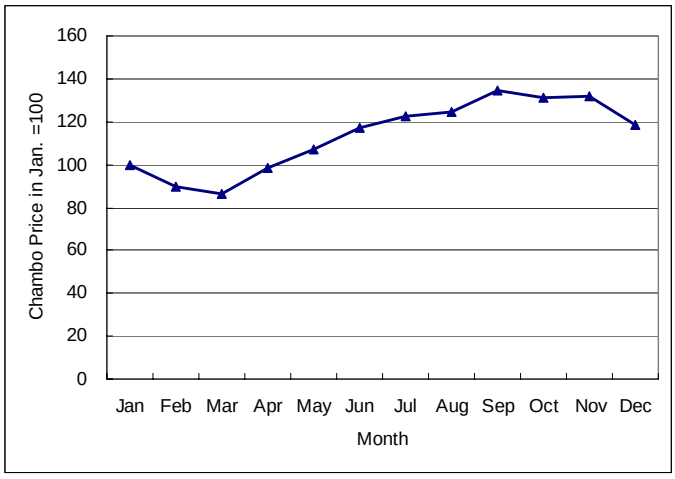
Based on experimental work undertaken by the NAC and at the Central and Northern Regions Fish Farming Centre in Mzuzu, the current recommended stocking rates in Malawi range between 2 and 4 fingerlings / m^2. However, there is no indication whether these stocking rates were recommended for optimal fish growth or yield. Moreover, there is no available mortality data to support the recommendations under farm conditions. It is highly likely that the mortality rate during the first week after stocking already exceeds 40% (Data obtained by ADiM Pilot Project). Thus, there is an urgent need to determine mortality rates during a complete grow out cycle under farm conditions. Only then can appropriate stocking densities be recommended. Based on the market price the farmer can then decide on the size at harvest and calculate an appropriate stocking rate and grow-out period to optimise profits.

2.2 Accumulation of Economic Information

Weak capacity of fish farmers in business planning is one of the constraints for commercial aquaculture. One of the reasons for such situation is inadequate information service regarding to aquaculture economy currently available in Malawi. Though not much study in this field has been done by the DoF, some existing information and knowledge may suggest a direction for future study.

Price information

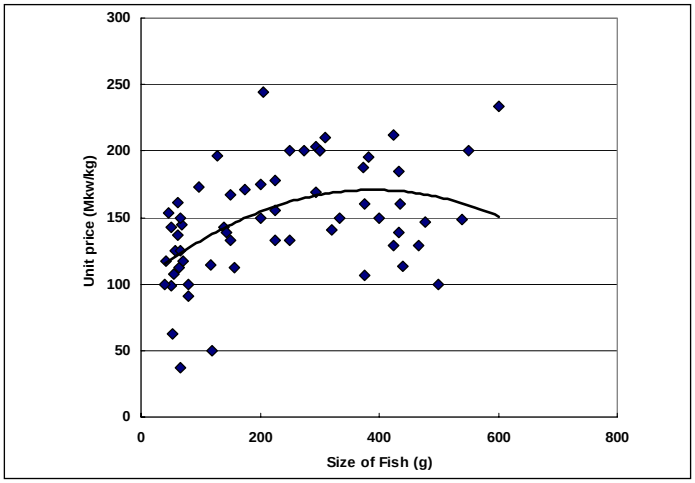
It would appear that the proximity to urban areas has a significant effect on how farmers sell their fish. In urban areas, farmers sell their fish per unit weight, while in rural areas farmers sell their fish on a per piece basis. For the more business orientated farmers in urban areas there is a clear need to understand seasonal price fluctuations (determined by lake fish supply and demand) and to schedule their harvests accordingly (Figure 1.14). Secondly, to maximise profit farmers need to understand the relationship between fish price and size upon which to schedule their production and harvesting cycles. Figure 1.15 shows that the price of tilapia in urban markets increases up to 400g, where after it decreases. Hence there is a need to build capacity in business management and planning.



Source: FRU, (2000/ 2001)

Figure 1.14 Changes of Chambo price by month (1996-2001 Average)

In rural areas, the seasonal fluctuations in demand and supply are obscure. Nevertheless, rural farmers must also be aware of the relationship between size and price and plan their production and harvesting schedules accordingly. Several of the Innovative Farmers have recognised this and are now applying this knowledge to enhance profitability.

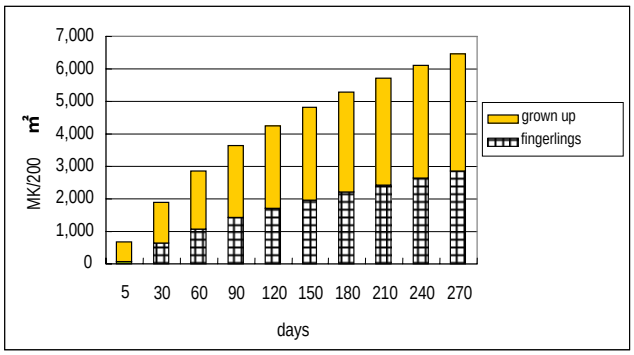


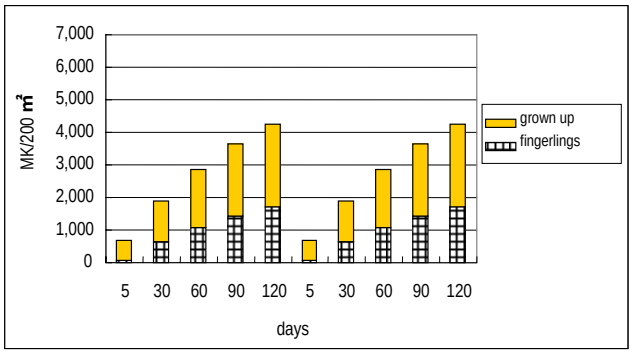
Source: JICA ADiM Study Team (2003-2005)

Figure 1.15 Relationships between size and price of fresh tilapia at Lilongwe market, May 2003

Figure 1.16 shows the simulation of fish sales under two different harvesting (cropping) strategies. The model predicts that a 4 month-cycle yields a higher gross income (MK 8,513/200m^2 pond) than a 9 month-cycle (MK 6,472/200m^2 pond). Although fish in the 9 month cycle reach a mean size of 114g (grey colour) and fetch a price of MK 142/kg, a large proportion of the biomass consists of smaller, low value fish (checked pattern). This is largely a consequence of in-pond breeding and stunting. In the 4-month cycle, fish are harvested before they begin to stunt at an average weight of 77g and sold at MK 126/kg. However, the total biomass harvested is greater, resulting in higher income. Many farmers have a protracted inter-harvest period. This behaviour has a negative effect on overall farm productivity and profitability.

The simulation model provides valuable insights into management dynamics. Clearly, there is a need for further case studies such that farmers may optimise income from their fishponds.





The two figures show a simulation model for profit differences between two different cropping schedules for *O. shiranus*. The graph on top shows a single 9 month cropping cycle. The profit is MK 6,472/ 200m^2 pond. Average individual size above 20g is 144g. Yet, half of the biomass is occupied by fingerlings. The bottom graph illustrates two cropping cycles of 4 months each. Each of the 2 harvest generates MK 4,257/ 200m^2, with a total profit of MK 8,513. The results show that the two cycle cropping pattern is more profitable.

Unit: MK

	1 cycle cropping pattern	2 cycle cropping pattern
Gross income	6,472	8,513

*fingerling and feeding costs are not included in the calculation

Data source: JICA ARTDMIS (2005)

Figure 1.16 Simulation of fish sales under two different cropping systems

Cost information

The major costs in Malawian small-holder aquaculture are capital costs (pond construction) and recurring production costs, (feed, fertiliser, seed and labour). Under current farming practices the costs are minimal, which allows even resource poor farmers to enter the sector. However, they do not have the resources to maximise fish production and profit.

Feed and fertiliser: Feed and fertiliser are the most important cost items in commercial and small-holder aquaculture. In the rural aquaculture sector in Malawi, as elsewhere in the region, maize bran coupled with green compost manuring is the most common practice. Green compost manuring has been demonstrated to be ineffective in SE Asia (P. Edwards, AIT, personal communication). The current practices are largely dictated by the fact that these commodities are mostly available free at household level and farmers do not have the resources to purchase other food and or fertiliser. However, plants with high C:N ratios such as Vetifer grass, black jack, cassava leaves, papaya leaves, sweat potato leaves, coco-yam leaves, etc. are relatively well known among farmers. These provide an option for farmers to focus on the production of *T. rendalli*, which becomes almost exclusively vegetarian at a size greater than 12-14 cm. Some farmers are aware of this and survey results have shown that those farmers who regularly feed adequate plant material are able to produce large *T. rendalli*, which according to them is the preferred species in rural areas and fetch a much higher price than *O. shiranus*. However, further studies are required to optimise the production of *T. rendalli*. Moreover, the relationship between water exchange rate and water fertility is not well understood under Malawian small-holder pond conditions. Knowledge of this relationship will go a long way towards providing farmers with more appropriate advice on species selection, as well as food and feeding practices and fertilisation.

Results of ARTDMIS at NAC have shown that production could be increased to 200g-400g/m^2 under optimum fertilisation practices. Clearly, improved nitrogen and phosphorous pond inputs, such as manure, inorganic fertiliser and more appropriate feeds are necessary for aquaculture to develop in Malawi. However, this is constrained by access to adequate quantities of manure or inorganic fertilisers and the availability and cost of formulated feeds. The average number of livestock per fish farmer household is around 4 chickens and less than 1 goat. There are only two feasible options for farmers to access manure. Chicken manure is available in broiler and layer farms in Blantyre and Lilongwe (most often the manure is available free of charge). The cost of transport is however such that most individual farmers will find it extremely difficult, if not impossible, to cover the transportation costs. Farmers in peri-urban areas could however organise themselves to purchase manure as a group, thereby reducing the individual costs. For this to become feasible requires training in co-operative (group) business management. Secondly, farmers could hold more livestock. This option however requires that farmers have access to initial capital and knowledge of animal husbandry.

The new cage culture initiative of MALDECO provides an opportunity for fish feed manufacturing in Malawi, which could have spin-offs for the more aggressive small-holder fish farmers. The success of the cage culture initiative depends largely on the development and manufacture of adequately formulated feeds. The currently available fish feed in Malawi is sub-optimal, both in terms of its formulation and quality and the cost of imported feeds are as high as USD450 per ton. MALDECO has taken up the challenge and will be undertaking the necessary research to formulate and manufacture their own feeds, using locally available ingredients and a minimum quantity of fish meal. Given the rapid progress of the MALDECO project it is reasonable to predict that a least cost feed will soon be produced in Malawi. This provides a future opportunity for those small-holder farmers who are intent on making a commercial success of their fish farming activities.

In the short term, it is crucial that farmers are made aware of opportunities presented by farm made feeds. Several of the Innovative Farmers have made good progress in formulating and manufacturing their own feeds using ingredients such farm grown soya, maize, maize bran, rice bran and brewers waste, while others plant high protein vegetables on pond dykes exclusively for the feeding of *T. rendalli*.

Table 1.13 attempts to summarise and consolidate some of the currently known and or suggested "best-practice" technologies.

Table 1.13 Summary of potential "best-practice" technologies for maximising profits.

Technology	Impact	Comments
Expansion of the use of *O. karongae*	Minimum mature size is over 80g, Uniform size under mixed-sex culture up to 80g under current culture practices. Improved nutrition may well preclude the need for all male fingerlings.	Relatively little is known about the species under culture conditions, though positive results have been shown by Pilot project. Need more basic research, particularly on nutrition and reproduction.
Production of *T. rendalli* using high protein vegetable matter	*T. rendalli* matures at a larger size than *O. shiranus*. Known from elsewhere that *T. rendalli* can be produced very successfully on appropriate vegetable matter.	Farmers must begin to appreciate the daily requirements of *T. rendalli* and feed their fish accordingly.
On-farm fingerling production of *C. gariepinus*	Provides opportunity for polyculture with *O. shiranus* for higher yields.	NAC needs to initiate on-farm participatory trials to produce fingerlings.

Technology	Impact	Comments
Mono-sex culture (hand-sexing)	No stunting, resulting in yield of over 200g/m^2/annum	Requires minimum equipment such as net and buckets and knowledge, but may very well be uneconomical .
Sex changed tilapia using androgen hormones	Hormonal sex change is the most cost effective way to mass produce all male fingerlings.	Environmental and health concerns are increasing, but technology is used internationally. However, it is unlikely to be sustainable unless supported by donors. It is not suitable for small-scale farmers.
Improved strains of indigenous tilapia	4^{th} generation shows 40% improvement in growth	Very effective technology to improve production. Needs to be applied to *O. shiranus, O. karonage T. rendalli and O. mossambicus*. Work on *O. shiranus* currently in progress in Malawi and on *O.mossambicus* in South Africa.
Testing of improved strains of *O. mossambicus*	Genetically improved *O. mossambicus* show 30-60% faster growth	University of Swansea (UK) and Stellenbosch (South Africa) working on strain selection of *O. mossambicus*. Information sharing might be first step.
Improved feeding, using farm made feeds (e.g. Soya, maize, and other suitable local ingredients	Enhanced growth and production, reduced FCR, reduced cost of production	Nitrogen content of maize bran too low to achieve profitable growth rates
Establishing dedicated hatcheries / fingerling producers.	More efficient use of grow-out ponds	No particular constraint. Stock large (> 5cm) and young fingerlings in 'grow-out' ponds. It is necessary to develop proper fingerling production units.
Least cost formulated fish pellets	Promote commercialisation of fish farming by local entrepreneurs (small to industrial scale).	Unstable supply of soya beans and other raw materials are possible risks
Improved pond fertilisation using inorganic fertiliser or animal manure	Enhanced growth rate, reduced FCR and lower cost of production.	Green compost does not provide the required phosphate and nitrogen levels needed for optimal primary production. Farmers need greater appreciation of the value of proper pond management.
Improved stock management, through regular grading	Enhanced growth, reduced FCR and lower cost of production	Currently farmers do not manage their stock, resulting in food and nutrient loss
Multi-cropping	May increase profits by 30-40%	Effective for *O. shiranus* mixed-sex culture under optimum fertilisation and feeding regimens. Farmers will only adopt multi-cropping if they increase their production.
Better pond site selection to reduce seepage	Reduce nutrient loss and improve primary production	Reduction of seepage is one of the most fundamental aspects of pond fish farming
Deeper and larger fish ponds	Improved fish growth and production	Experimental trials have confirmed field observations.
Group pond construction by farmers club	200m^2 pond can be constructed within 3-4 days	Need good leadership and facilitator to mobilize community/club labour force

Source: JICA ADiM Study Team (2003-2005)

3. Opportunities to Improve Support Services

The capacity of farmers to adopt some of the "best practices" as described above are largely dependent on the DoF extension staff, applied research at NAC, capacity building by and support by donors and NGOs and other farmers. However, currently, the aquaculture extension services of DoF are seriously constrained and face many challenges. Principally these include limited human and financial resources. Government has recognised the problems and has adopted several remedial actions including, (i) selection and intensification such that services are geared towards specific target zones and or target groups, (ii) devolution of the extension services as part of the Decentralisation Policy, and (iii) possible participation of the private sector in service provision. The overall lack of support services is recognised and specific strategies to address the problem have been formulated.

3.1 Selection and Intensification of the Government Services

The Department of Fisheries (DoF), being a public sector, has an obligation to provide continuous and impartial supports to all beneficiaries. Yet, its resources are limited. Considering such situation, the DoF needs to maximise the efficiency of services based on its contents, quality, and intensity reflecting on needs of beneficiaries. Selection of geographical priority zones, especially for rural aquaculture, need to be in line with the area development plan/programme. Rural aquaculture has more than one objectives and therefore being dealt as one of the components of livelihood enhancement measures. Bearing that in mind, priority areas for the DoF to enforce aquaculture have been selected (Table 1.14, Figure 1.16, and Figure 1.17).

Four aquaculture target groups, each of which requires different levels of institutional support, have been identified in Malawi. The four groups, their indicators and support needs are illustrated in Table 1.14.

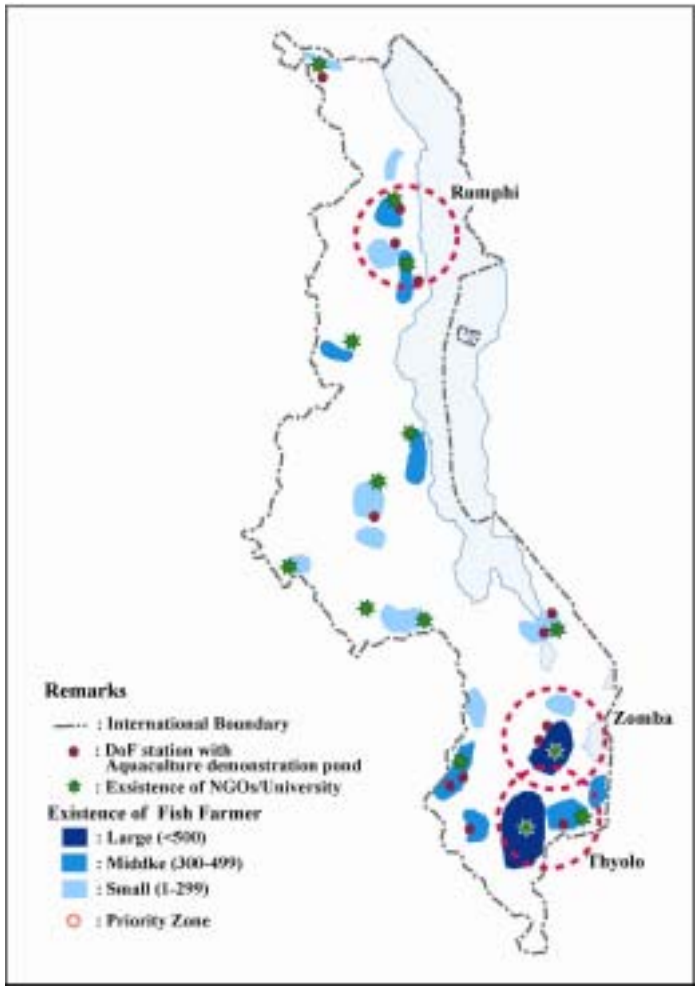
Table 1.14 Selection and intensification of the government services

Category		Indicator	Quality/intensification of services
Rural aquaculture [Priority area] • Zomba Dist. • Thyolo Dist. • Rumphi Dist.	Subsistence	• Practised by small-holder households • Low-input, low output • Un-scheduled harvesting • Fish retained as "savings" (fish keepers) • Food in-secure throughout the year • Most fish produced used for home consumption • Risk averse • Feed mainly maize bran and use green compost	• Poverty reduction and welfare • Holistic support to improve livelihood rather than fish production. Strengthen existing function of fish pond ► Role of the DoF - act as facilitator and link various supporters who are active in multi –sector agriculture development.

Category		Indicator	Quality/intensification of services
Commercial aquaculture [Priority area] • Southern part of the lake Malawi • Lower Shire	Intermediate	• Food secure throughout the year • Main purpose of aquaculture is profit • Regular feeding and fertilizing of ponds • Extensive to semi-intensive technology • Inorganic fertiliser may be used • Use farm made feeds [For example] Certain "Innovative Farmers"	• Enhanced production • Access to loans • Introduction of "profit-maximisation" technologies • Enhanced business management capacity ► Role of the DoF - provide intensive research and technical support
	Intensive	• Semi-intensive to intensive technology • Middle to large-scale where aquaculture provides >85% of income. • May be integration with commercial livestock production • Substantial and scheduled harvests and sales at urban markets • Income from aquaculture ensures self-sufficiency • Use farm made and commercial feeds [For example, G.K. Aquafarms]	• Introduction of modern technology • Financial support from private financial institutions • Legal support including tax exemption ► Role of the DoF - work together as research partners
	Highly intensive	• High investment in human capacity • High investment in hard & soft ware • Target is export market as well as domestic market • Cost of technology born by company • Generate employment • Tax payer [For example, MALDECO]	Basically independent ► Role of DoF - environmental and production monitoring ► Collaboration in technology development and training

Source: JICA ADiM Study Team (2003-2005)

Priority areas for rural aquaculture development are illustrated in Figure 1.17, and include certain areas in Zomba, Thyolo and Rumphi, followed by Mulanje and Mwanza. Criteria for prioritisation are described together with the Figure. Some physical as well as socio-economic factors that determine the priority area are illustrated in Attached Figures 11 – 15. For commercial aquaculture, the lower Shire valley have been identified as high priority areas, principally because of the favourable temperature conditions for intensive warm water fish culture (Figure 1.18). Other potential areas are specific localities within the Nkhotakota, Mchinji and Dowa Districts (along the Bua River), because of water availability and the proximity to the Lilongwe market.



Criteria for prioritisation

In the case of rural aquaculture, harvested fish is often used for household consumption or sales within community. Therefore, geographical and physical factors which affect growth of fish are not as critical as for commercial aquaculture. At the household level, factors such as labour, pond input and land availabilities as well as agricultural diversification have stronger impacts than the geographical factors.

A. Number of existing fish farmers: the number of farmers that satisfies a critical mass for efficient extension service provision is the important factor for rural aquaculture. Farmers can also actively interact each other.

B. Availability of service providers: The presence of NGOs and universities engaging in aquaculture activities is important for the DoF to provide effective extension services.

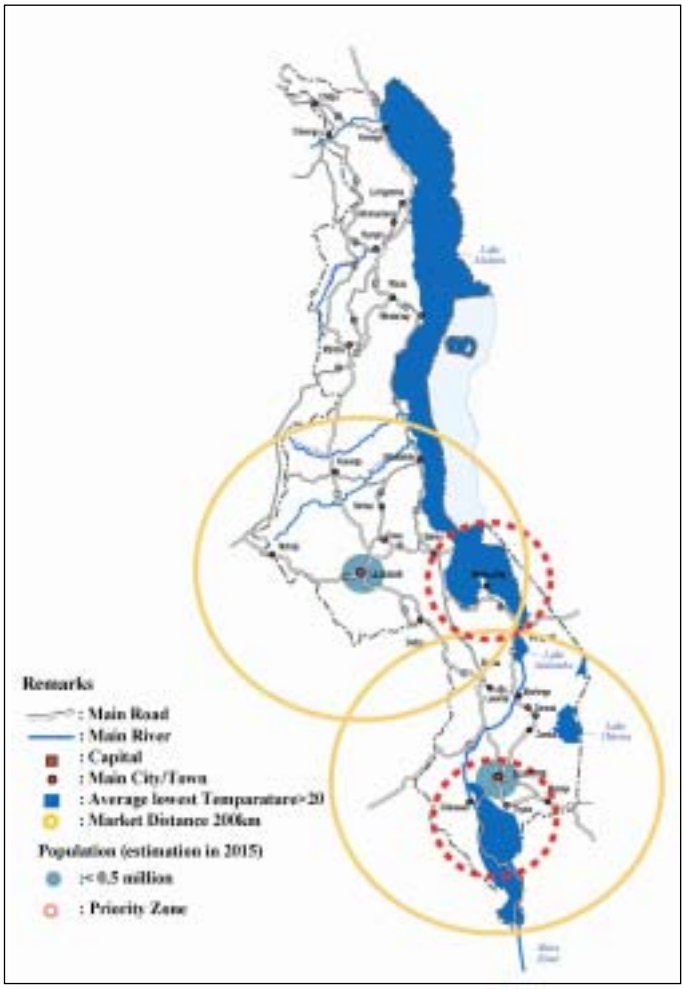
C. Rainfall: rural aquaculture is highly dependent on rainfall/ spring water. The area with annual average rainfall of less than 600mm is not selected as a priority area for rural aquaculture.

D. Air/water temperature: The growth of tilapia is influenced by water temperature. Therefore, it is ideal to select an area with minimum average temperature of 20 degrees Celsius. However, for rural aquaculture, the temperature is not an absolute requirement.

Other considerations

- Soil type and chemistry
- Conflicting activities (e.g. agriculture, mining)
- Environmentally sensitive areas
- Political factors to ensure balanced development

Figure 1.17 Potential area for rural aquaculture



Criteria for prioritisation

Commercial aquaculture targets city markets for sales of fish produced and hire inputs required for aquaculture including capital, labour and feed from the city. Therefore, the areas which are adjacent to cities with natural conditions are favourable for commercial aquaculture. Again, depending on the scale and production system, the priority area may differ.

A. Air/water temperature: Higher the water temperature, better the growth of fish. Water temperature at Lower Shire and Lake Malawi remains 20 ^{o}C in winter season.

B. Water resources: Since commercial aquaculture requires large quantity of water, the sites need to be close to rivers or lakes that can provide sufficient water throughout the year.

C. Market and accessibility to inputs: Transportation cost in Malawi is high. Therefore, farmers can substantially cut down overall cost through reducing transportation cost by being adjacent to the cities. At the same time, many of factories producing side products such as fishmeal and manure that farmers can utilise for aquaculture are found in big cities (e.g. Lilongwe and Blantyre).

D. Accessibility to services: the distance to the service centre is not critical if the farmers are benefiting enough from aquaculture that they pay for the services. However, it is convenient to be closer to the centre such as NAC which farmers can obtain various aquaculture technologies.

Other considerations

- Soil type and chemistry
- Conflicting activities (e.g. agriculture, mining)
- Environmentally sensitive areas
- Transportation and communication

Figure 1.18 Potential area for commercial aquaculture

3.2 Devolution of Extension Services

Devolution of the Government extension services to the District level is regarded as a basic instrument for more efficient service delivery. It provides the mechanism to place the service at the most appropriate point to reach the greatest number of beneficiaries. The fundamental focus of government should be to provide clear policy and direction, an institutional and regulatory framework for sustainable resource management and to support research and training (Figure 1.19).

Devolution may hold specific advantages for the development of the aquaculture sector in Malawi. The DoF could for example retain their function for the provision of "specialist" aquaculture extension services and training of other extension agents. The District Assemblies on other hand could take responsibility for more "generalised" aquaculture extension under the umbrella of agriculture extension. However, it requires that the agriculture extension officers are appropriately mobilised and effectively informed and trained such that they better appreciate the intrinsic value of aquaculture as part of agricultural diversification.

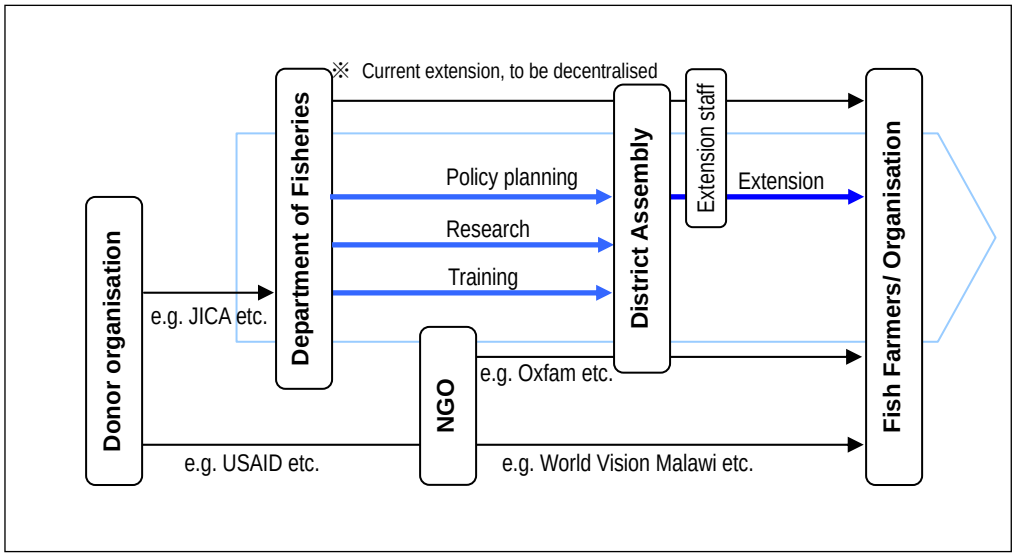


Figure 1.19 Flow of aquaculture services

3.3 Possible Participation of the Private Sector in Service Provision

Privatisation of government fish farming stations

Majority of the government demonstration stations has been constructed with supports from donors during 1980's and 1990's. However, after the withdrawal of donors, such stations are not functioning properly due to the lack of budget. Simultaneously, extension activities being implemented at those demonstration stations are loosing its importance in recent years as more attentions are paid to on-farm research. The Project, therefore, has proposed privatisation of the government stations and equipment as one of the draft strategies in 2004. Table 1.15 summarises before and after the leasing of the Kasinthula aquaculture station to the private firm. Since the lease, the firm has renovated the station and provided job opportunities for local people. Recently, the Mzuzu fisheries station has leased its pellet machine to the private firm. These cases of the 'privatisation' may increase once the NASP is implemented and be found to be effective and efficient for developing aquaculture.

Table 1.15 Impact of privatisation of Kasinthula Aquaculture Station

	Before privatisation (2003)	After privatisation (2005)
Contract	• 10 years lease contract • Leased 18 ha of pond area (rearing and grow-out ponds) including the working shed close to the ponds, yet JICA constructed hatchery facility is not leased. • Licensing of using common carp • Supply of technical information obtained from the pond to DoF	
Facilities	• Except for the ponds that are utilized by JICA staff, others were lying idle and derelict • No power connection • Over grown grass around ponds • Clogged drainage and underground broken pipes • Water was free of charge	• Rehabilitation of the ponds and the area took about 3 to 4 months • Constructed his own hatchery facility • Power connected from ESCOM • Monthly payment of water (10,000 MK) • Pick-up van, water test kit, etc.
Staff	15 staff, including 4 staff paid by JICA	• Retained three JICA staff and employed another nine from outside • DoF has retained two officers and 6 workers (including watchmen)
Activities	• Fingerlings of common carp, Mozambique tilapia and cat fish were produced; data not available • Fingerlings were sold to farm in lower shire • Some table-size fish were also produced.	• Starting experimental harvesting and sales of common carp (500g) and tilapia (50-100g) st super market in Blantyre • Applying formulated feed using by products from food factories
Financing	• Annual budget (2003) was MK 3,303,700 • Except personnel, budget for operation has largely depends on JICA finance	• 10 year lease at annual payment of USD 3,500

Source: JICA ADiM Study Team (2003-2005)

Privatisation of government fisheries stations offers a further and very practical opportunity to promote the development of fish farming in the country. At present, all government aquaculture stations are under resourced. The effect of this is that officers are not able to effectively interact with farmers in their areas, the supply of fingerlings to farmers is poor and, in general the stations cannot effectively perform their role as demonstration facilities. The lack of sufficient pond inputs for the stations, and operating costs for basic equipment such as motor cycles is common. With little contact and support from the DoF, it is apparent that officers stationed at these facilities are largely left to their own income generating activities and specifically rely on the land surrounding the ponds. This further discourages effective extension activities. However, the situation does provide an opportunity for privatisation and improved extension services. One of the models that could be considered is for the DoF to develop an arrangement whereby interested officers may apply to run the station for their own account. This would relieve the Department of having to pay his salary. In return for the privilege, they would be required to promote fish farming in their areas aggressively, failing which the station reverts to the DoF. Initially such an arrangement would have to be on a trial basis and would require monitoring by the DoF. This provides a scenario for a win-win situation.

It is believed that even the smaller stations are viable to run as independent small business operations, especially as they are all sited in localities with exceptional perennial water supply. This approach could have 4 major positive outcomes.

- The station would be operated at maximum potential, and become a good example to other farmers (Currently, the low level of fish production at most of the stations discourages, rather

than encourages farmers to adopt or improve their fish farming practices).

- There would be an increased incentive to operate the station effectively.
- The DoF would no longer have the budgetary burden of supporting the facility and the staff.
- Extension support from the station would improve, as this would be a requirement in exchange for the use of the station and its agricultural land.

In order to test this approach before a nationwide privatisation process commences, it would be appropriate to include these options into the regional focus area programmes. Chisenga station may provide an excellent test case as it is currently operated more or less independently due to its geographic isolation.

The opportunities for the private sector participation in aquaculture development

Majority of farmers depend on other farmers for aquaculture information (Attached Table 20). There are often farmers in each area who are influential to other farmers due to their innovativeness. Table 1.16 summarises numbers of visitors to 25 innovative farmers and two farmers' clubs the Project have selected for its Pilot Project. Especially for 7 innovative farmers and two farmers' clubs, they receive over 100 visitors annually. An extensionist visits approximately 100 households per year providing extension services (ALCOM, 1995). The figure, therefore suggests that the farmers and farmers' clubs selected under the Pilot Project have high potentials as the extension centres within the area.

Table 1.16 Number of visitors at innovative farmers and two farmers clubs in 2004

Unit: persons

	Innovative farmers	Farmers club*
Group visitors	30.0	144.0
Individual visitors	32.8	
Number of farmers who had visiting of innovative farmers	7.4	-
Number of farmers who adopted new technologies initiated by innovative farmers	89.5	-

Remarks: *Average of Mawila and Limbikani farmers' clubs (Zomba District)
Source: JICA ADiM Study Team (2003-2005)

The private sector, consisting of producers and service providers (e.g. feed manufacturers) should be considered as a valuable resource that can effectively complement government extension services at different levels. For example, many farmers rely on their peers for information and fingerlings. Therefore, by selecting certain leading farmers and investing in building their capacity will benefit the development of the sector at minimal cost. Moreover, joint government-private sector research can lead to greater efficiency in developing new and appropriate technologies, which can be disseminated to other farmers. The above examples illustrate some of the opportunities with which to enhance the participation of the private sector in the development of aquaculture in Malawi. Table 1.17 shows how the private sector can participate in bringing the full benefits of aquaculture services to producers.

Table 1.17 The role of the private sector in aquaculture development

Roles	Descriptions
1. Fingerling production	The private sector already plays an important role in seed supply. To supply adequate numbers of high quality and healthy fingerlings of desired species on a timely basis the DoF needs to support selected farmers who have the required infrastructure and the necessary business and technical skills and capacity. Potential partners include middle-scale fish farmers and farmer clubs
2. Feed production	Development of formulated feeds is largely depended on good nutritional research and interested commercial feed companies. Such companies could be valuable research partners to develop cost effective fish feeds.
	Potential partners include animal feed and milling companies.
3. Extension	NGOs are already good promoters of aquaculture in the country. They have particular strengths and capacities for the initial stages of promoting aquaculture, such as motivating and mobilising communities and training of selected individuals. A further advantage is that NGOs have their own financial resources.
	Potential partners include NGOs and farmers who have good leadership qualities (e.g. some of the Innovative Fish Farmers)
4. Research	Farmer can identify the best and most appropriate technologies through participatory research. Such opportunities are open to all types of farmers depending on the subject. The degree of participation will vary depending on their capacities.
	Potential partners include small, medium and large scale farmers

Source: JICA ADiM Study Team (2003-2005)

3.4 Effective Extension Tools

Table 1.18 attempts to summarise some extension tools (approaches).

Table 1.18 Summary of potential extension approaches that could be adopted to enhance aquaculture development

Type of method	Strength and Constraint	Impact and Comment
Class room training	**Strength** • Intensive information can be provided **Constraint** • One-way flow of information • High cost	To expose farmers with new concepts certainly has an impact. However, it needs to be combined with more participatory methods for farmers to adopt what they learn in the classroom.
Training and Visits	**Strength** • Intensive information can be provided • High impact through actual visit **Constraint** • One-way flow of information • High cost (lack of financial sustainability) • Tight schedule	T & V is expensive and is not sufficiently participatory. However, visiting a farm has great impact on trainees and provides an opportunity to discuss ideas. For greater impact, T & V can be combined with other more participatory methods.
Decentralised system	**Strength** • Improved accountability • Improved coordination with activities of other agencies • Better political commitment **Constraint** • Greater political interference • Utilisation of extension staff for other local government duties	Despite delays the process is now in progress. Decentralised extension has definite advantages as outlined above and it is strongly recommend. Pivotal for the success of decentralised extension services is for the DoF to sensitise District Assemblies on the value of aquaculture.
Fee-for-service/ private extension	**Strength** • Financially sustainable **Constraint** • Information exchange will only occur with business oriented farmers who can pay • Will only reach a very limited number of farmers	Most of the beneficiaries would not be able to afford the service. Therefore, public funds would be required to contract private service providers. It is highly unlikely that the treasury will be able to sustain such services.
Open Field Day	**Strength** • High impact with an actual demonstration • Can accommodate many participants **Constraint** • Short duration • Often limited to small number of technical topics • Needs seed money • Restricted to a limited area	An open field day provides an opportunity for farmers to visit fishponds and learn from experts as well as fellow fishfarmers. The effectiveness of Field Open Days has been demonstrated by NAC. It has an impact on a large number of people for a short period. However, information often flows one-way.
Farmer Field School	**Strength** • Cost effective • High impact through actual visits • Can focus on technical aspects or developing decision making and business skills. **Constraint** • Need a strong leader to access expertise and support. • Restricted to a limited area	Farmer trainers can play a significant role in aquaculture extension and contribute to the existing extension system. Selection of the location of schools is critical for success. The Innovative Farmers Approach of ADiM Pilot Project provides the basis for further development.

Source: JICA ADiM Study Team (2003-2005)

4. Lessons Learned from the Pilot Project

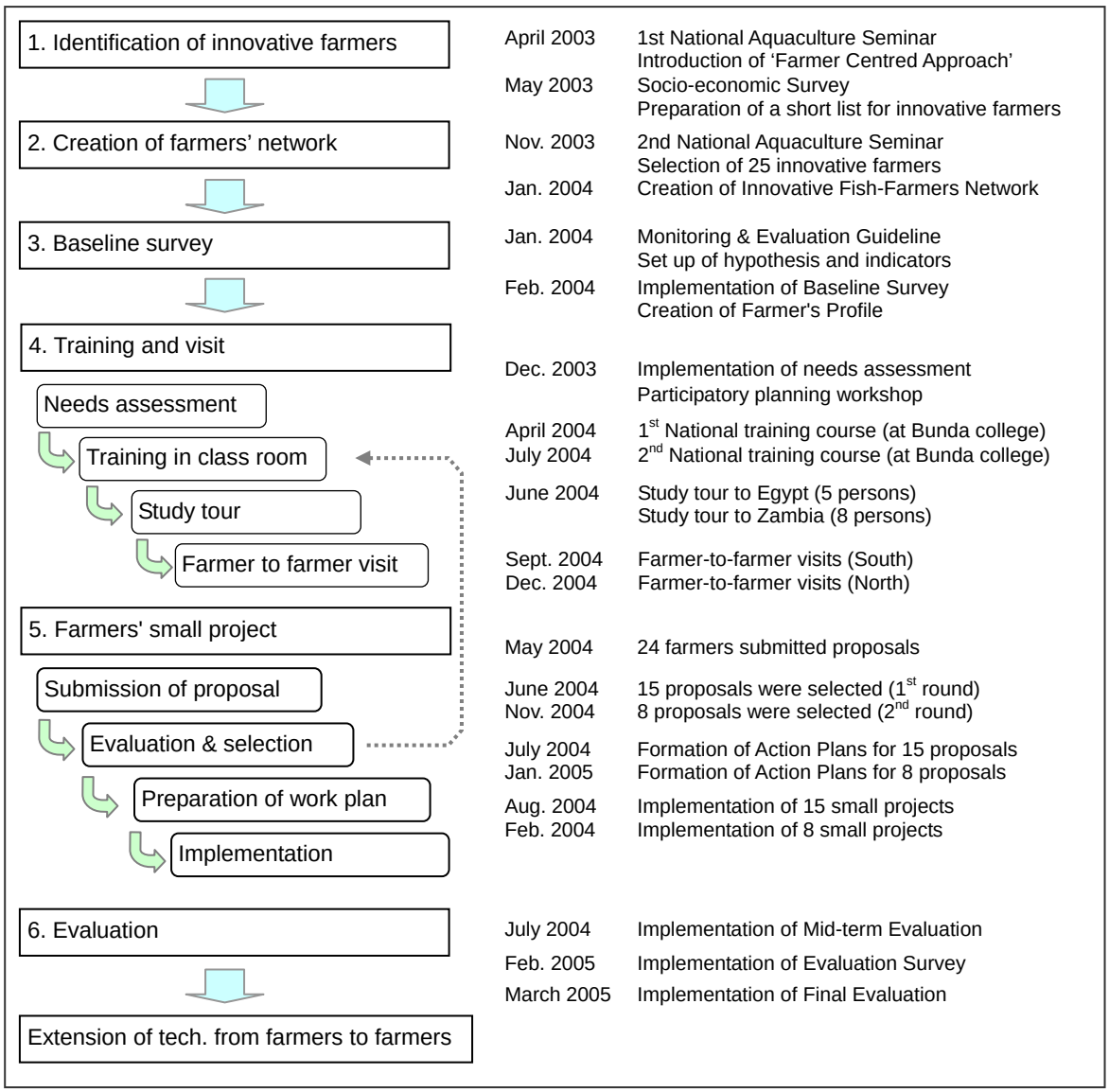
4.1 The Objective and Approaches

Fish farmers in Malawi largely depend on other fish farmers for aquaculture related information and purchase of fingerlings (ADiM Working paper No. 3). There observed a number of leading farmers in each geological area during the national survey. Promoting farmer-to-farmer extension through strengthening capacities of such farmers can largely contribute to efficient as well as effective aquaculture extension in Malawi. The farmer-to-farmer extension does not only subside the existing government extension system, but also has its own merit. Being handled by farmers by themselves, advises and information exchanged through the farmer-to-farmer extension will be more farmer-centred.

Fish farmers in Malawi are not uniform. Their objectives for initiating aquaculture are different. Their financial and social situations also vary. Therefore, to begin with, the Project targeted two different groups of fish farmers in the Pilot Project and sought possibility of farmer-to-farmer extension within each group. One group consists of farmers with relatively high income and innovative ideas that can lead their surrounding community members, whereas the other group consists of farmers' clubs having subsistence farmers for their members. The Pilot Project, through two approaches, 'innovative farmers approach' and 'farmers' club approach,' aims to promote active interaction among members of each group and verify quality of information exchanged through providing technical training. The most efficient and effective forms of farmer-to-farmer extension is identified and reflected to the NASP.

4.2 Innovative Farmers Approach

Figure 1.20 explains the process of the innovative farmers approach. The objective of the approach was to verify the effective technology development and extension on commercial aquaculture system through capacity building of so-called 'innovative' farmers who are considered to be a leading or a key farmer in the area. Under the Pilot Project, 25 innovative farmers are networked, and given opportunities to exchange their ideas. At the same time, the Project has provided various trainings to enhance their knowledge and ability in aquaculture. It was expected innovative farmers to learn and apply what they have learned into practice and share with their communities.



Source: JICA ADiM Study Team (2003-2005)

Figure 1.20 Process of the innovative farmers approach

Results

Three assumptions were set up in order to seek development potentials of the innovative farmers' approach. The assumptions are:

- Innovative farmers quickly adopt new ideas, therefore they are more productive,
- Innovative farmer's network leads information and technology transfer among the farmers, and
- Innovative farmers have an influence on their communities, therefore they promote aquaculture extension.

Table 1.19 Summary of results of the innovative farmers approach

Assumptions	Indicators	Results (comparison between before and after the implementation of the Pilot Project)
Innovative farmers quickly adopt new ideas, therefore they are more productive	1. Introduction of new technologies through trainings 2. Record keeping of fish farming activities 3. Drop out rate from the network	a. Feeding methods: farmers using soya beans have increased from 4 to 10. Among those 10, 3 formulate their own pellet using fish meal and poultry manure. b. Use of inorganic fertiliser: farmers using inorganic fertiliser have increased from 4 to 14 c. Sales of harvested fish: there was decrease in sales of fish by the fishpond and increase in the village market (24% to 36%) d. No significant change was observed for the growth of fish e. 2 out of 25 (8%) has dropped out from the Pilot Project
Innovative farmer's network leads information and technology transfer among the farmers	4. Number of technologies shared through the network	11 out of 16 (69%) declare that they have learned from other members. 87% of such information was obtained during farmer-to-farmer visits indicating the strong impact of visiting actual sites. On the other side, 7 out of 16 farmers (44%) are said to be information provider. Despite all being 'innovative' farmers, it is less than half whom actively providing information to others.
Innovative farmers have an influence on their communities, therefore they promote aquaculture extension	5. Number of visitors farmers have received 6. Evaluation from surrounding communities	Number of annual visitors farmers have received is 62.8 in average. The farmer who has received the maximum number of visitors scores the figure of 240. There were 3 farmers whom received less than 10 visitors in 2004/2005. Majority of community members who live adjacent to innovative farmers appreciate their presence. Innovative farmers provide information and sell fingerlings and suckers. On the other hand, there has also been a report on negative impact of innovative farmers including a dispute over the water/ land usage between an innovative farmer and community members.
Others	7. Cost	Under the Pilot Project, average training cost for each innovative farmer was approximately USD 1,960. It is relatively high compared to the other training course for farmers' trainers which is approximately USD 500-100.

Source: Data obtained by ADiM Pilot Project (2004-2005)

Lessons learned and development potentials for the approach

Innovative farmers recognise following three positive aspects in networking themselves.

