

**RETHINKING "FAILURE": FISH PONDS AND PROJECTS IN SUB SAHARAN
AFRICA**

**Summary Findings of ODA-Supported Research:
"Socio-Economics of African Aquaculture"**

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PREFACE

This report synthesises elements of research. It summarises the outputs of the ODA-supported project "Socio-Economic Dimensions of Aquaculture Development in Africa", and outlines various policy implications. The study was commissioned in response to the perceived failure of sub-Saharan African aquaculture. The principal objectives of the study were:

- * To understand the reasons why people construct fish ponds and what determines their management practices.
- * To assess intra-household and community level effects of aquaculture adoption.
- * To assess responses of farmers in rural communities to aquaculture development activities.
- * To combine these analyses with an assessment of technical and biological influences.
- * To provide guidelines for the promotion of aquaculture offering greater potential for positive results, and averting negative and unanticipated side effects.

The work was carried as a collaborative project between 1991 and 1993. It involved the School of African and Asian Studies, University of Sussex, and the Institute of Aquaculture, University of Stirling.

The component parts of the research were:

- * A comprehensive literature review of socio-economic dimensions of aquaculture development in Africa (Harrison 1994). This established the parameters for fieldwork.
- * An annotated bibliography related to the literature review (Harrison 1991).
- * A detailed study of aquaculture development in Luapula Province, Zambia (Harrison 1993a). This involved collaboration with the FAO implemented Aquaculture For Local Community Development Programme (ALCOM), and the Zambian Department of Fisheries. Field work took place over one year in 1991-2.
- * Testing the relevance of the Luapula findings through two principal means:
 - The circulation of the findings to individuals and organisations closely involved in aquaculture development and the incorporation of their comments.
 - Further field work. A comparison of the findings from Luapula with project activities in the Lake Basin, Kenya (Harrison 1993b) and in Northern Malawi (Stewart 1993).

This report is arranged in three sections. The first elaborates the context in which the study has taken place. It outlines past and current thinking concerning the problems and

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prospects for African aquaculture development. The analysis is derived from both the initial literature review and recent documentation and discussion.

The second section presents the field work findings. The Luapula study generated a wealth of detailed information concerning both aquaculture practices and the links between rural communities and the agents of development, which is available in full in the main report. The second section also incorporates findings from the comparative field studies.

The third section presents suggestions for planning and development policy based around the outputs of the earlier sections. These are principally aimed at bilateral and multilateral donors.

PRINCIPAL POLICY CONCLUSIONS

- * Many projects have been fundamentally misconceived because they focus on the delivery of technical inputs, use indicators which do not reflect objectives, and fail to learn from earlier mistakes. Aquaculture is no different from other aspects of rural development in these respects.
- * There is a temptation to see socio-economic considerations as barriers to be overcome in the process of technology transfer. This is too simple.
- * Aquaculture as practised in sub-Saharan Africa should be seen as a branch of farming, not fishing.
- * Providing support to an extension service specifically for aquaculture is unlikely to be justified. Aquaculture training should be incorporated within overall rural development strategies rather than isolated as a branch of fisheries
- * Donors should respond to government needs for training in managerial and planning capacity.
- * Where appropriate, and following assessment of capacity and needs, donors may facilitate the gradual transfer of fish farming activities to agricultural support institutions.
- * Training of extensionists should focus on the use of participatory approaches in extension and the place of aquaculture within farming systems. Key technical subjects are production cycles and fingerling supply, and pond location and construction.
- * Monitoring should focus on the pond as an addition to the farm, rather than as just a fish production unit.

These policy conclusions are elaborated in greater detail in section three, below.

PERSPECTIVES ON THE PROBLEM: FROM CONCLUSIONS TO STRATEGY

A finding of the report is that there is a need to think again about what the supposed failure of aquaculture really refers to. Whose failure is it? Whose needs have or have not been met? For this reason, the tables below are divided into problems as articulated by institutions such as donors and African governments and those articulated by farmers. There is naturally considerable overlap.

ISSUES AND PROBLEMS FROM THE PERSPECTIVE OF AQUACULTURE PROMOTERS

ISSUES/PROBLEMS	EXPLANATIONS/ COMMENTS	RECOMMENDATIONS
1. The development context	<ul style="list-style-type: none"> -Projects have been created from a wish to see aquaculture working rather than arising from the needs of the supposed beneficiaries. -Both needs identification and making the links between these and aquaculture is problematic 	<ul style="list-style-type: none"> -Participatory research on needs for and value of aquaculture in specific contexts -See section 4 on monitoring and evaluation, below
2. Lack of sustainability of project efforts, including collapse of infrastructure	<ul style="list-style-type: none"> -Inadequate assessment of limitations and priorities of host government department. -Investment in infrastructure may be unrelated to aquaculture's capacity to meet development need. 	<ul style="list-style-type: none"> -Understand institutional legacy: how and why projects failed. -Assess proposals for infrastructure in light of potential for meeting development needs -Focus on institutional strengthening including managerial training and planning capacity. -Rethink project approaches: greater flexibility, qualitative indicators, more time
3. Problems in extension services: - -poor morale -unable to reach farmers -inappropriate advice	<ul style="list-style-type: none"> - Lack of incentives, little participation in decision making, dependence on allowances. -Often spread too thin and under resourced because of sectoral location. -Training has been technically and fisheries based 	<ul style="list-style-type: none"> -Investigate more consultative approaches to extensionists training, and from these, options for improved incentives. -Need to establish: Feasibility of training advisers from other sectors to incorporate fish farming in their activities. Training focus on i) Aquaculture within the farming system ii) Participatory extension methods iii) Socio-economic issues iv) Technically: production cycles, fingerling supply / restocking.
4. Weaknesses in monitoring and evaluation	<ul style="list-style-type: none"> -Lack of clarity concerning overall objectives and mechanisms for their achievement. -Failure to incorporate intra- and inter-household resource control dynamics -Data-bases tend to be unreliable and inconsistent 	<ul style="list-style-type: none"> -Information needs should be objective oriented and achievable. -If objectives are mainly poverty oriented: monitor who are taking up fish farming through methods of PRA and sampling. -If objectives focus on the establishment and consolidation of fish farming use qualitative measures to find evidence of: maintained ponds, farmer-farmer fingerling supply. -Use PRA to monitor intra household and community resource control/ management issues. -Assess role of pond as addition to farm rather than as just fish production unit -Data collection should not be main job of extensionists. -Monitor and evaluate training and subsequent deployment of extensionists
5. Farmers do not respond as hoped: i) Failure to adopt ii) Poor management	<ul style="list-style-type: none"> -There is only a limited number of farmers for whom adoption makes sense. -Less than optimal fish production is acceptable to farmers if motivation is not primarily about fish production -Some farmers have capacity and willingness to improve management but need better extension advice -Some farmers have little or no capacity to improve because of poor pond location/construction or limited availability of inputs 	<ul style="list-style-type: none"> -Understand in advance of support to fish farming: -Biotechnical factors, other economic opportunities, land availability and tenure, valuation of fish, other potential of ponds, intra-household resource control. -Improved extension through agriculture (see above) -Support rather than "sell" fish farming ("development effect" dangers) -Focus on quality of advice regarding pond construction and location

ISSUES AND PROBLEMS FROM THE PERSPECTIVE OF FARMERS.

ISSUES/PROBLEMS	EXPLANATIONS/ COMMENTS	RECOMMENDATIONS
<p>1. Extension does not meet information needs</p>	<ul style="list-style-type: none"> -Poor training of extensionists -Extension focussed within fisheries sector instead of integrated with agriculture -Where farmers are highly dispersed, meeting their information needs may not be possible. 	<ul style="list-style-type: none"> -Support to training including of agriculturalists (see above) -In areas of high dispersion, train farmers in groups and on-farm. -Ensure group and individual extension is sensitive to different needs and priorities of men and women.
<p>2. Fingerling supply</p>	<ul style="list-style-type: none"> -Farmers do not know techniques of fingerling production -They have often learnt to expect that supplies will be delivered, by government or project 	<ul style="list-style-type: none"> -Training farmers in fingerling production to encourage farmer-farmer supply. -Support to economically self-sufficient fry production centres in areas of high density of fish farmers to maintain quality. -Unlikely to be viable to attempts to deliver fingerlings to farmers.
<p>3. Theft and predation</p>	<ul style="list-style-type: none"> - Ponds badly sited and constructed - Ponds poorly maintained - Some theft/predation may be unavoidable 	<ul style="list-style-type: none"> - Attention to pond location (near home) and construction in advice to farmers -With farmers, work out locally appropriate solutions (traps, slashing grass etc). -Because of theft dangers, pond should be only one among other strategies adopted by farmer. Diversification not specialisation.
<p>4. Marketing: lack of marketing channels</p>	<ul style="list-style-type: none"> -Fish farming has on occasion been encouraged in areas with restricted opportunities for marketing. This matters only if production for sale is primary motivation for adoption. 	<ul style="list-style-type: none"> -If farmers require cash gain: focus on areas with marketing potential (demand, infrastructure.
<p>5. Non fish farmers' concerns</p>	<ul style="list-style-type: none"> Important to consider - Members of fish farming households -Others in the community 	<ul style="list-style-type: none"> In monitoring, assess: -Shifts in resource-control within household as a result of fish farming. Especially: natural resources, time (labour), money. -Changing land values -Changes in control of common property resources

I. CONTEXT AND THEMES: SUMMARY

- * The report is a response to concerns that international assistance to African aquaculture has "failed" and that this is partly the result of a failure by technology-oriented promoters to understand the socio-economic dimensions of aquaculture. An extensive background review was carried out in the early stages of the project.
- * The term "African aquaculture" covers a wide variety of culture systems, socio-economic and ecological settings. Because the bulk of international assistance to African aquaculture has been to rural fish farming in ponds, this is the focus of the present study.
- * Many of the problems of African aquaculture development are not significantly different than those of other introduced technologies.
- * National support to aquaculture in Africa has been influenced by a range of factors including the political and economic environment, physical resources, and in particular the need to respond to donor requirements. There are weaknesses in national planning, infrastructure, and extension. Extension services are usually specialised and restricted to aquaculture. Few have the capacity to function according to plan. These weaknesses have been the subject of comment for many years.
- * External assistance to aquaculture development has usually taken the form of project aid. Often this has aimed to rehabilitate or build infrastructure such as state farms or hatcheries. Post-project evaluations of all but the most recent projects are seldom available. Although some projects have been deemed to be successful within their lifetime, the long-term viability of most is questionable.
- * Policy makers should be clearer about how their objectives relate to action.
- * There is a temptation to see socio-economic considerations as barriers to be overcome. This is too simple. Themes to consider include processes of resource access, the functioning of markets, control and decision making, and the effects of fish farming, both obvious and disguised. Among these, effects within households, such as control of labour or resources by different household members, may be especially important.
- * The study explores interactions both between rural communities and the outsiders who come to promote fish farming and between external donor and host institutions.

