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Designing Fisheries Programs in the Sobat River Basin

Upper Nile and Jonglei States, South Sudan

South Sudan Transition and Conflict Mitigation Program (SSTCM)

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This publication was produced for review by the United States Agency for International Development (USAID). It was prepared by Patrick Murphy, a consultant for the South Sudan Transition and Conflict Mitigation Program.

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I. SUMMARY

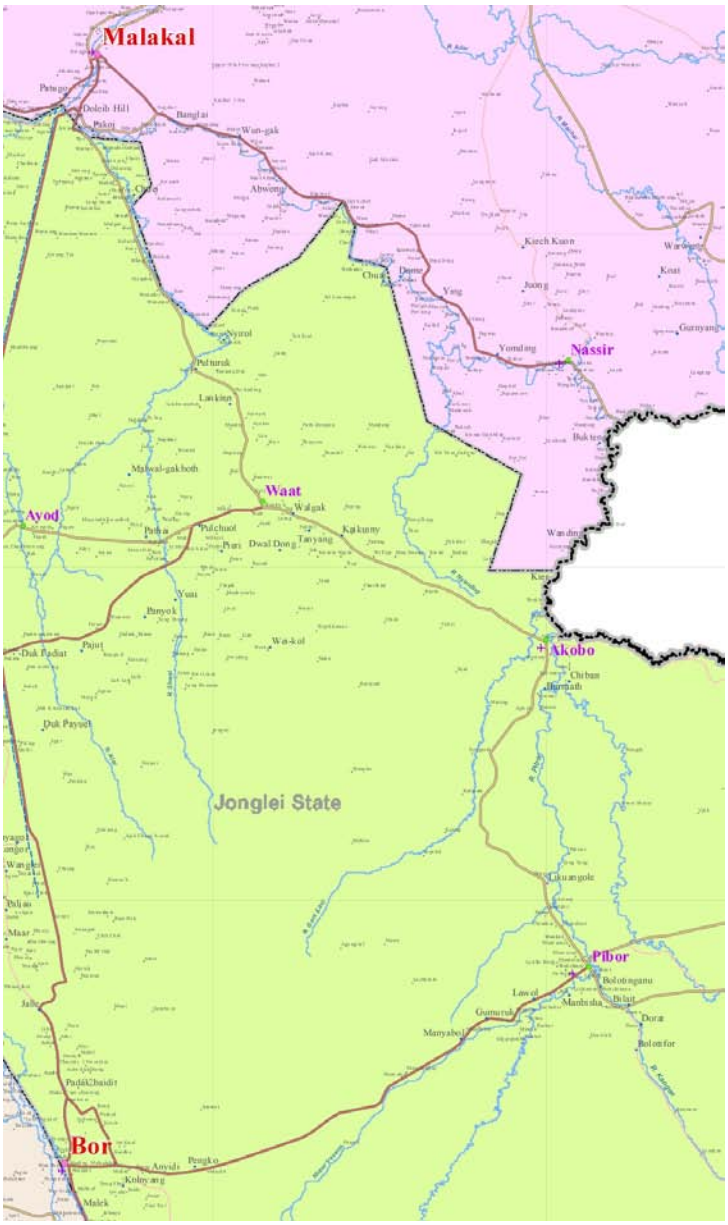
The Sobat River Basin covers an extensive area stretching from northeast of Boma in Jonglei to the rivers' intersection with the White Nile near Malakal in Upper Nile. Capture fisheries has great potential for development in the Sobat Corridor, but has remained a surprisingly neglected resource. The full utilization of the water resources is both a development opportunity and priority for security in the region.

The benefits of a fisheries industry in the Sobat Region include food security, youth engagement, enhanced cooperation amongst communities, opening up of waterways for transport, stimulation of trade and an integrated market, natural resources management, and conflict mitigation. Such benefits would contribute to an environment of greater stability in this currently volatile region.

The fisheries industry can be developed in phases: (1) first, a basic fisheries program that provides assets and support to fishers to fish and generate income; (2) second, enhancing the value-chain with support for value-added products and improved transportation; (3) third, promoting an integrated market with robust linkages to urban markets for trade, processing, and fresh fish transport. Support for the development and enforcement of government regulations overseeing trade, taxation, and natural resources need to run parallel with the gradual development of the fisheries industry.

II. INTRODUCTION

The Sobat River Basin covers an extensive area stretching from northeast of Boma to the rivers' intersection with the White Nile near Malakal. The rivers which constitute the Sobat Basin flow through Jonglei and Upper Nile states. The Sobat Basin develops as runoff from the mountains and foothills of the Ethiopian plateau. The Gilo, Baro, and Agwi rivers contribute the majority of the water to the Sobat Basin. The Pibor River, considered as part of the Sobat Basin, drains a wide area of plains, contributing significantly to the Sobat Basin in times of high rainfall. Seasonal runoff from the plateau creates an environment that nurtures fish reproduction. Consequently, the surrounding pools, lakes and rivers contain important fisheries resources. The main rivers that flow through Jonglei and Upper Nile states, are navigable waterways several months of the year, with river levels peaking around October and dropping as much as 25 feet until April. Capture fisheries has great potential for development in the Sobat Corridor, but has remained a surprisingly neglected resource. The full utilization of the water resources is both a developmental opportunity and priority.



The Sobat Basin is remote and parts of it remain volatile. Inter- and intra-ethnic tensions pose the major constraint to economic development of the region. The area suffers from very little infrastructure and service delivery. The road network is seasonal at best and while the rivers are the most reliable transport option, they are affected by insecurity issues along sections of the river, as well as expensive and limited fuel supply. There is limited mobile phone service, and very limited government services or presence in permanent offices except in the county headquarters.

However, the Sobat Basin has immense potential for a fisheries industry, which can in turn offer food security and greater stability in the region. Overcoming the above constraints with a positive economic benefit can – both in the short-run and in the long-term – help improve the security situation, as well as result in indirect effects of providing a transport corridor, access to the region during the rainy season, and developing a system for natural resources management.

Thus, supporting the fisheries industry in the Sobat Basin can help increase security through youth engagement, improved governance, and economic growth.

In early 2010, the UN called Akobo the "hungriest place on earth" after two years of drought and regional conflict. Together with assistance from USAID and other humanitarian actors, the people of Akobo have turned their community around.[1] Security has improved in Akobo, agriculture production increased in 2011, and fish harvested and dried during the 2011-2012 dry season largely supplemented the diet of the community during the hunger gap period in 2012. With improved transport, fisheries has the potential to trade with other regions in South Sudan for other commodities.

Coupled with other grants to address the destabilizing conflict associated with cattle raiding and inter-clan clashes in the region, USAID's South Sudan Transition and Conflict Mitigation (SSTCM) program, implemented by AECOM International South Sudan, launched a series of in-kind grants aimed at spurring fisheries livelihood activities in six locations in the Sobat River Basin during the 2011-2012 dry season. In concert with such grants, a fisheries expert, Patrick Murphy, was engaged to provide technical analysis and guidance regarding appropriate technology, investments, and management for the USAID-funded activities valued at approximately USD $1 million. In 2013, SSTCM engaged the same consultant to return to evaluate the previous year's pilot project,[2] as well as to provide guidance for designs of future fisheries programs in the Sobat Basin. Drawing on lessons learned from the SSTCM project and based on additional observations, meetings, and research carried out during his consultancies from the end of October 2011 to May 2012 and from March 2013 to May 2013, this report provides guidance for the development of future fisheries programs as well as ways to further develop and enhance the fisheries industry in the Sobat Basin as an engine and avenue of economic growth.

This report is intended to encourage the development of a fisheries industry as an engine for economic growth in the region and resulting increased stability, lay the foundation to cultivate such economic activity, analyze the pilot program, and provide an initial framework for a more comprehensive framework.

While SSTCM has commissioned a separate ecological assessment and an in-depth discussion of the ecological impact is outside the purview of this report, the consultant's observations and literature review suggests that the natural resources of the Sobat Corridor are currently underutilized. A review of available documents indicates that fisheries were exploited at much higher levels in past years. Ecological studies suggest that the Sobat fisheries harvests can be sustainably increased without fear of over-fishing. Although no recent data is available, various sources record yearly harvest ranging between 20,000 to 60,000 metric tons.

[1] "US helps Sudan town move past 'hungriest place'" at http://www.boston.com/news/world/africa/articles/2010/10/04/us_helps_sudan_town_move_past_hungriest_place/.

[2] A detailed evaluation of SSTCM's fisheries project is covered in a separate evaluation report.

III. BENEFITS AND IMPACT OF DEVELOPING THE FISHERIES INDUSTRY IN THE SOBAT RIVER BASIN

The potential benefits of developing the fisheries industry in the Sobat Basin range from supplementing basic nutrition in a food insecure region to improving stabilization and government management of natural resources through an avenue of economic growth. The development of a robust local fishing industry would engage youth at risk of participating in cattle-raiding, help diversify livelihood alternatives from cattle husbandry, promotes cooperation to build mutually beneficial relationships, contribute to increased individual income and an improved local economy, and create increased community resilience in the face of conflict and other challenges.

- Food Security. Fish provides a major source of income, even during the civil war era, and its potential for surplus as an export is great. Income from fish can and has been used to purchase food and other basic commodities. Fish harvested in the region is also a form of sustenance for the region, providing a great source of protein. Unlike cattle herding or farming, fishing produces an immediate food source that increases food security and community resilience. For the amount of calories burned to harvest fish versus the amount of calories produced for consumption, fishing compares favorably against other livelihood options (i.e., cattle herding and farming). Fish harvested in the rainy season can also be processed (dried or smoked), with a shelf-life of up to one year, for consumption during the seasonal hunger gap period.