① Enhancement of information exchange among farmers
② Building capacity on negotiating skills against the government
③ Building up new partnership with universities, NGO, and donors

Amongst those, the expected output during the implementation of the Pilot Project was ①. Yet, ②and ③, not as direct outputs of the Pilot Project, are also critical factors for the further success of their network. It is important to enhance the network as an organisation in line with ②and ③ in the NASP as it has already established the foundation. The network, the Innovative Fish Farmers Network Trust (hereafter called IFFNT), has been legally registered to the government during the Pilot Project as an organisation that represents fish farmers in Malawi. At the same time, the members had various opportunities to discuss and integrate with other stakeholders of the sector. Through such opportunities, the DoF has announced to provide some assistance from their HIPC

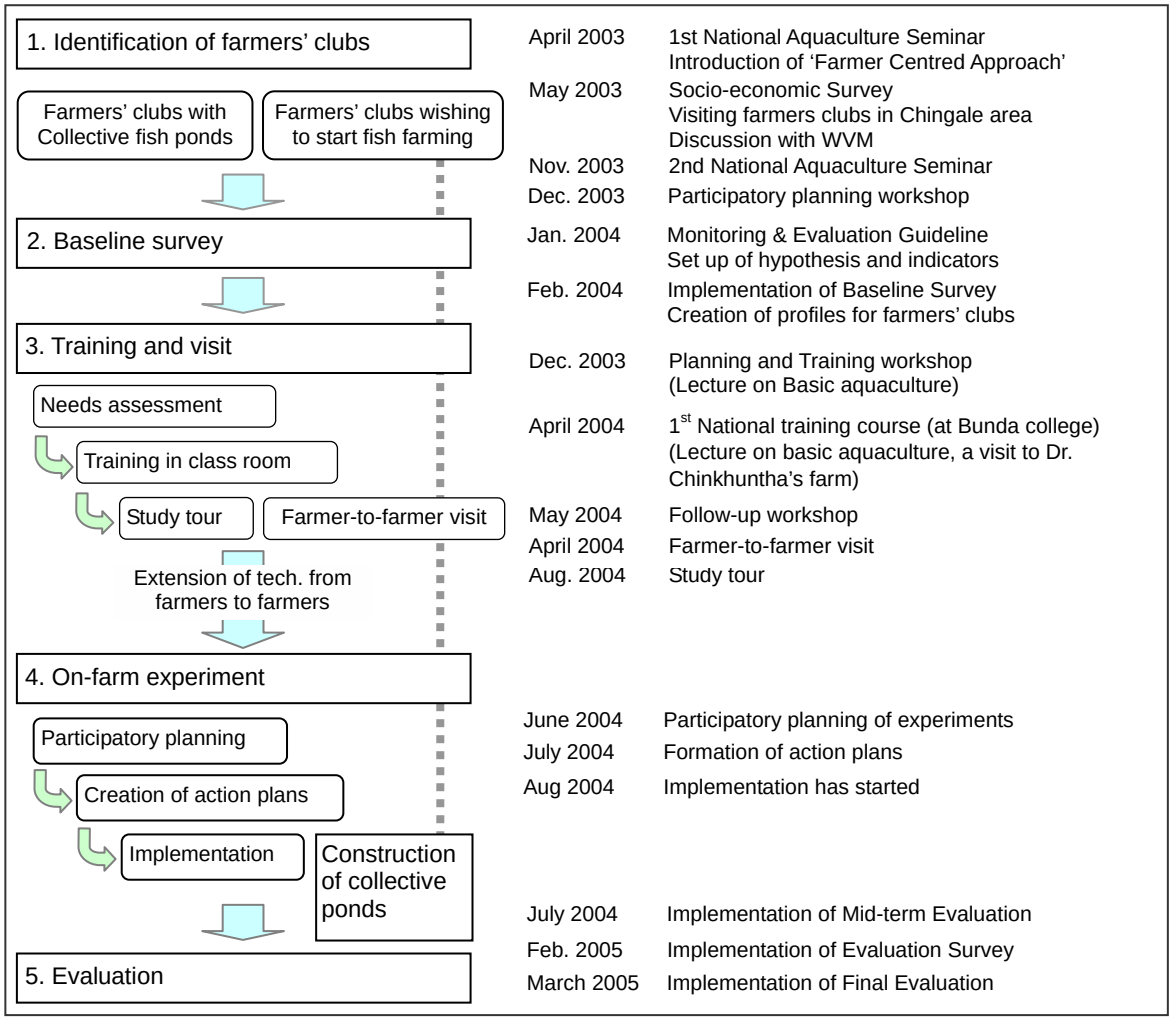
funds[1]. Other organisations, such as WorldFish Center and USAID are now inviting IFFNT for their workshops.

Challenges that IFFNT faces is that the IFFNT is a national organisation with small number of innovative farmers having no solid network at neither regional nor district level. In another word, IFFNT can be a lobby against the government, but is not ready to accept nor utilise the services/ assistance provided by the government. The two major reasons are the lack of accountability to receive public services/ assistance to small number of current membership, and inefficiency of providing services to members whom are scattered all around the nation. Considering such challenges, the increase in membership is one of the measures that IFFNT can take in future. However, the expansion of the membership needs to be in line with its principles. The members have to be someone who is innovative and able to guide his/her community for efficient and effective information exchange. At the same time, establishing a group at where each innovative farmer is based, and forming a cluster of members within IFFNT, for example, based on technology they want to emphasise on, can further enhance efficiency and effectiveness of information exchange. Recognition of such key farmers and financial assistance by the government are necessary for IFFNT to overcome challenges and foster into a sound independent entity.

4.3 Farmers' Club Approach

The 'farmers' club approach' seeks an effectiveness of targeting small-scale farmers in the clubs for development and extension on small-scale aquaculture system. The Pilot Project studies two existing farmers' clubs, Mawila and Limbikani farmers' clubs on their collective pond management as well as their activities as clubs. Through providing trainings, the Project aims to build further capacity of those two successful or 'model' clubs and such clubs to influence on and be duplicated to other newly established clubs. The Project also identifies the role of an NGO, the World Vision Malawi (WVM) as an effective intermediary.

[1] Budget which has been allocated aiming for the poverty reduction under MPRSP. DoF applies such fund for aquaculture development.



Source: JICA ADiM Study Team (2003-2005)

Figure 1.21 Process of the farmers' club approach

Results

Three assumptions were set up in order to verify the feasibility of the farmers' club approach. The assumptions are:

1. Farmers benefit household stability by being a member of a farmer club,
2. Aquaculture can contribute subsistence farmers in the club, and
3. Successful farmer club will be duplicated in the other area.

The results of the Pilot Project were summarised in the Table below.

Table 1.20 Summary of results of the farmers' club approach

Assumptions	Indicators	Results (comparison between before and after the implementation of the Pilot Project)
Farmers benefit household stability by being a member of a farmer club	1. Comparison between model farmers' clubs and newly established farmers' clubs on socio-economic conditions (e.g. income, productivity, etc.)	Average annual income for the model clubs is MK 29,680 whereas the income for the other three clubs is MK 17,371. Productivity for the model club is MK7,200/ha whereas it is MK6,010 for other clubs.
Aquaculture can contribute subsistence farmers in the club	1. Income from aquaculture	Two model clubs share MK 1,700 from aquaculture in 2004. For other 4 clubs, though 36 members possess fishponds, nobody generated any cash income in 2004. After the implementation of the Pilot Project, cash income from fish farming among members of Mawila farmers' club has increased from MK1,736 to MK3,470.
Successful farmer club will be duplicated in the other area	2. Process of duplication of the successful farmers' club to others 3. The roles being played by successful farmers' club	There observed appliance of new technologies in 4 clubs. There was one club, Teuka farmers' club, that has constructed 11 new collective ponds. There has been active intervention between Mawila and Teuka farmers' clubs. Members of Mawila voluntarily advised on pond construction. Mkamwalekani farmers' club being adjacent to Mawila, observed and learned how Mawila farmers' club practises.
Others		—

Source: Data obtained by ADiM Pilot Project (2004-2005)

Lessons learned and development potentials for the approach

The major positive characteristics of the farmers' club approach are explained in Chapter IV. In addition, following aspects are observed in the farmer-to-framer extension within the clubs.

Diversity of technologies transferred: there have been various technologies introduced into the farmers' clubs through farmer-to-farmer visits and various trainings implemented during the Pilot Project. Such technologies include not only aquaculture technologies but also technologies on small-scale irrigation, crop production, manuring, etc. Aquaculture extensionists tend to restrict their extension services in aquaculture sector whereas farmers, both club members and innovative farmers, do not specialise in aquaculture but practice agriculture as well as aquaculture. Therefore, farmer-to-farmer extension can provide more holistic extension service on rather integrated agriculture and aquaculture technologies.

The role of NGO: majority of members of the club understand their challenges and are very much interested in learning new information. However, their capacity to put learned information into a practice is yet still weak. The intervention of outsiders, such as NGO, is necessary for members to get together and collect some seed money. In order to do so, mutual trust needs to be built among members and between clubs and NGO which requires time.

Understanding of the community: in order to gain new club land, members need to obtain permission for land as well as water usage from the community, especially the village headman. Coordination and consensus building among community members is therefore a must. Once the village headman understands and become a club member, such process can be achieved rather swiftly.

PART 2 THE STRATEGY

Part 1 of this report provided the background information to contextualize the aquaculture sector in Malawi. This information has been used as the basis to develop the NASP that is presented in detail in Part 2. The broad issues presented in the background document are narrowed down considerably in Part 2 to focus on the strategies and actions that are needed to advance aquaculture development in Malawi.

1. Structure of the NASP

This National Aquaculture Strategic Plan (NASP) is composed of the following components:

Mission Value

Mission explains the purpose of the NASP and the reason for its existence
Value defines the manner in which the DoF staff are expected conduct their duties

Vision

Vision describes an ideal DoF that is necessary to fulfil the mission statement

Principle

Principle is the concept guiding the NASP

Strategy

Strategy identifies priority areas (strategic themes) and means (strategies) to accomplish the mission

Strategic themes [4 themes] = Goal
The NASP focuses on four broad strategic themes which are expressions of medium and long-term desirable results for aquaculture development

Strategies [12 strategies] = Objectives
The rationale, output and action for each strategy is defined

Output = Target
A set of performance outputs are provided to track progress in achieving the objectives.

Benchmark 2005
Each output details benchmark information at 2005

Action
Actions describes the activities needed to achieve the strategy

Action Plan (Complementary Projects)

Action plan describes the matrix composed of Output, Activities, Indicators, Partners, Implementers and Timeframes
The Action Plan includes two complementary projects. Since various elements of the strategies are crosscutting, the complementary projects combine the crosscutting elements into project-type actions for efficient and effective implementation of the strategies

Implementation

Implementation explains the implementation arrangements and timeframes

Monitoring & Evaluation

Monitoring & Evaluation explains the mechanism that provides feedback to the relevant authority to review and improve the plan on a regular basis

2. Mission and Value

2.1 Mission for the Aquaculture Sector

"Fostering a profitable and sustainable aquaculture sector"

Additionally, this mission is supported by the following:

To increase the economic and social benefits for fish producers and citizens in general, while contributing to sustainable fish supply, food security and economic growth. National poverty reduction and improved livelihoods will be achieved through the promotion of excellence and best practices of DoF services.

2.2 Best Value

The DoF supports best value. This refers to a needs based delivery of services in the most ***cost effective manner***.

The core values guiding the delivery of services requires an organisation that is:

☆	**Responsible**	Provide support for prospective aquaculture ventures that enable fish farmers to achieve high quality livelihoods
☆	**Professional**	Enhance customer confidence in technical and professional competence
☆	**Efficient**	Operate in a smart and practical way to solve problems
☆	**Trustworthy**	Work in partnership with customers and other organizations, and
☆	**Quality**	Ensures that staff are properly trained, equipped and supported to respond to customer needs.

3. Vision

The vision of the NASP is to create a practical DoF that is dedicated to improving technological innovation and extension for aquaculture development by the best possible use of available resources. It is anticipated that development in the aquaculture sector will continue along a dual pathway, comprising the small-holder and commercially-orientated subsectors. Taking this into consideration, and providing quality services, the DoF will strive to move the sector towards such that:

- Rural aquaculture forms a planned part of the on-farm production system and is integrated into the overall business activities of the farmer and moves towards a more scheduled and better-managed production system, which will increase cash income and improve the livelihoods of small-holder farmers.
- Small and large-scale commercial fish farming operations are competitive and are able to contribute significantly to the declining supply of tilapia from natural waters in Malawi, and support the rural economy through providing job opportunities for local people.
- The private sector is increasingly involved in service provision, through the provision of an enabling environment, thereby increasing the quality and efficiency of interventions.

	Phase	Category	Indicator	Conditions & Assumptions
Year 1958	Initiation Phase		• Low level of aquaculture adoption • Income from fish farming is low and sporadic	• Healthy capture fishery • Low fish price • Local fish preferred
2005	Developing Phase		National Policy and Strategy (outputs from NASP) • To facilitate the necessary institutional, legal, and administrative changes in the sector, and to increase the capacity of stakeholders • Improved DoF service delivery • Access to service improved • More farmers adopt aquaculture • Increased number of productive ponds • Some small-holder farmers move towards the commercialisation of their aquaculture activities. • Integrated operations introduced • Large-scale commercial sector initiated and growing	• Declining capture fishery • High fish price • Intensive government and donor support • Enabling investor environment
2015	Maturation Phase	Integrated rural aquaculture	• Improved management • Improved household security • Greater integration • Scheduled income from fish farming • Increased adoption of fish farming technologies into overall livelihood system	• Continued government and donor support • Stable national macro-economic climate • Appropriate regulations on fish trade • Water and environmental conservation
		Commercial Aquaculture	• Large-scale commercial sector established • Emerging commercial fish farmers derive most of their income from aquaculture	
2025	Sustainable Phase	Integrated rural aquaculture	• Household security • No outside financial support • Aquaculture plays pivotal role in livelihoods	• Stable national macro-economic climate • Water and environmental conservation
		Commercial Aquaculture	• Independent private sector • Effective producer organizations • Financially independent from government and donor support • Export market established	
2040 ?				

Figure 2.1 Phases of aquaculture development in Malawi

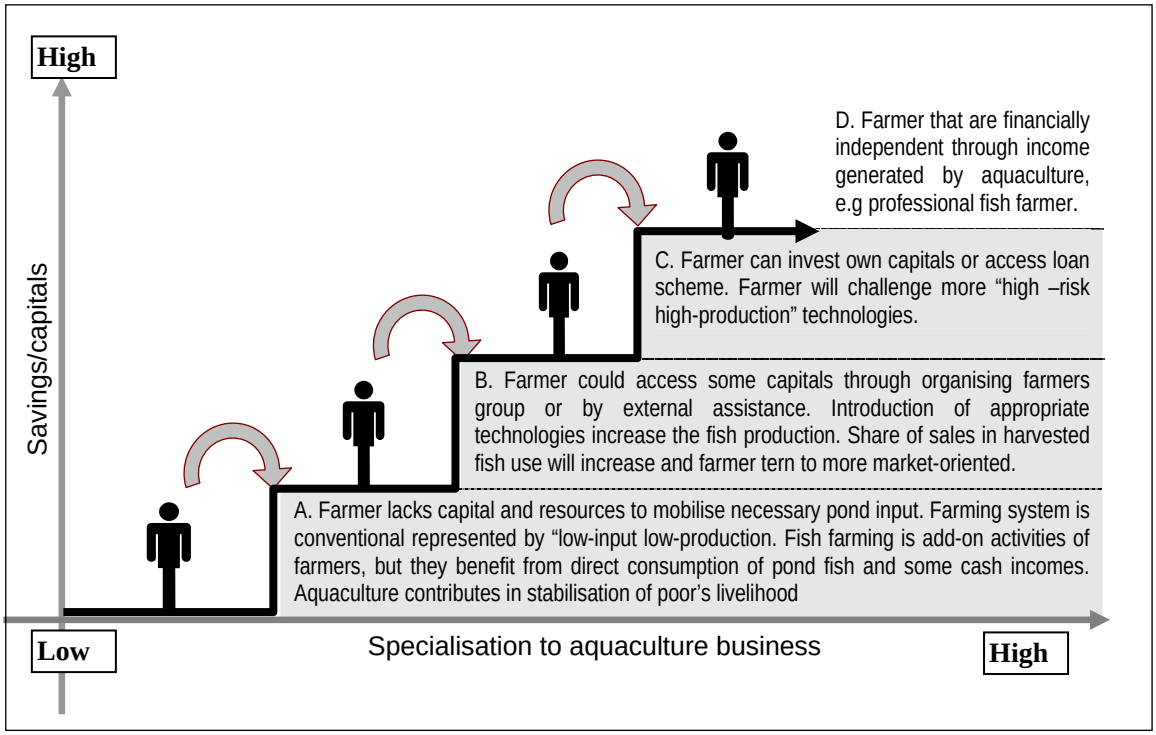


Figure 2.2 Path of progression of Malawian fish farmers

4. Overall Objective of the NASP

Given the current status of the sector, it is acknowledged that attaining the desired scenarios outlined in the Vision is a long-term process, spanning several decades (Figure 2.1). However, the NASP only encompasses a 10-year period, and its focus will therefore be on laying the foundation for this transformation process. Given this emphasis, the overall objective of the NASP is to facilitate the necessary institutional, legal, and administrative changes in the sector, and to increase the capacity of stakeholders to enable:

- *Improved livelihoods among rural small-holder fish farmers*
- *A successful commercial aquaculture sector*
- *The provision of quality aquaculture services at a national and local level*

5. Guiding Principle

The following five principles will be the pillars of the NASP:

A. The NASP should contribute to the national goal of eradicating poverty and hunger

A key theme behind the NASP initiative is poverty reduction, which also forms part of the broader development policy of Malawi and including the Millennium Development Goals (MDGs), Malawi Poverty Reduction Paper (MPRSP), National Strategy for Sustainable Development and Agenda 21. In addition, the NASP should form a part of National Fisheries and Aquaculture Policy (2002) reflecting the DoF's value, mission, and objectives. The NASP has to incorporate these imperatives in order to justify its implementation. With regard to potential funding for

implementation of the NASP, it is important for donors to place increasing emphasis on projects that contribute directly towards poverty reduction and economic growth.

B. The NASP should be a "customer-focused" initiative

The NASP has to be sensitive and responsive to the different needs of DoF customers, and as such should be "people-centred" and accountable. This means that the NASP must be "demand-driven". The DoF's customers and partners identified under the NASP include:

[End-Customers]	• Small-holder fish farmers • Commercial fish farmers • Civil society (Consumers, Fish traders, feed companies, etc.)
[Intermediate-Customers]	• NGOs • Local Governments • Farmers' Organizations
[Partners]	• Universities • Collaborative Ministries • Donors • International research institutions

The DoF has a responsibility to be accountable in the implementation of the NASP.

C. The NASP should be responsive to the needs and capacity of stakeholders

The NASP should be realistic with regard to the capacity of stakeholders and must therefore promote a demand-driven approach. To fully unlock the benefit of aquaculture, producers (particularly resource poor farmers) are required to respond to aquaculture technologies as well as to other mechanisms for rural development, such as cooperative/association management, basic education, financial/saving resources management, etc. Many fish farmers have limited capacity to respond effectively. The NASP should be responsive to the capacity of its stakeholders and assist all stakeholders appropriately.

D. The NASP should be an instrument to promote wider partnerships

The NASP must promote policy dialogue to facilitate the effective participation of stakeholders in the aquaculture development process. The NASP will support producer organizations, academic institutions, international research organization, donors and NGOs in sharing experiences and fostering closer coordination.

E. The NASP needs to encourage and facilitate a process of building the knowledge base

The NASP should be a mechanism to create a comprehensive knowledge base through its performance tracking and result management processes. Monitoring and evaluation are not only meant for ensuring implementation of the programme, but also to provide the opportunity for stakeholders to learn from experience through a feed back mechanism. Three requirements must be met to create these knowledge bases. Firstly, the NASP must include clear performance indicators. Secondly, monitoring and evaluation must be carried out by an independent professional with wide participation of stakeholders. Thirdly, there is a need for the DoF to be responsive to past experiences and be prepared to learn from these. The NASP will assist in creating these opportunities.

6. Conceptual Framework

The conceptual framework of the NASP is shown in the figure below. Since the NASP emphasises a 'people-centred approach,' three strata formed by different actors in the aquaculture sector comprise the spine of the framework. The first stratum includes the producers and other people directly benefiting from the aquaculture industry. In other words, they are the end-customers. Since they are the leading role players they are located at the top of the frame. The second stratum includes local government, NGOs and farmer organizations. They are considered as intermediate service providers between the producers and the DoF. Simultaneously, they are considered as the DoF's customers (intermediate customer). The DoF forms the base of the NASP (3rd stratum) and supports the groups in the upper strata. Under the NASP, strategic themes are set up taking into account concepts of how the DoF should act and provide services according to these strata, in order to achieve its mission.

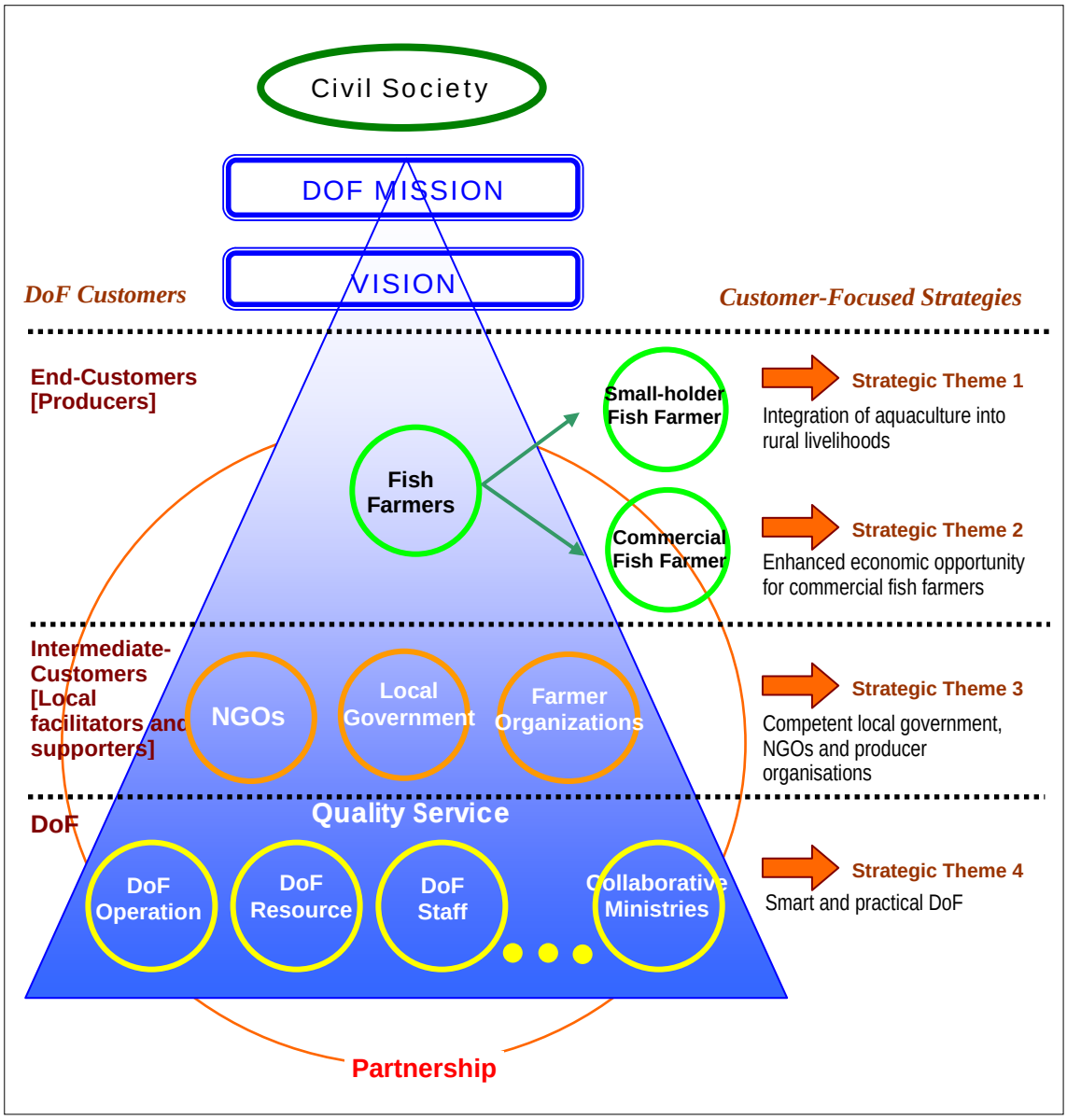


Figure 2.3 Conceptual Framework of the NASP

7. The Strategy

Four strategic themes and 12 strategies are proposed under the NASP. These should guide the focus of the DoF for the next 10 years in order to achieve their mission and vision. These themes and strategies are summarized in the table below:

DoF MISSION

VISION

- Improved livelihoods among rural small-holder fish farmers
- A successful commercial aquaculture sector
- The provision of quality aquaculture services at a national and local level

Themes	*Current situation*	*Strategies*
Strategic Theme 1 Integration of aquaculture into rural livelihoods	Contribution by aquaculture to sustainable livelihoods is limited.	1. Providing the opportunity for all stakeholders to develop their capacity to enhance the integrated livelihoods approach, which includes aquaculture
Strategic Theme 2 Enhanced economic opportunity for commercial fish farmers	There are no small-scale dedicated fish farmers in Malawi. There are two emerging large-scale commercial aquaculture operations	2. Enhancing institutional capacity of NAC to develop medium to large-scale commercial fish farming technologies 3. Providing an appropriate credit, business training and technology package for small and medium-scale commercial fish farmers 4. Creating a regionally competitive and investor friendly environment through sound policy, clear procedure and legal framework 5. Ensuring aquaculture activities are environmentally responsible and sustainable 6. Establishing links and information flows between producers and fish traders to enhance access to markets
Strategic Theme 3 Competent local government, NGOs and producer organisations	Low levels of recognition and poor technical skills relating to aquaculture within local government and NGOs.	7. Sensitising and building capacity of local government on their primary responsibilities in aquaculture development 8. Developing alliances between the DoF and NGOs to promote unified approaches in aquaculture extension 9. Fostering fish producer organizations that assist farmers to increase production, access to finance, markets and other services
Strategic Theme 4 Smart and practical DoF	Ineffective and inefficient service delivery by the DoF.	10. Building healthy DoF financial resource 11. Realising efficient DoF operation 12. Promoting quality DoF staff and information

Figure 2.4 Strategic map of the NASP

Strategic theme 1

Integration of Aquaculture into Rural Livelihoods

"Aquaculture should not be viewed as an isolated technology, but be considered as one of the aspects of rural development, forming part of a holistic approach to development"

- Africa Regional Aquaculture Review. FAO. 2000 -

Current Status

Fish farming is one of a variety of activities that is combined to maximize food security of small-holder farmers. This suggests that fish farming needs to be viewed as part of the overall agricultural system, rather than a stand-alone activity. Agriculture and aquaculture performance is intimately linked to poverty and food insecurity, and up to 40% of Malawi's fish farmers are food insecure (JICA, 2003). Without the prospect of improved food security through increased crop production, many farmers have adopted aquaculture as an additional livelihood option, although this is often at a very low level. The poverty cycle is worsened through low production, as cash earnings are not sufficient to invest in improved crop production for the next season. It is widely accepted that poverty reduction (if poverty is defined as a condition that lacks (i) political capabilities, (ii) socio-cultural capabilities, (iii) economic capabilities, (iv) human capabilities, and (v) protective capabilities (OECD/DAC, 2001)) requires concerted cross-sectoral intervention. Although the role that aquaculture plays in rural livelihoods is recognized (for example through generating additional cash income, improving food security, acting as a rural safety net and having a synergistic effect on net farm production), the rural poor have to overcome many broad socio-economic obstacles.

The livelihoods approach as it relates to aquaculture development is a relatively new way of thinking. This approach views aquaculture as a mechanism which can contribute to overall poverty reduction among poor farmers, rather than simply aiming at improving fish production per unit area. Better knowledge and management capacities to support this approach are critical elements in this strategy. Although many Government and NGO extension officers recognize the importance of a holistic approach to aquaculture extension and research, they often do not have the opportunity to further their understanding of these approaches to facilitate effective implementation. Further, researchers involved in aquaculture development often lack familiarity with social dynamics and cross-sectoral approaches. Sufficient capacity of farmers and their supporters to implement and manage livelihood approaches is critical to effectively address this strategic theme.

The ADiM Project, together with an NGO, examined the processes involved in such an integrated approach at a number of farmer clubs in Chingale, Zomba District. This study involved assessing best practice approaches in these clubs over the period of one year. These studies indicated that certain factors affected the rate of adoption of the integrated approach within these clubs. These factors include: (1) the presence of an appropriate facilitator; (2) application of the farmer-centred approach that empowers farmers; (3) a realistic timeframe for adoption and implementation; and (4) the need for enhanced communication and collaboration among stakeholders.

As far as the above points are concerned; (1) An outsider who can facilitate and mobilise farmers is critical to initiate the process of adapting and adopting new information effectively in their day-to-day activities. (2) The dependence of farmers on outsider assistance is prominent in Malawi in general, and effort needs to be placed during the facilitation process on encouraging farmers to think, judge, and act for themselves, and be responsible for what they do. This will ensure true ownership of the process. (3) It needs to be recognised that this development approach requires significant time for implementation, as it involves a change in the manner in which farmers behave and view the project and the facilitation process. (4) Last but not least, good information on the best

approaches to take to ensure integration needs to be made available to the farmers, and this information should be appropriate to the needs of farmers. In this regard it is essential for different sectors to collaborate in order to develop and provide quality information on the integrated approach.

Outcome

Improved livelihoods among rural small-holder fish farmers.

Strategic objectives - by the year 2015

+ Best practices for an integrated aquaculture livelihoods approach will be defined.
+ Integrated aquaculture livelihoods projects will have been actively adopted in the 9, out of 27, environmentally most suitable Districts.
+ Smallholder fish farmers in at least 3 Districts will experience increased income and improved food security measured by verifiable quantitative indicators.

Achievement of the strategic objectives

The DoF will focus on a livelihoods approach for rural fish farmers that will allow for a sustainable increase in food security and income generation, and which addresses the critical needs of farmers.

Considering the ultimate objectives of this strategic theme, a systematic and strategic step-wise approach to its implementation is required. In the short-term the DoF will develop an institutional structure and implementation model that will strengthen the ability of stakeholders to adopt and carry out effective approaches. The fact that livelihood approaches are relatively new in the aquaculture sector means that lessons learnt from the implementation process need to be fed back into the model on an ongoing basis. A better understanding of how the integration of fish farming can contribute to poverty alleviation is needed, and this will form the basis of research activities carried out under this Strategic Theme.

Four outputs are expected from this process. These are:

1) *Adoption of cross-sectoral, integrated livelihood initiatives into government policies and actions*
2) *Projects that adopt the integrated livelihoods approach that includes aquaculture, and an institutional model that supports this process.*
3) *Broader understanding of the context between aquaculture and the socio-economic, institutional and political status of poor farmers*
4) *Capacity increased within the DoF, local government and NGO staff to utilise tools and methods necessary to support the integrated livelihoods approach.*

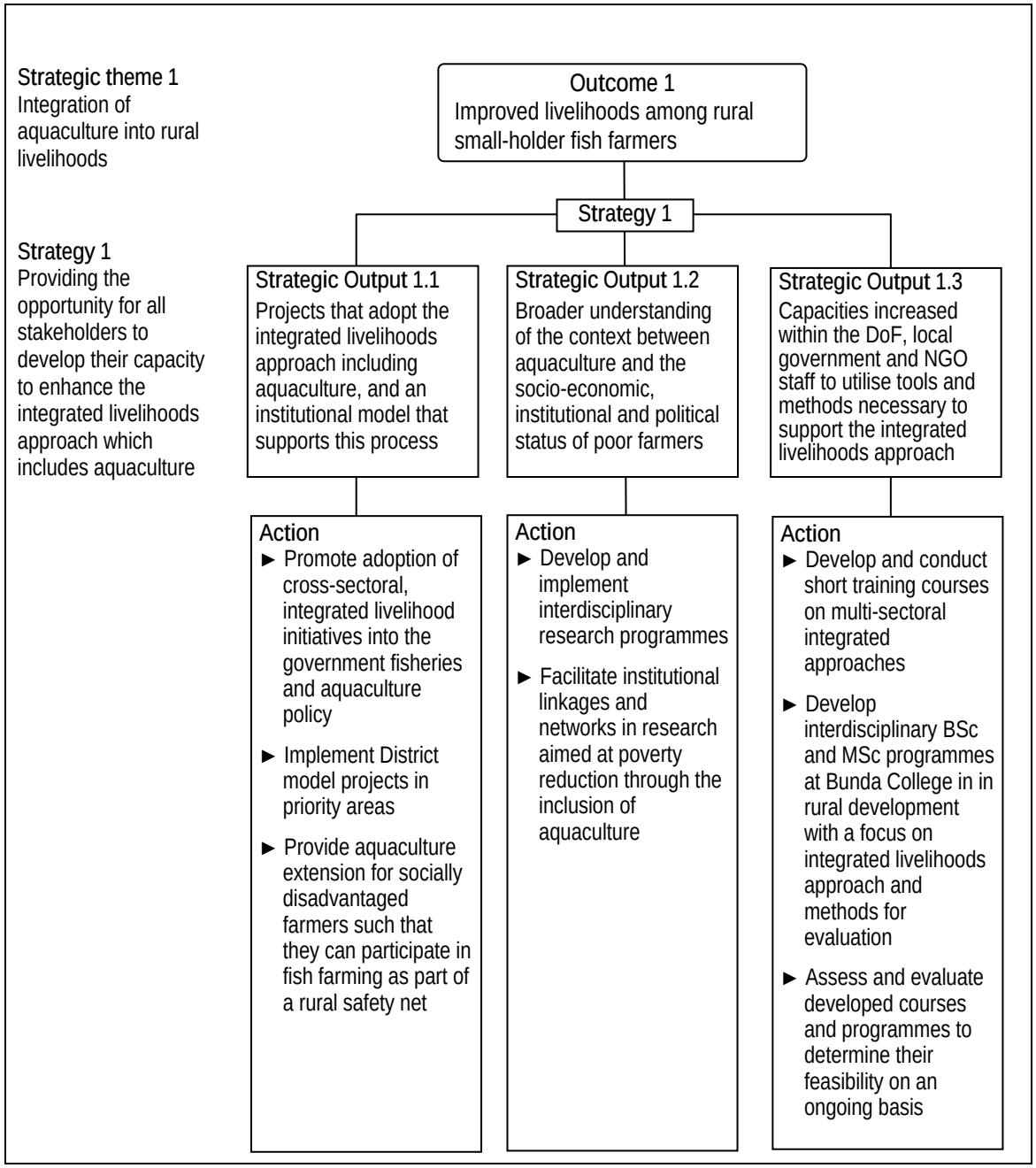


Figure 2.5 Strategic theme 1: strategies and outputs

Strategy 1 Providing the opportunity for all stakeholders to develop their capacity to enhance the integrated livelihoods approach, which includes aquaculture

Output 1.1 Projects that adopt the integrated livelihoods approach that includes aquaculture, and an institutional model that supports this process

A multi-sectoral livelihoods approach requires a sound environment and mechanism that brings partners from different sectors into the aquaculture development process. Importantly, it will be

necessary to initiate this process at a grass-roots level that will entail strong local organisation. From this standpoint, the DoF will develop and promote a model which places District Assemblies at the centre of the development process and its implementation. This will enable coordination of the sector through linking existing services within the District Assembly. For example, aquaculture extension can be provided together with crop and animal husbandry technologies more easily under the leadership of the District Assembly than as a stand-alone activity, especially after the pending decentralisation of extension systems. After decentralisation, it is anticipated that responsibility for all agricultural and natural resources functions will be combined at the District level.

The most effective means to develop institutions for this approach is through introducing a model project at District level that increases opportunities for the DoF, District Assemblies, donors, NGOs and other stakeholders to participate collaboratively. Introducing a scheme to encourage the adoption of livelihoods approaches into aquaculture development is directly aimed at improving the welfare of the poor. The scheme, tentatively called the "District Aquaculture Livelihoods Project" (see Section 8, Complementary Projects) will be implemented in priority Districts as a model approach that can be duplicated elsewhere at a later stage, if appropriate. Limited resources and different intensities of existing aquaculture practices and support mechanisms between Districts, suggests that a realistic short-term approach would be to focus on priority areas that can be considered 'Pilot Projects'. Up to three Districts will be identified using criteria that include: (i) presence of suitable institutional arrangements, e.g. the DoF and NGOs, (ii) potential for strengthening capacity for the improvement and adoption of an integrated approach (in this regard, the density of existing fish farmers and of potential new areas for fish farming would be important), (iii) the potential for collaboration with farmers, e.g. the presence of innovative farmers, (iv) natural and economic conditions, and (v) the need for regional balance in project focus areas. Districts being considered include Zomba , Thyolo, and Chitipa Districts.

Benchmark 2005	DoF has limited knowledge and lacks the resources to implement integrated livelihood approaches that include aquaculture
Target	Three model pilot projects in Zomba, Thyolo, and Chitipa Districts to be implemented by 2006.
Action	1. Promote adoption of cross-sectoral, integrated livelihood initiatives into the Government fisheries and aquaculture policy. 2. Implement District model projects in priority areas. 3. Provide aquaculture extension for socially disadvantaged farmers to have the opportunity to participate in fish farming practices as part of a rural safety net including women-headed households and households with HIV/AIDS orphans.

Output 1.2 Broader understanding of the context between aquaculture and the socio-economic, institutional and political status of poor farmers

Research is urgently needed to achieve this output. Primarily, knowledge of the impact of aquaculture on the livelihood of small-holder farmers is required. If aquaculture research is to respond effectively to the context and needs of poor farmers, increased investment in further interdisciplinary studies on livelihoods approaches is necessary. For the next 10 years, aquaculture research needs to take into consideration the following research agenda:

- Studies on developing a mechanism that can permit fish farmers to escape poverty.
- Studies on how fish farming can most effectively be integrated into other on-farm activities, including determining the actual value of fish farming to the overall livelihood of farmer households.
- Studies on a mechanism of interaction between fish farming and other development activities, in order to optimise synergies and minimise competition among these activities.

- Studies on community organisations, their importance in facilitating the effective use of community resources, and consequent effects on poverty.
- Studies on actual contribution of fish to human nutrition, changes over time, especially the impact on the incidence of poverty.
- Developing a common methodological framework, comparable definitions and data collection procedures for measuring poverty, coordination with other sectors, and evaluation against international standards.
- Defining appropriate and easily measurable poverty indicators which will ensure that the DoF activities can be adapted to impact positively on the livelihoods and well-being of the poor in particular.

Benchmark 2005: No current interdisciplinary research programme.

Target: An interdisciplinary research programme is developed and implemented by 2006.

Action:

1. Develop and implement interdisciplinary research programmes that produce a comprehensive base of information on the integration of aquaculture into the overall livelihood systems. This information should be used by DoF policy-makers for further strategic planning, policy development and project assistance.
2. Facilitate institutional linkages and networks in research aimed at poverty reduction through the inclusion of aquaculture. Institutional collaborators would include the NAC, Bunda College, Chancellor College, NGOs, donor projects and international research organizations.

Output 1.3 Capacities increased within the DoF, local government and NGO staff to utilise tools and methods necessary to support the integrated livelihoods approach

More specifically, these capacities include:

- Capacity in designing, operating and managing initiatives that follow an integrated livelihoods approach, and the tools and methods used in this.
- Capacity to generate knowledge and technologies that increase the impact of this approach.
- Capacity to assess and evaluate the results obtained through a multi-sector approach.

It is critical to be able to evaluate the benefit of adopting an integrated livelihoods approach. If quantitative or qualitative assessment cannot identify the advantage of using a particular approach, it is unlikely to be adopted and practised by either government or donors.

Benchmark 2005: There is no directed and systematic training programme to enhance capacity in the integrated livelihoods approach.

Target: The integrated livelihoods approach needs to be incorporated into curricula and taught in relevant training institutions by 2007.

Action:

1. Develop and conduct short training courses on multi-sectoral integrated livelihood approaches.
2. Develop an interdisciplinary BSc and MSc programmes at Bunda College in rural development with a focus on the integrated livelihoods approach and methods for evaluation.
3. Assess and evaluate developed courses and programmes to determine their feasibility on an ongoing basis.

Strategic theme 2

Enhanced Economic Opportunities for Commercial Fish Farmers

"Aquaculture is our business!"

- Farmer's opinion at National Planning Workshop. Lilongwe. 2005 -

Current Status

Establishing commercial aquaculture in Malawi is critical to the long-term economic sustainability and prosperity of the sector. However, contrary to the farmers statement above, examples of full-time dedicated fish farmers, or farmers who can sustain their livelihood solely through aquaculture, are rare in Malawi. In general, harvest of fish from ponds is not undertaken on a scheduled basis and a prolonged harvesting cycle is a widespread phenomenon. The tendency for farmers to hold fish for an extended period has been related to the pond being viewed as an asset and a savings bank rather than a production unit. This mindset is a constraint for profitable fish farming. Further, the entrepreneurial abilities of farmers have been suppressed to some extent through the lack of commercially orientated DoF services, and of donor assistance for commercially-orientated aquaculture development. Malawi's aquaculture development has followed a donor-guided path to a large extent, which has often been focussed on the resource-poor farmers. Significant human resources have therefore been left under-utilized among some of the more progressive farmers. There is significant potential for the development of commercial aquaculture in the private sector. The existence of successful and financially independent fish producers who derive most of their income from aquaculture will provide great incentive for potential entrepreneurs to invest in fish farming. This will result in increased wealth in rural areas and contribute to stability in the rural economy.

The issue of farming with exotic fish species in Malawi has stimulated lively debate. Current thinking among stakeholders (and in particular fish producers) as determined by extensive consultation at national level, and a planning workshop held in Lilongwe on the 3rd and 4th February 2005, includes the following farmer opinions:

- National policy should be responsible but should be conducive to development needs.
- Producers are unable to ensure scheduled production using currently available species.
- Literature exists that shows that *C. carpio* can be grown to the market size in 6 months.
- There is uncertainty as to the length of time that Malawi will remain isolated from exotic species that are already present in neighbouring states, and what the approach of the DoF will be regarding those exotic species that are already present in certain parts of the country.
- The issue of exotic species is the most important issue that needs to be addressed in developing aquaculture in Malawi, particularly with regard to *C. carpio* and *O. niloticus*.
- Farmers are strongly in favour of farming with *C. carpio*, believing that the species is already in many of the watersheds of Lake Malawi in neighbouring countries, but caution was expressed with respect to *O. niloticus*.
- Information outlining the basis for banning common carp needs to be made available to farmers.

The issues raised by farmers would suggest that the development of improved strains of *O. karongae*, *O. shiranus* and *T. rendalli*, developing efficient on-farm technologies for the production of *C. gariepinus* fingerlings and effective farmer training with respect to fish feeds, feeding and fertilisation is a top priority for the NAC.

However, despite over 20 years of experience in aquaculture research, the DoF and donors are still struggling to determine the best aquaculture interventions, especially in situations where inputs are scarce and or limiting.

Outcome

Fish producers that are financially independent through income generated by aquaculture.

Strategic objectives - by the year 2015

+ Financially independent commercial fish farmers/enterprises established
+ An active and effective network of researchers for Malawian and African aquaculture, including national, regional, and international research institutions, contributing to the identification of the best technical options for aquaculture production and the dissemination of these outputs
+ An improved economic, legal and administrative environment with incentives to encourage entrepreneurial farmers. Amongst others, these incentives could include effective credit schemes, tax exemptions, and a simplified licensing system.

Achievement of the Strategic Objectives

The DoF plans to sharpen the focus of its services, research and technology transfer toward areas with potential for commercial aquaculture in Malawi. Five strategic outputs have been specifically identified to achieve this. Firstly, technology must be developed and validated. This will require an improved institutional base. Secondly, an effective and coordinated research programme, involving the NAC and other international research organisations needs to be established. This research programme needs to strengthen the capacity of local scientists and technologists to generate appropriate technologies to support commercial aquaculture development. Thirdly, these technologies must be transferred to producers, together with an appropriate back-up service. This process needs to incorporate a viable plan of action to secure adequate financial support. Fourthly, an attractive and regionally competitive investment environment that reduces business risk and provides incentives for investment needs to be established. Finally, a protocol for responsible environmental assessment and management needs to be developed.

