

Aquaculture in the Central and Northern region of Malawi

Contribution to the ODA supported study on
Socio-Economics of Aquaculture in Africa

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Executive summary

Introduction

- 1 This report represents part of a research project funded by the ODA which aims to assess the socio-economic dimensions of aquaculture development in Africa. The information presented here was collected as part of a study of the economics of aquaculture in Malawi, commissioned by the EEC, for the Central and Northern Regions Fish Farming Project (CNRFFP). The objective is to consider aquaculture development in Malawi in the context of conclusions reached from the main ODA funded research based in Luapula Province, Zambia. As this document is intended as a reference to the reader of the main ODA research report, details of Luapula findings are not repeated here.
- 2 The project concept, activities and achievements are discussed. The initial project proposal, on which donor funding was agreed, was found to have major flaws in the assumptions made, most notably the grossly over optimistic production targets. A wider objective of nutritional benefits was initially specified as an implicit assumption relating to increased production, although the means to evaluate these benefits were not considered.
- 3 A mid term project evaluation identified these weaknesses, and a new set of objectives and targets were formulated. These included technology and infrastructure development, which has largely been achieved. Target numbers of farmers and average yields were also specified. The latter appears to have been achieved, although the former does not. A one year extension in the donor funding is currently being considered.

The Institutional context

- 4 Project management is discussed. There have been minor difficulties in the relations between the project manager appointed by the host government, and the donor representatives, largely due to problems of lack of maintenance of specified reporting procedures. Problems in the management of the extension programme have included disputes over the availability and allocation of funds, leaving field staff short of overnight allowances and demoralised. Technical problems in maintaining the full programme of fieldwork have been attributed to the donor requirement for the purchase of motorcycles manufactured in an EC country. They proved to be unsuitable, unreliable and long delays were experienced in the procurement of spare parts.
- 5 Links with agriculture: the importance of developing links between fisheries TAs' and DoA field staff was identified in the initial project documentation. However, although there have been a number of training courses for agricultural extension workers, there is, with a few exceptions, little contact in the field. Some doubt was expressed by the extension officer of the value of this training effort..

- 6 Training of extension workers: The lack of training in aquaculture technology of fisheries staff was highlighted by the extension officer. While those joining the project are given introductory aquaculture technology training, there appears to have been minimal training in extension skills, with one 5 day course run by an external consultant.
- 7 Training for farmers has included 5 day residential courses at local centres. The total number trained represents approximately 25% of the total number of registered farmers. About 6% of trainees (one course) were women.
- 8 The extension process, in addition to farmer training, is focused around visits to individual farmers "when ever possible". While the need to develop a farmer based fingerling market is identified and to some extent is being achieved, this apparently relies on the DoF for transport and communication, due to the distance between many farmers.

Motivations for adoption of fish farming

- 9 The main motivations for adoption appears to be food and income. There is conflicting evidence as to which of these is now most important. In terms of income generation, the perception of a ready pond side market for fresh fish prevails among fish farmers.
- 10 There is strong evidence that many farmers were motivated to adopt fish farming following the announcement of the project, in the expectation of benefits, due largely to their observations and experience of previous development interventions (non fish farming).
- 11 The development of fish ponds to claim land, as observed in Luapula, does not appear to occur in Northern Malawi, as wider land ownership prevails. Other forms of asset formation, in pond and fish, appear to be less prevalent than in Luapula.
- 12 Aquaculture groups have not been widely encouraged by the project, and those that have formed have been generally unsuccessful.

Viability of smallholder aquaculture

- 13 Given that cash income is a major motive for adoption, the economic viability discussed. The analysis of on-station production trials suggest that in a well managed smallholder fish farming operation, the purchase of inputs is justified. This conclusion conflicts with data from field studies, which suggests that many farmers buying a significant amount of inputs are achieving, at best, marginal benefits from the operation. This suggests that farmers should be encouraged to develop ponds suitable for their own on -farm resources, and discouraged from investing cash. Some farmers considered successful by extensionists (higher production) were found to achieve a lower contribution to income than others considered to be unsuccessful due to low inputs and outputs.

- 14 The methodological difficulties in making economic assessments, and the potential for error in the data, are discussed. The real test of viability, in terms of the individual farmers objectives, is the continued operation of the fish ponds. Whether an analysis from the outside, using criteria not necessarily appropriate to the motives of the fish farmer, suggests profits or loss, is less important.

Constraints to viability

- 15 The major constraints to the viability of smallholder fish farming are very similar to those identified in the luapula study: Poor understanding of livestock management, the amount of inputs required, and the limitations of the pond production system were a dominant feature.
- 16 The lack of on farm resources significantly limits production potential. Off-farm sources of pond inputs include free or purchased materials. There was evidence that over the longer term, gifts or favours of free inputs may not be a reliable source, or remain free. Purchase of inputs does not appear to justify the benefits.
- 17 Predation is reported to be serious problem, although in some cases it is not clear to what extent "the animal" is blamed for other losses such as theft by humans, of simply poor performance due to bad pond management.
- 18 Flooding and drought appear to have affected a significant proportion of farmers in some areas.
- 19 There was no direct evidence of success in fish farming resulting in social control mechanisms. The fact that most farmers gave some fish to relatives when harvesting was not presented as a problem.
- 20 Attitudes of expectation and dependency appear to prevail among smallholder fish farmers. While this may have been contributed to by the approach of the project, this is not isolated to fish farming, and is believed to reflect the legacy of past, and ongoing, development interventions in the sector.

Effects of Adoption

- 21 Fish farmers appear to be generally better off than their neighbours. Most pond owners are men, but women are usually involved in routine aspects of pond management. This is not reflected in the staffing or the activities of the extension services (in effect omitting a significant proportion of their potential target group)
- 22 The benefits to household cash income vary, as discussed above. The benefit of additional fish consumption to households, based on a small sample, appears to be minimal (few meals a year). In terms of nutritional benefits, this is probably insignificant compared to the reported consumption rates of dried fish (few meals per month or week). These farmers do not appear representative of the nutritionally most needy. There may well be exceptions.

- 23 It was not possible to draw any conclusions about the potential negative impact of fish farming on the household. However, there was no evidence that the labour requirement of the pond had any negative impact on other productive or reproductive activities of household members. All farmers thought fish farming was little effort after the initial pond construction.
- 24 There was no evidence of significant benefits or costs occurring in the local communities where fish farming has developed. Land or water conflicts were not reported in the project area, although there were suggestions of some water disputes in the south. The small production suggests that the impact on local communities is relatively insignificant. The generally higher price of cultured than dried fish suggests that those consuming farmed fish are probably not the nutritionally most deprived.

Lessons for future policy

- 25 There is a need to clarify the goals and measures of achievement of aquaculture development. This particularly applies to the specification of nutritional benefits while achievement is specified in production terms. Broad estimates of production may provide a useful indication of project performance. However, this measure is inadequate to assess individual farmers' "success", sustainability of operations, or benefits to households or communities. In the long term the only real measure of achievement is the sustained fish production as a rural farming activity.
- 26 Monitoring and evaluation require better definition of the type of information required to assess achievement. Objectives must be realistic, set in the context of the practical limitations. The use of computer database systems to collate and process information must be carefully evaluated, the potential benefits set in the context of the high cost of developing and maintaining such systems. They should be avoided if more simple approaches can be used.

