

PLAN OF WORK

**Aquatic Resource Use and Conservation for Sustainable
Freshwater Aquaculture and Fisheries in Mali**

**“Mali Project” of the
AquaFish Collaborative Research Support Program**

Contents

Introduction.....	1
Plan of Work	8
Theme I: Advancing Sustainable Freshwater Aquaculture Practices and Technologies (“Pond Culture”)	8
Theme II: Promoting Sustainable Rice-Fish Culture in Irrigated Systems (“Rice-Fish”)	16
Theme III: Building Community and Consensus toward Fisheries Management Plans (“Fisheries Planning”)	23
Project Monitoring and Evaluation	30
Impact Indicators: Baselines and Targets	30
Monitoring Plan	32
Project-Wide Schedule	34
Project Timeline	35
Appendix: Acronyms and Abbreviations	36

Aquatic Resource Use and Conservation for Sustainable Freshwater Aquaculture and Fisheries in Mali

Introduction

The population in West Africa is estimated to increase to 430 millions by 2025 and resultant pressures on natural resources cannot be ignored. With their economies largely linked to agricultural production, most West African countries must battle simultaneously to alleviate widespread poverty, ensure food security, and achieve environmentally sustainable economic development.

More than half of the people in West Africa consume fish products on a daily basis. Regionally, the fisheries and aquaculture sector employs about 5 million fishers, fish processors, and fish traders; along with other associated jobs. For example, the post-harvest sub-sector provides women with many jobs, playing a vital role in economic and social development. The Inland Delta of the river Niger provides livelihood opportunities for millions of people. Agricultural activities in this area include irrigated rice cropping, rain-fed agriculture, small-scale fisheries, and grazing and browsing herds and flocks.

The fisheries and aquaculture sector is an important element of the national economy of Mali. Annual fish production is estimated to be 100,000 tons, and under normal hydrological conditions, Mali is ranked among the highest freshwater fish producer countries in Africa. Mali alone has over 700,000 fishers, and its annual fish consumption is estimated at 10.5 kg per person for a population estimated at 12.6 million. Over the last ten years, the demand for fish for local consumption has increased tremendously, growing at a rate of over 7% annually due to population increases and exports, especially to other African countries. Therefore, fishing is and will continue to be an important source of income for a large portion of the population.

The aquaculture and fisheries sub-sector in Mali is characterized by:

- Contributing significantly to the GDP
- Having high production potential, particularly in the central delta of the Niger River (20,000 sq km)
- Engaging over 7% of the population
- Having good market potential
- Showing potential for improving productivity, income, nutrition, and for reducing poverty through technologies, training and marketing strategies.

While approximately 80% of the fish produced is marketed in urban areas, particularly the capital city, the supply is far from meeting the current demand of the local markets. According to recent assessments, a number of production constraints have contributed to this shortfall:

- A general decline in capture fisheries production in Mali,
- Poor technology base, poor adoption, and very little research on species and production, conditions and on post-harvest technologies,
- Inadequate policies on fisheries management and aquaculture development,

- Poor infrastructure and high input costs
- Poor organization of the stakeholders,
- Poor water retention of pond soils and water losses in lined or finished earthen ponds,
- Lack of coordination of different partners supporting the subsector,
- Poor marketing strategies and linkages, and
- Low processing technology, storage and post harvest losses management

Among the various problems facing the Malian fisheries industry, declining fish stocks is the most critical. Increasing aquaculture production is probably one of the most promising alternatives to increase the overall supply of aquatic products. However, aquaculture development must try to avoid some of the risks encountered in other countries and regions. NEPAD, WorldFish, FAO and other donors and consultants suggest:

- West Africa needs to adopt international guidelines on best practices to avoid—and mitigate—negative environmental consequences in the fishery sub-sector.
- Adoption of international guidelines will require close public and private sector cooperation.
- Approaches such as integrated irrigation aquaculture could become a key component in the process of West African family farm transformation in response to food security needs, market and livelihoods development.
- Commercialization schemes (e.g. linking smallholder farms to industry) to adapt integrated approaches to all levels and to different local contexts are needed to guarantee their financial and environmental sustainability over the long-term.
- South- South Cooperation with Asia is a rising opportunity to learn from existing best management practices applicable to the West African context.

In the future, regional and local demands for fish will continue to increase in Mali. This rising demand will put enormous pressure on wild fisheries and will generate a need for seafood dealers to diversify their fish sources, including turning to aquaculture. With the fast evolution of the world seafood market in terms of trade, especially for eco-labeled products, aquaculture has become a major player in the seafood industry. From 1989 there was global stagnation in fisheries production, but as the demand for fisheries products continued to increase, the result has been a fast increase in aquaculture production starting in 1992.

For over 30 years, national and international agencies have been developing agricultural technologies for the semiarid regions and attempting to pass them on through extension agencies. In spite of substantial research progress in the development of new practices, the diffusion of improved technologies has been slow. Two principal factors slowing this diffusion have been: (i) Lack of trained and knowledgeable aquaculture agents and (ii) Failure to put demand factors and new market development as priority concerns of the technology introduction process. Unless properly addressed, these same factors will inhibit the diffusion of aquaculture technologies. This project is designed to overcome factors slowing the diffusion of technology.

Overall Goal

The goal of the project is to improve the productivity and income of producers in targeted areas of Mali through facilitation of access to technologies and building the capacity of stakeholders involved in freshwater fish farming and capture fisheries management in target areas.

General Objectives

- Facilitate access and adoption of improved aquaculture production technologies in targeted areas to increase and diversify the incomes of farmers
- Develop the capacity of the GOM to help develop and disseminate relevant technologies
- Identify appropriate strategies for the implementation of integrated rice and fish farming in target areas
- Help develop an appropriate fisheries management plan to ensure long-term viability and sustainability of capture fisheries in the target area
- Help establish linkages useful for further development of aquaculture and fisheries in Mali

This Work Plan addresses three major themes:

- (1) Advancing Sustainable Freshwater Aquaculture Practices and Technologies
- (2) Promoting Sustainable Rice-Fish Aquaculture in Irrigated Systems
- (3) Building Community and Consensus towards a Fisheries Management Plan.

Across these three themes, the AquaFish CRSP will emphasize:

- Capacity building opportunities
- Sustainable solutions to aquaculture and fisheries development
- Public-private sector linkages

Strategy to Ensure Utilization of Research Findings

By remaining relevant at local and global scales, results from AquaFish CRSP research and outreach activities are more apt to be widely utilized by a) end-users; b) Host Country decision makers, researchers, educators and extension agents; c) USAID Missions, Bureaus, and other offices; and d) other stakeholders. We have proposed two targets directly related to capacity building and information dissemination. This degree of attention will ensure broad utilization of research findings. Dissemination and capacity building will be integrated into our research portfolio from the outset to meet these targets and not initiated as an afterthought. A Dissemination Strategy is included in this technical plan that addresses each of the key stakeholder groups.

Strategy for Maximizing Training and Capacity Building

Effective AquaFish CRSP short- and long-term training and capacity building will focus on four specific levels of engagement: Institutional, Researcher, Extension Services, and End-Users (e.g., farmers, fishers, consumers).

Increasing Institutional Capacity and Extension Services Capacity: Many Host Country universities and government laboratories do not have the equipment or supplies to address key issues confronting the aquaculture and fisheries management sectors and need assistance. In many cases, however, a lack of technical expertise in the areas of production and management constitute a greater need. AquaFish CRSP efforts will utilize short-term, “train-the-trainer” workshops to address this need. These exercises will ensure that a core group of exceptional individuals will be present in Mali to provide extension activities well beyond the project period.

Increasing End-User Capacity: AquaFish CRSP researchers and extension specialists, with assistance from their Malian counterparts, will need to identify leading fish farmers and fishers in the target areas identified for their work. These individuals tend to be more open to attend short-term training workshops and adopt innovative technologies. By interacting with farmers and having them articulate ongoing problems, lead farmers will collaboratively work with researchers to develop economically feasible and socially acceptable solutions. In addition, community leaders can serve as role models and will be able to reach out to those end-users who do not see direct benefits of attending short-term training workshops but could gain from adopting available technologies.