To achieve the strategic objectives, the DoF will adopt the following five strategies:

Strategy 2 Enhancing institutional capacity of NAC to develop medium to large-scale commercial fish farming technologies

Strategy 3 Providing an appropriate credit, business training and technology package for small to medium-scale commercial fish farmers

Strategy 4 Creating a regionally competitive and friendly investor environment through sound policy, clear procedure and legal framework

Strategy 5 Ensuring aquaculture activities are environmentally responsible and sustainable

Strategy 6 Establishing links and information flows between producers and fish traders to enhance access to markets

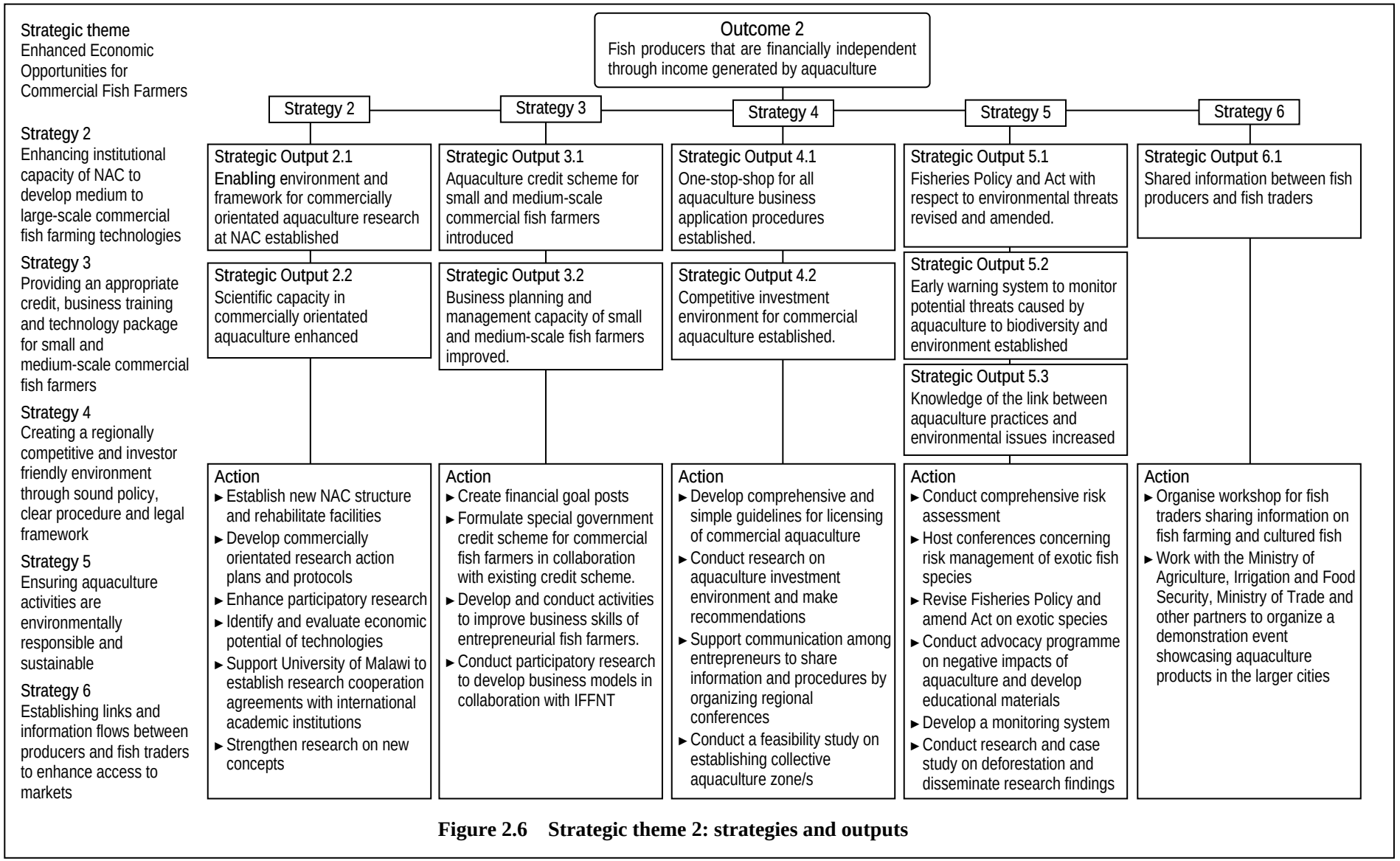


Figure 2.6 Strategic theme 2: strategies and outputs

Strategy 2 Enhancing institutional capacity of NAC to develop medium to large-scale commercial fish farming technologies

Although government fisheries stations played an important role in fingerling production and distribution in the past, this function has now been taken over to a large extent by private farmers. This has resulted in activities at the stations focussing more on research, and the maintenance of broodstock. These activities require a limited number of stations in the country, and available resources severely limit the effective operation of many stations. Concentration of resources and their use at selected stations is critical, and this is particularly vital as far as research activities are concerned. The NAC is identified as the centre that should be revitalised to adequately address the research needs of the aquaculture sector.

Research attention at the NAC was most often focused on the needs of resource-poor fish farmers, with little recognition of the development potential of commercially orientated aquaculture. Addressing the needs of his sector has the potential to yield the highest return on any research investment. Presently, there is a national need for, and a desire by, small and large-scale farmers to produce fish on a commercial and profit orientated basis. A quantum shift in research goals and approach therefore needs to take place. This includes the development of a new framework for the NAC in aquaculture research, which could encompass a re-definition of its role, structure and function, the rehabilitation of the facilities, enhancing the research network, and improving the capacity of researchers.

Output 2.1 Enabling environment and framework for commercially orientated aquaculture research at NAC established

DoF will organise workshops aimed at building consensus on a new structure of the NAC, its position within the DoF and orientation of its research action plan. This requires joint-planning and co-financing in collaboration with the Aquaculture Advisory Body, NAC staff, DoF top management, Bunda and Chancellor Colleges of the University of Malawi and invited external participants with knowledge of local conditions. DoF will also be required to rehabilitate the research ponds and water supply facilities.

Benchmark 2005: Activities at NAC are mainly orientated towards aquaculture for the resource-poor.

Target: Research plans and protocols for commercially orientated aquaculture research to be developed by 2006 and works to be carried out.

Action:

1. Establish a new NAC structure with staff redeployment and new job descriptions.
2. Rehabilitate basic facilities at NAC.
3. Develop research action plans and protocols to create knowledge and develop technologies to increase aquaculture production.
4. Establish a database of farmers who have the necessary resources to make changes from subsistence to commercial fish farming (potential commercial farmers).
5. Enhance participatory research.
6. In collaboration with appropriate external consultants, assist the University of Malawi in identifying and evaluating the economic potential of emerging scientific discoveries and technologies.
7. Working in collaboration with international research institutions, strengthen fundamental research on new concepts in business, marketing, and profit-orientated technologies.

Output 2.2 Scientific capacity in commercially orientated aquaculture enhanced.

The currently available expertise at NAC and at Bunda College is largely geared towards small-holder aquaculture and integration of aquaculture and agriculture. Hence there is a need to develop research capacity in experimental design, execution and interpretation of results for commercial scale aquaculture, and extension staff that understands the demands and needs of professional fish farmers and who can effectively promote its development in the country.

Benchmark 2005 There is not enough information and knowledge on commercial aquaculture in DoF.

Target Adequate number of personnel in commercial aquaculture to be trained by 2008 and disseminate their knowledge to other stakeholders in the aquaculture sector in Malawi.

Action
1. Develop systematic training programme with list of potential trainees
2. Provide advanced technology training opportunities at appropriate international research institutions or in collaboration with international researchers. There are requirements for at least: 2 fish nutritionist, 2 feed technologist, 1 genetics specialist, 1 fish disease specialist, 1 aquaculture engineer, and 5 extension trainees (training to include business planning, fish food and feeding, marketing, etc.).
3. Establish research and teaching agreements between University of Malawi and other international academic institutions in basic research and high-level education.
4. Support participation of researchers at international and regional aquaculture conferences.

Strategy 3 Providing an appropriate credit, business training and technology package for small and medium-scale commercial fish farmers

Supportive business services will play a key role in the development of small and medium-scale commercial farmers. Collaboration with rural and agricultural business advisory agencies, as well as the Department of Commerce, private financing organizations, and NGOs will be necessary to enhance the capacity of emerging farmers. To contribute to this process, the DoF will facilitate interaction between these agencies and farmers and provide advice to farmers on where to obtain such services.

Lending institutions have limited information on the aquaculture sector in general and are not easily able to assess the credit worthiness of farmers. Banks need to be sensitised and informed, and farmers need to be guided as to the process they need to follow in the preparation of project proposals and business plans. The DoF could assist farmers and the IFFNT with the preparation of bankable proposals with which to approach lending institutions, and in determining the requirements of these institutions. The DoF could greatly assist in this process by preparing an information package to be used by both lending institutions and farmers. This package could include definitions of perceived constraints such as limited collateral and guarantees, poor records of income and expenditure at farm level, and limited use of bank accounts. In addition, lending institutions need information on different categories of farms (on the basis of size, number of ponds, water supply, soil and climatic conditions), minimum infrastructural requirements and repayment ratios that qualify small scale farmers and fishermen in other parts of Africa and in other developing countries.

Output 3.1 Aquaculture credit scheme for small and medium-scale commercial fish farmers introduced

The DoF will promote collaboration with existing financial institutions and programmes, such as the ADB fisheries loan, MASAF, the Billion Kwacha Loan Fund, SEDOM, Compass II, NASFAM, and others to facilitate access to these services by fish farmers, where appropriate. The DoF will need to conduct a number of seminars for managers of these programmes to inform them of the requirements and nature of the fish farming sector, and to determine the conditions necessary to access their services.

Benchmark 2005	Farmers do not have access to financial services and credit.
Target	Farmers will have access to financial services and credit through support of the DoF by 2008.
Action	1. Create financial goalposts for farmers to "graduate" from the current situation to small to medium-scale commercial level. 2. Formulate special credit schemes for small and medium-scale commercial fish farmers in collaboration with existing credit schemes such as the ADB Fisheries Loan Scheme, MASAF, the Billion Kwacha Loan Fund, SEDOM, etc. 3. Conduct economic study of fish farming and its marketing.

Output 3.2 Business planning and management capacity of small and medium-scale fish farmers improved

Changing the attitude of farmers from one where aquaculture forms a minor component of the farming system to one where it is the dominant activity is critical to enable small and medium-scale commercial aquaculture. The DoF recognises the importance of raising awareness, and knowledge of commercial aquaculture. The DoF will be required to promote advocacy activities and training, including participatory research for business models, aimed at supporting farmers to develop their business strategies. An important element of this process is to identify and support farmers and farmer clubs that have the capacity to act as models for business–orientated approaches. These farmers would then be in a position to train others in best practice, and their model approaches can act as incentives for other farmers throughout the country.

Benchmark 2005	Farmers in Malawi have severely restricted in business management skills.
Target	100 farmers will receive business training and they will plan their own business strategies such that aquaculture is their principal source of income by 2008.
Action	1. Conduct business training and seminars to potential small to medium-scale farmers with provision of technology package. 2. Conduct consultative activities for entrepreneurial fish farmers to improve their business skills. Innovative Fish Farmers Network Trust and successful farmer clubs will be consulted to develop scenarios (business cases) with DoF. 3. Conduct participatory research enabling business models in collaboration with IFFNT.

Strategy 4 Creating a regionally competitive and investor friendly environment through sound policy, clear procedure and legal framework

The current investment environment in Malawi is not conducive for the development of commercial fish faming, and in comparison to Mozambique is not competitive. Though some incentives exist, they are often not implemented and/or take too long to be implemented, or are too little for rapid

capital redemption and application procedures are cumbersome. Hence, if Malawi wishes to attract investors in aquaculture there is a need to revise policy and legislation and to streamline procedures.

Output 4.1 One-stop-shop for all aquaculture business application procedures established

The DoF will design a streamlined application procedure, and align and sensitise relevant departments such that applications and EIA procedures are clear and unambiguous. The DoF will become a one-stop-shop for applications.

Benchmark 2005 The procedure to start commercial aquaculture is complex.

Target DoF to become an efficient one-stop-shop for investors to initiate commercial aquaculture by 2009.

Action
1. In collaboration with the Department of Environment, Ministry of Lands, and the Ministry of Local Government, develop comprehensive and simple guidelines for business licensing of commercial aquaculture ventures.

Output 4.2 Competitive investment environment for commercial aquaculture established

The Malawi Investment Promotion Agency needs to align policy and incentives for foreign and national direct investment with those offered by neighbouring countries and exceed these where possible (e.g. tax holidays, import duty on capital goods and raw materials, etc.) and to design and implement rapid compensation procedures. The concept idea of "collective aquaculture zones" may be one of the options for encouraging investment in commercial aquaculture.

Benchmark 2005 There is no clear understanding of, and guidelines for investment incentives for commercial aquaculture in Malawi.

Target The basic legal, fiscal and administrative environment for commercial investment to be established by 2007.

Action
1. Conduct research on the aquaculture investment environment that establishes a basis for the introduction of efficient and appropriate incentives and subsidies, including tax exemption for aquaculture operations and materials.
2. Support communication among entrepreneurs to share information and procedures by organizing regional conferences.
3. Conduct a feasibility study on establishing "collective aquaculture zone/s", such that basic infrastructure is established through a joint venture between the public and private sector and in which small to medium-scale farmers could buy participatory shares.

Strategy 5 Ensuring aquaculture activities are environmentally responsible and sustainable

Recognising that the country does not currently face major environmental threats from commercial aquaculture it is incumbent upon the DoF to ensure that the sector grows in a responsible and sustainable manner. Probably, the most urgent threat to the biodiversity of the lake is the translocation of exotic species such as *O.niloticus*, and others, from neighbouring countries into the catchment. Although common carp was introduced by the FAO to Malawi in 1976, *O. niloticus* has not yet been introduced. In 1983, the DoF developed guidelines for carp farming in Malawi. Though the current policy prohibits carp aquaculture, it is being farmed in the lower Shire and Zomba area. The current policy on carp was based on the outputs of a workshop held in 1991 and accepted on the basis of a majority vote. This process did not follow any recognised procedures or protocols and is

flawed and requires revision upon which a more informed decision can be taken on the use of exotics and legislated accordingly. Pressure to introduce exotic species for aquaculture, particularly *C. carpio* and *O. niloticus* is mounting. Hence, there is a need for a revision of the policy on exotic species with due respect to the conservation of biodiversity and international agreements to which Malawi is a signatory and to align policy with opportunities and needs, where appropriate and legislate.

Output 5.1 Fisheries Policy and Act with respect to environmental threats revised and amended.

The current fisheries policy and act are ambiguous and unclear on species introductions. To ensure responsible environmental management there is a need to review and amend the policy and the act. It is essential that the decision on exotic species and other environmental threats be informed by the best scientific expertise and available information. The assessment should be undertaken by an experienced panel of experts according to the most appropriate protocol/s and led by a respected international expert on fish introductions and translocations. The Director of Fisheries should be guided by the panel of experts to revise the policy and the Fisheries Act accordingly. Among other aspects, the assessment will require knowledge of the current distribution of *C. carpio* and *O. niloticus* in Mozambique, Tanzania and Zambia, with particular emphasis on the Lake Malawi catchments and appropriate multi-lateral action where necessary. It is anticipated that this would require at least two meetings of fisheries experts from the four countries.

Benchmark 2005	Policy and Act are unclear with regard to species introductions in Malawi.
Target	Based on a comprehensive study on exotic species and their introduction, the Fisheries Policy will be revised and the Act amended by 2009.
Action	1. Conduct comprehensive risk assessment with respect to conservation of biodiversity and international agreements and align with opportunities and needs, where appropriate and legislate. 2. Host conferences on contemporary issues concerning risk management and introductions of exotic fish species in collaboration with the Governments of Tanzania, Mozambique and Zambia. 3. Revise Fisheries Policy and amend Act with respect to exotic species.

Output 5.2 Early warning system to monitor potential threats caused by aquaculture to biodiversity and environment established.

Negative impacts of aquaculture activities should be avoided. Much can be done to avoid negative environmental impacts on aquatic environments in Malawi by aquaculture if adequate information on potential threats is available at an early stage. An early warning system should be set up to monitor urgent threats to biodiversity and disseminate this information widely to national and international authorities so that appropriate actions are swiftly mobilized.

The early warning mechanism should monitor:

- Introduction of exotic species and genetically modified fish, especially *O. niloticus.*
- Translocation of *O. mossambicus* and *C. carpio* into the Lake Malawi catchment.
- Water quality around fish cages in the lake.
- Use of hormones.
- Fish diseases and parasites.

Community fisheries organisations, NGOs and scientists working in the field are the best source of information. The challenge is to make this information widely available to DoF and other authorities,

so that appropriate actions are swiftly taken. Emphasis on advocacy for these groups is required to raise awareness of the environmental threat of aquaculture. For this purpose, country studies on alien and invasive fish species can also provide valuable baseline information for monitoring long-term trends.

Benchmark 2005	There is no effective early warning or monitoring system for possible negative environmental impacts of aquaculture.
Target	An effective early warning system to monitor possible negative impacts of aquaculture to be established by 2010.
Action	1. Conduct advocacy programme for fish farmers and fishers on the potential negative impacts of aquaculture and mitigation measures through various types of aquaculture training programmes and seminars. 2. Develop guidelines and educational material that warn against introduction of exotic fish into the Lake catchment. 3. Develop a monitoring system that can also be used by capture fisheries law enforcement officers.

Output 5.3 Knowledge of the link between aquaculture practices and environmental issues increased

Over the decades, Malawi has experienced increasing pressure on soil, water and forest resources. Escalation of deforestation and a decrease in water resources are direct threats to sustainable aquaculture. In the short-term, the DoF needs to increase information on the impacts emerging from environmental degradation on aquaculture practices.

Benchmark 2005	Information on environmental degradation is limited within the sector and no systematic study is available for aquaculture practitioners.
Target	Research and communication on the impact of environmental degradation on aquaculture will be shared amongst stakeholders by 2010.
Action	1. Conduct research and case studies on deforestation and water resources and how this impacts on aquaculture potential. 2. Disseminate research findings so that a common understanding of the impact of environmental degradation on aquaculture is developed amongst stakeholders.

Strategy 6 Establishing links and information flows between producers and fish traders to enhance access to markets

If a producer wishes to sell a certain quantity of product in the urban markets, an efficient means of transportation and marketing should be developed. Most traders currently do not have any information about aquaculture and farmed fish. The DoF should work with producers, fish traders and buyers to strengthen linkages between them, which will lead to scheduled harvests, and shipping of product to urban markets through appropriate contractual arrangements. The DoF will educate and inform traders on fish availability, fish farming practices and regulations through the mass media and various types of purpose designed workshops.

Output 6.1 Shared information between fish producers and fish traders

To create incentives for fish traders to handle farmed fish, dissemination of information about the product is required.

Benchmark 2005	No fish traders handle farmed fish.
Target	Through the dissemination of information fish traders will become involved in handling farmed fish.
Action	1. Organise a workshop for fish traders and share information on fish farming and cultured fish. 2. Work with the Ministry of Agriculture, Irrigation and Food Security, Ministry of Trade and other partners to organise a demonstration event showcasing aquaculture products in the larger cities.

Strategic theme 3

Competent Local Government, NGOs and Producer's Organizations

Current Status

Needs-based service delivery requires decentralised functions, and should adopt a bottom-up and participatory approach to ensure stakeholder involvement. Local government, NGOs and producer organizations have an important role to play in this approach. DoF services, especially extension, are important contributors to this emerging decentralisation process. In December 1998, the Malawi Parliament approved the National Decentralization Plan (NDP) to devolve various functions of the national government to the local District Assemblies (DAs). Although this process has been delayed, the DoF intends to complete the devolvement of extension responsibilities to the District offices by the end of 2005.

Constraints to the implementation of devolution of aquaculture services include: (i) lack of awareness on aquaculture practice among policy-makers and planners at District/village level, (ii) inadequate institutional and technical capacity, (iii) lack of information, (iv) inappropriate legislative framework, and (v) inadequate District funding.

NGOs currently provide important aquaculture extension services in various parts of Malawi. There has been a significant increase in the number of new ponds since the early 1990s. The most dramatic increase occurred from 1999 to the present, and this is largely a consequence of NGO activities. For example, in Thyolo District, the number of ponds has increased to more than 1,000 from only 44 in the 1990s. This is largely due to the active involvement of OXFAM in aquaculture promotion. OXFAM financially supports and collaborates with the District Assembly and involves them in their rural development programmes. In line with their activities, District fisheries officers and extension staff are encouraged to promoite aquaculture. On the other hand, World Vision Malawi is supporting about 300 fish farmers utilising its own extension officers to promote aquaculture in the Chingale area, Zomba District with occasional support from DoF extension staff. These joint and collaborative initiatives are extremely important for the development of the sector. However, there is clear evidence that the capacity of the NGO and DoF extension staff needs to be improved to develop small-holder aquaculture, particularly with respect to site selection, pond design and management, food and feeding and poor technical follow-up for new fish farmers.

The lack of an officially recognised producer organisation has made the dissemination of information a very difficult task. The Innovative Fish Farmers Network Trust (IFFNT) was established in 2004 as one of the ADiM Pilot Projects to contribute to the organisation and empowerment of fish farmers. This pilot project verified that fish farmer organisations are: (i) an effective way of sharing relevant information on best practices, (ii) effective as a lobbying mechanism that reflects customer needs, and (iii) can build partnerships between NGOs, research institutions and individuals to address common goals. However, the financial sustainability of the IFFNT is still in question. Uncertainty still exists as to the ideal organisational structure needed to allow fish farmer organisations to be most effective in the long term. A better understanding is required of the actual impact of such organisations and the types of organisations that are likely to have the greatest beneficial impact, if these structures are to be supported through DoF interventions.

Outcome

Quality aquaculture services become available at grass-roots level.

By the year 2015

+ Regional and national farmer organisations will have strengthened their capacity to manage aquaculture activities effectively.
+ All Districts will be able to provide quality aquaculture services through networks linking the DoF and NGOs.
+ There will be evidence of an increased number of extension officers who can advise on aquaculture, through the inclusion of fish farming extension into the job descriptions of all extension staff working in the natural resources sector at District level.

Achievement of the Strategic Objectives

To achieve this, the DoF will adopt the following three strategies:

Strategy 7 Sensitising and building capacity of local government on their primary responsibilities in aquaculture development

Strategy 8 Developing alliances between DoF and NGOs to promote unified approaches in aquaculture extension

Strategy 9 Fostering fish producer organizations that assist farmers to increase production, access to finance, markets and other services

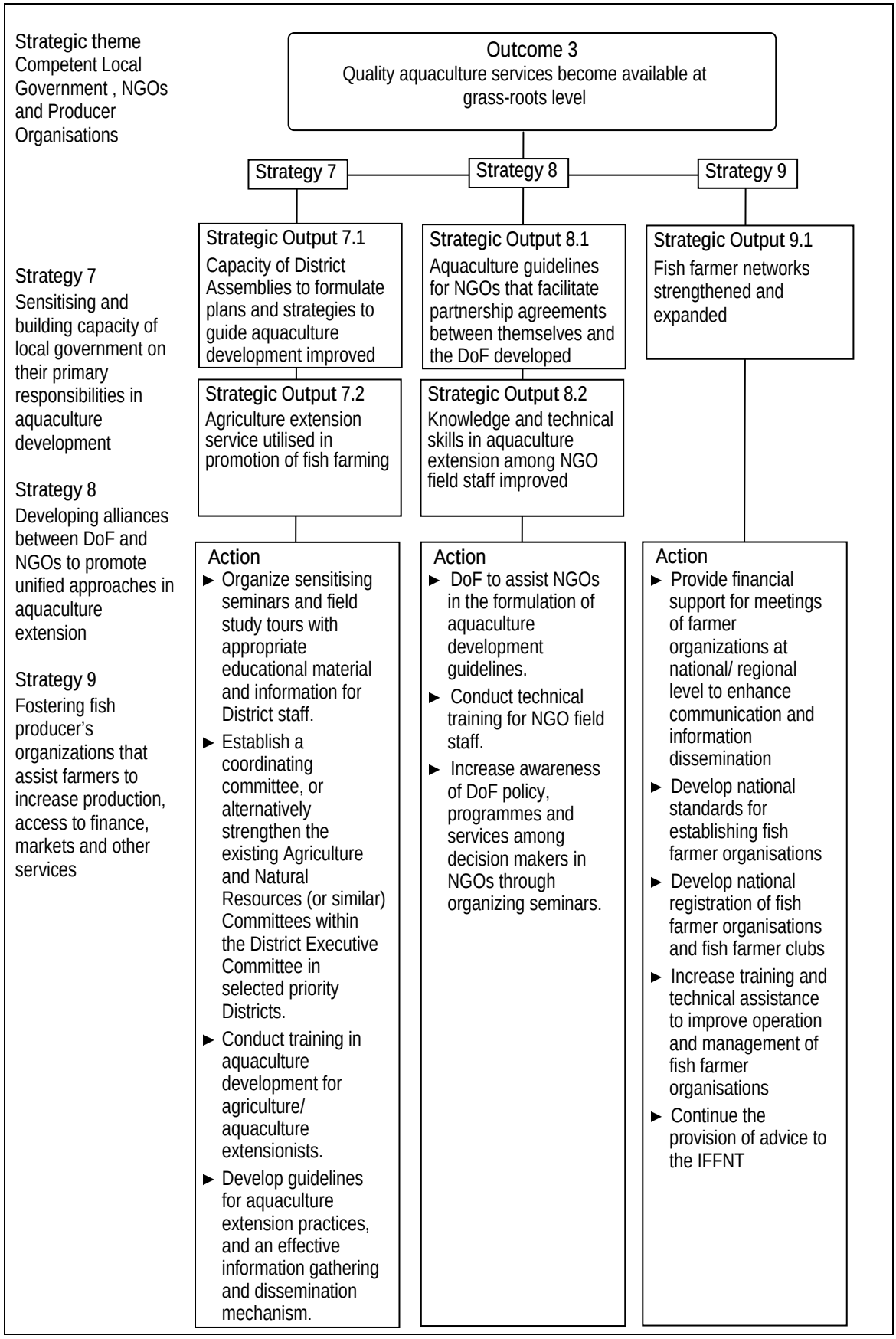


Figure 2.7 Strategic theme 3: strategies and outputs

Strategy 7 Sensitising and building capacity of local government on their primary responsibilities in aquaculture development

This strategy addresses institutional strengthening of DAs so that Districts can carry out effective aquaculture extension and development. In other words, the strategy supports decentralisation in decision-making and formulation of extension programme in aquaculture development. Currently, insufficient knowledge and understanding of aquaculture among the policy-makers and planners at District level are severe constraints to achieving this strategic objective.

Output 7.1 Capacity of District Assemblies to formulate plans and strategies to guide aquaculture development improved

In the early stages, devolving part of the DoFs functions to the District level will require focus on raising awareness of aquaculture and strengthening the links between the DoF and DA Office. Capacity in aquaculture technology and extension will need to be enhanced and extended to the agriculture and livestock extension sections in the DA. This is a new and exploratory approach for the DoF and therefore, the process will need to be monitored and evaluated carefully.

Benchmark 2005: There are only two Districts that include aquaculture programmes in their current DDPs 2001-05.

Target: Aquaculture component will be incorporated in the DDPs in the three Districts where model pilot projects are implemented by 2010. Subsequently, at least ten Districts will incorporate an aquaculture program in their DDPs by 2015.

Action:

1. Redefine responsibilities of DA in aquaculture development with emphasis on stakeholder participation.
2. Organize sensitising seminars and field study tours with appropriate educational material (such as video programmes), and information (e.g. District Aquaculture Profile) for District staff. Target audiences include: District Commissioner (DC), District councillors, District Executive Committee (DEC), Village Development Committee (VDC) and relevant community services and social welfare sections of the DA.
3. Establish a coordinating committee, or alternatively strengthen the existing Agriculture and Natural Resources (or similar) Committees within the DEC in selected priority Districts.
4. Develop guidelines for aquaculture extension practices, and an effective information gathering and dissemination mechanism that facilitates information sharing between the DoF and the DA office.

Output 7.2 Existing agriculture extension services utilised in promotion of fish farming

Benchmark 2005: There are very limited Districts (e.g. Tyolo District with support from Oxfam) that agriculture extension staff are encouraged to include fish farming when they provide extension services.

Target: Agriculture extension services to be utilised for further extension on aquaculture as well as integrated livelihood approach through enlightening agriculture extension staff with knowledge on aquaculture.

Action:

1. Conduct training in aquaculture development for agriculture extension officers as well as aquaculture staff based on redefined roles of the DA in the sector.
2. Assign and train advisors to the agriculture extension staff.

Strategy 8 Developing alliances between DoF and NGOs to promote unified approaches in aquaculture extension

Aquaculture development has occurred in many areas as a result of interventions by NGOs. These organisations often deal with situations at grass roots level where government services cannot effectively reach. NGOs are also generally committed to fostering community organization and empowerment that is an essential requirement for an integrated livelihoods approach that includes aquaculture. On the other hand, NGOs tend to be less able to deliver technical services than the DoF. The DoF can benefit from collaboration with NGOs, especially with regards to their broader-based and more people-orientated competence. Presently, five international NGOs are involved in aquaculture development. However, systematic coordination between the DoF and NGOs, or among NGOs themselves, is lacking. In addition, no specific training programmes on the technological aspects of aquaculture exist for NGOs.

Output 8.1	Aquaculture guidelines for NGOs which facilitate partnership agreements with the DoF developed
Benchmark 2005	There are 8 NGO programmes that have included aquaculture in their approach.
Target	Alliances between the DoF and NGOs involved in aquaculture will be established by 2008.
Action	1. The DoF needs to assist the NGOs in the formulation of aquaculture development guideline.

Output 8.2	Knowledge and technical skills in aquaculture extension among NGO field staff improved
Benchmark 2005	In the past 3 years, there has been no training programme for NGO staff in aquaculture.
Target	All NGO field staff in at least the 3 priority Districts will participate in a basic aquaculture training course.
Action	1. Conduct technical training for NGO field staff. 2. Increase awareness of the DoF policy, programmes and services among the decision makers of NGOs through seminars.

Strategy 9 Fostering fish producer's organizations that assist farmers to increase production, access to finance, markets and other services

Output 9.1 Fish farmer networks strengthened and expanded

The DoF will continue to work with the Innovative Fish Farmers Network Trust (IFFNT) to strengthen their potential functions. The DoF needs to assist the IFFNT (through the provision of grants and technical assistance) to move toward financial independence and to improve and expand their information-sharing capabilities at district and national level. The DoF also needs to support unregistered community-level fish farmer organisations, such as farmers club. This would include registration of these organisations, undertaking research to identify key constraints and opportunities associated with their activities, and management and technical assistance.

Benchmark 2005	IFFNT exists as an officially registered fish farmers organisation.
Target	IFFNT to be financially independent by 2012. Farmer organisations to be established in the three aquaculture priority Districts by 2009.
Action	1. Provide financial support for meetings of farmer organizations at national/ regional level to enhance communication and information dissemination among farmers. 2. Develop national standards for establishing fish farmers organisations. 3. Develop national register of fish farmer organisations and fish farmers clubs. 4. Increase training and technical assistance to improve operation and management of fish farmer organisations. 5. Continue the provision of advice to the IFFNT.

Strategic theme 4

Smart and Practical DoF

"Effective national institutional arrangement and capacity, policy, planning and regulatory framework in aquaculture are essential to support aquaculture development"

- Aquaculture Development beyond 2000. Bangkok Declaration -

Current Status

For the DoF to provide the best possible service to its customers (described previously under Strategic Themes 1-3) depends on the strong institutional capacity of the Department. The NASP cannot be successful without a practical, smart and efficient DoF. Challenges to be addressed in order to revitalise the DoF include:

Insufficient development budget within the DoF is a fundamental constraint to aquaculture promotion. Lack of resources such as vehicles and fuel to visit farmers has contributed to low staff motivation and a general poor quality of service offered to farmers. Donor assistance has been needed to fill the shortfall in development funding since the 1980s. The level of donor assistance in the fisheries and aquaculture sectors has declined in recent years, reflecting redirection of donor priorities and in some cases a shrinking budget for overseas development assistance. The DoF currently has 11 aquaculture stations that have to a large extent been established and operated through donor assistance in the past. Apart from the NAC, which is currently assisted by Japan, the DoF does not have the funds to resource the other stations effectively and this has de-motivated the staff. This constrains effective aquaculture extension to small-scale and aspirant commercial fish farmers. Moreover, because of the lack of operating expenses, equipment and ponds are deteriorating rapidly and the stations cannot carry out their mandate. Although financial autonomy of the DoF stations through generation of their own revenue from sales of fingerlings and other services may be possible, a system of revenue retention is generally not feasible under current government policy.

Increasing efficiency and flexibility in the DoF is critical. This will be attained through decentralising its services, contracting out services and sharing the cost of services with the private sector. During the course of this study, an important step towards involving the private sector in DoF operations has been the partial-privatisation of the Kasinthula station in 2004. The impact of this initiative is not yet fully apparent. However, it is probable that the initiative will add value through income from facility rental, employment of DoF staff by private farmers, the privately funded rehabilitation of the facility, and the generation of useful information on the economics of extensive aquaculture. Partnerships, such as this, will have a major effect on the sustainability of DoF stations in the future. It is also apparent in other countries that food fish and fingerling production is increasingly becoming the domain of the private sector, as a consequence of down-sizing within government. Privatization of government stations (refer to Part 1 of the NASP) is still a new concept to the DoF and more information on the processes followed in other countries, as well as guidelines for decision-making and implementation, are urgently required.

Lack of reliable statistical information and an inadequate information gathering system is a serious constraint to monitoring and evaluation of the aquaculture sector. Without reliable information on production, yield and number of fish farmers, it is difficult to formulate realistic development plans for aquaculture in the country. This problem is exacerbated by the widely scattered distribution of fish farmers in rural areas, which makes data collection a difficult task with limited resources available for mobilisation. Furthermore, inadequate information flow between researchers and information users (policy-makers, extension staff, private farmers, NGOs, etc.) limit the usefulness of information that is generated.

Outcome

High performing DoF and staff.

By the year 2015

+ There will be evidence of an increase in aquaculture development funding
+ Sustainability of services supporting aquaculture will increase due to improved capacity for planning, management, and coordination among stakeholders
+ Quality information (such as reliable aquaculture statistics) and adequate access to this information will improve the quality of DoF services

Achieving the Strategic Objectives

To achieve this, DoF will adopt the following three strategies:

Strategy 10 Building healthy DoF financial resources

Strategy 11 Realising efficient DoF operation

Strategy 12 Promoting quality DoF staff and information

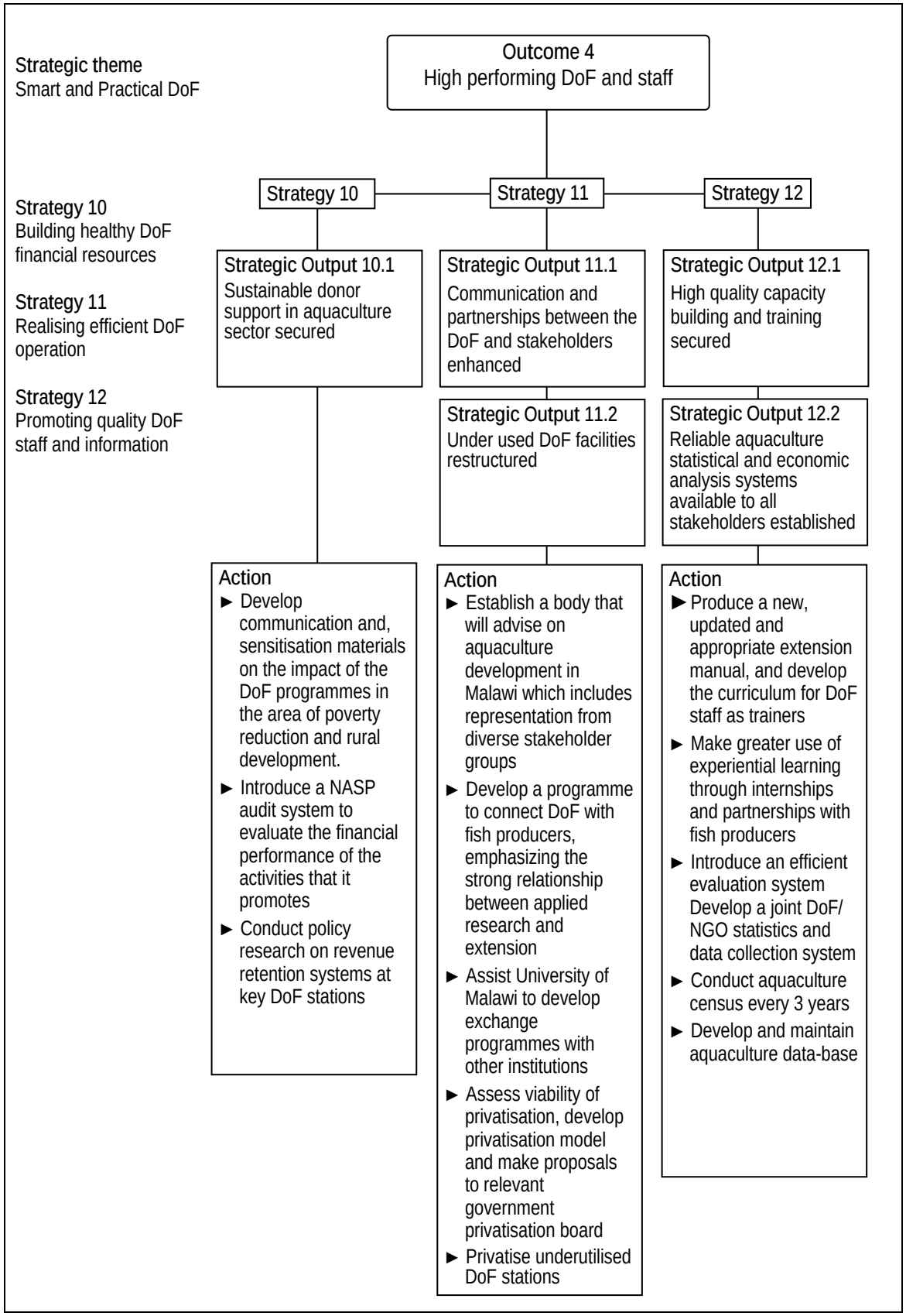


Figure 2.8 Strategic theme 4: strategies and outputs

Strategy 10 Building healthy DoF financial resources

The current macro-economic situation in Malawi is not conducive to increasing the DoF budget in the short term and cannot be considered as a realistic option in terms of the NASP. Therefore, increasing external financial contributions, economising on current expenditure, and introducing revenue retention systems are considered as key strategies for the DoF in order to implement the NASP. However, it is recognised that these options are often outside of the control of the DoF and are regulated by government policy. The necessary changes in policy need to be addressed through a comprehensive advocacy and dialogue process with relevant authorities.

Output 10.1 Sustainable donor support for the aquaculture sector secured

It is inevitable that the DoF will depend on donor agencies for development funding for the next 10 years. Strategic sensitisation of high-level officers in government and donor agencies on how aquaculture can fit into the PRSP and Country Assistance Strategies is pivotal.

Benchmark 2005	Only JICA has committed assistance for aquaculture-focused support.
Target	At least partial support provided to aquaculture development from several donors by 2007.
Action	1. Develop sensitisation materials on the impact of the DoF programmes in the area of poverty reduction and rural development. These should include publications, national media campaigns and web-based information. 2. Introduce a NASP audit system to evaluate the financial performance of the activities that it promotes 3. Conduct policy research on revenue retention systems at key DoF stations.

Strategy 11 Realising efficient DoF operation

Efficiency of the DoF aquaculture services will be improved by focusing on better communication among stakeholders, and organisational reform strategies. In addition, the NASP has identified priority areas (Zomba, Thyolo, Chitipa, and parts of the lake shore) for aquaculture extension to further concentrate the limited resources.

Output 11.1 Communication and partnerships between the DoF and stakeholders enhanced

The DoF is required to interact with a diverse set of stakeholders. Strong, open relationships with stakeholders can improve the effectiveness of DoF programmes. The DoF must strengthen its communication and connection with stakeholders to more effectively address important issues and to help in building public support for the DoF mission. The DoF will also focus on strengthened strategic partnerships with international and regional institutions to support their aquaculture development efforts.

Benchmark 2005	Limited interaction among DoF and stakeholders in aquaculture
Target	Scheduled periodic meetings with key stakeholders in aquaculture sector to be established by 2006.
Action	1. Establish a body that will advise on aquaculture development in Malawi which includes representation from diverse stakeholder groups. 2. Develop a programme to connect DoF with fish producers, emphasizing the strong relationship between applied research and extension, and how this can be

used to address practical problems of aquaculture in Malawi.

3. Assist University of Malawi to develop exchange programmes with institutions from countries where aquaculture is advanced.

Output 11.2 Under-utilised DoF facilities restructured

The eleven government demonstration stations (excluding the NAC) are unable to fulfil their mandates as a consequence of financial and capacity constraints. Consideration should be given to their partial or complete privatisation. Hence there is a need to undertake a complete evaluation of all stations (inclusive of the land) and to develop a business plan for each station to assess the level of privatisation that is possible. The mechanism of privatisation, through outright purchase or leasing, will be determined by the policy on state assets. The idea also provides opportunity for the Department to retrench supernumerary staff in a manner where incentives to these staff are provided, while at the same time retaining their services.

For example, the smaller stations, inclusive of the accompanying agricultural land, could be leased to officers to operate for their own account. The cost of the lease could be redeemed by the officer in exchange for continuing to provide extension services and fingerlings to small-scale farmers in the area and operating the station as a farmer school, thus furthering the development of aquaculture. Clearly, controls have to be put in place but the cost of such controls would be significantly lower than the salaries of station officers and their support staff. To make the process fair, aspirant retrenchees should be offered an opportunity to submit a proposal, a business plan and a plan for continuing extension services provision. Offers should be made to specific officers on the strength of their applications. Successful applicants should then be offered the farm (ponds and land) on a trial basis before signing a longer term lease agreement.

Commercially orientated business plans need to be developed for the larger stations (Mzuzu, Nchena-chena, the remainder of Kasinthula and part of the NAC). If the models are commercially viable then the business plans should be published and the farms put out to tender on a lease basis. This provides opportunity for the farms to contribute towards fish production and creation of wealth, the promotion of commercial scale aquaculture on a regional basis, and to ease the budgetary constraints of the DoF.

Benchmark 2005	Majority of the Government stations are under-utilised.
Target	Through privatisation and retrenchment, all stations should be operational by 2013.
Action	1. Assess viability of privatisation, develop final privatisation models and make proposals to relevant government privatisation board. 2. Privatise under-utilised DoF stations through workshops with interested and affected parties and a tendering process.

Strategy 12 Promoting quality DoF staff and information

The capacity of DoF staff to carry out their duties effectively depends on their motivation. The development of an appropriate evaluation system, good training, and access to quality information can contribute to higher motivation levels among staff towards their work.

Output 12.1 High quality capacity building training secured

Regular refresher courses aligning concepts of the NASP for DoF staff needs to be established. The curriculum development at the Malawi College of Fisheries at Mpwepwe will further enhance the quality of the training curses. Useful materials (e.g. manuals) need to be developed and utilised

during these courses. At the same time, an effective evaluation system will be introduced and its impact monitored through the performance and outputs of staff.

Benchmark 2005	Poor motivation among DoF staff
Target	An evaluation system will be in place by 2007 and performance of staff will be monitored. All staff of the DoF from TA level and above will undergo the alignment training at least once by 2012.
Action	1. Produce a new manual, including basic guidance on current fish farming extension and technologies. 2. Revise the curriculum at Malawi College of Fisheries in accordance with the NASP components. 3. Develop the new curriculum at Bunda College and provide training for trainers in accordance with the NASP components. 4. Make greater use of experiential learning through internships and partnerships with fish producers. 5. A proper evaluation system will be introduced.

Output 12.2 Reliable aquaculture statistical and economic analysis system for DoF staff and other stakeholders developed.

Under a best-bet scenario, it is recognised that extensive quantitative and qualitative assessments are necessary to fully monitor the development of the aquaculture sector. However, limited financial and human resources means that assessments are be limited to key data necessary for monitoring. Because NGOs play an important role in promoting aquaculture in rural areas that are often inaccessible to the DoF , the Department should work collaboratively with NGOs to reach these farmers. The DoF will take initiatives to develop a new information network through including NGOs in a joint statistical data collection system, and conduct the necessary advocacy and training required by NGOs. The ADiM study team has already identified indicators of change among fish farmers over time, which could form the basis for designing the follow-up monitoring system.

Benchmark 2005	There is no reliable statistical and economic aquaculture analysis system
Target	Statistical and economic analysis systems to be established and the first aquaculture census to be implemented by 2009.
Action	1. Develop DoF/NGO joint statistic and data collection system. 2. Conduct aquaculture census every 3 years. 3. Develop and maintain aquaculture data-base.

PART 3 ACTION PLAN AND IMPLEMENTATION

CHAPTER I ACTION PLAN

1. Action Plan

The NASP details the outputs of the 12 strategies, required actions, and by whom and when these should be carried out, as well as indicators to evaluate each output. The Action Plan will provide the basis for the DoF to develop annual work plans for implementation of the NASP.

For the swift and integrated implementation of the strategies, **two complementary projects are proposed**. The complementary projects aim at an integrated approach, and as such incorporate a range of the strategies and actions required to achieve the expected outputs of the NASP. This "packaged" approach is applicable because of the complex framework within which the aquaculture sector will develop in Malawi. These projects reflect aspects of the Action Plan outlined above and encompass some of those actions that will be implemented in the short-term, concentrating resources on priority areas for best effect. Two complementary projects, "District Aquaculture Livelihoods Project" and "Chambo Research Programme" are explained in detail in Annex 3.

