

PN.ABM-911  
80206

# Conservation for Development in Botswana, Kenya, Somalia, Sudan



---

**Camel Husbandry in Somalia**

**Ahmed Ali Hassan**

**Somali Women in Forestry**

**Amina Warsame**

**Fishing Potential in Somalia**

**Ahmed Abdullahi Yasin**

---

African-Caribbean Institute

Ahmed Ali Hassan's professional qualifications include a M.Sc. in animal science from Southern Illinois University. He is now Head of the Department of Botany and Range Management at Somali National University. His fellowship research centers on finding ways to improve camel management and nutritional systems in the central rangelands of Somalia, on behalf of achieving environmentally sustainable increases in the production of this animal which is so vital to the Somali people.

Amina Mohamoud Warsame, from the Somali Academy of Arts and Sciences, is exploring the actual and potential involvement of women in utilizing and protecting the country's endangered forest resources.

Ahmed Abdullahi Yasin obtained a Diploma of Marine Science from Tallin Marine College and a Post Graduate Diploma in Fishing Gear Technology from Grimsby College of Technology. He is now Deputy Manager of Fresh Water Fisheries in the Somali Ministry of Fisheries and Marine Transport. Mr. Yasin's fellowship research proceeds from the premise that Somalia's inland fisheries constitute an extremely important, but until now underutilized and yet potentially overexploited, natural resource. Examining the fish and fishermen of the upper and lower Shabelle River, Mr. Yasin is attempting to find ways of maximizing sustainable fish yields on behalf of increased food production, incomes, and employment. Just underway, this research is intended to follow up on the work of an Inland Fisheries Development and Extension Project, which the Ministry of Fisheries and Marine Transport conducted on a pilot basis between 1986 and 1989.

**African-Caribbean Institute  
African Natural Resources Fellowship Program  
Working Paper Series**

**CONSERVATION FOR DEVELOPMENT IN  
BOTSWANA, KENYA, SOMALIA, AND SUDAN**

**Edited by  
Rodger Yeager**

<b>Milk and Meat Production from the Camel: The Somali Experience Ahmed Ali Hassan .....</b>	<b>1</b>
<b>The Role of Somali Women in Forestry: Key Issues in Forestry Assistance Programs Amina Mohamoud Warsame.....</b>	<b>5</b>
<b>Inland Fishing Potential in Somalia Ahmed Abdullahi Yasin.....</b>	<b>9</b>

## FOREWARD

This publication is a part of a larger body of materials from eight authors in eastern and southern Africa that have been sponsored by the African-Caribbean Institute's Natural Resource Project. The combined works are in three main sectors. Papers by Betty Wamalwa and Mutasiin El Moula focus on traditional institutions in environmental management in Kenya and Sudan. Papers by Mohamud Jama, Ahmed Yasin, Ahmed Hassan, and Amina Warsame are concerned with specific sector issues in energy, dry land fishing, camel husbandry, and women in forestry in Kenya and Somalia. The final section by Eagilwe Segosebe and Alawiyya Ahmed concerns modern industrial waste management problems in Botswana and finally the important issues of environmental education in Sudan.

Further studies will focus on issues of forestry and women and the preservation of biological diversity in eastern and southern Africa. As with the projects that are nearing completion or currently underway, the African-Caribbean Institute will edit, publish, and disseminate the works. This commitment and all other aspects of the African Fellowship Program are intended to serve ACI's ultimate goal of assisting in the quest for genuinely African solutions to African problems of resource conservation and development.

In addition to those who participated in the project, the African-Caribbean Institute wishes to thank Dr. Richard Ford of Clark University who served as Senior Natural Resources Advisor and the national advisers in each country. We are also grateful to John Gaudet and John Koehring at USAID and to Diane Rocheleau and Eric Rusten of the Ford Foundation for advice and support.

At Dartmouth College the Environmental Studies Program under the direction of Dr. James Hornig has provided project support. Betty Ann Miller is acknowledged for her excellent production management as is Bonnie Stone for her professional assistance in publishing the text.

Norman N. Miller, President  
African-Caribbean Institute

Published by the  
African-Caribbean Institute  
© 1991 ACI

All Rights Reserved  
Printed in the United States of America

No part of this publication may be used or reproduced in any manner whatsoever without written permission, except in cases of brief quotations embodied in critical articles and reviews.

For further information, contact:  
African-Caribbean Institute  
4 West Wheelock Street  
Hanover, New Hampshire 03755 U.S.A.