I. CONTEXT AND THEMES

Optimism about the prospects for African aquaculture has waned in recent years. Simultaneously, there have been suggestions that aquaculture research and development has for too long remained the province of biological and technical specialists. The social, cultural, and political contexts in which aquaculture is promoted have too often remained largely invisible and shrouded under the technical language of project planning. The research on which this report is based is a response to these concerns.

1.1 Has African aquaculture failed?

When sub-Saharan African aquaculture is compared with that of Asia, Africa invariably emerges as a "failure" (table 1). Whether the comparisons are in terms of production in relation to donor support, or in terms of projects meeting their objectives, similar problems recur: donor and host objectives diverge; ponds are not maintained after donors leave; and productivity is less than technically possible.

Table 1: African and Asian aquaculture compared

	Sub-Saharan Africa	Asia	S.S Africa as % of Asia
Production from fish farming (t) (1987)	10,816	11,099,363	0.1%
International assistance to fish farming (US\$) (1987)	72.5	171.3	42%

Source: Lazard et al. 1991.

The comparison is misleading for two reasons. Firstly, the long history of fish farming in much of Asia is overlooked. More importantly, the comparison should be placed in context. These problems also occur in attempts to promote many other technologies for rural development, from small livestock to agroforestry. Structural weaknesses in sub-Saharan African economies combine with inappropriate or insensitive projects, which have been set up to reflect donor priorities. The results are widely documented. Only recently have alternatives been sought, which have a greater focus on farmer participation, and on process rather than blueprint projects. Therefore, while attempting to identify what is special about aquaculture, it is important to see and learn from parallel situations.

Fish farming has technical peculiarities. A particular set of problems derive from (for example) the breeding characteristics of tilapia, and the specific requirements for soil and water. But the same can be said for other activities. The difference is that, while lessons have been slowly learned concerning the fit of these diverse activities to rural livelihoods, aquaculture has for the most part remained a separate "sector", tenuously - and uncomfortably - attached to Fisheries Departments or Ministeres D'Eaux et Forets. Although dealing with fish in the technical sense, they have all too frequently had a catch management, biological sampling or conservationist focus. This study emphasises the closer association of rural fish farming with agriculture and assesses the practical implications of this.

1.2 The sector described

1.2.1 Aquaculture in Africa

In 1990, total African aquaculture production amounted to about 0.5% of the world total (FAO 1993a). Of this, a high proportion came from "Mediterranean Africa", mostly Egypt, and was produced for export markets. The most important sub-Saharan producers were Nigeria, Cote D'Ivoire, South Africa, Zambia, and Kenya. Between them, they accounted for 80% of production between 1984 and 1990 (FAO 1992) Of the 48 countries in sub-Saharan Africa, 31 reported aquaculture production in the mid 1980s (Satia 1989).

The term "aquaculture" refers to a diverse range of practices, undertaken in enormously varying locations with equally varied constraints and potentials. Forms of aquaculture are distinguished according to a variety of criteria. These include:

- the intensity of stocking rates and input levels;
- the scale of the operation (from small-scale fish farmers to industrial);
- the location (ponds, tanks, cages, pens, dams, lakes, rivers, the sea)
- the nature of the producer (from "subsistence" farmers to commercial operations)

A continuum is implied. At one end of this is a small scale farmer with a muddy little pond into which he or she sometimes throws some leaves and from which he or she obtains a few fish, most of which are eaten at home. At the other end is a large company with an intensive commercial operation. This study focuses at the muddy pond end of the continuum. This is where the bulk of development assistance has been directed and is where the perceived problems are supposed to lie. The majority of fish farms in sub-Saharan Africa are small-scale and extensive or semi-intensive. For most farmers, their fish farms are a part-time and secondary activity.

The study also considers what happens as farmers move towards greater commercial orientation and intensity, but the false dichotomy between "subsistence" and "commercial"

operations is not used. Purely subsistence farmers do not exist. The balance between the elements of production which are consumed within the household and those which are sold or exchanged, is constantly changing. With increasing intensification, farmers are likely to market all or some of the product. What is important is not "commercial" or "subsistence", but issues arising from the **degree and form** of commercialisation.

Most African aquaculture takes place in freshwater ponds. Increasingly there has been an interest in the use of brackish and marine water but this process is in its infancy. Although the *acadja* systems of west Africa have been described as one of the few examples of indigenous African aquaculture, they have not been the focus of development support. The most commonly produced and promoted species are tilapias (*Oreochromis* and *Tilapia* spp.), though recently there has been interest among donors in supporting catfish (*Clarias gariepinus*) production.

1.2.2 National support to aquaculture development

National support to aquaculture development includes extension and the supply of production inputs, research, education and training. This support has been influenced by a range of factors: the political and economic environment, physical resources, the need to respond to donor requirements. During the 1980s, a number of countries have accepted structural adjustment programmes. There has been a rethinking of accepted approaches to government involvement in development. In many sectors, the role of the state is increasingly reduced. Effects have included cutbacks in government expenditure on infrastructure and welfare services and the cutting of subsidies which have supported public sector employees. As with other sectors, aquaculture has been affected by a lack of operating funds and poor morale among public sector employees. At the same time, there has been pressure to turn previously government - controlled activities over to the private sector. Most significant among these activities is the production and distribution of fingerlings. Examples occur in Cote D'Ivoire, Madagascar, and Kenya.

According to a recent FAO study of 12 countries in the region, state fish farms total over 200 (Coche et al.1993). Most of these are very old and possibly less than half are in use. Several farms have been renovated under technical assistance projects but recurring problems of management, financial constraints and technical weakness persist.

Extension services for aquaculture are mostly located within Fisheries Departments in anglophone Africa, or in Ministeres D'Eaux et Forets in francophone areas. They are usually specialised and restricted to aquaculture. Any cooperation with agricultural extension is ad hoc, Zimbabwe being a notable exception. Most extension services have two aims: the production and distribution of fingerlings, and the provision of advice to farmers. There is little evidence that these are successfully carried out. Extension services were mainly created during the 1970s with the assistance of technical assistance projects.

There have been suggestions that they were never adequately resourced in terms of either personnel or operating facilities. During the 1980s, especially with the influence of structural adjustment programmes, this situation has become much worse.

Research takes place mainly at government research stations. The focus is strongly towards biotechnical research. The main subjects of research include integrated livestock and fish systems, the nutrition and feeding of fish, and the propagation of African catfish.

Education and training of extensionists usually takes place as part of an overall fisheries education. Often the bulk of their training occurs in-service. For higher levels there are a number of specialised university courses. Coche et.al (1993) conclude that in the majority of countries, staffing and training levels are adequate for the level of public development infrastructure. This is, as noted, poor in many countries.

A range of weaknesses were identified in national institutional support to aquaculture development. The sector usually receives low priority for development funds, which is a problem shared with the agriculture sector in general. In most countries there is also no coherent national plan for aquaculture development, although aquaculture receives a mention in national development plans. Although not characteristic of the aquaculture sector alone, there has been a heavy reliance on external funding.. As a result, projects and development activities are often based on donor priorities

1.2.3 External assistance to aquaculture development

External assistance to aquaculture has usually taken the form of project aid from bilateral and multilateral donors and non governmental organisations (NGOs). Since the early 1970s, more than 300 projects have been initiated in the region (FAO 1993b). Projects have aimed to build or rehabilitate infrastructure such as state farms and hatcheries. They have also been involved with staff training, fingerling production and distribution and support to extension. Behind all of this was the aim of increasing the production of cultivated fish in the region. To a lesser extent, projects have been involved in applied biotechnical research, data collection and studies of the potential for development. Two more recent programmes, ALCOM and ICLARM, have focused more on developing methodology and a fuller understanding of the context under which aquaculture may take root in Africa.

Assessment of the success or failure of projects is hampered by a lack of post-project evaluations. Two major studies have presented a fairly pessimistic picture. In 1987, the Thematic Evaluation of Aquaculture commented that failures in project implementation were strongly influenced by the weaknesses in cooperation between field staff and those in the headquarters of sponsoring organisations. Project management was hindered by a tendency to concentrate on achieving physical results as opposed to transfer of know-how

to counterpart staff. Six years later, another FAO study noted that the major reason for poor sustainability of aquaculture development projects was the inability of the public administration to take over financial responsibility on the departure of foreign financial assistance (Coche et al 1993). Also important were a lack of coordination among ministries, deficient management of state farms, inappropriate technology, loss of trained staff, and technical assistance being too short and diluted. Almost half the projects evaluated were considered to have poor sustainability.

The evidence concerning non-governmental assistance to aquaculture is even more limited. Not only are printed records absent but the label NGO covers a wide range of organisations, from large international donors to indigenous self-help groups. Assistance from external NGOs has frequently been linked to church-based groups. The American Peace Corps and British VSO have also sent volunteers to assist with aquaculture development projects. The comparative advantage of NGOs is thought to lie in their closer relationships with local people and their more flexible organisational structure (Fowler 1988). Whether this occurs in practice in the case of aquaculture is open to debate. In most situations in sub-Saharan Africa, NGOs work closely with government departments and are affected by comparable constraints.