Strategic Theme 1 Integration of Aquaculture into Rural Livelihoods

Outcome 1: Improved livelihoods among rural small-holder fish farmers

Output	Action	Indicators for Output	By whom	By when
Strategy 1: *Providing the opportunity for all stakeholders to develop their capacity to enhance the integrated livelihoods approach, which includes aquaculture*				
Output 1.1: Projects that adopt the integrated livelihoods approach that includes aquaculture, and an institutional model that supports this process	Promote adoption of cross-sectoral, integrated livelihood initiatives into the Government fisheries and aquaculture policy.	-Inclusion of an emphasis on integrated livelihood approaches in the policy -Development of a pilot project model plan -Implementation of the model in three priority Districts -Number of capacity building WSs implemented in target area -Number of personnel from different Ministries who participated in the WSs -Increase in the number of fish farmers in the target Districts -Number of farmers adopting integrated livelihood approaches that include aquaculture	DoF DA, NGOs, WorldFish Center	2006
	Implement District model projects in priority areas.			2006-2010 will then be ried in other areas)
	Provide aquaculture extension for socially disadvantaged farmers to have the opportunity to participate in fish farming practices as part of a rural safety net.			Late 2006-2010
Output 1.2: Broader understanding of the context between aquaculture and the socio-economic, institutional and political status of poor farmers	Develop and implement interdisciplinary research programmes that produce a comprehensive and integrated base of information on the integration of aquaculture into the overall livelihood systems. This information should be used by DoF policy-makers.	-Inclusion of an interdisciplinary research approach in the policy -Developed interdisciplinary research programmes -Number of courses or programmes implemented -Number of papers and reports produced	DoF Univ. of Malawi, International research institutes	2006-2008
	Facilitate institutional linkages and networks in research aimed at poverty reduction through the inclusion of aquaculture.			2007-
Output 1.3: Increased capacity of DoF, local government and NGO staff to utilise tools and methods necessary to support the integrated livelihoods approach	Develop and conduct short training courses on multi-sectoral integrated livelihoods approach.	-Methods for integrated livelihood approaches developed -Number of short training course conducted -Number of trainees attending the short courses -Number of trainees who utilise the methods learned in practice	DoF, Bunda College, NGOs, WorldFish Center	Early 2007-
	Develop an interdisciplinary BSc and MSc programmes at Bunda College in rural development with a focus on the integrated livelihoods approach and methods for evaluation.			Early 2007-
	Assess and evaluate developed courses and programmes to determine their feasibility on an ongoing basis.			2009

Strategic Theme 2 Enhanced Economic Opportunities for Commercial Fish Farmers

Outcome 2: Fish producers that are financially independent through income generated by aquaculture

Output	Action	Indicators for Output	By whom	By when
Strategy 2: *Enhancing institutional capacity of NAC to develop medium to large-scale commercial fish farming technologies*				
Output 2.1: Enabling environment and framework for commercially orientated aquaculture research at NAC established	Establish a new NAC structure with staff redeployment and new job descriptions.	-Changed policy -New established structure at NAC -Research plans and protocols developed -Research papers published in reputable regional and international journals -Network established -Agreement made between University of Malawi and other universities -Number of workshops/ meetings held for exchanging information -Number of commercial fish farmers involved in the process	DoF, Univ. of Malawi (collaboration with international research institutions)	2006-
	Rehabilitate basic facilities at NAC.			2006-
	Develop research action plans and protocols to create knowledge and develop technologies to increase aquaculture production .			2006-
	Establish a database of farmers who have the necessary resources to make changes from subsistence to commercial fish farming.			2006-
	Enhance participatory research.			2006-
	In collaboration with appropriate external consultants, assist the University of Malawi in identifying and evaluating the economic potential of emerging scientific discoveries and technologies.			2007-
	Working in collaboration with international research institutions, strengthen fundamental research on new concepts in business, marketing, profit-orientated technologies.			2007-
Output 2.2: Scientific capacity in commercially orientated aquaculture enhanced	Develop systematic training programme with a list of potential trainees	-Systematic training programme in commercial aquaculture -Number and kinds of training courses provided -Number of trainees -Network or an agreement established between DoF and Universities -Participation of trainees in international and regional aquaculture conferences -Number of training exercises conducted by trainees	DoF, Bunda College	2006
	Provide advanced technology training opportunities at appropriate international research institutions or in collaboration with international researchers.			2007-2008
	Establish research and teaching agreements between University of Malawi and other international academic institutions in basic research and high-level education.			2006
	Support participation of researchers at international and regional aquaculture conferences.			2008-

Output	Action	Indicators for Output	By whom	By when
Strategy 3: *Providing an appropriate credit, business training and technology package for small to medium-scale commercial fish farmers*				
Output 3.1: Aquaculture credit scheme for small commercial fish farmers introduced	Create financial goalposts for farmers to "graduate" from current situation to small to medium-scale commercial level.	-Number of sensitisation workshops on fish farming organised by DoF for financial institutions -Financial goalposts for farmers created -Number of farmers successfully accessing financial support	DoF, Partner organisation, NGOs, Commercial Bank	2007-
	Formulate special credit schemes for small and medium-scale commercial fish farmers in collaboration with existing credit schemes.			Early 2008-
	Conduct economic study of fish farming and its marketing.			Early 2008-
Output 3.2: Business planning and management capacity of small and medium-scale fish farmers improved	Conduct business training and seminars to potential small to medium-scale farmers with provision of technology package.	-Formation of technology package based on needs assessment -Number of training sessions on awareness building with respect to commercial aquaculture/ -Number of trainees participating in training programmes -Impact of trainees' on their peers -Changes in trainees' aquaculture practices	DoF, Partner organisation, private sector	2007-
	Conduct consultative activities for entrepreneurial fish farmers to improve their business skills. IFFNT and successful farmer clubs will be consulted to develop scenarios (business cases) with DoF.			
	Conduct participatory research enabling business models in collaboration with IFFNT			2007-
Strategy 4: *Creating a regionally competitive and investor friendly environment through sound policy, clear procedure and legal framework*				
Output 4.1: One-stop-shop for all aquaculture business application procedures established	In collaboration with Department of Environment, Ministry of Land, Ministry of Local Government, develop comprehensive and simple guidelines for business licensing of commercial aquaculture ventures.	-One-stop-shop to be established at DoF for initiating commercial aquaculture -Number of investors utilising the system -Dissemination of information to attract investors	DoF, Dept. of Environment, Min. of Land, Min. of Local Government, Min. of Trade	2007 (to be completed)
Output 4.2: Competitive investment environment for commercial aquaculture established	Conduct research on the aquaculture investment environment that establishes a basis for the introduction of efficient and appropriate incentives and subsidies, including tax exemption for aquaculture operations and materials.	-Research material prepared -Dissemination of information to attract entrepreneurs -The basic infrastructure for commercial investment established -Number of investors utilising the system	DoF Malawi Investment Promotion Agency, Min. of Commerce, DA	2007-
	Support communication among entrepreneurs to share information and procedures by organizing regional conferences.			2008-
	Conduct a feasibility study on establishing "collective aquaculture zone/s", such that basic infrastructure is established through a joint venture between the public and private sector and in which small to medium-scale farmers could buy participatory shares.			2008-2009

Output	Action	Indicators for Output	By whom	By when
Strategy 5: *Ensuring aquaculture activities are environmentally responsible and sustainable*				
Output 5.1: Fisheries Policy and Act with respect to environmental threats revised and amended	Conduct comprehensive risk assessment with respect to conservation of biodiversity and international agreements and align with opportunities and needs, where appropriate and legislate.	-Report on comprehensive risk assessment -Conference on risk management -Policy revised -Act amended	DoF, DoF from neighbouring countries	2008-
	Host conferences on contemporary issues concerning risk management and introductions of exotic fish species in collaboration with the Governments of Tanzania, Mozambique and Zambia.			2009
	Revise Fisheries Policy and amend Act with respect to exotic species.			2009
Output 5.2: Early warning system to monitor potential threats caused by aquaculture to biodiversity and environment established	Conduct advocacy programme for fish farmers and fishers on the potential negative impacts of aquaculture and mitigation measures through various types of aquaculture training programmes and seminars.	-Number of advocacy programmes on potential negative impacts of aquaculture implemented -Number of participants in the programme -Educational materials developed -Established monitoring system	DoF, DoF from neighbouring countries, World Wildlife Fund (WWF)	2009-
	Develop guidelines and educational material that warn against introduction of exotic fish into the Lake catchment.			2009-
	Develop a monitoring system that can also be used by capture fisheries law enforcement officers.			2009-2010
Output 5.3: Knowledge of the link between aquaculture practices and environmental issues increased	Conduct research and case studies on deforestation and water resources and how this impacts on aquaculture potential.	-Report on the results of a research -Meetings and WSs for disseminating of research findings -Number of participants in the meetings and WSs -Planned action for way forward	DoF, Department of Forestry, MAIFS, and other organisations	2010
	Disseminate research findings so that a common understanding of the impact of environmental degradation on aquaculture is developed amongst stakeholders.			2010
Strategy 6: *Establishing links and information flows between producers and fish traders to enhance access to markets*				
Output 6.1: Shared information between fish producers and fish traders	Organise a workshop for fish traders and share information on fish farming and cultured fish.	-Number of WSs organised and held -Number of fish traders who participated in the WSs -Number of fish traders who show interests in selling cultured fish after the event	DoF, fish producers and traders, Ministry of Agriculture, Irrigation and Food Security, Ministry of Trade	2009-
	Work with the Ministry of Agriculture, Irrigation and Food Security, Ministry of Trade and other partners to organise a demonstration event showcasing aquaculture products in the larger cities.			2010

Strategic Theme 3 Competent Local Government, NGOs and Producer's Organizations

Outcome 3: Quality aquaculture services become available at grass-roots level

Output	Action	Indicators for Output	By whom	By when
Strategy 7: *Sensitising and building capacity of local government on their primary responsibilities in aquaculture development*				
Output 7.1: Capacity of District Assemblies to formulate plans and strategies to guide aquaculture development enhanced	Redefine responsibilities of DA in aquaculture development with emphasis on stakeholder participation.	-Number of sensitizing seminars and field study tours -Material established -Number of materials distributed -Number of participants in seminars and study tours -Coordinating committee established -Number of training workshops on basic aquaculture implemented -Number of people trained at the training workshops -Guidelines developed -Information system developed -Number of districts with an aquaculture component in their DDP	DoF, DA, VDC	2006-
	Organize sensitising seminars and field study tours with appropriate educational material (such as video programmes), and information (e.g. District Aquaculture Profile) for District staff. Target audiences include: District Commissioner (DC), District councillors, District Executive Committee (DEC), Village Development Committee (VDC) and relevant community services and social welfare sections of the DA.			
	Establish a coordinating committee, or alternatively strengthen the existing Agriculture and Natural Resources (or similar) Committees within the DEC in selected priority Districts.			2007-
	Develop guidelines for aquaculture extension practices, and an effective information gathering and dissemination mechanism that facilitates information sharing between the DoF and the DA office.			2008-
Output 7.2: Existing agriculture extension services utilised in promotion of fish farming	Conduct training in aquaculture development for agriculture extension officers as well as aquaculture staff based on redefined roles of the DA in the sector.	-Training course developed - Material established and number of materials distributed	DoF, DA, VDC	2007-
	Assign and train advisors to the agriculture extension staff.	-Number of trainings for advisors and number of advisors registered to DA as advisors -Number of farmers advisor cover for further training		2007-
Strategy 8: *Developing alliances between DoF and NGOs to promote unified approaches in aquaculture extension*				
Output 8.1: Aquaculture guidelines for NGOs which facilitate partnership agreements with the DoF developed	The DoF needs to assist the NGOs in the formulation of aquaculture development guidelines.	-Aquaculture development guidelines developed -Meetings conducted between DoF and NGOs	DoF, NGO, WorldFish Center	2008

Output	Action	Indicators for Output	By whom	By when
Output 8.2: Knowledge and technical skills in aquaculture extension among NGO field staff improved	Conduct technical training for NGO field staff.	-Number of training courses implemented -Number of NGO field staff who have participated in the training -Number of key personnel in NGOs sensitised	DoF, NGO, WorldFish Center	2008-
	Increase awareness of DoF policy, programmes and services among the decision makers of NGOs through seminars.			2008-
Strategy 9: *Fostering fish producer's organizations that assist farmers to increase production, access to finance, markets and other services*				
Output 9.1: Fish farmer networks strengthened and expanded	Provide financial support for meetings of farmer organizations at national/ regional level to enhance communication and information dissemination among farmers.	-Number of meeting held -National standards for establishing of fish farmers organisations developed. -Number of fish farmers' organisations and fish farmer clubs registered -Number of training and technical assistance sessions implemented	DoF, IFFNT, DA	2006-
	Develop national standards for establishing fish farmers organisations.			2006-
	Develop national register of fish farmer organisations and fish farmers clubs.			2007-
	Increase training and technical assistance to improve operation and management of fish farmer organisations.			2006-
	Continue the provision of advice to the IFFNT.			2006-

Strategic Theme 4 Smart and Practical DoF

Outcome 4: High performing DoF and staff

Output	Action	Indicators for Output	By whom	By when
Strategy 10: *Building healthy DoF financial resources*				
Output 10.1: Sustainable donor support for the aquaculture sector secured	Develop sensitisation materials on the impact of the DoF programmes in the area of poverty reduction and rural development. These should include publications, national media campaigns and web-based information.	-Materials for sensitising donors in aquaculture developed -Number of media campaigns about aquaculture conducted	DoF, Donor	2006
	Introduce a NASP audit system to evaluate the financial performance of the activities that it promotes.	-Number of meetings for sharing the concept of the NASP with donors		2007-
	Conduct policy research on revenue retention systems at key DoF stations.	-Research papers on donors' engagement in each sector - Research papers on revenue retention system		2006
Strategy 11: *Realising efficient DoF operation*				
Output 11.1: Communication and partnerships between the DoF and stakeholders enhanced	Establish a body that will advise on aquaculture development in Malawi which includes representation from diverse stakeholder groups.	-A body that will advise on aquaculture development in Malawi established -Linking programme established	DoF, Bunda College	2005
	Develop a programme to link DoF with fish producers, emphasizing the strong relationship between applied research and extension, and how this can be used to address practical problems of aquaculture in Malawi.	-Regular meetings between DoF, fish producers, and other stakeholders implemented -Number of exchange programme offered by the University		2006-
	Assist University of Malawi to develop exchange programmes with institutions from countries where aquaculture is advanced.			2007-
Output 11.2: Under-utilised DoF facilities restructured	Assess viability of privatisation, develop final privatisation models and make proposals to relevant government privatisation board.	-Privatisation model developed and recognised by the respective board -Number of workshops conducted for tendering process -Assessment of privatised stations carried out -Number of operational privatised stations	DoF, Bunda College	2006-
	Privatise under-utilised DoF stations through workshops with interested and affected parties and a tendering process.			2007- by 2013, all stations to be operational)

Output	Action	Indicators for Output	By whom	By when
Strategy 12: *Promoting quality DoF staff and information*				
Output 12.1: High quality capacity building secured	Produce a new manual, including basic guidance on current fish farming extension and technologies.	-Materials developed. -Number of DoF staff who have completed experiential training -An evaluation system established	DoF, Bunda College	2006
	Revise the curriculum at Malawi College of Fisheries in accordance with the NASP components.			2007-
	Develop the new curriculum at Bunda College and provide training for trainers in accordance with the NASP components.		DoF	2008
	Make greater use of experiential learning through internships and partnerships with fish producers.			
	A proper evaluation system will be introduced.			
Output 12.2: Reliable aquaculture statistical and economic analysis system for DoF staff and other stakeholders instituted	Develop joint DoF/NGO statistics and data collection system.	-Data collection system established. -Census to be implemented -Data obtained -Accessibility of data	DoF, NGO	2008-2009
	Conduct aquaculture census every 3 years.			2009- onwards
	Develop and maintain aquaculture data-base.			2009-

2. Implementation Cost Estimates of the NASP

A cost estimation for each output of the NASP strategies is presented on the following page. This includes costs for both complementary projects, as well as a consultant fee for technical assistance (which is further discussed in Chapter II). These costs are calculated based on the proposed actions. The cost estimation needs to be reviewed during the planning phase of each strategy, and once a detailed action plan is developed.

Table 3.1 Cost estimates for the NASP

	Output	Cost (USD)
Strategy 1	1.1: Projects that adopt integrated livelihoods approach	548,750
	1.2: Broader understanding of the context between aquaculture and socio-economic, institutional and political status of poor farmers	
	1.3: Increased capacity of DoF, local government and NGO staff to utilise tools and methods necessary to support the integrated livelihoods approach	
Strategy 2	2.1: Enabling environment and framework for commercially orientated aquaculture research at NAC established	794,220
	2.2: Scientific capacities in commercially orientated aquaculture enhanced	
Strategy 3	3.1: Aquaculture credit scheme for small commercial fish farmers introduced	10,625
	3.2: Business planning and management capacity of small to medium-scale fish farmers improved	12,500
Strategy 4	4.1: One-stop-shop for all aquaculture business application procedures established	7,500
	4.2: Competitive investment environment for commercial aquaculture established	21,875
Strategy 5	5.1: Fisheries Policy and Act with respect to environmental threats revised and amended	14,500
	5.2: Early warning system to monitor potential threats caused by aquaculture to biodiversity and environment established	16,000
	5.3: Knowledge of the link between aquaculture practices and environmental issues increased	12,500
Str. 6	6.1: Shared information between fish producers and fish traders	8,000
Str. 7	7.1: Capacity of DA to formulate plans and strategies to guide aquaculture development enhanced	37,500
	7.2: Existing agriculture extension services utilised in promotion of fish farming	
Strategy 8	8.1: Aquaculture guidelines for NGOs which facilitate partnership agreements with the DoF developed	6,750
	8.2: Knowledge and technical skills in aquaculture extension among NGO field staff improved	23,875
Str. 9	9.1: Fish farmer networks strengthened and expanded	27,750
Str. 10	10.1: Sustainable donor support for the aquaculture sector secured	25,550
Strategy 11	11.1: Communication and partnerships between the DoF and stakeholders enhanced	179,300
	11.2: Under-utilised DoF facilities restructured	6,550
Strategy 12	12.1: High quality capacity building secured	22,750
	12.2: Reliable aquaculture statistical and economic analysis system for DoF staff and other stakeholders instituted	25,500
	Sub-total	**1,801,995**
	Technical assistance	**1,397,800**
	TOTAL	**3,199,795**

CHAPTER II IMPLEMENTATION

1. Institutional Arrangement

1.1 Implementation Structure

The implementing body of the NASP is the Ministry of Mines, Natural Resources and Environment, through the Department of Fisheries (DoF). Because the aquaculture section within the DoF is relatively small in comparison to the capture fisheries section, and levels of financial support for implementation of the NASP are not yet certain, the implementation body should be small and flexible, and utilise existing structures and staff within the DoF.

Efficient implementation of the NASP will be achieved through establishing a body that will advise on aquaculture development in Malawi (an appropriate name and the status of the Aquaculture Advisory Body will have to be developd by the DoF). This body will function as the executive body and it will be responsible for supervising the implementation of the NASP. In addition, a **NASP Coordination Committee** will be responsible for the day-to-day implementation of the scheduled activities at a national level. At District level, **District Committees** will be established in at least the three priority areas and be responsible for coordinating local level NASP activities, especially the Complementary Projects, and also for ensuring that these projects fit into the overall development plans for the District.

DoF's development projects are heavily dependent on external aid. Inadequate donor coordination could lead to a duplication of effort, and contradictory policy advice, which will further erode the productivity of existing institutions. To avoid these risks, only two bodies will be established under the NASP (the Aquaculture Advisory Body and the NASP Coordination Committee), and these will coordinate all aquaculture projects and allow the DoF to effectively control and harmonize policies and actions. The figure below suggests the recommended organisational structure for the implementation of the NASP.

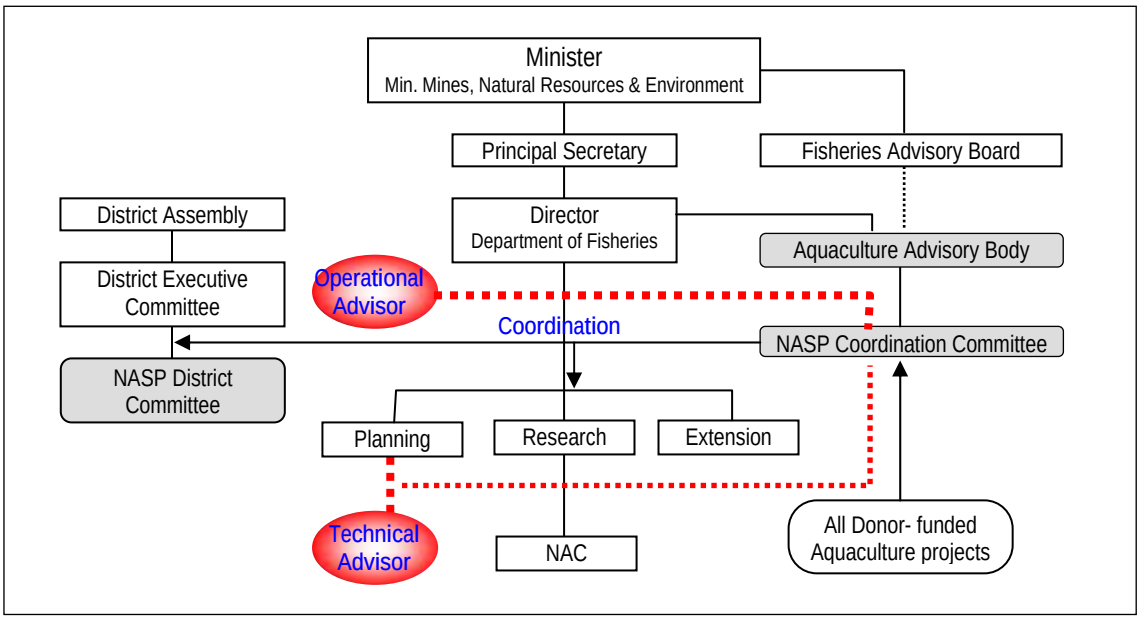


Figure 3.1 Organizational chart of the NASP implementing bodies

(1) Aquaculture Advisory Body

The Director of Fisheries will serve as the chair of the Aquaculture Advisory Body and the Board will be comprised of representatives of the public and private sector, and collaborating institutions (refer Strategy 11). The Director will also appoint representatives from the relevant Ministries and agencies such as the Ministry of Mines, Natural Resources and Environment, Ministry of Food and Agriculture, Ministry of Local Government and others, as needed. The Board will be responsible for ensuring the effective and uninterrupted implementation of the NASP and for coordinating actions with other sectors as required.

(2) NASP Coordination Committee

This Committee will draft the detailed annual work plans for the NASP and will coordinate the inputs from the DoF to ensure smooth day-to-day operations. Further, the Committee will be responsible for monitoring and evaluating the operation and management of activities, as well as reviewing and prioritising activities and their implementation on an ongoing basis. Regular monitoring reports must be submitted to the Advisory Board for their consideration and action. The Deputy Director of Fisheries will serve as the chair of this committee, and it will be comprised of four section heads (planning, research, extension, and the NAC). The Committee's main functions are as follows:

(a) Selection of personnel needed to implement the NASP, and carry out budgetary planning and control for the programme.

(b) Coordinate the work schedule of the Action Plan, secure capital, and efficiently distribute human resources.

(c) Designate and dispatch technical experts (local and/or international) to assist with the activities of the Action Plan as needed.

(d) Carry out monitoring and evaluation activities with the cooperation of District Committees to implement the District Projects, and revise and make changes as needed to resolve problems that arise.

(3) NASP District Committees

The District Committees will be established when the DoF initiates the "District Aquaculture Livelihood Projects" in the three focus Districts (Chitipa, Zomba, Thyolo). These Committees will be chaired by the District Planning Officer and comprise representatives of the section involved in the Project, as well as private organizations (fish farmer groups, NGOs). The Committee will be responsible for implementation of the Project and reporting to the Coordination Committee. In addition, the District Committees will ensure that the projects are aligned with local development policies and activities conducted as part of District Development Plans.

	Aquaculture Advisory Body	NASP Coordination Committee	NASP District Committees	DoF each sections	Operational Advisor (Foreign expert)	Technical Advisors (Foreign experts)
Planning and preparation for implementation						
Continuous sensitisation of key stakeholders in the NASP		●		○	●	
Set up the NASP as the official aquaculture development plan of the Ministry		●		○	●	
Preparation of an annual work plan		●		○	●	○
Budgeting for the annual work plan		●		○	●	
Approval of the implementation plan	●				●	
Implementation				●		●
Implementation of the annual plan			○	●		●
Implementation of complementary project 1			●	●		●
Implementation of complementary project 2			○	●		●
Coordination of activities		●	●		●	○
Monitoring & Evaluation						
Monitoring /preparing monitoring report		●		○	●	○
Organising annual evaluation meeting	○	●	●	○	●	○
Review of outputs	●				●	○

Remarks ●: Responsible body ○: Participation or collaborative body

Figure 3.2 Summary functions of responsible implementation persons and committees

1.2 Implementation Partners

Implementation of the NASP requires extensive collaboration and partnerships between the different sections in the DoF, other agencies and the private sector. The following table lists the DoF sections and prospective partners that will carry the primary responsibility for implementation of the various actions within the NASP.

Table 3.2 Primary DoF sections and partners

	Outputs	DoF Primary Sections	Partners
Strategy 1	**1.1:** Projects that adopt integrated livelihoods approach	Planning Unit/ Extension Unit/ District Fisheries Office	DA, NGOs, WorldFish Center
	1.2: Broader understanding of the context between aquaculture and socio-economic, institutional and political status of poor farmers	Planning Unit/ Research Unit/ NAC	DA, NGOs, WorldFish Center, Univ. of Malawi, international research institutes*
	1.3: Increased capacity of DoF, local government and NGO staff to utilise tools and methods necessary to support the integrated livelihoods approach	Malawi College of Fisheries (MCF)/ NAC	Bunda College, NGOs, WorldFish Center

	Outputs	DoF Primary Sections	Partners
Strategy 2	2.1: Enabling environment and framework for commercially orientated aquaculture research at NAC established	NAC/ Aquaculture advisory body/ Planning Unit	Univ. of Malawi
	2.2: Scientific capacities in commercially orientated aquaculture enhanced	NAC	Bunda College
Strategy 3	3.1: Aquaculture credit scheme for small commercial fish farmers introduced	Planning Unit	Partner organisations, NGOs, Commercial Bank
	3.2: Business planning and management capacity of small to medium-scale fish farmers improved	Planning Unit	Partner organisations, private sector
Strategy 4	4.1: One-stop-shop for all aquaculture business application procedures established	Planning Unit	Dept. of Env., Min. of Land, Min. of Local Gov.
	4.2: Competitive investment environment for commercial aquaculture established	Planning Unit	Investment Promotion Agency, Min. of Commerce, DA
Strategy 5	5.1: Fisheries Policy and Act with respect to environmental threats revised and amended	Aquaculture advisory body/ FRU/ NAC	DoF from neighbouring countries
	5.2: Early warning system to monitor potential threats caused by aquaculture to biodiversity and environment established	Aquaculture advisory body/ FRU/ NAC	DoF from neighbouring countries, World Wildlife Fund (WWF)
	5.3: Knowledge of the link between aquaculture practices and environmental issues increased	Aquaculture advisory body/ FRU/ NAC	Dept. of Forestry, MAIFS, etc.
Str. 6	6.1: Shared information between fish producers and fish traders	Planning Unit	Fish producers and traders, MAIFS, Min. of Trade
Str. 7	7.1: Capacity of DAs to formulate plans and strategies to guide aquaculture development enhanced	MCF/ District Fisheries Office	DA, VDC
	7.2: Existing agriculture extension services utilised in promotion of fish farming	MCF/ District Fisheries Office	DA, VDC
Strategy 8	8.1: Aquaculture guidelines for NGOs which facilitate partnership agreements with the DoF developed	Planning Unit	WorldFish Center, NGO
	8.2: Knowledge and technical skills in aquaculture extension among NGO field staff improved	MCF / NAC/ Extension unit	WorldFish Center, NGO
Str. 9	9.1: Fish farmer networks strengthened and expanded	Extension Unit	IFFNT, DA
Str. 10	10.1: Sustainable donor support for the aquaculture sector secured	Director of Fisheries	Donor
Str. 11	11.1: Communication and partnerships between the DoF and stakeholders enhanced	Aquaculture advisory body	Bunda College
	11.2: Under-utilised DoF facilities restructured	Planning Unit	
Strategy 12	12.1: High quality capacity building secured	MCF	Bunda College
	12.2: Reliable aquaculture statistical and economic analysis system for DoF staff and other stakeholders instituted	NAC/ FRU/ Extension Unit	NGO

Remarks: *International research institutes which JICA ADiM Study Team have been collaborating with are: WorldFish Center; Asian Institute of Technologies (Thailand); GIFT Foundation (Philippines); Central Luzon State Univ. (Philippines); Univ. of Arizona (USA); Univ, of Hawai'i (USA); Univ. Stirling (UK); Rhodes Univ. (South Africa); Swansea Univ. (UK);, Univ. of Stellenbosch (South Africa); Tokyo Univ. of Marine Science and Technology (Japan).

1.3 Technical Assistance

The management and monitoring capabilities of each of the committees and their members, involved in implementing the NASP, must be strengthened for the purposes of long-term sustainability. To contribute to this process, a proportion of the funds provided by international donor partners will be allocated to foreign technical assistance in the following disciplines: (1) NASP Implementation and Operation, (2) Institution arrangement, (3) Aquaculture technology, (4) Rural development and (5) Monitoring and evaluation and act as **operational and technical advisors** who will assist the Coordination Committee**.** The detailed Terms of Reference of the 'operational advisor' and the 'technical advisor' should be defined by the Department of Fisheries, in consultation with the relevant donor (Annex 6 shows the preliminary Terms of References for operational and technical advisors).

In addition to above operational and technical advisors, eight months are allocated to non-specific specialists who may be required for specific input as the NASP is implemented. Most of the specialists will be posted during the first 5 years of NASP implementation. After 5 years, the technical advisor will hand over to local expertise. The operational advisor will continue to assist in implementation and operation of the NASP. Those specialists should be involved in various committees and aquaculture advisory body as observer status.

Table 3.3 Time frame for foreign specialists' assignments

Unit: month

Title of specialists	Year										Total month
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1. NASP Operation											37
2. Institutional arrangement											5
3. Aquaculture technology											38
4. Rural development											9
5. Monitoring & Evaluation											9
Others (non-specific specialist)											8
	19	26	13	19	14	3	3	3	3	3	106

2. Implementation Schedule

To ensure the efficient implementation of the NASP the DoF needs to undertake the following key steps and activities.

- Be responsible for continuous sensitisation of key stakeholders on the objectives of the NASP through appropriate documentation (100 NASP brochures will be prepared and submitted by JICA to the DoF with this report), use of the mass-media and meetings,
- Formulate the NASP as the official aquaculture development plan of the Ministry and seek the , endorsement of the Malawi National Aquaculture Strategic Plan by Cabinet,
- Develop an annual work plan that will be prepared by the DoF/NASP Coordination Committee and participating donors. The work plan should include a detailed implementation schedule for the Action Plan,
- In association with donors the DoF will develop a budget for the NASP for 2006/07.

Currently, no international donor has committed to assisting with the implementation of the NASP. Therefore, during the early stages the annual work plans must be flexible enough to respond quickly and effectively to potential changes in budget allocations and the needs of beneficiaries. The Action Plan will be closely monitored and adapted according to the budget available for a particular year.

3. Monitoring and Evaluation Plan

The internal mechanisms for project monitoring and evaluation (M&E) that are currently in place in the DoF need to be strengthened to be effective in tracking progress in the implementation of the NASP. The NASP therefore incorporates an M&E plan to assist the DoF in this process.

Objective	The objectives of the M & E are to learn from experience, provide an objective basis for assessing the DoF's work and provide accountability in the achievement of its objectives. Performance information will integrate into DoF's annual budget decisions.
Indicators	Monitoring will be carried out based on performance indicators, which will be identified as the programme develops (monitoring indicators for the NASP are shown in the Action plan).
Source of Indicators	A. DoF's ongoing monitoring system B. Census and surveys C. Participatory evaluation workshops with stakeholders D. Regular financial/cost reports on NASP implementation
Institutional Framework	Overall responsibility for monitoring and evaluation of the NASP and the Complementary Projects lies with the Director of Fisheries and the NASP Coordination Committee. The Monitoring and Evaluation systems currently in place within the DoF are insufficient. To strengthen this component external assistance will be provided, at least in the initial stages.
Time frame	The DoF will publish an annual evaluation report on the NASP, detailing what the DoF has achieved and highlighting the areas where improvement is necessary, and up-dating performance indicators (output measures). Periodic reviews of the NASP activities are essential so that strategies and actions can be revised and up-dated at least every three years.

PART 4 EVALUATION AND RECOMMENDATION

CHAPTER I EVALUATION

Malawi has a vast potential for aquaculture development. The decline in production of key species from natural waters (particularly tilapiine fishes), and increased competition for limited fish resources on a global level, suggests that aquaculture must play an increasingly key-role in ensuring self-sufficiency in fish supply and food security in Malawi. Aquaculture also provides an additional livelihoods option for resource-poor farmers who are often unable to produce enough crops to feed their families. Aquaculture is still in its nascent phase in Malawi and this provides opportunity to establish a strong fish farming sector comprising both small-scale farmers and larger scale commercial enterprises.

The focus of the NASP is on capacity building of the aquaculture sector as a whole and is not only geared towards technologies that will increase fish production. Many of the benefits that will be achieved through the NASP will be indirect and as such difficult to measure quantitatively in terms of improved national fish production.

1. Consistency of NASP with Existing Policy and Plans

The NASP was conceived to recognise and address the most pertinent international and national development frameworks and this is illustrated in Table 4.1.

Table 4.1 Relationships between the NASP and the most pertinent development frameworks

Existing policy and plans	Linkage between the NASP and the development frameworks
A. Millennium Development Goals (MDG) The MDG describes the international development goals for 2015 and focuses the efforts of the world community on achieving significant improvement in peoples lives. The direct target of Goal 1 of the MDG is to "eradicate extreme poverty and hunger".	The Mission of DoF guided by NASP is "To increase the economic and social benefits for fish producers and citizens in general, while contributing to sustainable fish supply and economic growth. National poverty reduction and improved livelihoods will be achieved through the promotion of excellence and best practices of DoF services."
B. Malawi Poverty Reduction Strategic Paper (MPRSP) The MPRSP is built around four strategic pillars one of which is pro-poor economic growth for which agriculture has been identified as one of the key development sectors. The MPRSP also emphasises the importance of economically empowering the poor and growth of the private sector.	The NASP directly addresses the eradication of poverty and hunger. To achieve this NASP will empower farmers in economic activities through the promotion of profit-orientated aquaculture and strongly promotes the development of commercial aquaculture (MPRSP pillar 1). Increased fish supply from the sector will contribute nutritional status of the people of the people and will reduce children's malnutrition (MPRSP pillar 2). The NASP also pays attention to socially disadvantaged farmers for them to have the opportunity to participate in fish farming practices as part of a rural safety net, including women-headed households and households with HIV/AIDS orphans (MPRSP pillar 3). The NASP directly targets local government and NGO in their capacity building. The success of the

Existing policy and plans	Linkage between the NASP and the development frameworks
	NASP contributes to decentralisation process (MPRSP pillar 4).
C. The National Fisheries and Aquaculture Policy 2002 and other DoF initiatives The principal aquaculture goal of this policy is to increase and sustain fish production from small-holder and large fish farming operations. The "Chambo restoration strategic plan 2003-2015" is one of the initiatives of DoF to recover the Tilapia stocks in the lakes.	The NASP has recognised this policy and was guided by it in developing the strategies and action plans, to achieve DoF's goal of sustainable fish supply. In particular actions have been identified to increase the production of chambo as a means with which to partially compensate for the decline of the stocks in the lakes
D. FAO Code of Conduct for responsible fisheries Article 9 of the Code refers specifically to aquaculture development (including culture-based fisheries) with four sub-articles, namely responsible development of aquaculture under national jurisdiction; responsible development within trans-boundary aquatic ecosystems; use of aquatic genetic resources; and responsible aquaculture at the production level.	The NASP strongly promotes the use of indigenous fish species and advocates responsible development of the large-scale commercial sector through several of its strategies and action and has recommended the undertaking of a comprehensive risk assessment for the farming of common carp.
E. National Environmental Action Plan 2002 (Revised Draft Feb 2003) Strategy 1.5 of this Action Plan promotes aquaculture and focuses on the promotion of farmer clubs.	The NASP recognises the value of farmer clubs for the promotion of the integrated livelihood approaches as a means to improve food security at the household level (refer to Strategies 1, 8 and 9).
F. Agenda 21 Agenda 21 of the Earth Summit (Rio de Janeiro 1992), to which Malawi is a signatory, is a blueprint for sustainable development into the 21st Century. It deals specifically with social and economic dimensions such as poverty, conservation and management of resources and biodiversity.	The NASP will lead to increased fish production and alleviate poverty thereby reducing pressure on natural resources,

2. Effect of the NASP

A Equity, Efficiency and Sustainability

Through the promotion of integrated livelihood approaches the NASP will lead to greater equity (in terms of improving the living standard of poor fish farmers), efficiency and sustainability (in terms of aquaculture service provision).

Equity

Strategic theme 1 focuses on empowerment of the DoF and stakeholders in developing and implementing livelihood approaches aimed at improving the welfare of vulnerable people in rural areas, rather than directly focusing on increasing fish production. The approaches adopted are "people-centred" and "result-orientated" and are guided by clear targets and indicators of change to ensure that the NASP impacts on rural people. The strategies under this theme are directly geared towards the enhancement of the livelihoods of resource-poor farmers and improving their income

and food supply. This will contribute to poverty alleviation. The NASP also includes, as a target group, the most vulnerable people such as house-holds with AIDS orphans and women headed households, and this ensures equity in its implementation.

Efficiency

Strategic theme 2 is focused on capacity building in the development of production technologies. The NASP seeks to facilitate the most appropriate mechanisms to achieve increased production from aquaculture to address the shortfall in national fish supply from natural waters. In addition, this theme also addresses the need to build aquaculture into a meaningful contributor to the rural economy. A key element of the strategies within this theme is geared towards facilitating the greater participation of the private sector in developing aquaculture in Malawi. This will be ensured by:

- Promotion of participatory research, the results of which can be adopted and developed by innovative farmers and entrepreneurs (Strategy 2)
- Privatisation and leasing of under-utilised DoF facilities (Strategy 2)

Sustainability

The NASP is a medium to long-term sector plan. The influence that its implementation will have on government policy, strategies and actions in the aquaculture sector will be the most important output and will serve to guide future commitment and funding to the sector from the government and the donor community.

Furthermore, the NASP will promote participation and self-sufficiency which will contribute to increased sustainability of development efforts. This will be achieved by:

- Formation and strengthening farmer organizations to act as service providers and develop the capacity of their members (Strategy 9)
- Strengthen "Farmer-to Farmer" extension approaches, which will assist farmers in thinking, planning and acting by themselves (Strategy 1)
- Working with NGOs who assist farmers at grassroots level through improving the capacity for self-sufficiency. This will be achieved through an integrated approach rather than focusing only on fish farming as a stand-alone activity (Strategy 8)

B Regional impact

A key to the success of the NASP is international cooperation. Networking with international research institutions to address common regional problems in rural aquaculture and production technology development are important elements of Strategies 1 and 2, and will contribute to the development of aquaculture in Malawi and throughout the region. Recently several regional countries such as Zambia, Ghana, Cameroon has adopted aquaculture master plan. NASP encourage to link with these initiatives in exchange the experience and information. DoF, Malawi could play a leading role to coordinate with these countries in collaboration with FAO.

C Fish Production

The NASP focusses on increasing fish production and building the necessary capacity to support the development of the aquaculture sector. Should these approaches be successful, it is probable that increased resources will be attracted to the sector, resulting in a more rapid development. The

fundamental supporting mechanisms need to be in place for this development to occur. Assuming that the supportive conditions are established for aquaculture development as a result of the implementation of the NASP, some estimates regarding future aquaculture production can be made.

Table 4.2 Estimated aquaculture production by 2015

Category	2003	2015	Assumption
Rural fish farming	119 mt	441 mt	[2003 Base year] No. of ponds: 9,500 Production: 12.5kg/pond (706kg/ha: 2003) [Year 2015] No. of ponds: 29,815 (10% growth in pond numbers) Production scenario 1 : 90% of total ponds @ 12.5kg/pond (706kg/ha) Production scenario 2: 10% of total ponds @ 35.5kg/pond (2,000kg/ha)
Commercial fish farming	0 mt	3,500 –5,000 mt	[2003 Base year] no commercial operation [Year 2015] MALDECO produce at least 3,500 mt by cage culture G.K. Aquafarms produce at least 100 mt (10,000kg x 10ha-two crops) 20 innovative farmers produce 12 t (4,000kg x 3ha) Two additional commercial farms produce each producing 125 mt (=250 mt)
Total	***119 mt***	***4,303 mt***	

Source: Compiled by JICA Study Team (2003-2005)

3. Environmental Impact

The NASP is expected to have a positive impact on environmental management of the sector. Aquaculture development needs to proceed in a responsible manner that minimises environmental impacts. Of particular concern is the need to reduce potential risks to the biodiversity of the Lake, and other water bodies. Strengthening the capacity of the DoF will have a positive impact on their regulatory functions, especially with regard to managing the risks associated with large-scale pond culture, cage culture and the translocation of exotic species.

Strategy 7 of the NASP supports measures to enhance environmental protection. Enhancing awareness among private fish producers and ensuring their cooperation in environmental management would further reduce the potential for environmental degradation of the Lake. It will be important for DoF staff to be trained in appropriate environmental safeguards to enable them to carry out their research and monitoring functions effectively and responsibly.

CHAPTER II RECOMMENDATIONS

1. Recommendations

A. Fostering a long-term vision through an integrated livelihoods approach

Current understanding of the concept of rural aquaculture among both farmers and extension staff in Malawi is not always conducive to stimulate development of the sector. The sector faces many challenges. Many of these are related to inadequate organizational and technical capacity, which is exacerbated by financial and infrastructural constraints. However, development is further hampered by the mind-set of many small-scale farmers who do not view aquaculture as a means of increasing the overall production of their farm but rather as a 'savings bank' that provides fish or cash in difficult times. This approach does not encourage active management of fish ponds and results in many small-holders becoming 'fish keepers' rather than fish farmers. Fortunately, there is a growing realization that the integration of aquaculture into the farming system has the potential of increasing the overall viability of the smallholding, especially if the farming operation is managed correctly. There is a need to investigate options for maximizing the potential of this integrated approach, as it is probable that the majority of farmers will continue to rely on a number of on-farm activities, rather than risk focusing on fish farming alone as a livelihood option. The NGO sector has a particularly important role to play in advocating this approach in collaboration with the DoF, as their programmes often take a holistic view of development that would greatly facilitate successful integration of aquaculture into the farming system. Those farmers who do have the resources, and are prepared to risk focusing on fish farming, should be encouraged to do so, such that they may advance beyond the current level.

B. Effective farmer participation in aquaculture development

Aquaculture development efforts in Malawi have focused largely on rural small-scale aquaculture and consequently resource poor farmers have been the target of most donor-supported projects. However, the concept that fish farming can form the basis of a viable business has been embraced by some of the more innovative farmers, who see themselves as emerging fish farmers who will eventually focus their efforts on aquaculture as their main activity. This has become an increasingly attractive option as the price of fish in the country has risen dramatically in recent years. This trend is likely to result in a growing small-scale commercial aquaculture sector. Successes at this level will have the effect of encouraging other farmers to seriously consider fish production as a business.

To support this process, the DoF needs to provide services that will facilitate development of innovative and entrepreneurial farmers, and develop technologies that are appropriate to maximise profit. In addition, participation of such farmers in the development of fish farming in general needs to be encouraged. These farmers have the capacity to contribute towards fish supply in the country, as well as acting as agents for aquaculture promotion and development. The last point is particularly relevant with regard to the development of small-scale operations in rural areas, where innovative farmers are in daily contact with their fellow farmers.

C. International cooperation in aquaculture development

The importance of international cooperation in aquaculture development, especially as far as information exchange, research and capacity building is concerned, has been highlighted in various sections of the NASP for the following reasons:

- International research cooperation is vital for developing new information and technologies, as well as in promoting responsible research practices. This cooperation will synchronize national efforts with global initiatives in tilapia culture.
- The introduction of exotic species has trans-boundary implications in the watershed of Lake Malawi. Therefore national fisheries and aquaculture policies cannot be formulated in isolation. Regional policies are interlinked and the setting of regional goals is necessary to ensure the protection of the biodiversity of the Lake.
- Malawi is economically disadvantaged and physically vulnerable

In supporting international cooperation, it is recommended that the DoF and donors seek to strengthen communication and networking among existing partners in line with the NASP framework.

D. Midterm reviews

Flexibility in project implementation is essential to enable rapid responses to changes and uncertainties during the implementation of the NASP. A comprehensive review process of the NASP Action Plan will be required at least every 3 years to enable appropriate changes to be incorporated in the course of implementation.

E. Effective donor coordination

Inadequate donor coordination could lead to a duplication of effort, and contradictory policy advice, which will further erode the productivity of existing institutions. To avoid these risks, the NASP recommends that there should only be two bodies (the Aquaculture Advisory Body and the NASP Coordination Committee) responsible for coordinating all aquaculture projects in the country. This will allow the DoF to effectively control and harmonize policies.

ANNEX

Annex 1: The NASP Planning Process

Annex 2: Policy on Introduction of Exotic Fish Species in Malawi

Annex 3: Complementary Projects

Annex 4: Potential Contribution of Fish Farming to Individual Household Income in a Model Club

Annex 5: SWOT Analysis of DoF

Annex 6: Terms of References for Operational and Technical Advisors

Annex 1: The NASP Planning Process

In January 2003, ADiM Coordination Committee was formed under the Department of Fisheries, Ministry of Mines, Natural Resources and Environment aiming at technical coordination of the NASP preparation. The NASP is prepared based on the consultation from various types of stakeholder workshops at national and grass-roots levels. The participants of these workshops were counted more than 500 from the central and local government, academic institutions, private producers and donors. There are at least one national level workshops at each project stage so that participants could monitor the progress of the projects. The draft NASP was submitted to 4th National planning workshop in June 2005 and after consulting with stakeholders, the NASP was finalised. The process of the meeting and workshops is summarised as below.