Strategies for Maximizing Training for Host Country Nationals

Long-Term Training Opportunities: Involvement of promising baccalaureate students as graduate students and gender integration throughout AquaFish CRSP long-term training opportunities will be strongly encouraged. Funding is included for partial support of one to three advanced-level students (either undergraduate junior or senior, or graduate student) to assist in the implementation of the three Themes. The students are envisaged to be currently studying at a college or university in Mali. Students will be identified over the first year of the project by the Theme leaders and their Malian counterparts. All training will be in the student's country of current study (i.e., Malian students will remain in Mali).

Metric: 1-3 students

Short-Term Training Opportunities: Short-term training interventions serve a critical link between research and technology adoption. Effective vehicles for short-term training include train-the-farmer and train-the-trainer workshops, directed technical assistance projects, on-farm trials, applied work terms, study abroad opportunities, and focused information exchange programs involving key individuals. Many of these approaches will be applied to successfully implement the Mali AquaFish CRSP project dissemination strategy. To be most effective, short-term training opportunities will be demand-driven, specifically tailored, and implemented in-country or within the general region wherever possible.

Metric: Over 100 trainees; at least 3 workshops in Mali; 3 workshops for Malians in Kenya; 1 workshop for Malians in Asia; 2 international conferences for Malians (Senior technical managers) to share information with the broader CRSP group and with international aquaculture & fisheries communities.

Gender Integration Strategy

Women have assumed a leading role in aquaculture production in many countries. FAO has determined that women farmers receive only five percent of all agricultural extension services worldwide despite their increasing role in food production. Furthermore, extension programs rarely integrate women as part of the target audience, and policymakers have failed to recognize that men and women may be responsible for different crops and that information provided to men does not necessarily get passed on to women who need the information.

USAID policy requires that gender issues be addressed in all funded activities. Specifically, we will:

- Collect disaggregated gender data throughout the implementation of the project. These data will be analyzed to gauge gender integration success and take appropriate action.
- Require that all funded activities address gender integration within their planned scope of work. Projects must include a procedure for monitoring and evaluating gender integration as the project progresses with time. We anticipate that few activities will focus solely upon gender-related issues in the context of aquaculture and fisheries development. Nevertheless, team members will have to consider the effects of specific activities on gender and ensure that any possible negative effects are mitigated.
- Promote the participation of women in formal and informal education and training opportunities provided through the AquaFish CRSP. We will endeavor to include equal numbers of men and women within all AquaFish CRSP activities. Within the present Aquaculture CRSP, more than 40% of the students educated through formal training opportunities have been women. This number represents a trend moving towards greater gender equity in recent years as access to a pool of talented women in developing countries is becoming deeper. In addition, women scientists and administrators will be encouraged to participate.
- Tailor specific extension and technical services related to sustainable aquaculture and aquatic resource management to women producers. In addition, extension specialists sensitive to diversity issues will be included as an integral part of the delivery team to ensure women farmers and fishers feel welcome in AquaFish CRSP training opportunities

Plan for Coordination/Sharing of Information with End-users, Host Country Decision-makers, USAID, and Other Stakeholders

Dissemination Strategy

Aquaculture & Fisheries CRSP research investments require well coordinated and managed dissemination strategies. Capacity building is critical to an effective dissemination strategy. The AquaFish CRSP Mali Project will target four general audiences for its dissemination strategy, each requiring different levels of investment and approaches for effective communication.

1. End-users – Informal training sessions, typically through workshops, are the most common approach for information dissemination to end-users. The Mali Project will provide a broad range of workshops over the course of the program to target end-users and widely disseminate results and new technologies. Farmer and fisher cooperatives will be engaged to increase participation in these workshops. Broad representation of sector participants will ensure maximum adoption of technologies. The Mali Project will develop appropriate training materials, such as manuals or training “modules” in the predominant native language ?? of participants or other learning guides for less literate end-users.

Technology transfer is frequently more efficient if end-users can see firsthand the results of novel technologies and management strategies. CRSP AquaFish Mali Project participants will use on-farm trials wherever possible to expedite the adoption of results and technologies. In the short time frame of the Mali project, on-farm research will be limited. On-farm trials in Kenya have been a logical and successful step in transferring technologies to farmers. One of the purposes of cross-training in Kenya is therefore to view these trials as they are underway at established sites in Africa.

2. Host Country decision makers, researchers, educators and extension agents – Host Country decision makers will be engaged so that aquaculture and fisheries policies incorporate relevant research findings. These individuals will be invited to participate in local stakeholder meetings, AquaFish CRSP Regional Centers of Excellence, and end-user workshops to provide input on research directions while also accessing up-to-date information on research and outreach activities.

3. USAID – USAID personnel in Mali will be given the option to receive AquaFish CRSP publications, including *Aquanews*, Annual Administrative and Technical Reports, manuals, fact sheets, etc. to keep the Mission properly informed of AquaFish CRSP activities. The AquaFish CRSP manages three Regional Centers of Excellence for Africa, Asia, and Latin America/Caribbean. USAID personnel will be invited to participate in planning and assessment meetings to remain completely informed of progress and constraints facing the Project. Oregon State University will fold Associate Award activities in Mali into the fabric of the core research program.

4. Other Stakeholders – Aquaculture is but one use in a complicated web of stakeholders demanding sufficient quantities and quality of water. In many cases, aquaculture represents the newest user group for this precious finite resource. For these reasons, fish farmers and fishers must join other water users in developing effective water and watershed management plans. Future users of ecosystem services are presently enrolled in primary schools. Aquaculture and fisheries curricula in the classroom can reach the next generation and inform them of constraints that they may eventually face. Many primary schools recognize the benefits associated with curricula in the classroom by reaching out to students and engaging them using real life situations. The Aquaculture CRSP has experience participating in school fairs and classroom education through a project focused on the Amazon region. Where possible, efforts will be made to expand this type of activity to Mali.

Cross-cutting Theme: Biodiversity Conservation and Environmental Impact

The proposal recognizes that fragile environments require careful management to maximize benefits for people without overexploiting the resources upon which they depend for future sustainability. The proposed project is not anticipated to cause any adverse environmental effects.

Furthermore, the AquaFish CRSP Mali Project will ascribe to these USAID *environmental restrictions*:

- Biotechnical investigations will be conducted primarily on research stations in Host Countries;
- Research protocols, policies and practices will be established prior to implementation to ensure that potential environmental impacts are strictly controlled;
- All training programs and outreach materials intended to promote the adoption of CRSP-generated research findings will incorporate the appropriate environmental recommendations;
- CRSP Projects will not procure, use or recommend the use of pesticides of any kind. This includes but is not limited to algicides, herbicides, fungicides, piscicides, parasiticides, and protozoacides;
- CRSP Projects will not use or procure genetically modified organisms (GMO); and

- CRSP Projects will not use or recommend for use any species that are non-endemic to a country or not already well established in its local waters, or that are non-endemic and well established but are the subject of an invasive species control effort.

Potential Resources and Linkages for the Project

- AAM (Aquaculture Association of Mali)
- AEG: Ministry of Agriculture and Extension, Mali
- AFS (American Fisheries Society)
- AIT (Asian Institute of Technology), Bangkok, Thailand (Mr. Yuan Derun)
- AquaFish CRSP: Africa Project and Africa Regional Center of Excellence (Dr. Kwamena Quagraine)
- BADEA: Banque Arabe pour le Développement Economique de l’Afrique
- BOAD: Banque Ouest Africaine de Développement
- CECI: Centre Canadien d’Etudes et de Coopération Internationale
- Centre Piscicole de Molodo
- Direction Nationale de la Pêche, Ministry of Livestock and Fisheries Development, Mali.
- Direction Régionale de la Pêche-Koulikoro
- FAO: Food and Agriculture Organization of the United Nations (Dr. Matthias Halwart, Dr. John Moehl, Devin Bartley)
- Fisheries and aquaculture associations; APAM (Richard Toe)
- Global Livestock CRSP (Dr. Tag Demment)
- Institut d’Economie Rurale (IER), Mali
- INTSORMIL CRSP, University of Nebraska (Dr. John Yohe)
- JCA: Agence Japonaise de Coopération Internationale
- MCC: Millenium Challenge Corporation
- Ministère de l’Elevage et de la Pêche, Mali
- Ministry of Agriculture, Mali
- Ministry of Environment, Mali
- Ministry of Livestock and Fisheries, Mali
- NEPAD (New Partnership for Africa’s Development) (Dr. Sloans Chitimaro)
- PADEPECHE: Programme d’Appui au Développement de la Pêche
- PMEDP: Programme pour le Moyens d’Existence Durables dans la Pêche
- PNUD: Programme des Nations Unies pour le Développement
- USAID/EGAT (Washington) (Mr. Harry Rea)
- WARDA: West African Rice Development Association
- World Aquaculture Society
- WorldFish Center, International Agricultural Center of the World Bank