Future institutional frameworks

- 27 The rationale for an independent aquaculture extension system is questioned, in view of the limited development potential and budgetary constraints. The justification for the relocation of this advisory role within the agriculture department is based on both cost and the rationale of viewing fish farming as simply one activity in a diverse farming system, rather than an isolated activity.
- 28 The practical constraints to achieving this are discussed. Under the present system of agricultural extension, a simple transfer of responsibility is not likely to result in significant improvements in the system.
- 29 This implies that for any major change in institutional framework to be effective, it would have to be accompanied by major internal changes to address existing problems. It is believed that a more participatory approach to the development process is required. Such changes cannot be achieved quickly. The development of different attitudes and skills in the extension service would require a major efforts

to design and implement appropriate training programmes for staff entering the service, and staff already employed.

Short term changes

- 30 There is a need for better collaboration between various institutions involved in aquaculture research and development in Malawi. The results of extensive research into the role of the fish pond in the farming system, and the development of participatory extension methods (by ICLARM) does not appear to have produced any change in the approach of the DoF extension services. In relation to a more integrated approach to agricultural development, the need for collaboration also extends to include other institutions involved in the development of the rural farming sector.
- 31 Immediate requirements for the future project activities include the issue of developing local fingerling supplies, which must be set in the context of the need to maintain stock diversity to prevent stunting. There is a need to investigate potential protective and management measures to reduce the impact of predation.
- 32 The project must aim to consolidate the existing achievements. There is a danger that having gone through a period of rapid adoption, many farmers who are disappointed with the results, due to poor pond management, or unrealistic expectations, will abandon their ponds. The current approach to extension must focus on how best to address the constraints outlined above.

1 Introduction

This report represents part of a research project funded by the ODA which aims to assess the socio-economic dimensions of aquaculture development in Africa. The information presented here was collected as part of a study of the economics of aquaculture in Malawi, commissioned by the EEC, for the Central and Northern Regions Fish Farming Project (CNRFFP) September to October 1993 (Stewart, 1993).

The objective here is to consider aquaculture development in Malawi in the context of conclusions reached from the main ODA funded research based in Luapula Province, Zambia. As this document is intended as a reference to the reader of the main ODA research report, details of Luapula findings are not repeated here.

2 The Central and Northern Regions Fish Farming Project

2.1 Project concept and description

The initial formulation of this project was prepared in 1983 (Landel Mills, 1983), the financing agreement prepared in 1986, and EEC funding was opened in 1988. The pre-implementation activities and some initial construction work was initiated in 1988. Phase I started with the arrival project co-manager and counterpart staff in March 1989. Phase II is due to end in March 1994. A one year extension of donor support has been provisionally agreed.

The project is jointly funded by an EDF / EEC development grant (76%) and the Government of Malawi (24%). Administration of the project at a local level is the responsibility of the project manager, appointed by and responsible to the department of fisheries, as are all other in-country staff. These include research, extension and administrative personnel. Expatriate staff, employed through external consultants managing the project, have included the project co-manager, and counterpart research and extension officers. At present the research officer is the only remaining expatriate staff member.

Project goals

The primary objective was to "establish, over a five year period, the technical and economic parameters for fish farming in the north, and to provide an infrastructure and extension service for continued development and support of the industry"(Annual report 1989/90). The wider objectives, detailed in the project submission document, were "directed towards alleviating the problems of limited fish supplies in the Central and Northern Regions". they were, specifically, to:

- provide nutritional benefits to rural populations (in particular " to help alleviate nutritional deficiencies amongst rural children") ;
- increase the incomes of rural farmers.
- improve fish production by estates to bring nutritional benefits to workers and local populations;
- improve the fish production from the country's many storage dams.

The specified output of the research programme was concerned with technology development (appropriate species and production systems for upland aquaculture) and on-farm research, to monitor the impact of aquaculture development.

The annual report of 1989/90 indicates that "while the immediate target group for these activities was reported to be rural farmers, the project also aims to identify opportunities for fish farming by estates and businessmen". Project targets given in the submission document, included "expected annual quantities" of cultured fish in a number of sectors, including smallholder production (~88tn), estates (350tn), dams (50tn), and farms (~208tn).

To achieve these objectives, the project provided infrastructure in the form of a central station for research, training and fry production, and a series of regional extension stations and fry production centres throughout the project area. It was proposed that "use should be made of existing agricultural extension services where possible, to benefit from its much wider rural coverage and from the knowledge of the smallholder sector". This was to be achieved at a field extension level by the integration of the project activities with those of the Ministry of Agriculture, through the Agricultural Development Division (ADD). Finally, it was proposed that a credit systems should be established for pond construction and inputs, to be administered by the ADD along side agricultural rural credit.

During the mid term evaluation of the project in 1991, it was recognised that the production targets were grossly optimistic: a very significant proportion of the development potential identified in documentation of both donor and host government representatives, was not achievable due to factors outside the control of the current project. As a result, a revised set of objectives were drawn up during the Project Planning Workshop of 1992. The goal of the project was no longer specified in the wider nutritional and economic benefits, as these were seen to be beyond the scope of the immediate project. It focused on what was previously termed the "project purpose", specifically to "Establish, over a five year period, the technical and economic parameters for developing fish farming in Northern and Central Malawi", while the project purpose became to "Consolidate research and extension activities for smallholder aquaculture and appraise the technical and economic viability of semi-intensive systems and small water bodies".

This summary includes targets for the number of farmers assisted (600 in both the Central and the Northern region). Although a total production objective was not stated, it was implied since yield increase, from 1.2 to 1.5 tonnes /ha/yr was identified. The project role in the development of commercial aquaculture was focused on assessing this potential, rather than promoting the development at this stage. Commercial sector production targets were dropped.

2.2 Project activities and achievements

2.2.1 Infrastructure development

The project has developed or rehabilitated 9 extension stations (6 are fry production centres) . The project HQ at Mzuzu also has a research facility. In March 1993, 12 extension staff were employed (technical assistants, TA, and senior technical assistants, STA). Each extension worker is expected to cover a radius of 20 - 40 km. The project area covers about two thirds of the country.

2.2.2 Training

Training of fish farm extensionists

The basic technical training for fisheries TAs' is provided at Mpwepe training Centre, of the Natural Resources College. However, this training, which is based principally on capture fisheries, does not apparently prepare graduates for advising farmers on fish farming. There is therefore a requirement for extra training in fish farming for both new graduates and those being transferred from fisheries to aquaculture (Vincke, 1993). At the start of the project, in 1990, all extension workers were given a three week introductory course (22 participants), since backed up by occasional refresher courses. Later recruits have been given informal on the job training at the project HQ, Mzuzu, before being posted.