Stage	Date	Meeting	Objective, Participants, and Outputs
Situation Analysis	28 Jan. 03	Coordination Committee 1	Objectives: Establish Implementation arrangement of the Master Plan Study Project & get consensus on whole study process and schedule Participants: 22 [DoF:13, MoMN:1, JICA Malawi:2, JICA Expert:1, ADiM:5] Output: Project counterpart, Committee member decided
	30 Jan. 03	Coordination Committee 2	Objectives: Discussion on the Draft Inception Report Participants: 21 [DoF:8, MoMN:1, MoAI:5 JICA Malawi:2, JICA Expert:1, ADiM:5] Output: Inception Report approved
	21 Feb. 03	Aquaculture Situation Analysis Workshop	Objectives: Better understanding the current situation and to form a platform for aquaculture promotion in the future Participants: 20 [DoF:7, MoMN:1, Academic:1, Donor:3, NGO:4, ADiM:4] Output: Concept of Aquaculture forum disccussed
	15 April 03	Coordination Committee 3	Objectives: Discussion on Inception Report & Signing of M/M for the Master Plan Study on Aquaculture Development in Malawi Participants: 17 [DoF:6, JICA Monitoring Team:2, ADiM:9] Output: Minutes of Meeting on Inception Report
	16-17 Apr. 03	First National Aquaculture Workshop (Kick-off Seminar)	Objectives: Address and discuss the issues on Malawi's aquaculture from the wide point of views of different stakeholders Participants: 126 [MoMN:2, DoF:50, District officer:3, Private sector:2; NOGs:3, Donor:3, Farmers:35, JICA:4, JICA Domasi Project:2, ADiM: 9] Output: Consensus among various stakeholder has established
	17 July 03	Aquaculture Researcher's Meeting	Objectives: Identification of the necessary research activity for development strategy Participants: 36 [DoF:21, Academy:3, Private sector:2, JICA Domasi Project:4, ADiM:6] Output: Research activities which is going on has shared and necessary research activities has proposed among key master plan developer
Preliminary Strategic Framework	18-19 July 03	Coordination Committee 4	Objectives: Discuss on the strategy of the priority objectives and activities for aquaculture development Participants: 10 [DoF:4, ADiM:6] Output: Preliminary strategic framework developed
	25 July 03	Aquaculture Forum Meeting	Objectives: Aiming to formulate the consensus on proposed aquaculture development strategic framework and concept of pilot project among the key persons who is in Aquaculture Forum

Stage	Date	Meeting	Objective, Participants, and Outputs
			Participants: 32 [DoF:5, Farmers:14, NGOs:4, Private sector:2, District officer:1, Academic:1, ADiM:5] Output: Preliminary strategic framework approved by representative stakeholders
	21 Nov. 03	Coordination Committee 5	Objectives: Discussion on Interim Report for the Master Plan Study on Aquaculture Development in Malawi Participants: 15 [DoF:3, Academic:1, NGOs:1, JICA Monitoring Team:1, JICA Domasi Project:3, ADiM:6] Output: Interim Report explained to DoF
	26 Nov 03	Coordination Committee 6	Objectives: Discussion on Interim Report and Signing of M/M for the Master Plan Study on Aquaculture Development in Malawi Participants: 16 [MMNRE:2, DoF:4, JICA Monitoring Team:2, JICA Malawi:1, ADiM:7] Output: Interim Report approved
Pilot Project	28 Nov. 03	Second National Aquaculture Workshop	Objectives: Formation of primary consensus on aquaculture strategy and proposed pilot project among the various type of stakeholder. Participants: 99 [DoF:44, Farmers:33, NGOs:8, Private:3, Donor:3, District officer:1, Academic:2, Other ministry:2, JICA:2, JICA Domasi Project:4, ADiM:7] Output: The idea on aquaculture strategy and proposed pilot project was shared among the various type of stakeholder.
	29 Nov.- 1 Dec.03	Participatory Planning workshop for IFFNT	Objectives: Training for counterparts of 'the Mater Plan Study on Aquaculture development in Malawi' and sub-contractors of Pilot projects. Participants: 53 [DoF:21, Farmers:25, ADiM:7] Output: Action Plan for IFFNT project has developed
	11-12 Dec.03	Participatory Planning workshop for F-club	Objectives: Training for counterparts of 'the Mater Plan Study on Objectives: Aquaculture development in Malawi' and sub-contractors of Pilot projects. Participants: 14 [DoF:4, Farmers:4, NGOs:2, ADiM:4] Output: Action Plan for F-Club project has developed
	24-26 Jan. 04	Participatory pre-election planning workshop	Objectives: Election of committee members, and Preparation of constitution and regulation for IFFN, PP2 Participants: 32 [DoF: 3, Famers:24, ADiM:5] Output: Committee member IFFNT has approved
	26 Feb. 04	Coordination Committee 7	Objectives: Informing and discussing on initial qualitative impressions of the baselines survey of Innovative Farmers & Farmers' club (Pilot project) Participants: 12 [DoF:5, Academic:1, ADiM:6] Output: Baseline Survey Report
	1 July 04	Participatory Mid-term Evaluation workshop for pilot project	Objectives: Evaluate the progress of pilot project at the middle stage of its implementation Participants: 34 [DoF:3, Famers:24, Academic:2, ADiM:5] Output: The progress of pilot project has been shared and discussed for future action plan
	19 Jul. 04	Coordination Committee 8	Objectives: Discussion on efficient and effective implementation of two projects (ADiM & Domasi project) for their future coordination. Formation of the consensus on the coming activities of ADiM (Training programme & manual, Research programme, etc.) Participants: 24 [DoF:9, Academic;1, NGOs:1, Farmers:4, JICA Monitoring Team:3, JICA Malawi:1, JICA Domasi Project:1, ADiM:4]

Stage	Date	Meeting	Objective, Participants, and Outputs
			Output: Aquaculture Task force for coordination has set with Department of Fisheries
	3-6, Aug. 04	Regional Workshop	Objectives: Information exchange and discussion on aquaculture development in developing countries with a view to assist in the review of current strategy and policy for aquaculture development in Malawi. Participants: 37 [Researchers and specialist:5, MMNRE:3, DoF:10, DoF in neighbouring Countries (Zambia/Mozambique/Tanzania):3, Private sector:9, Donor:7] Output: Recommendation for future strategies and policies to develop fish farming in Malawi and for greater regional and international collaboration has been made.
NASP Planning	3-4, Feb. 05	3rd National Aquaculture Workshop	Objectives: Share the information on the draft NASP Participants: 73 [DoF: 32, Farmers:16, Academic: 4, NGOs:8, Private:8, ADiM: 5] Output: Consensus and comment on the draft NASP
	21 Feb. 05	Workshop for priority project (Thyolo)	Objectives: Discuss on District Livelihood Project under NASP Participants: 34 [DoF:1, Key persons from Thyolo (District officer/NGOs/Private sectors):31, ADiM:2] Output: Conesus has been established and possible implementation system has been discussed
	22 Feb. 05	Workshop for priority project (Zomba)	Objectives: Discuss on District Livelihood Project under NASP Participants: 38 [DoF:1, Key persons from Zomba (District officer/NGOs/Private sectors):32, ADiM:5] Output: Conesus has been established and possible implementation system has been discussed
	23 May 05	Coordination Committee 9	Objectives: Discuss on Draft Final Report Participants: 11 [DoF:5, ADiM:6] Output: Comment on Draft Final Report
	31 May & 1 Jun.05	4th National Aquaculture Workshop	Objectives: To develop final NASP & To promote coordination in African aquaculture development amongst stakeholders including donors and international research institutions & To raise awareness of the NASP amongst DoF and relevant stakeholders in Malawi Participants: 106 [Researcher:6, DoF:32, MMNRE:3, Other Ministry:2, Local Gov.:3, Academic:4, NGOs:7, Donor:5, Farmers:33, JICA:1, JICA mission:4, ADiM:6] Output: Comment on NASP from stakeholders
	2 Jun. 05	Coordination Committee 10	Objectives: Discussion on Draft Final Report and Signing of M/M for the Master Plan Study on Aquaculture Development in Malawi Participants: 18 [DoF:9, JICA:1, JICA Mission:4, ADiM:6] Output: Minutes of Meeting on Draft Final Report
	3 Jun. 05	High official meeting	Objectives: To establish further partnership among different ministry to implement NASP. Participants: 14 [MoL:1, MoA:3, MMNRE:1, DoF:3, JICA MALAWI:1, ADiM:5] Output: Consensus on the NASP among related high officials

MMNRE: Ministry of Mines, Natural Resources, and Environment
MoL: Ministry of Local Government
MoA: Ministry of Agriculture, Irrigation and Food Security
NASP: National Aquaculture Strategic Plan (NASP)

Annex 2: Policy on Introduction of Exotic Fish Species in Malawi

1. Control of Exotic Fish Species

Malawi has an aquatic ecosystem of more than 20% with the lakes forming the largest components of the water systems (the four major lakes are Lakes Malawi, Malombe, Chilwa and Chiuta). These aquatic ecosystems form the most significant water body in terms of fish production and aquatic biodiversity. Aquatic life of these water bodies is known to be more diverse than the terrestrial life; the Lake Malawi alone has the largest number and the most diverse communities of freshwater fish species in the world. The fishes of Lake Malawi are, therefore, the most remarkably diverse and abundant faunal groups in the world.

Lake Malawi is the national treasure in view of the diverse and abundant faunal groups and it is considered a "hot spot" in the world. To protect its biodiversity, Malawi has national policies and mechanisms on fisheries and environment, which are relatively modern in comparison to its neighbours. It has pride on the enactments of legislation and Acts, whose mechanisms are embodied in three national laws, and they are:

- National Fisheries and Aquaculture Policy, 2001
- Fisheries Conservation and Management Act, (No 25 of 1997)
- Environment Management Act, (No. 23 of 1996)

National Fisheries and Aquaculture Policy of 2001 clearly indicates

- "…to prohibit the introduction of exotic live fish species unless and until scientific evidence justifies otherwise" and
- "…Develop protocols for the management and conservation of the genetic diversity of farmed fish (significance of endangered endemic species)"

Further, Malawi's **Fisheries Conservation and Management Act** has rules and regulations on the transfer and stocking of fish within Malawi water area and prohibition on the introduction of alien fish species into our waters.

Then, the **Environment Management Act** refers to the Conservation of Biological Diversity, wherein it states acts and guidelines to be followed for protecting and conserving our indigenous fish species.

Malawi is a party to various **international agreements and conventions**, and has endorsed and signed them. To emphasize some, the signatories are:

- To the **Convention of Biological Diversity** (CBD) and ratified in 1994;
- To **Cartagena Protocol of Biosafety** in 2000, and
- To **Convention of Wetlands on International Importance (RAMSAR**) ratified in 1997 and since then Lake Chilwa has been declared a Ramsar Site.

With these measures (policy and legislations) in place, Malawi is very cautious and vigilant when it comes to introducing alien fish species. A good example is when an attempt was made to bring in Red Tilapia from a Southeast Asian country; it was impounded at the point of entry in Malawi (airport).

Therefore, in order to enhance Malawi's commitment to protect and conserve its biodiversity and to implement the requirements of international conventions, particularly, the CBD, Malawi has prepared a "**Biodiversity Strategy and Action Plan**". This Action Plan provides strategic framework for action to conserve and sustainable use of our Biodiversity according to the objectives of CBD. Malawi's respective ministries and department are to review and amend their existing laws, legislations and regulations based on the **Biodiversity Strategy and Action Plan**.

2. Exotic Fish Species in Aquaculture

Exotic fish species is generally associated with commercial aquaculture in Africa, Asia and elsewhere around the world. In Malawi, the need for use or introduction of exotic fish species is often raised in recent years basically to promote and develop commercial aquaculture as an alternative to supplement the declining capture fisheries which is the main source fish supply. High demand and high fish price has created interest among private sector to initiate and venture into commercial aquaculture. However, the major problem is the choice of fish species; the local (indigenous or native) culturable fish species are poor in growth performance and are not attractive to prospective investors.

Malawi is the only country in the sub-Saharan countries can safely claim it has a clean slate in terms of absence of alien fish in fish farming, except for the common carp, in spite of the ban, which was introduced in 1976 for commercial trial and later banned in 1991. In spite of the ban fingerlings of common carp are still being produced and farmed on experimental basis in Domasi and Kasinthula. Otherwise, there are officially no alien fish species in Malawi, in comparison to the neighbouring countries (Zambia, Mozambique and Tanzania) that have introduced Nile Tilapia and Common carp for aquaculture use.

3. Status of Commercial Aquaculture

Malawi, in reality has no aquaculture activity as a commercial entity or profit-oriented fish farming; it is rather rural aquaculture, in which most of the output or harvest is consumed by the producer and his/her family. Therefore, it can be defined as carried out by small-scale farming or farmer household or communities.

However, the Malawian government realized the enormous potential of aquaculture in food security (protein supply) and poverty alleviation, and it yearns to develop commercial aquaculture. Malawi's attempts and efforts so far to develop aquaculture technologies through donor-supported through research and development targeting the small-scale farmers stalled behind and always remained at "infant stage". On the other hand, private sector efforts to develop commercial aquaculture are also short lived and did not improve and sustain for a number of reasons, such as lack of commercial fish farming expertise, inadequate fingerling production (quality and quantity), etc. The most important factor that has limited the development or emergence of commercial aquaculture is the choice of fish species; the local culturable fish species are poor in growth performance and not attractive to prospective investors. As an example, most prospective commercial investors prefer *Oreochromis niloticus* (Nile tilapia) a major fish fishes dominating the tropical aquaculture production, including in Zambia, Zimbabwe and Tanzania.

4. Development Approach to Profit-Oriented Aquaculture

Launching or start-up of commercial aquaculture is a serious and challenging issue in view of the absence of suitable proven technology for indigenous species coupled with slow growth performance and other factors (technical/non-technical/institutional) that have kept investors away. There are more unknowns than known in terms of technical and non-technical pre-requisites for commercial fish farming.

Despite the prevailing constraints in technical and non-technical aspects, there are two investors who have recently taken a bold approach to launch commercial aquaculture: Maldeco Aquaculture Ltd (a parastal company) to grow-out local indigenous species known as "Chambo" (*Oreochromis karongae*) in floating cages in Lake Malawi. A private commercial farmer (G.K. Aquafarms Ltd.) has taken a lease of the Kasinthula Fisheries Station in Chikwawa (Lower Shire) for commercial pond culture using indigenous tilapia species and common carp (*Cyprinus carpio*).

As a development approach, two options are suggested for the promotion or emergence of commercial aquaculture. The first option is the use of only indigenous fish species and the other option is to consider the introduction of exotic (alien) fish species only after adequate risk analysis (assessment) is conducted.

The first option is highly recommended and this would require, in view of absence of suitable proven technology for native culturable fish species, to enhance and improve culture technology and operation and management need from fingerling production to on-farm operation through collaborative or joint with private sector. The second option is highly contentious in view of strict legislation and policy in place on the introduction of non-indigenous fish species to Malawi; although this option is much sought after by the prospective investors because of the successful commercial farming of exotic fish species.

5. Conclusion

Introducing an exotic fish species is a two-edged sword; it can replenish fish supply or devastate a habitat or environment. Although introduction of exotic species has usually resulted in ecosystem disruption, these species are a valid means to improve production and economic benefit from aquaculture.

With the adequate policy and legislation in place in regard to introduction of exotic fish species, the decision to introduce or allow exotic fish species for aquaculture use depends on the Malawian government alone.

So, before making any hasty decision, the competent authority in Malawi needs to strengthen its institutional capacity, have well planned regulatory/enforcement capacity and capability, a quarantine system, and stakeholders (beneficiaries) must be made aware on the risks associated with introduced fish species.

Should Malawi decide to introduce an alien species; it must address both the beneficial and negative aspects of species introductions, it should conduct a proper risk analysis as outlined in the EIFAC/ICES code of practice. In other words, the decision should be made following all the internationally agreed code of practice. It is highly recommended that Malawi apply the code when deciding on the importation of exotics into the country, as in the past, Malawi had introduced alien fish species (introduction of carps in 1970s) without regard of environmental impacts and assessment of risks and benefits.

As recommendation, the use of exotic fish species in aquaculture must be avoided as far as possible, and instead, indigenous species must be encouraged and promoted with a view to protect and conserve of the rich biodiversity (national treasure) of Malawi.

Annex 3: Complementary Projects

The complementary projects presented below adopt an integrated approach, and as such incorporate a range of strategies and actions that are required to achieve the expected outputs. This "packaged" approach is applicable because of the complex framework within which the aquaculture sector will develop in Malawi. These projects reflect aspects of the Action Plan outlined above and encompass some of those actions that will be implemented in the short-term, focusing resources on priority areas for best effect. Two complementary projects are described below. The first, "District Aquaculture Livelihood Project" targets small-holder farmers with the aim of building an institutional model for the integrated livelihood approach that includes aquaculture. The second project, "Chambo Research Programme" focuses on aquaculture research with the aim of contributing to the development of medium and large-scale commercial aquaculture.

Table 3.1 Expected Outputs for Strategies to be incorporated into Two Complementary Projects

	Output	Component		Comment
		P1	P2	
Strategy 1	1.1: Projects that adopt integrated livelihoods approach	✪		The main strategy for P1.
	1.2: Broader understanding of the context between aquaculture and socio-economic, institutional and political status of poor farmers	✪		The main strategy for P1.
	1.3: Increased capacity of DoF, local government and NGO staff to utilise tools and methods necessary to support the integrated livelihoods approach	✪		The main strategy for P1.
Strategy 2	2.1: Enabling environment and framework for commercially orientated aquaculture research at NAC established		✪	The main strategy for P2.
	2.2: Scientific capacities in commercially orientated aquaculture enhanced		✪	The main strategy for P2.
Strategy 3	3.1: Aquaculture credit scheme for small commercial fish farmers introduced			
	3.2: Business planning and management capacity of small to medium-scale fish farmers improved			
Strategy 4	4.1: One-stop-shop for all aquaculture business application procedures established			
	4.2: Competitive investment environment for commercial aquaculture established			
Strategy 5	5.1: Fisheries Policy and Act with respect to environmental threats revised and amended			
	5.2: Early warning system to monitor potential threats caused by aquaculture to biodiversity and environment established			
	5.3: Knowledge of the link between aquaculture practices and environmental issues increased			
Str. 6	6.1: Shared information between fish producers and fish traders			
Str. 7	7.1: Capacity of District Assemblies to formulate plans and strategies to guide aquaculture development enhanced	✪		The project will be implemented at the District level and local gov. plays a major role.

	Output	Component		Comment
		P1	P2	
	7.2: Existing agriculture extension services utilised in promotion of fish farming	✪		The project will be implemented at the District level and local gov. plays a major role.
Strategy 8	8.1: Aquaculture guidelines for NGOs which facilitate partnership agreement with DoF developed			
	8.2: Knowledge and technical skills in aquaculture extension among NGO field staff improved	✪		Training of NGO field staff can enhance further extension within the target District.
Str. 9	9.1: Fish farmer networks strengthened and expanded			IFFNT members can play an important role as farmer trainers in target District*
Str. 10	10.1: Sustainable donor support for the aquaculture sector secured	✪	✪	Need to attract more donors for further expansion of the projects
Strategy 11	11.1: Communication and partnerships between the DoF and stakeholders enhanced	✪	✪	Communication and involvement of stakeholders are important for both P1 & 2
	11.2: Under-utilised DoF facilities restructured			P1 fits well with privatisation of under-utilised facilities in target District*
Strategy 12	12.1: High quality capacity building secured			P1: Integrated livelihood approach** P2: More scientific and technical training*
	12.2: Reliable aquaculture statistical and economic analysis system for DoF staff and other stakeholders instituted			In order to have sound data, statistics should be reliable***

✪: Strategies which are achieved through implementation of complementary projects
P1: "District Aquaculture Livelihoods Project"; P2: "Chambo Research Programme"
* There is a strong link, however P1 does not directly include this activity
** Experience from P1 and P2 will be incorporated into the Output of Strategy
*** There is a strong link, however P2 does not directly include this activity

1. District Aquaculture Livelihoods Project

Goal	Improved livelihoods among rural smallholder fish farmers
Project Objectives	To develop an institutional model to support an integrated livelihoods initiative which contributes to the quality of life of rural small-holder farmers through the inclusion of aquaculture into their livelihoods strategies
Target area	1. Zomba District (Southern Region): 1,500 beneficiaries 2. Thyolo District (Southern Region): 5,000 beneficiaries 3. Chitipa District (Northern Region): 1,500 beneficiaries
Period	5 years from 2006 to 2010
Implementing agency	District Assembly of above mentioned 3 Districts Department of Fisheries, Ministry of Mines, Natural Resources and Environment
Collaborating organisations	World Vision, Oxfam, Compass II, University of Malawi
NASP strategies incorporated	Strategy 1, 7, 8, 10, and 11
Estimated Cost	USD 548,750

(1) Project rationale

The livelihood approach as it relates to aquaculture development views aquaculture as a mechanism which can contribute to the improvement of the overall livelihood system among poor farmers, rather than simply aiming at improving fish production per unit area as a stand alone activity. Better knowledge and management capacities to support this integrated approach are critical to realise the benefits that it can bring to poor farmers.

This project focuses on developing a model for a supportive framework for this approach at the District level. It will provide the opportunity for lessons learnt from this process to be used to inform implementation in other areas, particularly with regards to the best manner of integrating aquaculture into the overall livelihoods of the beneficiaries. The outcomes from this project are expected to provide important information and capacity for approaching poverty alleviation in a multi-disciplinary manner. Furthermore this project may:

- Promote decentralisation and the empowerment of local people through enhanced participation at all levels.
- Strengthen the capacity for the rural poor to withstand environmental shocks through adoption of broader based livelihood strategies.
- Provide opportunities for diversification in poverty reduction strategies and programmes.
- Enhance the understanding of local policy-makers and planner's of the potential of aquaculture as a tool in poverty reduction.
- Help to strengthen synergies between stakeholders at all levels.
- Provide a framework to monitor and analyse the manner in which livelihood systems can help to mitigate against poverty, through the identification and use of appropriate indicators.

(2) Project objectives

The main objective are to develop an institutional model to support an integrated livelihoods initiative which contributes to the quality of life of rural small-holder farmers through the inclusion of aquaculture in their livelihoods strategies.

Other specific objectives are:

- To enhance a locally facilitated, multi-sectoral, livelihoods approach to fish farming development in the focus-area.
- To increase the level of integration of aquaculture into farming systems, either individually or in clubs.
- To encourage the adoption of this integrated approach by new farmers who have the necessary resources to either operate independently or as a member of a club.

(3) Project Components and Activities

A. Overall Project Approach

The overall approach should be based on strategies developed in the NASP, mainly in Strategic Theme 1 "Integration of aquaculture into rural livelihoods". The project will focus on the specific details of the long-term support for including aquaculture as an element of rural development in these areas, acknowledging that the household economics of small-holder fish farmers is closely linked to other farm activities.

Although the actions chosen in this project are multi-sectoral in nature, they need to compliment those already practised in the focus areas, especially with regards to the activities of NGOs, farmers and local government. The actions need to take into consideration how best to improve existing conditions through supporting the inclusion of appropriate level aquaculture development into existing initiatives, including the development plans of district authorities.

To realise the potential of an integrated livelihoods approach, the project aims to achieve three main outcomes. These are:

(i) Strong institutional frameworks and staff capacity to support research and extension.

(ii) Strong research capacity to develop options for best-practice technologies for small-holder aquaculture and to monitor and evaluate the impact of the approach.

(iii) Strong extension mechanism and capacity of extension officers (both public and private) to promote technologies and disseminate information.

In order to achieve these outcomes the project will take the following stepped approach encompassing three activity components (institutional, research and extension) as summarised below:

Table 3.2 Step-wise approach for project implementation

Step	Institutional	Research	Extension
1	► DoF, District Assembly (DA), and NGOs sensitised to the approach	► DoF and University researchers are sensitised	► Farmers are sensitised
2	► Coordination committee at District level formulated	► Research collaboration network among national & international research institutes formulated ► Existing research findings translated into user friendly packages	► Farmers are organized into farmers clubs ► Farmer field school established with training provided to farmer consultant (teacher) ► Use of extension media diversified
3	► Institutional capacity building of DA and NGOs enhanced ► Cross-sectoral technological know-how of extensionists in relevant sectors enhanced	► Studies on understanding of overall livelihood system conducted ► Participatory research promoted ► Monitoring and impact assessment carried out	► Farmer to farmer extension promoted through farmer field school ► Demand-driven service (multi- sectoral) provided
4	► Institutional model framework for livelihood approach established	► Technological how-how for livelihood approach developed	► Livelihood of smallholder fish farmer improved

B. Institutional Component

Output: Institutional model for livelihoods approach established

Strong institutional capacity is a pre-condition for the smooth operation of the research and extension components.

Table 3.3 Activities, major inputs, and actors for Institutional Component

Activities	Major inputs	By whom
1. Meeting of senior national level stakeholders to discuss an indicative budget and potential sources of funding.	Meeting	HQ DoF
2. A high level delegation from the DoF meets with the DEC to sensitise this body and discuss the practicalities of implementing such a focus area programme	Meeting at District Assembly Offices	DoF/ DA
3. The DEC mandates an existing sub-committee, or establishes a new one, to coordinate local level implementation of the programme. A competent DoF staff member sits on this committee	Meeting	DoF/ DA
4. The responsibility and accountability of the DA is defined in terms of project administration and implementation	Administration	DA/ DoF
5. The responsible sub-committee arranges a planning workshop with the multi-sector facilitators/stakeholders, including DoF, other government sector extension staff (notably agriculture), farmers representatives, and NGOs	Planning workshop	DA/ DoF /NGOs/ other government sector extension staff (notably agriculture)/ farmer representatives
6. Detailed and achievable annual implementation plans and budgets, and collaboration between projects/programmes, and organizational responsibilities within the focus area project, are worked out by each facilitator/stakeholder organisation, and submitted to the DA for overall coordination	Planning meeting Coordination meeting	DA/ DoF
7. The DA is responsible for coordinating a field sensitisation programme in potential target communities to introduce them to the project	Field sensitisation programme	DA/ DoF
8. Organisational development at a community level is carried out with interested communities, making use of existing clubs/groups as far as possible	Study on existing clubs/ groups Meeting	DA/ NGOs/ DoF
9. Extension staff from the various sectors are trained together in a multi-sector sustainable livelihoods approach. Facilitated by appropriate NGO staff, IFFNT members who live close to the priority area, and outside consultants	Training on multi-sector sustainable livelihoods approach	NGOs/ Innovative farmers/ DoF

C. Research Component

Output: Technological know-how for livelihoods approach developed

The ADiM study team identified a number of indicators suggesting that fish farmers are better-off than their non-fish farming neighbours. However, the question still remains as to whether these fish farmers have become better-off as a direct result of adopting fish faming, or if they were already in a stronger position than their neighbours prior to adopting fish farming. Have fish farmers simply become involved in aquaculture because they are generally more innovative in nature than non fish farmers, and if so, would current fish farmers have the capacity to make a success of fish farming? These questions need to be investigated further in order to determine the best approaches to ensure that appropriate development options are adopted These research requirements need to be addressed in this project, and specific focus areas may include studies on:

- Strategies that have allowed certain farmers to escape from poverty, and the constraints that have prevented others from doing this.
- Community organisations and farmers clubs and their importance for aquaculture practices, mobilisation of community resources, and poverty alleviation.
- The integration of on- and off-farm activities, understanding on-farm resource flows, and methods used to maximize the utilisation of the available inputs.
- The financing of livelihood approaches that answers the question "Can a multi-sectoral approach be effective while relying on separate budget allocations to the different sectors? If so, how?"
- Developing methods and approaches of measuring the performance of fish farmers against people engaged in other activities, and the comparative impacts on poverty alleviation of these different options.
- An analysis of case studies in Malawi and elsewhere, and in different sectors. The aquaculture sector can learn a great deal from other fields of academic research as well as from more general models of development.

Table 3.4 Activities, major inputs, and actors for the Research Component

Activities	Major input	By whom
1. A baseline survey of the focus-area carried out at the start of the project, and objectively verifiable indicators identified, so that project progress can be measured over time	Baseline survey	DoF/ Bunda college
2. Appropriate research programme drawn up and implemented which focuses on understanding and improving the integrated livelihoods approach for small-holder farmers	Planning workshop	DoF/ Bunda college
3. Relevant outputs from the technical research programme aimed at supporting commercially orientated aquaculture is made available to the focus-area programme for incorporation where appropriate	Participatory needs assessment Training	DoF/ Bunda college
4. An annual monitoring and evaluation process is carried out to measure progress against objectively verifiable indicators of change	Annual monitoring Participatory evaluation workshop	DoF/ Bunda college

D. Extension Component

Output: Livelihood of smallholder fish farmer improved

An interdisciplinary team comprising NAC researchers, NGOs, and District extension staff (agriculture, irrigation, livestock, forestry and aquaculture), will be responsible for implementing the extension component. Further, its activities would be complemented by private farmers through "farmer-to-farmer extension". The project will establish a farmer field school that will form a base for training, demonstration, meetings, research, and fingerling supply.

Activities and services that compliment aquaculture activities and which are already occurring in the focus areas, especially with regards to the activities of NGOs and local government, will be harnessed as part of this project. These activities and services may include the following:

- Improved varieties and technology that could increase production of maize and other crops

(Department of Agriculture)

- Small-scale irrigation technologies (Department of Irrigation)
- Animal husbandry, especially chickens and goats
- Nutrition and public health education
- Credit schemes in combination with financial and business management training

Table 3.5 Activities, major inputs, and actors for Extension Component

Activities	Major input	By whom
1. Information needs of farmers are determined through consultation with established farmer organisations	Needs assessment	Interdisciplinary team (NAC research, NGO, and District extension staff), farmer organisations, outside consultants
2. Information and extension material on integrated livelihoods approach that includes aquaculture is developed by NAC in line with the information needs assessment, and distributed to facilitators of the focus-area programme including multi-sectoral extension workers and farmer school instructors	Information and extension materials on integrated livelihood approach	Same as above
3. Detailed extension programme designed and implemented	Planning meetings and Focus-area extension programme	Same as above
4. Farmer field school established at Mawila Club (Zomba), Mr. Nikoloma's farm (Thyolo), and Mr Ngambi's farm (Chitipa), including the necessary infrastructural requirements, and capacity of farmer instructors enhanced	Infrastructural requirements for initiating a farmer school Training of trainers (capacity enhancement)	Same as above
5. Training programme at farmer field school developed and appropriate groups trained on site. These groups could form part of other projects/programmes who wish to learn how to integrate fish-farming into their livelihoods systems	Training programme Kit for starting integrated aquaculture livelihood project	Same as above
6. Capacity of farmer groups is strengthened through institutional/ organizational training, including principles of business management. Facilitated by appropriate NGO staff/outside consultants	Institutional/ organizational training	Same as above

The farmer field school

Its characteristics

The farmer field school is one of the most participatory methods of extension. Farmers are trained to train other farmers and their farms will be used as demonstration farms. This method can contribute to optimise the effect of the extension in areas where government extension staff is limited or too far away. It is also important to note that this method puts more emphasis on building decision making skills than the adaptation of technical know-how.

Steps for the implementation of a Farmer Field School

1. Sensitisation of the target farmer club (e.g. Mawila Farmer Club)
2. Developing an action plan in participatory manner
3. Construction of simple accommodation and a lecture room on Club land
4. Training of farmer trainers (5 members of Mawila Farmer Club, Development Facilitator from WVM, innovative farmers in the vicinity area, government extension officers)

   The table below shows some possible subjects in which farmers trainers should be trained. Training can be undertaken at Bunda College over a one week period in association with appropriate field visits.

Table 3.6 Possible training subjects for farmer trainers

Contents	Trainer
Basic aquaculture technology	Bunda College/ NAC/ WorldFish Centre
Integrated agriculture technology	Ministry of Agriculture, Irrigation and Food Security (MAIFS)/ Bunda College
Basic business management/ farm management	Bunda College/ MAIFS/ Private sector
Extension methods	Department of Extension, MAIFS
Participatory approach (e.g. PRA)/ Community Driven Development (CDD)	NGOs

5. Selection of the target farmers within the District
6. Implementation of the farmer field school

   The farmer field school will target approximately 20 farmers for 3 full days during the dry season and 1 and half days during the wet season (reduced interference with farm activities). Three groups are the maximum to be targeted in one year for at least the few years.

A proposed curriculum for a framer field school is shown in the table below.

Table 3.7 The proposed curriculum for the farmer field school

Time schedule		Contents	Trainer
DAY 1 (dry season)	AM	The purpose of farmer field school	Mawila Club
		Discussion on expected outputs of the school	Participants
	PM	Visit sites and learn about dry season farming, water management, and pond management	Mawila Club
DAY2 (dry season)	AM	Technical know-how on dry season farming, water management, and pond management	Invited trainer
	PM	Record keeping and business management	Invited trainer
DAY3 (dry season)	AM	Develop own farm design	Participants
	PM	Discussion on farm designs	Participants
DAY 4 (wet season)	AM	Discussion of any changes made on their farms as a consequence of the previous session	Participants
		Visit sites and learn about wet season farming, water management, and pond management	Mawila Club
	PM	Technical know-how on wet season farming, water management, and pond management	Invited trainer
DAY 5 (wet season)	AM	Discuss outputs and lessons learnt and the way forward	Mawila Club Participants

(4) Work plan

The time schedule takes into account the time consuming nature of project implementation in rural areas. The work plan should also allow a degree of flexibility, so that changes that become necessary through on-going consultation can be incorporated.

Table 3.8 Work plan for the District Aquaculture Livelihoods Project

		Components	Year 1	Year 2	Year 3	Year 4	Year 5
			2006	2007	2008	2009	2010
Institution Component	1	Meeting of senior stakeholders on budget and funding					
	2	DoF meets with the DEC to sensitise and discuss on the project					
	3	The DEC establishes a sub-committee to coordinate implementation of the project					
	4	The responsibility and accountability of the DA is defined					
	5	The sub-committee arranges a planning workshop					
	6	Annual implementation plans and budgets are worked out					
	7	The DA coordinates a field sensitization programme					
	8	Organisational development at a community level is carried out					
	9	Extension staff and key farmers are trained					
Research Component	1	A baseline survey of the focus-area carried out					
	2	Appropriate research programme drawn up and implemented					
	3	Project incorporates with other programme					
	4	An annual monitoring and evaluation process is carried out	△	△	△	△	△
Extension Component	1	Information needs of farmers are determined					
	2	Information and extension materials developed					
	3	Detailed extension programme designed					
	4	Farmer field school established and capacity of farmer instructors enhanced					
	5	Training programme at farmer field school developed and implemented					
	6	Capacity of farmer groups is strengthened through training					

(5) Project Cost Estimation

The total project cost, based on 2005 prices and not including inflation related increases rates, is estimated at USD 548,750 (Approximately MK 62.0 million). Cost estimation by component is summarised as follows:

Table 3.9 Cost Estimation for the District Aquaculture Livelihoods Project

Unit: USD

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1. Institutional component	126,990	9,360	0	0	0	136,350
2. Research component	29,143	15,943	12,643	10,071	79,500	147,300
3. Extension component	77,350	20,500	52,625	44,125	8,000	202,600
4. Monitoring fee	13,889	13,889	13,889	13,889	6,944	62,500
Total	247,372	59,692	79,157	68,085	94,444	548,750

2. Chambo Research Programme

Goal	Commercial fish farmer in Malawi is succesful
Project Objectives	To develop technologies that ensure maximum profits for fish farmers, specifically; • To determine biological performance of *O. karongae* and *O. mossambicus* in different culture systems, e.g. small to medium-scale pond, and cage culture • To develop technical options for commercial aquaculture • To determine the impact of common carp which has already been introduced into the country and assess options to avoid or mitigate any negative impact. • To develop a mechanism for public/private sector research collaboration
Target area	1. National Aquaculture Centre (NAC) 2. Private fish farmers/enterprises
Period	5 years from 2006 to 2010
Implementing agency	Department of Fisheries, Ministry of Mines, Natural Resources and Environment
Collaborating organisations	University of Malawi, NGOs, Regional and international research organizations
NASP strategies incorporated	Strategy 2, 10, and 11
Estimated Cost	USD 794,220

(1) Project rationale

Commercial aquaculture is defined as fish farming that seeks to **maximise profit**, as opposed to small-scale integrated aquaculture where the goal is generally **utility maximisation** (FAO, 2000). The emergence of these commercial aquaculture ventures (professional fish farmers) is considered to be a major turning-point in aquaculture development which contributes to a sustainable aquaculture sector. In many Asian countries where substantial aquaculture production is established, commercial and rural aquaculture systems complement each other resulting in a general improvement in fish supply and decrease in poverty levels. For example, commercial fish farmers are able to generate their own revenue which they are prepared to use to verify and develop technologies with little dependence on government support. Commercial fish farmers are also in a position to assist those smallholders with similar profit objectives to overcome their technological problems. The high demand for inputs such as fingerlings and fertilisers from the commercial sector also has the effect of lowering prices of these commodities through competition, which in turn benefits the small-holder farmer. Furthermore, employment is generated in the commercial sector and this contributes to an increase in purchasing power and food security among the rural poor.

The more than 20 years of aquaculture research in Malawi has largely focussed on resource poor farmers. Consequently there are no available model approaches to commercial aquaculture in the country. As more information on commercial aquaculture has become available, and the price of fish in Malawi has increased, there has been a growing resurgence of interest in small, medium and large-scale commercial fish farming. Hence, there is a need for Government to react to these demands and provide the supporting frameworks to allow development in the sector. One of the fundamental requirements for the development of a commercial sector is access to reliable and current information on suitable technologies. This project will focus on providing the research backup required to generate this information.

Priority research requirements to support commercial aquaculture development were identified by stakeholders at the regional aquaculture workshop held in Mangochi from August 1-6, 2004. These include:

- Research on *O. karongae* and *O. mossambicus* to be conducted to comprehensively assess their potential performance for commercial aquaculture.
- The potential of commercial aquaculture to contribute to enhancement of wild tilapia stocks in Lake Malawi as part of the "Chambo Restoration Strategic Plan".
- The risks associated with the introduction of exotic species, especially *O. niloticus* and common carp, on the capture fisheries and the conservation of biodiversity should be assessed.
- Participatory research with medium and large-scale commercial aquaculture operations should be encouraged.

(2) Project objectives

The main overall objective of this project is to develop technologies that ensure maximum profit for fish farmers.

More specifically,

(i) To determine biological performance of *O. karongae* and *O. mossambicus* under different culture systems, e.g. small to medium-scale pond culture, and small, medium and large cage culture conditions

(ii) To develop technical options for commercial aquaculture

(iii) To determine the impact of common carp which has already been introduced into the country and assess options to avoid or mitigate any negative impact.

(iv) To develop a mechanism for public/private sector research collaboration

(3) Project Components and Activities

A. Basic approach

The overall approach should be based on the strategies developed in the NASP, mainly as part of Strategic Theme 2 "Enhanced economic opportunity for commercial aquaculture". The project is composed of two components, an institutional capacity component and a research component. Institutional capacity is a fundamental requirement to carry out effective research. While the private sector must be encouraged to participate in aquaculture research, the primary responsibility for its facilitation lies with the DoF. Currently there are no collaborative research initiatives between government and commercial fish farmers and the NAC needs to play a leading role in facilitating links with the private sector where possible. For example, Mr. Nikoloma, a member of the Innovative Fish Farmers Network Trust, is a pioneer of *O. karongae* fingerling production. Quality brood stock and fingerling production could be enhanced through applied research at his farm and this would benefit other entrepreneurial farmers. Joint feasibility studies on improved strains of *O. mossambicus* (which has already been developed at Swansea University in the UK and the University of Stellenbosch in South Africa) is also an option and could easily be conducted in partnership with G.K. Fish Farms Ltd. at Kasinthula, while testing the economic feasibility of small cages could be undertaken in collaboration with MALDECO. Important advantages of this kind of participatory research are that the research directly reflects the needs of the producers as well as creating capacity in both the public and private sectors. This project will aim to create research linkages with the private sector as much as possible.

Current legislation regarding the introduction of exotic species into Malawi requires that the aquaculture sector focus on the farming of indigenous species. This means that much of the information required on these species needs to be generated locally. Hence, there is additional pressure on the DoF to facilitate appropriate research through the NAC. To faqcilitate this process, this project will foster research linkages with international research institutions who would be invited to assist in addressing the research agenda.

B. Institutional Capacity Component

The NAC will be the key research station in this project. Recent renovations and infrastructure development carried out at the Centre through assistance from the Japanese government, means that minimum additional facilities or equipment will be required for the Centre to respond to the priority research topics identified. In the medium-term, the capacity of researchers at the NAC and at Bunda College needs to be enhanced. The project will facilitate continued and increased collaboration with international research institutions who have contributed to the development of the NASP. These include: (i) Rhodes University (Republic of South Africa) (ii) Asian Institute of Technology (Thailand), (iii) Central Luzon State University (The Philippines), (iv) University of Idaho (U.S.A.) and (v) University of Hawaii (U.S.A.)

Table 3.10 List of Activities for the Institutional Capacity Component

Activities	Major input	By whom
1. Renovation of experimental ponds and water canals at NAC, e.g. clearing of silt and construction of experimental hatchery (artificial incubation) for mass fingerling production	Labour and materials for renovation Construction of hatchery	NAC/DoF
2. Provide advanced technology training by the appropriate international research partners. Capacity requirements are: a. Fish nutritionist (2) b. Feed technologist (2) c. Genetics specialist (1) d. Fish disease specialist (1) e. Aquaculture engineer (1) f. 5 extension trainees (training to include business planning, fish food and feeding, marketing etc)	Bursaries	Donor Community and appropriate international institutions
3. Develop legal frameworks for public/private sector collaborative research	Workshop	DoF/Planning Section
4. Support University of Malawi to establish agreements with international academic institutions in basic research and high level education.	Grants	Univ. of Malawi, Donor Community
5. Formulate and establish a research network with international research institutions to strengthen fundamental research on new concepts in commercial aquaculture technologies.	Research workshop, Financial support for 10 researchers to attend international and regional aquaculture conferences for 5 years	NAC, Univ. of Malawi,Donor Community

C. Research Component

The following research priorities were identified at the Mangochi regional workshop (2004) and the commercial aquaculture development task force meeting held on 30th-31st August, 2004 at NAC. The following table lists the priorities and can be used as the basis for developing a commercially orientated aquaculture research plan.

Table 3.11 Suggested Research Priorities

Area	Research topics	By whom (potential partner)
1. Reproduction and quality fingerling production	■ Quality fingerling supply technology established, this includes for example: ● All male (methyl testosterone sex change) fingerling production technologies ● Mass fingerling production technology for *O. karongae* ● Optimising mass transportation of fingerlings under tropical conditions. ● On-farm commercial scale fingerling production of *C. gariepinus.*	NAC supported by donors
2. Genetics	■ Improved strains of indigenous tilapia established, this includes for example: ● Biology and genetics of *O. karongae* (species complex) and *T. rendalli*. (Focus on age, growth, reproductive seasonality, size and age at maturity, relative fecundity and genetic differences of 4 geographically separated "populations" of *O. karongae* and 2 populations of *T. rendalli* (high and low altitude populations). Use biological (e.g. fecundity, k, Lm50, Lt50) and genetic markers and parameters as basis for long term selection programme. ● Strain selection and development (*O. karongae, O. shiranus, O. mossambicus and T. rendalli*) ● Growth, feed conversion and production of local and improved strain of *O. mossambicus* (University of Stellenbosch strains)	Collaborative research between Bunda College, FRI, Chancellor College, NAC and external research institutions (MALDECO) (G.K. Aquafarms Ltd) (Univ. of, Stellenbosch)

Area	Research topics	By whom (potential partner)
3. Nutrition and growth	■ Nutritional requirements of indigenous tilapias determined ■ Cost effective formulated feed developed ■ All male tilapia culture technologies estabioished and tested ■ Fertilisation (inorganic and organic) and complementary feeding strategies evaluated These include for example: • Size dependent optimal daily ration and feeding frequency for *O. karonga*e and *T. rendalli*. • Growth trials with formulated feeds (using locally available ingredients) under optimum feeding regimens at commercially viable densities of *O. karongae*, *O. shiranus T. rendalli, C. carpio, O. mossambicus* and *O. placidus* at NAC and Kasinthula (*O. mossambicus*, *O. placidus* and *C. carpio* trials at Kasinthula and *O. karongae*, *O. shiranus* and *T. rendalli* trials at NAC). • Effect of density on growth and feed conversion ratio under optimum nutrition and feeding conditions in cages and ponds of *O. karongae* and *T. rendalli*. • Growth trials of all male (methyl testosterone sex change) and mixed sex *O. karongae*, *T. rendalli* and *O. mossambicus* under optimum feeding regimes using "optimum" formulated feeds. • Digestibility studies of locally available feed ingredients (plant, fish and animal origin) by *O. karongae* and *T. rendalli* as a basis for feed formulation and least costing of diets. • Economic comparison of controlled fertilisation and complementary feeding trials vs. controlled feeding using optimum feeds.	As above
4. Production system	■ Impact of pond depth on fish production • Increase the number of case studies for comparative purposes • Size grading	
5. Environment	• Impact assessment of common carp	FAO (G.K. Aquafarms Ltd), NAC
6. Socio-economics and Marketing	■ Enabling socio-economic environment for commercial aquaculture determined, this includes for example: • Economic and Financial Analysis of different production technologies • Fish marketing structure • Fish supply and demand analysis • Tenure systems for the development of aquaculture • Detailed GIS information for decision support and development of commercial fish farming in Malawi	Bunda College (Dept. of Agricultural Economics) and international collaborators
7. Evaluation	■ Cost effective research tools and mechanism identified, this includes for example: • Cost benefit analysis of research programme	External

(4) Work plan

The Work plan may be affected by the requirements of research partners and the availability of external funds. Therefore, a detailed work plan needs to be developed through consultation with research partners and donors. The table below presents a preliminary schedule of activities:

Table 3.12 Work plan for the Chambo Research Programme

	Components	Year 1	Year 2	Year 3	Year 4	Year 5
		2006	2007	2008	2009	2010
1	Identify research partners					
2	Develop detailed work plan					
3	Develop budget					
4	Conduct renovation on NAC					
5	Conduct advanced technology training					
6	Execute research plan					
•	Quality fingering supply technology established					
•	Improved strain of indigenous tilapia established					
•	Nutritional requirements of indigenous tilapias determined					
•	Effective formulated feed developed					
•	All male tilapia culture technologies determined					
•	Impact of common carp is determined					
•	Enabling socio-economic environment determined					
•	Cost effective research tools and mechanism identified					

(5) Project Cost Estimation

The total project cost, based on 2005 prices and not considering escalations due to inflation, is estimated at USD 794,220 (Approximately MK 89.7 million). A cost estimation by component is summarised as following.