1.3 Questions of targets and objectives

Recent discussions of policy for aquaculture development have focused on how to create a sustainable knowledge base. Questions focus on what kind of aquaculture operation should be assisted under which conditions (see Wijkstrom 1991; Lazard et.al 1991; FAO 1987). As with other aspects of development, a two-pronged argument is now regularly developed. On the one hand this advocates the efficiency of working with "model" farmers who show potential to intensify their operation, and to market an increasing proportion of their product. On the other, privatisation of as many aspects of the production process as possible is recommended. The aim of this is to by-pass ineffectual government channels. Intensification and consolidation of the activities of model farmers is increasingly seen as the key to sustained fish farming in Africa (see for example Lazard et.al 1991, Nash 1986). This is in marked contrast to an earlier orthodoxy that aquaculture is a technology to help improve the livelihoods of the poorest farmers and that as many of these as possible should be assisted in their fish farming.

The decision to support one or other approach is closely related to views of the reasons for aquaculture development, to assumptions both about who the ultimate beneficiaries will be, and about the nature of the processes which give rise to the benefits. For example, if a limited number of slightly better off farmers are supported for reasons of increased productivity, there is often an assumption that knowledge and motivations

established among such farmers will trickle down to others. The assumption is seldom closely examined. The objective of increased productivity from ponds in order to ensure that a few farmers will continue, is not necessarily compatible with that of better overall availability of fish. If greater availability of fish for the malnourished is the aim, then focussing on model farmers may be irrelevant to the poorest people who cannot afford to buy fish anyway. This fact is frequently glossed over in the process of development planning.

1.4 The missing socio-economic dimension?

The Thematic Evaluation of Aquaculture drew attention to a lack of socio-economic background in project preparation, which led to "hasty and uncritical" attempts at the transfer technology. In looking for an explanation for poor technical performance, planners are increasingly aware of the need to understand the rural communities who are apparently not responding as hoped.

There is a temptation to construe socio-economic considerations as barriers to be overcome in the process of technology transfer. They also help to explain why a technical message apparently does not work. Thus, the incorporation of the missing socio-economic ingredient may help provide solutions. Obviously, there is no such simple answer. A number of themes need greater consideration and understanding, both in general and in local contexts. Central among these are:

- * Access to resources such as land, labour, and inputs for fish farming.
- * The existence and functioning of marketing channels and their effect on aquaculture development.
- * Socio-cultural aspects of fish farming including mechanisms of control and decision making.
- * The effects of fish farming, both obvious and more disguised. In particular there is a lack of information about the effects of fish farming within households.

Those studies which have taken place have tended to see socio-economic problems in aquaculture development in terms of adoption (getting people to dig ponds) and sustainability (ponds are abandoned on the departure of donor assistance). However, consideration of rural communities alone presents an incomplete picture. The interaction between these communities and the outsiders who come to promote fish farming is also of fundamental importance. This needs to be supplemented by an appreciation of the

different perspectives of the various institutional stakeholders in the development process.

The relationship between external donor and host institutions is critical to the functioning of any development project. In the case of aquaculture, divergent expectations of the reasons for, and the means to achieve, aquaculture development are widely seen to constrain many projects. The divergence occurs both in the higher echelons of planning and at the level of project implementation. Donor priorities are influenced by the need for accountability at home and the timely disbursement of funds. Issues which may appear important to donor organisations, such as careful beneficiary targeting or sensitivity to gender may appear less relevant to those who implement the project, whether expatriate advisers or local government personnel. Host governments may respond to opportunities for donor-funding and foreign exchange without the capacity to continue support. In turn, donors commit funding despite managerial and institutional weaknesses. Each stakeholder in the development process negotiates a position in relation to their own priorities.

Although the phenomenon is increasingly widely noted, the implications continue to be overlooked in project planning. In 1987, the Thematic Evaluation of Aquaculture recommended that detailed attention should be given to the recipient government's effective commitment to aquaculture. In 1991, a study of Francophone aquaculture development (Lazard et.al 1991) noted that most current aquaculture development plans still reflect opportunism rather than any long term plan for the future.

This study explores how objectives vary for the different stakeholders in the aquaculture development process. While aquaculture specialists want to see their techniques and applications working, government officials and donors may have different aims, and all of these may be a far cry from the frequently invisible and unheard objectives of farmers.

II. FIELD WORK FINDINGS: SUMMARY

The Institutional Context

- * During the resurgence of aid to aquaculture in the 1970s and 1980s, few lessons were learned from colonial efforts to promote the technology.
- * Donor and host priorities, perceptions, and agendas are frequently different and are seldom addressed in project documents.
- * Quantified project objectives tend to be over-optimistic and only modified subsequently.
- * In extension, problems arise from shortages of transport, inadequate numbers of extensionists, and training unrelated to the role of aquaculture as one among several activities.
- * Farmers' perception of the restrictive role of fisheries extensionists is a significant constraint.
- * The assumption that governments or donors should supply fingerlings is questioned. For improved farmer-farmer supply of fingerlings, an improvement in knowledge concerning fingerling production is needed.

The motivations of fish farmers

- * The decision to construct fish ponds is influenced by the state of the local economy. Where there are diverse economic opportunities and perceived scarcities, adoption will be weighed more carefully than where there is perceived abundance or a lack of other economic opportunities.
- * The experience of previous development interventions, whether aquaculture, fisheries or agriculture, profoundly influences the way that people respond to the next one. Some farmers adapt their behaviour in anticipation of benefits associated with donor agencies and government departments. Fish farming is part of this process.
- * When building ponds for household food consumption, farmers consider both overall availability and the potential that the fish will be there when needed. Fish ponds have an important function as sources of fish for special occasions and for

honouring visitors.

The adoption process and the effects of adoption

- * Fish farming is unlikely to make much of a difference to the poorest people in a community who do not have the funds with which to buy cultured fish which often have cheaper substitutes.
- * The least productive fish farmers are often those for whom the few fish produced make more of a difference.
- * Fish farmers tend to be men, better off, and more socially and politically active than others in the community. They are also more likely to be part of a culture of "development", through contact with other projects and agencies. They are more adept at gaining access to advice and extension.
- * Although few women own ponds, many play an active part in pond management. Women's lack of pond ownership is partly due to constraints in access to land and labour. It is also because fish farming has generally been promoted for men by men.
- * Potential negative effects of fish farming stem from intra-household control of the products and inputs including labour. The gains from fish farming do not necessarily benefit all household members equally.
- * Conflicts over the use of resources may arise when fish ponds are dug on common property land. The people most disadvantaged are often those who are least able to articulate their interests.

Constraints to long term viability

- * The "failure" of African aquaculture has been blamed on the absence of a tradition of livestock management. Fish farmers construct ponds with little knowledge of how to manage them.
- * Knowledge of appropriate use of locally available feeds and manures, fingerling production and pond restocking is frequently absent.
- * Losses through theft, animal predation and drought or flooding of fish ponds are important. Although to some extent unavoidable, good advice on pond location and

construction could reduce problems.

- * While social control mechanisms exist in any society, they were not found to be directly relevant to fish farming.

II. FIELD WORK FINDINGS

This section outlines the findings of field work which was undertaken to address some of the issues outlined above. A detailed study of aquaculture development in Luapula Province, Zambia was undertaken. Over one year, the relationship between a donor supported project, Aquaculture for Local Community Development (ALCOM), the Zambian Department of Fisheries, and villagers in Luapula Province, was documented. The study involved a wide range of research methods, from participant observation as a resident in a village of ALCOM activity, to a structured survey and case-study based information collection. The findings of this study are presented in Harrison 1993a. In the second instance, two short visits to Kenya and Malawi served as a mechanism for testing and verifying the conclusions from Luapula. In Kenya the focus of the study was the FAO-executed project, Development of Small Scale Fish Farming in the Lake Basin Area. In Malawi, research was carried out with the EC-funded Central and Northern Region Fish Farming Project.

At a fundamental level, there are findings concerned with the institutional context of aquaculture development. Problems often arise directly from the compromises entailed in the project planning process. Evidence for this was found in Luapula, Kenya, and Malawi, and from the literature. Findings also relate directly to rural aquaculture. Problems at this level should not be addressed in isolation from the institutional context.

2.1 The institutional context

2.1.1 Learning from the past?

Friday June 3rd

Then to Fiyongoli...The lower half acre ponds are not in use. Only the 1/6 acre ponds are in use at present...In the eight ponds were two unstocked controls which were weed grown...The farm is to become a mixed farm with sheep, pigs, etc. All rather remote from the original project. (Harding) admitted that the JFRO staff already have a full or overfull plate and cannot give much attention to Fiyongoli (Hickling 1960).

The impression persists among those without experience that fish in some wonderful way can grow on their own, without any trouble. This is not the case. Fish, as with any other form of grown produce must have the wherewithal to grow and can no more flourish without the proper conditions and attention than livestock, plants, or poultry (Northern Rhodesia government, 1951).

DRAFT REPORT: RETHINKING "FAILURE": FISH PONDS AND PROJECTS
Findings of ODA-Supported Research: "Socio-Economics of African Aquaculture"
School of African and Asian Studies; University of Sussex/Institute of Aquaculture, University of Stirling

These comments might have been made in 1994. Colonial attempts to promote aquaculture during the 1950s established certain principles about the appropriate way to promote aquaculture. These included the importance of technology development through on-station research, the delivery of an appropriate message to farmers, and support to farmers in certain key aspects of the production process, especially fingerling supply. Variations existed, but the essence of the model was the same in both francophone and anglophone Africa.

The Thematic Evaluation of Aquaculture noted in 1987 that most projects implemented during the 1970s and 1980s were essentially based on the same premises which justified support for aquaculture in colonial times. Attempts were made to rehabilitate and re-establish what already existed in terms of both physical infrastructure and personnel. There was scant examination of the reasons for the collapse of the earlier efforts.

Field work findings confirm the trend. In Luapula, a government fish farm was constructed during the 1950s for both research and extension purposes. It was assumed that dissemination of the message would be through farmers cooperatives. No questions were asked about the local propensity to cooperative organisation. Technical problems regarding the operation of the government fish farm arose largely from the poor motivation and working conditions of those charged to carry out the work despite the existence of technologists keen to see their technology working.

The ALCOM pilot project did try to understand the priorities and circumstances of fish farmers. In this respect, it moved away from earlier models. It also indicates a general shift in approaches and priorities of donors. No simple transfer of technology was advocated. The weakness of the pilot project was in its failure to understand or incorporate the priorities and circumstances of institutional partners. Although a huge amount of information was collected, insufficient attention was given to its practical application.