- Youth Engagement. Unemployed and under-educated youth are at risk for involvement in violence. Cattle husbandry, small-scale farming, and cattle-raiding are the primary income-producing options for many in the Sobat Basin. Past fisheries programs have targeted young men; however, there is room to engage women in the fisheries industry and future programs could include a broader spectrum of both women and men participants. Enabling local communities to capture market opportunities would enhance stability in this area where lack of economy opportunity is part of the conflict dynamic. Anecdotal evidence collected by the consultant also suggests that youths productively engaged in legitimate economic activities also feel a greater sense of civic engagement and accountability.

- Enhancing Cooperation among Communities. The development of a fisheries industry in the Sobat could induce positive relationships between neighboring communities. Communities could be encouraged to work together in a positive and productive manner. The consultant saw evidence of fishermen from different clans working together to solve problems and leverage assets. For example, one clan had access to good fishing sites in a pool while another clan had transportation support provided under SSTCM's support. The SSTCM-supported group offered to help transport the other group's fish in the same vehicle in exchange for access rights to the parts of the pool that yielded more fish. The Jikany Nuer and Lou Nuer fishermen in Wanding fished together, which prompted their wives to team together when visiting the fishing camps.

- Waterways as Roads. Promoting economic incentives for cooperation to secure river channels for the transportation of fish could create mutually beneficial relationships among the Murle community in Pibor, the Lou Nuer community Akobo, and the Jikany Nuer community in Nasir. It could also encourage an improved and more transparent system of taxation on the river. Opening up or improving road or navigable rivers to transport fish would improve transport linkages so desperately needed in the region to reduce the sense of isolation, stimulate economic growth, and improve stability.

- Stimulate Trade. Accessing transport and trade of fish would also enhance linkages between producers in rural areas with town markets, which would stimulate trade. Improved business skills by fishermen would also stimulate trade. For example, as a result of the trainings conducted under the SSTCM project, fishers became more sophisticated in marketing and looked for entrepreneurial ways to transport dried fish to sell in the Juba market. SSTCM fishers also transported fish to Ethiopia and brought back beverage commodities to sell.

- Management of Natural Resources. Government management of natural resources of the Sobat River Corridor is currently nascent. Other areas in South Sudan enforce seasonal restrictions on gear types and harvesting methods. The development of the fisheries industry in the Sobat Basin, coupled with the development of natural resources management and research, would contribute to the government's capacity to manage the various natural resources in the region and improved governance in general.

- Conflict Mitigation. Providing economic opportunities to marginalized youths, enhancing community resiliency through food security, improving governance capacity, promoting positive interactions between communities, and the stimulation of trade resulting from the development of a fisheries industry will all contribute to stability in the Sobat Basin.

- Ancillary Benefits/Integrated Market. Fish by-products can be used in other industries as a result of introducing new processing techniques. Fish parts that have been previously discarded can be ground up to be used as poultry feed or fertilizer.

IV. BACKGROUND AND METHODOLOGY

Patrick Murphy, the consultant engaged to provide technical assistance to SSTCM's fisheries project and the author of this report, has been involved in the fishing industry for over 40 years as a fisherman, fish processor, fish broker, fish transporter, and consultant. He was the sole proprietor of Walrus Island Fisheries, Inc. (WIF), a fish purchasing and processing company that used planes to buy fish from remote fish camps throughout Alaska. He was also the President of Ocean Pacific Fisheries, Inc. (OP), a fishing and fish processing company that targeted Alaskan salmon, groundfish, and herring. OP operated a fish processing ship, which froze fish products for transport to markets in Japan.

The consultant made an initial assessment of the Sobat Corridor in November 2011, with a rapid assessment of the status of fishing activities, technologies, and value chains in the region.

Fishing activities were ongoing at the time and provided evidence of significant volumes of fish throughout all the rivers that constitute the Sobat Basin.

Following the initial assessment, the SSTCM fisheries project targeted 220 youths who were provided fishing assets and then began fishing. The consultant remained in the field, observing and instructing fishers, quantifying harvests, and monitoring markets until the end of the dry season in May 2012. To evaluate the outcome of the previous year's fisheries program, the consultant returned to the field in March 2013 and met other stakeholders in Juba and the state capitals of Malakal and Bor.

The consultant has also taken the opportunity to assess other fishing sites in Central Equatoria, Lakes, and Unity states. These have allowed comparisons to be drawn between those areas and the Sobat Corridor.

In addition to direct interactions with the fishermen, the consultant has also engaged with other stakeholders, including:

- the Padak Fisheries Training Center, outboard engine and fiberglass trainers, FAO trainers, UNIDO staff and field agents, who have provided the consultant opportunities to participate and sit in on lectures and training sessions;

- consultations, throughout the SSTCM project and as part of the evaluation, with government entities and local authorities, including county commissioners, state governors, ministers from the state's Ministry of Animal Resources and Fisheries (SMARF), fisheries agents, payam administrators, and chiefs;

- meetings, as part of the evaluation, with community members, including youths, women, and elders;

- interviews with non-governmental organizations (NGOs), community-based organizations (CBOs), and other interested parties during the SSTCM fisheries project and for the evaluation;

- toured and evaluated in Upper Nile and Jonglei states a cold storage plant, ice-making facility, and a refrigerated fish-packing barge; and

- conducted research in markets in Nasir, Malakal, Akobo, Bor, and Juba throughout the consultant's engagement in South Sudan to document the value-chain, including the collection of anecdotal marketing data provided by buyers from Kosti and Khartoum.

V. DESIGNING A BASIC FISHERIES PROGRAM

As outlined above, developing a fishing industry in the Sobat Basin has many benefits. Basic fishing programs serve several important functions. They provide money-making opportunities in an area where few options exist for employment. They provide diversion for idle youth. Fishing programs offer opportunities to promote group cohesion. Successful fishers gain status

and set positive examples for at-risk youth. Fish are plentiful, self-sustaining, available year-round, easy to capture, not targets for raiding nor do they suffer destruction by flooding, as do crops. Fishing should be the cornerstone for food security in the Sobat Corridor. Basic fishing programs should evolve into business opportunities that have not yet developed.

A. Challenges to Market Entry

At the present time, the supply of fish harvested from the Sobat Basin can be increased with additional donor interventions. Access to fishing assets is a limiting factor to increasing fishers' participation. The costs associated with interventions are driven by what types of assets are provided. At the basic and least expensive, fishermen need twine and lines to build nets, lines, and hooks to build longlines. Insufficient start-up capital restricts access to such basic assets. In addition, limited amounts of these assets can be secured in local markets in Nasir and Akobo.

Many men already fish in the Sobat Basin. However, a high percentage of Sobat fishers are subsistence or survivalist fishermen, using fish mainly for family consumption or bartering. Most participants in the SSTCM fisheries project were part-time dry season (the most productive season) fishers, engaging in cattle-herding or cattle-raiding otherwise. With the assets provided by SSTCM, the fishermen committed to fish the entire dry season. Some of the fishers even continued fishing during the 2012 rainy season. They harvested fish both for family consumption and for commercial markets. This indicates that fishing efforts and harvests increased with access to fishing and processing equipment.

Prior to the SSTCM fisheries project in 2011, most fishermen on the Sobat Corridor had no or only dugout canoes that last four to six years. There were a few fiberglass canoes remaining from a 1992 fishing project. Increasing access to additional equipment options and processing training may encourage participation by more individuals, both women and men.

Fishing has traditionally been considered a low-status occupation in the Sobat Basin. The participants in the SSTCM program gained status due to their successes in earning money. Seeing such success, other community members expressed a desire to join the fisheries program and the white fiberglass canoes now convey a status symbol. However, the status issue may remain an impediment for new potential fishers.

B. Lessons from the SSTCM Project for a Basic Fisheries Program (Phase I)

The SSTCM fisheries project targeted six locations along the Sobat Corridor – Nasir, Jikmir, Makak, Wanding, Dengjok, and Nyandit – in Nasir and Ulang counties of Upper Nile and Akobo county of Jonglei. Support took the form of distribution of material inputs (canoes, motorboats, fuel, hooks, twines, and other fishing equipment); local support in the form of CBOs who helped manage resources and implementation; training in motorboat use and maintenance, fiberglass repair, and an introduction of a basic accounting system to measure fish yields; and construction of fish storage units to help safely store the fishermen's catch and a fish market in Nasir. The table in Appendix A shows what was provided. The consultant remained engaged in the field activity locations throughout the implementation process through May 2012, providing real-time monitoring and evaluation that allowed SSTCM to modify and

improve the program as it progressed, in response to emerging challenges.

Fishers who were supported by the SSTCM program have encouraged other youths to join them. The existing fishing groups have transportation (motorboats) that can be shared. Providing net-making and hook-making supplies to new recruits will marginally increase, at little cost, the numbers of fishers in the region. The consultant's evaluation suggests that fishers in the SSTCM program are securing new fishing assets without further donor assistance. They may even self-fund new fisher recruits.

New programs could expand the geographic reach or recruit additional fishers in the region. The SSTCM program was begun as a tool to mitigate conflict. It has had successes in this regard. Monies have been earned which has encouraged youth to forego cattle raiding. Follow-up on this approach will require similar commitments from donors, implementing partners, CBOs, community leaders, and fishers. The legacy of violence and retribution will not soon disappear. Continued interventions by the donor community are necessary.

Drawing on the lessons of the SSTCM fisheries project, a basic fisheries program might consider a design based on the following suggestions:

- Organizing fishers into groups and teams. The SSTCM program had five groups of 30 members and one inter-ethnic group of 60 members. Each group was composed of five member teams. This arrangement promoted teamwork and allowed for division of labor. These teams remained stable throughout the project and provide evidence that similar sized teams should be the foundation for future programs.

- One fiberglass canoe for every five-member team.

- One fiberglass delivery boat with a 15 HP motor for every 30 participants, and some start-up gasoline and oil. (Note: motorboats are not critical and can be left out, especially if fuel costs remain exorbitant.)

- Heavy-duty plastic tarps (approximately 20' square) for fish delivery. (Quantity of tarp depends on number of fishers.)

