New Partnership for Africa's Development (NEPAD)

Comprehensive Africa Agriculture Development Programme (CAADP)

Food and Agriculture Organization of the United Nations

Investment Centre Division

GOVERNMENT OF THE REPUBLIC OF ZAMBIA

SUPPORT TO NEPAD–CAADP IMPLEMENTATION

TCP/ZAM/2906 (I)

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Volume III of IV

BANKABLE INVESTMENT PROJECT PROFILE

Sustainable Aquaculture Development Programme

October 2005

ZAMBIA: Support to NEPAD–CAADP Implementation

Volume I: National Medium–Term Investment Programme (NMTIP)

Bankable Investment Project Profiles (BIPPs)

Volume II: Nega–Nega Smallholder Irrigation Scheme Development Project

Volume III: Sustainable Aquaculture Development Programme

Volume IV: Smallholder Dairy Development Project

NEPAD–CAADP BANKABLE INVESTMENT PROJECT PROFILE

Country: Zambia

Sector of Activities: Fisheries – Aquaculture Sub–sector

Proposed Name: **Sustainable Aquaculture Development Programme**

Area of Coverage: Country–wide

Duration: 12 years

Estimated Cost: **Total ..... US$11.64 million**

Suggested Financing:

Source	***US$ million***	***% of total***
Government	0.84	8
Financing institution(s):		
– Grants	1.29	11
– Loans	5.52	47
Beneficiaries	0.24	2
Private Sector	3.74	32
Total	***11.64***	***100***

ZAMBIA:

NEPAD–CAADP Bankable Investment Project Profile

"Sustainable Aquaculture Development"

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Abbreviations

ACP	Agricultural Commercialization Programme
ASAWA	Association for Advancement of Women in Africa
ATAC	Aquaculture Technical Advisory Committee
C/B	Copperbelt Province
CAADP	Comprehensive Africa Agriculture Development Programme
DOF	Department of Fisheries
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GOE	General Operating Expenses
JICA	Japanese International Co–operation Agency
MACO	Ministry of Agriculture and Co–operatives
MENR	Ministry of Environment and Natural Resources
MEWD	Ministry of Energy and Water Development
mt	metric ton
NACP	National Agricultural and Co–operative Policy
NGO	Non–Government Organization
NARDC	National Aquaculture Research and Development Centre
NMTIP	National Medium–Term Investment Programme
NORAD	Norwegian Agency for Development Co–operation
PRSP	Poverty Reduction Strategy Paper
RIF	Rural Investment Fund
TNDP	Transitional National Development Plan
USAID	United States Agency for International Development
ZNFU	Zambian National Farmers Union

I. BACKGROUND

A. Programme Origin

I.1. The proposed profile on a *Sustainable Aquaculture Development Programme* was prepared in collaboration with the *Department of Fisheries* (DOF) of the *Ministry of Agriculture and Co–operatives* (MACO). Aquaculture development is a priority area in the agricultural sector. MACO's Concept Paper (November 2003) on priority interventions in the agricultural sector highlights these disciplines as key areas of focus. In addition, the draft *National Agricultural and Co–operative Policy* (NACP), the *Agricultural Commercialization Programme* (ACP), the *Poverty Reduction Strategy Paper* (PRSP) and the *National Medium–Term Investment Programme* (NMTIP) underscore the importance placed on aquaculture development. Fisheries (including aquaculture), livestock and forestry have been recognized as the 5th new pillar under the *Comprehensive Africa Agriculture Development Programme* (CAADP). Government, with the assistance of the FAO, is also in the process of developing a national aquaculture development strategy which will highlight development guidelines for, among others: private sector fingerling production, fish feed production and distribution, enhanced marketing, sustainable extension and accessible credit as well as outlines the roles of key institutions including research, education and outreach.

I.2. There is strong recognition by government that aquaculture can and should play an important role in terms of food security, nutrition and income generation. Expansion of aquaculture, i.e. to involve more farmers requires financing and imparting of technical know–how. Further, promotion of out grower type of arrangements where big aquaculture players are linked to small–scale farmers, as well as delivery of effective extension services will need to be explored further.

B. General Information

I.3. Fish production is important in rural life. About 25,000 fishers and 30,000 others in fish processing and trading are estimated to derive their livelihood directly from fishing. Fish forms a very important part of diets throughout the country. It is estimated that up to 55% of the national average protein intake is from fish. The current estimated annual fish production from capture fisheries ranges between 60,000 and 70,000 mt. An estimated 8,000–10,000 mt is produced through fish farming (aquaculture). Total fish production is far less than national demand conservatively estimated at 120,000 mt. This will increase further with population and incomes. There are also good export possibilities in neighbouring countries and beyond though there are no accurate figures on how much fish is currently exported. Recorded per capita fish consumption has fallen from 16.5 kg in the 1970s to about 7 kg currently. This can be attributed to increases in population, decline in fish stocks in inland fisheries and reduction in incomes.

I.4. The potential for increased fish production in Zambia is very high given abundant lakes, rivers, and other water sources which if properly managed could lead to sustainable increase in fish production. The scope for expansion is therefore amply justified, both in terms of potential supply capacity and demand.