**MILK AND MEAT PRODUCTION FROM THE CAMEL:  
THE SOMALI EXPERIENCE**  
Ahmed Ali Hassan

## **INTRODUCTION**

The camel plays an important role in the subsistence lives of the Somali nomadic pastoralists, providing them with food, power, and money. Camel milk is a major part of the Somali diet and the meat is eaten as well. Adult camels are used for transportation, as well as for drawing water from deep wells, milling oil from sesame seeds, and other tasks. Somalia has one third of the world's camels, and each year a significant portion of the nation's GNP comes from the sale of camels to Arabian Gulf countries.

The total land area of Somalia is 637,000 sq.km of which more than 80% is arid or semi-arid rangeland, used exclusively for grazing. Most of the country receives less than 500 mm of rain each year, and the rangeland is the driest area. The wet and dry seasons are controlled by monsoon winds. From late December to March is the driest time of year. The heavy rains come during "gu," a rainy season that lasts until May. June through August is again dry, ending in the small wet season known as "deyr."

Animal husbandry is the main occupation of the nomadic pastoralists who make up 60% to 70% of the population in Somalia. The animals raised by the nomads are primarily camels, cattle, sheep and goats which together total about 42 million head. The camels in Somalia are estimated at over six million, the largest population in the world.

Camels are well adapted to Somalia's harsh environment. A camel can last for over two weeks without drinking water, and can, without harm, lose up to 30% of its body weight through dehydration. Such water losses would be fatal to humans and most other animals. Camels can also eat plants that are generally unpalatable or indigestible to other domestic animals, a great asset in the scrubby rangeland. During the dry seasons camels have lower mortality and higher milk production than other livestock. The importance of camels in Somalia has focused attention on research into improving traditional camel raising.

## **CAMEL MANAGEMENT**

Traditional camel pastoralism is a successful system in Somalia's dry environment (Reusse 1982). Nomads free-graze their camels, moving according to the availability of browse and water. During the dry seasons they bring the camels to rivers or areas with perennial wells. As the local vegetation is consumed, the nomads move again, often towards the coastal regions that receive more rain. A group of nomads and their camels can move as much as 400 km from wet season to dry season grazing areas. One of the major concerns for the nomads is fulfilling the camel's salt and mineral requirements. In the dry season the herds must often be taken to salt wells, but during the wet season salt is obtained from the browse.

In the wet season the nomads and camels migrate away from the rivers to the shrub rangeland, in order to avoid tse-tse flies and other disease bearing pests. During this time milk production increases. Milk surpluses and some animals are sold at local villages for money to buy sugar, rice, cloths and other products.

Problems the nomads face in camel management include camel diseases, poisonous plants and predation from hyenas. However the main problem is the shortage of browse and water during dry seasons and droughts. The success and failure of camel pastoralism in Somalia is generally dictated not by humans, but by the harsh and highly variable environmental conditions prevailing in the country. And yet camels have enabled the nomads to live in this difficult environment, while at the same time furnishing the people with a source of high quality animal proteins.

## **MILK PRODUCTION**

Camel's milk is the main component of the diet for the majority of the nomadic pastoralists in Somalia. As shown in Table 1, camels produce more milk than other types of domestic animals in Somalia.

**Table 1. Total Somali Milk Production (Liters/yr)**

Camels	864
Goats	596
Cattle	470
Sheep	337

Source: Ministry of Livestock, Forestry & Range, 1987/88.

In Somalia a lactating camel produces an average of 5 kg/day of milk (Rossetti & Congui 1955); however accurate figures are not available for the amount of milk consumed by the calf, and only 1-4 kg/day may be available to the nomads (Yagil 1982). The lactation period varies widely with season and management practices, and can last from 8-18 months (Mares 1954). A calf is born every 24 months, and the lactation cycle repeats.

In general, the milk yield reaches its peak in the first several weeks and then declines gradually. A Somali camel is normally milked twice a day, just after sunrise and about 2 hours after sunset. But the frequency of milking may be increased to 3 to 4 times per day during the favorable seasons and in early lactation, or when milk markets are nearby.

Camel milk is cherished throughout Somalia and is generally preferred over the milk of other species of domestic animals. The nomads believe that it has healing properties and so it is often given to sick people. Camel milk is usually consumed fresh, but surplus milk can be fermented either to a slightly sour state (Suusac) or to a very sour condition (Karuur). In Somalia it is not processed to butter or cheese (Hashi 1984).