In both Malawi and Kenya, the projects reviewed aimed to rehabilitate existing infrastructure which had persistent technical and managerial problems. New infrastructure was also constructed. In Kenya, because the emphasis was on local hatcheries rather on large centralised government stations, there has been more scope for adaptation to the problems. In both places attempts were made to deal with the problems as they became apparent rather than at a more fundamental level.

2.1.2 Donor-host relations

Field work confirmed how the agendas of donors and host stakeholders may differ - and the negative effects these differences have for projects. This is particularly important where differences in priorities and agendas are glossed over in project documentation but emerge during the course of the project. Donor and host priorities are not monolithic or fixed in opposition. They also belong simultaneously to institutions and to the individuals attached to these institutions. They are constantly negotiated and changing. Nonetheless, certain common oppositions emerge.

Among government planners in Zambia, there remains a strong belief that the principal means of support for aquaculture should be through the rehabilitation and support of government fish farms. Donors are decreasingly willing to commit funds for such purposes. In Luapula, the ALCOM pilot project started with a body of knowledge but without enough consideration of the resources available in terms of staff, expertise or money. While the main Departmental objective relates to "rational exploitation of fish stocks", the donor was concerned with "methodology development". Despite the use of the language of participation and consultation, the donor's role was developed principally in Harare, with strategic adaptations made by field-based personnel. Few of the results of numerous studies are available in the province. The relationship between the two organisations was soured by unfulfilled expectations on both sides.

In Kenya and Malawi, the institutional arrangements are very different because the donor-funded projects carry with them much more of the paraphernalia of development projects: vehicles, allowances, overseas study tours, the construction of physical infrastructure etc. There are therefore more serious problems of sustainability to be addressed. Over the history of the projects, prospects for sustainability have seemed poor. In Kenya, the project has been beset by misuse of funds and has relied on the donor for most aspects of its functioning. Recently, an attempt has been made to address this through establishing the economic viability of many of the project activities. Unusually, donor and host agendas are beginning to converge. In Malawi, there are reports of discontent among extension staff over the availability and management of funds and the payments of allowances.

In Kenya, the project implementing agency is not the fisheries department, but a separate government parastatal under the control of a different government ministry. The institutional separation has not been supplemented by consultation or collaboration between the involved parties. This results in considerable replication of activities and sometimes conflicting advice at the local level.

2.1.3 Project design

In all of the research sites, the donor, with varying degrees of participation and consultation with the host, formulated the project according to generally accepted conventions. Each project had a project document in which were outlined; the background and justification for the project, overall and immediate objectives and criteria for their measurement, the means by which they were to be reached, and donor and host responsibilities. In Kenya and Malawi, the objectives laid out in the project document were also given quantifiable targets: increases in tons of fish produced and in numbers of operating fish ponds. There is a valid logic behind this: it is important for donors to be able to show that money spent on fish culture (rather than on alternatives) is justified.

Where quantifiable goals were specified, two fundamental weaknesses appear: First, the expected increases in yields and in tons of fish produced were over-optimistic and were probably part of the process of getting the project approved. Objectives were subsequently modified. Second, and more fundamentally, little consideration was given as to how such targets were to be related to broader nutritional or food security objectives. In connection with this, the extrapolation of overall production statistics from a small quantity of (probably inaccurate) data, was not justifiable. In Malawi, the project goal was reformulated to have less emphasis on wider nutritional and economic objectives.

The problem of finding relevant and measurable indicators of project success and failure has arisen in numerous aquaculture projects, as in many other areas of rural development. A common response is to set up ever-more sophisticated databases. This was done in both Kenya and Malawi. The databases were limited not only by the quality of the information entered (which was of course circumscribed by the capacity of the extension service to function as data collectors), but by sustainability on departure of the expatriate expert.

2.2 The role of promoters

2.2.1 Advice and extension

An aim of the research was to monitor the effects of extension on fish farming practices. In Luapula extension barely took place. In all research sites, good advice and extension play a key role in the development of sustained pond management, but the inconsistency and irregularity of this advice often appears to do more harm than good.

In Zambia, fish farming extensionists receive a brief training as part of their overall training in fisheries. During training, it is not specified whether the newly qualified extensionists will be posted to capture fisheries or fish farming extension. At any point in their careers they may be transferred from one sector to the other. In Luapula the

extensionists responsible for fish farming are so few and poorly resourced as to be ineffective. The department cannot afford to supply vehicles to the extensionists, nor does it effectively monitor their activities.

The primary role for the fisheries department in Luapula province is "the rational exploitation of fish stocks" in two lakes which supply almost 40% of Zambia's fish. This involves the monitoring of catches and types of gear used, and policing the closed season. Associated with this role is the tendency for farmers to assume that anybody connected with the department of fisheries, including fish farming extensionists, necessarily has a restrictive and controlling role. The phenomenon was also observed in Kenya.

Similarly in Kenya, most fish farming extensionists have received only a brief training in aquaculture and none in extension approaches. In the Lake Basin Area, there are many more extensionists than in Luapula, but they are equally hampered in their ability and incentive to work effectively. Kenya does have a core of well trained graduates for whom there are problems of deployment. These are, however, all biologists.

The kind of pond management practices adopted by farmers depends on a combination of personal characteristics and capabilities of that farmer, and the effects of their interaction with external change agents. In communities where a deference to authority has been inculcated in farmers, the mere fact of receiving regular attention from extension may influence practices. Farmers believe they need "encouragement". Correspondingly, when attention ceases, so may improved practices. This phenomenon was observed in Luapula. Here, the uneven nature of extension support is accompanied by a great variety of management practices. The one factor that the most productive farmers have in common is the frequency of their contact with project personnel or the better extensionists. Because the farmers selected for most regular contact were those who had already been deemed to show most promise, it is not possible to assert whether better management is the result of or just coincidental with extension contact.

Obviously quality of advice is as important as its regularity. This is as applicable to the approach of the extensionist as to the technical content of information. Few extensionists encountered in the research sites had received any training in extension techniques. Exceptions existed among a number of people trained directly by the projects in Kenya and Malawi. Thus any appreciation of the variety of farmers' needs and constraints, gender issues in management, and methods to address these, is usually due to personal characteristics of individual extensionists. Furthermore, the limited training received by most extensionists has been as part of an overall fisheries course within which aquaculture is just a component. Little or no attention is given to the fit of aquaculture to other aspects of farming. Lastly, in all research sites, the farmers' perception of the restrictive role of fisheries extensionists is a significant constraint.

Personal characteristics of extensionists also disproportionately influence the way in which they do their job. Where motivation is generally low, because of poor working conditions, lack of transport, low salaries and negligible consultation from superiors, good or bad extension becomes largely the product of individual personalities.

Given the parallel findings that advice is important to farmers and that neither government nor project supported extensionists are in a position to do this effectively on a farmer by farmer basis, consideration must be given to alternative approaches.

An alternative tested in all research sites was training farmers in groups. This method is usually cheaper than direct extension and reaches a wider range of farmers. It can be much more effective when it allows sufficient room for discussion among participants and incorporates an element of flexibility and adaptability to farmers specific needs. Training courses held within the farmers' own community and using farmers ponds for demonstration are better than those held in urban centres: there is more chance that less articulate and visible members of the community will feel able and willing to attend.

Another possibility is farmer-farmer exchanges. In Luapula this involved transporting farmers over considerable distances to learn from each other. The technique was not cost effective because of the large distances involved for very few farmers. Those who were transported were also people who were already receiving more than average extension attention. Nonetheless, the idea that of helping farmers to learn from each other should be further explored.

Little evidence was found that agricultural extensionists facilitate the spread of management knowledge about fish farming. In all research sites, some attempts have been made to train agriculturalists in the rudiments of fish culture, but this has been sporadic and inconsistent, despite its prominence in project planning documentation. Contact between agriculturalists and either fish farmers or fish farming extensionists is minimal.

2.2.2 The provision of inputs

Many fish farming development projects have started with the assumption that the government or project has a responsibility to provide certain inputs. Mostly this refers to fingerlings, but it may extend to pond inputs, feeds and tools. The assumption is increasingly being questioned from a number of perspectives:

- The cost of constructing and maintaining the required facilities (hatcheries, transport).
- The tendency of such an approach to inhibit farmer-farmer supply.
- The implications of both of these factors for long-term viability.

In Luapula, the government continues to attempt to supply fingerlings from two government fish farms. It is impossible to meet expressed demand because of technical difficulties at the government farms and a lack of transport. A mission-sponsored fish farming scheme provided fingerlings, via the Department of Fisheries. Partly as a result of these efforts, farmers believe they should be supplied with subsidised fingerlings, which inhibits the development of a private market. The problem cannot simply be overcome by a cessation of external attempts to supply fingerlings. Farmer knowledge of techniques of fry production is limited, resulting in gradual reductions in the quality of fingerlings produced. Development of farmer-farmer fingerling supply therefore requires an improvement and consolidation of this knowledge.

In Kenya, an attempt to move away from dependence on government supply of fingerlings is in its infancy. A legacy of expectation persists among farmers because of previous free supplies. Nonetheless, the project approach of training fingerling producers and limiting the role of fry production centres to the maintenance of quality, has promising prospects for long term viability.

In Malawi, farmers obtain fingerlings from both the Department of Fisheries and other farmers. When they buy from other farmers, the Department of Fisheries frequently assists with transport. Training in fingerling production has not been an important part of the project. As a result, it is likely that on the withdrawal of donor support, fingerling supply will increasingly become a problem.

2.2.3. The provision of credit

The type of aquaculture practised in most of rural Africa requires inputs which are generally available on-farm. The need for credit will therefore be minimal in most cases. Credit may be useful to assist particular categories of producers faced with particular constraints (such as pond construction for women farmers). It may also play a role in increasing production inputs among farmers with an established knowledge base

and guaranteed marketing opportunities. However, field work evidence points to a need for caution in embarking on credit programmes. Not only are there numerous practical problems in implementation, but credit can easily become a tool to be manipulated by those who have least need of it.