Plan of Work

Theme I: Advancing Sustainable Freshwater Aquaculture Practices and Technologies (“Pond Culture”)

Implementing Partners, Collaborators, and Stakeholders

CRSP Theme I Leader: Dr. Charles Ngugi, Moi University (MU), Kenya

Mali Theme I Coordinator: Dr. Hery Coulibaly, Direction Nationale de la Pêche, Ministry of Livestock and Fisheries Development (MLFD), Mali

Collaborators:

- Boureima Traore, Director Regional Bamako, Mali
- Dr. Kwamena Quagraine, Purdue University
- James Mugo Bundi, Graduate Student, Moi University

Stakeholders:

- Fish farmers in the Koulikoro North East of Bamako area
- Extension workers in the GOM
- Middlemen, fish processors, fishmongers, and other production chain links
- Consumers
- Aquaculture Association of Mali

Introduction

Unlike in Asia, where the tradition of fish farming dates back thousands of years, only in the last few decades has aquaculture become a source of income and food in West Africa. Recent FAO studies along with the NEPAD Action Plan (2005) recognize the potential that aquaculture holds for the region—a potential still largely untapped at 0.15% of world production in 2002.

However, despite its great development potential in the delta area, aquaculture is still a very new emerging food production sector and its potential has yet to be realized.

The production constraints mentioned earlier (decline in capture fisheries production, poor technology base, poor adoption, very little research, inadequate policies, poor infrastructure, high costs of inputs, poor water retention in ponds, and poor organization among the players and stakeholders) will continue to affect the growth of pond culture in Mali, as will the regional and local demand for fish. Failure to address these constraints will also hamper efforts to increase aquaculture’s contribution to the health and economy of the country.

Aquaculture production technology is available regionally, but the quality of technologies and knowledge of how to use them is not readily available in Mali at this time. Thus, the strategy is to interest farmers in using appropriate technologies through *technology transfer* approaches

such as mentored trainings of key adopters, workshops, and improved access to timely quality information. ACRSP pond culture technologies initially rely on natural pond fertilization. Once best practices for water management techniques are understood by local farmers, additional inputs can range from composts, rice meal waste from local rice factories, to inorganic fertilizers.

Having access to an appropriate quantity of high quality water is critically important for the survival, growth, and reproduction of species used in aquaculture and fisheries. Competing water uses include other agricultural production, damming for potable water supplies, sanitation, hydroelectric energy production, industrial uptake and drainage, and other uses of common waterways including shipping, commercial and recreational fishers, and natural biodiversity. Determining water allocation amongst numerous stakeholders is a complex undertaking that requires process-oriented watershed and integrated resource management planning. Aquaculture is frequently a new demand on otherwise overexploited water sources and stakeholders must become actively involved in resource management planning to assure an equitable share of finite water resources for sector success. For success, aquaculture must operate within an enabling policy framework that addresses water rights issues, and those intending to engage in aquacultural activities need to work in cooperation with other water users.

Nile Tilapia (*Oreochromis niloticus*) and African catfish (*Clarias*) are the principal aquaculture species in Mali. Both are well adapted to low rainfall conditions (200-600 mm/year) and high temperatures. Farmers' economies and nutrition are dependent upon fish, as they can serve as basic human food, bait, or feed for livestock; they can be sold in the local marketplace and as export commodities. Interestingly, there is a new marketing channel where Mali Embassies in foreign countries, especially within the ECOWAS (Economic Community of West African States) region, are importing fish from Mali for their nationals residing in those countries.

The present supply of catfish fingerlings in the country appears intermittent and preliminary information indicates that farmers collect them from the wild or from rice paddies for stocking in ponds. Demand for fingerlings is on the increase. Farm-based production could be a highly profitable business for fish farmers. A primary concern with respect to fingerling survival has been cannibalism. Growth and survival of *Clarias* nursed in the hatchery and later transferred to ponds will be a primary focus in this project.

The activities of Theme I will primarily address the first of the two principal factors mentioned earlier that slow the diffusion and transfer of useful, sustainable aquaculture technologies—*the lack of trained and knowledgeable aquaculture agents*. The planned activities for this theme will take a South-South approach for technology transfer and training. The AquaFish CRSP, through its Africa Regional Center of Excellence in Kenya, will cross-train Mali nationals in aquaculture technologies developed elsewhere.

General Objectives for Theme I

The general objectives for Theme I are to:

- Improve the skills of farmers, extension workers, and students in pond design, fish seed production (catfish propagation), pond management, and record keeping
- Field test alternative strategies for pond management, including using different stocking

densities, fertilization strategies, and feeding regimes (on-farm trials)

- Identify appropriate management practices for tilapia and *Clarias* production in Mali
- Demonstrate appropriate management strategies to farmers and others not participating in the project's workshops and on-farm trials (farmer field days)
- Identify potential marketing channels and potential methods for adding value to fish products

The AquaFish CRSP will carry out these objectives concurrently with building local capacity, engaging stakeholders, and being sensitive to environmental concerns that may arise.

Plan of Work

The CRSP's Africa project has evolved a system including technology introduction, development of farmer groups, marketing strategy innovation, and linking of farmer groups to food and feed processors. This system is functioning well in Kenya and exchange with the Kenya ACRSP site is part of the implementation strategy. Theme I will draw on the expertise of ACRSP and AquaFish CRSP scientists in its technology development, extension, and marketing activities.

Key adopters or outreach specialists in Mali will be identified for participation in workshops/training or on-farm trials. University students will be identified for training in Mali and Kenya. Senior technical managers will be selected to attend international meetings, where networking with a large number of topic-area specialists will be possible. Field trials will test use of feeds formulated from locally available material for increased fish production. Hatchery managers will be trained in fish breeding e.g., catfish propagation techniques.

Planned Activities for Theme I

Workshops

Among technologies used in the overall process of raising fish in ponds, many are long-standing, widely accepted "standard" practices while others may have been developed or refined as a result of ACRSP work over the years. These standard technologies lend themselves readily to transfer through workshops and short courses. This has been successfully done in the Kenya Project during the past decade and this approach will also be used in this project in Mali. Workshops (short courses) will be conducted to introduce appropriate pond construction and pond and hatchery management practices to private fish farmers, extension officers, members of cooperatives or associations, and others who can benefit from this knowledge. Resource persons will be drawn from Kenya (Moi University) and Mali (Ministry of Livestock and Fisheries Development (MLFD)).

- Three (3) workshops will be conducted in Mali over the life of the project (approximately one workshop per year).
- Workshops will be held at Koulikoro, Regional de la Peche du District de Bamako.
- Fifteen (15) participants will be selected for each workshop
- Workshops will average 7 days in length
- Topic areas for workshops will include site selection, pond construction, hatchery management/fish seed production (especially *Clarias*), pond management, and

harvesting.

- Workshops will include some “lecture” type instruction but will place greater emphasis on “hands-on” learning, especially with regard to seed production activities.
- The effectiveness of these workshops will be evaluated at the end of each workshop through structured questionnaire by the Direction Nationale de la Pêche, Ministry of Livestock and Fisheries Development (MLFD), Mali. This evaluation will form part of the project report that will be submitted at the end of every workshop.
- Three (3) additional workshops will be conducted in Kenya for Malian participants. Two trainees will participate each year, for a total of six over the life of the project.

On-Farm Trials

Research conducted by ACRSP in Kenya and at other ACRSP research sites has identified management practices and technologies that are suitable in this region, but it cannot be assumed that results obtained under controlled experimental conditions are directly transferable to the farm. Similarly, it cannot be assumed that the best technologies for one country are also the best for another country within the region. On-farm trials are one way of testing ACRSP technologies in new areas. We will work with Malian counterparts to initiate field trials (on-farm trials) to test CRSP pond management strategies on actual farms and to provide opportunities for project personnel to work with and train the extension officers involved in the trials.

