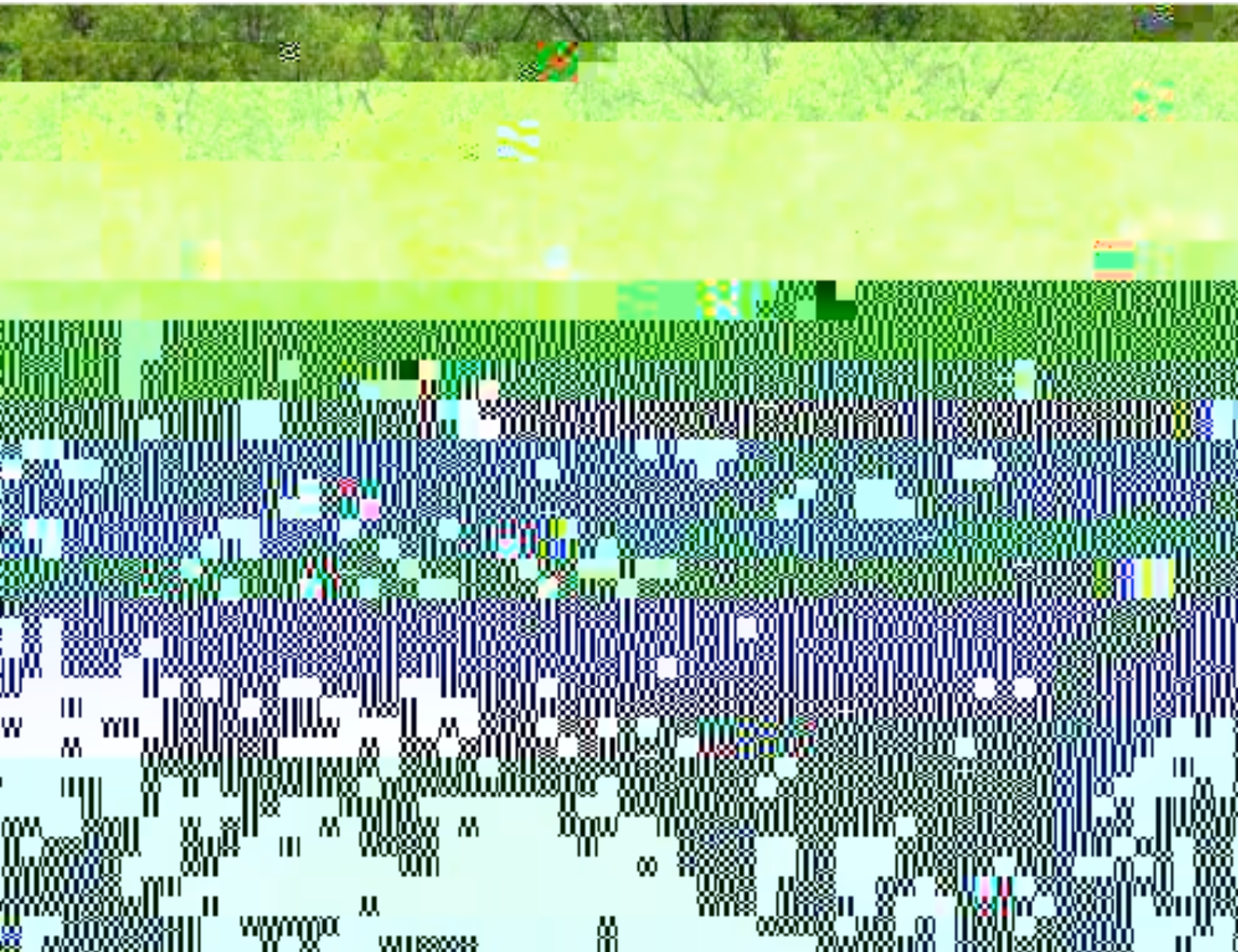


Natural resource dependence, livelihoods and development

Mariculture exchange between Kenya and Tanzania

David H.O. Mirera and Melita A. Samoilyš



IUCN Eastern and Southern Africa Regional Office 2008



The designation of geographical entities in this book, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of IUCN, CORDIO or Kwetu concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or

Table of Contents

,

Acknowledgements

We are grateful to all the institutions that helped to make this exchange visit a success through on the ground organisation: Kwetu Training Centre, Institute of Marine Science of the University of Dar es salaam, ACDI/VOCA-SEMMA project and KIBODO Trust. We appreciate the welcome we received from all the groups that we visited in Kenya and Tanzania during the study tour. We extend our sincere thanks to Dr. Nigel Preston, Dr. Aviti Mmochi, Dr. Betty Nyonje, Dr. Msuya, Mr. Juzar, Mr. Lugazo who helped to organise field visits and provided technical support to the exchange visit participants. We are also grateful to all the community representatives who participated in this learning and experience sharing process.

