INTERNATIONAL ATOMIC ENERGY AGENCY

IAEA-PDE-93/02
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PROJECT DESK EVALUATION

A DESK EVALUATION REVIEW OF PROJECT

URT/5/007

TSETSE FLY ERADICATION

DEPARTMENT OF TECHNICAL CO-OPERATION

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EVALUATION SECTION

DEPARTMENT OF TECHNICAL CO-OPERATION

PROJECT DESK EVALUATIONS

A Project Desk Evaluation (PDE) is an intensive review process, using agreed guidelines, of the design, implementation, and the outputs of a project. Its purpose is to convey concisely as comprehensive a picture of a project's performance as can be obtained without a special evaluation mission to the project site. It also seeks, where possible, to draw generalizable lessons that go beyond the specific project under review. Frequently, Project Desk Evaluations are conducted on a set of similar projects, e.g. radiation protection projects or projects in nuclear medicine, in various countries and reported on together. In this way a wide range of approaches, strategies, problems and trends relating to a common type of undertaking can be examined and conclusions confidentially drawn.

Project Desk Evaluations are carried out by the staff of the Evaluation Section, Department of Technical Co-operation, with the assistance of the relevant staff in the Agency concerned with the specific projects. Upon completion, each Project Desk Evaluation is submitted to the Deputy Director General of the Department of Technical Co-operation.

DESK EVALUATION REVIEW OF PROJECT

URT/5/007

TSETSE FLY ERADICATION

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EXECUTIVE SUMMARY

The tsetse fly, through its blood-sucking habits is the vector of transmission of trypanosomiasis (human sleeping sickness and nagana in livestock) affecting human health and livestock development over a large portion of the African continent. In all of Africa some 30 species of the tsetse fly (Glossina sp.) are known, and on the mainland of Tanzania several species are found. On Zanzibar only one specie of tsetse is found, Glossina austeni, on Unguja Island.

Agriculture constitutes close to 45% of the gross domestic product (GDP) of Zanzibar. Productivity in agriculture on Zanzibar is a mainstay for economic growth. A major factor limiting the agricultural productivity and wellbeing of the Zanzibari people is poor animal health. The parasitic disease, trypanosomiasis, transmitted by the tsetse fly, G. austeni, prevents livestock development of Zanzibar needed to fulfill its meat and milk requirements. The only solution to the problem is the eradication of the tsetse fly. In combination with other vector control methods, the Sterile Insect Technique (SIT) is the only eradication procedure available.

Once tsetse is removed from the island, trypanosomiasis will in turn disappear, and livestock production should grow to numbers beyond those imported yearly by Zanzibar. With the absence of disease, local cattle breeds can be genetically upgraded by crossing with exotic breeds thus improving meat and milk production as well as animal traction for farming. Significant economic benefits to the country are expected from the successful eradication of the tsetse fly from Zanzibar.

The technology gained from the eradication of tsetse on Zanzibar can be extended to tsetse control and eradication on mainland Tanzania and other African countries. The specie G. austeni extends along the East-African coast from Somalia to South Africa's Zululand. After the eradication of tsetse from Zanzibar, the same SIT approach mastered on Zanzibar and mainland Tanzania can be adopted in other parts of the African continent. The technology is not new to the region. Selected parts of West-African countries having approximately the land mass of Zanzibar (1,500 km^2 in Nigeria) or greater (3,000 km^2 in Burkino Faso) have been freed from tsetse species using the Sterile Insect Technique. Zanzibar would be, however, the first geographically fully isolated area to be freed from the tsetse pest and the debilitating disease it spreads.

Project URT/5/007 was initiated in 1984 to assist the Government of the United

Republic of Tanzania in developing membrane feeding technology for the mass breeding of tsetse flies, which is required for the application of the sterile insect technique to eradicate the tsetse fly from the island of Zanzibar. As the project progressed the objectives focused on the development of inter-related management practices with SIT to control and eventually eradicate the tsetse species infesting Zanzibar. As depicted by the project title, tsetse fly eradication on Zanzibar is the ultimate goal of on-going work of project URT/5/007; however, tsetse fly eradication is not the immediate objective of this project.

The total budget of the project for the years 1984 through 1994 includes 53 man-months of expert services, $402 755 for equipment, and $ 1 959 for fellowship training. Additional funds for 57 man-months of fellowship training were provided from sources outside of the project. Resources provided by the United Republic of Tanzania for the project included staff, local facilities, and local running costs.

A Desk Evaluation Review (DER) of Project URT/5/007 was requested by the Africa Section to provide an assessment of project achievements and to determine to what end the project may lead in the near future. Also the review could help determine how experiences gained during the developments of this project might be utilized in the management and implementation of similar projects in Tanzania or the region.