In Luapula, very few farmers receive credit for fish farming. Those that do are larger scale farmers who have used the money for pond construction and then run into serious repayment problems following technical difficulties. In 1992 a number of small scale farmers applied for loans to expand their pond area. For all of them, ability to repay was completely unrelated to the size of the loan. Demands for loans are prevalent because a combination of low real interest rates and a history of non-repayment make loans more like grants in the view of farmers. At the same time, loan acquisition procedures are sufficiently complicated to ensure that only the slighter better educated (and also better-off) apply.

In Kenya, some fish farmers face problems in access to feeds. A credit scheme designed for pond construction was modified to meet this need. Loans are given in kind, not cash. Provision is also made to ensure that farmers receiving credit are trained in production techniques and that they have sufficient production potential to repay. The scheme is a promising alternative to earlier fiascos. There are weaknesses in two areas though. First, those taking advantage of the loans and training should be those who manage the ponds. An obvious point, but one overlooked in gender-blind planning. In many cases the wives of male pond owners do the bulk of pond management, but they less frequently benefit from loans or training opportunities. Second, beneficiaries from the scheme are mainly those who are adept at claiming resources rather than those who need the inputs.

2.3 The motivations of fish farmers

The research considered the motivations of fish farmers for digging ponds and their subsequent management. An improved understanding of why farmers dig ponds increases the predictability of attempts to promote improved management. Extensionists and donors alike are often perplexed by the apparent unwillingness of some farmers to adopt management practices to maximise productivity. In Luapula it emerged that improved production of fish ponds was certainly not the only and often not the most important reason for people to become fish farmers, or at least to dig fish ponds.

Factors influencing adoption operate both within households and in the wider community. The presence of diverse economic opportunities, effective marketing channels, and perceived scarcities, make it likely that the decision to adopt fish farming will be weighed more carefully than where there is perceived abundance and a lack of other economic opportunities. In Luapula, population density is low, land is thought to be abundant, there

are restricted economic opportunities and people like fish. A range of factors combine to induce people to dig ponds: the chance of earning some extra cash, the possibility of fish for household consumption, the hope or expectation of development assistance. A similar picture is evident in Northern Malawi. In Western Kenya, high population density has led to pressure on land. Efficient marketing channels support a dynamic local economy. Unlike Luapula, the primary reason for both digging and managing ponds is income generation.

The legacy of previous development interventions has a profound influence on the way that rural people respond to new ones. In Luapula, this was particularly marked though it was evident in the other research sites. Individuals create their own interpretations of "development" and respond to these interpretations in a strategic manner. The process of aquaculture development is part of this process. Many farmers have learned to adapt their behaviour in anticipation of where they see possible benefit, particularly in terms of the perceived priorities of donor agencies and government departments. In this context, small-scale farmers do not make calculations based on the likely inputs and outputs to their ponds. Most have little if any conception of likely yield or potential markets.

Differences between households and within households influence motivation. For a resource-poor household, the cost of digging a pond may be greater and as a result incentives for better management may be greater. Ironically, those who are more likely to dig ponds for reasons of "development" also tend to be men, better educated, and slightly better off. They are also more adept at gaining access to development assistance and advice and may thus monopolise limited extension services. The relative isolation of fish farming promotion from agricultural development activities tends to compound the phenomenon. In considering farmer motivation for pond construction it may therefore be important to take a closer look at their other experiences of external intervention.

In Western Kenya, the resources required for fish farming do not have zero opportunity cost. The benefits of fish farming must therefore be sufficiently high to justify their use. Land used for fish farming may have alternative uses. Inputs such as animal manure are also used more intensively for other farming activities. Farmers are influenced by the association of fish farming with development assistance but this association is made weaker by the presence of high cash demand for fish and good marketing infrastructure.

Forms of land tenure and access influence motives for pond construction. In Western Kenya, virtually all cultivated land is individually owned. Land is bought and sold and opportunities for claiming marginal land are limited. In Luapula, the system of land acquisition and tenure is in transition. The traditional system based on ancestral cultivation and use rights is gradually giving way to more formalised mechanisms. Increasingly people are seeking title deeds and ownership rights. In an atmosphere of increased

competition for land, fish ponds serve as a means both to claim land and to create permanent assets.

Where ponds are built as part of asset formation, security of tenure is obviously important. In Luapula, inheritance practices and divorce procedures combine to discourage women from becoming pond owners. For example, in the case of divorce, women are expected to return to their maternal home. This would mean leaving behind an asset such as a fish pond. For men on the other hand recent changes in matrilineal inheritance practices mean that they feel in a position to leave something permanent and tangible to their children.

Just as ponds themselves may constitute a long-term asset, so fish in ponds play a similar role. Again this is more likely to be the case the weaker the marketing infrastructure. For farmers in Luapula, the value of fish for food is less a matter of increased availability than that fish will be there when needed as an asset for special occasions or honouring unexpected visitors. After as many as four years, several farmers had not drained their ponds because they were "saving them for an emergency". Such an approach to the fish in the pond obviously has negative consequences for pond productivity.

2.4. Who adopts?

Fish farmers tend to be men, slightly better off than others in the community, slightly better educated and much more likely to be active participants in social and political activity than non fish farmers. These factors are intimately connected with each other and to some extent causally associated. They are not, however, determinants of ability to adopt.

2.4.1 Women and Men

In all of the research sites, most individual fish pond owners are men. This disguises the considerable pond management undertaken by women, especially when ponds are for household consumption. Their lack of pond ownership is partly due to constraints in access to land and labour for pond construction and partly because in the past the technology has been promoted for men by men. The view that aquaculture is not an activity for women is compounded by both men and women in rural communities. It is part of an association often made between men and "progressive development": men are also growers of hybrid maize, European vegetables, and other "new" crops. Nonetheless, examples exist of women both hiring labour for pond construction and constructing ponds themselves.

The assumption that fish farmers are men has implications for extension. To many extensionists, women fish farmers are invisible. The few who are pond owners in their

own right are often not as articulate as their male neighbours and hence less able to make use of the extension service. Women managing ponds for their husbands are often bypassed in training. The same is true for many aspects of agriculture although the specific constraints may be different.

In many development projects a common solution to the problem is the formation of women's groups. The advantages and disadvantages of such groups are regularly debated. On the one hand, they provide an opportunity to overcome the constraints women face as individuals. On the other hand, they may become dominated by an elite and are often beset with problems over control of funds. Women do not form an homogeneous category and are not equally disadvantaged by shortages of time, limited access to household or outside labour, or a low view of their own capabilities. The formation of women's groups is not a substitute for increased sensitivity to the repercussions for gender relations of the adoption of the technology.

2.4.2 Wealth

The technical requirements are such that in theory no member of rural communities is precluded from adopting small scale fish farming given adequate land and water resources. However, fish farming households tend to be better off than others in terms of asset and livestock ownership. This fact reflects a combination of ease of adoption with attitudes which accompany accumulation: such people may be in a better position to invest resources in new technologies and may be more inclined to do so.

2.4.3 Social standing and political activity

As with wealth, having a high profile in terms of political or religious activity may indicate both a greater propensity to adopt a new technology and a greater ability. In rural Luapula, party politics were not an important means of social advancement. More significant was participation in the affairs of the Church and externally-assisted groups. A tension existed between traditional authority structures and the bureaucratization of village life through which holding an office in a local organisation was part of being "modern" - with all of its implications for development assistance. The office holders in one formal group often appeared as office holders in another, and all identified themselves with modernity and "being developed". The level of such social activity of fish farmers was in marked contrast to the rest of the community.

2.4.4 Access to knowledge: entering the culture of development

Fish farming is perceived as something that comes from outside, but which can be learned through contact with promoters. In this respect it is similar to other "new" crops which are partially dependent on outside advice and assistance. In rural Luapula hybrid maize and European vegetables are seen in a similar way. Because in the past they have been

promoted by donors and the government, they are closely associated in people's minds with development. People who are already participants in a culture of development are also more likely to be fish pond owners.

2.5 The effects of adoption

The research explored the effects of aquaculture adoption on both adopters and non adopters. Promoters assume that more productive fish farming will lead to improved household food security and more sustainable livelihoods. Commonly it is also assumed that all members of a fish farming household will benefit equally from the activity.

2.5.1 Household food security

In the research sites, those households which are most successful at producing fish are already obtaining significant quantities of fish from elsewhere (rivers, markets). The food security impact of aquaculture is less on such households than on those who, although less successful in fish farming, have no access to other sources of fish. In Luapula, production levels are so low that any impact on general household food security is negligible. Where there is increased production and marketing, as in Western Kenya, household consumption of fish from the pond may decrease. However, more productive farmers continue to buy fish from the market. For those households with lowest productivity where the few fish produced are consumed within the home, the marginal benefits may be higher.

For poorer people in a community who are unable to buy fish and are not in a position to dig a pond, fish farming is unlikely to make much of a difference to their wellbeing. Those who are short of fish because they do not go fishing or do not have the cash with which to buy fish, are equally unable to buy cultured fish. When cultured fish are sold, prices are generally higher than alternatives sources of fish. Production is a long way from being sufficiently high to drive prices down. Some non-fish farmers will benefit from gifts from friends and relatives. Fish farming also occasionally generates labouring opportunities for non fish farmers.

2.5.2 Household income effects

In Luapula, a combination of poor marketing infrastructure, low production levels, and the diversity of reasons which encouraged people to dig ponds in the first place, make the direct income effects of fish farming negligible in most cases. Little fish is either sold or exchanged. In a growing economy with a strong income motivation for fish farming, as in Western Kenya, direct income effects appear to be significant. There is also evidence that indirectly, fish farming contributes to enhanced expenditure on other aspects of farming, education and the purchase of a wider variety of foods. However findings from Malawi indicate that many of those farmers who apparently obtain significant incomes from their

fish ponds (and are therefore "successful" in terms of production) may in reality be making little or no cash profit because of outlay on inputs.

2.5.3 Intra-household labour effects

Fish farming adoption may have negative labour impacts within the household. These can take the form of male labour being diverted from other more productive activities, or the increase of women's workload either as a result of taking up activities previously undertaken by men or because they are directly assisting with fish farming activities. Most evidence concerning intra-household labour effects is derived from the Luapula study because of its greater depth and detail.