- Five spools of #15 twine and #18 twine for every fisher.[3]
- Two spools of 100 meter ½" line (rope) for every fisher.
- 20 kilos of sheet lead for every fisher.
- One box of 100 #6 hooks; one box of 100 #7 hooks for every fisher.
- One gaff hook for every five-member team.
- One appropriately styled fish cleaning knife for every fisher.
- Two plastic tarps (approximately 5' square) for fish cleaning for every five-member team.
- One large plastic barrel and one large plastic tub (for fish cleaning) for every five-member team.
- Salt for fish processing.
- Training on fish processing techniques, basic accounting and business principles, fiberglass repair, and (if motorboats are provided) motorboat operation, repair, and maintenance.
- Storage must be provided for salt supplies, fuel, replacement fishing gear. The SSTCM program had a fish-storage building component. Soil blocks were produced by local youths and used to construct storage buildings. However, it is not critical for fish storage buildings to be constructed for future programs. Storage can be rented in the major towns in the Sobat Corridor or in payam tukuls.

Appropriate assets and methods can be ascertained through an assessment that tries to answer the questions listed in Appendix B.

Engaging coordinators to supervise fishing groups helps to manage the process among fishers and coordinate with the implementing partner. Under the SSTCM program, coordinators were hired by partner CBOs, with SSTCM funding the salaries of the coordinators for the first fishing season. Coordinators managed storage and allocation of assets after the initial distribution of assets. The initial distribution was coordinated between the SSTCM staff and CBO coordinators.

[3] Note: Factory constructed multi-ply nylon nets can be found in retail stores in Nasir and Akobo. These nets are more expensive and effective than cotton twine built nets. All nets require repair and are eventually destroyed. Repair twine for factory nets has not been sourced in Nasir or Akobo and fishers using factory-produced nets may not have access to or money for replacing the nets. Cotton twine built nets are relatively inexpensive. Significant quantities of cotton twine are locally available for repair and replacement. Replacement of destroyed cotton twine nets can be accomplished in a relatively short time. When multi-ply factory produced nets and repair twine are available and affordable, the nets are significantly more effective at catching fish than are cotton-twine nets.

Prior to the construction of the fish storage units, replacement twine, hooks, lines were kept in storage units provided by the CBOs. Fuel and salt were stored in payam headquarters.

Effective coordinators kept in close contact with the group they managed and knew where teams were fishing. This allowed coordinators to address problems before they disrupted group cohesion. Frequent communication allowed coordinators the time to replace assets as needed; they advised on marketing strategies; coordinators kept SSTCM staff and consultant abreast of positive/negative developments.

The total cost of the SSTCM fisheries program in 2011-2012 was approximately $1 million. Dry season fishing income fluctuates greatly. At the height of the season, CPUE (Catch Per Unit Effort) can average 100 fish per day. Dried fish sell for between two to five SSP, depending on the species and size. Fresh fish in the dry season can bring as much as 30 SSP per fish and the 25 Nasir fishermen sold fresh fish for 300-500 SSP (gross) daily for several weeks straight in the Spring of 2012. It was reported that five-member teams in the SSTCM program earned as much as 15,000 SSP in 2011-2012. Income in the 2012-2013 season is expected to be higher given the fishers will have a full dry season to fish, as they had a late start in the 2011-2012 dry season.

The success of several of the SSTCM fishers groups provides evidence that future programs might benefit from referring to the SSTCM model as a starting point for managing a program. That being said, the strengths of CBOs and coordinators varied considerably. All future programs require daily coordination with the implementing partner until initial problems have been identified and solutions found that will promote problem solving and group cohesion.

In addition, while women were not targeted for the SSTCM program because it was designed to target young men who were at risk of involvement in cattle raiding, women want to be included and were outspoken about having been neglected. Future programs should recognize that fish processing (which includes drying, cooking, smoking, grinding of fish bones and offal) offers an avenue for women's involvement. The traditional role of women in food preparation should be promoted by training programs. Women have participated in the FAO/UNIDO trainings and women are currently enrolled in the Padak training of trainers programs. Having women trainers should serve as the role models that will encourage women's participation in fisheries.

A basic fisheries program will face several challenges. Limited transportation to bring fish to market is a major challenge for development in many areas of the Sobat Corridor. Fishers with reasonable access to Nasir and Malakal have always found a market for dried fish. Fishers in the Jonglei area can sell fish in Nasir, but are heavily taxed during transit. Insecurity caused by several issues retards development in some areas more than others. Educational deficits retard business developments that could increase fishers' income.

Nevertheless, basic fishing programs allow for entry into a new livelihood. Markets exist for dried fish, and that is the majority of what is produced in the Sobat Corridor. For most fishers, producing the maximum amount of dried fish is the best course of action for increasing their income. In other areas of the world, fishers who have ready markets do not need to consider expanding their fisheries related horizons. The Sobat Corridor represents different

opportunities because it is fishing at its most basic. Improvements to fishing, transportation and marketing offer opportunities that in other countries have already been developed; they have not yet evolved in this region.

VI. ENHANCEMENTS TO DEVELOP A FISHERIES INDUSTRY

While a basic fisheries program puts fishers on a more solid footing, additional assistance would enhance sustainability and leverage value-add opportunities. Donors may be the best actors to fund follow-up programs to enhance and expand from the basic fishers program as such support requires more substantial capital and technical expertise. Making fishing a more attractive livelihood on the Sobat and maximizing profit to stimulate economic growth in the region will require business management skills, improved processing methods, coordination to transport fish to major markets such as Malakal or Juba, and access to wholesale distribution channels. This will increase fisher participation, which will in turn increase the supply of fish and opportunities to create an integrated market.

There should be positive additions to the supply side when new recruits enter the industry. The anticipated technological advances in processing, growth of marketing skills, increasing diversity of transportation options, better communication, suggest the supply of a diversity of fisheries products will show an upward trend.

The challenges of new donor programs are likely to be similar to those faced by the SSTCM program. However, with the success model shown by that program, there may be increasing demands made by recruits for inclusion, including women. These should be anticipated and will require problem solving when they occur.

A. Additional Support for Sustainability and Value-Add (Phase 2)

While fishermen supported by the SSTCM project are purchasing to replenish expended fishing supplies and getting fish to market without additional SSTCM assistance a year after the project ended, there remains assistance that could be provided to ensure fishers' sustainability, including:

- Additional Business Management Training. While simple record-keeping for harvest and processing can be developed initially, fishers would greatly benefit from additional training on basic business management, including how to set up an accounting system to:
    - maintain records for fish sold to reinforce training;
    - account for revenue and expenses, as well as manage distribution of income (after subtracting harvesting, holding, and shipping costs);
    - marketing; and
    - manage supplies such as fishing gear and fuel for transport.

- Arrangements for Procurement of Fishing Supplies. Improving communication between fishers and traders in local markets can help establish a more reliable system for procuring fishing supplies, including the timing and type of supplies.

  There have been some improvements in communication in the Sobat Corridor with improved mobile phone network coverage; however, large parts of the Sobat Basin remain without mobile phone network coverage. Several villages have satellite phones as well as HF radio communication.

- Sustainable Modalities of Transport for Dried Fish to Major Markets. Transportation of dried fish to markets is time-proven – rafts constructed of plastic tarps filled with fish are floated to the markets in Nasir and Akobo. No fuel or other transportation expenses are required; smoked fish will use the same transport methods. The provision of small motorboats and start-up fuel would help facilitate more efficient transport; however, high fuel costs may prohibit such option from being financially feasible.

  Once a sufficient volume of fish is accumulated, the fish can be hauled to Malakal or Juba, where they would fetch significantly higher prices, by renting a larger boat or, if the water level of the river is insufficient, by a renting a truck. To facilitate this, assistance is needed:

  - To coordinate the collection of fish from various fishing groups along the Sobat, the business negotiations for renting the transport boat, and subsequent distribution of revenue.

  - To coordinate bringing back goods to maximize on round-trip transport costs and to replenish fishing supplies and equipment.

  - To negotiate and help set the enforcement of a system of tax collection (or understanding that no taxes should be required) on the river.

- Distribution Channels. Market research is needed to help fishers determine wholesale prices. In addition, the fishers may need assistance with finding reliable wholesale buyers and in setting up a purchase and sale system.

- Training on Fish Processing. Progress is being made in the dissemination of new processing and preservation techniques. UNIDO, FAO and Padak trainers are in the field providing hands-on instruction in value-adding and processing that will utilize fish parts that had previously been discarded, as well as processing additions that will add value. These techniques are low cost. The major expense to defray is the training costs. The greater challenge is to find acceptance for new ideas by the fishing community. Lessons from other fishing areas can be used as tools for finding acceptance

for new ideas.

- Improve Quality of Fish Processed and Dried. While the fishermen are currently drying and salting the fish, training on proper methods of the drying and salt process of fish would help improve the quality of processed fish and reduce loss of product through spoilage.

- Equip and Train to Smoke Fish. To enhance product, provision of equipment and training on smoking fish would help to increase profit. Challenges to the use of smokers in the Sobat Basin include the lack of wood for fuel and the lack of cultural acceptance/familiarity with smoked fish. However, lessons from other fishing areas shed light on acceptance for smoked fish. For example, fishers in Terekeka have found ready markets for smoked fish in Juba. The evolving designs of chorkor fish smoking ovens require less fuel – an important feature in areas of low fuel availability. Previously discarded fuel sources such as maize husks, sorghum stocks, and various reeds are available as fuel sources. Wood chips and sawdust from wood shops can be used to fire ovens. This information was provided through training to Terekeka fishers. As a result of new processing techniques they have increased their profits significantly.