This review is the result of a thorough study of the files and documents available in the IAEA Headquarters including all expert field reports on project URT/5/007 and extensive discussions with IAEA personnel involved in the project. The facts contained in this review were compiled, therefore, from all sources available at IAEA Headquarters to provide a comprehensive chronicle of project accomplishments, which forms the basis for the findings and recommendations provided.

ACCOMPLISHMENTS

The project has provided, as of 4 May 1993, 32.5 man-months of expert services, equipment valued at $365 474, and three months of fellowship training. Training to local staff was provided mostly from funds outside of the project. A total of 12 project-related fellowships and three project-related scientific visits have provided 57 man-months of training abroad for local staff. Three project-related fellowships, which started on 19 April 1993 at the IAEA's Seibersdorf Laboratories, will provide an additional 12 months training.

To meet project objectives and to eventually eradicate the tsetse fly, Glossina austeni, from Zanzibar, efforts have had to concentrate on the following tasks:

- to build up the expertise and capacity of local staff on mainland Tanzania with the know-how and facilities to maintain large colonies of tsetse capable of supporting a SIT programme on Zanzibar,
- to establish a field team on Zanzibar island with the facilities and capability of mapping tsetse and monitoring population densities and fecundity of tsetse prior to and during a SIT eradication programme, and
- to establish with local staff the teamwork and logistics required to implement appropriate surface and aerial sterile fly releases.

Accomplishments of project URT/5/007 must be measured, therefore, according to the degree to which the above tasks have been performed by local staff. The achievements of project objectives can be assessed by the preparedness of staff on mainland Tanzania and Zanzibar to carry out the above tasks for an eradication programme.

Early in the project, artificial membrane technology for in-vitro feeding was established in the Tsetse and Trypanosomiasis Research Institute (TTRI) at Tanga. Most of the TTRI research officers and technicians received training in relevant aspects of the SIT. Staff of the TTRI at Tanga had achieved good expertise in mass rearing including good blood quality testing procedures, fly production and handling procedures, and optimum use of colony males to obtain a maximum output for release.

Excellent work has been accomplished at the mass-rearing laboratory of the TTRI at Tanga with the establishment and maintenance of a large colony of female flies fed in-vitro on locally collected blood. Evidence for the achievements at the TTRI was provided by the growing mass-rearing productive capacity of the TTRI facility over the years as the local staff expertise and facilities improved. The colony of female flies maintained at the TTRI facility has increased from 42,000 in 1989 to 85,000 in December 1992. To put these numbers into perspective the IAEA's mass-rearing facility at Seibersdorf has now a back-up colony of 122,000 producing females, and to initiate a full-scale eradication programme on Zanzibar female fly colony sizes of about 250,000 at Tanga and 150,000 at the Seibersdorf Laboratory will be required.

Achievements in the field on Zanzibar Island were also assessed during expert missions. In 1990 the usefulness of the sticky target approach for trapping flies in the field was confirmed and some simpler and cheaper sticky panels were designed locally. Furthermore, closer coordination of the activities of the UNDP/FAO/DLDZ Animal Disease Project, URT/86/022, and the IAEA/TTRI/DLDZ Project, URT/5/007 was agreed upon. The FAO team recognized that the use of insecticide treatments would not result in eradication of the pest and supported the integration of the SIT for eradication.

In July 1991 Agency expert (Vreysen) reported that staff of TTRI and Department of Livestock Development, Zanzibar (DLDZ) have achieved expertise in good entomological monitoring activities on Zanzibar. A good survey and mapping of apparent densities of flies was established in the north and south of Jozani Forest (a primary habitat for the tsetse fly on Zanzibar Island). More recently Agency expert (Vreysen) reported in December 1992 that TTRI and DLDZ in co-operation with FAO field staff have well established fly suppression techniques using insecticide-impregnated screens in north Jozani Forest.

Excellent progress in sterile fly release programme, logistics and implementation has been achieved. A programme schedule and logistics were established for the transport of sterile flies from Tanga to Jozani Forest. By late 1990 four releases of sterile flies were already accomplished at Jozani Forest. The field teams on Zanzibar island were able to utilize the sticky targets they had designed to recapture flies in the field to study the effect of sterile fly releases. They found the recapture rates of sterile flies and the mating of sterile flies to be good. All female flies caught five to six days after release were found to be inseminated.

Obstacles to recruitment of a long-term expert arose during the early stages of the project. Efforts to recruit M. Weiss from the former FRG for 12 months in 1985 were promising; however, the proposed expert withdrew in 1986 due to the inappropriate timing and duration of the assignment. Another expert, IAEA staff member (Baumgartner) was proposed by the IAEA in 1986; however, this expert was not accepted by the national authorities of Tanzania due to differences in the background of the expert and the tasks of the assignment. The Agency might have further consulted with the authorities at this time to reconsider the case of Mr. Baumgartner, who's services could have saved time in project implementation.