I.5. DOF is responsible for provision of extension and research services on both capture and fish farming and has the mandate to enforce the fish ban which runs from 1st December to end of February each year on almost all major water bodies. The Department also collects fish levies from all major commercial fishers. DOF has 19 fish culture stations throughout the country, 5 of which are aquaculture research stations. The other centres are for extension, training demonstrations and production of fingerlings. Most of these centres are in a poor state of repair due to budgetary

constraints. As a result, overall funding to the agricultural sector in general and the MACO's various Departments has declined over time in real terms.

I.6. Zambia has a long history in aquaculture promotion dating back forty years. A number of donors have been active in assisting including *Japanese International Co–operation Agency* (JICA), *United States Agency for International Development* (USAID), *Norwegian Agency for Development Co–operation* (NORAD), and the FAO. Through these and DOF's efforts, a number of farmers have been encouraged to practice aquaculture. Through extension work in fish farming, more than 6,000 small–scale fish farmers now own a total of over 13,000 fish ponds throughout the country. At the same time fifteen large commercial fish farmers have taken up the activity in Copperbelt, Southern and Lusaka Provinces where ideal conditions for business exist. Aquaculture is expanding in all the nine provinces of the country and as a result, Zambia is now one of the largest aquaculture producers in Sub–Saharan Africa. Table 1 below indicates estimated aquaculture production from 1995 to 2000. Data was not available for the period 2001–03. As can be seen, there has been a steady increase in production over the years.

Table 1: Estimated national aquaculture production

Year	Production (mt)
1995	4,800
1996	4,500
1997	5,000
1998	6,000
1999	7,000
2000	9,000

Source: Department of Fisheries (DOF)

I.7. As Table 2 shows, the current leading fish farming areas are North Western, Northern and Eastern Provinces. These provinces have higher numbers of fish farmers and more area under fish ponds. Due to the activities of aquaculture projects, the number of small–scale farmers taking up fish farming has increased over the years in the other provinces as well.

Table 2: Estimated number of fish farmers, and number and area of fish ponds in Zambia

Province	Number of fish farmers	No. of fish farmer groups/associations	Number of fish ponds	Area of fish ponds (ha)
Lusaka	240	n.a.	419	10.1
Central	352	12	560	10.8
Eastern	1,469	76	3,463	70.1
Copperbelt	201	5	446	11.4
North Western	1,988	24	3,245	114.5
Luapula	345	28	1,178	31.0
Southern	60	n.a.	86	1.9
Northern	1,681	21	4,277	84.6
Western	126	2	236	7.4
Total	6,462	168	13,910	341.8

Source: DOF. (n.a.: not available)

I.8. Aquaculture systems range from extensive to intensive systems and multi–species to mono–species culture. There are three levels of fish farmers; small–scale, emergent (smallholder) and commercial. Small–scale fish farmers rely on family labour and practice extensive culture and they rarely feed their ponds. Their fish is mainly for subsistence. Emergent fish farmers have income generation apart from the element of food security for their households. They purchase some inputs

and practice integration i.e. fish farming, crops and livestock. They may use family or hired labour for various tasks. Commercial fish farming is usually very large, intensive and involve large investments. Theirs is market oriented and may include processing for exports.

I.9. The commonly used fish species for aquaculture include; the three spotted bream, the green headed bream, and the red breasted bream. The Kafue River strain of the three spotted bream is the most commonly farmed species in Zambia, particularly in the commercial sector. Other species include the common carp, the Nile tilapia and even crayfish.

I.10. Most small–scale fish farmers still lack technical skills in areas like pond construction and fish husbandry practices. They also lack capital to improve and increase their investment in aquaculture. Limited funding and lack of capacity (training, staff shortages) continue to constrain the effectiveness of the DOF's extension support.

I.11. Long standing constraints in aquaculture include: inadequate extension services, lack of comprehensive training packages and materials, chronic shortages of fish seed (fingerlings), high cost of fish feed and poor marketing support. Easy access to good quality, cheap supply of fish seed is a necessary condition for smallholder aquaculture development. Fish yields through time tend to decline because farmers do not have access to high quality fingerlings to restock after harvesting.

II. PROGRAMME AREA

II.1. The proposed programme area is country–wide, targeting high potential aquaculture development areas in suitable site irrespective of their geo–political delineation. Generally aquaculture development in Zambia has not been uniform, with major determining factors being rainfall[1] (availability of ample water) and markets. There tend to be larger concentrations of small–scale fish farms in areas or districts that have rainfall ranges of 700–1,400 mm annually. Since commercial fish farmers have the capacity to store and manage water through reservoirs and dams, location of their operations is determined more by markets. The following paragraphs summarise the aquaculture situation in each province.