Camel milk has a higher water content than does the milk of other livestock. This allows the nomads to survive primarily on milk, without additional drinking water.

When a lactating camel is deprived of water, the water content of the milk actually increases from 84% to 91%, allowing both the calf and the nomads to survive dry seasons.

### MEAT PRODUCTION

Camels are well liked for their tasty meat by all Somalis. Slaughtering of mature camels is not a common practice among the nomads except on certain occasions such as festivals, marriages, births and in treating injuries. During drought periods, camel calves are slaughtered at birth to produce meat and milk for family consumption. Castration of males is a practice which is usually employed by the nomads for fattening animals destined for market.

Liveweight statistics of camels in Somalia are scanty and vary greatly with the variety of camel and the climatic condition. In the south, where Benadir camels are common, an average adult male may weigh 554 kg, and an average adult female 514 kg. In the northern parts of Somalia, the typical camel weighs 350-400 kg. Saleable meat makes up 43% to 46% of the live weight (Congui 1953). The camel plays an important role in satisfying part of the local demand for animal meat. Table 2 shows the contribution of camels to the meat supply of Somalia.

**Table 2. Number of Animals Slaughtered in Municipal Abattoirs**

	1985	1986	1987
Cattle	130,196	112,923	106,206
Camels	106,890	103,099	84,994
Small ruminants	838,990	723,461	563,094

Source: Ministry of Livestock, Forestry & Range, 1987/88.

Camels are exported to some Arabian Countries, chiefly Saudi Arabia, Yemen and Egypt. These sales are an important fraction of the GNP of the country, and a source of hard

currency. Table 3 shows the numbers of camels and other livestock exported over a three year period.

**Table 3. Somali Livestock Exports (1,000 Head)**

	1985	1986	1987
Goats	749	860	971
Sheep	709	840	971
Cattle	42	67	92
Camels	7	14	21

Source: Ministry of Livestock, Forestry & Range, 1987/88.

## CONCLUSION

Somali nomadic pastoralism is considered to be a successful system of camel management. It has developed to respond to the seasonal environment of the semiarid rangeland. But it is well understood that the full economic potential of the camel in Somalia is yet to be realized. Milk production and animal growth are limited primarily by lack of water and forage. And yet in recent years, milk and meat consumption in Somalia have increased substantially as a result of the exploding human population. The camel, if efficiently managed, could be utilized to furnish a significant portion of the proteins necessary for humans.

Before camel productivity in Somalia can be improved, there is an urgent need for better management of the grazing and water supplies in the country together with an improvement in the camel husbandry practices. Developing better feeding strategies of the camel is a prerequisite for any improvement in milk and meat production. The government of Somalia has recognized the importance of the camel to the nation and has encouraged the improvement of camel husbandry through development projects and research. Current research includes studies on all aspects of camel husbandry in Somalia, including: meat and milk production, feed and nutrition, major diseases, reproduction, breed characteristics, and socio-economic and cultural aspects. This work has been undertaken in the last several

years and concrete results have already been achieved in some aspects.

In conclusion, there is not a single approach regarding the improvement of camel productivity in Somalia. Instead, all the available resources and knowledge must be pooled together in order to maintain and gradually improve the traditional camel pastoralism in Somalia to take full advantage of this unique animal which produces milk, meat and other by-products in an environment where other domestic animals often cannot survive.

## BIBLIOGRAPHY

- Congui, S. 1953. "Indagini sul Macello, Sulla Distribuzione Ponderale e Sulla Correlazione Fra le Diverse Parte del Corpo del Dromedario Somalo," Zootec. e Vet. 8:188-191.
- Cozzi, P. 1965. "L'alleuamento del Bestiame in Somalia," Riv. Ag. Sub. Trop. 59:4-6.
- Hashi, A.M. 1984. "Milk Production of the Camel," Camel Forum, Working Paper No. 6.
- Knoess, K.H. 1977. "The Camel as Meat and Milk Animal," World Animal Rev., 22:39.
- Mares, R.G. 1954. "Animal Husbandry, Animal Industry and Animal Disease in the Somaliland Protectorate; Parts 1 and 2," Brit. Vet. 110 (7): 422-423, 470-481.

Ministry of Livestock, Forestry and Range.  
Somali Livestock Statistics. 1987/88.

Reusse, E. 1982. "Somalia's Nomadic Livestock Economy: Its Response to Profitable Export Opportunity," World Animal Rev., 43:2-11.