During the initial delays in recruitment, missions to Tanzania undertaken by IAEA technical officers from Headquarters and the Seibersdorf Laboratories (Gingrich in Nov.-Dec.'84 for 9 days and Hamann in Feb. '85 for 17 days) helped establish project momentum. Three other experts (Van der Vloedt, Hall, and Offori) provided services in 1986 for a total

duration of six weeks. It was only in 1988, over four years into the project, that an expert was recruited to provide long-term services (Madubunyi, 12 months).

The assignment of Mr. Madubunyi from Nigeria (April '88 to April '89) was hampered by the absence of a reliable vehicle for field work on Zanzibar. The TC project request submitted to the IAEA in 1983 stated that a Land Rover was already available for the execution of the project. However, the vehicle (Land Rover TX 6499), left behind in Tanzania after the termination of the USAID project in 1980, was not roadworthy. The national counterparts had agreed to repair it prior to Madubunyi's assignment. However, as this was not done, the Agency decided then to purchase a Lada 4-wheel drive vehicle. Seeing that the vehicle ordered would not reach the expert during his assignment, the Agency authorized an imprest account to provide funds for hiring a vehicle needed for field trips to Jozani Forest. It was only in October 1988, six months into his assignment, that the expert was able to hire a vehicle and begin field work with the local staff. At the conclusion of his mission the expert reported that only one-third of the assignment objectives was accomplished due to the lack of a proper vehicle. Assurance should have been provided to the IAEA by the national counterparts of the availability of a functioning vehicle for field work on Zanzibar before the arrival of the expert. Another vehicle (Land Rover 109 Station Wagon) was provided to the TTRI at Tanga and received in April 1985.

The lack of a project vehicle at Zanzibar hindered the field work during the initial years of project implementation. Since the arrival of the first vehicle in Zanzibar in 1990, field work had progressed rapidly.

Throughout most of the project years there were signs of a need for stronger Government support for the project at a high level (Deputy Minister or Minister). There even existed at times a lack of adequate collaborative arrangements between TTRI and DLDZ, and even a need to define the obligations of the two institutions. Funds were not always available for running costs either at TTRI, Tanga on mainland Tanzania, or for field work with the DLDZ on Unguja island. The problem of lack of funds for local running costs was foreseen as a possibility by the TO (Lindquist) in the evaluation of the initial project request received by the IAEA in 1983.

The need for a project document with agreements on procedures for execution of field components of the project was first recommended by Agency expert (Offori) following a mission to Tanzania in 1986. Mr. Offori expected to meet with the Minister or Deputy Minister of Agriculture on this matter in 1986, but the meeting could not take place. The Director

General (Macha) of the existing Tanzania Livestock Research Organization (TALIRO) at that time assured the expert of Government support, and that a project document would be drafted and submitted to the IAEA by the end of 1986.

Also, in 1989 Agency expert (Madubunyi) informed the IAEA that there appeared to be no standing collaborative arrangement between either TTRI or DLDZ or their parent organizations. He recommended the respective Governments of the United Republic of Tanzania and Zanzibar request the two ministries of agriculture to articulate a formal protocol of collaboration between their respective institutes on tsetse eradication in Zanzibar. In turn, the Area Officer (Ericson) informed the Registrar (Nyanda) of the Tanzania National Radiation Commission that, for the project to succeed there must be written commitment from all parties concerned.

Agency expert (Vreysen) in late 1990 recommended that the Ministry of Agriculture and Livestock Development, Tanzania should come to an agreement with the Ministry of Agriculture, Livestock and Natural Resources, Zanzibar to secure sufficient provisions and staff. The expert repeated his recommendation in his report of April-June 1991 that the two ministries come to an agreement on terms of running costs of the project.

By July 1991 some consensus on tsetse suppression and releases of sterile flies had been achieved with all persons and institutions (TTRI, DLDZ, and FAO) involved. A schedule of sterile fly releases every ten days on Zanzibar was established. From June to November 1992 a total of 121,715 sterile males were transported from the TTRI to Jozani. Losses were minimal in transport with over 91% of all flies released. Transport was found not to affect the survival, or insemination capacity of the males. Releases of sterile males continued from January to March 1993 having considerable impact on the reproductive status (induced sterility) of wild target female flies. The logistics of sterile fly shipments and conditions of fly transport have been worked out. The possibility of releasing large numbers of sterile male G. austeni on Zanzibar Island was now soundly tested and validated.