II.2. ***Northern Province.*** This is an important aquaculture province lying in rainfall zone III, with the Provincial Headquarters at Kasama. In this province, fish culture begun in the 1950s when ponds were constructed at missionary stations and at selected centres. Misamfu Fish Station (Kasama) is located in the province. As at the close of year 2002, there were about 2,000 fish farmers owning 5,000 fish ponds, averaging 200 m^2. Most of the farmers practice green manuring method with a crib in the earthen ponds. Traditionally the people of Isoka, Nakonde and Mbala districts are livestock keepers and therefore find it easy to integrate with fish farming, although on a small–scale. Average fish production is about 1.5 to 2 tons/ha/year. A 5 hectare commercial fish farm has been constructed on the shores of Lake Tanganyika to raise lake based species of cichlids for both consumption and ornamental for export purposes. The farm is in its first cycle of production.

II.3. ***North Western Province.*** This province is active in aquaculture, also located in rainfall zone III. Solwezi is its Provincial Headquarters. Large numbers of Angolan refugees at Maheba received external (donor) assistance to engage in fish farming activities and continue receiving extension support from the Zambian Government. The province has about 2,000 fish farmers with

[1] Zone I receive less than 800 mm annual rainfall and is in the southern part of the country.
Zone II receives between 800–1,200 mm annual rainfall and lies in the central part of the country.
Zone III receives more than 1,200 mm annual rainfall and lies in the northern part of the country

over 3,000 fish ponds. These are earthen fish ponds constructed on a variety of sites including dambos and are fed by canals draining from rivers or utilizing underground water. Green manuring and composting using a crib is common with small–scale integration with poultry and livestock. Fish production averages about 2 tons/ha/year.

II.4. ***Copperbelt Province.*** This province too lies in the agro–ecological zone III and hosts the *National Aquaculture Research and Development Centre* at Mwekera. The province reports 200 small–scale, 50 medium and 4 commercial fish farming ventures. Small– and medium–scale fish farmers operate 445 fish ponds, all of which are earthen, constructed in dambos and river catchments. Water supply is mainly by way of diversion canals. Commercial fish farms have 50 ha under water, and their facilities are a combination of earthen and concrete fish ponds/ raceways with some integration with livestock are popular. Average fish production from commercial ventures is 6 tons/ha/year. Green manuring using a crib is common among small–scale farmers while more intensive management using pelletized feeding is practiced by larger farmers. Due to the presence of a large poultry industry in the province, chicken manure is readily available for use in fish ponds. Average fish production is 2.5 tons/ha/year for the small–scale farmers.

II.5. ***Southern Province.*** This province is well known for its dam/reservoir fish ranching since water is a limiting factor. The province belongs to agro–ecological zone I. This is an agricultural province where people are traditional livestock keepers. There are about 300 communal dams (constructed to mitigate the effects of droughts), averaging 2 ha each, that have been stocked with fish. As at the year 2002, there has been a drop in the number of practicing small–scale fish farmers currently at 60 owning 80 fish ponds of average size 150 m^2 each. The province has 2 commercial fish farmers utilizing 60 ha of water surface for fish culture. There is integration with pigs and extensive usage of cattle and chicken manure in these ventures. Their average fish production is over 6tons/ha/year. In addition, there are 4 commercial fish farmers on Lake Kariba using 44 cages (cages measure 6 m x 6 m x 3 m) and 10 pens to grow fish and feeding pelletized feed. The average production of *Oreochromis niloticus* is 3.5 tons/cage. Average fish production from small–scale operations in dams and fish ponds is quite low at 1.5 tons/ha/year.

II.6. ***Central Province.*** Most of this province is in the agro–ecological zone II and is a very important aquaculture province actively integrating fish farming with irrigation of crops. A lot of earthen fish ponds are found in association with vegetable gardens, this has made it easy for the fish farmers to adopt the crib system for green manuring utilizing vegetable wastes. There are 300 small–scale fish farmers owning 560 fish ponds mostly constructed in dambos. There are about 100 dams used to irrigate crops and to feed or irrigate ponds. Average fish production is 2.5 tons/ha/year.

II.7. ***Lusaka Province.*** Most of the province lies in agro–ecological zone II and houses the capital city – Lusaka. This has created an ideal business environment for all categories of fish farmers[2]. The DOF Chilanga Fish Station, located in peri–urban Lusaka. In 2002, the province has over 240 small–scale and emergent fish farmers with 500 ponds and 3 commercial fish farms with a pond area of 80 ha. Owing to a flourishing poultry industry in and around the capital city, most ponds are fed with chicken manure with green composting using cribs. There is also use of wheat, maize bran and pelleted feed in feeding fish. The integration of ducks and/or pigs in rearing of fish is also becoming prominent among all levels of farmers in the province. Out grower schemes for easy access to cheap supply of quality fish seed is a developing industry among the small–scale farmers. Average fish production averages 2.5–6 tons/ha/year between small–scale and commercial farmers.

[2] DOF categorises fish farmers as small–scale, emergent or commercial.

II.8. ***Eastern Province.*** This province, like the southern, is largely utilizing dams and reservoirs for fish culture. It lies in the agro–ecological zone II and hosts Chipata Fish Culture Station. Dambos are used for fish culture purposes and, this being an agricultural and livestock province, manures and agro–by products are readily available for use in ponds and dams. Green manuring using cribs constructed in various ways and at different locations in ponds is practiced. Most of the fish ponds also provide water for irrigating crops and vegetable gardens. The province has close to 1,500 small–scale and emergent fish farmers owning about 3,500 ponds. The average fish production stands at 2.5 tons/ha/year though there is greater potential for attaining higher yields.