This study was funded through the IUCN Eastern and Southern Africa Regional Programme project "Building capacity and strengthening policies for coastal communities to manage their marine resources in East Africa", supported by Keidanren Nature Conservation Foundation (KNCF). Nigel Preston of CSIRO, Australia, funded his own participation in the visit, and Kibodo Trust funded one participant from Kiunga, for which we are very grateful.

Executive Summary

Aquaculture entails rearing aquatic organisms such as finfish, shellfish (crustaceans, molluscs) and seaweeds in a process whereby at least one phase of growth is under the control of human beings. Mariculture is aquaculture conducted in seawater, usually along coasts.

Mariculture holds a great promise in East Africa as a means to furthering economic development, contributing to poverty alleviation and increasing food security. However, poor technical understanding, absence of supportive policy frameworks and weaknesses in intersectoral coordination continues to hinder its development. Indeed, several mariculture initiatives in Kenya and Tanzania Kenya during the last two decades have shown only limited success, in spite of promising mariculture research findings and the availability of sound models for mariculture development from other parts of the world. It should be noted, though, that Tanzania has made progress towards profitability in culturing seaweed, and is now a significant producer. Pearl farming is also developing and appears to hold some promise.

mariculture development. Notably, extension services should be strengthened through capacity building and partnerships with development NGOs and the private sector. Technical assistance as well as approaches and strategies can be sourced from countries that have successfully developed community-level mariculture, such as Vietnam.

While developing the mariculture industry will require increased financial as well as policy and institutional support from government, this can be greatly augmented through close collaboration with development agencies and donors. Using market mechanisms while ensuring small-scale ventures are safe from

1. Introduction

Sustainable use of biodiversity has significant links to human wellbeing and poverty reduction. More than

- Participants should gain knowledge that can be disseminated to other community members, enabling them to make informed decisions.
- The exchange visit should help to achieve closer collaboration between mariculture practitioners, donors, researchers and buyers in the region.
- The exchange visit should contribute to improved sharing of experiences and lessons learned from mariculture and related information.

Mariculture initiatives by Kwetu (David Mirera)

Mariculture in Kenya has a relatively short history, with few success stories. Initiatives have largely been un-coordinated, with insufficient sharing of information between projects and institutions. Thus mariculture initiatives are often failing to learn from past experiences.

Kwetu started mariculture trials in 1997 by constructing a 0.8 ha prawn pond. Community extension did not commence until late 2004, when enough information had been collated based on the trials and from research for culturing milkfish, prawns, mullets and mud crabs. The early stages of the mariculture extension work proved difficult due to a lack of tradition in fish culture among coastal communities, but with time there was appreciation from the community that fish can be grown in ponds, and now mariculture is

milkfish culture manual has been developed (Requintina et al., 2007). Other mariculture research trials in Tanzania have focused e.g. on shellfish, including pearl oysters, as well as mud crab (*Scylla serrata*). Small-scale mariculture is now practiced by several communities including in Tanga region, on Mafia Island and on Zanzibar.

The future of mariculture seems bright, with the development of a national mariculture strategic plan for 2023, based on advice to parliament as well as the Minister of Fisheries from the Vice Chancellor of the University of Dar es salaam and the Director of IMS. Extensive economic analysis of milkfish and seaweed culture has also been conducted (Sullivan et al., 2007).

Aquaculture in the world and relevance to East Africa (Dr. Nigel Preston)

Most wild capture fisheries in the world are at or over maximum sustainable yield, and will at current rates collapse within a few decades. Aquaculture will thus be essential to provide seafood products. With the world population expected to increase to 8.5 billion people by 2020, 1.1 billion in Africa alone, an estimated 40 million tons of aquaculture food will be required by 2030. While since the 1950s aquaculture has been the fastest growing food-producing sector in the world, it is still not achieving its potential in places such as Eastern Africa. With improved technologies, mariculture can contribute a more resilient and prosperous coastal East Africa, meeting the food and income demands of the growing population while also reducing pressure on wild stock, without compromising biodiversity and ecology.

For example, there are new approaches to sustainable mariculture that capitalise on capture and re-use of

Entrepreneurship. Kwetu has pioneered the development of sustainable mariculture in Kenya during the last 10 years, including through trialling oyster culture, pond polyculture and silvofisheries.