The above training was principally technological. In view of the need for training in communication skills, a 5 day course was run for project TAs', and individuals from other projects, in 1992. It is not clear to what extent basic communication and extension skills are part of the initial college training, but it appears that training in this area is lacking.

Training of Agricultural extension staff

Three 5 day courses have been provided since 1990, training 54 agricultural staff in the basics of aquaculture. The participants have been reported to be enthusiastic. However, the project extension officer was doubtful to what extent they will be "motivated to carry out tasks such as inventory of ponds, which must be the project priority" (Vincke, 1993). The problem of transfer of these individuals to areas with no potential for fish farming was also cited.

It was not possible to contact any of these extension workers trained by the project, or assess the impact of the training. It is reported that in Dedza, far from the project HQ, the fisheries TA is based in the agricultural extension office, and relies to some extent on the Agricultural TAs to act as the initial contact for farmers interested in fish farming

It is surprising that the project expatriate extension officer considered pond inventory as the project priority regarding the potential role of DoA extension workers: ie data collectors rather than information providers. As this post ended in early 1993, it was not possible to discuss the issue further.

Training of farmers

Training for farmers has consisted of 5 day residential courses, and occasional field days. The courses have been run at local agricultural or Smallholder Coffee Authority training centres, by the project training officer assisted by the local extensionists. Courses usually include one field trip to the nearest fish farm station. A total of 261 farmers have been trained to date, including one training course for 15 women (members of Income Generating Activity womens groups). A further 59 farmers have taken part in open days.

2.2.3 The extension approach

Vincke (1993) reports that soon after posting the extensionist organised information / awareness programme through local leaders, and DoA field staff, to inform the population of the CNRFFP objectives and extension plan. They also were required to make a inventory of existing ponds, new and abandoned. Their general duties were as follows;

- Make contacts with farmers who wish to start farming
- Visit the site and advise on all aspects of pond construction
- arrange for stocking of the pond, from DoF or other farmers
- advise farmer on pond management
- provide advice and assistance whenever possible
- help with the organisation of farmers clubs
- fill in reporting forms for the project database
- propose and arrange training courses in collaboration with the training officer

As well as advising, the extensionist "should also listen to farmers, to understand problems and relay these back to the project management"

2.2.4 Project achievements: number of farmers and production

The present number of fish farmers recorded by the project, at 1205, reaches the revised project target. In terms of yields, however, rather than increasing as specified in the targets, data available suggests that, if anything, yields have actually decrease by a small amount over the last two years. Due to the problems of obtaining meaningful data for this sector, it is uncertain how much confidence should be placed in the figures available.

The estimation of yields is based on extrapolated data for a small number of farmers recorded by the TA's and submitted to the project HQ for entry on the data base. This includes details of weight of fry and larger fish, the period since stocking (or last harvest), and the fate of the output, in terms of sales, home use or gifts. Where this information is complete, there is no reason to believe that it is not reasonably accurate. The problem comes in the extrapolation of this to annual yields for the individual farmers, and to yields for the sector as a whole. In the case of annual yield estimates, the harvest data does not include fish which may have been taken as partial harvests at other times. Where this occurs, it would tend to make the recorded yield an underestimate. On the other hand, it is not clear to what extent it is reasonable to extrapolate from a relatively small number of

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samples (70 in 1992/93) to all farmers ponds: are the farmers who's ponds are harvested really representative of the whole sector? This problem has become more acute in the last year due to problems in the field extension service: only 5 harvest records were available up to October in 1993.

Given these limitations, the current average yield estimated by the project (about 11 kg/100m² /yr), and the extrapolated total output of about 30 tonnes per annum, are only broad indicators, and may well represent an overestimation. Furthermore, yield figures do not give any indication of the economic viability of these production systems (in cases where farmers invest cash in fish farming), of the wider benefits (or costs) to households or communities which may arise as a result of adoption of fish farming.

Taken at face value, however, the achievements of the smallholder development component of the project appears to be broadly within the targets of the revised project objectives. The project also set out a range of infrastructure development and research objectives which appear to have been fulfilled (see Stewart 1993)

2.3 Relationship between Institutions

2.3.1 Project formulation

It is clear that in formulation of the project, assumptions were made in the specification of achievements which, in retrospect, could not be justified by the potential for development. There were over optimistic production estimates made in the initial project documentation (prepared by external consultants, assisted with information provided by representatives of the host government). There also appeared to be no provision for the assessment of the stated wider objectives of nutritional benefits arising from this production. This latter point is not unique to this project, and is a criticism which could be levelled at most aquaculture development programmes in the region (Harrison 1994).

2.3.2 Project implementation

A number difficulties have been encountered in the implementation of the project both in terms of management by the host government, and spending restrictions imposed by the donor.

Project management

A number of management problems have occurred in implementation, which have limited the effectiveness of the extension service. Problems relating to the extension activities have principally been associated with poor staff relations between the management and field extension workers, arising through the availability and allocation of overnight subsistence allowances. In addition to being essential for the field extension workers to reach the more distant farmers in their allocated areas, these allowances also represent a significant bonus to the relatively low salaries of these staff. It appears that field staff perceived that a disproportionate amount of this budget had been used by project management. This was reported to hampering the field extension activities at both a

practical level, and in terms of staff motivation, there being a high level of discontent. It is unclear how much this was due to misuse of funds, or lack of information transfer on the availability and justification for the use of funds. It is suspected that both factors were involved.

Poor relations between the project management and donor representatives have occurred due to the failure to fulfil the stipulated reporting requirements.

Technical problems

These have principally associated with transport, particularly the unsuitability and un-reliability of the British motor cycles purchased by the project. The procurement of spare parts, through government supplies, has proved to be very difficult and slow. While these were purchased to fulfil the donor requirement of providing European equipment where available, in this case it appears that non European motorcycles would have been both more suitable and more easily maintained.

The research component of this project was also set back by serious flooding in 1991. The risk of this was identified by consultants involved in the initial survey of the proposed site for the project head quarters and research station, but does not appear to have influence the decision to proceed with the development in the chosen site.

2.4 The future

A principal objective of the donor support to this project was the development of the infrastructure and the technology to allow the DoF to provide ongoing support to the smallholder sector in the region. However, it is not clear to what extent the DoF will be able to meet ongoing costs of maintaining this infrastructure. It was the opinion of a number of project staff that with the cessation of donor support, the DoF will have great difficulty in maintaining the current level of extension services. Even during project support, this service has been limited due to problems mentioned above.

3 Who are the fish farmers and what motivates them to adopt fish farming

3.1 Who are the fish farmers ?

Before considering the motivations of those adopting aquaculture, it is useful to consider who is involved in aquaculture. A survey of fish farmers in the project region by Johnson (1992) suggests that "fish farmers are different from the general population. They are of a higher social status, have achieved superior educational status, and enjoy a much higher income level than others..... The typical fish farming household is headed by a man {of middle age}, established both in the community and financially". This study found that fish farming households in the project region had nearly three times the wealth, in stocks, of the baseline population. In terms of income, the average recorded for fish farming households was more than twice the national average.