II.9. ***Luapula Province.*** This province lies in agro–ecological zone III. It hosts the Fish Station at Fiyongoli. Aquaculture activities are popular owing to the strong fishing background of the local people coupled with abundant water resources in form of many perennial streams and rivers. Dambos are favoured sites for construction of fish ponds due to the very high incidence of underground water supply. Compost cribs are a common feature in most of these fish ponds. As at 2002, there were an estimated number of 700 small–scale fish farmers owning about 1,200 ponds. Average fish production is estimated at 2 tons/ha/year.

II.10. ***Western Province.*** This is a province cuts across all the agro–ecological zones. It has large fishing grounds created by flooding of the Zambezi River. There is little in terms of fish farming activities. Fish farming development in this province is centred around Kaoma where there is a small Government Fish Station, though fish ranching is practiced in lagoons found on the plains. In the Kaoma area, there are currently some 120 fish farmers, with slightly over 230 ponds. Preferred fish species are *Clarias* and *Tilapia rendalli*. Despite the livestock rearing tradition, the aspect of integrating fish farming has not been fully exploited. Average fish production is still very low at 1.5 tons/ha/year. There has been a slow growth of fish farming in the province as the local people are traditionally livestock keepers and fishers restricting most of their activities to the flood plains.

III. PROGRAMME RATIONALE

III.1. Capture fisheries have been fully– or over–exploited, thereby reinforcing the need to develop aquaculture to improve fish production and consequently raise per capita consumption of fish to improve nutrition levels as well as income. Fish is very important to the national economy and contributes significantly to employment, income and food production. Its contribution to Gross Domestic Product (GDP) is estimated to be 1.8%. Most past interventions in the agricultural sector in terms of programmes and projects have tended to focus on crops at the expense of fisheries. In the spirit of agricultural diversification, it is important to increase investments in fisheries and in particular in aquaculture development as this has already been identified as a key priority area by the MACO as well as within the CAADP framework.

III.2. Supporting aquaculture development in C/B will contribute to food security, income and employment creation and sustainable livelihoods, improved environment and natural resource management. Fish farming decreases pressure on further exploitation of capture fisheries and provides for sustainable land utilization including use of farm wastes and crop residues for fish feed. Integrated fish farming can be achieved where farmers use their animals to obtain manure for their fish. Another possible activity that can be integrated with fish farming is storage water for irrigation.

III.3. Each region and province in Zambia has a unique aquaculture history, character and economy with the northern region leading in numbers of fish farmers and area under fish ponds. Aquaculture practices are defined by three levels of fish farmers; small–scale, emergent (smallholder)

and commercial. These levels are determined by the facilities employed, the level of management end the producers' motivation.

III.4. ***Small–scale farmers***, who form the largest portion of Zambia's aquaculture community, are often found in rural areas. They own between 1–5 small mostly poorly constructed family earthen fish ponds (average 100 m^2) with little or no management at all. Family labour is used here and fish is usually produced for home consumption; rarely is there a surplus for sale or barter. The preferred species of fish are the indigenous tilapias; *Oreochromis andersoni. O. macrochir, Tilapia rendalli, Clarias gariepinus.* Production ranges from 10–30 kg/are/year, the higher figures coming from high rainfall areas.

III.5. The ***emergent (smallholder) fish farmers*** are found in both rural and peri–urban areas. They are owners of 1 to 10 earthen fish ponds that are relatively well managed with some levels of intensification and some form of integration with crops, livestock and irrigation horticulture being practiced. An element of investment and commercialisation is taking place in this category. The species cultured are mainly tilapias and the exotics common carp and *O. niloticus*. Production ranges from 20–40 kg/are/year.

III.6. ***Commercial fish farmers*** are defined by increased water surface area and higher levels of investment. They are, to a greater extent, found along the line of rail, with larger production units. This is due to higher population density which provides for a ready market for their produce. There is, in this category, a higher level of structural investments and management involving, intensive feeding, integration of systems between fish and livestock. This category of fish farmers own more than 10 fish ponds mostly earthen, with other systems made of concrete are often found on their premises, including raceways and hatchery facilities. The latest innovation within this group is the introduction of cages and pens in large water bodies, such as those developed in Lake Kariba. Among the finfish cultured species there are tilapias, carps (*Cyprinus carpio* and *Ctenopharyngodon idella*) and the African cat fish, *Clarias gariepinus*. Crustaceans are also grown including the Louisiana Freshwater Crayfish, *Procambarus clarkii*. Culture practices include; mono–sexing, mono– and poly cultures, feeding pelletized feed, inorganic fertilizing and manuring. Average yields are 3 to 5 tons/ha/year.

III.7. "Emergent" farmers are the catalysts for aquaculture development in the country. Larger entrepreneurs with access to resources will continue to invest in commercial aquaculture and make significant contributions to the national production of cultured aquatic products; but the entry requirements for such larger operations will dictate that this number is relatively limited. However, smaller– and medium–scale enterprises potentially have a much broader constituency given their more modest resource requirements, assuming the enterprises themselves can be demonstrated to be worthy investments (i.e., profitable).