Table 3.13 Cost Estimation for the Chambo Research Programme

Unit: USD

Components	Year 1	Year 2	Year 3	Year 4	Year 5
	2006	2007	2008	2009	2010
1 Identify research partners	2,167				
2 Develop detailed work plan	2,167				
3 Develop budget	2,167				
4 Conduct renovation on NAC	50,270				
5 Conduct advanced technology training	228,045	152,030			
6 Execute research plan		84,250	84,250	84,250	42,125
7 Monitoring fee	13,889	13,889	13,889	13,889	6,944
Sub-TOTAL	299,204	250,169	98,139	98,139	49,069
TOTAL					794,220

Annex 4: Potential Contribution of Fish Farming to Individual Household Income in a Model Club

It is necessary to consider the maximum returns that could be possible from a club situation given the prevailing conditions affecting farming operations within the system. This will allow a realistic view to be taken regarding the potential that this kind of system may have in community development.

The objective of this process is to formulate the most appropriate model for clubs, understanding that there is a requirement for flexibility as prevailing conditions change.

Aspects to consider in developing a model approach include the following:

a. Proportion of household income that the club activities are currently providing, and the potential that could be achieved with improved management of fish production.

b. Potential of predominantly fingerling or food fish production given improved management and changing market conditions.

c. Opportunities of combining fingerling and tablefish production in the same club to spread market risk, and to reduce fingerling costs.

d. Scenarios where table fish production is maximized through optimal feeding and on a sliding scale depending on the ability of club members to provide the necessary food inputs.

e. Maximum production based on current management and inputs as compared to optimal conditions. **It is likely that the realisable maximum will be somewhere in-between these two figures.**

To understand the potential benefits that could be realised by club members it is first necessary to determine the current relative importance of club activities to the livelihoods of individual member households.

Current situation at Mawila Club

Information on cash income obtained from the socio-economic survey of Mawila Club members during February 2005 (based on income generated from club and individual activities in 2003 and 2004) provides an indication of the level of impact that club activities have on the overall household status of members.

Table 4.1 Income characteristics of Mawila club members

Average net income from club activities (members without pond/s)	MK	Average net income from club activities (members with pond/s and fish sales)	MK
• Share of income from vegetable production (indirectly as food)	343	• Share of income from vegetable production (indirectly as food)	343
• Winter maize seed multiplication	1,375	• Winter maize seed multiplication	1,375
		• Sale of table fish and fingerlings	3,583
Total	1,718/yr (USD15)		5,301/yr (USD46)
Percent of total average household income for all club members	13%		39%

***** Average household income/club member (including fish sales) is estimated at MK 13,463 based on survey results

Table 1 above shows that club activities contribute an average of around 13% to mean overall net household income (cash and cash equivalent) for those members who do not have ponds, and 39% for those members that do have ponds.

This indicates that club members who have pond/s and sell fish are earning far greater benefits from the club than those that do not have ponds, or those that have ponds but do not sell fish.

Theoretically there is an opportunity to improve the household status of those members who do not have ponds by allowing them access to ponds, and by improving fish production . In this way all members could theoretically improve their income.

The importance of fish sales to overall household income is clearly shown in the table above. However, there are other non-cash benefits that accrue from being a member of aclub, including access to agricultural inputs and loans from World Vision (the participatory NGO at Mawila Club).

To summarise – Despite the fact that fish ponds are hardly managed at present the accrued benefits from the sale of fish make a significant difference to the overall income of individual club members in comparison to those that do not have ponds. Fish production at the club could be increased substantially through better pond management and utilisation of un-used club land. Other benefits associated with club membership are very important and need to be considered. For example, club members perceive that the benefits of membership far exceed their labour inputs (3 days a week).Due to limited availability of club land and consequently the total number of possible ponds it may be appropriate to consider linking the upper limit of membership with the available area for pond construction and other agricultural activities.

Fish production potential of Mawila Club

It is useful to consider scenarios where fish production and consequent income is increased for those members who have ponds. This can provide targets with regard to the further development of Mawila Club and the development of other clubs.

To determine realistic projections it is necessary to consider a number of different possible scenarios that may be appropriate depending on opportunities that may exist at a particular time.

The main issue that needs to be considered is the comparative benefits of producing table fish, or fingerlings for the market. This choice would depend mostly on **market opportunities** that exist at a given time. What might make the most economic sense at one time may be inappropriate at another time. However, it is apparent that the market for table fish is likely to be more stable than that for fingerlings in the long-term.

The choice also depends on the **availability of particular inputs** required for production and the best returns possible under these conditions. These basic conditions are likely to change considerably from year to year depending on environmental and other contributing factors that would affect the club as a whole.

Tables 2 and 3 provide estimates of the lower and upper limits of production and income that could be expected through table fish and fingerling production respectively. They also show an estimated target production that lies between these two limits.

Table 4.2 Focus on Table Fish Production

	Lower limit	**Upper limit**	**Target**
Total pond area	0.76 ha	0.76 ha	0.76 ha
Pond area available (20% for fingerling production)	0.61 ha	0.61 ha	0.61 ha
Production per hectare per year (from 0-19kg/yr group in socio-economic survey, and small-scale commercial estimates)	0.52 tonnes	6.00 tonnes	2.00 tonnes
Total fish production	317 kg	3 660 kg	1 220 kg
Income from fish sales (gross profit at a sale price of MK180/kg)	MK 57,060	MK 658,800	MK 219,600
Cost of inputs (* expenditure)	MK 0	MK 289,872	MK 96,624
Net profit per club	MK 57,060	MK 368,928	MK 122,676
Net profit per pond owner (31)	MK 1,840	MK 11,901	MK 3,957
Current average annual income/club member (excluding fish sales)			MK 11,913 (USD 104)
Potential average annual household income per club member with pond/s (31)			**MK 15,870 (USD 138)**
% increase from current average total household income (excl. fish sales)			**33.2%**

* Labour has not been considered as a cost. Input costs are estimated conservatively at around 44% of sale value

Table 4.3 Focus on Fingerling Production

	Upper limit (commercial)	**Target (clubs)**
Total pond area	0.76 ha	0.76 ha
Pond area available (20% for breeding ponds)	0.61 ha	0.61 ha
Production per hectare per year (80% mortality - from T. Hecht production model estimates)*	2,300,000 pieces	575,000 pieces
Total fingerling production	1,403,000 pieces	350,750 pieces
Income from fingerling sales (gross profit from sale price of MK 5/piece)	MK 7,015,000	MK 1,753,750
Cost of inputs (MK 3.5 /fingerling)	MK 4,910,500	MK 1,227,625
Net profit per club	MK 2,104,500	MK 526,125
Net profit per pond owner (31)	MK 67,887	MK 16,972
Current average annual income/club member (excluding fish sales)		MK 11,913 (USD 104)
Potential average annual household income per club member with pond/s (31)		**MK 28, 885 (USD 251)**
% increase from current average total household income (excl. fish sales)		**142%**

* This model is based on *O. mossambicus* fecundity data (from Proceedings of the 6th International Symposium on Tilapia in Aquaculture, 2004)

Which is the best development option?

Increasing the overall table fish or fingerling production at clubs through better management and equitable distribution of ponds has the potential to increase the benefits accruing to individual club members. The ideal approach requires that each club member has at least one pond. This would mean that there would be a slight reduction in the benefits that the current pond owners, who often have more than one pond, are receiving from fish production, but would allow more people to benefit in the long term.

In the case of Mawila and other clubs it is unlikely that maximum production of food fish or fingerlings will be able to be achieved, given the many constraints that exist with farming at this level. It is therefore probably more appropriate to consider achievable levels of production and subsequent income somewhere in between the current and maximum scenarios. Clubs need to be able to adapt to the market with regards to focusing on fingerling or table fish supply, and flexibility in production mode is necessary. Fingerlings give better profits provided that there is a market demand. Overall, however, the market for table fish seems to be more stable, which suggests that this option is less risky and therefore the better long-term option.

Annex 5: SWOT Analysis of DoF

Poverty Alleviation by Aquaculture development with 1) Healthy DoF finance system 2) Effective DoF management 3) Capacity DoF staff and valuable information sharing among stakeholders		**External Environment**	
		O (Opportunity) • **Increase of budget** • **Increase of no. in qualified researcher and extension staff** • **Aquaculture development policy at local government level** • **Develop media system for information exchange** • **Demand of Fish**	**T (Threat)** • **Too many imported fish** • **Shortage of donors' support** • **No communication with other stakeholders** • **Relies heavily on external funding and it hinders long-term establishment**
Internal Environment	**S (Strength)** • **Existence of master plan on aquaculture development** • **Existence of Innovative Fish farmers with aquaculture technology** • **Existence of extension staff** • **Existence of research center** • **Existence of private farm**	Strategy with S & O 1) Trained staff (research and extension) available 2) Desire to adopt enabling aquaculture policies. 3) Field research and extension stations are strategically located. 4) Aquaculture is recognized as important to food security & Income Generation 5) DoF with strategically located aquaculture facilities (NAC/ private sector/ academic/ NGOs/ District gov.) 6) Market survey is implemented	Strategy with S to avoid T 1) Appropriate policy for controlling fish (Export and Import) 2) Involve various stakeholder in the process of aquaculture development (NGOs & Private sector) 3) Strategic Aquaculture Development Plan with DoF Initiative is implemented 4) Materials for sensitizing donors in aquaculture developed
	W (Weakness) • **No information sharing system among various stakeholders** • **Shortage of no. of extension staff** • **Low capacity. of extension staff** • **Unstable budget allocated to aquaculture development** • **No collaboration in the field level** • **No commercial aquaculture**	Strategy with O to overcome W 1) Establishment of statistics and data collection system (DoF/University of Malawi/NGOs/Private sector) 2) Data obtained 3) Accessibility of data to all stakeholders 4) Dependent Budget for aquaculture development 5) Systematic finance system 6) Train the facilitator for extension staff	Strategy to avoid T & W 1) Establish a body that will advise on aquaculture development in Malawi which includes representation from diverse stakeholder groups 2) No of media campaigns about aquaculture conducted 3) Establishment of commercial aquaculture

Annex 6: Terms of References for operational and technical advisors

A. Operational Advisor for the National Aquaculture Strategic Plan

The expert will be responsible for operation and management of the NASP at national level. Policy and institutional issues regarding NASP implementation will be addressed by the expert. Specifically, the expert will support the NASP Coordination Committee at DoF, HQ with following tasks:

- Revise National Policy and Act to support requirement of the NASP
- Establish national level multi-stakeholder aquaculture advisory body
- Establish and advise producers organisation
- Conduct annual monitoring and evaluation
- Promote partial privatization of DoF station
- Establish international research network
- Establish District coordination body (Zomba & Thyolo)
- Conduct sensitisation and awareness activities
- Operate capacity building and education programme
- Provide overall supervision and coordination

B. Technical Advisor for the National Aquaculture Strategic Plan

The expert will be responsible for supervision of research and extension activities among the NASP in terms of technical aspects. Specifically, the expert will support the National Aquaculture Centre with following tasks:

- Develop detailed research programme and its implementation for profit-oriented aquaculture
- Develop detailed research programme and its implementation for rural livelihood and aquaculture
- Establish multi-sectoral livelihood approach at Zomba & Thyolo

Specifically, these advisors task in the NASP strategies are described as shown in Table 8.1.

Table 8.1 Major terms of references for external advisors by strategic components

	Output	TOR of external advisor
Strategy 1	1.1: Projects that adopt integrated livelihoods approach	• Advice the Aquaculture Advisory Body and NASP coordination committee on the scope, timing and contents of the complementary project 1. • Coordinate relevant institutions involved in the complementary project 1.
	1.2: Broader understanding of the context between aquaculture and socio-economic, institutional and political status of poor farmers	• Formulation of research agenda. • Coordinate with institutions outside and inter-agency research activities. • Develop an integrated database to manage integrated livelihood approaches.
	1.3: Increased capacity of DoF, local government and NGO staff to utilise tools and methods necessary to support the integrated livelihoods approach	• Establish multi-disciplinary committee to monitor and evaluate capacity building of all stakeholders in this approach, e.g. District assembly, NGO, farmers organisation, etc.

	Output	TOR of external advisor
Strategy 2	2.1: Enabling environment and framework for commercially orientated aquaculture research at NAC established	• Analyse cost and benefit of farmer's participatory research and extension • Coordinate inter-agency agenda regarding to establishing semi-autonomous status of NAC.
	2.2: Scientific capacities in commercially orientated aquaculture enhanced	• Advice the DoF on researchers training and education • Seek and coordinate international institutions (AIT, Rhodes university, Stellenbosch Univ., etc.) for research and education agreement with Univ. of Malawi and NAC. • Seek financial source for Malawian researchers to participate international aquaculture meeting (e.g. ISTA, etc.)
Strategy 3	3.1: Aquaculture credit scheme for small commercial fish farmers introduced	• Coordinate with financial institutions to introduce credit scheme for fish farmers.
	3.2: Business planning and management capacity of small to medium-scale fish farmers improved	• Apprise business capacity of potential commercial farmers to manage the business training programme. • Develop database on potential commercial farmers.
Strategy 4	4.1: One-stop-shop for all aquaculture business application procedures established	• Complete the packaged licence system for aquaculture in collaboration with relevant agencies.
	4.2: Competitive investment environment for commercial aquaculture established	• Assess the potential and effect of existing tax exemption system applicable to aquaculture business.
Strategy 5	5.1: Fisheries Policy and Act with respect to environmental threats revised and amended	• Coordinate with FAO/HQ for formulation of policy and regulation regarding to management of exotic fish species.
	5.2: Early warning system to monitor potential threats caused by aquaculture to biodiversity and environment established	• Arrange advocacy programme to NGOs on policy for use of exotic fish species.
	5.3: Knowledge of the link between aquaculture practices and environmental issues increased	• Coordinate regional (Tanzania, Zambia and Malawi) meeting on monitoring of exotic fish in Lake Malawi basin
Strategy 6	6.1: Shared information between fish producers and fish traders	• Coordinate the meetings among fish farmers and traders, and evaluate its impact • Arrange advertising programme of farmed fish at various trade fairs.
Strategy 7	7.1: Capacity of District Assemblies to formulate plans and strategies to guide aquaculture development enhanced	• Coordinate DoF with local government in policy dialogue.
Strategy 8	8.1: Aquaculture guidelines for NGOs which facilitate partnership agreements with the DoF developed	• Review existing partnership arrangement between government and NGOs.
	8.2: Knowledge and technical skills in aquaculture extension among NGO field staff improved	• Evaluate capacity building of NGO staff involved in the NASP
Strategy 9	Output 9.1: Fish farmer networks strengthened and expanded	• Assess and monitor the effect of IFFNT.
Strategy 10	10.1: Sustainable donor support for the aquaculture sector secured	• Coordinate with donor agencies for promotion of NASP • Holding inter-disciplinary annual meeting including donor agencies to announce progress of the NASP.

	Output	TOR of external advisor
Strategy 11	11.1: Communication and partnerships between the DoF and stakeholders enhanced	• Participate to Aquaculture Advisory Body as observers. • Establish regional/international information network to share the experience and lessons learnt from ongoing aquaculture development programme (e.g. Zambia, Ghana, Cameroon, Madagascar, etc.)
	11.2: Under-utilised DoF facilities restructured	• Apprise the status, condition and value of government fish farm to manage privatisation of these facilities.
Strategy 12	12.1: High quality capacity building secured	• Evaluate periodically work of each researchers in NAC. • Advise on curriculum development in diploma course at Malawi College of fisheries.
	12.2: Reliable aquaculture statistical and economic analysis system for DoF staff and other stakeholders instituted	• Make recommendations regarding the content of aquaculture statistical report. • Complete various types of fish farmer's registrations.

ATTACHED TABLES AND FIGURES

Table A1 Currency equivalent

Year	MK per 1 USD	USD per 1 MK
1994	4.49	0.22248
1995	4.49	0.22248
1996	15.39	0.06498
1997	15.44	0.06475
1998	25.52	0.03918
1999	45.10	0.02217
2000	47.49	0.02106
2001	80.80	0.01238
2002	78.27	0.01278
2003	88.84	0.01132
2004	110.25	0.009082
2005	113.00	0.008850

Remarks: Data is represented by the rate in April of each year
Source: OANDA.COM The Currency Site (http://www.oanda.com/convert/classic)

Table A2 Historic trends in fresh Chambo price

Year	Price (MK/kg)		Price (USD/kg)	
	Wholesale	Retail	Wholesale	Retail
1990	2.1	3.0	0.7	1.1
1991	2.5	3.3	0.9	1.2
1992	3.4	4.4	0.9	1.2
1993	5.6	7.3	1.3	1.7
1994	7.8	10.0	1.7	2.3
1995	19.7	19.9	4.4	4.4
1996	29.5	34.3	1.9	2.2
1997	32.4	37.7	2.1	2.5
1998	66.0	76.8	2.6	3.0
1999	77.0	83.9	1.7	1.9
2000	89.0	104.0	1.9	2.2
2001	124.0	145.0	1.5	1.8
2002	130.0	160.0	1.7	2.0
2003	1300.0	160.0	1.5	1.8
2004	164.5	202.4	1.5	1.8
2005	199.0	244.9	1.8	2.2

Source: MALDECO official price list

Table A3 Difference in average annual cash income between fish farming household and non-fish farming households

Unit: MK

	Non-fish farming households	Fish farming households	Income specifically from fish farming
Average annual cash income	6,337 (USD57.48)	17,526 (USD158.97)	1,706 (USD15.47) (9.7% of total annual cash income)

Remarks: Data were obtained from 144 farmers who are members of farmers' clubs in Chingale area, Zomba District
Source: ADiM Pilot Project baseline survey (2004)

Table A4 Livestock ownership and household income from livestock

	Overall	Cattle	Goats	Sheep	Pigs	Poultry
Households that receive livestock income (%)	23.80					
Percent of households owning (%)		5.20	22.40	1.20	6.20	44.70
Average herd size, of those owning (head)		6.20	4.20	4.70	3.60	8.40
Mean annual household income from livestock, all HH (MK)	216.00	95.86	53.99	5.61	30.58	31.86
Mean annual household income from livestock, all HH (USD)	8.46	3.76	2.12	0.22	1.20	1.25

Remarks: Data were obtained in 1998 from the Malawi Integrated Household Survey with sample number of 6,586
Source: Poverty monitoring system, Government of Malawi (2001)

Table A5 Malawi food balance sheet, 1971 and 2001

	Domestic Supply ('000mt)					Domestic Use ('000mt)					kg/A/ capita	Per day capita		
	Production	Import	Stock	Export	Total	Feed	Seed	Fertilizer/ Manure	Waste	Food		Calorie	Protein (g)	Fat (g)
1971 TOTAL												**2,415.0**	**74.2**	**46.9**
Veg. product												2,321.0	67.6	39.9
Ani. product												94.0	6.6	6.9
Cereals	1,352.0	29.0	-121.0	14.0	1,246.0	130.0	39.0	36.0	164.0	877.0	188.7	1,641.0	43.5	17.0
Starchy roots	184.0	0.0	-15.0	81.0	88.0	2.0	10.0		14.0	61.0	13.1	26.0	0.5	0.0
Pulses	173.0	0.0	0.0	9.0	165.0	5.0	21.0		43.0	96.0	20.6	194.0	11.9	1.0
Meat	22.0	1.0	0.0	0.0	22.0					22.0	4.8	30.0	1.7	2.5
Milk	17.0	10.0		0.0	27.0				1.0	26.0				
Eggs	8.0	0.0		0.0	8.0				1.0	7.0	1.4	5.0	0.4	0.3
Fish*	60.0	1.0	0.0	2.0	59.0					59.0	12.8	24.0	3.7	0.9
2001 TOTAL												**2,160.0**	**54.1**	**28.5**
Veg. product												2,105.0	50.5	24.4
Ani. product												55.0	3.7	4.1
Cereals	1,711.0	164.0	300.0	1.0	2,174.0	253.0	52.0	32.0	134.0	1,702.0	146.4	1,270.0	33.4	12.8
Starchy roots	6,166.0	0.0	-812.0	1.0	5,353.0	2,210.0	70.0		708.0	2,365.0	203.4	386.0	6.3	0.7
Pulses	228.0	0.0	2.0	4.0	226.0	6.0	36.0		57.0	128.0	11.0	104.0	6.4	0.6
Meat	58.0	0.0	0.0	0.0	58.0					58.0	5.0	33.0	1.7	2.9
Milk	35.0	8.0	0.0		43.0				2.0	42.0	3.6	6.0	0.3	0.3
Eggs	20.0	0.0	0.0		20.0		1.0		2.0	17.0	1.4	5.0	0.4	0.3
Fish*	41.0	2.0	0.0	0.0	41.0					42.0	3.6	7.0	1.1	0.2

Remarks: Differ from the data by DoF
Source: FAO Food Balance Sheet (1971-2001)

Table A6 % for total daily per capita expenditure and calories for food consumed among groups with different wealth status

		Poorest	2nd	3rd	4th	Wealthy family	All
% for total daily per capita expenditure for food consumed	Meat (%)	3.5	5.1	7.2	8.7	14.1	9.2
	Eggs (%)	0.2	0.2	0.5	0.5	0.8	0.5
	Fish (%)	7.0	5.7	5.8	6.2	6.8	6.2
	Milk or milk products (%)	0.5	0.4	1.0	1.1	2.2	1.3
% for total daily per capita calorie for food consumed	Meat (%)	0.4	0.7	1.0	1.4	3.0	1.4
	Eggs (%)	0.0	0.0	0.0	0.0	0.1	0.0
	Fish (%)	1.0	1.1	1.3	1.9	2.1	1.5
	Milk or milk products (%)	0.1	1.1	1.3	1.9	2.1	1.5

Remarks: Data were obtained in 1998 from the Malawi Integrated Household Survey with sample number of 6,586
Source: Poverty monitoring system, Government of Malawi (2001)

Table A7 A summary of status of fisheries and fish stocks in Malawian waters 1999

Fish Stock(s)	Fishery/Survey	Water body	Area(s)	Long term trends (1976-96)			
				Catch	Effort	CPUE	B_{cur} (%)
All	Traditional	South East Arm	All	Increasing	Increasing	Stable	111
All	Traditional	South West Arm	All	Variable	Increasing	Decreasing	35
All	Traditional	Upper Shire	All	Decreasing	Variable	Decreasing	25
All	Traditional	Lake Malombe	All	Decreasing	Increasing	Decreasing	20
All	Traditional	Lake Chilwa	All	Decreasing	Increasing	Decreasing	11
All	Traditional	Lake Chiuta	All	Decreasing	Increasing	Decreasing	21
All	Traditional	Lower Shire	All	Decreasing	Decreasing	Variable	51
All	Commercial dem.	South East Arm	B	Decreasing	Decreasing	Decreasing	42/65 *
All	Commercial dem.	South East Arm	C	Increasing	Increasing	Stable	63/88 *
All	Comm. Pelagic	South East Arm	A-C	Decreasing	Stable	Decreasing	31
All	Semi-commercial	South East Arm	A	Variable	Variable	Stable	84
All	Semi-commercial	South West Arm	D	Variable	Variable	Stable	72
All	Semi-commercial	SWA-Salima	E-G	Decreasing	Decreasing	Stable	84
Chambo	Trad./Commer.	Lake Malawi	All	Decreasing	Increasing	Decreasing	32
Chambo	Traditional	Upper Shire	All	Decreasing	Variable	Decreasing	1 **
Chambo	Traditional	Lake Malombe	All	Decreasing	Decreasing	Decreasing	10
Kampango	Traditional	Lake Malawi		Decreasing	Increasing	Decreasing	43
Bombe	Trad./Commer.	Lake Malawi	All	Decreasing	Increasing	Decreasing	58/25 ***
Utaka	Trad./Commer.	Lake Malawi	All	Increasing	Increasing	Decreasing	37
Kambuzi	Traditional	Lake Malawi	All	Increasing	Increasing	Stable	88
Kambuzi	Traditional	Lake Malombe	All	Decreasing	Stable	Stable	33
Usipa	Traditional	Lake Malawi	All	Increasing	Increasing	Variable	197
Demersal	Monitoring Surveys	SE & SW Arms	A-F		Constant	Stable	93 ****

Remarks: * Means for 1991-93 and 1995-97 respectively, ** Current CATCH (%), *** Means for 1994-96 and 1994 & 1996 respectively, **** CPUE 1999/mean CPUE 1994-96
Source: Bulirani (1999)

Table A8 Total potential yields from Malawi's capture fisheries

Unit: mt

Capture Fishery Area	Potential Yield	Comment
Lake Malawi Inshore	31,000	at MSY
Lake Malawi Demersal Stock	8,500	at MSY
Lake Malawi Pelagic Stock	14,000	11,000mt from ADB Project targets and 3,000mt already harvested by various sectors
Lake Malombe	7,000	at MSY
Lake Chiuta	2,500	at MSY
Lake Chilwa	10,000	1976 – 1999 average
Lower Shire	5,000	1976 – 1999 average
Total	***78,000***	

Source: ADiM Working Paper No.1

Table A9 Fish production in Malawi, Capture fisheries 1980-2000

Year	Total catch	Tilapiines
1980	49.0	21.2
1981	51.9	19.0
1982	58.9	21.6
1983	62.3	20.6
1984	58.9	22.6
1985	58.1	21.2
1986	68.4	22.8
1987	69.2	18.7
1988	60.4	17.0
1989	64.8	15.1
1990	76.6	13.1
1991	59.4	13.7
1992	60.9	10.8
1993	52.5	9.5
1994	56.1	7.5
1995	41.5	5.0
1996	52.4	3.4
1997	43.3	2.9
1998*	**50.3**	**5.3**
1999	48.2	7.2
2000	**55.9**	**7.2**

Source: ADiM Working Paper No. 1

Table A10 List of major aquaculture related projects in the past and present in Malawi

Project	Duration	Objectives	Main activities and Achievements
FAO Kasinthula Project (FAO)	1970-1976	Demonstrate commercial viability of aquaculture in Malawi	Main activities: ▪ Construction of ponds and offices at Kasinthula ▪ Research on *O. mossambicus, O. shiranus, T.rendalli* and *O. karongae* as suitable candidates for aquaculture. ▪ Introduction of Chinese and Common Carp Main achievements: ▪ Introduction of common carp. ▪ Successful stimulation of commercial aquaculture at Kasinthula and SUCOMA ▪ Use of *O. mossambicus* and common carp at the Domasi
ICLARM/ GTZ Aquaculture Project (ICLARM/GTZ)	1986-1995	Through collaborative biological and socioeconomic research to develop and demonstrate a more appropriate system for aquaculture in Malawi and to develop Domasi as the lead research centre	Main activities: ▪ Development of National Aquaculture Centre infrastructure. ▪ Development of low-tech farming technologies. ▪ High level staff training. ▪ On-farm/On-station farmer participatory Research and Development Major achievements: ▪ Development of aquaculture research facilities. ▪ Six staff trained from B.Sc. to M.Sc. levels. ▪ A basket of technologies defined for dissemination to farmers through extension service. ▪ Establishment of a library and information service for aquaculture. ▪ Development of R&D protocols and technologies for fish farming experimentation. ▪ Initiation of Research Extension Teams (RET) and training of extensionist in RESTORE field data collection from farmers. ▪ Introduction of seasonal fish farming in small water bodies (Thamandas in the Lower Shire). ▪ Initiation of selective breeding of tilapias at NAC
Mulanje/ Phalombe ODA Project (British ODA)	1987-1990	Mitigate large deficit in animal protein consumption in the district by demonstrating and stimulating integrated aquaculture-agriculture practices	Main activities: ▪ Construction of a station at Chisitu. ▪ Promotion of integrated fish farming practices and training of farmers Main achievements: ▪ Established 146 fish farming families producing an estimated 2 tonnes /ha per family per annum in 1992. ▪ Trained Fisheries Department personnel to continue the work after completion of the project

Project	Duration	Objectives	Main activities and Achievements
Malawi-German Fisheries and Aquaculture Development Project: MAGFAD (ICLARM/GTZ)	1989-1995	To improve the standard of living of fisheries and fish farming communities	Main activities: ▪ Test integrated aquaculture systems. ▪ Develop extension methods and materials. ▪ Develop and test potential "estate" (commercial) aquaculture models Major achievements: ▪ Aquaculture staff trained through short courses, in-service training and study tours abroad. ▪ Development of extension aids. ▪ Fish farming promoted and small scale farmers trained in aquaculture techniques.
Central and Northern Regions Fish Farming Project: CNRFFP (EU)	1989-1995	Phase 1 - Establish the technical and economic parameters for developing fish farming in the Central and Northern regions of Malawi. Phase 2 – Not implemented	Main activities: ▪ Establish cost-effective extension service. ▪ Train farmers ▪ Train Fisheries Department staff. ▪ Determine the technical and economic viability of fish farming. ▪ Evaluate the potential for small water body development. Major achievements: ▪ Major infrastructure development (regional headquarters and nine satellite stations). ▪ Extension service operational in 10 areas servicing 1,600 farmers spanning 2/3 of the country. More than 500 farmers trained. ▪ Viability demonstrated by 25 pond trials and 2 independent consultancies. ▪ Assessment of potential development of small water bodies completed.
Border Zone Development Project (BZDP)	1996 to present	The aim of the aquaculture component of this multifaceted development project was to enhance pond production through improved management and the integration of fish farming with other agricultural activities in the Nchenachena, Mpompha and Livingstonia areas	Main activities: ▪ Selection of a core group of farmers for participation ▪ On farm participatory trials ▪ High level extension and farmer club formation ▪ Promotion of record keeping ▪ Farmer training in integrated agriculture technologies through workshops and on farm demonstrations ▪ On farm catfish spawning Major achievements: ▪ Fish production of core group of farmers significantly enhanced through farm integration

Project	Duration	Objectives	Main activities and Achievements
Project on Aquaculture Research and Technical Development of Malawian Indigenous Species (JICA)	1999 to present (Continuation from Research Project for Small Scale Aquaculture of Malawian Local Species implemented b/w 1996-1999)	Screen indigenous cyprinids for suitability in aquaculture and to promote on farm cooperative research	Main activities: ▪ Development of hatchery and office infrastructure at NAC ▪ Rehabilitation of Kasinthula facilities. ▪ Staff and farmer training ▪ Development of breeding/hatchery techniques for indigenous cyprinids (Mpasa, Ntchira, Ningwi, Thamba, Kadyakolo) ▪ Development of suitable feeds and appropriate rearing techniques for the new species and current species. Major achievements: ▪ On-going major infrastructure development at NAC, comprising hatchery, offices and laboratories, guest house and staff houses. ▪ Hatchery techniques for cyprinids have been defined and mass fingerlings are being produced. ▪ Feeds have been developed for different sizes of fish and rearing techniques for current and new species are being developed. ▪ Initiation of GMIT (all male tilapia production) experiments. ▪ Initiation of on-farm trials and continuation of integrated on-farm fish farming
National Aquatic Resource Management Programme: NARMAP (GTZ)	1998/9-2002	To secure the sustainable utilisation of fisheries resources in Malawi through the establishment participatory fisheries management	Main activities: The project provided assistance to the DoF at three levels to achieve its objectives: (1) An Management and Evaluation (M&E) advisor was stationed at DoF headquarters; (2) A research and fisheries management advisor was stationed at the Fisheries Research Unit of DoF in Monkey Bay; and (3) an extension advisor was stationed at the Mangochi Fisheries Office

Source: ADiM Working Paper No. 2

Table A11 Existence of fish farmers and ponds by Districts

District	Number of fish farmers	Number of ponds
[Northern Region]		
1. Chitipa	84	n.a.
2 Mzimba	480	567
3 Mzuzu	137	n.a.
4 NkhataBay	386	443
5 Rumphi	430	667
Sub-total	*1,517*	n.a.
[Central Region]		
6 Dedza	185	216
7 Dowa	179	n.a.
8 Mchinji	40	n.a.
9 Nkhotakota	305	221
10 Ntchisi	111	156
11 Ntcheu	102	116
Sub-total	*922*	n.a.
[Southern Region]		
12 Balaka	31	45
13 Chikwawa	72	n.a.
14 Machinga	2	n.a.
15 Mangochi	116	n.a.
16 Mulanje	232	n.a.
17 Mwanza	265	n.a.
18 Phalombe	54	n.a.
19 Thyolo	1200	n.a.
20 Zomba*	*327	n.a.
Sub-total	*1,972*	n.a.
TOTAL	***4,411***	***n.a.***

Remarks: *It is underestimated. Estimation by JICA Study Team counts over 500 fish farmers in Zomba District.
Source: Worldfish Center and DoF (2003)

Table A12 Potential production from small-holder farmer

Year	The annual increase rate of pond (15%*)		
	Number of ponds	15kg/200m^2 0.75mt/ha (mt)	45kg/200m^2 2.25mt/ha (mt)
2003	4,000	60.0	180.0
2004	4,600	69.0	207.0
2005	5,290	79.4	238.1
2006	6,084	91.2	273.8
2007	6,996	105.0	314.8
2008	8,045	120.7	362.0
2009	9,252	138.8	416.4
2010	10,640	159.6	478.8
2011	12,236	183.5	550.6
2012	14,072	211.1	633.2
2013	16,182	242.7	728.2
2014	18,610	279.1	837.4
2015	21,401	321.0	963.1
2016	24,611	369.2	1,107.5
2017	28,303	424.5	1,273.6
2018	32,548	488.2	1,464.7
2019	37,430	561.5	1,684.4
2020	43,045	645.7	1,937.0
2021	49,502	742.5	2,227.6
2022	56,927	853.9	2,561.7
2023	65,466	982.0	2,946.0
2024	75,286	1,129.3	3,387.9
2025	86,579	1,298.7	3,896.1

Remarks: *The annual increase rate of pond is estimated as 15%, according to the calculations based on the socio-economic survey results JICA, 2003.

Table A13 Share of fish sales in total cash income at Mawila and Limbikani farmers' clubs in Zomba District

	Limbikani**	Mawila**	Malawi**	Average
HH who has sold fish within the year (%)	66.7%	37.5%	45.2%	
Total cash income/yr* (MK)	16,253	19,677	21,071	
Total cash income from fish farming/yr* (MK)	1,640	1,736	3,470	
% of income from fish farming in total income/yr* (%)	10.1%	8.8%	16.5%	11.8%

Remarks: *for those who sold fish only, ** sample size: Limbikani (Feb. 2004)- 28; Mawila (Feb. 2004)- 24; Mawila (Feb. 2005)- 31

Source: ADiM National socio-economic survey (2003), ADiM Pilot Project evaluation survey (2005)

Table A14 Gender ratio of fish farmer

Unit: % (Number)

	National Census*	ADiM National socio-economic survey,2003			
	Population	0-19kg* fish farmer	20-59kg* fish farmer	60kg* fish farmer	Number of Respondent
Male	51%	92% (223)	91% (42)	100% (20)	404
Female	49%	8% (20)	9% (4)	0% (0)	47

Remarks: National Census was implemented in 1998. *The amount of fish harvest in last two years.
Source: NSO (2002). ADiM National socio-economic survey (2003)

Table A15 DoF staff qualification

Post	Grade	Qualification
Fisheries Scout	SCIII*	MSCE
Fisheries Assistant	TA**	MSCE + Certificate in Fisheries Management
Senior Fisheries Assistant	STA***	Same as above
Assistant Fisheries Officer	TO****	MSCE + Certificate in Fisheries Management + Diploma in Fisheries Management
Senior Assistant Fisheries Officer	STO*****	Same as above
Fisheries Officer	PO******	MSCE + BSc (eg. Bunda College BSc in Aquaculture & Fisheries Science)
Senior Fisheries Officer	P8	Same as above
Principal Fisheries Officer	P7	BSc + MSc
Assistant Chief Fisheries Officer	P6	BSc + MSc
Deputy Chief Fisheries Officer	P5	BSc + MSc
Chief Fisheries Officer	P4	BSc + MSc
Deputy Director of Fisheries	P3	BSc + MSc
Director of Fisheries	P2	BSc + MSc

Remarks: *PBX Operator, **Technical Assistant, ***Senior Technical Assistant, **** Technical Officer, *****Senior Technical Officer, ******Principal Officer
Source: DoF (2004)

Table16 List of department of fisheries stations

	DoF Station	Region	District	Demonstration Pond			No. of DoF staff engaged in aquaculture	*(No. of staff engaged in aqua. Extension)
				Existence	Number	Total area (ha)		
1	Chisenga	North	Chitipa	○	4	0.04	1	(1)
2	Karonga		Karonga				3	(3)
3	Ntchenachena		Rumphi				1	(1)
4	Mphompha		Rumphi	○	4	0.10	1	(1)
5	Embangweni		Mzimba				1	(1)
6	Mzuzu		Mzuzu	○	43	1.20	6	(3)
7	Nkhatabay		Nkhata Bay				2	(2)
8	Limphasa		Nkhata Bay	○	21		1	(1)
9	Nkhotakota	Central	Nkhotakota				1	(1)
10	Sengabay		Salima				1	(1)
11	Lilongwe		Lilongwe				4	(4)
12	Kalira		Ntchisi	○	4	0.16	1	(1)
24	Mchinji		Mchinji				1	(1)
25	Ntchewu		Ntcheu				1	(1)
26	Dedza		Dedza				1	(1)
13	Mpwepwe	South	Mangochi	○	3	0.04	1	(1)
14	Mangochi		Mangochi				1	(1)
15	Namwera		Mangochi	○	5	0.07	0	0
16	Domasi		Zomba	○	85	5.00	16	0
17	Zomba		Zomba				3	(3)
18	Chinseu		Zomba	○	12	1.00	1	(1)
19	Chisitu		Mulanje	○	15	2.00	3	(3)
20	Thyolo		Thyolo				1	(1)
21	Kasinthula		Kasinthula	○	12	0.75	2	(2)
22	Kunenekude		Mwanza	○	5	0.20	1	(1)
23	Neno		Mwanza	○	1	0.03	0	0
27	Blantyre		Blantyre				1	(1)
28	Machinga		Machinga				1	(1)
29	Bangula		Nsanje				1	(1)
30	Phalombe		Phalombe				2	(2)
	TOTAL			***13***	***214***	***10.59***	***60***	***(41)***

Remarks: *Out of 60, 41 fisheries officers are engaged in Aquaculture extension.

Table A17 Number of graduates from the department of aquaculture and fisheries science, Bunda College of Agriculture 1997-2005

Unit: persons graduated

Academic Year	Bachelor of Science*	Master of Science**
1997-1998	11	-
1998-1999	13	-
1999-2000	2	-
2000-2001	6	-
2001-2002	10	-
2002-2003	9	3
2003-2004	18 (projection)	4
2004-2005	17 (projection)	Not available

Remark: *Agriculture with Aquaculture Optional. **Aquaculture and Fisheries Science
Source: Bunda College

Table A18 Licenses required to start aquaculture

	Sort of fish farmer or pond size is required to obtain one	Procedure required	By whom is the license issued	Current problems
Right to land	Depends on the type of land utilized. You may not pay if it is customary land or you can lease the land It may depend on the location as well. You may pay land rates if you are operating in peri-urban or urban areas. But it is not mandatory to pay for the land if you are to start fish farming.	Fill application forms to Ministry of Lands, Surveys and Physical planning The site is surveyed and upon successfully confirmed you are issued a title deed (applies to lease land only)	Ministry of Lands, survey and Physical Planning	Beauracratic procedures make the process to be un-necessarily long.
Right to access water	Any obstruction of water for fish farming of any pond size requires a license	Apply to Ministry of Water Development for approval		This requirement is not reinforced and is not usually done. Currently There is Water Resources Board that monitors this.
Aquaculture license	Fish farm of no less than 4 ha	Application to the Director of Fisheries	Licenses are currently issued by DoF through Reinforcement office of Extension section	
EIA	Fish farm of no less than 4 ha	Application to the department of Environmental Affairs		It sometimes takes un necessarily too long period to complete.

Source: DoF information compiled by JICA ADiM Study Team (2003-2005)

Table A19 Recurrent Budget of DoF

Unit: MK

	Fiscal Year 2001/02	Fiscal Year 2002/03	Fiscal Year 2003/04	Fiscal Year 2003/04
DoF Total (USD)	35,357,817 (USD 437,597)	71,493,585 (USD 884,821)	115,550,325 (USD 1,430,078)	133,368,860 (USD 1,650,604)
NAC/ Mzuzu* Fisheries Office (USD)	3,158,819 (USD 39,094)	6,935,223 (USD 62,905)	14,031,857 (USD 173,661)	16,735,269 (USD 207,120)
Proportion of NAC/ Mzuzu* Fisheries Office	8.9%	9.7%	12.1%	12.6%

Source: DoF information compiled by JICA ADiM Study Team (2003-2005)

Table A20 Sources of information for fish farming by category

Unit: %

Status	No Harvest	0-19	20-59	60+	New	Ex Fish farmer	ALL
Family member	6.3	5.7	8.5	20.0	4.5	5.9	8.4
Discussion w/ neighbours	30.4	24.1	31.9	40.0	9.1	5.9	23.5
Observation of neighbours	34.2	42.4	44.7	25.0	31.8	26.5	34.1
Farmers club	21.5	13.9	21.3	25.0	13.6	0.0	15.8
Extension officer	57.0	52.2	72.3	70.0	63.6	29.4	57.4
Project	16.5	28.2	14.9	25.0	27.3	0.0	18.6
Reading material	0.0	2.0	6.4	0.0	4.5	0.0	2.1
Radio	25.3	22.0	31.9	40.0	9.1	2.9	21.8
School	3.8	2.4	0.0	5.0	9.1	2.9	3.8
Training	13.9	14.3	34.0	30.0	13.6	2.9	18.1

Remarks: Multiple answers was accepted in this question.
Source: ADiM National socio-economic survey (2003)

Table A21 List of loans and credit providers in Malawi

Category	Providers	References
Government	**- Not directly involved but through projects and donors**	
	One village one product (OVOP), co-supported with Japanese and Thailand Governments	Promotes production and processing of products of potential economic advantage in an area by providing technical and financial support to increase production and/or processing of that product in the area
	Rural Development fund, funded by Malawi Government	Work with farmers' groups
	Agricultural Production & Investment Project (APIP)	Loan facility smallholder farmers on input (fertilizer and seed) and at rganizati prices
	Malawi Rural Finance Company financially supported by European Union for rural area business loan schemes	Seed and fertilizer loan through Malawi rural finance cooperation
	Highly Indebted Poor Country (HIPC) Scheme	Treadle pump on loan/ Small livestock on 'Pass-on' programme
	Targeted Input Programme (IIP)	Non returnable input supply by Government (starter pack)/ Small fertilizer (25kg) and seed (10kg) package
	IFAD Project (International Fund for Agricultural Development)	Flood plains integrated irrigation project (irrigated crop/fingerlings supply)/ Horticultural Development Project for vegetable farmers/ Malawi agricultural Sector Investment Programme/ Horticultural and food crops Development Project (World Bank) food security Programme
	Emergency Drought Recovery Project funded by Malawi Government and World Bank	Implement projects for drought solution
NGO	World Vision International	Christian NGO involved in promoting development and relief programmes
	Total Land Care	A USAID supported NGO promoting increased land resource productivity such as crop yields by proper utilization of soils,water, vegetation and inputs such as fertilizer, water pumps, seed, livestock for farmers. Also provides inputs on loan.
	Land resource conservation	USAID supported NGO promoting conservation of land resources such as soil, water and vegetation – works together with Total Land Care
	Harvest help / find your feet	Work with rural community to increase agricultural output through provision of expertise and some facilities
	Malawi Enterprise Zone Association	NGO to promote Malawian businesses with technical expertise and source funding

	Action Aid	Work with rural communities to improve livelihood- education, agriculture and advocancy
	AFRICARE	Like Action Aid but include rural infrastructure such as roads
	Concern Universal	Supports NGO's working in food security, disaster relief and assistance in rural needs such as water supply
	OXFAM	Works with communities in Food security, Natural Resources management and Advocancy such as HIV/AIDS prevention – also supports NGO's
	Danish Church Aid	Food security
	Nkhoma, Livingstonia and Blantyre Synods of the C.C.A.P Church	Christian work and helps in rganizatio and relief needs of people such as irrigation, fertilizer supply and water pumps and provison of food and clothing to natural disaster victims.
	Irrigation and food Programme	Promotes irrigation for food curity
	Catholic Agricultural Development Commission in Malawi (CADECOM)	Activities of Catholic Church promoting agricultural production by initiating and supporting projects such as irrigation, livestock production with experise and capital
	Horticultural Development of Malawi (HODOM)	Vegetable group loans
Private company	MWASACHO (Private Company)	Provides agricultural inputs to group of farmers on loan
Association	National Smallholder Farmers Association of Malawi (NASFAM)	
Financial institution	Malawi Rural Finance Company	Provides loans and advice for commercial and agricultural businesses at annual interest repayment
	Malawi Union of Savings and Credit Corperatives (MUSCO's)	Mother body of Savings and Credit Corporatives by volunteer members of institutions or groupings of people
	Banks	Restricted to large-scale farmers
	New Building Society Bank	One of the banks in Malawi with low minimum individual cash balance
	Foundation International Community Assistance (FINCA)	Provide loans for small-scale farmers, weekly payment

Source: Compiled by JICA ADiM Study Team (2003-2005)

Table A22 Access to tax and import duty subsidy or exemption

Subjected to tax/duty exemption	Individuals/ rganization who are subjected to tax exemption	Notes
Tax/duty exemption for agricultural business and related commodities	Farmers and Farmers' Associations	Farmers individually apply for his/her business to be registered. The application can be made for tax/duty exemption through "food security" and "poverty reduction" national framework. Farmers need to submit their 2 year tax returns for assessment. The returns should have all tax balances set (no credit) such as provision tax, pay as you earn tax, and withholding tax. These documents should be accompanied with a letter of application (and filled forms – obtainable from MRA) for tax refund. The MRA supervisor will assess the forms and tax refunds and/or exemption is normally effected.
Tax/ duty exemption on imported goods (e.g. agricultural machinery are tax-free)	Farmers, Farmers' Associations and importing agents	Farmers register with MRA based on the nature of the imported goods.
Tax/ duty exemption on fish and other agricultural products unless processed	People engaged in agriculture/ aquaculture business	Process of exemption facilitated when farmers are in association
Tax reduction or refund	Ones who make a contribution for reduction in unemployment	Also refunded in case of having been overtaxed or wrongly taxed ie academic organization, donor funded agencies,none profit making or religious activities.
Exemption on provisional tax on income	People whose annual taxable income is less than MK 60,000 per annum (used to be MK 36,000)	
Non-profit making goods/businesses	NGOs & religious and charity organisations	NGO can use the NGO surtax exemption arrangements for promotion of aquaculture development.
Goods imported through donor funded projects	Donors	Development projects supported by donors can apply for the surtax exemption arrangements.
Materials and equipments used under the project/ import duty	Academic organizations	E.g. Bunda College can collaborate with farmers and MRA on behalf of farmers on imported inputs.