The exchange visit participants visited the demo/training mariculture facility owned by Kwetu Training Centre. The facility has 7 fishponds served by a sluice gate, and a set of mud crab drive-in cages with a

struggled as the Forest Act bars any human activity in mangrove forests. However, with the introduction of co-management in the Forest Policy of 2005, communities were allowed to carry out non-destructive livelihood activities in the forest, and activities at the site could develop.

The group has grown milkfish in their 8x10m pond since 2005. However, only a maximum of 15kg has been obtained per four-month culture period. This low production is likely due to the ponds not being stocked to the required density. Consequently the group has not been able to conduct economic return simulations to ascertain profitability. The group also intends to employ a caretaker to keep watch of the stocked fishponds.

A focused, carefully planned and conducted fish production programme would enable the group to attain profitability. The facilities are currently under a milkfish culture research experiment conducted by David Mirera of Kwetu, funded through a grant from the Western Indian Ocean Marine Science Association (WIOMSA).

2.3 Mariculture Site Visits, Zanzibar

Bweleo, Fumba and Nyamazi mariculture groups

The Bweleo, Fumba and Nyamazi community mariculture groups are focusing on pearl oyster farming. The bivalves are implanted with artificial button pearls made from plastic, and hung in sacks on buoyed lines. Upon harvest the pearls that have formed (so called half-pearls, which remain attached to the shell) are used for jewellery, while the meat used for food and/or sold. Exchange participants received a presentation on the activities and were demonstrated the various steps of the process. The potential profits from pearl farming are considerable – the first harvest from Bweleo fetched a lot of money after being sold in the USA at approximately 100 USD per prepared pearl. In addition to Zanzibar, pearl farming is currently conducted also on Mafia Island.

Makoba mariculture fish ponds

Much of the early marine fishpond culture research in Tanzania (rabbit fish, milkfish and mullets) was conducted at Makoba. The ponds were initially used for salt production, but it was abandoned due to high fresh water influx, which made it unprofitable. After conversion to mariculture, the facility has contributed greatly to development of pond construction and fish culture practices.

The expansive pond area of about 10 ha is owned by the Tanzania Prisons Department. In 1992 six ponds were constructed with technical advice from IMS and later the Prisons Department constructed five more. Most ponds vary in size between 10x12m to 12x15m, with one relatively large pond of c1.5 ha. Two water reservoirs in front of the ponds regulate water supply through sluice gates. A set of smaller concrete ponds of 8x8m were constructed for growing out fish fry to a size where they can be separated by species before stocking of culture ponds.

Mariculture research in the area has focused on e.g. rabbit fish, seaweed, shellfish, milkfish and mullets, including using milkfish fingerlings imported from Philippines for culture. The IMS mariculture team has formulated local fish feeds using coconuts husks, maize bran and trash fish, which have been tested in the ponds. To ensure effective operation of the mariculture pond facility, one technical staff from the prisons department and a local community member were trained in Israel. However, at the time of visit the pond facility was poorly maintained and not functional, despite the resources used to develop the facility and the human expertise in place. It was noted that this was due to the restricted access to the site as it is a

The ponds have been created by conversion of mangrove forest, which is inferred e.g. from high concentration of sulphate in the area. Participants were advised by Dr. Nigel Preston that such areas are not suitable for mariculture since the soil chemistry commonly leads to high mortality of culture organisms. Thus there is no need to cut mangroves for mariculture – in addition to production being limited by mortality it is expensive and environmentally unsustainable. A more suitable area for mariculture is behind mangrove areas, beyond the highest tide level where land is usually relatively flat, although this may occasionally require some water pumping. To improve areas that have already been cleared either for culture of fish/prawns or for salt production in an environmentally acceptable and not expensive manner, mangroves can be planted along the dykes and lime can be added to help neutralise the sulphuric acid.

The Makoba r hav 16 (o(ov) 233 2 dnfl 0 () impalitn35 (imp-66 (theerrormon) -51 (man-66() -49 75) 57 (-1) 80 2 dnfl 0 () p

2.4 Mariculture Site Visits, Tanga, Tanzania

Sustainable Environmental Management through Mariculture Activities

600 crabs in drive-in cages with individual compartments (1x1x1ft) made of mangrove chelipeds, each costing TSH 1000 or just over USD 0.8 per piece. However, due to high mortality and escape no harvest was made. In January 2007 activities were restarted using cages of 5x6m with individual crab compartments as above. These can be made in on to three days by between five and ten people. From the 400 crabs stocked 250 were harvested in May the same year, with a total weight of 120 kg. Further

Starting mariculture

In most areas it may be difficult to start prawn farming due to the limited mariculture knowledge and