  The Terekeka high-season fishery occurs during the rainy season, the opposite of the Sobat season when the best fishing is found during the dry season. Traditionally, Sobat fishers have put little effort into commercial fishing during the rainy season because it is too difficult to dry fish in the traditional manner. With the advancements in chorkor smoking ovens, the rainy season should become the time to "dry-hot smoked" fish. Dry-hot smoked fish requires 10 -18 hours of smoking; that time is available when Catch Per Unit Effort (CPUE) is low. Damp fuel is the best fuel for dry-hot smoking; the rainy season provides such fuel. Hot smoked fish have a shelf-life of up to nine months. The extended shelf-life of the product allows producers to hold product until transportation is easily available. It also allows the producer to hold product while waiting for favorable market conditions. Research in the Juba markets documents a strong demand for such products.

- Use of Fish By-Products. Trainers are providing the information to begin production of fish by-products such as fish paste, fish oil, ground fish parts for chicken feed, fish by-products for fertilizer, and fish bones for jewelry. There are vast supplies of discarded fish parts produced by Sobat fishers – marketing expertise is needed for the by-products to find acceptance. Literature research documents that all the above by-products are being utilized in many West, Central and East African countries. Those countries provide templates for both acceptance of new processing techniques by fishermen and marketing of new products to consumers.

  By-products like fertilizer and chicken feed could be used locally and would not incur great transportation costs. SMARF staff in Bor expressed enthusiasm for the idea of using by-products. Coordination with SMARF staff would be a logical first step in finding acceptance for usage of such products. The Borlaug Institute (a division of Texas A&M

University) in Bor also expressed interest in experimental trials using fish-based fertilizer.

- Ecological Research and Natural Resources Management. The Sobat Corridor has regulations over fishing, but no funding currently exists for enforcement or research activities. Wildlife and Fisheries officers can be found in Nasir and Akobo; however, they often produce conflicting information about fishing rules, regulations, seasons, or harvest methods. Fishermen are required to have licenses, but interviews by the consultant have not found compliance with such requirement. Support for government regulations and enforcement of natural resources management in parallel with the development of the fisheries industry is critical.

  As reported above, historical data from the British era pre-1950, documents significant yearly volumes of fish bought by traders from the North (modern-day Sudan). To this day, similar fish volumes continue to be purchased by buyers from Sudan. This strongly suggests that the reproductive capacity for fish in the Sobat Corridor has remained healthy and stable. Data suggests that periodic droughts have reduced harvests as evidenced by lower exports. However, no biological conclusions can be drawn as to the reasons for lower harvests. Perhaps fishermen had no access to fishing gear or water levels were too low for transportation. What is more apparent is the long-term biological sustainability was not affected by droughts. The harvest levels did not have a downward trend but returned to average following the return of normal rainy seasons.

  Unlike other fishing areas that serve various user groups such as mining, logging and other natural resource extractors, the Sobat corridor fishery has no such competition at this time. This factor contributes to the ecological health and relative ease of managing sustainability in the area.

  Long-term biological oversight is needed to insure ecologically sustainability – not only for the fisheries resource - but the health of the entire biological communities. Data to feed into the proper management of such resource need to be collected gradually over time. Currently, there is no government commitment in this regard. The international community may be the only entity that can provide the resources to fund such oversight.

  Government capacity to deliver fisheries services to this remote area has been extremely limited compared to areas in proximity to Juba. However, the John Garang University Padak Training Center has graduated fisheries trainers who have taught courses in the Sobat Corridor. These modest efforts offer encouragement for fishers to develop new fishing, processing, handling and marketing techniques. Both men and women are training at the Padak Center. Having women trainers may lower the barrier that currently discourages women from involvement in the fisheries industry.

B. A Robust Fisheries Industry and an Integrated Market (Phase 3)

Expanding and developing the fisheries industry in the Sobat Basin has the potential for large-scale economic growth. Significant investments in transportation and infrastructure developments would be required. In addition, several fisheries-related industries exist, which would require further exploration.

- Transport. The Sobat Corridor is remote and not easily accessed on a year-round basis. During the rainy season the rivers are navigable, but roads are generally impassible. The navigable rivers present transportation options that could stimulate trade between the states of South Sudan as well as between South Sudan, Ethiopia and Sudan. Improvements to seasonal roads should promote additional transportation options that may provide an opportunity for constructing infrastructural improvements that will increase value-added options for fish.

  During the dry season, rivers are navigable until late April/early May when they fill with water hyacinth and become too shallow for most boat travel. Roads are generally open from February through April of the dry season. Air transport is possible year-round depending on the condition of the landing strips. In some areas of Jonglei, airboats are used in areas of shallow water and water hyacinth.

- Fresh Fish Industry. Fresh fish have the greatest value of any fish product, selling for a price of up to four times as much as dried fish. However, without reliable transportation, selling high value fresh fish is restricted as fresh fish in hot climates have a 9 – 12 hour shelf-life unless they are iced. To transport fresh fish, the following is needed:

  - Flake ice;[4]
  - High quality insulated holding boxes known as "totes";
  - Refrigerated storage to hold iced fish in totes until shipped;
  - Refrigerated shipping (truck or boat); and
  - Refrigerated storage at fresh market destination.

  Properly handled, iced fresh-water fish can have a shelf life of up to 20 days. Proper handling requires fish to be immediately gutted and all blood removed prior to icing. Flake ice is required for keeping fresh fish in excellent condition. Flake ice can be packed inside the belly cavity and surrounding all sides of the fish. The only existing ice

[4] Note that flake ice production does not require a large facility. Modern ice makers can be mounted on top of an insulated container (10'-40' in size). A refrigerated container of similar size can be placed in proximity to the ice container. Totes with iced fish would be held in that container, prior to shipping. Sun protection in the form of a roof will add additional protection, but is not required. Container-mounted ice making systems are industry standard. They have the added benefit of being built, tested and adjusted at the factory, prior to shipping. Both the insulated container for holding totes and the ice-making container can have integral diesel power negating the need for additional generators. Solar ice-makers are another alternative to consider.

plant in the Sobat area is a block ice producer in Malakal. Block ice will insure reasonable quality for a short period.

- *Refrigeration and Ice Production*. When infrastructural support exists, ice-making equipment is a priority. The necessary support includes: ice maker, electricity, clean water source (well-filtered river water), ice storage facility and transportation options for delivery of ice to fishers.

  When iced fish are transported and held for extended periods in hot climates, cold storage should be provided or the ice will quickly melt. Cold storage currently exists in Bor. However, no ice production exists in Bor. SMARF built a refrigerated barge to transport fish that sits unused at the riverside. In its current configuration, the barge cannot be realistically used to transport fish. However, it is currently capable of refrigerating fish. The barge has sufficient generation capacity to also power ice-making equipment. In addition to the barge, SMARF built a modern cold storage plant – currently lacking a generator – as part of a fisheries complex that is well designed and strategically located on the riverside in Bor.

  With the addition of an ice-maker, Bor would have the major infrastructural components necessary for a modern fish processing facility.[5] The costs of flake ice machines vary according to tonnage capacity. Pre-shipment prices for a basic two-ton machine start at $12,000 U.S. dollars.

  The fisheries complex in Bor is of sufficient size to permit all value-added processing options to be performed on site. The consultant has suggested to Minister Gai of the Jonglei SMARF that the refrigerated barge be moved and anchored to the beach adjoining the fisheries complex. The barge and cold storage plant in proximity to each other represents excellent possibilities for an up-to-date processing facility. SMARF Minister Gai encourages the development of a public/private partnership or for a private-entity to take the initiative in putting these assets to use.

  Options currently exist in Juba to receive fresh and iced fish. Refrigerated containers in Juba have the ability to hold products at the correct temperatures to insure quality. Currently, there are new and used containers available in Juba. New containers can be shipped from Dubai. The price for such containers FOB Juba ranges between 15,000 – 20,000 U.S. dollars. Ice is available in Juba that is suitable for holding fish for sale to the domestic market.

- *Transport*. Transportation is the greatest impediment for bringing high-value fresh fish to market. Dry season road access is available from Bor to Akobo; road access is available from Malakal to Nasir. Nasir and Akobo are the

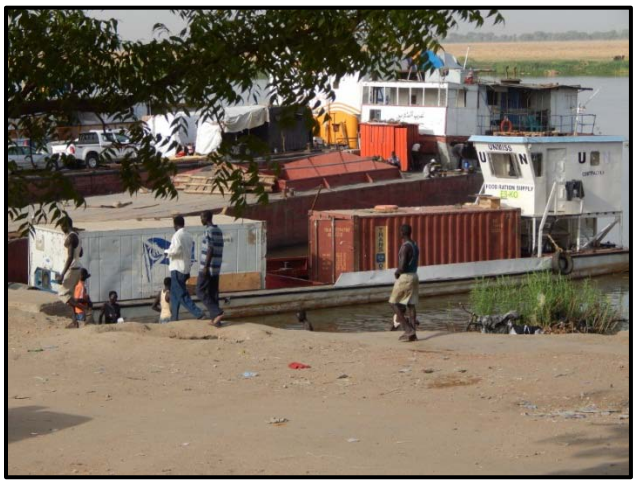
[5] Neither the refrigerated barge nor the cold storage plant is a freezer. They are cooling rooms. Freezers for fish need temperatures of -40 degree Fahrenheit. Cooling rooms (referred to as cold storage) keep temperatures of approximately 10 degrees – cold enough to cool but not freeze.

logistically centralized gathering points for collecting fresh fish. Fresh fish could be cleaned and bled at the newly constructed market in Nasir, or shipped whole on ice. No facility is currently operational in Akobo for cleaning fish, but areas exist for storage prior to shipping.

When ice becomes available in Bor, it can be readily shipped by truck to Akobo, making possible the delivery of fresh fish to Bor. If the cold storage is operational in Bor, holding iced fish there would permit either truck or river transport to the Juba markets.