Source: Compiled by JICA ADiM Study Team (2003-2005)

Table A23 Malawi College of Fisheries – List of Graduates since 1995

1. Certificate in Fisheries Management, Pre-service Course (2-year course)

Unit: person graduated

		1995-1997	1999-2000	*2002-2003
Total Number of Graduates*		18	23	14 (projection)
Current Position at DoF	Aquaculture	3	11	
	Capture Fisheries	9	7	
	Capture Statistics	0	1	
	Marine Engineering	0	0	
	Enforcement	0	2	
	Retired	0	0	
	Resigned	2	1	
	Deceased	2	0	
	Unknown	2	0	
	Others	0	1	

Remarks: They Graduated as Fisheries Technical Assistants

2. In-service Course Upgrading course (6-month course)

Unit: person graduated

Year		1995-1996	2000-2001
Total Number of graduates		11	12
Current Position at DoF	Aquaculture	1	4
	Capture Fisheries	2	6
	Capture Statistics	0	0
	Marine Engineering	2	1
	Enforcement	0	0
	Retired	2	0
	Resigned	0	0
	Deceased	4	1
	Unknown	0	0
	Others	0	0

Remarks: They Graduated as Fisheries Technical Officers

3. Special Course (2002)

- Special course for 10 Namibian students for Inland Fisheries Course with emphasis on Aquaculture for 6 months. The students graduated with a Certificate in Inland Fisheries

4. Other Courses

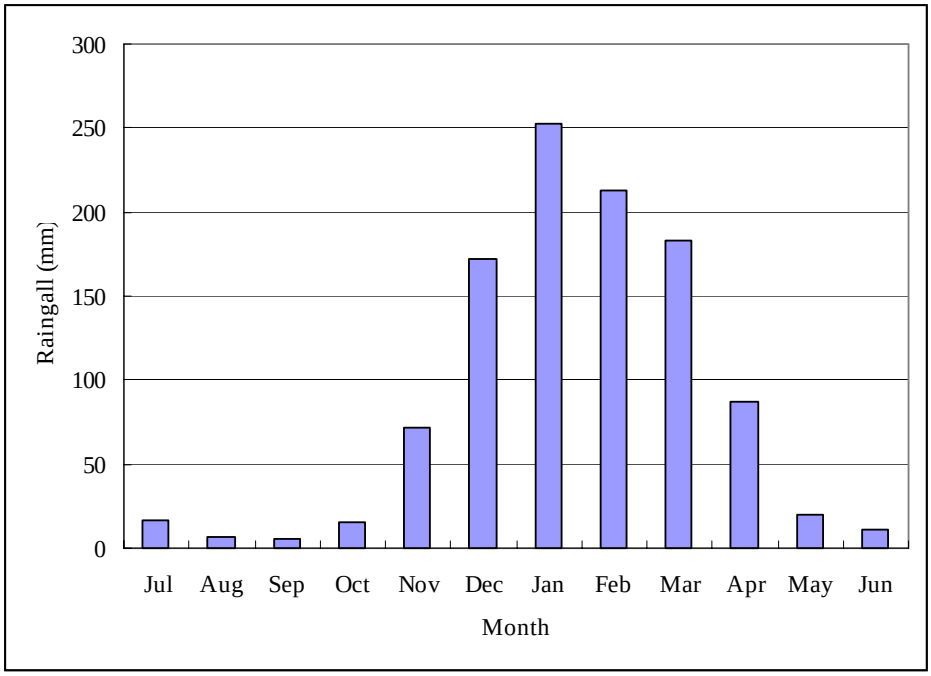
(1) Specialized courses earmarked for resource users such as:
-Post Harvest Technology for Fish Processors
-Outboard engine use & maintenance for fishers

Source: Malawi College of Fisheries

Table A24 Dissatisfactions of farmers with their fish farming

Items	Answer (person)	Share (%)	Comment
Satisfied with fish farming	258	63.9	7.9% person had no answer
Dissatisfied with fish farming	114	28.2	
[Reasons]			
Better species needed	**8**	**3.2**	Dissatisfaction regarding to fish growth (Sub-total: 28.1%)
Fish don't grow	**62**	**24.9**	
No harvest	23	9.2	
Lack finances	12	4.8	
Lack technical support	24	9.6	
Predation	18	7.2	
Inadequate water	11	4.4	
Small pond	**49**	**19.7**	Dissatisfaction regarding to fish pond (Sub-total: 24.1%)
More ponds	**8**	**3.2**	
No pond	**3**	**1.2**	
Limited market	5	2.0	
Other	26	10.4	
Total	249	100.0	

Source: ADiM National Socio-economic survey 2003

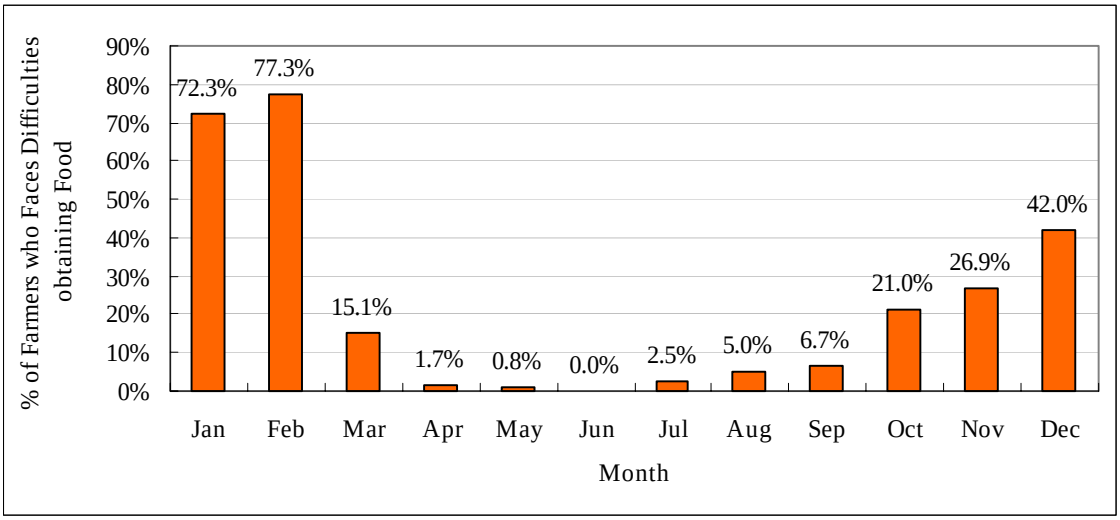


Unit: mm

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Northern Region													
1 Chipata	0	0	0	1	53	163	186	235	208	60	4	0	910
2 Karonga	3	0	0	2	31	147	147	130	217	164	22	0	863
3 Nkata Bay	65	23	10	15	57	173	215	223	331	347	118	48	1,625
4 Mzimba	1	2	1	4	72	119	253	183	155	24	10	0	824
5 Muzuz	37	15	7	20	53	128	205	165	238	156	33	14	1,071
Central Region													
6 Nkotakota	10	2	9	7	78	213	312	256	292	122	31	10	1,342
7 Salima	1	0	1	5	27	190	274	301	233	70	16	1	1,119
8 Chitendze	0	0	3	11	70	168	243	176	148	31	2	1	853
9 Deza	2	0	1	12	85	156	253	200	154	46	3	0	912
South Region													
10 Mangochi	2	4	2	11	35	154	195	141	152	44	3	1	744
11 Makoka	3	2	3	19	68	193	238	202	145	44	2	3	922
12 Chichiri	6	4	9	28	94	210	300	256	152	92	9	12	1,172
13 Chileka	1	0	2	24	94	158	235	222	105	37	4	2	884
14 Bvumbwe	29	14	4	22	90	203	311	250	169	55	12	13	1,172
15 Thyolo	35	14	15	20	95	202	338	262	180	76	26	23	1,286
16 Ngabu	26	7	4	19	75	155	241	184	87	44	11	13	866
17 Misoma	60	29	20	39	131	247	356	259	244	124	49	38	1,596
18 Makhanga	16	7	8	10	74	115	244	191	91	24	10	14	804
National Average	***17***	***7***	***6***	***15***	***71***	***172***	***253***	***213***	***183***	***87***	***20***	***11***	***1,054***
Share by month (%)	**2**	**1**	**1**	**1**	**7**	**16**	**24**	**20**	**17**	**8**	**2**	**1**	**100**

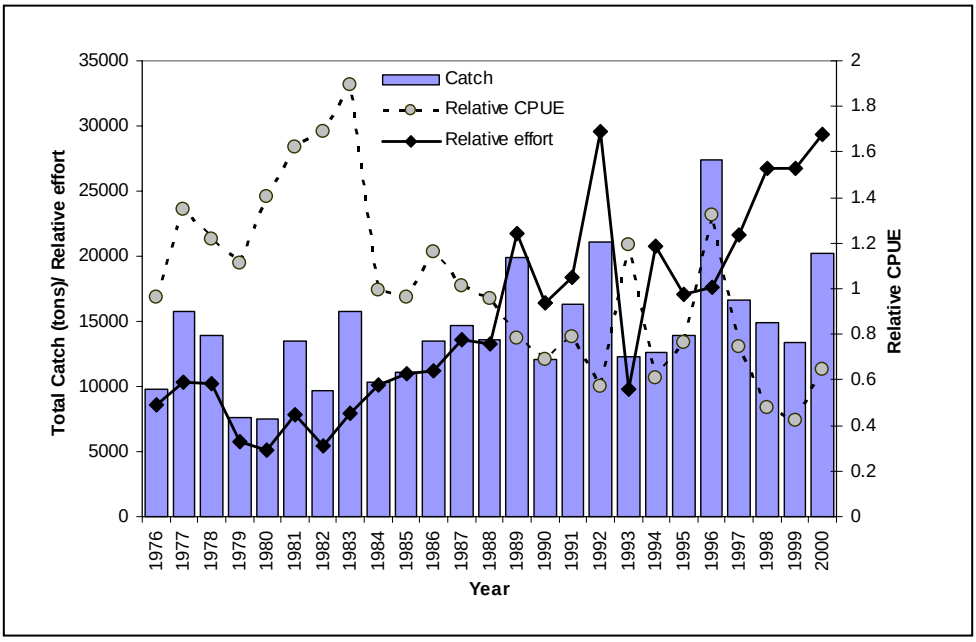
Source: NSO (2002)

Figure A1 National average monthly rain fall 1992-2001



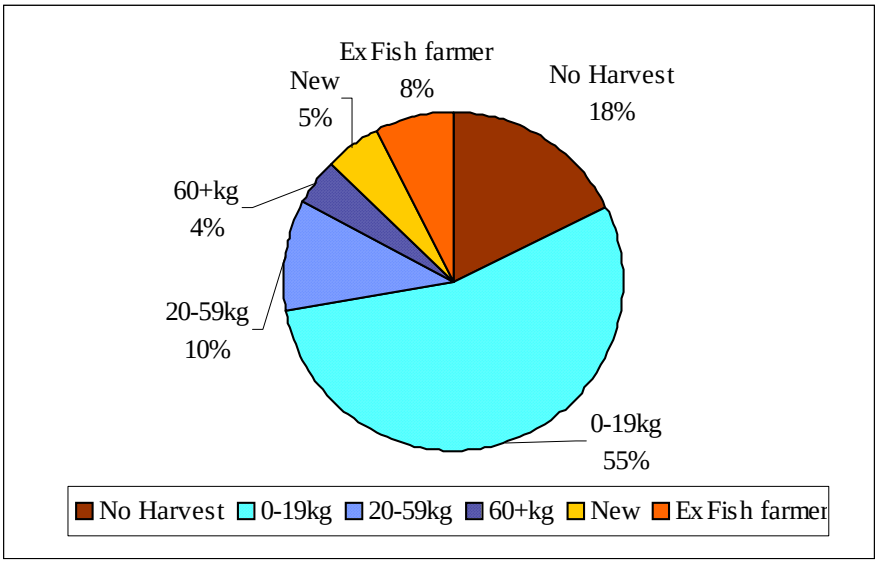
Source: ADiM Pilot Project evaluation survey (2005)

Figure A2 Farmers who face difficulties obtaining food in respective month



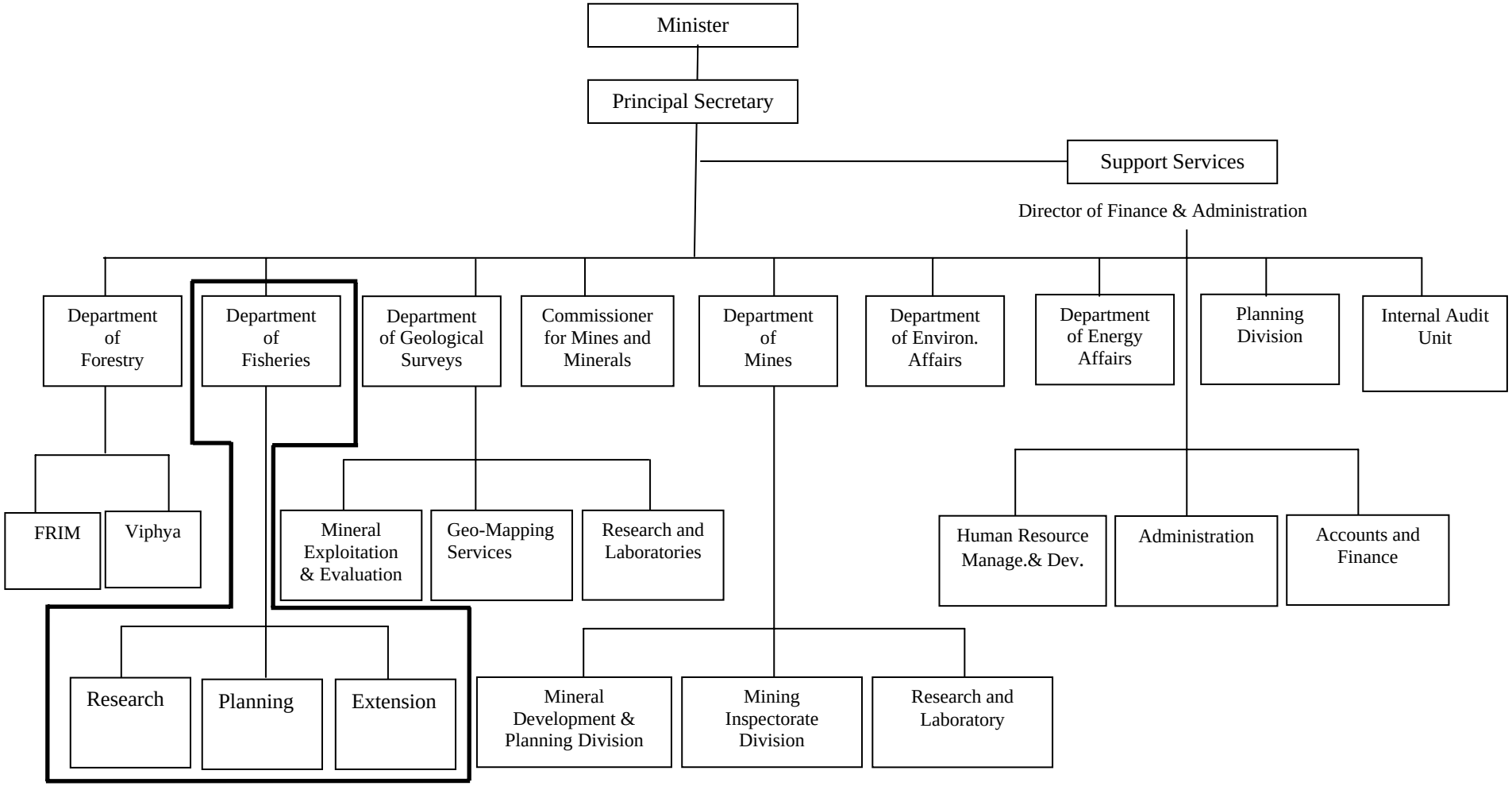
Source: ADiM Pilot Project evaluation survey (2005)

Figure A3 Total catch (tons) small scale fishery of southern Lake Malawi, and relative effort and CPUE calculated for a combination of gill nets, beach seines and open water seines from 1976 to 2000 in southern Lake Malawi



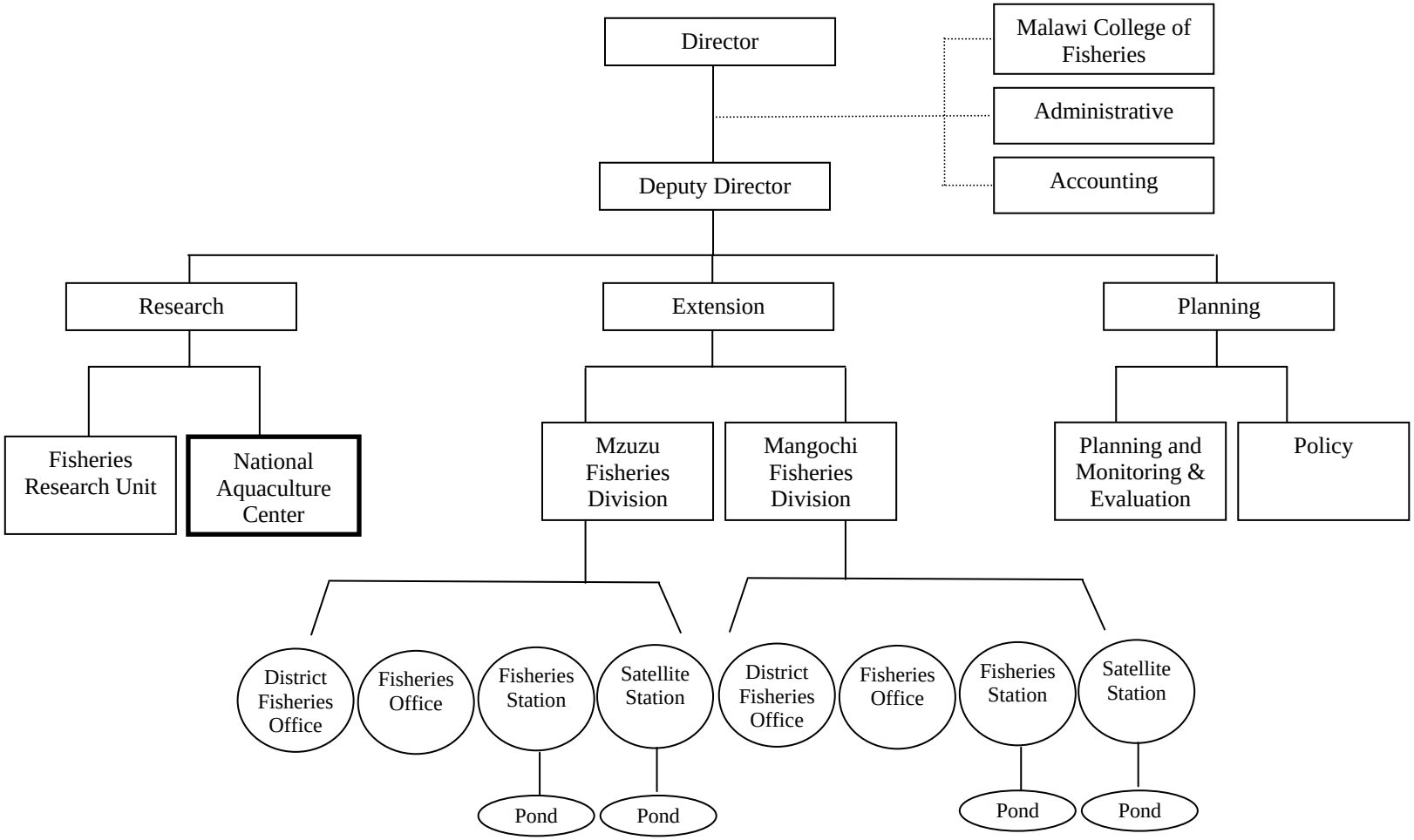
Remarks: Production level is categorized according to the production amount during last two years
Source: ADiM National socio-economic survey (2003)

Figure 4 Composition of fish farmers by production level



Note: Department of Fisheries is indicated in ☐ . Manage=Management, Environ=Environmental, Dev.=Development
Source: DoF information compiled by JICA ADiM Study Team (2005)

Figure A5 Organisational chart of Ministry of Mines, Natural Resources and Environment



Remarks: Under extension Mzuzu Fisheries Division Office is controlling Northen Region and Mangochi Fisheries Division is controlling Southern Region
Source: DoF information compiled by JICA ADiM Study Team (2005)

Figure A6 Organisational chart of Department of Fisheries

	World Vision Malawi	Oxfam	Action Aid	CARD	Concern Universal	CARE International	Christian Service Committee	CIPRA International	US Peace Corps	COMPASS
[Sector]										
Aquaculture	●	●	●	●	●	●	●	●	●	●
Agriculture	○	○	○		○	○	○			
Food & Nutrition	○	○	○			○	○			
Education		○				○				
Health	○	○				○	○			
CCB		○	○				○			
Water & Sanitary							○			
Environment					○					
Health					○					
[Northern Region]										
Chitipa	●		●							
Karonga										
Rumphi									●	
Mzuzu										
Mzimba			●							
Nkhata Bay	●		●							
[Central Region]										
Kasungu	●									
Nkhotakota	●									
Ntchisi	●		●							
Mchinji	●			●						
Dowa										
Salima										
Lilongwe	●					●		●		
Dedza					●					●
Ncheu										
[Southern Region]										
Mangochi										●
Balaka										
Machinga										
Zomba	●									●
Mwanza			●							
Blantyre										
Chiradzulu										
Phalombe			●				●			
Chikwawa										
Thyolo	●	●								
Mulanje	●	●								●
Nsanje										

Remarks: COMPASS and U.S. Peace Corp is not NGO

●: Aquaculture activities ○: Other activities

Source: CURE, Annual Report (2002)

Figure A7 Activities of major NGOs by sector and district

Donor	Country assistance strategy	Priority sector	Possibility of fisheries sector support	Experience in fisheries support	Scheme for private business
	○: exist ×: non exist		○: possible △: part of others ×: difficult	○: exist ×: non exist	○: exist ×: non exist
USAID	○	Education Health Democracy	○		○
JICA	n.a.	n.a.	n.a.	○	n.a.
GTZ	○	Education Health Good governance		○	×
NORAD	○	Health/HIV Good governance House Environment	△		×
DANIDA	Stopped assistance since 2004			○	n.a.
CIDA	○	Education Health Water	△ (as community development)	○	○
DFID	○	Agriculture/food Livelihood	△		○
ICEDA				○	
EU	○	Infrastructure Natural resources Public work	△ (as resources management)	○	○
UNDP	○	Health/HIV Good governance Poverty reduction	○	n.a.	○
FAO	n.a.	Agriculture/food Natural resources	n.a.	○	n.a.
IFAD	○	Agriculture/food Irrigation	n.a.	n.a.	n.a.
World Bank	○	Education Health Agriculture/food	○	○	○
ADB				○	

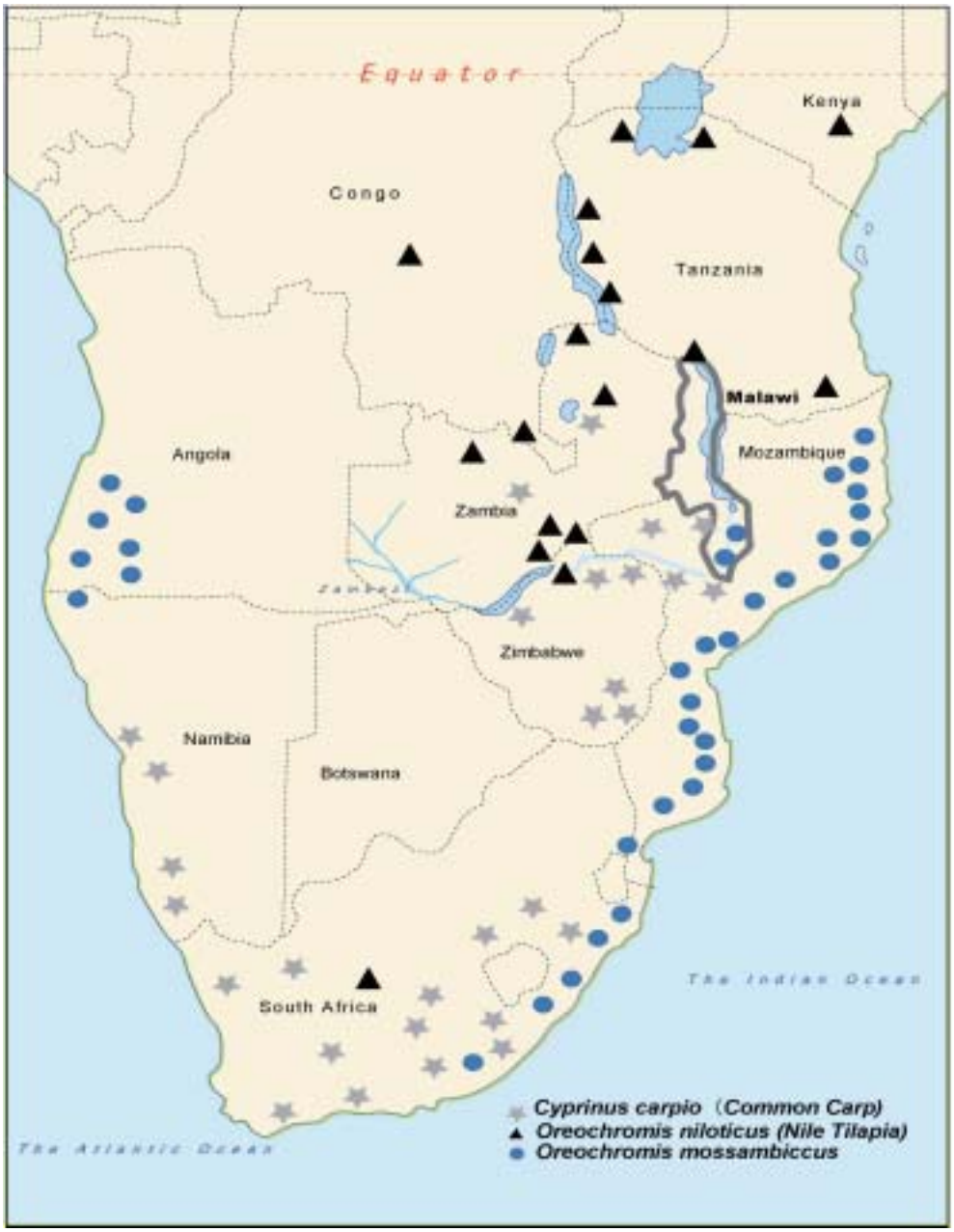
Source: Interview Survey by JICA ADiM Study Team (July 2003)

Figure A8 Major donor's policy on fisheries assistance

Kind of Technology			Interest (Low → High: 1 2 3 4 5 6 7 8 9 10)	Score*
1.	Fish pond construction and rehabilitation	Designing and construction of fish pond		8
		Designing and construction of the water canal		3
		Rehabilitation of pond/Deeper pond		2
2.	Controlling water losses in ponds	Sealing by organic matter/ Gleization		2
		Sealing by compacting		1
3.	Protecting pond and water canals against erosion	Protection of dikes and canals by vegetation		0
4.	Selection of fish and species	***O. Rendalli* (Tilapia)**		**9**
		O. karongae (Chambo)		**8**
		C. gariepinis (Mlamba)		**0**
		All male culture (hand sexing)		2
5.	Broodstock management	Genetic selection of high growth brood stocks		2
		Introduction new brood stocks		6
6.	Fertilizing fish ponds	Inorganic fertilizer in fish farming		7
		Organic fertilizer: animal manures		3
		Composting		6
7.	Fish feed and feeding	Different kind of feed		2
		Feeding rate & amount		1
8.	Integrating animal husbandry and Fish	Integrated chicken rearing (broilers)		0
		Integrated laying hens		5
		Integrated goats farming		3
		Integrated duck rearing		0
9.	Animal control	Controlling wild fish		4
10.	Record keeping, accounting	New record keeping form		2
11.	Fingering marketing	Sales marketing of fingerings		4

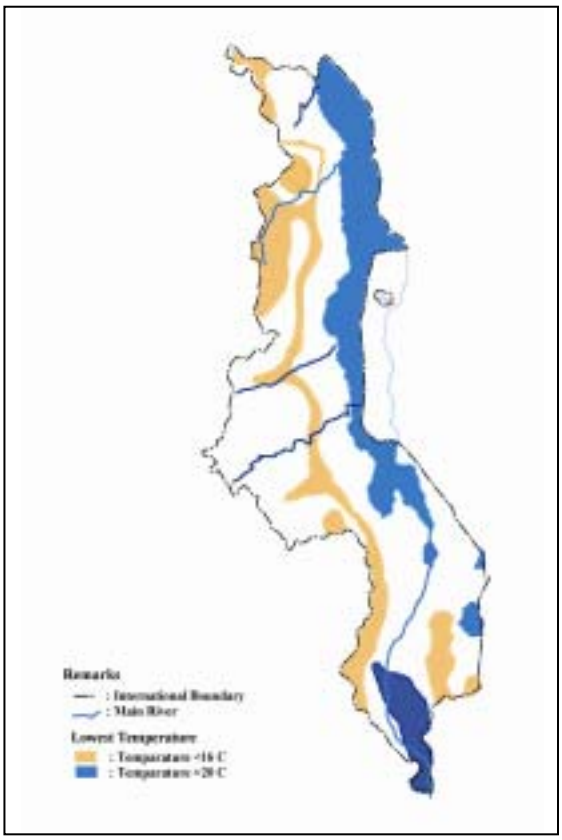
Remarks: Score shows the degree of interest
Source: JICA ADiM Study Team (2003)

Figure A9 Needs Assessment; expected aquaculture technology to be developed among Innovative Fish Farmers, 2003



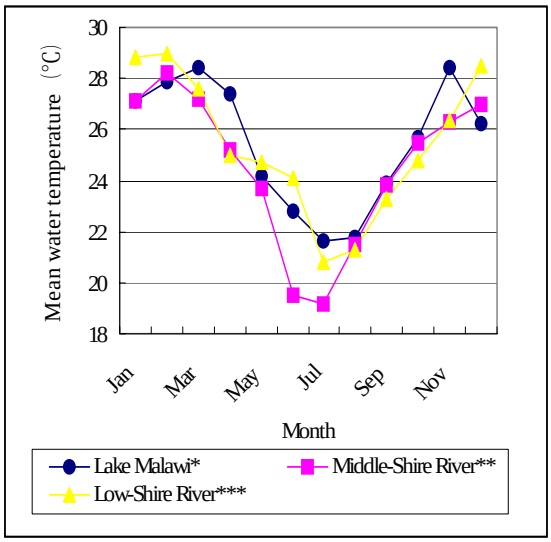
Source: DoF information compiled by JICA ADiM Study Team (2005)

Figure A10 Distribution of alien fish species in Southern Africa



Source: ICALRM (1991)

Figure 11 Warm area and cool area in Malawi



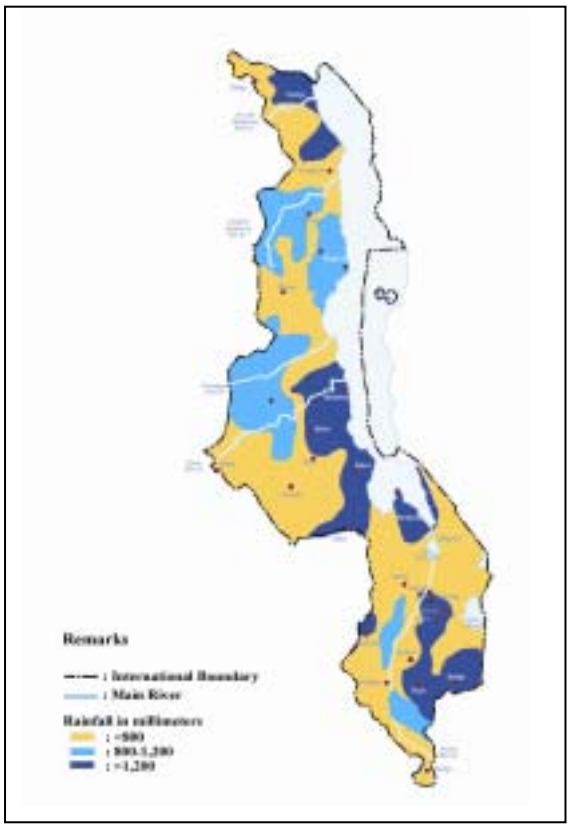
Remarks: * South east of Lake Malawi, ** Domasi, *** Kashinthula
Source: Balarin, J. D.1997

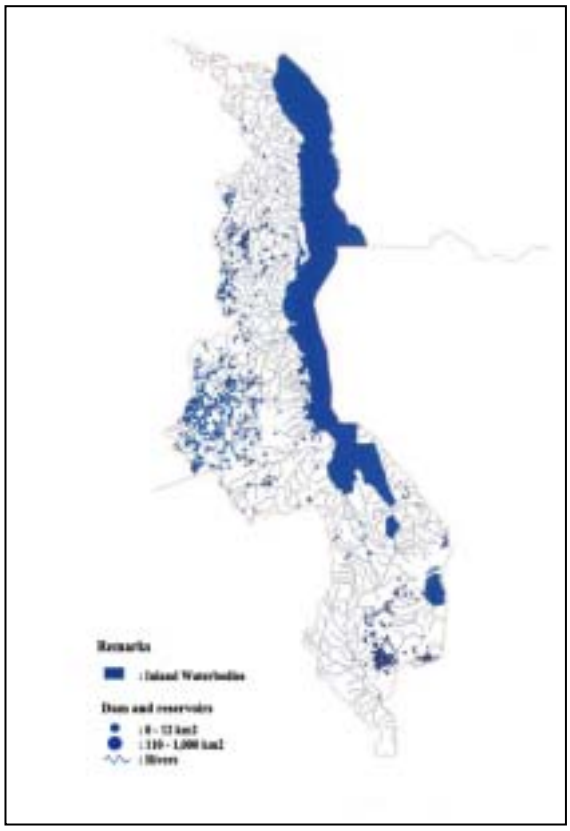
Figure A12 Mean water temperature of select locations

Water temperature

Previous several study suggested temperature affects fry production and fish growth in Malawi. Maluwa (1991) found maximum fry production of O. shiranus only achievable at temperature above 20C. At a temperature below 22C tilapia growth tends to decline dramatically and that a range of 25-27C is considered optimum (Balarin. 1997), then the best site would be those which are found in areas with the highest temperature all year round.

Lower Shire is well known as hottest in Malawi and only the land area where the average lowest temperature is above 20C year round. On the other hand, water temperature of the Lake Malawi also higher (above 22C) and suitable for aquaculture.





Source: ICALRM (1991)

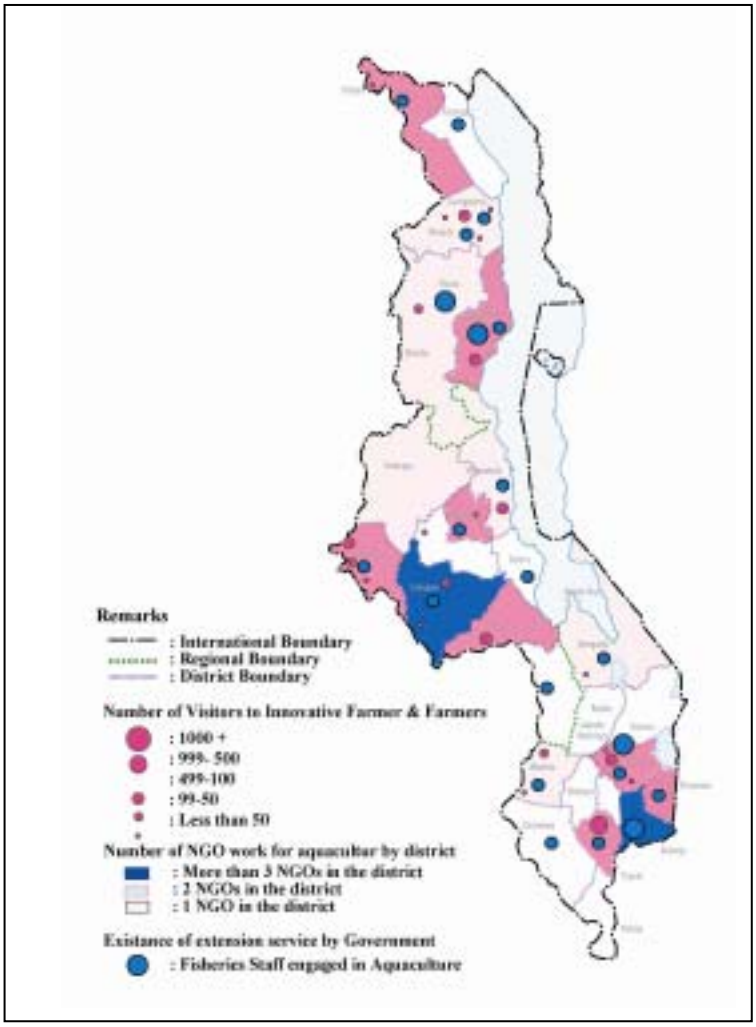
Figure A13 Water resource and rainfall

Figure A14 Distribution of Wetland

Water resources for fish farming in Malawi

Rainfall in Malawi varies 800-1,600 mm with national average of about 1,000 mm. Differences are not outstanding between three regions, but generally it increases at eastern side of mountains where is affected by monsoon and decrease at great valley, e.g. upper and lower Shire river. On the other hands, seasonal difference is distinct. The rainfall occurs during summer month between December and March. Rainfall of these month accounts for around 80% of annual rainfall. These rainfall pattern might affect fish production cycle especially for small-holder fish farmers who depends on water supply to rainfall.

There are many perennial large rivers and lakes in Malawi, such as Shire, Bwanje, Bua, Dwangwa, etc., while most of small rivers carry water only seasonally. For commercial fish farmers, these perennial rivers and lakes could be a very important factor in water suppling. On the other hands, for most of small-holder farmers, permanent water supplies tend to located only in Dambo (wetland). The occurrence of the Dambo is widespread in the country and fragmented. District with large areas wetland are Mzimba (Northern Region), Kasungu, Lilongwe, Mchinji, Dedza, (Central), Machinga, Chikwawa and Nsanje (Southern). The total area of Dambo is estimated to be between 480,000 ha and 600,000 ha (IFAD. 1998). Dambos are subject to customary tenure and often communal use and this makes difficult for individual farmer to access to suitable land for pond construction.



Source: JICA ADiM Study Team

Figure A15 Location of DoF offices and Major NGOs activities in aquaculture extension

Socio-economic setting for aquaculture development

Support services, such as information, fingerings, credit, etc. are critical factors for rural aquaculture. These services will be provided by not only DoF, but also by NGO and other successful farmers. Then the area where these provisions are found is the suitable for rural aquaculture. Currently there is 10 Districts where NGO support fish farming and at least 5 farmers/farmers club are very actively in farmer-to-farmer extension. These are Chitipa, Nkatabay (Northern), Kasungu, Dowa, Mchinji, Lilongwe (Central), Zomba, Mwanza, Thyolo, Mulanje Districts (Southern).

On the other hand, if DoF wish to provide the services efficiently, density of fish farmer is important factors. There is only two Districts where more than 500 fish farmers are located. These are Zomba and Thyolo Districts (Southern).

APPENDIX

Appendix 1 List of JICA ADiM study team and DoF counterparts

List of ADiM Study Team

	Title	Name	Institution
(1)	Project Manager	Mr. Sachio Yamamoto	System Science Consultants Inc.
(2)	Aquaculture Specialist	Prof. Thomas Hecht	Enviro-fish Africa Ltd
(3)	Fisheries Production/ Data Analysis Specialist	Dr. Olaf Weyl	Enviro-fish Africa Ltd
(4)	Fisheries Economist	Mr. Kouzo Baba	System craft Co. Ltd
(5)	Fisheries Economist	Dr. Tamotsu Tomiyama	System Science Consultants inc.
(6)	Community Development Specialist	Dr. Timothy Andrew	Enviro-fish Africa Ltd
(7)	Institution Specialist	Ms. Yuki Kobayashi	KIR International Corp.
(8)	Integrated aquaculture Specialist	Dr. Kenzo Utsugi	System Science Consultants Inc.
(9)	Project Monitoring	Ms. Yuki Niimura	System Science Consultants Inc.
(10)	Risk Assessment	Dr. Ibrahim Allahpichay	System Science Consultants Inc.
(11)	Coordinator	Ms. Chigusa Seki	System Science Consultants Inc.