III.8. Current develop tactics have taken heed of lessons learnt and realised that to a large extent successful aquaculture development is based on density dependent factors. Spreading resources too thinly is a proven recipe for failure. Moreover, given the particular bio–physical and socio–economic requirements for profitable and sustainable aquaculture, not all sites are equal. A number of recent national aquaculture development strategies (including the one for Zambia), as well as the *NEPAD Action Plan for the Development African Fisheries and Aquaculture*, acknowledge the need to concentrate effort. This latter Plan (August 2005) calls for, among others, the following action with respect to aquaculture in Africa:

- Developing sector–wide strategies at national level for expansion and intensification of aquaculture;

- Supporting priority aquaculture zones;
- Encouraging private sector investment across the sector;
- Applying proven technologies to increase production;
- Maintaining the competitive advantage that Africa's environment provides for aquaculture production;
- Harnessing the opportunities for small and medium enterprise development provided by expanding domestic markets for fish, including growing urban demand;
- Supporting the emerging regional trade in aquaculture products.

III.9. Careful selection of development sites combined with a concentration of investment (i.e., from multiple investors) can minimise cost, optimise service and market access and promote collective management. Such sites of concentrated aquaculture development could be considered as "parks" where the optimal set of conditions exists to facilitate profitable and sustainable production. Parks serve not only as important demonstrations sites for replication and as major producers of aquatic products, but they also concentrate those elements which promote aquaculture with indirect affects for the small–scale farmers with fishponds. Appendices 1 and 2 present a schema for a prototypical aquaculture park as well as a summary input/output analysis for a typical farm which could occupy such a park.

IV. PROGRAMME OBJECTIVES

IV.1. The ***overall objective*** of the programme, in line with Government of Zambia priorities as well as those of NEPAD, is to increase income and nutritional status through increased production of farmed fish, or other aquatic products, for domestic and export markets, in a sustainable manner.

IV.2. The ***specific objectives*** are to:

- Identify sustainable and profitable aquaculture production systems including the requirements for these to be successful.
- Develop private sector support services including, but not limited to, private suppliers of seed and feed.
- Establish 10–15 functioning and profitable fish "parks" (i.e. geographical concentrations of aquaculture production in pre–selected high potential zones).
- Improve the marketing of fish through addressing pertinent issues like product quality, shelf life, post–harvest handling, small–scale processing, packaging and improving market information.
- Strengthen the fish farmers' organizations.

IV.3. Activities to be undertaken with respect to the above objectives are predicated on the fact that the aforementioned national aquaculture strategy elaborated through the projects TCP/ZAM/2901 & TCP/ZAM/3006 has been officially approved and implemented. The endorsed National Strategy is anticipated to be operationalized in the near future.

V. PROGRAMME DESCRIPTION

V.1. The proposed initiative has been more properly classified as a programme which will run for 12 years and comprise 4 phases (i.e., pre–investment, institutional development, pilot or investment – stage 1) and expansion (investment – stage 2) phases.

V.2. ***Monitoring and evaluation*** activities will begin in Year 1 and continue throughout the life of the programme.

Table 3: Proposed chronology for implementation of the four programme phases

Years	1	2	3	4	5	6	7	8	9	10	11	12
Pre–investment												
Institutional												
Investment–Stage 1												
Investment–Stage 2												

Phase 1: Pre–investment (year one)

V.3. The ***objective*** of this phase is to validate the technology and establish the overall operational framework for the sub–sector including definition of profitable production systems and establishment of baseline date against which to measure progress.

V.4. ***Indicative activities*** during this phase include: (a) objectively and scientifically selecting profitable systems ad identifying requirements for each (b) educating participants in the sub–sector as to realistic potentials for aquaculture production and the requirements to obtain these potentials; (c) sensitizing central investors in the sub–sector including banks, donors, private industry, private–public joint ventures, etc.; (d) defining, reviewing and adopting a national aquaculture strategy with full participation of key stakeholders; and, (e) developing a national aquaculture database (with GIS) to monitor growth in the sub–sector as well as serve as a planning tool in there selection of high potential zones.

Phase 2: Institutional Strengthening (years 2–4)

V.5. The ***objective*** of this phase is to organise and strengthen institutions (public and private), including methods for delivery of capital (credit) and information (extension) inputs, marketing and processing.

V.6. ***Indicative activities*** during this phase include: (a) continued education concerning the application of the national strategy including a focus on educating lending institutions; (b) operationalizing the national database including tools to assist in the identification of high potential zones; (c) selection of high potential zones corresponding to priority production systems; (d) selection and training of input providers in these zones; (e) training of producers, would–be producer and service providers in business planning, record keeping and financial management; (f) identification and reinforcement of market channels including identification of opportunities for improved value added and quality control; (g) training of extension and outreach staff including development of appropriate training materials; (h) improvement of input delivery systems; (i) assessment of alternative production systems including Small Water Bodies, minor lakes, etc.; (j) strengthening of national producer groups; and (k) establishment of *"one stop shop"* for investors in the sub–sector including standardization and harmonization of such critical entry issues as environmental impact, access and land tenure.