The most time consuming activity in fish farming, pond construction, does not appear to conflict with other activities in Luapula because it is generally undertaken during periods of light demand on male labour. Pond construction is fitted around other tasks. In households where farmers have constructed several ponds, there is some evidence that this reduces time spent on other agricultural activities. In Kenya, there is a greater likelihood that ponds will be constructed using hired labour. The implications of this will be more closely related to alternative uses of the money spent than direct labour effects.

Fish pond management is also fitted around other aspects of farming. Women and children spend substantial amounts of time on pond management activities, most often when they are in households where a smaller proportion of the product is marketed. Where the expected destination of a pond harvest is household relish, women are more likely to have an active decision making role. Thus, participation in pond management by women and children partially reflects their own perceptions of their vested interests. Although additional time/labour burdens do not currently appear to be a problem for women, it is also clear that the unpaid labour of women should not be taken for granted - as it implicitly is by many planners. The active management role taken by the wives of male fish farmers has implications for extension which have not yet been addressed.

2.5.4 The control of resources and the distribution of benefits.

The gains from fish farming, whether of income or food, do not necessarily benefit all household members equally. The distribution of benefits should always be empirically established. It is a result of both perceived contribution and bargaining power of individual household members. Household structure will also influence the distribution of benefits. In polygamous households for example, different wives will have unequal claims to the products of the fish farming enterprise.

In Luapula, low levels of production, mean that the surplus is often too small to be marketed. The nutritional benefits of fish farming, though small, are felt by all members of fish farming households. This is part of accepted practices governing distribution of

food. In other places, practices will be different.

If sufficient fish are harvested for some or all of the crop to be sold, the intra-household effects depend on who controls the income and on what it is spent. An extensive literature documents how income in the hands of women is more likely to be spent on general household needs rather than "personal discretionary expenditure". The research examined this proposition in the case of aquaculture. As with the use of fish for food, control and destination of income will depend on a range of considerations. In any situation there will be an element of negotiation. In Western Kenya, where a large proportion of pond fish is marketed, women invariably take the fish to market and have a significant say in the disposition of the income. In Luapula, the few fish marketed were sold at the pond side. The cash was usually controlled by men but tended to be used for basic household needs. There were indications that increased production of fish would result in a greater diversion of income towards the male pond owner. Many mentioned plans to sell fish and then open a bank account or buy an asset such as a bicycle. In Luapula, individual accumulation does not necessarily end up reaching other household members because of the division of assets commonly associated with divorce and inheritance.

2.5.5 Community level effects

Fish farming relies on resources which are thought to be abundant or to have few alternative uses: land, water, pond inputs. As households are not isolated units, the research considered whether fish farming is the cause of actual or potential conflicts over these resources. The question is especially pertinent where fish farming involves the use of resources which are viewed as common property or open access. In Kenya, where ponds are built on private land, no disputes were identified. In Luapula, many fish ponds are dug in land to which people do not hold formal title and which has previously been thought to be marginal. However, under conditions of environmental and economic change, previously marginal land can acquire a new value. This is happening in the low-lying wetland - dambos - where fish ponds are dug. As the potential of the dambos is recognised for the cultivation of crops as well as for fish ponds, localised scrambles to claim the land occur. Although the dambos cover a large area, that which is attractive because close to villages is of course more limited. As this scramble for land takes place, existing users find it increasingly difficult to exercise their common property rights. Disputes arise over the diversion of drinking water sources and over the loss of places for women to soak cassava. Frequently those who are most disadvantaged are those who are the least articulate.

Regarding other inputs, such as manure and vegetation for feeding the fish, no evidence of resource conflict at the community level was identified. In Luapula, this can be partly attributed to the low level of use of such inputs as are available. Because ponds are increasingly integrated with vegetable gardens, they may represent a net benefit in terms

of availability of vegetative matter.

The evidence is mixed. What is clear is that benign resource control effects of fish farming should not be taken for granted. It is important to establish what the alternative uses of different resources are - and by whom. These will not be static. As the value of inputs changes, there are increased possibilities that the interests of specific groups may come into conflict. This may occur both because of the spread of fish farming itself and because of other pressures such as rising population density or environmental change. When this occurs, the ability of disadvantaged groups or individuals to articulate their interests becomes increasingly important.

2.6 Constraints to long term viability

2.6.1 The consolidation of indigenous knowledge

Sustained adoption of fish farming requires more than many people digging ponds. The promotion of fish farming aims to create a knowledge base that will outlast the departure of donor assistance. To a large extent the supposed failure of African aquaculture is blamed on the absence of a tradition of livestock management in general and fish management in particular. In most places, fish farming has been introduced over the last forty years or so to areas where livestock management is a subsidiary activity. Furthermore, it has been introduced as a branch of fisheries, not of farming. This certainly influences management practices. People often dig fish ponds with inadequate knowledge of how to manage them. Fish farmers may treat the fish in their ponds in much the same way as their small livestock: left to fend for themselves and slaughtered (harvested) to meet special needs rather than any concern with productivity.

Key gaps in knowledge exist concerning the appropriate use of feeds and manures. More fundamentally, farmers frequently fail to apply the concept of a production cycle to fish farming. This is partly related to their expectation that outsiders should regularly supply new fry rather than farmers restock ponds from their own supplies, and the view that farmers should not make their own decisions in this regard.

Gaps in knowledge are unevenly spread. In areas with a longer history of extension advice there are signs of consolidation and the creation of a sustainable knowledge-base. Even where there are significant knowledge gaps, some farmers continue to innovate and work out solutions to their own problems. A long-term perspective is therefore essential in assessing the prospects for aquaculture development - longer than the duration of most projects.

In Luapula, ponds are generally underfertilised. Application of manure is sporadic at best and frequently non-existent. This is partly because of low levels of livestock ownership. Also important is limited knowledge about possible uses of animal manure. Similarly in Malawi, where availability may also be limited, a lack of understanding of the amounts of manure which could be beneficially applied is a critical constraint to pond productivity. In Western Kenya on the other hand, knowledge of and willingness to use manure in all aspects of farming is much more entrenched. Greater boundedness of land has meant that small livestock are increasingly tethered or fenced. Techniques of zero-grazing for cattle are being developed. The prohibitive price of chemical fertiliser leads farmers to experiment with resources available from the farm. In Luapula, both agricultural extension and farmers are only beginning to question the absolute necessity of chemical fertiliser for non-traditional crops. Thus, although the research sites have many similarities in

customary attitudes to livestock management, a combination of economic imperatives and a different experience of development combine to produce different management practices.

Pond feeding similarly reflects a combination of knowledge, availability of feeds, and to a greater extent, other demands on labour. It is invariably an activity which is fitted in around other activities, both agricultural and social. It is very often undertaken by women and children. Unsurprisingly, those farmers with ponds located closer to their houses tend to feed their fish most frequently.

In all research sites, there are farmers who wish to expand their pond area but have a poor understanding of required inputs. Often existing ponds are under used. The phenomenon was least frequently observed in Western Kenya where, because of land pressure, opportunities for expansion are fewer and resources have to be more intensively used.

In Luapula and Malawi, many farmers are reluctant to harvest their ponds. This is caused by a combination of the tendency to treat the ponds as assets and savings banks, deficiencies in harvesting techniques, and poor knowledge about the growth and breeding patterns of fish. After as much as three years farmers are "waiting for the fish to grow". In Western Kenya, the effects of training appear in farmers' clear ideas about appropriate times for harvesting.

2.6.2 "Natural" constraints to viability

There are a number of constraints to viability to which it is not easy to find solutions. Principal among these are animal predation and the impacts of droughts/flooding on fish ponds. However, with both of these problems, good advice can play an important preventive role.

In Luapula, the principal stated reason for the abandonment of ponds was animal predation. The problem is widespread elsewhere. In part, what is assumed to be animal predation may in fact be a plausible explanation for the results of poor pond management. There is nevertheless also a real problem of predation. Common predators are otters, birds and snakes. The impact of predation is however greatly modified by pond location and levels of management. Proximity to the home obviously gives greater opportunities for control of predators. Well maintained ponds with slashed grass and with "green" water are less likely to be susceptible to predation. Badly located and constructed ponds are more likely to be subject to problems of water shortage or to flooding. Many examples of both were found in Luapula. In most cases they were the direct result of ponds being constructed without adequate knowledge or advice. This in turn arose from a concern to show keenness and in some places, the scramble to lay claim to the best land.

2.6.3 Social constraints: theft and "social control"

Theft

Fish ponds are vulnerable to poachers. Theft from fish ponds is often mentioned as a factor retarding the development of fish farming in sub-Saharan Africa. Reports of theft from ponds should not, however, always be taken at face value. To some extent it is possible to mistake predation by birds and animals for predation by people. As with predation, theft by humans is a plausible explanation for low productivity. Lastly, a certain amount of "theft" is accepted as redistribution. Farmers talk about members of the extended family harvesting their ponds without permission. This is viewed as inconvenient but up to a point as unavoidable and therefore accepted. Theft is also closely related to pond location: clearly the closer the pond to the house, the less likely it is that thieves will be tempted.

"Social Control"

The issue of theft as a mechanism of redistribution is closely associated with wider questions of social control in aquaculture development. The potentially inhibiting role of existing rules concerning reciprocity, accumulation and appropriate behaviour has been widely noted. It is suggested that individuals who invest too much time and energy in economically productive activities as opposed to meeting their social obligations are regarded as deviants who must bear social costs. The nature of these vary from theft to social ostracism, to accusations of witchcraft. Some commentators (e.g. Ruddle 1991, Nash 1986, Hayward 1987) suggest that aquaculture, with its potentials for accumulation and image of modernity, is subject to such pressures.

A simple distinction between "modern" and "traditional" societies misrepresents the complex ways in which people interpret social phenomena. Accounts of particular beliefs and behaviour as internal to rural communities and in opposition to those outside are misleading because they are presented as if they stood independently of people's interpretation and use of them. An apparent consensus within a rural community as to what are traditional practices or codes of behaviour obscures complex negotiation. Thus it makes less sense to counterpose "traditional" and "modern" values than to ask why and by whom particular beliefs or actions are labelled as traditional or modern in particular situations.