Refrigerated trucks drive between Malakal and Nasir. The ice plant in Malakal is expanding and may produce sufficient ice for fish cooling. Fill the refrigerated Nasir bound trucks with ice; unload ice in Nasir; bring sufficient fresh fish by outboard from fishermen in the Jikmir area. Ice the fish in Nasir; send to the Malakal market. It has been reported but not confirmed that refrigerated boats are still operating between Malakal and Sudan. If this is the case, it would be possible to send fresh fish to the Sudan market.

During the 2011-2012 SSTCM project, UNMISS brought a boat with a refrigerated container from Malakal to Nasir on a regular basis, prior to the river levels becoming too low for safe travel. Similar boats have been found in Malakal. These boats can be used to transport ice upriver and return with refrigerated iced-fish, downriver.



Refrigerated and dry storage trucks have been seen in Burbiay, Ethiopia – across the Baro river from the Jikmir fish camp. Jikmir fishermen have sold small amounts of dried and fresh fish to this market. The road from the landing site is the major collection point for goods going between Gambella and the Sobat Corridor. The transportation exists; markets in Ethiopia need to be researched. If ice delivery becomes possible to Bor, iced fish could be sent in several directions: (1) north to Nasir, then onwards; (2) north and east to Ethiopia; and (3) west to the Akobo West markets.

- *Packaging*. At this time, there are no facilities in South Sudan capable of freezing fish. Until such facilities are built, there is no need for packaging. Neither iced nor fresh fish require packaging. Value-added products like fertilizer, fish meal, chicken feed would require storage materials, most likely bags.

- Fiberglass Canoe Industry. The locally produced wooden canoes used by fishers have a 4-6 year lifespan. They are expensive, heavy, unstable and contribute to deforestation. The fisheries complex in Bor, offers suitable space to develop a fiberglass canoe building industry. Advantages of fiberglass canoes include:

    - fiberglass construction is inexpensive and requires basic technology;
    - little infrastructural support would be required;
    - supplies are readily available;
    - training would require as little as two weeks;
    - there is a constant and growing demand from existing and new-entry fishers;
    - canoes can have a 20-year lifespan; and
    - de-forestation will be reduced.

- Academic and Technical Input

    As further elaborated below, the John Garang University in Bor has fisheries-related staff. However, the university is restricted by a lack of funds. The Borlaug Institute, which is part of Texas A&M University, has been involved in academic research in the field of aquaculture. As reported above, Borlaug staff expressed interest in fish as fertilizer and chicken feed products. It is conceivable they would offer academic and technical advice for advancing such research. UNIDO, FAO and several implementing partners contribute technical advice on a regular basis.

    The current ecological research project is in contact with the Department of Ichthyology and Fisheries Science at Rhodes University, Graham, South Africa to see how practical ecological data can be collected for consideration in future fishers industry development.

The Bor fisheries complex includes a building designed to stock and sell fisheries related equipment. This should be maximized to not only sell existing fishing equipment, but a platform to introduce new ideas in fishing gear as well as display new fish products. The building could also serve as classroom for trainers.

VII. CONCEPTUAL TIME FRAME AND ESTIMATED COSTS TO DEVELOP THE SOBAT BASIN FISHERIES OVER A THREE-YEAR PERIOD

A. Government Policy

SUDAFISH is the recently released government action plan to develop fisheries throughout South Sudan. This policy encourages private investments in infrastructure, including: ice making facilities, cold storage facilities, processing facilities, refrigerated trucks and boats, fish canning facilities, and improvements to canoes and small delivery vessels. SUDAFISH does not address the government's ability to contribute to these improvements, but will give the highest priority to any plan that promotes development.

JICA is currently writing the fisheries policy document that will become the basis for fisheries management throughout South Sudan. Although little research has been done in the Sobat Basin, it should be expected that policies will be enacted specific to that area.

B. Investments in Production Component

An incremental conservative approach to adding fishers on a yearly basis is recommended. The on-going environmental assessment will contribute baseline data in parallel with increasing fishers. Creel surveys will yield data necessary for predictions on sustained yield. It is expected that that data will justify the continued expansion of the fishing component.

Year One:

This chapter addresses three counties: Ulang, Nasir and Akobo. Ulang County is under-represented in fisheries in the Sobat Corridor. County Administration, elders and fishers are concerned that they have been neglected in past fisheries programs. For that reason, they should be chosen as the major grantees for Year One. Existing Akobo fishers should also get some fuel support in Year One as they will be commuting long distances with boats they own, to supply the fresh fish going to Bor. Existing Nasir fisher groups should have a leased truck to deliver dried and smoked fish to the Malakal market.

- 90 new fishers from Ulang County to receive the necessary assets to enter the fisheries industry.
- These first year fishers should harvest approximately 2,000 fish each.
- The 90 new fishers should produce 180,000 fish in total.
- Dried fish selling prices are found in the pro-forma: Prices are listed for local, regional and national (Juba) markets

Required assets for the 90 Ulang fishers in Year One:

- 18 canoes.
- 3 - 19' motorboats with 15 HP outboards.
- Twine, hooks, and processing equipment.
- Training in processing, accounting, and marketing.
- Training in boat maintenance and handling.
- 9 barrels of outboard gas for Ulang.

Additional support to existing Akobo and Nasir fisher groups:

- 6 barrels of outboard gas for Akobo.
- 9 chorkor smoking units to be constructed for 6 existing fisher groups in Nasir and Akobo. 3 constructed for Ulang fishers.

Year Two:

Nasir and Akobo counties have similar numbers of fishers, but Nasir has access to a new fresh fish market. Development of that market needs to be promoted. Therefore, Nasir was selected to be the primary focus in Year Two. Forty-five new Nasir fishers will receive two motorboats and fuel, as they will be making frequent trips to the fresh markets.

- 45 new fishers from Nasir County to receive the necessary assets to enter the fisheries industry.

- First year fishers should harvest approximately 2,000 fish each.

- The 45 new fishers should produce 90,000 fish in total.

Required assets for the new 45 Nasir fishers in Year Two:

- 9 canoes.
- 2 - 19' motorboat with 15 HP outboards.
- Twine, hooks, and processing equipment.
- Training in processing, accounting, and marketing.
- Training in boat maintenance and handling.
- 6 barrels of outboard gas.

Year Three:

Year Three will focus on new recruits in Akobo, providing them with two motorboats and fuel, as they will be traveling long distance to supply the fresh fish going to Bor.

- 45 new fishers from Akobo County to receive necessary assets to enter the fisheries industry.

- First year fishers should harvest approximately 2,800 fish each. The harvest numbers for Akobo are expected to be higher than Ulang and Nasir, as they have more productive fishing areas and fishers will continue fishing during the rainy season.

- The 45 new fishers should produce 126,000 fish in total.

Required assets for the 45 new Akobo fishers in Year Three:

- 9 canoes.
- 2 - 19' motorboats and 15 HP outboards.
- Twine, hooks, and processing equipment.
- Training in processing, accounting, and marketing.
- Training in boat maintenance and handling.
- 9 barrels of outboard gas for Akobo.

C. Investments in Storage and Processing Components

Year One:

- Construct modern chorkor smoking units at nine sites.
- Construct fresh market in Malakal.
- Remodel fisheries co-op building in Akobo
- Move refrigerated barge from present site to fisheries facility in Bor.
- Install generator to operate ice machine.
- Install 2 – 4 ton ice machine at facility.
- Install bore hole and raised water tanks.
- Purchase 24 – 1 ton capacity nesting polyfiber totes with lids for Bor facility.
- Purchase one 20' refrigerated container to place in Juba.
- Fuel grant to operate equipment

Year One training in processing justifies the construction of modern smoking units. Training and new units should diversify fisheries products and lead to increased income. Malakal is the largest market in the northern end of the Sobat Corridor and requires a modern hygienic facility.

Reconstruction of the Akobo co-op will provide a suitable building for everything related to the fisheries industry: equipment sales, processing, and retail fish sales.

Bor has most of the infrastructural components of a modern fish processing facility already in

place. By moving a refrigerated barge (pictured) to the site, it will allow cold storage to become operational. With the addition of water, generator, ice-making and totes, high-value fresh fish can be purchased from Akobo and local Bor fishermen.

Twelve 1-ton totes are required – six totes with ice only will be shipped to Akobo and exchanged for six totes filled with ice and fish for the return trip to Bor. Twelve 1-ton totes are needed for onward shipment to Juba – six filled with fish and ice southbound; six filled with commercial items returning to Bor. A refrigerated container is required to hold the totes of iced fish in Juba.

This Design of a Fisheries Program in the Sobat River Basin anticipates additional benefits of developing the infrastructure in Bor. Bor is centrally located to receive fish from Akobo as well as from Lakes and Unity States. Those areas have very productive fishing during the rainy season – slow season fishing in the Sobat Corridor. Good access to Lakes and Unity fish will allow the Bor facility to operate year-round. Bor can also be accessed year-round by boat and truck from Juba.

Year Two:

- Install borehole and raised water tank in Nasir for ice-making.
- Purchase 20' refrigerated container for Nasir.
- Purchase 2 – 4 ton ice machine for Nasir.
- Purchase 12 – 1 ton capacity nesting polyfiber totes with lids.
- Purchase generator to power ice machine.
- Construct fresh market in Ulang County.
- Purchase one 20' refrigerated container in Malakal.
- Purchase one 20' refrigerated container to place in Juba.
- Fuel grant to operate equipment.

Year Two recommended infrastructure projects in Nasir are justified because Nasir is the town closest to the best fishing in the Sobat Corridor. Ice-making is required to target the high-value fresh markets that exist in Malakal and the potential markets in Sudan and Ethiopia. Totes are a requirement for the iced fish.

Construction of a fresh market in Ulang County is the next requirement to develop the infrastructure. As more fishers enter the industry, there will be greater need for a hygienic retail market.

A second refrigerated container should be necessary in Juba, as iced fish from the second year of operation in Bor, should be increasing. Iced fish coming from Nasir will require refrigerated storage in Malakal.