Phase 3: Investment – Stage I (years 3–6)

V.7. The ***objective*** of promoting and facilitating economically–viable pilot systems. During this stage 3–5 pilot aquaculture" parks" will be developed in high potential zones, using high priority profitable production systems.

V.8. ***Indicative activities*** during this phase include: (a) identification of specific "parks", the installation of needed infrastructure and subdividing into economically viable farm plots to be leased to private investors; (b) assist with and ensure the supply of essential production inputs at selected sites; (c) assist with ensure necessary market channels are in place for the produce coming from these sites; (d) provide technical and business training and backstopping to operators of farms at pilot parks; (e) evaluate level of outreach/extension support necessary and ensure that this level is viable from qualified change agents; (f) ensure appropriate record keeping and the inputting of date into national database; (g) assess market opinions and new markets; (h) assess and develop as appropriate complementary production systems including Small Water Bodies or related aquatic resources; and, (i) continue to support national producer organisation (s).

Phase 4: Investment – Stage II (years 6–12)

V.9. The ***objective*** of undertaking wider adoption and implementation of pilot systems. The number of aquaculture parks will be expanded from the 3–5 pilot sites to a total of 10–15 sires country–wide.

V.10. ***Indicative activities*** during this phase will be very much the same as in Phase 3. However, the focus will shift to the new sites will diminish support to the initially and now well–functioning pilot parks.

VI. INDICATIVE COSTS

VI.1. The programme's financial resources are employed in two ways: to provide technical assistance (TA) and related budgetary support and to provide "facilitated" loans (L). TA requirements also fall in two categories; close long–term assistance during the first years and then reduced periodic support in subsequent years. Assuming a six–month lag between programme start–up and fielding of international TA, the long–term period is calculated for 5½ years (Phases 1–3) and the short–term TA for the following six years (Phase 4).

Table 4: Indicative annual budget for long–term TA periods

International Staff	295,000
National Staff	75,000
FAO Assistance	45,000
Travel/GOE	88,000
Training	59,000
Supplies/Equipment	35,000
Contingency (10%)	55,200
Overhead (13%)	84,800
Total	737,000

Table 5: Indicative annual budget for short–term TA periods	
International Staff	–
National Staff	85,000
FAO Assistance	68,000
Travel/GOE	41,000
Training	18,000
Supplies/Equipment	3,500
Contingency (10%)	21,700
Overhead (13%)	30,800
Total	268,000

VI.2. Using the above indicative budgets, the overall programme budget can be derived as in Table 6. Using the per cent distribution of source of funds as indicated in Table 7, the financial contribution for different partners to the programme can be seen in Table 8. Support from the financing institutions is divided into grants and loans; 19% for the former and 81% for the latter. Grant inputs are foreseen chiefly for Phases 1 and 2 when the groundwork is being laid for important private sector investment; both in terms of investing their own capital as well as assuming a significant portion of the loan responsibilities. It is assumed that part of the funds recovered from loan repayment by the private sector will be re–invested in additional production through some form of revolving account arrangements.

Table 6: Indicative costs per phase and for technical assistance (TA) vis–à–vis loan capital (L)														
Phase	Years *(amounts in US$ thousands)*												Total	TA/L
	1	2	3	4	5	6	7	8	9	10	11	12		
1	350												350	TA
2		737	737	737									2,211	TA
3			850	550	500	300							2,200	L
					737	737							1,474	TA
4							268	268	268	268	268	268	1,608	TA
						800	500	400	200				1,900	L
									800	500	400	200	1,900	L
Total	350	737	1,587	1,287	1,237	1,837	768	668	1,268	768	668	468	11,643	

Table 7: Percent contribution to budgets for different programme phases from different funding sources						
Phase	Government	Grants	Loans	Beneficiaries	Private Sector	Total
Pre–investment	10	75		5	10	100
Institutional	20	30	20	10	20	100
Investment – Stage 1	10	10	50		30	100
Investment – Stage 2			60		40	100

Table 8: Distribution of funds per phase from different sources (in US$)						
Phase	Government	Grants	Loans	Beneficiaries	Private Sector	Total
Pre–investment	35,000	262,500		17,500	35,000	350,000
Institutional	442,200	663,300	442,200	221,100	442,200	2,211,000
Investment – Stage 1	367,400	367,400	1,837,000		1,102,200	3,674,000
Investment – Stage 2			3,244,800		2,163,200	5,408,000
Total	844,600	1,293,200	5,524,000	238,600	3,742,600	11,643,000

VII. PROPOSED SOURCES OF FUNDING

VII.1. To support implementation of the proposed programme, it is expected that funding will come from various sources, namely, government, international financing institution(s), beneficiaries and the private sector. Government contribution will be in kind i.e. in terms of staff, supplying offices/buildings for research and extension staff as well as taxes and fiscal revenues foregone. Through yearly budgetary provision, direct financial support would be availed to the DOF in the programme implementation area. The bulk of the funding for actual programme implementation will come from co–operating partners. Beneficiaries' contribution would be in kind in terms of labour such as digging of fish ponds, provision of materials such as fish feed, and cash for other requisites. The private sector will be key in the provision of fish seed, feed, nets, ice, and other materials which can be sold to fish farmers.