- Two (2) groups of farmers will conduct simultaneous trials over the life of the project. There will be a farmer’s field day held at the end of each on-farm trial.
- Ten (10) farmers will be selected for participation in each group.
- Trials will be conducted in 20 ponds over the life of the project (approximately 10 new ponds per year).
- Leaders and participants will participate in a half-day, pre-trial workshop to discuss alternative management strategies and choose those to be implemented.
- Trials will test alternative pond management strategies using locally available inputs; examples of potential strategies to be tested include varying the number of fish stocked, type of feeds, and fertilizer applications.
- Farmers will purchase their own fingerlings, fertilizers, and feeds to produce both catfish and tilapia as part of cost share in the project. Farmers will also provide their own labor in pond construction and management. However, during training farmers will be sensitized to the need to use agricultural byproducts from their farm as inputs for the production of catfish and tilapia.
- Trials will last approximately six (6) months each, depending on fish growth
- On conclusion of each set of trials, leaders and participants will meet in a half-day post-trial workshop to share results and assess the relative advantages and disadvantages of the different strategies tested.

Activity Site

The proposed target area for Theme I (Pond Culture) is the **Koulikoro-Bamako** peri urban area. Pond culture is already being practiced throughout this area, although no quantified data is available. However, modern practices have not been widely adopted. Farmers are willing to adopt new aquaculture technologies to improve productivity and the demand for both fresh and processed fish exists.

Villages, stakeholders, and collaborating producer associations in targeted areas will be identified. Final selection of farmers and ponds will be made in collaboration with the GOM and USAID/Mali.

Fish farmers participating in the project will be selected based on the following criteria:

- The owner is interested in participating in the project and would wish to practice new technologies for Nile tilapia and African catfish pond production
- Average water depth of the pond will be 70 cm plus or minus 10 cm
- Selected ponds should not be prone to flooding, and seepage should be less than 10 cm per week
- Where no ponds exist, farmers will be encouraged to construct at least one pond using their own resources
- The farmer wishes to manage the ponds for profit and wishes to run the enterprise as a small scale business activity.

Schedule:

General timetable for theme activities:

November 25 th to December 1st, 2007:	Planning and scoping activity for Theme I
January 1, 2008 to August 31, 2010:	Project activities implemented
September 1-30, 2010:	Reporting

Approximate Dates for Workshops

- Year 1 in Mali: July 2008
- Year 1 in Kenya: November 2008
- Year 2 in Mali: March 2009
- Year 2 in Kenya: July 2009
- Year 2 in Mali: November 2009
- Year 3 in Kenya: March 2010

Approximate Dates for On-Farm Trials

- Year 1 in Mali: November 2008 (immediately after the workshop)
- Year 2 in Mali: March 2009 (immediately after the workshop)

Anticipated Benefits

- Government extension officers will receive short-term training in pond culture management, including enterprise budgeting, cash flow analysis, and development of business plans, and it is expected that the information and expertise they gain will ultimately be disseminated to a considerably wider audience of extension workers and fish farmers.
- Fish farmers will also learn how to keep good records regarding the operation of fish ponds so that evaluations can be based on facts and so that there are records of the actions that did or did not result in increased fish production. This will in turn result in higher fish production and increased revenues from fish sales for participating farmers.

- Farmers will be able to evaluate and compare alternative technologies tested in their own ponds, then apply those technologies that prove most appropriate under their own conditions.
- Other farmers and farmer groups or associations who know about the project may elect to adopt the new technologies or apply the improved management practices they have observed from neighbors (farmer-to-farmer extension).
- Data recorded during the course of these activities will be useful for the development of enterprise budgets and business plans for the types of pond or cage systems used.
- Marketing channels in at least one target area will be identified
- Malians at several levels (government workers, students, etc.) will have attended AquaFish CRSP program-wide meetings, and shared information at international scientific meetings
- The capacities of GOM institutions will be strengthened
- The capacity of selected cooperatives, associations, and individual farmers in the use of technologies and marketing practices will be improved
- A Malian graduate student supported by this activity will benefit from longer-term and more in-depth studies in aquaculture. He/she will gain the knowledge and ability to move into managerial and/or supervisory positions that contribute to future development in the aquaculture sector in Mali.

Specifics:

- Three pond culture workshops will be offered in Mali. 45 fish farmers/fish hatchery managers and extension workers from the public and private sectors will be trained in these workshops
- Three workshops will be held for 6 Malians in Kenya over the 3-year period (2 trainees per year)
- One or two Malian students will be involved in Mali
- One fish farmers' field day will be organized in collaboration with the Aquaculture Association of Mali

Desired Outcomes, Impact Indicators, and Targets for Theme I

The desired outcomes, impact indicators, and benchmarks associated with Theme I are shown in Table 1. The collective desired outcomes, impact indicators, and benchmarks for the Mali Project as a whole are listed following the work plans for the three themes (Table 4).

Table 1. Desired Outcomes, Impact Indicators, and Targets for Theme I, Pond Culture

Desired Outcomes	Impact Indicators	Baseline	Target
Increased aquacultural knowledge and skills for HC extension agents	# of extension agents trained in workshops	0	45
Increased aquacultural knowledge and skills for HC farmers	# of farmers trained during on-farm trials	0	20
Increased aquacultural knowledge and skills for HC students	# of students trained/mentored in Mali	0	1
	# of students trained in Kenya	0	6
Development of pond aquaculture training materials for Mali	# of training modules/manuals developed	0	5
	# of fact sheets/brochures developed	0	5
Identification of appropriate pond management packages for HC	# of management packages tested in on-farm trials	0	5
	# of appropriate management packages identified	0	4
Increased pond production area in target areas	# of new ponds constructed	0	20
	total area of new ponds (m ²)	0	4000
Increased productivity in ponds of participating HC farmers	# of kg fish produced per hectare per year	1500 kg/ha/yr*	3000 kg/ha/yr
	% increase in productivity	0	100%
Increased income for participating HC farmers	increase in annual income for individual participants	___ CFA/ha/yr *	___ CFA/ha/y r
Participation of senior Malian technical managers in int'l aquaculture mtgs.	# of Malians who attend int'l aquaculture meetings	0	3
Establishment of relevant linkages between HC and external contacts	# HC individuals linked with external contacts	0	5

* Some baseline values will need to be estimated or adjusted by the theme leaders during the first set of on-farm trials).

Theme I Monitoring and Evaluation

Monitoring and evaluation will be continuous activities throughout the life of the project. The local collaborators will monitor the field work regularly, while the theme leader will communicate with local collaborators regularly to track progress. The status of the indicators shown in Table 1 will be monitored and used as the basis for evaluating the progress of this theme's work towards its listed targets. The Theme I leader, with assistance from team members, will prepare periodic reports addressing each of the indicators and targets described in the table.

Theme II: Promoting Sustainable Rice-Fish Culture in Irrigated Systems (“Rice-Fish”)

Implementing Partners, Collaborators, and Stakeholders

CRSP Theme II Leader: Prof. Yang Yi, Shanghai Fisheries University, China

Mali Theme II Coordinator: Dr. Hery Coulibaly, Direction Nationale de la Pêche, Ministry of Livestock and Fisheries Development (MLFD), Mali.

Collaborators:

- Madi M. Kheita, Alhassane Abdou Sidy Toure, Department of Fisheries, Ministry of Livestock and Fisheries, Mali
- Mr. Wu Zongwen, Sichuan Aquacultural Engineering and Technology Research Center, China
- Mr. Yuan Derun, Asian Institute of Technology (AIT), Thailand

Stakeholders:

- Rice farmers in the Koulikoro area
- Fish farmers in the Koulikoro area
- Extension workers of the GOM
- Middlemen, fish processors, fishmongers, and other production chain links
- Consumers

Introduction

Integrated rice-fish culture can be dated as far as 2,000 years back in China, and has been widely practiced in Southeast and Southwest provinces of China today as well as in many other Asian countries. In a rice-fish culture system, a large area of rice field and big volume of water provide essential living space and natural food for fish, and fish in turn, benefit rice production through reducing/eliminating weeds, controlling insects, loosening soil, and directly fertilizing rice field by fish excreta. Rice-fish culture has experienced major changes in last 30 years. The traditional way of extensive operation has been changed to high standard and more intensive culture. The systems have also diversified from a combination of only rice and fish to more complex integrated systems incorporating the culture of other aquatic species, low rising fruit trees, vegetables, etc.