Only one in ten registered fish farmers are female, although in practice most fish farming operations involve female labour. This is set against a background figure of about 30% of rural households headed by women. One reason given for the lack of adoption by women is that female headed households are generally poorer than others, while it is observed that fish farmers are generally better off (the only female fish farmer visited during this study was the head of a relatively wealthy household). Another factor is that women generally have poor access to the extension service. Johnson notes that (in 1992) all fisheries extension officers in the North were men. While there is acknowledgement of the need for a greater recognition of the role of women in the development and implementation of the extension programme, to date this does not appear to have resulted in any real changes in the practice, although one woman is now employed at the Mzuzu station.

A small sample of fish farmers visited during this mission appeared to confirm this view. The selection of farmers was based on the local extension workers choice of a few successful and unsuccessful farmers. No guidelines were given as to the criteria for this selection, but the choice of the TA appeared to be based on standards of pond management and recorded harvests.

Six of these were the focus for farm budget case studies (Stewart 1993). Of these all had sources of off-farm income. In four households, the head (man) was involved in building, either as seasonal work, or full time. None of the project records gave any indication of these activities. One farmer worked at a local broadcasting station. The only female headed household in the study received a small off farm income from her husband, who was a retired civil servant, now in private business in Blantyre. This farmer had noticeably greater assets in buildings and livestock than other farmers visited. There was also some indication that her apparent wealth was the cause of some friction within the local community.

It must be noted that the data presented by Johnson has large standard deviations, and can only be taken as a general indicator. The findings do not mean that the less well off households do not or can not take part in aquaculture production.

Motives for adoption

3.2 Fish for food and fish for income

Most farmers interviewed indicated that their main reason for starting to grow fish was to have fresh fish to eat, followed by cash income. Studies by both Vincke (1993) and Johnson (1992) report a similar finding. Convenience of access to fresh fish, as an initial motivation for adoption, did not appear to be influenced by the location of the farmer (ie highland or lowland lakeside areas) (Maluwa, pers com).

Evidence for the reasons for continuing to farm fish is conflicting. Farmers interviewed on this study all suggested that cash income is now more important. Harvest data collected by field extension workers, compiled on the project data base, suggests that about 70% of fish produced is sold, the remainder used for home consumption or gifts (Vincke 1993). Johnson (1992), however, found that on average fish cash income represented only 26% of harvests, the remainder being used for food (40%), gifts (20%) and payment for labourers (13%).

It is likely that there are significant inaccuracies in the specific details of both studies, due to the problems of data collection in this sector. In general terms, however, these discrepancies are probably not too important. The only real conclusion which can be drawn is that both food and cash are important factors motivating and continued operation of these fish ponds.

3.3 Asset formation.

Land

Unlike in Luapula, there was no evidence of aquaculture development being motivated by land claims in the Northern region of Malawi. Vincke, 1993 reports that the average land area owned by fish farmers in the project region is 8 ha (56% own between 1 and 10 ha, 18% less than 1ha), but on average, less than half is currently under cultivation. There was no evidence of land conflicts arising from fish pond developments. In general, such conflicts are less likely to occur due to established ownership.

The pond and fish stocks as assets

In the time available it was not possible to ascertain to what extent the pond, or the fish, are regarded as an asset. One farmer visited said he last time fish were taken was for a funeral. Others said they would sometimes take fish if they had visitors. Both suggest fish being held as an asset of social value. However, it was not clear to what extent these attitudes influenced the quality of the pond management: there was no direct evidence in these cases that fish were not being harvested over long periods in order to keep stock for these purposes. There was no evidence to support or refute the potential role of the pond as an asset.

3.4 Development effect

There is strong evidence that the expectation of material benefits is a major factor in motivating farmers to adopt aquaculture.. The chairman of a local fish farmers club reported that many club farmers had started fish farming because they had seen benefits obtained by other farmers (in the form of loans and subsidised cattle) from showing interest in an externally funded dairy project (Brooks, 1993)

All of the farmers visited during this mission indicated that they expected more support from the project than they have received. This included requests for loans for pond construction, for a fence to prevent predation, assistance with equipment , pond inputs, the provision of more fingerlings, and assistance with the acquisition of poultry to provide manure for ponds. One farmer, who had invested a large amount of cash in his fish pond operation, but was not making any effort to manage these ponds, indicated that the project had provided the "wrong kind of fish". Another appeared to be quite angry when asked about the role of the DoF extension services in comparison to the Agricultural support. She wanted to know why the fisheries extension service could not assist more with her problems (inputs), and why they could not visit more often, like the agricultural advisor.

Farmers did not appear to understand the limitations in what the DoF could realistically offer. This is probably partly due to the development culture for the sector, but must also be attributed to the expectations created, perhaps inadvertently, by the project. The perception that what is due has not been delivered is often taken as a reason for not achieving the expected results. In some cases this can result in farmers abandoning their ponds. (see factor affecting sustainability).

These findings are not isolated to fish farming, and are believed to represent a major constraint to the development of sustainable rural production activities.

3.5 Marketing systems

The perception of a ready market for fresh farmed fish prevails among smallholder fish farmers. The ease of marketing may well act as an incentive in the adoption of fish farming for cash. Farmers reported that if the harvest is announced beforehand, all fish can be sold at the pond side. The ease of marketing for the smallholder fish farmer is partly due to the very low output from fish farming at present. The local demand easily absorbs the current production. It is therefore not necessary for farmed fish to be integrated into the extensive marketing network for wild fish.

If there was a significant expansion in production, this situation could change as the capacity of rural communities to purchase fresh fish is believed to be limited. Although at present a harvest might all be sold very quickly, another the next day, or on subsequent weeks in the same village or area, may well not produce the same eagerness to buy.

At the current stage of development, marketing is not an important limiting factor. Furthermore, given the constraints which limit the output of smallholder fish farming, this will probably not be a major issue in the future.

4 The Economics and Management of Fish ponds

In the Luapula study, a lack of tradition of livestock management and knowledge of fishfarming production cycles, lack of inputs, both in terms of availability and application, and a range of problems such as predation, theft and drought were recognised as major constraints to the viability of fish farming.

The situation in Northern Malawi does not appear to significantly different. This section first considers information available on the economic viability of fish ponds, followed by a discussion of the constraint to smallholder fish farming

4.1 The economics of smallholder aquaculture

During this study, a selection of "successful" and "unsuccessful" fish farmers (DoF TA criteria for selection) were visited with the objective of making an economic analysis of the fish pond and other farming activities. (see Stewart 1993). Difficulties of applying quantitative analysis to smallholder farming operations, and the potential for error in the results of individual farmers budgets, limit the conclusions which can be drawn for individual farming operations. However, the attempts to make an economic analysis, together with other information, is believed to give broad indications of viability and contribution of the fish pond to the farming operation. The results can also highlight a number of important aspects of smallholder pond operations in general which can be of wider use in the development of appropriate extension approaches.

The analysis of fish pond operations for 6 farmers suggested that three made significant contributions to cash income. Two made cash losses, but achieved marginal contributions, or broke even, in terms of total income (ie also applying market values to the fish consumed at home). One businessman farmers had received no income on a very large capital investment made in pond developments.