VIII. PROGRAMME BENEFITS

VIII.1. The main benefits of the programme will be a contribution towards poverty reduction by improving the incomes of fish farmers, boosting employment opportunities in fishery and fish–related activities and enhancing food security and nutrition. There could also be foreign exchange benefits arising from increased fish exports and increased local and national government tax revenues arising from fish activities.

VIII.2. The specific benefits would be:

- Increased national fish supply;
- Potential fish supply to local processors for export products;
- Increased incomes among farmers operating for–profit fish farms at the 10–15 "parks" developed through the programme;
- Improved services for all fish farmers including increased availability and quality of fish seed and feeds;
- Improved aquaculture extension services and overall public sector support achieved through geographic concentration in high potential areas;
- Improved marketing channels for aquaculture products and production inputs, included expanded intra–regional markets;
- Improved quality control of aquaculture products and inputs;
- Improved monitoring of aquaculture sub–sector;
- Improved national aquaculture producer organisations.

IX. IMPLEMENTATION ARRANGEMENTS

IX.1. DOF will be the lead implementing agency and will be responsible for the overall coordination, monitoring and evaluation of the programme. At the headquarters of DOF, an *Aquaculture Technical Advisory Committee* (ATAC) will be formed to advise on programme

implementation and will be comprised of representatives from various stakeholder institutions. It will be report to the Permanent Secretary and will be headed by the Director of Fisheries or his/her representative. It will be responsible for programme level planning, coordination, monitoring and evaluation, sensitization and accountability. The ATAC will be assisted by a *National Programme Coordinator* who will be responsible for the day–to–day running of the programme.

IX.2. One of the key members of the ATAC will be a representative of the Zambian National Farmers Union (ZNFU) which, in 2004, included aquaculture in the assortment of agricultural production enterprises which it supports. ZNFU has, thus, become an important interest group for aquaculturists and well as a critical liaison to general agricultural services such as credit, extension, etc.

IX.3. The private sector will be involved in all the programme implementation aspects ranging from financing, production, marketing to training. It will also supply fish fry and fish feeds to farmers.

IX.4. FAO will provide technical assistance in the form of direct technical assistance as well as technical and operational backstopping.

IX.5. The Civil Society, comprised of NGOs, CBOs, professional bodies and associations, will be involved in the process of designing and management of the programme, execution of programme activities like capacity building and delivery of services based on their field experiences, sensitization and identification of supplementary funding.

IX.6. The programme will potentially incorporate all aquatic production systems from Small Water Bodies to cages or raceways, as long as these can be developed in line with the objective of having profitable and sustainable production systems.

X. TECHNICAL ASSISTANCE REQUIREMENTS

X.1. Technical assistance (TA) will come from a variety of national and international sources. International long– and short–term assistance will be complemented by appropriate South/South co–operation (TCDC) as well as by direct support from FAO. Specific technical inputs are foreseen in the following areas.

- Aquaculture production technology;
- Fish feed formulation;
- Fish breeding and hatchery operations;
- Post–harvest handling, packaging and processing techniques;
- Database and GIS development;
- Site selection and farm construction;
- Cage culture;
- Enhancements of Small Water Bodies (including minor lakes);
- Land use and land tenure;
- Record keeping and business planning, including financial management.

XI. ISSUES AND PROPOSED ACTIONS

XI.1. Below are some outstanding issues, as well as proposed actions that could be taken.

XI.2. ***Environmental Issues.*** The types of impact envisioned in this programme by component are: (i) breed contamination through cross–breeding and loss of indigenous breed biodiversity through over–emphasis on superior breeds, (ii) the main risk of water points (dams, ponds) for aquaculture is over–supply at the new site, leading to excessive concentrations of animals with implications to land degradation and soil erosion. There are also risks of new permanent water sources encouraging new human settlements, with the associated problems of land clearing for cultivation, tree cutting for building and firewood (for processing of fish) and setting deliberate bush fires, as well as associated water–borne diseases such as bilharzia and malaria. (iii) effluents (solid, liquid and gaseous) from processing plants that are released into the environment may be toxic to aquatic life, (iv) the construction of dams and ponds in swamps and cutting of trees and vegetation in the process of preparing the sites will lead to localized soil and vegetation disturbances. Therefore it is important to formulate mitigation and monitoring measures at an early stage of programme planning.

XI.3. ***Capacity at the DOF.*** The Directorate of Fisheries headquarters is not adequately staffed. At the district and lower levels, there is inadequate managerial, technical and logistical capability. Development project/programme implementation and monitoring capacity is therefore constrained. Training and temporary technical assistance can help mitigate this problem.

XI.4. ***Institutions.*** In aquaculture development, apart form MACO, the other key institutions are *Ministry of Energy and Water Development* (MEWD) and *Ministry of Environment and Natural Resources* (MENR). The *Water Board* under the MEWD comes into the picture on matters related to water rights. Fish farming involves construction of fish ponds along water points such as streams and rivers. Therefore, it would be important that fish farmers are made aware of the importance of obtaining water rights before they embark on their fish farming activities.