Year Three:

- Purchase 1-20' refrigerated container for Malakal.
- Purchase 2 – 4 ton ice machine for Malakal.
- Install borehole and water tank for ice in Malakal.
- Purchase generator to power ice machine.
- Construct fresh market in Juba.
- Construct floating dock or flat barge in Malakal.
- Install borehole in Akobo adjoining fish co-op building for processing water purposes.
- Purchase stainless steel processing tables for value-added options at Bor facility.
- Fuel grant to operate equipment.

Year Three construction of ice-making, ice storage and flat barge or floating dock in Malakal is a necessity.

Malakal is the main port accessible from the Sudan markets. Flat barges or floating docks are the basic infrastructural necessity of ports. (Flat barges have advantages over floating docks. They do not require an environment assessment. They can be relocated as necessary. They can be fitted with unloading equipment and provide a more stable platform for moorage of larger vessels than does a floating dock.) The largest volume of fish from the Sobat Corridor will be transported to Malakal by road or river. As the volume of fish increases, the need for ice and storage increases.

Juba requires a modern hygienic fish market. Currently, fresh fish in Juba are exposed to all the elements that cause rapid decomposition: sun, wind and dirt.

Access to clean water in proximity to the Akobo co-op building will increase hygiene and promote the expansion of value-added products.

D. Investments in Transportation Components

Year One:

- 18 canoes required for 90 local fishers (see above).
- Three motorboats required for 90 local fishers (see above).
- One refrigerated truck capable of transporting six tons. This truck will transport between Bor and Akobo; Bor and Juba.
- One truck capable of transporting dried fish between Nasir and Malakal.
- Fuel grant for outboards (see above).
- The refrigerated truck required for Year One is needed because ice making has come on line in Bor. The Nasir area truck will only transport dried and smoked fish, as no ice making is available in the area.

Year Two:

- Nine canoes required for 45 local fishers (see above).
- Two motor boats required for 45 local fishers (see above).
- Refrigerated container boat for transport between Nasir and Malakal.
- Refrigerated truck capable of transporting six tons between Nasir and Malakal.
- Fuel grant for outboards (see above).

Year Two: refrigerated truck and refrigerated boat are required for the Nasir area. Dry season the roads are usable. Rainy season will utilize the boat. The refrigerated truck can also be used to transport dried and smoked fish in the Nasir area.

Year Three:

- Nine canoes required for 45 local fishers (see above).
- Two motorboats required for 45 local fishers (see above).
- Refrigerated container boat for transport between Nasir and Malakal.
- Refrigerated truck capable of transporting six tons between Bor and Akobo; Bor and Juba.
- Fuel grant for outboards (see above).
- Lease (or purchase) a boat capable of transporting a 20' refrigerated container between Malakal and Khartoum (assuming political situation permits).

Year Three should find Malakal fully capable of supplying iced fish to the markets in Khartoum and Kosti (assuming political situation permits). A boat capable of transportation will be necessary.

The refrigerated truck and boat is necessary for Nasir to Malakal.

E. Investment in Training Components

Year One:

- Training of fishers (see above).
- Training of personnel to operated Bor facilities and refrigerated container in Juba.
- Production of manuals, translations, and posters.

Year Two:

- Training of fishers (see above).
- Training of personnel to operate ice-making operations in Nasir and refrigerated container in Malakal.

- Refresher training for Bor personnel.

Year Three:

- Training of fishers (see above).
- Training of personnel to operate ice-making in Malakal.
- Refresher training for personnel in Bor, Nasir and Malakal.

Year One production of manuals, translations and posters should include materials for years Two and Three.

Training for equipment personnel (not fishers) may include facility tours in neighboring countries.

Fuel Grants to Operate Equipment

A provisional six-month start-up grant for the first year of all new equipment is necessary.

Following the start-up grant, a revolving loan fund should be in place.

F. Income and Expense Proforma

Year One Expenses

Item	Description	Unit	Quantity	Unit Cost SSP	Total Cost SSP	Unit Cost USD	Total Cost USD
I	**Materials & supplies**						
	canoes		18			3,050	54,900
	motorboats		3			5,000	15,000
	outboard		3			5,000	15,000
	Twines & hooks for 90 fishers		90			117	10,530
	processing equipment		90			84	7,560
	Outboard engine gas & 2 stroke oil	litres	3,000	15	45,000		15,000
	smoking units		9			1,000	9,000
	construct Malakal market		1			150,000	150,000
	Rehabilitation of Akobo co-op		1			100,000	100,000
	Generator 40 KVA		1			25,000	25,000
	ice machine		1			18,000	18,000
	install borehole with OH tanks		1			40,000	40,000
	nesting polyfiber totes		24			860	20,640
	Juba refrigerated container		1			18,000	18,000
	Sub-total Materials & Supplies						**498,630**

2	**Travel and Transportation**						
	refrigerated truck Akobo-Bor-Juba		1			36,000	36,000
	dry truck Nasir-Malakal		1			27,000	27,000
	move barge to Bor		1			8,000	8,000
	transportation of equipment		1			35,000	35,000
	SUB-TOTAL TRANSPORTATION						**106,000**
3	**Other Direct Costs**						
	process, accounting and market training for fishers		1			13,000	13,000
	boat maintenance training for fishers		1			7,100	7,100
	refrigeration training		1			4,500	4,500
	International staff for professional management in Bor, Incl house, tax, medical, travel, benefits		1			180,000	180,000
	SUB-TOTAL DIRECT COSTS						204,600
	Grand Total					0	**809,230**

Estimated Year One Income from New Fishers (only)

Location of Sale	Number of Fishers	Fish	Price (SSP)	Total (SSP)	Total (USD)
Ulang	90	2,000	5	900,000	300,000
Malakal	90	2,000	15	2,700,000	900,000
Juba	90	2,000	23	4,140,000	1,380,000

Year Two Expenses

Item	Description	Unit	Quantity	Unit Cost SSP	Total Cost SSP	Unit Cost USD	Total Cost USD
1	**Materials & supplies**						
	canoes		9			3,050	27,450
	motorboats		2			5,000	10,000
	outboards		2			5,000	10,000
	twine & hooks for 45 fishers		45			117	5,265
	processing equipment for 45 fishers		45			84	3,780
	outboard gas and 2 stroke oil	liters	1,500	15	22,500		7,500
	Nasir borehole with O/H tank		1			40,000	40,000
	generator		1			25,000	25,000
	ice machine		1			18,000	18,000
	polyfiber totes		12			860	10,320
	construct Ulang market		1			150,000	150,000
	Malakal, Juba refrigerated		2			18,000	36,000

	containers						
	Sub-total Materials & Supplies						**344,315**
2	**Travel and Transportation**						
	refrigerated container boat Bor and Nasir		2			35,000	70,000
	refrigerated truck for Nasir		1			36,000	36,000
	fuel grants for transporters and refrigeration (cost recovery basis)		1			25,000	25,000
	transportation of equipment		1			20,000	20,000
	SUB-TOTAL TRANSPORTATION						**126,000**
3	**Other Direct Costs**						
	process, accounting, & marketing training for fishers		1			6,500	6,500
	boat maintenance training		1			3,600	3,600
	refrigeration refresher training Bor		1			3,100	3,100
	professional management in Bor and Nasir		1			180,000	180,000
	Sub-Total Other Direct Cost						**193,200**
	Grand Total						**663,515**

Estimated Year Two Income from New Fishers (only)

Location of Sale	Number of Fishers	Fish	Price (SSP)	Total (SSP)	Total (USD)
Nasir Sales	45	2,000	5	450,000	150,000
Regional Sales	45	2,000	15	1,350,000	450,000
Juba Sales	45	2,000	23	2,070,000	690,000

Year Three Expenses

Item	Description	Unit	Quantity	Unit Cost SSP	Total Cost SSP	Unit Cost USD	Total Cost USD
1	**Materials & supplies**						
	canoes		9			3,050	27,450
	motorboats		2			5,000	10,000
	outboard		2			5,000	10,000
	twines & hooks for 45 fishers		45			117	5,265
	processing equipment for 45 fishers		45			84	3,780
	outboard gas and 2 stroke oil	liters	2,000	15	30,000		10,000
	Malakal refrigerated container		1			18,000	18,000
	Malakal ice machine		1			18,000	18,000
	Malakal generator		1			25,000	25,000
	Malakal bore hole with O/H tanks		1			40,000	40,000
	Juba Market upgrading		1			150,000	150,000
	Akobo bore hole with O/H tanks		1			40,000	40,000

	Bor stainless steel processing equipment		1			5,000	5,000
	Malakal dock or flat barge		1			140,000	140,000
	Akobo generator		1			15,000	15,000
	Sub-total Materials & Supplies						**517,495**
2	**Travel and Transportation**						
	refrigerated container boats Nasir/Malakal Khartoum/Malakal		1			120,000	120,000
	refrigerated truck Akobo-Bor-Juba		1			36,000	36,000
	Fuel grants for refrigeration/processing equipment (cost recovery)		1			15,000	15,000
	transport equipment to Malakal-barge, reefer equipment, generator		1			60,000	60,000
	SUB-TOTAL TRANSPORTATION						**216,000**
3	**Other Direct Costs**						
	refrigeration refresher training Bor and Nasir		2			3,100	6,200
	professional management in Malakal		1			200,000	200,000
	Sub-Total Other Direct Cost						**206,200**
	Grand Total						**939,695**

Estimated Year Three Income from New Fishers (only)

Location of Sale	Number of Fishers	Fish	Price (SSP)	Total (SSP)	Total (USD)
Akobo Sales	45	2,800	5	630,000	210,000
Regional Sales	45	2,800	15	1,890,000	630,000
Juba Sales	45	2,800	23	2,898,000	966,000

F. Additional Notes on Conceptual Design

This chapter does not include income in the pro-forma that will be produced by existing fishers. As such, harvest numbers and sales potential in local, regional and national markets should be considerably greater than the figures found in the pro-forma.