DoF Counter Part

I Coordination Committee (Development of Strategies and Planning)

	Title	Name	Department
(1)	Coordinator	Mr. Alexander Bulirani	Deputy Director, HQ
(2)	Fisheries Socio-Economist	Dr. Steve Donda	CFO* Planning, HQ
(3)	Extension and Training	Mr. Orton Kachinjika	CFO* Extension, HQ
(4)	Fisheries Aquaculture Research	Dr. Moses Banda	FRU
(5)	Aquaculture Technologies	Mr. Alfred Maluwa	NAC

Remarks: This committee will be composed of above Malawian Counterpart and JICA ADiM Study Team Members.
*Chief Fisheries Officer

ii Administrative and General Counterparts

	Position	Name	Department
(1)	National Project Coordinator	Mr. Brino. B. Chirwa	HQ
(2)	Regional Coordinator (Souht)	Mr. Sabstone Unyolo	NAC
(3)	Regional Coordinator (North)	Mr. Robert Jere	Mzuzu fish farm
(4)	Fisheries Officer	Mr. Meurice Makawira	HQ
(5)	Technical Officer	Ms. Ida Chimangeni	HQ

iii Field Counterparts

	Title	Name	Department
(1)	Coordinator	Ms. Jacqueline Kazembe	Malawi College of Fisheries
(2)	Counterpart	Mr. Dick Kachilonda	Malawi College of Fisheries
(3)	Counterpart	Mr. Timothy Njobvu	Malawi College of Fisheries
(4)	Counterpart	Mr. Max Ngochera	FRU

Appendix 2 List of participant in NASP planning process

Malawi

Ministry of Mines, Natural Resources and Environment

Mr.	H.	Chipongwe	Planning Officer
Mr.	R.	Kabwaza	Environmental affairs : Director
Mr.	D.	Katsunga	Minister
Mr	D,	Mia	Deputy Minister
Mr.	G.C.	Mkondiwa	Principal Secretary
Mr.	M.M.	Mononga	Principal Secretary
Mr.		Ndhlovu	Controller of Planning
Mr.	T.R.	O' Dala	Principal Secretary
Mr.	S.	Sita	PRO
Mr.	H.	Sidik	Deputy Minister

Department of Fisheries/ Ministry of Mines, Natural Resources and Environment

Mr.	D.	Banda	District MH
Dr.	M.	Banda	FRU
Mr.	D.D.	Bandula	HQ
Mr.	P.	Bato	Zomba Office
Mr.	J.	Bob	Mzuzu
Mr.	A.	Bulirani	HQ
Ms.	I.	Chimangeni	HQ
Mr.	J.Y.	Chimangeni	HQ
Mr.	B.B.	Chirwa	HQ
Mr.		Chirwa	Ntcheu
Mr.		Chirwa	District KA
Mr.		Chirwa	District CK
Mr.	J.	Collines	Training coordinator &public relations officer
Mr.	C.B.	Denis	Fisheries Assistant
Dr.	S.	Donda	HQ/Planning
Mr.	L.	Elliot	Mzuzu
Mr.	B.	Elufe	Sec
Mr.	C.	Esau	Nkhata bay
Mr.	F.	Fanuel	HQ
Ms	I.A	Gondwe	Fisheries Assistant
Mr.	C.	Jambo	HQ
Mr.	B.	Jere	Mzuzu fish farm
Mr.	C.T.B.	Joshua	Thyolo Disitrict
Mr.	D.	Kachilonda	MCF
Mr.	O.	Kachinjika	HQ
Mr.	M.	Kamuvu	HQ
Mr.	I.C.	Kapute	NAC
Mr.	F.	Kapute	Fisheries Officer
Mr.	G.	Katunga	Nchisi
Mr.	I.	Kaulendo	Fisheries Officer,
Ms.	J.	Kazemba	Principal, MCF
Mr.	G.	Khota	NAC
Mr.	M.	Kumbikano	Mzuzu
Mr.	D.	Kumwenda	Nkhatabay
Mr.	M.	Lawrence	District KK
Mr.		Lipunga	District LS
Mr.	E.	Lungu	Mzuzu
Mr.	M.	Makuwila	HQ
Mr.	L.	Makwinja	Nkhotakota

Mr.	A.	Malizeni	Kunenekude/Chitipa
Mr.	A.	Malizeni	Mwanza
Mr.	A.	Maluwa	NAC
Mr.	P.P	Maseko	District Fisheries Officer
Mr.		Mbamba	NAC
Mr.		Mfune	District SA
Mr.	E.	Mkandawa	Mzuzu
Mr.	R.P.	Mkandawire	NAC
Mr.	S.	Mponela	Thyolo District
Mr.	N.	Msowoya	HQ
Ms.	D.	Msukwa	Extensionist
Mr.	C.J.	Msusa	District Fisheries Officer
Mr.	S.	Mtegha	Chinseu office/Zomba
Mr.	B.Y.	Munthali	Nkhata bay
Mr.	W.	Namoto	Fisheries Research Assistant
Mr.	M.	Ngochera	FRU
Mr.	L.P.	Ngoma	HQ
Mr.	F.P.	Nindi	Zomba District Office
Mr.	F.	Njaya	Divisional Fisheries Officer
Mr.	T.	Njobvu	Dedza
Mr.	N.	Nkhota	Senior Administrative Officer
Ms.	D.	Nyirenda	Mzuzu
Mr.	M.	Nyirenda	HQ
Mrs	C.	Pasani	HQ
Mr.	B.	Patrick	Assistant District Fisheries Officer
Mr.		Pelani	Mangochi
Mr.	C.	Phiri	Mangochi
Mr.	U.	Sabstone	NAC
Mr.	A.	Saukani	Fisheries Officer
Mr.	F.	Sidira	HQ
Ms	F.	Sidral	HQ
Dr	C.	Sloans	Director
Mr.	B.	Somanje	Fisheries Officer
Mr.	K.M.	Thengo	Mulanje
Mrs.	N.	Tiwonge	Namwera
Mr.		Zgambo	District NB
Mr.	L.	Ziyite	Chitipa

Other Ministries

Dr.	K.	Kafumba	Energy
Mr.	L.	Kalinala	Geological Survey
Mr.	A.	Kamanga	MAIFS, Economist
Mr.	A.	Katheuwera	Water Department
Mr.	D.	Kazembe	MAIFS, Director, Irrigation
Mr.	M.	Mainala	Water department
Mr.	G.	Malumba	Mining
Mr.	M.N.S.	Msowoya	MAIFS, Director, Extension
Mr.	C.	Ngowena	Geological Survey
Mr.	E.	Njewa	Environmental Affair:
Mr.	D.Y.C.	Wirima	Ministry of Finance

Local Government/District Assembly

Mr.	M.D.	Banda	Zomba District , Judiciary (MAGISTRATE)
Mr.	F. C.	Bwanali	Zomba District, Central Hospital
Mr.	E.N.	Chasueka	Zomba District, Transport & Public works Roads,
Mr.	A. C.	Chekani	Zomba District, District Forestry Office

Ms.	N.	Chilanga	Zomba District, Rural housing Department
Mr.	J.	Chingawale	Zomba District
Mr.	L. T.	Daiton	Zomba District, Labour Service
Mr.	C.	Davie	Zomba District, District Commissioner
Mr.	O.M.	Kadondo	Thyolo Disitrict, Community Service
Mr.	R.	Kanyika	Mzuzu District
Mr.	E.H.	Kaphuka	Thyolo District
Mr.	D.	Kaunda	Thyolo Prison
Mr.		Khosa	Zomba District Agriculture Department,
Mr.	M.	Kumbemba	Zomba District, Tourism
Ms.	M.	Lukhere	Thyolo Hospital
Mr.	J.	Lungu	Zomba District, Phisical Planning Department
Mr.	S.S.	Machuma	Thyolo District, Education, Thyolo Secondary
Mr.	F.	Malembatsa	Zomba District Water Department
Mr.	A.B.	Masi	Thyolo Disitrict, Information
Mr.	M.	Meya	Thyolo Disitrict, Community Service
Mr.	G.K.	Miliner	Zomba District
Mr.	J. D. S	Monjeza	Zomba District Assembly
Mr.	P.T.	Mphonda	Zomba District, Information Department
Mr.	K.N.	Mponoa	Thyolo District
Mr.	J.E.	Mselela	Thyolo Disitrict Water Department
Mr.	O. M.	Msyamboza	Zomba District, Social Welfare Office
Mr.	S.	Mussa	Thyolo District
Mr.	A.	Mussa	Zomba District, ZamZam Foundation
Mr.	C.	Mwazamkumba	Zomba District
Mr.	E. J.	Nathebe	Zomba District Water Department
Mr.	C.R.	Nawanga	Zomba District Transport & Public works Roads
Ms.	E. C.	Ndalama	Zomba District Gender Committee Service
Mr.		Ndundu	Chitipa District
Mr.	J.	Nguluwe	Mangochi District, District Commissioner,
Mr.	D.	Ngwala	Youth Department
Mr.	D.G.	Nserebo	Thyolo Disitrict Education Department
Mr.	J.C.	Nyierenda	Thyolo Disitrict Agriculture Department
Mr.	W. M.	Phiri	Trade & PVT Section Devision
Mr.	A. G.	Saiti	Zomba District, Police
Ms.	C.G.	Sosola	Zomba District, Redcross
Mr.	M.	Themba	Zomba District, Planning
Mr.	B.B.	Type	Thyolo Disitrict, Labour Office

Private fish producers/fish farmers

Mr	A.	Ajibu	Fish farmer, Farmers Club, Chingale
Mr		Akim	Fish farmer, Farmers Club, Chingale
Mr.	P.	Banda	
Mr.		Baula	Member of IFFNT, Mulanje
Mr.		Binali	Member of IFFNT, Zomba
Mr	P.K.N	Bittieli	Kasungu
Mr	T.	Bweza	Mulanje
Ms		Chamvula	Member of IFFNT, Mzimba
Mr.	P.F.	Chaonekera	
Dr.	G.	Chinkuntha	Chairman of IFFNT, Dowa
Mr	W.J.	Chitonya	Zomba
Mr.	R.	Chokani	Treasurer of IFFNT, Mchinji
Mr	P.	Chopi	Mangochi
Mr	H.	Dafuleni	Fish farmer, Farmers Club, Chingale
Mr.	A.	Dandauleni	Alick
Mr	J.	Emmanuel	Fish farmer, Farmers Club, Chingale
Mr	P.	Ernest	Fish farmer, Farmers Club, Chingale

Mr	K.	General	Fish farmer, Farmers Club, Chingale
Mr.	C.	Harawa	Cooper
Mr	S.	Histon	Farmers Chitipa
Mr.	E.	Holm	Consultants, MALDECO
Mr.	C.	Horace	MALDECO Fisheries, Chief Accountant
Mr.	M.	Ilovo	Nkhotakota
Mr	R.	Jemusi	Fish farmer, Farmers Club, Chingale
Mr	H.	Kachale	Mzuzu
Mr	J.	Kachali	Mzuzu
Mr.	I.M.	Kalemango	Member of IFFNT, Mangochi
Mr.	U.S.	Kalembo	Member of IFFNT, Lilongwe
Mr	G.M.	Kamanga	Farmers Karonga
Mr.	J.	Kamanga	Member of IFFNT, Rumphi
Mr	A.	Kamoto	Fish farmer, Farmers Club, Chingale
Mr.	M.	Kampata	Member of IFFNT, Mchinji
Mr		Kapinga	Fish farmer, Farmers Club, Chingale
Mr.	M.F.	Katengeza	Secretary of IFFNT, Lilongwe
Mr	L.	Kaunda	Rumpi-Mpwepwe
Mrs	E.	Kaunde	Zomba
Mr		Kholomana	Thyolo-Luchenza
Mr	M.	Kotokwa	Thyolo
Mr	I.	Lanjesi	Fish farmer, Farmers Club, Chingale
Mr	J.	M'bwana	Fish farmer, Farmers Club, Chingale
Mr.	J.	Magasa	MALDECO Operations Manager
Mr.	W.	Mahango	Member of IFFNT, Rumphi
Ms.	B.	Malata	Mchinji-Kamwendo
Mr	L.	Malonie	Fish farmer, Farmers Club, Chingale
Mr	R.	Mandiwa	Zomba
Mr	S.	Maurice	Fish farmer, Farmers Club, Chingale
Mr.	I.	Mavumbanya	Member of IFFNT, Rumphi
Mr	N.	Mchembe	Farmers,Chikwawa
Ms.		Meya	Fish farmer, Farmers Club, Chingale
Ms	G.S.	Mkaliainga	Member of IFFNT, Zomba
Mr.		Mkhutumula	Member of IFFNT, Mwanza
Mr	M.	Mkondiwa	Salima-Chipoka
Mr.	S.	Mlemba	Stenar
Mr.		Moyenda	Member of IFFNT, Mwanza
Mr.	S.	Msiska	Member of IFFNT, Rumphi
Mr.	B.F.P.	Msyali	Member of IFFNT, Nkhotakota
Mr.		Mulemba	Member of IFFNT, Zomba
Mr	A.S.	Mwenifumbo	Farmers Karonga
Mr	H.	Mzikamanda	Lilongwe
Mrs.		Mzumala	Mzuzu
Mr	H.	Ndalama	Lilongwe
Mr.	J.J.	Ngambi	Member of IFFNT, Chitipa
Mr.	F.	Nikoloma	Member of IFFNT, Thyolo
Mr.	M.	Nyirongo	Michael
Dr.	S.	Pala	G.K. Aquaculture Ltd
Mr	T.	Phillinpina	Nkhotabay
Mr	E.	Samson	Fish farmer, Farmers Club, Chingale
Mr.	L.	Sikepe	Member of IFFNT, Nchisi
Mr	R,	Tembo	Mchinji-Ndawambe
Mr	H.N.	Thima	Lilongwe
Mr.		Twaibu	Member of IFFNT, Zomba
Mr.		Zembere	Member of IFFNT, Mchinji
Mr.	A.	Zimba	Member of IFFNT, Nkhata Bay
Mr.		Zungalana	Member of IFFNT, Dowa

NGO

Dr.	L.	Buhenawa	Diphitas International
Mr.	W.	Bwanqupe	PLDO
Mr.	L.	Chimphero	World Vision
Mr.	G.	Chimsale	Oxfam, Thyolo Disitrict
Mr.	G.	Chiwosi	AGRIC, Thyolo Disitrict
Mr.	E.	Chiziwga	Project Hope, Thyolo Disitrict
Mr.	D.	Chunga	CPAR
Mr.	E. K.	Edward	World Vision
Mr.	R.	Himsale	CARD
Dr.	D.	Jamu	Worldfish Center
Mr.	T.	Kachule	Project Hope, Thyolo Disitrict
Mr.	W.	Kalumula	World Visioni, Mphuka A.D.P
Ms.	P.	Kanauji	Worldfish Center
Mr.	D.	Kanyerere	World Vision
Mr.	K.	Kasawala	World Vision
Ms.	R. G.	Kaunda	Women Lobby, Zomba District
Mr.	A.	Khaoreya	World Vision
Mr.	D.	Luka	CBRLD, Thyolo Disitrict
Mr.	J.	Makina	Oxfam
Mr.	L.	Mangaka	Action Aid
Mr.	K.	Matekenya	Action Aid
Ms.	A.	Michongwe	HBC-CADECOM, Zomba District
Mr.	M.T.	Mkaudawire	YONECO, Zomba
Mr.	R.	Mkwapatira	CADECOM, Zomba District
Mr.	V.T.	Moyo	World Vision
Mr.	K.	Mtombosola	World Vision
Mr.	D.	Mtoseni	Concern Universal
Ms.	M.M.	Mwale	CARD, Thyolo
Mr.	W.	Mwambo	Thyolo Active Youth Organization
Mr.	E.	Mwendo-Phiri	World Vision Malawi, Chingale ADP
Mr.	B.	Naauwale	AYISE, Thyolo Disitrict
Mr.		Nagoli	Worldfish Center
Mr.	C.	Namathawa	Project Hope, Thyolo Disitrict
Mr.	M.N.	Nkhwimba	World Vision
Mr.	T.	Nyangum	C.I.S.P, Zomba District
Mr.	M.	Prein	Worldfish Center
Mr.	H.	Wala	World Vision
Mr.	J.	Willie	Rural Housing Programme, Thyolo Disitrict
Mr.	F.	Zande	CARE International
Mr.	G.	Zimba	SFEDP

Donor

Dr.	J.	Balarin	Danish Hunter's Assoc.
Mr.	G.	Hawes	Malawi-Canada Programme Support Unit
Mr.	T.	Johnson	Copass II
Mr.	J.B.	Kamangira	IFAD Malawi
Mr.	J.	Kawaye	DFID Malawi
Mr.	P.	Le Rour	AFR Novel Resource
Mr.	F.	M'buka	The World Bank Malawi Office
Ms.	E.R.	M'mangisa	UNDP Malawi
Mr.	M.	Mazlan	FAO
Mr.	P.	Mogstad	Royal Norwegian Embassy Malawi
Mr.	M.	Mustafa	Malaysia Cooperation
Dr.	M.	Mustafa	Malaysian Cooperation
Mr.	S.	Mynt	FAO SPFS-AQUA
Mr.	M.	Jusoh	FAO, Representative in Malawi

Mr.	A.	Nkhoma	FAO Malawi Office
Ms.	P	Sigurðardóttir	ICEADA Malawi
Mr.	A.	Tembo	USAID Malawi
Ms.	M.	Uotila	European Union Malawi

University of Malawi

Mr.	D.	Kafumbata	Chancellor College
Mr.	J.	Kang`ombe	Bunda College
Dr.	E.	Kaunda	Bunda College
Dr.	G	Matiya	Bunda College
Mr.	B.	Mkoko	Chancellor College
Mr.	O.	Msiska	Bunda College

International

Mr.	P.	Blow	Lake Harvest Ltd., Zimbabwe
Mr.	B.	Bolivar	GIFT Foundation International, Inc., Philippine
Dr.	R.	Bolivar	Central Luzon State Univ., Philippine
Dr.	P.	Edward	Asian Institute of Technology, Thailand
Mr.	M.	Kalende	FAO. Africa Regional Office, Ghana
Mr.	C.	Maguswi	Department of Fisheries, Zambia
Mr.	J.	Moehl	FAO Regional Office, Ghana
Mr.	H.	Mongi	Department of Fisheries, Tanzania
Dr.	H.	Eda	JICA Expert, ARTDMIS
Mr.	H.	Suzuki	JICA Expert, ARTDMIS
Mr.		Futami	JICA Expert, ARTDMIS
Dr.	K.	Masuda	JICA Expert, ARTDMIS
Mr.	M.	Futagawa	JICA Expert, ARTDMIS
Mr.		Igarashi	JICA Expert, ARTDMIS
Mr.	H.	Omizo	JICA Expert, ARTDMIS
Mr.	J.P.	Murama	Aquaculture Department, Ministry of Fisheries, Mozambique
Dr.	A.	Tacon	University of Hawaii Aquatic Farms, Ltd.
Dr.	Y.	Yang	Asian Institute of Technology, Thailand

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ADiM Working Paper No. 4. 2005 Socio-economic Survey on Fish Farmer's Club in Chingale, Zomba

ADiM Working Paper No. 5. 2005 Evaluation of Two Farmer's Approaches for Aquaculture Development in Malawi

ADiM Working Paper No. 6. 2005 Commercial Aquaculture Development, Its Potential and Risk

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Appendix 4: Scope of Work and Minuites of Meeting on Scope of Work

SCOPE OF WORK
FOR
THE MASTER PLAN STUDY
ON
AQUACULTURE DEVELOPMENT
IN MALAWI

AGREED UPON BETWEEN
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL AFFAIRS
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

LILONGWE, SEPTEMBER 16, 2002

Mr. George C. Mkondiwa
Principal Secretary
Ministry of Natural Resources and
Environmental Affairs
MALAWI

Mr. Takashi Mizuno
Team Leader
Preparatory Study Team
Japan International Cooperation
Agency
JAPAN

Mr. Ambrose Mzoma
Deputy Director-Debt and Aid Management
Ministry of Finance and
Economic Planning
MALAWI

I. INTRODUCTION

In response to the request of the Government of Malawi, the Government of Japan has decided to conduct the Master Plan Study on Aquaculture Development in Malawi (hereinafter referred to as "the Study") together with the Government of Malawi in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of Malawi.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are

1. To formulate a national aquaculture development plan (master plan) for sustainable development of fisheries in Malawi; and

2. To transfer relevant technology to the Malawi counterpart personnel through on-the-job training in the course of the Study.

III. OUTLINE OF THE STUDY

1. Study Area

All water bodies in Malawi; namely Lake Malawi, Lake Malombe, Lake Chiuta, Lake Chilwa and all rivers, dams and small water bodies, and inland areas.

2. Scope of the Study

In order to achieve the objectives above, the Study shall consist of the following activities.

(1) To clarify the situation of aquaculture by reviewing fisheries in Malawi

Main activities are as follows:

1) Data collection and analysis, and extensive field survey on the following aspects:

(a) General situation:

a) Natural conditions (topology and geography, meteorology, water resources, soil condition, vegetation, etc.)

b) Social and economic conditions (population, education, health, transport and communications, energy provision, economic structure, etc.)

c) Agriculture and animal husbandry (production, technology, and

management)
d) Fisheries sector (production, processing and marketing, etc.)
(b) Situation of fisheries resources management:
a) Communities and organizations in resources management
b) Fishing gear and fishing methods
c) Technology and method of resources management
d) Fishing data (fishing conditions, information collecting system, etc.)
e) Legislation and institution (regulations, etc.)
(c) Situation of aquaculture:
a) Management and technology (fish farmers' organization, marketing, capacity building, farming technique, stock enhancement, etc.)
b) Economic
c) Training and extension programmes
d) Legislation and institution (regulations, by-laws, land tenure, etc.)
e) Environmental issues (natural conditions, IEE/EIA procedure, etc.)
2) Review of projects
Review of previous fisheries projects in general as well as aquaculture development projects

(2) Survey of target groups for aquaculture's practice and extension
(3) Identification of appropriate technologies and methods for target groups such as in small-holder fish farming, stock enhancement, fish preservation and floating net cage
(4) Formulation of strategy on aquaculture development
(5) Preparation of pilot projects
(6) Implementation of pilot projects
(7) Formulation of aquaculture development plan (master plan) by target groups, appropriate technologies, institutional arrangement, extension/training system, marketing, financial aspects, and environmental aspects
(8) Selection of priority project(s)
(9) Preparation of implementation plan of the priority project(s)

IV. STUDY SCHEDULE

The Study will be carried out during a period of approximately thirty-two (32) months, in accordance with the attached tentative work schedule (ANNEX).

V. REPORTS

JICA shall prepare and submit the following reports to the Government of Malawi:

1 Inception Report
Thirty (30) copies at the beginning of the second field work.

2 Progress Report
Twenty (20) copies at the end of the second field work.

3 Interim Report
Thirty (30) copies.

4 Field Report (1)
Twenty (20) copies.

5 Field Report (2)
Twenty (20) copies.

6 Draft Final Report
Fifty (50) copies. The government of Malawi will provide JICA with its comments on Draft Final Report within one (1) month after receipt of the Draft Final Report.

7 Final Report
Fifty (50) copies within two (2) months after receipt of the comments from the Government of Malawi on the Draft Final Report.

VI. UNDERTAKING OF THE GOVERNMENT OF MALAWI

1. To facilitate the smooth conduct of the Study; the Government of Malawi shall take necessary measures:

(1) To permit the members of the Japanese Study Team to enter, leave and sojourn in Malawi for the duration of their assignments therein and exempt them from foreign registration requirements and consular fees;
(2) To exempt the members of the Japanese Study Team from taxes, duties and any other charges on equipment, machinery and other material brought into Malawi for the implementation of the Study;
(3) To exempt the members of the Japanese Study Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the team for their services in connection with the implementation of the Study;
(4) To provide necessary facilities to the Japanese Study Team for the remittance as well as utilization of the funds introduced into Malawi from Japan in connection with the implementation of the Study;

2. The Government of Malawi shall bear claims, if any arises, against the members of the Japanese Study Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the Japanese Study Team.

3. Department of Fisheries shall, at its own expense, provide the Japanese Study Team with the following, in cooperation with other organizations concerned:

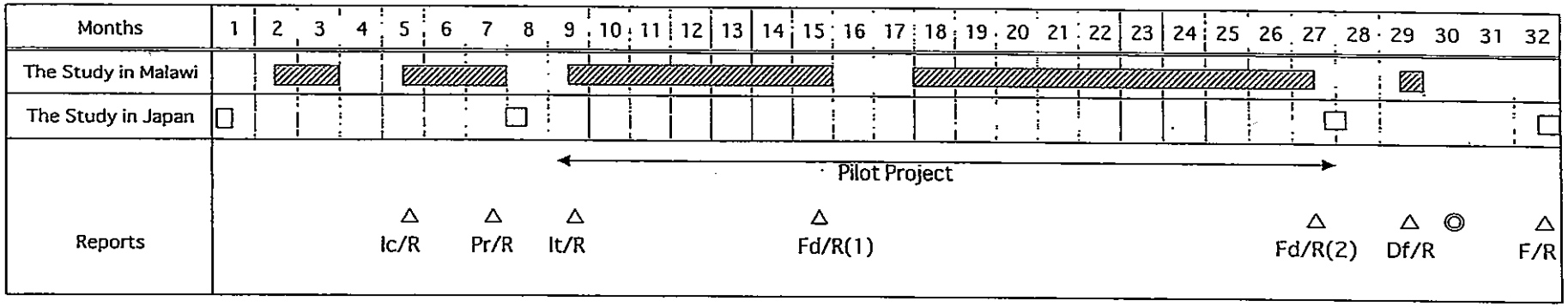
(1) Security-related information on as well as measures to ensure the safety of the Japanese Study Team;
(2) Information on as well as support in obtaining medical services;
(3) Available data and information related to the Study;
(4) Counterpart personnel;
(5) Suitable office space with necessary office equipment and furniture in Lilongwe;
(6) Credentials or identification cards.

VII. CONSULTATION

JICA and Department of Fisheries shall maintain constant communication and consult with each other in respect of any matters that may arise from or in connection with the Study.

ANNEX

TENTATIVE SCHEDULE



(Remarks)

Ic/R	:	Inception Report
Pr/R	:	Progress Report
It/R	:	Interim Report
Fd/R	:	Field Report
Df/R	:	Draft Final Report
◎	:	Comments on Df/R by the Government of Malawi
F/R	:	Final Report

MINUTES OF THE MEETINGS
ON
SCOPE OF WORK
FOR
THE MASTER PLAN STUDY
ON
AQUACULTURE DEVELOPMENT
IN MALAWI

AGREED UPON BETWEEN
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL AFFAIRS
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

LILONGWE, SEPTEMBER 16, 2002

Mr. George C. Mkondiwa
Principal Secretary
Ministry of Natural Resources and
Environmental Affairs
MALAWI

Mr. Takashi Mizuno
Team Leader
Preparatory Study Team
Japan International Cooperation
Agency
JAPAN

Mr. Ambrose Mzoma
Deputy Director-Debt and Aid Management
Ministry of Finance and
Economic Planning
MALAWI

1. Introduction

In response to the request of the Government of Malawi, the Preparatory Study Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), and headed by Mr. Takashi MIZUNO, visited Malawi from 9 September to 17 September 2002 for the purpose of discussing and confirming the Scope of Work for the Master Plan Study on Aquaculture Development in Malawi (hereinafter referred to as "the Study")

The Team had a series of discussions with the Malawian officials concerned of the Ministry of Natural Resources and Environmental Affairs on the Scope of Work for the Study. The list of participants in a series of meetings is attached in the ANNEX.

As a result of discussions, the Ministry of Natural Resources and Environmental Affairs and the Team agreed on the Scope of Work for the Study.

This document sets forth the main issues discussed and agreed upon by both sides in relation to the Scope of Work for the Study.

2. Title of the Study

Both sides agreed that the title of the Study should be changed from "The Study on Fisheries Projects Review and Aquaculture Development in Malawi" to "The Master Plan Study on Aquaculture Development in Malawi".

3. Objective of the Study

The Malawian side requested that the study should develop a Master Plan for the fisheries sector to act as a framework which can guide the department on future activities for the development of fisheries industry. The Team explained that instead of developing a Master Plan for the whole fisheries sector, the Team will only develop an Aquaculture Master Plan because it has vast experience in aquaculture than capture fisheries. Both sides agreed that the objective of the Study is to formulate an aquaculture development plan.

4. Review of Fisheries in Malawi

Both sides agreed that the review process should be consultative involving exchange of opinions and experiences as well as holding seminars/workshops between the Study Team and Malawian counterparts so that the pertinent issues can be ironed out. In addition, it was recognized that although aquaculture contributes a small

proportion to total national fish production, it is nevertheless, important at rural household level in terms of food security and income. Consequently, both sides agreed that the review will cover not only aquaculture but also whole fisheries sector, and clarify the importance and necessity of aquaculture development.

5. Counterpart Agency for the Study

The Department of Fisheries shall act as counterpart agency to the Study Team during the implementation of the Study and also as a coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

6. Pilot Projects

The pilot projects will be identified through consultations and analysis of information to define the needs, and shall be decided through the discussions between both sides.

7. Assignment of Counterpart Personnel

The Malawian side will assign the counterpart personnel to the Study Team in the following fields :

1) Aquaculture
2) Fisheries Economics
3) Fisheries Biology
4) Administration and Management
5) Sociology
6) Policy and Legislation

8. Counterpart Training in Japan

The Malawian side requested that the counterpart personnel be trained in Japan as one of the activities to achieve technology transfer.

9. Office Accommodation

The Malawian side promised to provide the Study Team with a suitable office space within the buildings of Ministry of Natural Resources and Environmental Affairs and to make its best effort to provide desks, chairs, the use of internet services and one

telephone with facsimile function in the office as required, except internet/telephone bills.

10. Equipment for the Study

The Malawian side requested that the following equipment and materials for the Study be provided by JICA. The Team promised to convey the request to the JICA headquarters.

1) Four wheel drive vehicle
2) Personal Computer
3) Fax Machine
4) Photocopy Machine

11. Final Report

The Malawian side agreed that the Final Report would be open to the public.

12. Financial Support on Travel Expenses for Counterpart Personnel

The Malawian side requested that JICA consider providing financial support on travel expenses for the counterpart personnel. The Team will convey the request to JICA headquarters for consideration.

ANNEX

List of Participants in a series of meetings

Malawi Side

Ministry of Natural Resources and Environmental Affairs

Mr. George C. Mkondiwa	Principal Secretary

Department of Fisheries

Mr. S. A. Mapila	Director of Fisheries
Mr. S. Chimatiro	Deputy Director of Fisheries (Administration)
Mr. A. Bulirani	Deputy Director of Fisheries (Technical Services)
Mr. O. M. Kachinjika	Chief Fisheries Officer (Extension and Training)
Ms. C. L. Pasani	Fisheries Officer
Mr. P. G. Ngoma	Fisheries Economist

Ministry of Finance and Economic Planning

Mr. A. Mzoma	Deputy Director (Debt and Aid Management)
Mr. D. Y. C. Wirima	Assistant Director

Japan Side

Preparatory Study Team

Mr. Takashi Mizuno	Leader
Mr. Takayuki Nishizaki	Member

JICA Malawi Office

Mr. Hiroshi Murakami	Resident Representative
Mr. Kenichi Matsumoto	Assistant Resident Representative
Mr. Keiichi Okitsu	Assistant Resident Representative
Mr. Vincent A.L.Mkandawire	Aid Coordinator

JICA Expert

Dr. Hiroki Eda	NAC, Domasi
Mr. Hiroshi Omizo	NAC, Domasi
Mr. Hiromasa Suzuki	NAC, Domasi
Dr. Shinsuke Morioka	Bunda College of Agriculture

Appendix 5: Minuites of Meeting on Inception Report

MINUTES OF MEETING
ON
INCEPTION REPORT
FOR
THE MASTER PLAN STUDY
ON
AQUACULTURE DEVELOPMENT IN MALAWI

Lilongwe, 15th April, 2003

Mr. George C. Mkondiwa
Principal Secretary
Ministry of Natural Resources and
Environmental Affairs
Republic of Malawi

Mr. Sachio Yamamoto
Team Leader
JICA Study Team

Japan

Witness by:

Mr. Takashi Mizuno
Team Leader
Advisory Team
Japan International Cooperation Agency (JICA)
Japan

MINUTES OF MEETING
ON
THE INCEPTION REPORT
FOR
THE MASTER PLAN STUDY
ON
AQUACULTURE DEVELOPMENT IN MALAWI

Lilongwe, 15th April 2003

The Scope of Work for the Master Plan Study on Aquaculture Development in Malawi was agreed upon between the JICA (Japan International Cooperation Agency; hereafter referred to as JICA) Preparatory Study Team and the Malawian side on September 16th, 2002. In accordance with the Scope of Work, JICA sent to the Republic of Malawi the JICA Study Team headed by Mr. Sachio Yamamoto on January 27th, 2003.

The Study Team submitted to the Malawian side 30 copies of the Inception Report in the English language on April 9th, 2003. The Study Team explained the contents and procedures of the Study on April 10th, 2003. Subsequently, discussions between the Malawian side and the Study Team were held on April 15th, 2003. The Malawian side agreed on the contents and study procedures presented in the Inception Report.

List of participants in the meeting and the list of counterparts are attached as Annex-I and II, respectively.

ANNEX-I

LIST OF PARTICIPANTS
IN
THE INCEPTION REPORT MEETING

1. Ministry of Natural Resources and Environmental Affairs

Mr. George C. Mkondiwa	Principal Secretary

2. Department of Fisheries, Ministry of Natural Resources and Environmental Affairs

Mr. Sloans K. Chimatiro	Director
Mr. Alexander Bulirani	Deputy Director
Mr. Orton Kachinjika	Extension Coordinator
Dr. Steve Donda	Fisheries Planning
Mr. Maurice Makuwila	Planning and Information
Mr. D. Bandula	Regional and International Corporation

3. JICA Advisory Team

Mr. Takashi Mizuno	Leader
Dr. Koji Yamanaka	Committee member, JICA Advisory Committee

4. JICA Study Team

Mr. Sachio Yamamoto	Team Leader
Prof. Tom Hecht	Aquaculture Technology
Dr. Olaf Weyl	Fisheries/Data analysis
Dr. Tim Andrew	Community Development
Mr. Kouzo Baba	Fisheries Economist
Ms. Yuki Kobayashi	Institution
Dr. Kenzo Utsugi	Integrated Aquaculture
Mr. Sadatoshi Matsuoka	Community Nutrition
Ms. Chigusa Seki	Coordinator

ANNEX-II

COUNTERPARTS

Name of Counterparts

i Coordination Committee

Name	Assignment
Mr. Alexander Bulirani	Coordinator
Dr. Steve Donda	Planning
Mr. Orton Kachinjika	Extension
Dr. Moses Banda	Research
Mr. Alfred Maluwa	Aquaculture Technologies

Remarks: This committee will be composed of above Malawian Counterpart and JICA Study Team Members

ii Administrative and General Counterparts

Name	Assignment
Mr. Maurice Makuwila	Fisheries Officer
Ms. Chikondi L. M. Pasani	Fisheries Officer
Mr. Noel Nkhota	Senior Administrative Officer
Ms. Ida Chimangeni	Technical Officer

iii Field Counterparts

Name	Assignment
Mr. Dick Kachilonda	Fisheries Research Unit
Mr. W. Namoto	Fisheries Research Unit
Mr. Timothy Njobvu	Mpwepwe Fisheries School
Ms. Jackie Kazembe	Principal, Mpwepwe Fisheries School
Mr. Max Ngochera	Fisheries Research Unit
Mr. Sabstone Unyolo	National Aquaculture Centre

Appendix 6: Minuites of Meeting on Interim Report

MINUTES OF MEETING
ON
INTERIM REPORT
FOR
THE MASTER PLAN STUDY
ON
AQUACULTURE DEVELOPMENT
IN
MALAWI

Lilongwe, 26 November 2003

Mr. Bright B. Kumwembe
Deputy Principal Secretary
Ministry of Natural Resources and
Environmental Affairs
Republic of Malawi

Mr. Sachio Yamamoto
Team Leader
JICA Study Team
Japan

Witnessed by:

Mr. Masaru Okamoto
Leader/ Fisheries Development
Monitoring Team
JICA, Japan

MINUTES OF MEETING
ON
INTERIM REPORT
FOR
THE MASTER PLAN STUDY
ON
AQUACULTURE DEVELOPMENT
IN
MALAWI

Lilongwe, 26 November 2003

The Scope of Work for the Master Plan Study on Aquaculture Development in Malawi was agreed upon between the Japan International Cooperation Agency (hereafter referred as JICA) Preparatory Study Team and the Government of the Republic of Malawi on 16 September, 2002. In accordance with the Scope of Work, JICA sent a Study Team, headed by Mr. Sachio Yamamoto, to the Republic of Malawi on 27 January, 2003.

The Study Team submitted 30 copies of the Interim Report (in the English language) to the Ministry of Natural Resources and Environmental Affairs on 24 November, 2003.

The report was presented by the Study Team to the participants of the Coordination Committee meeting on 21 November, 2003. Subsequent discussions between the Malawian counterparts and the Study Team were held on 26 November, 2003. The Interim Report, inclusive of its findings and goals for aquaculture development in Malawi, has been accepted by the Malawian counterparts and support the Study Team to develop the Master Plan. The contents of the Minutes of the Counterpart Meeting held on 26 November, 2003 have been jointly accepted by the Study Team and the Counterparts, and are attached as Annex-I.

List of participants in the Coordination Committee is attached as Annex-II.
List of participants in the Counterparts Meeting is attached as Annex-III.

ANNEX-I

CONTENTS AGREED BY THE COUNTERPARTS MEETING FOR THE INTERIM REPORT

1. National Project Coordinator

Department of Fisheries will assign a suitable person as full-time National Project Coordinator to the Pilot project. His responsibilities are noted in the Interim Report (6.5 Implementation arrangement). The exact responsibilities will however be defined in detail during the stakeholders' planning workshop, which is to be held from 29 November to 1 December 2003.

2. Staff Deployment for Implementation of the Pilot Project

Department of Fisheries will assign two divisional extension coordinators representing the Northern and Southern regions, who will support "Sub-component 1" during the pilot project. In Zomba District, one extension officer will be assigned for the support of "Sub-component 2".

3. Study of Large-scale Fish Farming systems

JICA study team will undertake an analysis of large-scale fish farming systems as part of the "Terms of Reference" of Phase II of this study (Field work in Malawi 4). This involves the following activities:

(1) Analysis of case studies in Southern Africa

(2) Market survey for the products from large-scale fish farming systems

(3) Risk assessment of exotic species

ANNEX-II

LIST OF PARTICIPANTS IN THE COORDINATION COMMITTEE HELD ON 21 NOVEMBER, 2003

1. Ministry of Natural Resources and Environmental Affairs, Department of Fisheries

Mr. Alexander Bulirani	Deputy Director
Dr. Steve Donda	Chief Fisheries Officer, Planning
Mr. Alfred Maluwa	Head of National Aquaculture Centre

2. Bunda College (University of Malawi)

Dr. Emmanuel Kaunda	Head of Aquaculture and Fisheries Science Department

3. WorldFish Center

Dr. Daniel Jamu	Project Leader, Fresh Water Resources

4. JICA Monitoring Team

Ms. Tomoko Maekawa	Coordinator

5. JICA Malawi Office

Mr. Tatsuya Murase	Deputy Resident Representative
Mr. Kenichi Matsumoto	Assistant Resident Representative

6. JICA Domasi Aquaculture Team

Dr. Hiroki Eda	Team Leader
Mr. Hiroshi Omizo	Expert
Mr. Hiromasa Suzuki	Coordinator

7. JICA ADiM Team

Mr. Sachio Yamamoto	Team Leader
Dr. Timothy Andrew	Community Development
Ms. Yuki Kobayashi	Institution
Dr. Kenzo Utsugi	Integrated Aquaculture
Ms. Yuki Niimura	Project Monitoring
Ms. Chigusa Seki	Coordinator

ANNEX-III

LIST OF PARTICIPANTS FOR THE COUNTERPARTS MEETING HELD ON 26 NOVEMBER, 2003

1. Ministry of Natural Resources and Environmental Affairs

Mr. Bright B. Kumwembe	Deputy Principal Secretary
Mr. Charles V.B. Ndhlovu	Controller of Planning Services, Planning Division

2. Ministry of Natural Resources and Environmental Affairs, Department of Fisheries

Mr. Sloans K. Chimatiro	Director
Mr. Alexander Bulirani	Deputy Director
Dr. Moses Banda	Chief Fisheries Research Officer, Fisheries Research Unit
Ms. Jacqueline Kazembe	Principal, Mpwepwe College of Fisheries

3. JICA Monitoring Team

Mr. Masaru Okamoto	Leader/ Fisheries Development
Ms. Tomoko Maekawa	Coordinator

4. JICA Malawi Office

Mr. Kenichi Matsumoto	Assistant Resident Representative

5. JICA ADiM Team

Mr. Sachio Yamamoto	Team Leader
Prof. Thomas Hecht	Aquaculture Technology
Dr. Timothy Andrew	Community Development
Ms. Yuki Kobayashi	Institution
Dr. Kenzo Utsugi	Integrated Aquaculture
Ms. Yuki Niimura	Project Monitoring
Ms. Chigusa Seki	Coordinator

Appendix 7: Minuites of Meeting on Draft Final Report

MINUTES OF MEETING
ON
DRAFT FINAL REPORT
FOR
THE MASTER PLAN STUDY
ON
AQUACULTURE DEVELOPMENT
IN
MALAWI

Lilongwe, 2 June 2005

Mr. Thouse R. O'Dala
Principal Secretary
Ministry of Mines, Natural Resources
and Environment
Republic of Malawi

Mr. Sachio Yamamoto
Team Leader
JICA Study Team
Japan

Witnessed by:

Dr. Sloans Chimatiro
Director, Department of Fisheries
Ministry of Mines, Natural Resources
and Environment
Republic of Malawi

Mr. Juichiro Sasaki
Leader/ Fisheries Development
Monitoring Team
JICA, Japan

MINUTES OF MEETING ON DRAFT FINAL REPORT FOR THE MASTER PLAN STUDY ON AQUACULTURE DEVELOPMENT IN MALAWI

Lilongwe, 2 June 2005

The Scope of Work for the Master Plan Study on Aquaculture Development in Malawi was agreed upon between the Japan International Cooperation Agency (hereafter referred as JICA) Preparatory Study Team and the Government of the Republic of Malawi on 16 September, 2002. In accordance with the Scope of Work, JICA sent a Study Team, headed by Mr. Sachio Yamamoto, to the Republic of Malawi from January, 2003 to June, 2005.

The Study Team submitted 50 copies of the Draft Final Report (in the English language) to the Department of Fisheries, Ministry of Mines, Natural Resources and Environment on 23 May, 2005.

The Study Team explained the Draft Final Report of the Study at the 12th Coordination Committee Meeting on 2 June 2005. Subsequently, discussions between the Department of Fisheries and the Study Team were held, concluding the following points:

(1) The Department of Fisheries agreed on the contents and study procedures presented in the Draft Final Report.

(2) The undertakings of JICA and the Department of Fisheries are attached as Annex-I.

(3) Comments made on the Draft Final Report, are detailed in Annex-II and shall be considered for inclusion into the Final Report.

The list of participants of the 12th Coordination Committee Meeting (morning session) is attached as Annex-III and the list of participants of the afternoon session is attached as Annex-IV.

ANNEX-I

UNDERTAKINGS OF JICA AND THE DEPARTMENT OF FISHERIES, MINISTRY OF MINES, NATURAL RESOURCES AND ENVIRONMENT

1. The Department of Fisheries, Ministry of Mines, Natural Resources, and Environment will seek the endorsement of the Malawi National Aquaculture Strategic Plan by Cabinet.

2. The Department of Fisheries will present the comments on the Draft Final Report, if there is any, to JICA Malawi office before 1 July 2005 which will be forwarded to the Study Team and incorporated in the Final Report.

3. JICA shall consider the production of the Final Report in two formats, suitable for its own purposes and those of the Department of Fisheries.

4. The Department of Fisheries will request JICA to host the output of the Master Plan Study on Aquaculture Development in Malawi on its website.

ANNEX-II

CONTENTS OF RECOMMENDATIONS FOR THE DRAFT FINAL REPORT

1. All maps and the statements used in the document should respect the official international boundaries of the Republic of Malawi.
2. One page summary of the 'Situational Analysis of Aquaculture in Malawi' should be included on the Part I of the Draft Final Report.
3. A paragraph needs to be inserted that describes the spectrum of farmers on a development continuum or path of progression that clearly illustrates how a farmer may progress along the continuum.
4. The Zomba Trout Farm should be included into existing commercial operations in Malawi.
5. The role of private sector in aquaculture development as a partner of the Department of Fisheries needs to be clearly outlined.
6. The wording, statement, or terminology should be revised in consideration with following points:
   a) On the Map of Malawi, EPA boundaries needs to be deleted, wording from ADD to District Boundaries and spelling of "irrigation" (bottom right) need to be corrected.
   b) The statement, 'the National Aquaculture Strategic Plan is built on the experiences of the past,' should be included in the preamble.
   c) On Page 0-3, paragraph 5, the statement, "The mistake of the past was that aquaculture development was promoted largely as a separate entity" was considered to be false and needs to be corrected to better reflect the integrated nature of aquaculture promotion in Malawi during the last 10 years. The statement on Page 1-5, last paragraph is considered to be more appropriate and this should be consistent throughout the document.
   d) On Page 1-11, on line 3 '2' should be replaced with '2000'.
   e) On Page 2-11, the word 'free' should be deleted.
   f) On Page 2-12, Output 1.3, the target date of 2006 should be revised to 2007.
   g) On Page 2-21, the bench mark for Output 5.2 needs to be revised.
   h) On Page 2-22, the bench mark for Output 5.3 needs to be revised.
   i) On Page 2-24, the statement on NGO needs to be revised.
   j) The term 'subsistence farmers' should be replaced with either 'small-scale sector' or the 'rural aquaculture sector'.
   k) The term 'profit-oriented farmers' should be replaced with 'large scale commercial aquaculture,' 'industrial aquaculture' or 'stand alone aquaculture.'
   l) 'University of Malawi' should be referred as a collective term for Chancellor and Bunda Colleges except where Bunda College is the more appropriate institution.
   m) The terminology needs to be standardised throughout the document.
7. The link between the overall goal and vision of the National Aquaculture Strategic Plan and the existing development plans of the Malawi Government needs to be clearly addressed.
8. The National Strategy for Sustainable Development and Agenda 21 should be referred where exotic species are discussed.
9. The curriculum development and training of trainers should be included within the strategy for the quality capacity building.

10. Fertilisation strategies (inorganic and organic), as well as fertilisation and complementary feeding need to be included as two additional research topics for the Chambo Research Programme (Page 3-18).
11. The threat of fish diseases needs to be acknowledged in the document.
12. The implementation structure (Page 3-27) should be revised in consideration with following points:
    a) The Terms of Reference for a body that will advise on the development of aquaculture in Malawi shall be defined.
    b) The term 'Aquaculture Advisory Board', as referred to in the National Aquaculture Strategic Plan will be replaced by "A body that will advise on aquaculture development in Malawi".
    c) A sentence will be added to clarify the implementation and functions of the body.
    d) Technical advisor should be attached to the planning unit which can coordinate both research and extension. Therefore, the position of the 'technical advisor' in the Figure 3.1 needs to be revised.
    e) Both operational and technical advisors need to be involved in the body as observers.
13. The technical assistance (Page 3-30) should be revised in consideration with following points:
    a) The Terms of Reference of the 'operational advisor' and the 'technical advisor' should be defined by the Department of Fisheries, in consultation with relevant donors. Demarcation of two advisors needs to be addressed.
    b) Table 3.14 should be revised according to Figure 3.1.
    c) The link between each strategy and the technical assistance needs to be explained.
    d) The specialist for 'institutional building' needs to be rephrased as an 'institutional arrangement' specialist.
14. Sensitisation of the stakeholders on the contents of the National aquaculture Strategic Plan should be indicated in the Draft Final Report.

ANNEX-III

LIST OF PARTICIPANTS IN THE 12th COORDINATION COMMITTEE MEETING HELD ON 2 JUNE 2005 MORNING SESSION

1. Department of Fisheries, Ministry of Mines, Natural Resources and Environment

Mr. Alexander Bulirani	Deputy Director
Dr. Moses Banda	Chief Fisheries Officer, Research
Dr. Steve Donda	Chief Fisheries Officer, Planning
Mr. Orton Kachinjika	Chief Fisheries Officer, Extension
Ms. Jacqueline Kazembe	Principal, Malawi College of Fisheries
Mr. Sabstone Unyolo	Fisheries Officer, National Aquaculture Centre
Mr. Brino Chirwa	Fisheries Officer/ National Project Coordinator

2. JICA Monitoring Team

Mr. Juichiro Sasaki	Leader/ Fisheries Development
Mr. Masaru Okamoto	Fisheries Development
Dr. Kunihiko Fukusho	Aquaculture Technique
Mr. Makoto Hirata	Project Management

3. JICA Malawi Office

Mr. Kenichi Matsumoto	Assistant Resident Representative

4. JICA Study Team

Mr. Sachio Yamamoto	Team Leader
Prof. Thomas Hecht	Aquaculture Technology
Dr. Timothy Andrew	Community Development
Dr. Olaf Weyl	Fisheries Production/Data Analysis
Ms. Yuki Niimura	Project Monitoring
Ms. Chigusa Seki	Coordinator

ANNEX-IV

LIST OF PARTICIPANTS IN THE 12th COORDINATION COMMITTEE MEETING HELD ON 2 JUNE 2005 AFTERNOON SESSION

1. Ministry of Mines, Natural Resources and Environment

Mr. Thouse R O'Dala	Principal Secretary
Mr. Joseph Matola	Director of Finance and Administration

2. Department of Fisheries, Ministry of Mines, Natural Resources and Environment

Dr. Sloans K. Chimatiro	Director
Mr. Orton Kachinjika	Chief Fisheries Officer, Extension
Mr. Brino Chirwa	Fisheries Officer/ National Project Coordinator

3. JICA Monitoring Team

Mr. Juichiro Sasaki	Leader/ Fisheries Development
Mr. Masaru Okamoto	Fisheries Development
Dr. Kunihiko Fukusho	Aquaculture Technique
Mr. Makoto Hirata	Project Management

4. JICA Malawi Office

Mr. Kenichi Matsumoto	Assistant Resident Representative

5. JICA Study Team

Mr. Sachio Yamamoto	Team Leader
Ms. Yuki Niimura	Project Monitoring