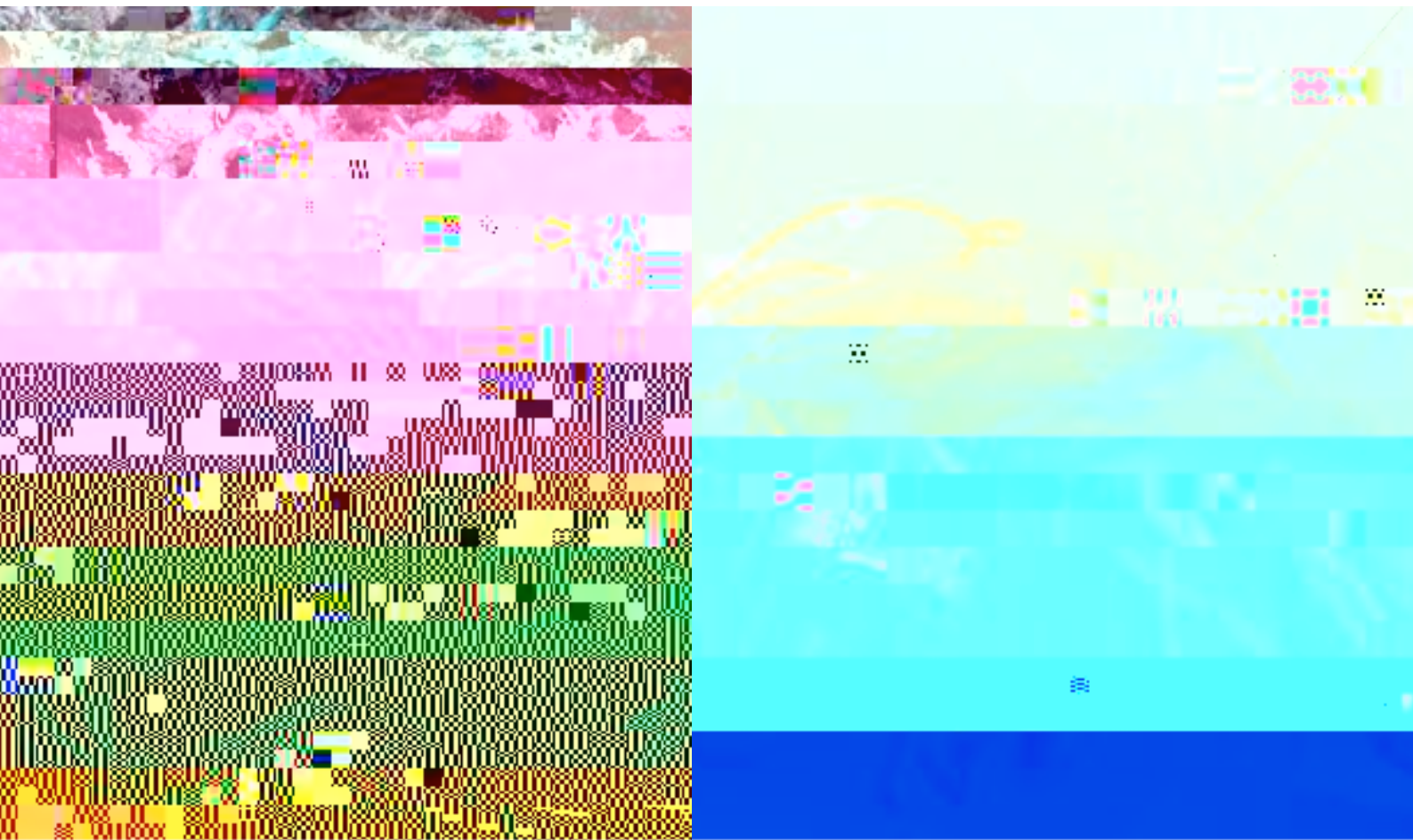
Notably such policies and strategies must recognize the new technologies and approaches available to reduce or eliminate negative environmental impacts of mariculture.

Addressing bottlenecks to conducting Environmental Impact Assessments or Strategic Environmental Assessments for mariculture is also required so that these can be used as tools to facilitate sustainable development. Similarly, as the mariculture industry needs to be business-based, assessment of economic feasibility and impact on livelihoods should be required, and facilitated.

Capacity building

The mariculture industry moves rapidly and current initiatives in East Africa can benefit by learning from the innovations and technology tried elsewhere. Expertise should be called in from areas where it is available, and specific trainings organized, especially for extension workers/Fisheries Division officers, who can then more actively provide sound technical advice. There is also a need to organise seminars for policy makers, including visits to mariculture ventures to help them understand the industry and its potential. Exchange visits for communities and practitioners need to be maintained for community learning as they provide good exposure to different approaches and interaction with mariculture experts.