The adoption of rice-fish culture will bring opportunities for farmers to diversify farming activities and products, improve diets and nutrition for farm households, increase income, reduce or eliminate use of hazardous chemicals such as pesticides and herbicides, and make better use of water—the precious yet increasingly scarce resource. Integration of fish culture in agricultural irrigation systems and rice fields, combined with integrated pest management (IPM), also provides a potential biological control for the spread of some water-borne diseases such as malaria through eliminating the intermediate host of pathogens such as mosquito larvae.

WARDA, FAO/FIRI, and others have undertaken substantial assessments of irrigated systems in Mali. One major recommendation that has arisen is the potential for aquaculture in rice-based irrigated systems for livelihood diversification and for achieving greater fishery productivity.

The irrigated rice cropping area in the Niger River delta in Mali is considered to be very suitable for rice-fish culture. The irrigation system provides a reliable and sufficient water supply which is essential for fish growth. The principal aquaculture species in the delta and regionally, tilapias and African catfish (*Clarias* spp.), are well adapted to rice field conditions with shallow water and high temperatures.

However, diffusion of rice-fish culture technology in the region, like other improved aquaculture practices, has been slow. Two principal factors slowing this diffusion have been identified: (1) the lack of trained and knowledgeable aquaculture agents, and (2) the failure to put demand factors and new market development as priority concerns of the technology introduction process.

Another major issue constraining the Malian fisheries industry is inefficient post-harvest processing. The proportion of fish processed in Mali accounted for 75% of total catches in the late 1990s. The major processing techniques are drying and smoking, involving relatively simple processes with traditional open-air ovens. Initiatives are needed to identify appropriate post-harvest technologies for producing value-added products for both local and export markets and transfer the technologies to all stakeholders on the value chain.

The practice of aquaculture is still in its early stages in Mali, but as the area under culture expands, culture techniques are diversified, and culture systems are intensified, concerns may arise over potential negative environmental and social impacts. The development of best management practices (BMPs) should be encouraged to safeguard the long term sustainability of aquaculture before it is too late. Several standards and guidelines have been developed for responsible fisheries and aquaculture practice in other regions. Comparisons between current aquaculture practices and these standards and guidelines should be carried out and recommendations on BMPs should be generated through active participation of all stakeholders in the sector.

Therefore, this project is designed to facilitate adoption of rice-fish culture in irrigated areas of Mali, improve efficiency of aquaculture/fisheries post harvest processing through technology transfer, and initiate the development of BMPs in aquaculture.

General Objectives for Theme II

The general objectives for Theme II are to:

- Strengthen HC institutional capacities by providing training in fish breeding, culture, and harvesting techniques for irrigated rice-fish culture systems (workshops)
- Field test and demonstrate applicable fish breeding, culture, and harvesting techniques for irrigated rice culture systems
- To examine the relevance of current aquaculture BMP guidelines to local contexts, and to identify issues and challenges in their development, adoption, and implementation, particularly in relation to IPM (Integrated Pest Management) and the reduction of water-

- borne diseases such as malaria
- To identify and recommend appropriate post-harvest technologies for producers or other stakeholders

Plan of Work

The Aquaculture CRSP (ACRSP) and the Aquaculture and Fisheries CRSP (AquaFish CRSP) have extensive experience working with government agencies, education and research institutions, NGOs and private sectors in Southeast/South Asian countries and China, where rice fish culture originated and is widely practiced. The CRSP will involve Asian counterparts in teaching best management practices for integrated rice-fish culture in irrigated areas. The AquaFish CRSP will seek to build bridges between public and private sector participation, and will emphasize capacity building for a broad swath of actors involved in the aquaculture and fishery sub-sector in Mali.

Theme II will draw on the expertise of ACRSP and AquaFish CRSP scientists in its technology development, extension, and marketing activities. Key adopters or outreach specialists in Mali will be identified for further training and the Mali theme coordinator will be invited to international meetings where networking with a large number of topic-area specialists will be possible.

In the area of post-harvest, there are a number of existing technologies that can be used by local entrepreneurs to process fish products to competitive, commercial products for the marketplace. Additionally, processing of high quality local products leads to exports, both within and outside the region. Appropriate technologies and/or experts will be identified and recommendations for dissemination and adoption will be delivered to farmers, processors, traders and other stakeholders involved.

Initiation of IPM strategies and BMPs will start with critical examination of existing standards and guidelines in a multiple stakeholder consultation workshop. Fish farmers, traders, processors, government officers, and academia will be invited. Recommendations will be generated regarding the development of BMPs and their implementation.

Planned Activities for Theme II

Field demonstration of technologies

Rice plots will be selected to conduct demonstration trials to compare rice cultivation alone with integrated rice-fish culture. Tilapia hapa spawning and fry production as well as nursing will also be incorporated in the systems. Farm selection will be based on the following criteria:

- Sufficient water supply through irrigation systems;
- Willingness of farmer(s) to participate in the project on adopting rice-fish technology;

Training and Workshops

- One to two Malian graduate students with good English and French will be identified to participate in the project. They will be trained in rice-fish culture technology, help conduct the field demonstration activities, and collect field data for monitoring and

evaluation purpose.

- One to two key technical staff will be trained in Sichuan province of China and at the Asian Institute of Technology, Thailand for two weeks on Rice Fish Culture plus Capacity Building for Effective Skills Transfer.
- A one-week training workshop on Integrated Rice-Fish Culture Techniques and Extension will be organized in Baquineda for 20 participants including government extension officers and university staff members. They will be responsible for setting-up extension network, training of farmers and disseminating new technologies.
- A one-day stakeholder workshop on Appropriate Post-harvest Technology will be organized in Baquineda following the above-mentioned training workshop for 20 participants including fishers, fish farmers, middlemen, fish traders, processors, government officers responsible for aquatic food quality and safety, and researchers.
- A one-week consultation workshop on BMPs for aquaculture and rice-fish culture - Issues and Challenges, will be held in Bamako for 20 participants including fish/rice farmers, government officers, processors, traders, representatives from development agencies and academicians.

Activity Site

This activity will be centered in the **Koulikoro area**, possibly in the irrigated area near Baguineda. Rice culture is already in place throughout this area. Although integration of rice and fish has been tried in this region, modern practices have not been widely adopted. Farmers were initially apprehensive because they argued that fish destroyed rice in paddies leading to poor yield. They are now better informed and are willing to adopt new technologies (Rizipisciculture) as an alternative source of livelihood.

Schedule

General timetable for theme activities:

October 22, 2007 to December 31, 2007:	Planning and scoping activity for Theme II
January 01, 2008 to August 31, 2010:	Project activities implemented
September 1-30, 2010:	Reporting

Approximate dates for major activities:

- Year 1 in China and/or Thailand: Training on Rice Fish Culture plus Capacity Building for Effective skills Transfer, June - July 2008
- Year 2 in Mali: Workshop on Training and Extension Capacity Building for Integrated Rice-Fish Culture, September 2009
- Year 2 in Mali: Rice-fish demonstration set-up, first rice crop, June 2009
- Year 2 in Mali: Workshop on Appropriate Aquaculture Post Harvest Technologies, September 2009
- Year 3 in Mali: Workshop on BMPs - the Issues and Challenges, November 2009

Anticipated Benefits

- Research institutions capacity strengthened
- Improved capacity of selected cooperatives, associations, and individual farmers in the

- use of technologies and marketing practices
- Increased understanding by selected cooperatives, associations, and individual farmers in the sustainable management of aquaculture
- Adoption of improved aquaculture and post harvest technologies

Specifics:

- 1 training course in China and/or Thailand for 1-2 Malians
- 3 Theme II workshops offered in Mali
- 1-2 Malian students involved in Mali
- 55 people trained from public and private sector

Desired Outcomes, Impact Indicators, and Targets for Theme II

The desired outcomes, impact indicators, and benchmarks associated with Theme II activities are shown in Table 2. The collective desired outcomes, impact indicators, and benchmarks for the Mali Project as a whole are listed following the work plans for the three themes (Table 4).