In Luapula, certain codes of behaviour are adhered to, but these are not fixed. Variation is partly the result of the ways particular individuals choose to identify themselves with tradition or modernity. For example, a number of people are keen to define themselves as being progressive or modern, particularly in their approach to farming. Among such people are many fish farmers. However, concentrating on economically productive activities does not necessarily imply that people ignore obligations to others. Accumulation

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as such is not condemned. Although there are many reasons for jealousy, ownership of a fish pond is not one of them: few fish farmers are sufficiently successful aquaculturists. On the contrary, they are more likely to be pitied by non fish farmers for wasting their time. Fish farming was never found to conflict with other social obligations such as the attendance at funerals. Indeed one of its attractions is its capacity to be fitted around such activities.

In Luapula, "levelling mechanisms" do exist to control socially unacceptable behaviour. Among such mechanisms is the use of accusations of witchcraft and the inculcation of fear of it. No evidence was found that fear of witchcraft accusations discourages the adoption of fish farming. In the villages, people commonly consider that water is a poor conductor of magic. On the other hand, socially inappropriate behaviour is certainly controlled. For example, in Luapula deviousness and boastfulness were widely condemned. It is important for the agents of development to understand how in any particular setting deviance is defined, because their interaction with particular farmers may be locally condemned.

3. POLICY IMPLICATIONS

3.1 The decision to support aquaculture

The policy implications relate to strategies for small and medium scale rural fish farming in ponds. The evidence from both field work and other studies casts doubt on the value of continued support to African aquaculture in this form. However, there is more to the "failure" of rural African aquaculture than is initially apparent. The failure of aquaculture development projects should not be confused with the failure of aquaculture. Although projects have been misconceived, in terms of objectives and the means by which they might be reached, and how impacts are to be measured, there is still evidence that fish farming can become established as a valuable part of rural economies. It takes both time and a rethinking of approaches.

It is unlikely that aquaculture will be a panacea for a fundamental problem of protein shortage in Africa. Nevertheless, many advocates of aquaculture still speak in terms of food security and the beneficial effects for resource poor farmers. Policy makers face a dilemma: **either** to try to develop activities and approaches which reach the resource poorest, or to focus on technology development which may be viable in the long term, but which is unlikely to be closely related to food security - at least in the short term. As with many other technologies, those most likely and most able to become productive fish farmers are not the most needy. The greatest food security and/or income impacts often coincide with lower levels of production. This dilemma should be acknowledged. Nonetheless, small scale fish farming can be, and often is, a valuable diversification for a wide range of farmers. As one among a range of strategies it can reduce vulnerability and improve the productivity of other crops.

A rethinking of approaches must address the fact that up till now, most projects supporting rural aquaculture have taken a familiar format. This has involved a focus on the delivery of tangible inputs, and on the creation of physical structures with much less attention given to institutional capacity and to the ability of governments to make optimal use of existing resources. Critically, the institutional position of aquaculture as part of fisheries has only been informally questioned. Fish farming is an aspect of farming, not fisheries. In many cases it constitutes an addition, usually minor, to the range of activities undertaken by farmers. In most African countries there exists an extension service for agriculture which is considerably better resourced than that for aquaculture. Similar problems in capabilities, morale, and adaptability to farmers' needs exist. There is no reason why these should be addressed separately for fish farming and agriculture.

Analyses of the future for donor assistance to aquaculture have generally accepted an

assumption that such assistance should take the form of **projects** - aquaculture projects. Very occasionally, these are added-on to other rural development programmes. More commonly, projects stand alone, focusing on the transfer of this one technology. This is understandable. The chaos and conflict that can result from multi-technology, "integrated" projects have been well documented. There is little that is unique about aquaculture in this respect. However, the isolation of rural aquaculture as part of fisheries rather than as one among many potential contributions to rural development is closely connected to its supposed failure.

The research illustrates the continuing importance of advice and information for fish farmers. Many farmers are able to manage their fish ponds. Many more adopt the technology with limited knowledge of input requirements. They may be prepared to expand without adequate input availability. A legacy of expectation and dependency among farmers may translate these knowledge gaps into requests for further outside assistance. In the past, there has been little capacity respond to farmers' needs

A change in direction and an ability to learn from mistakes will create different prospects. Neither of these can be a simple product of research. We conclude that there are specific ways in which donors can and should support rural aquaculture development in Africa. An overall strategy is outlined below, followed by a more detailed discussion of its practical implications.

3.2 An overall strategy

The strategy outlined below has a central objective: to find ways for aquaculture to become incorporated into farming practices in rural in Africa. It is aimed at both donors and African governments.

The strategy is based on five considerations:

- 1 In aquaculture planning, there is a need for greater clarity and transparency in both objectives and the indicators with which their achievement is to be measured.
- 2 The different needs, constraints, and incentives of the various stakeholders involved in the development process should be properly recognised.
- 3 Aquaculture projects which are technology driven and are based on the delivery of technical inputs have poor sustainability. Given existing weaknesses, providing support to extension services specifically for aquaculture is unlikely to be justified.

- 4 Farmers need more appropriate and consistent advice than has been available.
- 5 Fish farming is more closely associated with farming than fishing.

The strategy can be summarised as follows

The promotion of rural aquaculture should not take place in isolation from other development strategies and activities. In specific geographical areas, needs will vary. It is critical therefore to have an adaptive and flexible approach to these varying needs. Techniques of participatory appraisal should be used for their identification.

Existing fisheries departments are generally not capable of providing regular and appropriate advice to farmers. Limitations exist in terms of numbers of personnel and in terms of their capacity to operate, particularly regarding transport. Providing support to an extension service specifically for aquaculture is unlikely to be justified.

Support to rural fish farming should not be limited to fisheries departments. In many places, it will be appropriate for donors to facilitate the gradual transfer of responsibility for rural fish farming activities to agricultural support institutions. This should take place in response to governments' assessments of their own needs and capacity.

A key aspect of the facilitation should be the training of trainers of agriculturalists in techniques of both fish farming and extension. Agriculturalists may come from either government supported extension services or from existing projects, whether donor-supported or non-governmental. Further training of aquaculture experts should be closely tailored to the needs and capacities of existing agricultural extension institutions.

In addition to advice, support is still needed in certain technical aspects of fish farming, particularly the maintenance of fingerling quality. While it should be an aim of fish farming development to make such support unnecessary, in the short term, it should continue, along with a parallel effort to develop local capacity.

The practical implications of this strategy from the level of government to the particularities of training and research needs and monitoring and evaluation are outlined below.

3.3 Practical implications

In practical terms, the strategy can be interpreted in several ways. The details will depend on donor-government negotiation and on existing institutional structures. Because of the great diversity of African countries in terms of institutions, history, economic, social and physical characteristics, no simple recipe book is possible - or desirable. The details of the strategy outlined above will vary throughout the continent. An aim of donors should be to establish where it is feasible.

3.3.1 Coordination and cooperation

The first and vital step is discussion and coordination between donors and between donors and African governments. Such discussion should aim to build on existing collaboration and seek ways to develop linkages between fisheries and agricultural departments.

At a national level, key questions to consider relate to:

- *Past experiences of attempts to promote aquaculture:*

Many countries have had a long history of efforts to promote rural aquaculture. These should be identified, and the lessons of evaluations synthesised. What were the different hopes and expectations of different stakeholders? To what extent were they met and what are the effects?

- *National priorities and objectives for fish farming:*

Is fish farming supported as a means for diversification/income generation in the rural sector, as a means to increase overall fish availability (possibly for supplying urban populations), as a means of improving food security, or as a tool for economic growth?

On what basis are these priorities established, and how will fish farming contribute to this?

- *The scope and capacity of existing extension for aquaculture:*

Information needs to be collected not only on numbers of personnel, their training and means of operation, but also on morale, incentives and the way extension operates in practice. What are the existing links with agriculture? If, as in Zambia, these are weak, working through agricultural extension will be a sensible alternative.

- *Expertise and functioning of agricultural extension:*

How is existing extension for agriculture resourced, what are its objectives, what are the constraints, and how are these overcome? How is training of agriculturalists

undertaken and how might aquaculture be incorporated into this?

- *Existing basis in rural fish farming*

What is the history and extent of rural fish farming? Are there areas of greater density of fish farmers which could be given higher priority? Are there fundamental socio-economic constraints? (people don't eat fish, lack of markets). What are the marketing constraints and opportunities? What is the role of fish in the rural economy?

- *Bio-technical considerations (water, climate etc):*

Does further support to fish farming make sense in the prevailing bio-technical conditions?

Decisions on priorities for training can be derived from the answers to these questions

3.3.2 Formulating objectives

Poverty focused objectives require that specific efforts are made to reach the poorest/most vulnerable people. However, it will often be the case that for these people, fish farming may not be the best option.

Objectives concerned primarily with the establishment of rural fish farming may be achieved with little direct influence on either poverty or food security. This should be acknowledged.

3.3.3 Identification: sites and targets

The focus of this strategy is on providing training rather than site-specific aquaculture projects. Recommendations do not therefore relate to choosing geographical locations for projects. As noted above (section 3.1), the decision to support training would be the product of negotiation between donors and national governments.

Nonetheless, guidelines are necessary to indicate those areas where the most benefit is likely to arise from support to aquaculture through agricultural extension. The direction taken within the guidelines depends on policies regarding objectives and ultimate beneficiaries. In all cases, technical appropriacy (suitable climate, soils, and water availability) should be established. This appears an obvious point, but is one which has been overlooked in the past.

If the principal aim of support to fish farming is the establishment of autonomous knowledge, two considerations are likely to be important.

- i) Population density and availability of land. The evidence from fieldwork shows that where fish farmers are relatively close to each other and where, for reasons of land availability, ponds are closer to houses, the prospects for sustainability are higher. Furthermore, where there is greater perceived scarcity of land, it is more likely that the decision to adopt will be the result of a more sound assessment of costs and benefits.
- ii) Marketing opportunities and potentials. In many cases, this will be closely related to the point above. If there are economic gains to be made from fish farming, existing independently of the efforts of fish farming promoters, there are better chances that the technology will survive. Such gains are of course more likely if fish farmers know that they will be able to sell their fish.

If the principal aim of support to fish farming is the improvement of food security, the picture is much more complicated.