Rossetti, G and S. Congui, 1955. Zootechnical and Veterinary Investigations on the Domestic Animals of Somalia. Ispettorata Veterinario, Amministrazione Fiduciaria Italiana della Somalia, Mogadishu.

Yagil, R. 1982. "Camels and Camel Milk," FAO Animal Production & Health Paper No. 26. Rome.



**THE ROLE OF SOMALI WOMEN IN FORESTRY:  
KEY ISSUES IN FORESTRY ASSISTANCE PROGRAMS  
Amina Mohamoud Warsame**

## **INTRODUCTION**

In Somalia there is no doubt that trees are indispensable to the life of the people, but when deforestation occurs and when there is a shortage of forestry products, women feel the effects more directly than men. In rural Somalia it is the women who gather wood for fuel. Trees also provide a source of fruits and nuts, medicines, dyes and animal fodder, all of which are harvested by women. Many of the household items women use, as well as building materials, also come from trees. Trees planted in the house compounds provide shade and shelter for young children while the mothers attend to their many chores. These are but a few of the uses of trees; there are many more.

Because of their dependence on trees, women are likely to be receptive to forestry assistance programs. Even before a forestry program is implemented, some women respond actively to the increasing scarcity of forest resources. Women in refugee camps provide one example of this response. One report from Qoryooley tells how one particular woman planted many trees in her compound for fuel wood and building materials. Other women in the camps bought wood from her. This woman is said to have come up with the idea of planting trees when she recognized the shortage of wood products and its impact on her life. The report states that she rarely went out to collect fuel while other refugee women often had to travel long distances to collect firewood.

Women are considered by project staff to be an indispensable force in forestry programs. "They work more, accept work for food programs easily and are always there when most men leave villages and migrate to urban centers" said one Somali governmental official. In another instance a forestry officer, writing on recommendations for nurseries, stated that "a permanent nursery should never be established far from a good source of part-time labour. Women are especially effective in nursery work and cause less damage to planting stock than men." But using women in forestry projects such

as nurseries is not necessarily the same as assisting them. While, for example, women are readily hired as cheap labour, few programs in Somalia take the pains to train them for managerial positions.

## **THE ROLE OF THE SOMALI GOVERNMENT IN FORESTRY**

Since the early 1960s deterioration of the Somali environment from the cutting and burning of green trees for charcoal, as well as over-grazing by livestock, have demonstrated the need for government involvement in environmental protection. Measures were taken such as passing laws to control the use of forest and range land, to promote sand dune stabilization, and to name April 17 as the day for afforestation. But much of the legislation which is meant to protect wildlife and forests is outdated, weak and badly enforced.

In consideration of the importance of the forestry sector, the government presented clear strategies and policies in its five-year National Development Plan (1987-91). These policies have the general objective of ensuring an adequate and constant supply of forest products by promoting the active participation of the public in conservation and development effort. Several activities aimed at fulfilling these objectives have been undertaken, including the development of nurseries and plantations, watershed protection projects and anti-desertification activities, as well as training and research.

Despite these activities there are many constraints that hinder forestry development in Somalia. These include the shortage of trained staff and the lack of knowledge about forestry in general. Equally important is the lack of financial support which results in a dependence on foreign aid for forestry assistance projects. This often leads to projects with short time spans, a situation which is not productive in an arid environment like Somalia.

If the government objective of ensuring an adequate and constant supply of forest products

is to have any meaning, a conscious effort must be made to promote the active participation of women in all forestry schemes in the country. However, encounters with forestry personnel often demonstrate a strong bias against the involvement of women in all but the lowest levels of forestry. In general the feeling is that forestry is a male field and that men should supervise the women in forestry projects. Such a bias seems to be demonstrated in field projects as well as in forestry education.

Discussions with forestry project staff gave the impression that when projects were being planned, the primary community contacts were with male elders. These elders consulted with other men to come to a conclusion as to what would be best for the community. But such a system does not necessarily account for the needs of the women in the community, because the uses of forest products by men are often different from those of women. This approach of contacting only the male elders in a community is often reinforced because the project staff are themselves mostly men.

One promising development regarding the participation of women in forestry projects is the establishment of the Family Extension section of the National Range Agency. The National Range Agency, part of the Somali Ministry of Livestock, Forestry and Range, is the main public institution responsible for forest resources in the country. The staff of the Family Extension service is made up of women, and these female extension officers have resolved to make up for the many years in which rural women were overlooked. "We now meet women elders and ordinary women and discuss with them about their problems" said one extension officer. Another promising undertaking is found in Gendershe (see box on the following page).