Photo: Pearl oyster with plastic button pearl.



5. References

- Bryceson, I. (2002). Coastal aquaculture developments in Tanzania. Sustainable and non-sustainable experiences. *Western Indian Ocean J. Mar. Sci.* 1: 1-10.
- Bwathondi, P. O. J. (1981). The culture of rabbit fish (*Siganus* spp) in Tanzania. IFS. Stockholm, Sweden. 36pp.
- Christensen, M. S. (1995). Small scale aquaculture in Africa: Does it have a future? *World Aquaculture* 26: 30-32.
- Giasuddin, M. and M.F. Alam. (1991). The mud crab (*Scylla serrata*) fishery and its bio-economics in Bangladesh. In: C.A. Angel (Ed) *The mud crab: A report on the seminar convened in Surat Tahi, Thailand, November 5-8 1991.* pp 29-40
- Kador, A. (1991). Mud crab – A potential aquaculture resource of Bangladesh. In: C.A. Angel (Ed) *The mud crab: A report on the seminar convened in Surat Tahi, Thailand, November 5-8 1991.* pp 95-102.
- Mirera H. O. D. (2006). Silvofisheries gain momentum in the mangroves of Kenya. *WIOMSA Newsbrief* (September 2006. www.wiomsa.org)
- Mirera H. O. D. (2007). In the face of poverty mangrove wetlands are lifelines: Viability indicators in assessing polyculture of milkfish (*Chanos chanos*) and mullets (*Mugil cephalus*). *CORDIO Status Report.* 2007.
- Mirera H. O. D. (in press). Experimental polyculture of milkfish (*Chanos chanos*) and Mullet (*Mugil cephalus*) using earthen ponds in Kenya. *Journal of Aquatic science.*
- Mirera H. O. D. (in press). Mud crab (*Scylla serrata*) culture: Understanding the technology in a silvofisheries perspective. *WIO Journal of Aquatic Sciences.*
- Mirera, H. O. D. (2007). Community Mariculture Initiatives by Kwetu Training Centre along the Kenyan Coastline. *Samaki news.* Vol. 2.
- Mshigeni, K. E. (1983). *Mwani: ukulima wake baharini na manufaa yake kwetu.* Tanzania Publishing House, Dar es-salaam. 43 pp.
- Mshigeni, K. E. (1973). Exploitation of seaweeds in Tanzania. The Genus *Euchemia*, and other algae. *Tanzania Notes and Records,* 72: 19-36.
- Msuya, F. E. and Mmochi, A. J. (2007). Inventory of small scale mariculture in Tanzania. 34 pp.
- Obura, D. (2005) East Africa – Summary. Pp. 25-31 In: *Status Report, Coral Reef Degradation in the Indian Ocean.* CORDIO/IUCN/SIDA.
- Requintina, E. D., Mmochi, A. J. and Msuya, F. E. (2007). A guide to milkfish culture in the Western Indian Ocean region. 52 pp.
- Sullivan, K. A., Mmochi, A. J. and Crawford, B. (2007). An Economic analysis of milkfish farming in Tanzania: Potential for economic development and policy issues. Sustainable coastal communities and ecosystems. Coastal resources centre of the University of Rhode Island and the WIOMSA. www.crc.uri.edu.23p.

Appendix 2. Exchange Visit Participants

Name	Address
Mohamed Sabiri Bashiri	KIBODO Trust, Kiunga, Kenya
Lali Kombo Lali	KIBODO Trust, Kiunga, Kenya
David Mirera	Kwetu, P.O. Box 98422, Mombasa, Kenya
Betty Mindraa Nyonje	KMFRI, P.O. Box 81651, Mombasa, Kenya
Ali Kidadi Bunu Rasheed	P.O. Box 13, Faza, Kenya
Melita Samoily	CORDIO, P.O. Box 24562, Karen 00502, Nairobi
Rashid Ayubu	Wakapa, Pangani, Tanzania
Bakari M.H. Lusewa	P.O. Box 90, Korogwe, Tanga, Tanzania
Ali Mataka	P.O. Box 1434, Zanzibar, Tanzania
Aviti John Mmochi	IMS, P.O. Box 668, Zanzibar, Tanzania
Juzar Sachak	ACDI/VOCA-SEMMA, P.O. Box 829, Tanga, Tanzania
Frida Urio	ACDI/VOCA-SEMMA, P.O. Box 829, Tanga, Tanzania
Lugazo Zuberi	ACDI/VOCA-SEMMA, P.O. Box 829, Tanga, Tanzania
Nigel Preston	CSIRO, Brisbane, Australia