The most significant point derived from these analyses is that, according to the selection criteria of extension workers, two of the three successful farmers appeared to receive a smaller contribution from their fish pond than two of the "unsuccessful" farmers. Although the latter produced small yields, they invested little. The apparently successful operations, while producing larger yields and revenues, reported purchased inputs at a cost similar to or greater than the cash incomes derived. This observation has been confirmed by Brooks and Maluwa(1993) during on farm monitoring, which indicated that over several production cycles, farmers purchasing most of their inputs, on average, just covered operating costs.

A similar, if more extreme result was reported by Johnson (1992), who found that most farmers operated at a loss. She concluded that farmers may be accepting this as a price for the convenience of access to fresh fish for home use. It is unclear, however, whether her analysis included the value of fish consumed at home as income (in-kind) against cash expenditure. This is an important point in the evaluation of semi-subsistence farming activities. For crops where cash costs are incurred for inputs, but the output is used mainly for home consumption, a cash "loss" may be derived, while a net benefit to the household is achieved.

3.4 Development effect

There is strong evidence that the expectation of material benefits is a major factor in motivating farmers to adopt aquaculture.. The chairman of a local fish farmers club reported that many club farmers had started fish farming because they had seen benefits obtained by other farmers (in the form of loans and subsidised cattle) from showing interest in an externally funded dairy project (Brooks, 1993)

All of the farmers visited during this mission indicated that they expected more support from the project than they have received. This included requests for loans for pond construction, for a fence to prevent predation, assistance with equipment , pond inputs, the provision of more fingerlings, and assistance with the acquisition of poultry to provide manure for ponds. One farmer, who had invested a large amount of cash in his fish pond operation, but was not making any effort to manage these ponds, indicated that the project had provided the "wrong kind of fish". Another appeared to be quite angry when asked about the role of the DoF extension services in comparison to the Agricultural support. She wanted to know why the fisheries extension service could not assist more with her problems (inputs), and why they could not visit more often, like the agricultural advisor.

Farmers did not appear to understand the limitations in what the DoF could realistically offer. This is probably partly due to the development culture for the sector, but must also be attributed to the expectations created, perhaps inadvertently, by the project. The perception that what is due has not been delivered is often taken as a reason for not achieving the expected results. In some cases this can result in farmers abandoning their ponds. (see factor affecting sustainability).

These findings are not isolated to fish farming, and are believed to represent a major constraint to the development of sustainable rural production activities.

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The broad conclusion from the above is that in most cases the extra benefits achieved by the reported purchase of inputs does not appear to justify the extra costs. This result conflicts with the conclusion reached from the analysis of viability of on-station production trials, which suggest that in a well managed smallholder fish farming operation, the purchase of inputs is justified by the output achieved, at average market values. (Stewart 1993),

It is therefore apparent that a number of other factors influence the reported performance of the smallholder fish farmers. These could include:

- i Stock loss due to predation or theft may limit the production potential. There is evidence that for many farmers stock loss is a very serious problem, whatever the cause. Brooks and Maluwa(1993) reported up to 80% stock loss in on-farm monitoring programme.
- ii the data for purchases and level of inputs may be exaggerated, either due to farmers not really knowing, or perhaps wishing to be seen by the project representatives as a "good" fish farmer. Johnson found that farmers asked about their pond inputs were quick to provide information on inputs and applications, even when there was little evidence that these had been applied.
- iii the harvests may be understated. In cases where DoF have not been involved in harvesting, farmers may be reluctant to disclose information on income. Farmer may be reluctant to report partial harvests, even if they do recall the details, due to early extension messages which discouraged partial harvesting, to allow the project to monitor productivity.
- iv the fish may have been sold at a low price for other reasons. For example, one farmer visited sold her fish at about a third of the average market price. It appeared that the low price was motivated by a wish to be seen as a benefactor to the local community. (see below)

Due to the real uncertainties in the data available, it is not possible to make an accurate assessment of the viability of individual operations. However, as discussed above, the issues raised by attempting such analysis give some insights to the relative important of various aspects which influence viability. For the individual farmer, the real test of viability, in terms of meeting the farmers objectives, is the continued operation of the fish ponds, whether an analysis from the outside, using criteria not necessarily appropriate to the motives of the fish farmer, suggests profits or loss.

4.2 Comparisons of pond system in Northern Malawi and Luapula

There does not appear to be any major difference in the standard of pond management observed in Malawi and Luapula province. In the short time available it was not possible to fully investigate the influence of other opportunities for income generating on the efficiency of pond management. In Luapula there were few opportunities for income generation. It was proposed that where there are greater opportunities for generating cash

study there was no indication that the expansion of ponds was motivated by other factors, such as land claims, as observed in Luapula. The motivation appeared to be to increase the cash benefits. However, such expansion is not likely to produce significant extra benefits if extra inputs are not available. Where cash is invested in expansion, cash losses may result.

4.5 Lack of knowledge and availability of inputs

Feed and fertilisers

Lack of on-farm resources and lack of understanding of the amounts which can be beneficially applied appear to be among the greatest constraints to the productivity of small scale fish farming (Brooks and Maluwa, 1993; Stewart, 1993). While research station trials demonstrate that these systems can be highly profitable when on-farm resources are used, in practice the full potential appears never (or very rarely) to be reached. Brooks and Maluwa(1993) has noted that during the on-farm monitoring programme farmers applied inputs at only 10% of the rate used in the on-station trials. These farmers, having received more attention from the project staff during the monitoring, were aware that they did not put enough into their ponds. They believed that about three times the amounts were required: they did not know that inputs could be increased ten times to achieve the "proper" potential of the pond. This highlights the point made above, which suggests many farmers wish to expand, motivated by increased income, without understanding that existing ponds are under utilised.

The strategy of farmers in response to the shortage of on-farm resources is either to obtain additional inputs from others, at no cost, or to purchase them.

Obtaining inputs from relatives and neighbours is commonly reported. However, the dependence on others can cause problems. An example was encountered during this study. The DoF records for one case study farmer showed that over the last production cycle, inputs applied and yields had fallen significantly. When questioned about this, the farmer said that he used to get manure from a neighbour, but now no longer liked to ask: at first it was not a problem, but later, the neighbour would sometimes tell him that it was not convenient just now, or to come another time. The man no longer seemed happy with this arrangement, so the farmer stopped asking. Although this farmer bought a pig, which provides enough manure for a viable production system, it is well below the amount required to achieve the ponds full potential (he still talked of building more ponds). For the poorer farmers, the option of buying livestock to integrate with the fish pond may not be an option.

The purchase of inputs usually applies to madeya, but has also been recorded in at least one case for manure. Although the analysis of station trials suggests that in a well managed system this is a viable option, data from the smallholder sector suggests that in practice many farmers buying inputs may not be recouping their cash investment (discussed above).