Table 2. Desired Outcomes, Impact Indicators, and Targets for Theme II, Rice-Fish

Desired Outcomes	Indicators	Baseline	Target
Capacity strengthening for HC institutions	# of Malian technical staff trained in China	0	2
	# of Theme II workshops held in Mali	0	3
	# of HC extension & university staff trained in workshops	0	20
	# HC participants trained in post-harvest tech. workshop	0	20
	# HC participants trained in BMP workshop	0	20
Increased aquacultural knowledge and skills for HC students	# of students trained/mentored in Mali	0	1
Identification of appropriate rice-fish management packages for HC	# of rice-fish management packages tested in on-farm trials	0	1
	# of appropriate rice-fish management packages identified	0	1
Increased management skills for HC rice-fish farmers	# of rice farmers who participated in on-farm trials	0	2
Increased area used for rice-fish production in target area	# of additional hectares used for rice-fish	0	1
Increased fish productivity in rice paddies of participating HC farmers	# kg fish produced in rice paddies per hectare per year	0*	_____ kg/ha/yr
Increased income for participating HC rice farmers	estimated annual profit from individual paddies used in trials	_____ CFA/ha/yr*	_____ CFA/ha/yr
	% increase in income for participants from target population	0	20%
Assistance provided to producer organizations	# of producer organizations assisted	0	3
Establishment of relevant linkages between HC and external contacts	# HC individuals linked with external contacts	0	5

* Some baseline values will need to be estimated by theme leaders during first in-country visit after scoping visit (prior to beginning activities).

Theme II Monitoring and Evaluation

Monitoring and evaluation will be continuous activities throughout the life of the project. The local collaborators will monitor the field work regularly, while the theme leader will communicate with local collaborators regularly to track progress. The status of the indicators shown in Table 2 will be monitored and used as the basis for evaluating the progress of this theme's work towards its listed targets. The Theme II leader, with assistance from team members, will prepare periodic reports addressing each of the indicators and targets described in the table.

Theme III: Building Community and Consensus toward Fisheries Management Plans (“Fisheries Planning”)

Implementing Partners, Collaborators, and Stakeholders

CRSP Theme Leader: Mrs. Nancy K. Gitonga, FishAfrica, Kenya

Mali overall project coordinator and administrator: Dr Hery Coulibaly, Director of Fisheries, Ministere de L’Elevage et de la Peche, Direction Nationale de la Peche (DNP)

Mali Theme Coordinator: Mr. Soumaila Diarra, Division Amenagement des Pecheries et Aquaculture, DNP

Collaborators:

- Boureima Traore, Mali DNP Fish processing expert (Fisheries Regional Director, Bamako)
- Mr. Peter Nzungi, Fisheries Department, Kenya (for Statistics and Frame Surveys)
- Mr. Manyala, Moi University
- Fishing communities representatives (Fishing Council Members and the commune Mayor)
- Fishers and traders associations and groupings (Sélingué and Bamako areas)
- Office de Developpement Rural de Sélingué (ODRS)
- Hinna Haidara, ODRS Project de Developpement des Ressources Halieutiques dans Le Lac de Sélingué

Stakeholders:

- Fishers and traders in Mali
- Consumers
- Fishermen associations
- Landing sites leaders
- Fishing communities
- Fish transporters
- Fish processors
- Ice-making plants
- Central Government officials of relevant ministries
- Fisheries research institutions
- Local Authorities representatives

Introduction

Like Themes I and II, the Fisheries Planning theme takes a South-South approach for technology transfer and training. CRSP, through its Africa Regional Center of Excellence in Kenya, will train Mali nationals on fisheries management and processing technology.

The rural sector is the driving force for Mali's development as it accounts for about 45 percent of

the GDP, employs 70 percent of the total population and contributes more than 75 percent of Mali's export earnings. About 88 percent of Mali's poor population however live in the rural areas and an estimated 73 percent of the total population live on less than one dollar a day. Most of fisheries and aquaculture activities are rural based and therefore the need to accelerate development of these activities to contribute to poverty alleviation. The capture fisheries ought to also be managed in a sustainable way alongside aquaculture development initiatives.

The CRSP's Africa (global) project has evolved a system including technology introduction, development of farmer groups, marketing strategy innovation, and linking of farmer groups to food and feed processors. This system is functioning well in Kenya and exchange with the Kenya CRSP site is part of the implementation strategy. Alongside this development, Kenya Fisheries Department has been trying and testing a participatory fisheries management system with the stakeholders and other key players. This was a complete shift from a command-and-control paradigm to an ecosystem management paradigm, and it has achieved good results. Theme III will draw on the expertise of ACRSP and AquaFish CRSP scientists in its technology development, extension and marketing activities. Key adopters or outreach specialists in Mali will be identified for further training at international meetings where networking with a large number of topic-area specialists will be possible.

Many women are involved in post harvest fisheries activities, especially in trade and processing. In the area of post-harvest, a number of technologies now exist that can be used by local entrepreneurs to process fish products to competitive, commercial products for the marketplace. Additionally, processing of high quality local products leads to exports, both within and outside the region. The design-plan phase will determine if assistance is required to upgrade processing technologies, and whether training is needed on sanitation and related issues, as these two were prominently brought during discussions with various stakeholders. This is the opportune time for market expansion in Mali through training and transfer of appropriate processing technologies to entrepreneurs.

Post-harvest can be an essential factor in profitability because fish is highly perishable. The proportion of fish processed in Mali accounted for 75 % of total catches in the late 1990s. The major processing techniques are drying, smoking and burning. Generally, four fish marketing channels tend to operate: (i) wholesale markets that first centralize then redistribute the fish production towards distant areas; (ii) medium wholesale markets located in production and consumption centers; (iii) retail markets in cities and villages; and (iv) on-site at the farm or harvest/landing area.

General Objectives for Theme III:

The general objectives of Theme III are to:

- Conduct frame surveys to assess the status of a targeted area of the fishery
- Review applicable fisheries policies and laws
- Provide sound advice on fisheries management issues
- Assist in the formulation of a fisheries management plan and implementation strategy
- Develop an improved data collection, storage, dissemination system, including data application in planning
- Provide advice on potential new post-harvest technologies

The AquaFish CRSP will carry out these objectives concurrently with building local capacity, engaging stakeholders, and being sensitive to environmental concerns that may arise.

Plan of Work

Planned Activities for Theme III

Activities planned under this theme include:

- Conducting a frame survey on Lake Sélingué
- Providing training to strengthen the capacity of grass roots units, fishers and processors associations and cooperatives
- Holding stakeholder workshops on the formation of grassroots fishing community groups
- Providing advice on small enterprise development through aquaculture and fisheries
- Identifying and recommending applicable post-harvest technologies for fishers or other stakeholders, including options for adding value, especially on cured fish
- Assisting with the identification of alternative management strategies for Lake Sélingué for biodiversity conservation
- Assisting with the identification of markets and market access

Activity Site

The proposed target area for this theme is **Lake Sélingué**, in the Sikasso Region. There are about 2,000 fishermen, spread over about 70 fishing camps that are directly involved in fisheries in Sélingué. Most of them are professional migrant fishermen or farmer-fishermen native to the Inner Delta region of Niger and they migrate seasonally back to their region of origin.

There are about three months from October to January when major fishing in Lake Sélingué is closed. During this time, most fishers abandon fishing and either migrate to other water bodies in the region or engage in other activities. These communities have developed strategies that are less than adequate to help them to partially compensate for the lack of financial capital and to cope with the vulnerability characterised by a sharp seasonal shortfall in resource availability. While some fishers during this time migrate to other water bodies to carry out fishing, some who have farms carry out what they call market gardening as an alternative to fishing. There is need, therefore, for alternative livelihoods especially because most fishers do not own land and simply migrate from various parts of Mali to Sélingué to carry out fishing.

There is also need to adjust the present mechanism for fisheries management with a view to making it more participatory, and move beyond mere consultation with the communities. This paradigm shift would create a sense of resource ownership, which and enhance fisheries management and regulation of fishing effort.

Sélingué fisheries communities face social, economic, and infrastructure challenges which make them vulnerable to poverty. However, the social situation of fisheries communities could change if various issues could be addressed through appropriate interventions.