Monetary and inkind material support for new fisher groups is only available for the first year of their existence. Likewise, with the exception of refrigeration retraining, it is expected that material and supplies will be funded through grants in Year One, but will be sustained from the fishing entities after the initial investment.

The existing fishing infrastructure between Nasir and Akobo is primed for expansion. CBO's in Akobo are actively promoting growth. Save the Children in Akobo plans to follow on the SSTCM projects. SSTCM has a history of implementing several successful fisheries projects in the Sobat Corridor. CRS, The Borlaug Institute and the Padak Training Center in Bor, are currently involved and have plans for further involvement in fisheries projects. Local government entities have proven responsive to development; state government departments in

Malakal have offered unconditional support for fisheries development.

Coordination between government entities, NGO's, fishers, CBO's and private or the public/private sector will be necessary for the success of this three year project.

The existing infrastructure in Bor is controlled by MARF and Minister Gai has encouraged the formation of a public/private entity.

Fishers, led by coordinators chosen by CBO's, exist in Nasir and Akobo (as well as in Lakes and Unity states) CBO's need to be identified in Ulang County.

The foundation of this project is predicated on increasing fish production. The history of good production and coordination with fishers exists; the model for increasing fisher's participation exists. The funding necessary for increasing fisher participation has been outlined in this report.

Increased fish production justifies investments in training, processing and transportation infrastructure. Transportation associated with the project will stimulate trade and contribute to economic development not just in the Sobat Corridor, but also in several regional states. The pro-forma indicates that this project will contribute to significant economic growth at the local, regional and national levels.

VIII. MAPPING OF STAKEHOLDERS

Multiple stakeholders are currently involved in fisheries: Ministry of Animal Resources and Fisheries, Director General of Fisheries, Director of Fisheries for Jonglie and Upper Nile State, community members, traders, donors, and implementing partners.

A. Government Authorities

The main institutions responsible for fisheries management and development in South Sudan are the Directorate General of Fisheries and Aquaculture Development (DGFAD) within the Ministry of Animal Resources and Fisheries (MARF) and state Fisheries Departments. The Fisheries Administration within MARF, like other administrations, has not been able to discharge its mandatory obligations with regard to planning, policy formulation, training and overall supervision of the sector due to the civil strife and upheaval, which the country underwent for many years.

The Fisheries Administration in South Sudan recognizes the importance of fisheries and aquaculture and their potential to contribute to overarching goals of development. The Administration is committed to working with private investors to sustainably exploit the potential of fisheries.

- Jonglei State MARF Minister Nyang Gai, together with his Director General Dr. Mary and several staff members, has gone out to the Akobo area and met with fishermen, the

Akobo Youth Association, and Save the Children, toured the abandoned fish co-op building, traveled to fish camps, and took note of the various aspects of fisheries program. Recent meetings by the consultant with the minister and staff have repeated the themes of growth and improvements of the fisheries industry in the state as well as strongly recommending that Bor become a focal point for development of value-added processing. The minister is proactive in promoting any program that will stimulate fisheries development in the state. He encourages public/private partnership as the best option for fisheries development. The Mission Statement and functions of MARF is included in Appendix C.

- Upper Nile State MARF Director General of Fisheries Peter Gony encourages research and analysis that would promote an understanding of the current state of fisheries in the Sobat Corridor. He has expressed encouragement, following a visit to the new fish market constructed by the SSTCM program in Nasir, in the progress of a fisheries industry and has suggested for further improvements in processing and delivery points.

- Local Government. Local government authorities have direct communication with communities. They also administer rules and regulations, including access and taxation. They play an important and integral role in the regional economy.

B. Communities and Traders

- Local CBOs. As noted above, local CBOs play an important role in helping to coordinate fisheries groups and act as a liaison with donors/implementers. All future fisheries programs must have support from CSO's as they provide local knowledge of the formal and informal decision making processes that influence the success (or failures) of programs.

    - Akobo Youth Association (AYA) provided invaluable support to the SSTCM project in Jonglei. The coordinator interacted on a daily basis with all participants in the program. He (David Makuach) acted as liaison between payam administrators, commissioner, fisher teams, and SSTCM staff. He promoted and encouraged marketing decisions, proper use of assets, storage and accounting of assets, smoothed the waters in times of crisis. AYA remains involved, and plans to support efforts by Save the Children to work on fisheries in Akobo as part of the USAID Jonglei Food Security Program (JFSP).

    - Other CBOs SSTCM worked with, including the Youth Association for Research and Development (YARD) (formerly UNSYAD) and Nasir Community Development Association (NCDA). Their involvement has been more opaque and their contribution has largely depended on the individual coordinators hired through these CBOs with SSTCM funding during the span of the SSTCM fisheries project.

- Traders. The most aggressive fish traders in the Sobat Corridor – specifically Nasir – are coming from Sudan as they are well-organized and equipped with both ice-carrying and dry boats and trucks. These traders purchase fish from fishers in Upper Nile and

Jonglei States (as well as Unity and Lakes).

Traders come to Akobo on an intermittent basis due to insecurity and unreliable fish production. (The SSTCM project has increased the reliability of fish production, which may encourage buyers to access Akobo on a regular basis).

- Fishers. Fishers are obviously important for their input into the fisheries economy, both as suppliers and as traders. Fishers from the Jikmir area have sold limited amounts of dried and fresh fish into the Ethiopian market at Burbia and brought back goods to trade.

- Businessmen in both Nasir and Akobo sell fishing gear including twine, nets, hooks, knives and other processing equipment.

C. Donors and Implementers

- USAID has supported fisheries in the Sobat Region through its SSTCM project. USAID's JFSP also intends to support fisheries in Jonglei through implementing partners CRS and Save the Children. In addition to the consultancy that resulted in this report, SSTCM has also commissioned a preliminary ecology study to try to begin collecting ecological data. In addition, SSTCM also has fisheries projects in Lakes and USAID supports WCS in its fisheries projects in Gemeiza and Pochalla. USAID also supports the Padak Fisheries Training Center.

- The Padak Fisheries Training Center located near Bor has been rehabilitated recently and serves as the center for training of fisheries trainers. Three-month courses are presented in basic fisheries biology and ecology. Advanced processing techniques, accounting, marketing and fishing techniques constitute the core curriculum. The students are chosen by various administrations. Following graduation, they are sent to villages and fish camps to promote fisheries development.

    - Padak receives support from several sources, most of which is from USAID. The Borlaug Institute provides logistical supplies, such as wheelbarrows for transporting fish equipment, bicycles, boats and vehicles as necessary, books and classroom supplies, and chorkor fish smoking ovens. CRS supports students while they are enrolled. SSTCM rehabilitated the center. At this time, the government is not providing monetary or material supports; the center is dependent on the above named entities for operational funding. Support for the teaching and administrative staff is tenuous. It appears that the continuation of the program is contingent on securing additional funding from sources other than the government.

    - The Borlaug Institute is located on the campus of the John Garang University in Bor. Borlaug supports University fisheries instructors by providing housing and logistical support, as the University currently has no funding. Borlaug has several mandates that include: funding small entrepreneur grants; follow-on fisheries projects in collaboration with Save the Children; start-up trainings that might

include such projects as fiberglass canoe building; and constructing advanced fish smoking ovens.

- As noted above, CRS supports fisheries as part of the JFSP, together with Save the Children, and other projects that support the Padak Center. CRS' mandate allows funding of fisheries projects on a reciprocal basis. Assets may not be provided for free; a payback of some kind is required.

- FAO and UNIDO offer training programs in construction and use of fishing equipment, marketing, processing, value-adding, and business skills. These programs are essential for the development of the industry. Favorable reports from fishing groups that have received training attest to the necessity of greater involvement by FAO and UNIDO. Both agencies have limited resources and trainers and need encouragement from partners/donors to expand their capabilities. Schedules for training need be set well in advance of expected programs because of FAO and UNIDO's limited resources.

- GIZ has funded fisheries projects in several areas of South Sudan. Infrastructure including a fish market, ice making, fisheries training center, marketing education and co-op development was established by GIZ in Terekeka. GIZ constructed a fisheries training center in Nyang, Lakes State, and provided training and assets in Shambe, Lakes State.

- JICA is currently writing a fisheries document that is meant to become the policy guide for the country. JICA's research includes but is not limited to: yearly harvest estimates; market surveys; species identification; import and export analysis; base-line biological data.

- CIDA funded the UNIDO program in Upper Nile and remains engaged in fisheries in the Sobat Region.

(Pisces Aid conducted a fisheries project in the Sobat Corridor from 1992 – 1996. This project is affectionately referred to by Sobat Corridor residents as "Tom's Project." The Tom Murphy family delivered fishing equipment including canoes, to fishers in the Sobat area. "Tom" purchased dried fish from the equipment recipients and delivered the fish to the displacement camp at Waat. It is not known how or if fishers were paid for fish, or received assets in lieu of payment. Several of the canoes are still in use and have been seen as far away as Taiyar in Unity State. The legacy of that project favorably influenced the SSTCM project and the consultant was often asked if he was Tom or is related to Tom.)

IX. CONCLUSION

The Sobat Corridor is rich in under-utilized fisheries resources. The potential for enhancing income, living standards and nutritional status of fishers remains relatively untapped. Training and capacity building are the components necessary to ensure sustainable fisheries and the development of value-added activities in fisheries.

Capture fisheries should be the cornerstone of fisheries policy-making in South Sudan. Unlike aquaculture, which employs few people and requires advanced technological capacity, capture fisheries employ large numbers of participants and requires little technological sophistication. This natural resource does not suffer from depredations common to cattle-rearing or farming. Consequently, it provides food security. Both capture fisheries and aquaculture require transportation to reach markets. However, unlike aquaculture, capture fisheries markets are often in proximity to the place of harvest. Flooding, which causes great damage to other industries, is the lifeblood of the Sobat Corridor. Wet season flooding replenishes and nurtures the healthy wetlands necessary for fish reproduction. Reproduction costs nothing in terms of human resources, yet it produces vast amounts of high quality protein that, when sustainably harvested, will feed a significant portion of the population of South Sudan.