The opportunities for women in forestry are diminished by their lack of education. But women find it difficult to gain a forestry education in Somalia. Institutional structures can prevent women from gaining an education. For example, the Afgoi Forestry and Wildlife Institute, a component of the British Forestry Project, was started in 1987 for secondary school graduates. Initially the program was a two year certificate course. But beginning in 1989 the program shifted to concentrate on diploma

courses for staff members already in service. In the first two years 140 students graduated from the Institute; all were men. Despite assurances that there is no policy which explicitly excludes female students, such a record may reflect an institutional structure that does effectively prevent women from gaining a forestry education. And with the new structure of the program it will be even harder for people not already in the field of forestry to get an advanced education.

Despite the efforts of the different forestry projects staff, there is still a lack of recognition on the part of the community that individual actions create the larger environmental problems of desertification and deforestation. The difficulty an individual has in obtaining firewood is related to the wider issues of deforestation, but at the same time a woman who desperately needs firewood for fuel will not hesitate to cut down a tree. This will add to the crisis in the future, and the vicious cycle of degradation continues.

#### KEY ISSUES AND RESEARCH PRIORITIES

To more fully understand women's role in forestry assistance programs, it is necessary to examine their dependence on and access to the forest resources that are available, as well as their participation in every phase of forestry projects. In Somalia the most important issues surrounding the study of women in forestry are the recognition of the twin problems of environmental degradation and poverty, and the acknowledgement that women are part of the solution to Somalia's environmental problems. Priorities for research into the role of women in forestry assistance programs include studying:

- the division, by gender, of labor in forestry activities and uses of forest products,
- the differences between the forestry needs of refugee populations and resident populations,
- the forestry training and education opportunities available to women,

- the effectiveness of female extension officers, and the opportunities for women to become extension agents,
- the assessment of the impact of forestry projects on the income, time allocation and work load of women.

### Gendershe Case Study

Gendershe is a coastal village 45 km from Mogadishu. A plantation was established there, with funding from 1986 to 1989. Because the plantation was a success, the project was extended from a pilot project of a few months, to a three year program. The Gendershe plantation project was part of a wider coastal revegetation program extending along 70 km of coast, stretching from Gezira to Merca. The specific objectives of the plantation program were:

- a) to arrest the progressive deterioration of the land in the coastal strip by restoring vegetation cover,
- b) to prevent the further movement of sand dunes in the area,
- c) to provide wind breaks and shelter-belts in the area, thereby protecting areas further inland,
- d) to provide a better habitat for wildlife to encourage their increased population in the area, both in number and species,
- e) to alleviate the threat and destructive effects of floods,
- f) to provide fruit which not only increases income, but also enhances general nutrition and health.

To facilitate these objectives, the project established a nursery with a capacity of 40,000 trees per year. The trees grown included: coconut, *Casurina equisetifolia*, *Conocarpus lancifolia*, *Acacia molifera*, *Zizyplus Maritiana*, *Acacia nilotica* and *Leucaena*. Altogether the number of surviving trees in 1989 was approximately 60,000 in the biggest site. There were two smaller sites in nearby villages.

The staff of the project in Gendershe site consisted of eighty people, sixty of whom were women. The men drew the water from the wells, managed the nursery and brought in the soil. The women, on the other hand, took the lion's share of the work of watering the plants. Each woman had a small clay pot (Ashuun) with which she watered the tree seedlings. As women are the traditional pot makers, some village women found a new market for their pots because of the plantation project.

The permanent staff were given 180 shillings a month as payment, plus rations from the work for food program. Every month each worker was given the following food items: 60 kg maize, 5 kg oil, 2 kg sugar, 5 kg powdered milk, 4 kg peas. The monthly payment, meager as it might look, was a great assistance to the laborers, considering the high price of food stuff.

Nursery management was taught to the staff, and almost everyone knew how to plant and take care of seedlings. The project coordinator was also given six months of training in forest related issues. But, with the exception of a female manager for the coconut trees, all the supervisors (Hor-joogayaal) were men.

## RESOURCES BIBLIOGRAPHY

Buck, L, Agroforestry Extension Training Resource Book, CARE International, New York, 1988.