Fish stocks

The availability of stocks and the maintenance of the diversity of these stocks, is critical to the sustainability of smallholder aquaculture. For most farmers, initial stocks are obtained from the DoF, or other farmers. In the latter case, DoF assistance is often involved in the transport of fingerlings. Subsequently, farmers generally retain fingerlings for restocking. In the short term this is adequate, but in the longer term, there is a danger of decline in performance due to inbreeding. This is an aspect which must be taken into account in seeking to develop a sustainable rural aquaculture sector. In the short term, while seeking to develop rural fingerling markets, there may be a need for some ongoing institutional support in maintenance of stock diversity.

Low input / output systems.

It is apparent that low input, low output fish farming operations, although achieving well below the pond potential, can still be considered worthwhile. However, the sustainability of these operations is uncertain. With the low effort strategy, there is a greater chance that the poor management (in terms of long production cycles) and high losses due to predation and theft, will at some stage mean that farmers will not be in a position to restock their ponds from their own stocks. In the absence of support from the DoF, either to provide fingerlings or the transport to bring fingerlings from another farmer, these ponds might end up being abandoned, unless there are other fish farmers nearby. These low input systems may therefore be more sustainable in regions with a relatively high density of more established fish farmers, and will probably not be sustained if the farmer is isolated.

4.6 Losses (predation and theft)

Losses due to predation by frogs (in the case of fry), birds, otters, mink and humans are a major threat to the viability and sustainability of fish farming in Malawi. However, it is extremely difficult to estimate the scale or extent of the problem. The on-farm monitoring of a number of Mzuzu farmers indicated losses of up to 80% from initial stocking (Brooks and Maluwa, 1993). Johnson (1992) reported that over 80% of farmers in four of the project activity areas complained of predation problems. During fieldwork for this study, a number of farmers complained that "the animal" had taken a lot of their fish. At one pond site, droppings containing the remains of fish bones and crustacean shells were observed, and during this mission an otter was caught in a live-trap on the CNRFFP station. In some instances predation is thought to be a very serious constraint, and may be responsible for farmers giving up fish production.

There may, however, be another side to the "predation problem". In this study the most serious complaint came from the least "successful" farmers. There is some doubt whether their lack of success is solely due to predation, or predation is being proffered as an explanation of poor results due to lack of inputs and bad management. A real predation problem may exist, but be made more serious due to longer production cycles, and failure to harvest. The reason for this doubt is highlighted in an example from Nchenachena. In interviews with two farmers with ponds in the same dambo, one attributed his very poor yields to predation, while the other, although acknowledging the problem, was still producing considerably more fish.

There is no obvious solution to the predation problem, but it is of some concern that the research efforts of the project have not attempted to address the issue: while it is important to understand the production potential of a system, and the expected outputs from alternative production strategies, this information is of little benefit to farmers if their fish are going to be consumed by predators.

No single measure will solve the problem for farmers who are truly suffering losses. One farmer asked for a loan to build a fence around his ponds, which is not a realistic option. The investment would never be justified, even if loans were available. The problem must be approached by investigating protective and management strategies which might reduce the impact of predation. For example one farmer thought that predation was only a problem in the dry season, when the lack of water in rivers and dambos made the animals come to the ponds. If this is the case, harvesting fish at the beginning of the dry season, leaving fingerlings in the pond, might reduce the impact of predation, as very small fish may be less prone to predation. Protective methods, such as putting many branches in the pond, or placing many sticks protruding from the pond base, have been suggested as a means to hinder the movement of predators in the pond and providing cover for the fish.

This approach may also hinder theft. (This was reported in Zambia, and observed in a small number of cases during field studies. There was no indication whether it was proving an effective measure). These suggestions are provided to illustrate potential approaches to the problem, not solutions.

The siting of new ponds in relation to the house is another strategy to reduce the risk of losses, although for many farmers not a practical proposal. Houses are traditionally located on the slopes above the dambo, and in the Northern Region where land is perceived to be abundant, most ponds are some distance from the house. Two farmers with relatively large fish yields lived close to their ponds, and did not complain of predation or theft. One reported that his dogs kept the animals away.

Theft was not reported to be a problem by the farmers interviewed during this study, although one farmer said that he was reluctant to practice partial harvesting using a hook and line "because people might see him and get the idea". A number of people interviewed, both farmers and DoF staff, suggested that local approaches to dealing with theft acted as a strong disincentive to theft. These include beating, reporting to the headman and paying compensation, or, in a few cases, as a last resort, reporting to the police (in the past the party officials).

It is not clear to what extent theft occurs, or to what extent animals are blamed where people have stolen. It was suggested by one interviewee that there may be a reluctance on the part of farmers to implicate other villagers in the loss of their fish, that it is easier to blame the animal..

4.7 Flooding and Drought

Both flooding and drought have been reported as problems in the project area, the extent varying in different regions. Johnson (1992) reports that in Dedza, in central region, more than half of farmers interviewed had problems with water supply. In the north, flooding was reported as a greater problem, reported by about one third of farmers. It was not possible to ascertain to what extent these problems could have been avoided by better siting and construction of ponds. Over the last three years there have been both severe periods of drought, and unusually heavy flooding.

4.8 Social control and Obligations

It is not possible in a short study such as this to assess the presence or role of levelling mechanisms. However, a few observations can be made.

Most of the farmers interviewed indicated that there was no problems in being successful. People didn't mind if someone was known to be a hard worker. In one case, however, there may have been evidence of levelling mechanisms. A comparatively wealthy female fish farmer complained that other women did not want here to join the poultry club, as she was doing well enough already. It also appeared that her decision to sell fish at less than half the average market price ("so local people can buy them") may have been influence by this situation. If there was any "levelling", it appeared to be due to the womans' overall success, and obvious wealth. It seems very unlikely that this was in any way associated specifically with the fish pond. In fact, it appears in this case the fish may have been used in an attempt to counter negative feelings in the community.

In terms of social obligations, all farmers indicated that when they harvested ponds, some fish were given to relatives. This was not presented as a problem. (Could it influence the frequency of harvests??)

4.9 Dependency culture: Creation of unrealistic expectations

The fact that expectations of benefits are involved in the initial motivation to adopt aquaculture has been discussed (3.4 above). Unrealistic and unfulfilled expectations are thought to represent a major constraint to the development of sustainable rural aquaculture.

In many cases the project may have unwittingly reinforced this problem. For example, the research into alternative species, and knowledge of this work: The "waiting for a better fish" attitude of some farmers is based on the belief that DoF will soon provide fingerlings which will make the pond very productive. This may well have a negative development effect, in that some farmers attribute the poor performance of their pond with poor fish. This will hinder the work of extensionist trying to help farmers learn about pond management, and how to make the best use of what is available. This is not an isolated observation. In Luapula the promise of a better fish appeared to influence

farmers decisions concerning re-stocking of ponds.

The attitudes of dependency are not isolated to fish farming, and reflect the traditional approach to the development of the rural agricultural sector, where the government delivers technical packages, provides inputs on credit and the marketing infrastructure for outputs. While this may be appropriate for certain crops where there is a need for such inputs and infrastructure, it has not resulted in the sustainable rural development which was hope for. Conversely, the dependency created by this approach may represent a major constraint to the development of sustainable rural production activities.