The fishing system on the Sélingué Lake allows free access to the resource, although fishers observe some fishing traditions of the Niger Inner Delta. There are no major conflicts within or

between the Sélingué fisheries communities, but sometimes disputes occur between fisheries communities from different regions due to incompatible fishing practices or destruction of nets. There are no institutionalised systems for managing disputes and conflicts directly related to fishing but rather a series of ad hoc arrangements.

The Government of Mali promotes a sectoral policy that places emphasis on the participation of fisheries communities in fisheries management, in keeping with a national policy of decentralised management of natural resources. The technical decentralisation of the Ministry of Agriculture with the transfer of administrative skills to the Office for the Rural Development of Sélingué (ODRS) was another policy shift. The ODRS carries out certain advisory support missions to the fisheries communities including the drawing up of local fishing agreements and monitoring of fishing activities. Both the government and the communities agree on the need to establish a sustainable partnership for management.

Though very little smoking or drying of fish occurs in Sélingué, preservation of fish was noted to be a major problem in many areas of Mali. Smoked and dried fish are very popular fish trade commodities in the entire West African region but the traditional fish smoking technology that is currently used is very low and inefficient and therefore the need to improve. Reduction of post-harvest losses contributes to sustainable fisheries management due to increased available harvested fish.

Statistical data collection and dissemination for Sélingué are areas that require improvement. Thus an initial frame survey ought to be conducted to come up with baseline information that will help in monitoring the impact of management plan put in place.

Inputs

Fisheries management systems have been developed and tried in many parts of the world fisheries, including Mali, and success is measured through evaluation of stocks and the health of the ecosystem. About 2 years ago Mali undertook a project and developed fisheries management plans through an FAO effort known as Local Fisheries Convention for Sélingué, but the fish stocks continue to decline. This is because of poor and sometimes lack of implementation. In Kenya two inland fisheries lakes went through a participatory process of developing management plans with good success as indicated by the quick reversal of fisheries declines, followed by remarkable stocks recovery. Thus, the strategy is to interest fishers and managers in using technology through technology transfer approaches facilitated through mentored trainings of key adopters, workshops, and improved access to timely quality information.

Good processing technologies assist to reduce post harvest losses and therefore maximize harvested fish stocks utilization, thereby reducing fishing pressure as available fish for consumption increases. Thus it is prudent to examine the handling, preservation, and marketing strategies when developing interventions for fisheries management of capture fisheries.

Schedule

General timetable for theme activities:

October 22, 2007 to December 31, 2007	Planning and scoping activity for Theme III
July 2008 to August 31, 2010	Project activities implemented
June 2009	Mid-term review
September 2010	Reporting

Approximate dates for major activities:

Year 1 in Mali:	Planning design and review with Mali counterparts; November 2007 to December 2008
Year 1 in Mali:	Stakeholders Workshops, July 2008
Year 1 in Mali:	Frame survey Trainings, July 2008
Year 1-2 in Mali:	Frame Surveys by Mali counterparts. August to November, 2008
Year 3 in Mali:	Stakeholders Workshop for field experiences sharing and up-scaling of developed and successful technologies & plans. Dissemination of information

Anticipated Benefits

- Capacity strengthening for HC institutions
- Better understanding of Lake Sélingué fisheries
- Establishment of beach management committees
- Increased understanding by selected cooperatives, associations, individual fishers, and beach committees of the concepts and methods for sustainable management of fisheries
- Fisheries management plans in place and implementation strengthened
- Adoption of improved fishing technologies
- Establishment of at least one Fisheries Farmers Field School (FFFS)

Specific:

- One training workshop for Malian frame survey enumerators
- One Frame Survey conducted for Lake Sélingué fishery
- Two stakeholders workshops/training on market gardening through Fisheries Farmers Field School(s) (FFFS)
- One beach management committee established and operational
- Implementation of at least one local fisheries management plan for Lake Sélingué
- Training of fifty (50) fishermen and traders in alternative livelihoods in Fisheries Farmers' Field Schools (FFFS).

Desired Outcomes, Impact Indicators, and Targets for Theme III

The desired outcomes, impact indicators, and benchmarks associated with Theme III are shown in Table 3. The collective desired outcomes, impact indicators, and benchmarks for the Mali Project as a whole are listed following the work plans for the three themes (Table 4).

Table 3. Desired Outcomes, Impact Indicators, and Targets for Theme III, Fisheries Planning

Desired Outcomes	Indicators	Baseline	Target
Capacity strengthening for HC institutions	# of Frame Survey training workshops conducted	0	1
	# of Frame Survey enumerators trained	0	25
Improved understanding of Lake Sélingué fisheries	# of Frame Surveys completed for Lake Sélingué	0	1
Establishment of beach management committees	# of beach committees established	0	2
Identification of alternative fisheries management strategies	# of alternative strategies identified	0	1
Adoption of improved fisheries management plan(s)	# of new local fisheries management plans adopted	0	1
Improved management of landing sites on Lake Sélingué	# of landing sites under improved management	0	2
Identification of improved fishing techniques	# of improved techniques identified or under testing	0	1
Adoption of improved fishing techniques	# of fishers who have adopted (an) improved technique(s)	0	20
Establishment of schools for alternative livelihood training	# Fisheries Farmers' Field Schools (FFFS) established	0	1
	# of stakeholders workshops held through FFFS	0	1
Fishers and traders trained for alternative livelihoods	# fishers or traders trained	0	50
Income improvements for targeted groups	increase in annual income for individual participants	0*	_____CFA/yr
Assistance provided to fishery related associations and orgs.	# of organizations/associations assisted	0	4
Estab. of relevant linkages between HC and external contacts	# HC individuals linked with external contacts	0	5

* Some baseline values will need to be estimated by theme leaders during first in-country visit after scoping visit (prior to beginning activities).

Theme III Monitoring and Evaluation

Monitoring and evaluation will be continuous throughout the life of the project. The local collaborators will monitor the field work regularly, while the theme leader will communicate with local collaborators regularly to track progress. The status of the indicators shown in Table 3 will be monitored and used as the basis for evaluating the progress of this theme's work towards its listed targets. The Theme III leader, with assistance from team members, will prepare periodic reports addressing each of the indicators and targets described in the table.

Project Monitoring and Evaluation

Impact Indicators: Baselines and Targets

Five main USAID indicators have been selected for this project, as follows:

Agricultural Sector Productivity Indicators (EG 5.2)

- 1.** Number of new technologies or management practices under field testing as a result of USG assistance.
- 2.** Number of new technologies or management practices made available for transfer as a result of USG assistance.
- 3.** Number of individuals who have received USG-supported short-term agricultural sector productivity training

IEHA Indicators

- 4.** Number of farmers who have adopted new technologies or new management practices as a result of USG assistance.
- 5.** Number of processors who have adopted new technologies or new management practices as a result of USG assistance.

Indicators #1 and #2 deal with new technologies or management practices that will be field tested and made available for transfer, respectively, by the project. These will provide, first, a measure of the range of different technologies that have been considered for suitability/applicability in Mali, and second, an indication of the number from among those tested that have been deemed suitable for adoption by farmers or fishers.

Indicator #3 will show how many individuals have received short-term training or participated in on-farm trials (field testing), indicating how effective the project has been in reaching large numbers of beneficiaries. This information will automatically be separated according to project theme (Pond Culture, Rice-Fish Culture, Fisheries Planning) and will be disaggregated by gender.

The two IEHA indicators (#4 and #5) are perhaps the most indicative of success, in that they will show how many individuals (farmers or processors) have actually adopted new technologies as a result of our interventions.

The above indicators are shown together with their baseline values in Table 4. The baseline values for all indicators are 0 (zero). Also shown are the project's target values for each indicator for fiscal years 2008, 2009, and 2010, with male and female targets indicated as male/female.

Table 4. Indicators, baselines, and targets for the Mali Aquaculture and Fisheries Project, 2007-2010. Male (M) and female (F) targets for indicators 26, 40, and 41 are shown in parentheses (M/F) following the overall targets for those indicators.