Cook, C., and M. Grut, Agroforestry in Sub-Saharan Africa, World Bank, 1989.

Dankelman, Irene, and Joan Davidson. Women and Environment in the Third World: Alliance for the Future. Earthscan Publication in association with IUCN, London, 1988.

Food and Agriculture Organization (FAO) & Swedish International Development Authority (SIDA). Restoring the Balance: Women and Forest Resources. FAO, Rome, 1987.

This provides an introduction to the importance of forest products to women, the problems women have in obtaining these products, and an outline of what can be done to improve the situation. Short case histories are also included from Cape Verde, China, Honduras, India, Indonesia, Jamaica, Korea, Sudan and Thailand.

Food and Agriculture Organization (FAO). Tree Growing by Rural People. FAO Forestry Paper 64, Rome, 1985.

Guyer, Jane I. "Women's Role in Development" in Strategies for African Development, R. J. Berg and J. S. Whitaker eds. University of California Press, Berkeley, 1986.

Overholt, Catherine, et al., eds. Gender Roles in Development Projects: A Case Book. West Hartford, CT: Kumarian Press, 1985.

Östberg, Wilhelm. We Eat Trees: Tree Planting and Land Rehabilitation in West Pokot District, Kenya, A Baseline Study. Forestry, Trees and People, FAO/SIDA. Working Paper 82, International Rural Development Centre, Swedish University of Agricultural Science. Uppsala, 1988.

This case study provides background information for forestry development projects in the semi-arid West Pokot District of Kenya. The forestry activities of women's groups are described. An extensive reference list is included.

Rocheleau, D. E., A Community-Based Approach to Agroforestry Research and Development, Ford Foundation, Nairobi, 1988.

Rocheleau, D. E., F. Weber, and A. Field-Juma, Agroforestry in Dryland Africa, International Council for Research in Agroforestry, Nairobi, 1988.

This book is a practical guide to developing agroforestry practices suitable for the subhumid and semi-arid regions of Africa. It contains planning methods, agroforestry techniques, species lists, examples of questionnaires, and good references.

Rojas, Mary. Women in Community Forestry: A Field Guide for Project Design and Implementation. FAO, Rome, 1989.

This manual has guidelines for observing what women are doing, asking the right questions, and involving women in forestry projects.

Wachiira, K. K. Women's Use of Off-Farm and Boundary Lands: Agroforestry Potentials, International Council for Research in Agroforestry, Nairobi, 1987.

van der Borg, Brigitte, ed. Women's Role in Forest Resource Management: A Reader. Regional Wood Development Programme in Asia, Project Working Paper No.1. FAO, Bangkok, 1989.

This is a compilation of articles on important aspects of women in forestry. It has background information on the design and implementation of forestry activities that involve women. The collection includes Restoring the Balance: Women and Forest Resources (see reference 4).

## INLAND FISHING POTENTIAL IN SOMALIA

Ahmed Abdullahi Yasin

### INTRODUCTION

For thousands of years, man has gradually increased the productivity of the land by improving methods of horticulture and animal husbandry, and by utilizing terrestrial resources such as forests, water, wildlife, and soil. However, in recent years, land use has intensified and access to resources has increased. Such pressures cannot be allowed to go unnoticed as the natural resources become scarce and require careful management.

Farmers and pastoralists in many countries have enjoyed the advantages of scientific research projects which have been sponsored by a variety of governmental, commercial, and educational institutions. However, in the field of fisheries, and especially inland fisheries in Africa, there have been relatively few studies of traditional fishing practices and local consumption preferences, or of fish habitats. The importance of freshwater fisheries is particularly slow to be recognized in nations such as Somalia, where the traditions of inland fishing have been limited to a small percentage of the population. However, studies are suggesting that freshwater fishing may be a greatly underutilized resource and one which can improve both nutrition and income for a number of rural communities.

Production from Somalia's freshwater resources constitutes a base for providing both food and income. But the aquatic system which supports such resources is under increasing pressure from competing claims, including settlements, expanded use of water for irrigation, dam construction, and toxic buildup from fertilizer and pesticide residue. This pressure often conflicts with the interests of fisheries, especially by producing changes in the quantity and quality of the resource in question. The development and sustainability of fisheries under such conditions become not only a problem in terms of the continued provision of food at optimum yields, but also in terms of maintaining a viable environment.