This suggests that there is a need to re-evaluate the whole approach to rural development programmes, including the approach to the development of smallholder fish farming. There is a need to try to reduce the level of dependency, and the expectation of the project meaning material support. This level of change is beyond the scope of one project, or one technology focused development programme and would require a major change in extension methodologies for the whole rural sector.

5. Effects of Adoption and the development process

The question of who adopts aquaculture, and an assessment of the economic viability of fish pond operations are discussed above. A number of additional issues concerning the effects of adoption, identified in the Luapula study, are discussed below.

5.1 Nutritional benefits from fish consumption

One of the main justifications for the development of smallholder aquaculture is the provision of high quality fish protein for the alleviation of nutritional deficiencies amongst rural populations. This goal, however, was not included in the revised objectives of this project. The above discussion suggests that fish for home consumption is a main factor in the adoption of aquaculture, but this does not necessarily mean that the wider nutritional objectives of aquaculture development are being met.

In Malawi, fish is the cheapest, and traditionally the most widely consumed source of animal protein. Although in many rural areas distant from the lake, fresh fish is rare, dried fish is available almost everywhere. Farmers interviewed during this study claimed to buy dried fish often, ranging from once or twice per month, to several times per week. Fresh fish, however, was rarely, or never purchased in areas far from the lake. Even in the lakeside areas, a fairly wealthy farmer reported that fresh fish was rarely purchased (at most once or twice per month).

Although motivated primarily by fish for food, in most cases fish farmers only reported taking a small amount of fish for home use, on special occasions, or when harvesting to sell. In the latter case, this was usually enough for one or two meals for the family, and a few fish for relatives. (Johnson (1992) reported that less than half of the farmers surveyed indicated that their fish consumption had increased, although it was not clear how this related to the fact that half the farmers had not yet harvested their ponds).

In spite of the uncertainty in the data available, it is clear that the amount of fish taken for home consumption is small. The importance of this in nutritional terms therefore depends on whether there is a real need, or deficiency.

In this case, the reported frequency of consumption of dried fish suggests that the impact of farmed fish will be insignificant, and furthermore, that these relatively wealthy fish farmers are not likely to be those who are least well nourished.

The impact on the nutrition of the non fish farming population is also likely to be negligible, as the fish sold are generally (though not always), more expensive than dried fish, and are not likely to reach the nutritionally deprived members of the community.

Therefore while the fish produced may well improve the quality of the diet for some, there is no evidence to support a direct link between production and nutritional benefits in a large proportion of the fish farmer population.

5.2 Labour

It is not possible to fully investigate the household labour impacts of aquaculture development, or intra-household labour divisions during a short term study of this nature.

In male headed households, the women and children appeared to be involved in the routine aspects of pond management. Johnson (1992) reports that more than half of all feeding of fish is done by women and girls, who are also involved (to a lesser extent) in other activities such as fertilising, stocking, harvesting and maintenance. Therefore although only one in ten registered fish farmers are female, in practice most fish farming operations involve female labour.

In terms of total labour requirements, the general impression from farmer interviews is that this is not seen as a labour intensive activity. While farmers acknowledge that pond construction is a lot of work, none saw the routine management as a problem. One women fish farmer indicated that although she employed three labourers, she fed the pond herself, because it was her recreation.

Given the resource constraints which limit the fish pond operations, it seems that the development of sustainable aquaculture, appropriate to the resource base will not have any significant impact on the labour requirements of the farm household. Even where the scale of the operations could be increase by the purchase of inputs, labour is not likely to represent a major constraint.

5.3 Intra-household control and distribution of resources

In the time available, it was not possible to investigate this issue fully. Furthermore, attempts to talk to the wives in male headed households without the influence of husbands' answers was not possible in any of the case studies.

In the case of male headed households, when the man was asked who made the decisions concerning farming activities, while the older men said it was their decision, several replied that both men and women were involved in the decision making, . However, when pressing the issue further, concerning harvesting and sales, it transpired that even in these cases the men were responsible for all the major decisions regarding fish harvests for home use and cash sales. In seeking more general information about the use of cash from the fish pond, school fees, and the purchase of fertiliser for maize were cited.

5.4 Community level effects

Again, it is not possible to make any proper assessment of such effects, either positive or negative, on a short term visit.

The fact that fish farming does not appear likely to result in community level nutritional benefits is discussed above. There was no widespread evidence of land conflict over fish pond development, although one case was reported. There were no reports of water conflicts in the project region. In the south, extension workers on the Mulange Phalombe

project suggested that during the period of drought, some disputes had occurred. Where a number of farmers had built ponds down the dambo, those lower down, whose ponds dried up first, complained about others taking all the water. There was no indication of any action or attempts at resolution.

5.5 Group adoption of aquaculture

Reports from project staff indicate that in the early days of the project, farmers were encouraged to form clubs, so that the DoF could deal more easily with assisting. (eg a club could borrow a net). These groups, however, did not work well, failed to meet and fell apart. Others suggest clubs are active and successful, as farmers are used to clubs for other crops. Information from farmers suggested that clubs were still in operation, and active, although this often did not coincide with the information from the extension worker or other sources. It is likely that the reports from these farmers were influenced by the presence of the researcher, to whom they wished to say 'the right thing'.

Johnson (1992) reported that "virtually all farmers claim to want to join a club and cite benefits such as ... new methods of farming, availability of loans, and assistance with digging ponds. However, there is only one such club functioning, located in Mzuzu" Reason for the failure or lack of clubs in other regions were given as lack of farmers ability to organise themselves and cooperate, and the dispersed location of fish farmers in some regions. In Nchenachena the extensionists were reportedly not keen to encourage farmers to form a club. Although Johnson suggested that this is an area where fisheries could play a more active role, the view of the Nchenachena extension workers, interviewed during this study, was that if they encouraged the club, it would not last. If farmers wanted one, they would then be glad to assist.

The findings here confirm the conclusions reached in the Luapula study. As long as the motivation for club membership is the expectations of material benefits, these are not likely to represent effective and sustainable mechanisms for the extension system. This does not mean that groups of farmers can not be involved in the extension process, but that there is a need to clarify the role of such group activities, and the likely benefits farmers are to derive.

6 Lessons for future policy and approach

The results of this study, and the work in Luapula, suggest that aquaculture has a contribution to make in the development of the rural farming sector in the region, but perhaps not to the extent, or as envisaged, by many of the major development efforts. Although to date the benefits of these efforts have been small, this must be set in the context of the relatively short time frame of most projects, particularly given the lack of any similar technological experience in the region. In Malawi, the aquaculture development activities of the DoF have not been without problems, but some achievements have been made. It now appears to be time to re-evaluate the policy and approach to aquaculture development. Lessons from the past, the achievements and problems, must be used in the effort to find new ways to stimulate the sustainable development of the smallholder sector, working within the prevailing budgetary constraints. A number of key issues identified in Luapula are broadly confirmed by the findings of this study in Malawi. These include the need for clarification of goals, and a re-evaluation of the institutional framework, and a change in the extension approach to the development of the rural aquaculture sector.