- i) Most evidence indicates that those who are currently benefitting from fish farming are not those who are worst off. There is little to show that the benefits of cultured fish production make any difference to the resource poorest who are both not adopters and not in a position to buy cultured fish.
- ii) Given this, the promoters of aquaculture then have to make a strategic choice about whether or not to make special provision to enable the resource poorest to benefit from the technology. An obvious way is to target particular groups for advice and/or assistance. As aquaculture is only one among a range of options, the value of supporting it for particular groups should be established in relation to alternatives.

3.3.4 The technical approach

The strategy does not preclude the development of higher intensity aquaculture with greater commercial orientation. Policy oriented toward **either** higher or lower levels of intensity is not recommended. Rather, the stress of this report has been on the **appropriacy** of the technology to the farming system and the farmer in question. Support should adapt to the needs, priorities and capabilities of farmers, not the other way round. For many fish farmers, extensive and semi-intensive practices are currently the most appropriate. However, for some, greater intensification is both possible and desirable. This cannot be dictated in advance by strategy, which is why emphasis on adaptability in training is vital.

Where greater intensification of practices develops, there is a role for governments in monitoring and controlling for socio-economic impacts, as elaborated below (especially related to land, labour and resource control issues).

3.3.5 The provision of production inputs.

The overall strategy suggests that in general the provision of non-sustainable production inputs should be avoided. Neither governments nor donors should see the distribution of fingerlings, tools, or feeds as an important role for themselves. On the other hand, there may be justification for limited support in targeted areas regarding production inputs.

Fingerling supply

Private supply of fingerlings should in general be supported through the training of farmers. While it is true that many intending fish farmers complain about a lack of fingerlings with which to start, this is considerably amplified by expectations of assistance. On the other hand, there is a need to maintain quality of fingerlings, especially in the early years of a shift to farmer-farmer supply of fingerlings.

For this reason, support to small fry production centres (FPCs) is justified. These should have objectives of maintaining fingerling quality, acting as sources of advice to farmers, and achieving their own commercial viability (i.e. selling fingerlings at non-subsidised rates). The actual size, location and technical details of such fry production centres should be decided after careful evaluation of marketing potentials and opportunities, and existing fish culture. For example, decisions on the appropriate species to be cultured will depend on local conditions.

The aim of support to FPCs should be the consolidation, not introduction, of aquaculture. It therefore makes sense for them to be located in areas with existing fish farmers, preferably not widely dispersed. Farmers need to be able to collect fingerlings using their own (usually very limited) means. The fry production centres should be run by intermediate level aquaculturists who have received training, not only in the technical aspects of aquaculture, but in extension techniques and management skills. They could thus also fill a function of providing support to extensionists.

The provision of other production inputs

In certain cases, there may be justification for the supply on loan of harvesting equipment. There is also scope for encouragement of private sector and collective equipment management. There is unlikely to be good reason for the provision of other production inputs such as digging equipment or processed feeds.

The question of credit

There are likely to be few cases where the provision of credit for small scale rural aquaculture is justified. The value of small scale fish farming is that it can make use of existing on-farm resources. Where credit is offered there are dangers that it either is manipulated by those least in need of it, or it becomes a burden for those who are not in a position to repay their debts.

3.3.6 Training

Before any specific recommendations for training can be made, a training needs assessment is vital. Such an assessment should identify strengths and weaknesses in existing institutional arrangements, and aim to build on strengths and address weaknesses. Recommendations for training might include:

At the senior and intermediate levels.

Training should take advantage of existing skills and capacities of personnel. Particularly at the intermediate level, knowledge of technical aspects of fish culture remains important. But this is worth little if it is not incorporated with an understanding of the practical application of that knowledge. There are likely to be critical areas that need supplementing. For example, many senior aquacultural personnel with advanced qualifications in biological aspects of fish culture are, in practical terms, managers, policy makers and administrators. Their training should reflect this.

Intermediate level fish culturists may have multiple roles for which they need to be equipped: from the training of agricultural extensionists, to the management of fry production centres, to the ability to adapt fish culture techniques to the needs of local farmers.

Training of extensionists

A wide range of materials and methods are available outlining basic technical aspects of fish culture and advice on the adaptation of these to local conditions. Approaches building on farmer participation in extension are also becoming more effectively developed. The training of non-specialist advisers in fish culture should build on these materials. However a number of key aspects should be highlighted.

Training of trainers

Existing extensionists from fisheries departments can be a valuable resource for building basic technical knowledge among agricultural extensionists if they are to act as the main extension agents.

Technical considerations

The research revealed the key importance of pond location and construction. Many of the

specific problems confronting small scale fish farmers would not have arisen if their ponds had been located close to their houses, and had been constructed so as to avoid flooding or drying out. Training of advisers should stress the importance of these factors.

Second, a recurring gap in farmer knowledge is the application of the concept of a production cycle to their fish farming. To a large extent this arises from the assumption made by both extensionists and farmers, that they should be supplied with fingerlings, and re-supplied when the fish appear to stop growing. If the expectation of government fingerling supply is reduced, farmer knowledge in breeding and restocking needs to be correspondingly increased.

Socio-economic aspects of extensionists' training

A weakness of assessments of socio-economic aspects of aquaculture development is that they have seldom if ever been used to inform and advise the people who are in close contact with farmers. They have not been used in extension training. A similar complaint is levelled at the practical relevance of socio-economic information in other sectors. It is a theme of this study that it is neither useful nor possible to single out aquaculture as a sector for which exclusive, socio-economic concerns will be relevant. Rather, recurrent themes will have their particular relevance to fish farming. Extensionists working with fish farmers should be able to identify how and where they are pertinent - and to alter their approaches accordingly. This ability should be the result of training in participatory approaches to extension.

Approaches to intra-household issues in fish farming development

The effects of small scale fish farming will be experienced differently by different household members. At low levels of production and sale, fish farming contributes to the well being of household members equally. However, this is more questionable with greater commercial orientation. The effects of fish farming within the household will depend on who controls the income, on what it is spent, on the extent to which resources with alternative uses are used in fish farming, and on whether labour is diverted from other activities.

Ability and willingness to contribute to the operation will be similarly variable. The labour of wives and children may be an important input to fish farming, but such labour should be neither taken for granted nor ignored. Although it is common for the wives of male pond owners to undertake the major part of pond management, this is seldom reflected in extension approaches. Information transfer from husbands to wives is unlikely to be as effective as direct training of pond managers. Promotion of fish culture also often implicitly assumes that members of the household will all be willing to contribute time and labour. In many cases this is true, but not always.

There can be no hard and fast guidelines for extensionists on how to approach intra-household issues - in aquaculture development or with any other aspect of farming. There is a danger that extensionists, especially male extensionists, will assume that they are expected to deal with "women" as a difficult target group and a burden on their work. Emphasis in training should instead be on awareness of differences between men and women and ability to act on them. For agricultural extension generally, a wide range of guidelines already exists. General points are:

- The timing and location of training courses should take into account constraints of all people who are likely to benefit from attending. Women may find it difficult or may be restricted by men from travelling long distances or being absent from home for training courses.
- The need for sensitivity to appropriate behaviour concerning meetings between women and unrelated men, while convincing men of the practical value of such meetings.
- If contact farmers are used, evaluation of the criteria for their selection according to how these enable or prevent female fish farmers from being selected.

3.3.7 Monitoring and evaluation

Throughout this report, we have stressed that statistics documenting tons of fish produced and numbers of fish farmers indicate very little. First, there are serious problems in the quality and validity of such data. Second, their relationship to objectives such as improved food security or strengthened rural incomes is unclear.

Questions concerning the disguised effects of the development of aquaculture also remain unanswered. As the most successful fish farmers are unlikely to be the most food insecure, monitoring should also consider resource control, both within households and within communities. At present, fish farming appears to have few negative effects, but this may change with greater levels of intensity.

Is it possible to develop more meaningful indicators with which to monitor and evaluate support to aquaculture? Given the findings relating to the positive role that effective extension can play, combined with a need to take a longer-term perspective on the establishment of the technology, a number of qualitative guidelines are recommended. Techniques of participatory appraisal are likely to be useful in monitoring and evaluation.

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Examples of objectives and indicators include:

Objective	Indicators
<p><i>Longer term:</i></p> <p>Fish farming established among rural communities</p>	<p>Visible evidence of pond maintenance; Evidence of marketing of cultured fish Farmer-farmer supply of fingerlings</p>
<p>Fish farming integrated with agricultural extension</p>	<p>Agricultural extensionists trained in fish culture where appropriate Fish culturists operating as support/trainers for agriculturalists</p>
<p>Self-supporting fry production centres established.</p>	<p>Fry production centres operating without outside assistance</p>
<p>No negative and unanticipated side effects.</p>	<p>Evidence of land disputes, changing land values Evidence of changing prices/availability of resources with alternatives uses.</p>
<p><i>Short term</i></p> <p>Facilitate transfer of rural aquaculture development to the agricultural sector</p>	<p>Assessments of scope/willingness for such a transfer Training of trainers carried out Managerial training of senior/intermediate personnel carried out Training of agricultural extensionists and their deployment.</p>
<p>Operational fry production centres</p>	<p>Assessed viability in terms of farmer demand, ability to pay for quality fry.</p>

3.3.8 Research needs

Future research should be able to address these monitoring and evaluation needs. In both technical and socio-economic spheres, research is carried out which does not necessarily have direct applications. In many cases, a lack of coordination between researchers leads to a reinventing of the wheel. Examples of where research may be of use include:

Social research

- Monitoring and assessing the content and nature of extensionists' training, from different perspectives (relevance, acceptability)
- Where extension for aquaculture is taking place, assessing the fit of fish farming to other aspects of farming practices, including intra-household effects, community resource control effects.
- Assessing changing attitudes, perceptions and priorities of the stakeholders, including the institutional stakeholders.
- Monitoring the functioning of extension, including the role of fish farming within agricultural extension and the nature/scope of farmers' training courses.

Technical research

Small scale fish farming is a relatively simple technology. When complications arise, they are usually the result of particularities of the environment or farm into which the technology is being introduced. It therefore makes more sense for technical research to be adaptive to and closely involving farmers themselves than for it to attempt to deliver technical "packages". Again therefore, the training of extensionists in more participatory methods is critical.

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