The proper management and exploitation of aquatic resources requires a high level of

information, which is, unfortunately, lacking in most third world nations. To compensate for this information gap, a need exists to learn from direct field experimentation and research, working directly with rural communities and introducing environmentally sustainable approaches and technologies which these communities can use. This is especially true in Somalia, where it is estimated that some communities could derive as much as 50 percent of their protein from freshwater fish. Such high quality protein could be extremely useful in reducing malnutrition, but because inland fisheries supply only the domestic market and contribute little for export, most developing countries give low priority to the freshwater sector.

### SOMALIA'S FRESHWATER ENVIRONMENTS

Somalia has two main rivers, several artificial reservoirs, and many swamps (deshegs), all of which are rich in fish and have not been fully studied or exploited. Both rivers, the Shabelle and the Juba, originate in the Ethiopian highlands and flow in a generally southerly direction across Somalia toward the Indian Ocean. The Juba enters the Indian Ocean at Gob-weyn estuary near Kismayo. The Shabelle does not reach the Indian Ocean, but ends in an inland wasteland near Hawai, 120 km north of Kismayo.

A survey on the Juba River showed very little fishing on the river itself, but high levels of activity in the adjacent swamps. This pattern occurs in many African flood plain fisheries because most of the fish disperse to the swamps during the high water periods, and also because strong currents in the rivers do not allow the nets to be set in the main channels at those times. During the low water seasons some fishing does occur in the main channel of the river. The primary fishing zone of the Juba extends from Sakow south to the mouth of the river. On the Shabelle, fishing activity is concentrated in the area from the Jowar region down-stream.

Developing a freshwater fisheries is a complex undertaking in the semi-arid environment of Somalia. Very few species are adapted to survive desiccation. Annual losses of fish trapped in temporary water sources are enormous. However, some fish are more adaptable to harsh environments than others. For example, the lung fish buries itself in a pool of mud and secretes a cocoon of hard slime in which it rests, coiled, so that the mouth is upward and connects to an air passage. The *Clarias*, a catfish, takes refuge in the soft muck of dry swamps and pools, or seeks out wet sand where it can survive by breathing air. Thus, it is clear that some species are adaptable to the difficult environment of Somalia.

Seasonal fluctuation is an important element in fisheries project planning. Fish reproduction is heavily dependant on the season and is especially sensitive to temperature and water flow conditions. In Somalia, spawning may occur at low or rising water (September to November, or April to June) or at peak flood (December and July), depending on the species. But rarely does spawning take place during falling water levels. If the rains are unreliable or inadequate and the flood cycle is interrupted, spawning may be interrupted and the hatch reduced. With high and constant temperatures, hatching is rapid, while lower or inconsistent temperatures reduce hatching. Furthermore, the timing of hatching is closely related to water temperatures.

Feeding also follows seasonal cycles. The best breeding habitat rarely coincides with the best feeding zones, so most fish species found in Somalia have two distinct centers of concentration, and migrate between breeding and feeding grounds during the course of the year. These shifts can be over long distances, and are usually either longitudinally, within the main channel of the river, or laterally, between the floodplain and the main channel.

Most Somali fishermen work only during part of the year. When the floods begin to rise, they generally remove their fishing gear from the water and wait until the crest of the flood has passed. From December to April, with falling water levels, they fish actively and the season is highly productive. Men spend much of their time setting traps, repairing gear,

and building boats, while the women help with curing and marketing the catch. The fishing gear most commonly is comprised of gill nets with 60 mm to 153 mm mesh, local traps, and long lines. When the rains come and the fishing yields drop, the fishermen become farmers and till their fields, obtaining harvests from the land while the fish breed and multiply.

## DEVELOPMENT OF FRESHWATER FISHERIES

The first feasibility study of Somali freshwater fisheries was undertaken in 1983 by the Ministry of Fisheries and Marine Resources. The project focused on the area around Lugh, along the northern stretches of the Juba River, and demonstrated that Somali freshwater fisheries can be developed with inexpensive techniques. The survey also showed that there are 13 different freshwater species, including prawns available for development.

Following that success, the Ministry of Juba Valley Development, in a cooperative effort with the United States Agency for International Development, established the Juba Development and Analytical Studies Program. Within this program, a three year project assessing the environmental impacts of a proposed Juba River dam was undertaken. The overall goal of the project was to assess the status of freshwater fisheries in the Juba Valley. Specific objectives were to estimate the present economic value of the Juba River fisheries and to estimate the potential fish production in the new reservoir, as well as to forecast effects on fish populations downstream of the new reservoir.