6.1 Clarification of goals and measures of achievement

6.1.1 Nutritional benefits?

The wider objective of nutritional benefits from smallholder aquaculture do not appear to be fulfilled by the current adoption patterns observed in Malawi. This does not mean some farmers do not benefit, but that the overall impact is probably insignificant. In this and other projects there is an implicit assumption that more fish means nutritional benefits, although the need, or the means to evaluation the benefit have not been explicit in development proposals.

6.1.2 Production as indicator

The use of production as the sole criteria of overall achievement, or individual farmers' "success" is inadequate, and does not necessarily reflect the likely sustainability of these developments. In addition to the difficulty in the collection of accurate data, production does not reflect the economic viability, or the other values a farmer might place on having a fish pond. It certainly does not reflect the potential for nutritional benefits being derived. However, in spite of these limitations, broad estimates of production, used in consideration with other measures and perspectives, are important in measuring the impact of the development effort in the short term. In the long term the only real measure of achievement is the sustained fish production as a rural farming activity.

6.1.3 Monitoring and evaluation

In relation to the clarification of goals, there is a need to better define the information requirements to assess achievement. The use of database systems to collate and process information should be set in the context of the practical limitations of collecting data from the smallholder sector. Due to problems of accuracy, the information on project databases

is often of limited value, and may not be justified when set against the costs of collection. In developing information systems, it is essential that the goals are achievable, meaningful and useful: Computer based systems should not necessarily be developed where more simple approaches can be used.

6.2 Institutional aspects for future policy

6.2.1 Aquaculture: Farming or Fishing?

The rationale for aquaculture projects to liaise with the agricultural extension services has been recognised in many projects in the past, including the CNRFFP. There have been various attempts to develop links with the DoA through the provision of aquaculture training for agricultural TAs. There are also a number of DoF extension workers who have an agricultural background. However, in general there appears to be no major efforts at integration of activities with the DoA system. This finding confirms observations in both Zambia and elsewhere in Malawi. This suggests that it is perhaps time to consider a more radical policy change, relocating the role of extension support to aquaculture firmly within the agricultural advisory system.

6.2.2 Justification for integration of extension services

A major argument in favour of integration is the high cost of the independent aquaculture extension system, particularly in view of the small number of fish farmers, and the resource constraints faced by the DoF extension service.

The need to change the approach of the extension service is also put forward as justification for integration. At present extension is focused on delivering single technology recipes rather than helping farmers develop their own knowledge and skills to achieve production systems suitable to their own circumstances: an approach which should take account of all the farming activities. At present most of the aquaculture extensionists have a fisheries background, with a short training in aquaculture. They do not generally have training in livestock or crop production on which to base a more integrated approach to aquaculture extension messages.

6.2.3 Potential constraints to institutional changes

The issue of relocation of the role of aquaculture extension was discussed with a range of DoA and DoF personnel. There appeared to be a widespread agreement that, in theory, the DoA is a more appropriate avenue for the extension of aquaculture advice. The logic that aquaculture is just another farming activity was identified by all.

However, in addition to the suggestion that there may be political difficulties in implementing such a change, a number of more immediate constraints which would prevent this as a practical proposition were given, as follows:

The DoA service faces the same resource constraints as the DoF. DoA TAs' are over worked, poorly trained and poorly motivated. Much of the TAs' work is involved in the administration and collection of loans. As a result, their interactions with farmers are not always positive. The DoF staff commented that "aquaculture would die" if transferred to the DoA, because their main interest is crop production, in particular maize. Fish farming would be given very low priority.

The possibility of using the VA (veterinary Assistants) of the livestock division was also suggested. The constraint here is that they do not have the training in general agriculture, and would therefore fall into the same specialist category as the DoF advisers.

It is apparent from the above comments that a simple transfer of the aquaculture development objectives to the DoA would not solve many of the major problems identified in this report. Many of these problems are also faced by the agricultural extension services, associated with institutional constraints, the top down extension approach, and problems of expectations and dependency within the smallholder sector in general.

This implies that for any major change in institutional framework to be effective, it would have to be accompanied by major internal changes to address existing problems. It is believed that a more participatory approach to the development process is required. Such changes can not be achieved quickly. The development of different attitudes and skills in the extension service would require a major efforts to design and implement appropriate training programmes for staff entering the service, and staff already employed.

6.3 Short term recommendations

6.3.1 Institutional collaboration

In relation to the research, and the development of more appropriate extension approaches, there is a need for better collaboration between various institutions involved in aquaculture research and development.

For example, there has been a significant amount of work carried out by ICLARM, in the Southern region of Malawi, on the role of the fish pond as part of the farming system. This has included investigation of alternative on-farm resources for pond inputs, research into some of the social and economic aspects of smallholder fish farming, and the development of more participatory extension methodologies. However, to date this work appear to have been carried out largely in isolation, and has not produced any significant changes in the approach of the DoF extension services. It is therefore hard to asses how useful the findings are for application on a wider scale.

The need for collaboration also extends to include other institutions involved in the development of the rural farming sector.

6.3.2 Extension

In a simplified view of the project process, the CNRFFP appears to have gone through the period of rapid adoption, and is now entering the period of farmers becoming disappointed, for reasons discussed above. In Chibote, Luapula, such disappointment has been followed by abandonment.

If the present achievements of the CNRFFP are to contribute to any form of lasting benefits, it is essential that efforts are made to consolidate the existing developments, rather than promoting further adoption, or expansion of existing farmers ponds. Given that major changes in the extension system will not be achieved in the short term, the extension services of the project will need to carefully re-examine the allocation of resources, the extension approach, and the training needs of extension workers and farmers.

It is clear that many farmers do not fully understand the potential and limitations of fish production. While pond management information is included in the current extension message, it is apparent that in many cases the concepts are not being taken up. This problem perhaps highlights the need for a more interactive extension process, which should seek to help farmers discover and develop their own ideas, based on their own aspirations and perceptions of viability. In seeking this change, there is also a need to try to reduce the level of dependency, and the expectation of the project meaning material support.

6.3.3 Fingerling supplies

The availability of stock is critical to sustainable development. While seeking to encourage sustainable local fry production and marketing, the need for the maintenance of stock diversity to prevent inbreeding and stunting may require specific institutional support, at least in the short term.

6.3.4 Research requirements

Further technology development in aspects such as alternative species for development, and the investigation of alternative pond inputs, are not considered a high priority at present, in view of the other constraints faced by smallholder sector. One aspect of immediate importance is the investigation of potential approaches to limit the impact of predation (and theft). This could be investigated through farmer based research. While there is a need for better understanding of the social and economic aspects of aquaculture development to provide more appropriate support, this is not thought to be something individual projects should attempt in isolation.

In the long term, if appropriate training can be provided, and a change in the extension approach implemented, the activities of the extension service should become a much more interactive with the farmers, and the current boundaries between research and extension in the development of the smallholder sector should be reduced or removed.

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