Appendix A

Assets Provided under the SSTCM Fisheries Project

Formed and Engaged Fishing Groups along the Sobat from Nasir (Upper Nile) to Akobo (Jonglei)	➢ Fishing groups in Nasir, Jikmir, Makok, Wanding, Dengjok, and Nyandit. ➢ Fishing groups supported by local community based organizations (CBOs), including the Upper Nile State Youth Agency for Development (UNSYAD), Nasir Community Development Agency (NCDA), Akobo Youth Association (AYA). ➢ Approximately 220 participants selected in collaboration with the local CBOs based on a criteria to engage youth at risk for participating in conflict, including cattle raiding.
Supplied Fishing Gear	➢ Fishing gear included hooks, twine to make nets, knives, plastic buckets, spring balances to weigh fish, plastic sacks, salt, and plastic tarp and mosquito nets for drying and processing. ➢ Other materials included notepads, pens, clear bags, and markers to facilitate record-keeping. ➢ Solar/wind-up radios were also provided to improve linkages with media communication.
Provided Canoes and Boats	➢ 44 fiberglass canoes (with life expectancies of 15-20 years) in total provided to six fishing sites. ➢ Six 19 foot fiberglass motorboats, each with a 15 hp. outboard motor, provided in total to transport fish. ➢ Provided start-up fuel (five barrels) for each of the six motorboats.
Boat Operations and Repairs Training	➢ Trained 18 drivers in a three-day course on basic operations, technical river navigation, and basic motorboat engine maintenance and repair, with a follow-on advanced course. ➢ Trained 12 youths on fiberglass canoe maintenance and repair. ➢ Provided repair tool kits for motorboats and fiberglass canoes.
Constructed Fish Storage Sheds	➢ Fish storage sheds in Nasir, Jikmir, Makak, Wanding, Dengjok, and Nyandit.
Constructed Fish Market	➢ Fish market in Nasir
Constructed Smokers and Drying Cages	➢ Smokers in Jikmir, Makak, Wanding, and Dengjok ➢ Drying cages in Jikmir, Makak, Wanding, and Dengjok ➢ Fish processing training provided

Provided a Floating Dock	➢ Provided a floating dock, as a pilot project, to facilitate the loading and unloading of fish and landing for commercial boats in Nasir, the largest fish market town in the Sobat.
Established Cooperative Income Generation and Distribution	➢ The youths were divided into five-person per canoe teams, with an elected group leader. Coordinators were appointed for each payam by the respective local CSOs that oversaw these teams. In some cases, a committee was supposed to decide where each group will fish, for how long, how profits are shared, how recurrent costs are covered, and how shared costs are covered. This committee provides leadership and decides how the key assets of the program (i.e., motorboat and storage facility) are used to serve the wider group. ➢ A considerable volume of high value fresh fish were transported to the Nasir and Akobo markets by the program's fishing groups. These sales generated cash income, which (in the case of several groups) was being kept by the group leaders to be distributed after decisions on future expenses/investments have been decided upon by the entire group. Similarly, a portion of revenue was retained by the leader in Jikmir for procurement of supplies needed to sustain the group's livelihood.
Support to Fishermen for Record-Keeping	➢ Fishing expert consultant designed and monitored record-keeping and accounting, including of volume of fish caught, processed, and sold. ➢ Team leaders were given additional training in basic accounting and business principles.

Appendix B

Assessment Questions to Determine Appropriate Assets

Basic fisheries programs should first assess the fishing environment. An assessment should address the following questions:

- Will fishing be done in rivers/pools/swamps, or all three? This information will dictate the types of fishing gear that should be made available.

- What are the seasonal changes of the environment? Does the area flood? Does the area dry up – preventing use of boats? Seasonal changes require the availability of transportation and processing options. Shallower boats with smaller engines may be used when river levels fall. As the dry season progresses, river access may decrease but vehicle transportation may become viable. Processing options such as drying may not be possible during the rainy season. Smoking of fish during the rainy season may become practical. Fresh fish delivery options change with seasonal changes.

- What transportation is available seasonally? In the Sobat, transportation by boat is possible in the rainy season, by truck in the dry season.

- Who and where is the market? This influences the type of processing options fishers should target: fresh, smoked or dried. It also dictates the transportation options: trucks, boats, donkey carts, plastic tarp rafts, or carrying on head. High season fishing with large CPUE requires processing that can handle fish quickly so that fish are not destroyed by infestation and rot. This is the season to dry fish. Slow fishing allows time to smoke fish. Marketing high-value fresh fish is influenced by transportation options in both high and low season.

- What species and volumes are currently harvested? This influences the decision about what types of processing should be used and which markets should be targeted. The market needs be researched to find if there is acceptance for the three main methods of processing found in South Sudan. Currently, smoked fish does not have acceptance in the Sobat Corridor markets. With further process and marketing training the valuable smoked options should increase. All species of dried and fresh fish are acceptable in the markets. Distance to markets dictates whether fresh fish should be transported. Fresh fish deteriorates quickly in hot weather.

- Are the fish stocks of commercial quantity or limited to feeding the local population? This dictates the type of quantity of gear that needs be provided. When fish stocks are limited, the number of participants will also be limited. This reduces the need for a diversity of fishing gear. Transportation needs will be minimal, possibly precluding the necessity of providing motorboat or truck transportation.

- Is communication possible? The following may need to be provided: cell phones and money for scratch cards, HF radios, satellite phones and credit, wind-up/solar radios. Access to canoes, boats, and vehicles promotes communication.

- Are CBO's involved? CBO's were critical to the success of the SSTCM program. They provided communication between the fishers, the government, the implementing partner, and the entire community. Their duties spanned all phases of the program (e.g. delivery, storage and record keeping of assets and monies earned). Encouragement and problem solving of fisher groups in times of stress. CBO's need be included in the planning process prior to the initiation of a fisheries project. They can provide the information/problem solving understood by local people.

- Is there support from the local government? Local government cooperation will be required for success. Communication between the implementing organization and the local government must be on-going well before the program is initiated. As the program progresses, local government must be kept in the communication loop. They are integral to the success of the program.

- Are there other current user groups besides the target group? If so, will access to fishing sites be problematic? Prior to the initiation of the SSTCM project, meetings were conducted between the grantee, current user groups and the target groups. Certain fishing areas were traditionally off-limits to certain fishers. This information must be known prior to initiation of the project. All the parties must sit together to find opportunities that will encourage the disparate groups cooperation.

- Does the target group have a fishing history? If so, commercial or artisan? If groups have a fishing history, they will have specific information about gear types they require (or desire). If they are artisan fishermen, the gear types they require will be minimal. All targeted groups will benefit from training in processing, marketing and value-added developments. If the target group has access to commercial markets sufficient to require motorboats for transportation, training in maintenance is essential.

- What are the current fishing assets? This information will guide what assets might be provided. If the fishermen use a certain gear type but need more of the same, the decision making for provision of assets is relatively straight-forward. If fishing equipment needs improvement, providers may find equipment locally or may need to locate equipment from distant locations. This will create delivery complications that must be anticipated well in advance of the program's inception. If markets are available but have not been accessed, transportation choices must be made to enhance market access.

- What are the processing options – what processing is currently in use? Prior to initiating a program, research should be done on how fishers are currently processing. This will guide what materials should be provided. If other processing options exist that will enhance the fishers income, training should be initiated/processing equipment provided that will be usable for what is currently in place and what might be anticipated post processing training.

- Is data available from past fisheries projects in the area? CBO's, local government personnel, fishers, and fish buyers may provide background on past fisheries activities/harvests. The consultant has found that current data does not exist on harvest or biological research.

- What is the security environment? The government, CBO's, community leaders, fishers, and militia members have information on security. Their input is critical to understand the security situation. The security environment will be fluid and current updates required.

Answers to the above questions will provide a starting point for identification of necessary assets. The budget will guide asset procurement.

Appendix C

Ministry of Animal Resources and Fisheries

Mission:

To promote, regulate and facilitate animal production and fisheries, value- addition and access to credit and Regional and International markets for food security, poverty alleviation and socio-economic development, the operation areas in animal Resources and Fisheries Sector.

Functions:

The Ministry of Animal Resources and Fisheries performs the following functions and duties:

1. Formulate legislation, regulations, policies and standards for the development of the animal and fisheries resources of Southern Sudan;
2. Provide policy guidance and monitor performance of livestock and fisheries activities undertaken in Southern Sudan;
3. Protect against environment degradation through pasture and soil conservation through proper usage of grazing areas;
4. Identify and promote investment opportunities in livestock and fisheries in Southern Sudan;
5. Human resource training in the field of animal production and fisheries;
6. Provide technical advice on animal health and disease control policies and introduce plans to improve livestock health and production in Southern Sudan;
7. Encourage the private livestock sector and regulate the delivery of veterinary services and supplies;
8. Monitor and investigate the prevalence, spread and impact of animal diseases in the livestock populations;
9. Support a meat inspection service at appropriate levels of government and the development of abattoirs;
10. Promote and coordinate partnership between public institutions and private livestock owners and operators and provide needed technical assistance for the transformation of traditional livestock practices into a modern market-oriented system;
11. Promote the improvement of fishing and fish processing technologies to improve the quality and quantity of fish catches in Southern Sudan;
12. Ensure the sustainability of the fisheries sector through the development and enforcement of policies and regulations governing the exploitations of fish stocks;
13. Promote and develop aquaculture fish production;
14. Promote effective community-based extension programmes in livestock and fisheries production;
15. Promote the development of bee-keeping industry and other emerging livestock resources;
16. Promote animal welfare; and
17. Provide technical assistance and training to state governments and other local governments to build their capacity.