EG 5.2 Agricultural Sector Productivity Indicators	Baseline	FY08 Targets	FY09 Targets	FY10 Targets
15. Number of new technologies or management practices under field testing as a result of USG assistance./ <i>IEHA same as FACTS Indicator</i>	0	0	6	6
16. Number of new technologies or management practices made available for transfer as a result of USG assistance./ <i>IEHA same as FACTS Indicator</i>	0	0	2	2
26. Number of individuals who have received USG-supported short-term agricultural sector productivity training/ <i>Male attendance at ST training; Female attendance at ST Training, on agricultural sector productivity</i>	0	15 (8/7)	75 (38/37)	65 (33/32)
IEHA				
40. Number of farmers who have adopted new technologies or new management practices as a result of USG assistance.	0	0	8 (4/4)	8 (4/4)
41. Number of processors who have adopted new technologies or new management practices as a result of USG assistance.	0	0	2 (1/1)	2 (1/1)

Monitoring Plan

Plan for Data Acquisition

The baseline values for all indicators and all themes are assumed to be 0 (zero) at the start of the project. For each theme, the **Theme Leaders** will be responsible for recording and storing the required data. Data will be initially recorded on forms developed for the purpose, but will also be transferred to electronic format immediately following each activity. For activities such as workshops and on-farm trials (indicator numbers 15 and 26), **Theme Leaders** will transmit these data to the Project Coordinators (OSU and DNP) once for each such activity within 60 days of the end of the activity. Following field testing of technologies in on-farm trials, **Theme Leaders** for each theme will jointly determine which of their tested technologies can be “made available for transfer” (indicator number 16) and transmit this information to the Project Coordinators within 60 days of the end of each trial. **Theme Leaders** will work with DNP or other extension personnel to track the adoption of new technologies by farmers, fishers, or processors (indicator numbers 40 and 41) and transmit these data to the Project Coordinators within six months of the conclusion of each related activity (workshop or on-farm trial). **Project Coordinators** will maintain backup copies of all data submitted.

Plan for Data Analysis, Review, and Reporting

OSU and DNP **Project Coordinators** will review the data for accuracy and completeness and contact the Theme Leaders with any questions that arise within 30 days of receipt of data from the Theme Leaders. The **Project Coordinators** will then summarize the data for inclusion in quarterly reports and in the final report to USAID.

The **Project Coordinators** will submit quarterly reports to USAID/Mali within 10 days of the end of each quarter. The quarterly schedule is as follows:

- 1 January – 31 March
- 1 April – 30 June
- 1 July – 30 September
- 1 October – 31 December

A final project report will be submitted to USAID/Mali by the Project within 90 days of the end of the project (i.e., by 31 December 2010).

Additional Data Planned for Collection

Additional data will be collected and reported on throughout the project period to further show program successes and progress. For example, success stories arising out of project activities such as workshops and on-farm trials will be recorded in as much depth as possible, along with photographic records. Cost sharing/leveraging will be tracked to the extent possible.

Following are *examples* of additional data that the Aquaculture and Fisheries Project will attempt to collect (as shown in Tables 1-3 under “Plan of Work,” above):

- Number of students trained or mentored in Mali

- Number of participants trained outside of Mali
- Additional aquaculture production area resulting from project efforts (either number of additional ponds or rice paddies or additional area in hectares)
- Estimated increase in fish productivity in ponds or rice-fish systems in targeted areas (kg/ha/yr or percent)
- Estimated increase in income for fish farmers in targeted areas (CFA/ha/yr or percent)
- Number of extension publications developed (e.g., fact sheets, brochures)
- Number of frame surveys conducted for lake fisheries
- Estimated increase in income for fishermen in targeted areas (CFA/ha/yr or percent)

Project-Wide Schedule

Year 1: October 1 2007 through September 30 2008

- **Nov 2007 to Dec 2008:** In Mali, ALL: [Planning design & review with Mali counterparts](#)
- **May to September, 2008:** Theme II: [Planning for Rice-Fish Demonstration and Workshop on Training and Extension Capacity for Rice-Fish Culture](#)
- **June to July 2008:** In China or Thailand, Theme II: [Training on Rice Fish Culture plus Capacity Building for Effective Skills Transfer](#)
- **July 2008:** In Mali, Theme I: [Mali Pond Culture Workshop #1](#)
- **July 2008:** In Mali, Theme III: [Stakeholders Workshops](#)
- **July 2008:** In Mali, Theme III: [Frame Survey Training](#)
(two Theme III workshops, end-to-end)
- **August to November 2008:** In Mali, Theme III: [Frame Surveys by Mali counterparts](#)
- **Continuous:** ALL: [monitoring, evaluating, and impact reporting](#)

Year 2: October 1 2008 through September 30 2009

- **November 2008:** In Kenya, Theme I: [Kenya Pond Culture Workshop #1](#)
- **March 2009:** In Mali, Theme I: [Mali Pond Culture Workshop #2](#)
- **March 2009:** In Mali, Theme I: [Pond Culture On-Farm Trials #1](#)
(immediately following the Pond Culture Workshop)
- **June 2009:** In Mali, Theme II: [Rice-fish demonstration set-up, first rice crop](#)
(at beginning of rice season)
- **July 2009:** In Kenya, Theme I: [Kenya Pond Culture Workshop #2](#)
- **June 2009:** Theme III: [Mid-term review; field visits, and meetings](#)
- **September 2009:** In Mali, Theme II: [Workshop on Appropriate Aquaculture Post Harvest Technologies](#)
- **September 2009:** In Mali, Theme II: [Workshop on Training and Extension Capacity Building for Rice-Fish Culture](#) (just before harvest)
- **Continuous:** ALL: [monitoring, evaluating, and impact reporting](#)

Year 3: October 1 2009 through September 30 2010

- **November 2009:** In Mali, Theme I: [Mali Pond Culture Workshop #3](#)
- **November 2009:** In Mali, Theme I: [Pond Culture On-Farm Trials #2](#)
(immediately following Pond Culture Workshop #3)
- **November 2009:** In Mali, Theme II: [Workshop on BMPs - the Issues and Challenges](#)
- **November 2009:** In Mali, Theme III: [Stakeholders' workshop and meetings for field experiences sharing and up-scaling of developed and successful technologies & plans. Dissemination of information](#)
- **March 2010:** In Kenya, Theme I: [Kenya Pond Culture Workshop #3](#)
- **September to December 2010:** ALL: [Final Reporting](#)

Color coding:

ALL

Pond Culture

Rice-Fish

Fisheries Planning

Project Timeline:

Associate Award Issued by USAID/Mali: Day One	Year 1 10/07 - 09/08	Year 2 10/08 - 09/09	Year 3 10/09 - 09/10
Plan-Design Phase			
Design Team meeting; arrangements in Mali	■		
Work Plan to USAID (60 days)	■		
Final project planning, design and review	■		
Theme I: Pond Culture			
Trainings/Workshops in Mali		■	■
On-Farm Trials in Mali		■	■
Trainings/Workshops for Mali counterparts in Kenya		■	■
Monitoring and Evaluation	■	■	■
Dissemination of information	■	■	■
Publications; Final Report			■
Theme II: Rice-Fish Culture			
Trainings/Workshops in Mali		■	■
Trainings/Workshops for Mali counterparts in China or Thailand	■		
Rice-Fish demonstration in Mali		■	■
Monitoring and Evaluation	■	■	■
Dissemination of information	■	■	■
Publications; Final Report			■
Theme III: Fisheries Management			
Stakeholders Workshops/Trainings for Mali counterparts	■		
Fisheries surveys in Mali	■		
Monitoring and Evaluation		■	■
Field experiences sharing and up-scaling of developed and successful technologies & or plans		■	■
Dissemination of information		■	■
Assessment Report or Final Report			■
All:			
Continual improvement and lessons learned activities		■	■
Final Report			■

Appendix: ACRONYMS and ABBREVIATIONS

GDP = Gross Domestic Product

NEPAD = New Partnership for Africa's Development

FAO = Food and Agriculture Organization (of the United Nations)

GOM = Government of Mali

CRSP = Collaborative Research Support Program

ACRSP = Aquaculture Collaborative Research Support Program

AquaFish CRSP = Aquaculture and Fisheries Collaborative Research Support Program

HC = Host Country (Mali)

AIT = Asian Institute of Technology (Bangkok, Thailand)

ECOWAS = Economic Community of West Africa

MLFD = Ministry of Livestock and Fisheries Development

BMP = Best Management Practice

IPM = Integrated Pest Management

DNP = Direction Nationale de la Pêche

NGO = Non Governmental Organization

ODRS = Office de Développement Rural de Sélingué

FFFS = Fisheries Farmers' Field Schools