In 1986, inland fisheries development and extension projects were established within the Ministry of Fisheries and Marine Resources. The extension work aims toward organizing and training communities along the rivers, testing fishing gear for freshwater uses, and developing markets for fish.

Fisheries development projects have demonstrated that fish can be caught in Somali rivers using simple and inexpensive methods. Further, it has been shown that the populations along the rivers will accept fish as food. The fishermen engaged in fishing activities regularly and maintained their gear.

Most importantly, fish is readily marketable, providing fishermen with a cash income and the community with a wider economic base.

Research on other African rivers has shown that a positive relationship exists between basin area and annual catch rates. By applying similar calculations to Somali rivers, which have a total channel area of 18,900 ha, it has been calculated that the annual catch could reach 4,646 tons. In addition, both major rivers in Somalia feature extensive flood plain complexes. In particular, the area of the lower Shabelle has been calculated at 62,00 ha. The floodplain areas of 12 similar African rivers average only 49.5 kg/ha. It may be estimated that the potential average catch from the river and flood plains of the Juba and Shabelle could be in the region of 10,000 to 18,000 tons per year.

## AQUACULTURE

The aim of fish-culture is to stock and utilize fish with greater intensity than can be achieved in wild populations. Controls can be gained over growth, quality, and quantity, as well as ecological impacts, and sustainability. Further, the goal is to utilize production with a minimum of investment so as to maximize returns to the fishermen. Natural and artificial ponds, running and stagnant water, natural rivers, and irrigation canals may all be used for aquaculture. Despite the considerable adaptability and flexibility of certain fish species, it is a further challenge to match these species to particular conditions and varieties of the water. In order to support fish-culture production, the following species variables must be considered:

- 1) ability to withstand the climate of the region in which it will be cultured;
- 2) ability to thrive on food other than that found in the natural habitat;
- 3) flavor, texture, durability in transport, and ease of preparation that please the consumers;

- 4) ability to thrive in conditions of high density populations within restricted areas;
- 5) adaptability to artificial breeding and live transportation;
- 6) resistance to disease.

Several species are particularly well suited to fish farming in Somalia. These include *Clarias*, *Tilapia*, *Labeo*, and prawns. The least important of these is *Labeo*.

The African catfish (*Clarias*) is popular for farming because it grows fast, is productive, and is resistant to disease and problems of handling. It can be transported long distances without water. It can survive in water with low oxygen, an environment not suitable to many other fish. In terms of market popularity, *Clarias* brings high prices with a low feeding cost because it eats insects, worms, crustaceans, decomposing organic matter, fish meal, rice, and bran. Reproduction of the *Clarias* begins at the beginning of the rainy season. As river levels rise, spawning takes place among large schools of adult males and females in the shallows, along the edges of rivers, reservoirs, swamps, and lakes. This species is considered to be the easiest to raise in Somali aquacultural systems.

Species of the genus *Tilapia* are found in the lakes of many African nations. These fish are easily transported as they can withstand high water temperatures and their respiratory demands are low. The optimum temperature for development is 20°C to 30°C, although some species can grow in temperatures down to 12°C or 13°C. Certain species of *Tilapia* can also adapt to brackish water. *Tilapia nilotic* is one of the most common and readily available species in Somalia.

Species of prawns are also suitable for aquaculture. They live in brackish water in the larval stage and as they mature they migrate upstream. Prawns are distributed throughout the tropical and sub-tropical regions of the world, and more than 100 species are known to exist. Somalia, being tropical and having warm inland waters, as well as brackish waters along the coast, enjoys a good potential for prawn production. Some species are found in the Juba

River, its irrigation channels, and its estuary. The latter is now one of the most important sources of prawns in Somalia.

## CONCLUSIONS

There are several compelling reasons to develop freshwater fishing resources in Somalia. Aquaculture in particular is considered to be an important option for Somalia for the following reasons:

- Several species exist locally which, if properly managed, can be turned into valuable commercial products.
- Both of Somalia's major rivers exhibit considerable seasonal fluctuation. Thus, for a year-round fishing industry, the rivers cannot provide a sustainable source of fish and aquaculture is an important alternative.
- Often, fish produced through aquaculture are healthier and grow faster than those caught in rivers and seas.
- The more Somalia increases fish production, the more the economy will stabilize and protein deficiencies will be reduced.
- Increases in aquaculture will contribute to a more integrated use of Somalia's very scarce land and water resources.