XII. POSSIBLE RISKS

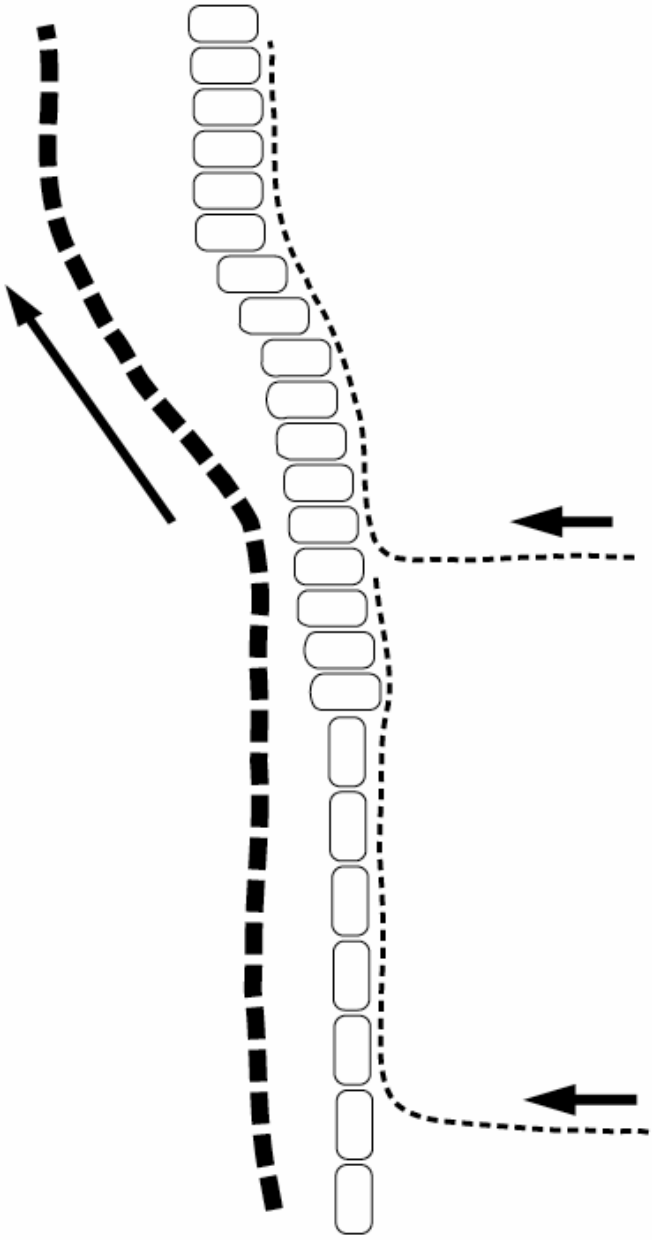
XII.1. The major risks include:

- ***Implementation delays***. Delays in implementation of a number of previous projects have been registered in various institutions. While some of the delays may be attributable to factors beyond the scope of the projects, many were due to bureaucratic red tape in implementing institutions and might similarly jeopardize the implementation schedule of the proposed programme. Innovative and flexible programme management coupled with decentralized decision–making should help to minimize this risk.

- ***Unpredictable public financing.*** The Government of Zambia has not been in position to fulfil its counterpart financing for some projects in the past, due to a shift in priorities and shortfalls in anticipated revenue levels. The timing and predictability of the flow of funds can disrupt planning and timely implementation of the programme. To help minimize such a risk, the programme proposes cost–sharing with and cost–recovery from farmers/beneficiaries rather than over–dependence on government. Farmer access to micro–finance institutions for borrowing is another avenue although it is limited.

Appendix 1: Diagram of pond "cluster" integrated in a large irrigation scheme which could serve as a template for an aquaculture "park"

An indicative site on the Kafue River has already been identified (Nugent 2003).



Appendix 2: Indicative inputs/outputs for a typical farm within an aquaculture park

Pond dimensions: .....150 m x 40 m
Number of ponds:.....8
Total water surface area: ..... 4.8 ha
Yield:..... 6 t/ha/yr
Total harvest:.....28,800 kg
Average fish size:.....3 fish/kg
Sales price: .....2.00 US$/kg
Feed price:.....0.50 US$/kg
Feed conversion: ..... 1.3 kg feed to 1 kg fish (1.3:1)
Fingerling price: .....US$0.05 each
Survival:.....90%
Labour:.....1 farm manager and 1 full–time labourer + casual labour

Construction Costs:
2,000 m of levee@6 m^2/linear m and 2.00 US$/$m^3$ .....US$24,000
Other facilities/structures/drains .....US$10,000
Total construction costs.....US$34,000

Revenue:.....US$57,600

Operational Costs:
Feed.....US$18,720
Seed.....US$4,800
Labour .....US$9,000
Miscellaneous.....US$4,000
Depreciation .....US$3,400
Total operational costs .....US$39,920

Profit.....US$17,680