Integration of the various teams and persons involved has been established. The mass-rearing facility of TTRI on the Tanzania mainland, field teams of TTRI and DLDZ on Zanzibar, and the FAO project staff have acquired the expertise and established the teamwork to mount a concerted, integrated, full-scale operation using different tested and effective methods for monitoring and eradication, including the SIT.

FINDINGS

While tsetse fly eradication on Zanzibar is anticipated to be the eventual outcome of the on-going work of project URT/5/007, tsetse fly eradication is not the immediate objective of this project per se, and consequently the project title can be misleading. The purpose of this project is to assist the Government of Tanzania in developing the technical infrastructure capable of mounting a tsetse eradication effort using SIT. This includes the development of the know-how, facilities and teamwork needed for the mass rearing and release of sterile male flies and good entomological field monitoring teams on Zanzibar working together with staff trained to employ other methods of fly suppression and control. The project objectives encompass the development of the inter-related management practices with the Sterile Insect Technique, which is required to control and eventually eradicate the tsetse species infesting Zanzibar.

The objectives of project URT/5/007 have been mainly achieved. Improved facilities and local expertise needed to mount an integrated SIT effort against the tsetse fly on Zanzibar have been established. An effective transfer of technology has taken place.

The TTRI staff have acquired the expertise needed to maintain good quality control in tsetse fly mass-rearing. To carry out a full-scale eradication programme on Zanzibar, a colony size of about 250,000 producing females flies must be achieved and maintained. This would require a three-fold increase over the current female colony size maintained at the TTRI. The technology to achieve this colony size is now at the TTRI, Tanga; only enlarged facilities and additional inputs of equipment and staff will be needed.

Likewise the entomological monitoring teams of the TTRI and DLDZ on Zanzibar have acquired the expertise needed to trap flies and measure their apparent population densities and dynamics needed to plan and assess the progress of an SIT programme. The teams have also established the co-operation with the FAO field staff for the employment of fly suppression techniques using insecticides wherever needed on Zanzibar prior to sterile male releases. Close co-operation between the laboratory and field teams of TTRI, DLDZ, and FAO will be vital to the success of tsetse eradication on Zanzibar.

A regular schedule of sterile fly release has been carried out since June 1992. Field studies of flies trapped in the wild have provided positive results in terms of sterile male survival, dispersal, mating competitiveness and insemination capacity with sterile sperm. The possibility of releasing large numbers of sterile male tsetse flies on Zanzibar Island was now soundly tested and validated.

Project URT/5/007 was first approved for the period of 1984 to 1986 to provide assistance to the Government of the United Republic of Tanzania in acquiring membrane feeding technology, which is required for tsetse fly mass rearing. Project approvals during subsequent years up to 1994 provided for continuation of IAEA and national inputs to prepare the country for a costly tsetse eradication programme. An additional US$ 3.7 million from donor funds will be required after 1994 for tsetse eradication on Zanzibar. At the inception of this project no study was made of the economic returns of a tsetse eradication programme. A thorough study of the economic returns of this project at the beginning could have provided information useful for making project approvals and for acquiring support from the Tanzanian and Zanzibari Government Ministries and donor countries or organizations concerned.

Factors which contributed to significant delays in implementation were mainly, among others, obstacles to recruitment of a long-term expert during the early stages of the project; lack of a roadworthy vehicle for the field work on Zanzibar Island during the initial years of project implementation, and occasional lack of sufficient running costs of the recipient institutes for electricity, gasoline, staff salaries, etc. Project objectives have been achieved after almost ten years of project implementation; however, one can only speculate as to how shorter a time period would have been required to reach project objectives had the obstacles been avoided.

Obstacles to a smooth implementation of the project were caused, inter alia, by the complexity of managing a project between mainland Tanzania and Zanzibar and the need for a project document with defined obligations and commitments of all parties involved. In this context we must keep in mind the structure of the Government of the United Republic of Tanzania in the management of this project. Project URT/5/007 is being implemented at two host institutions, namely, the TTRI at Tanga on mainland Tanzania and the DLDZ on Unguja island, Zanzibar. Although Zanzibar is part of the United Republic of Tanzania, it is self-governed with the election of its President and House of Representatives conducted under the terms of a separate Zanzibari Constitution. Zanzibar has a Government with full autonomy in many matters. The United Republic of Tanzania has two vice presidents; one is the union president or prime minister and the other is the President of Zanzibar. The United Republic of Tanzania has, therefore, two agriculture ministries, one on mainland Tanzania and another on Zanzibar. The implementation of project URT/5/007 requires co-operation and financial support from two host institutions and two agriculture ministries.

The complexity of managing a project with two independent host institutions and two autonomous Governments (Ministries) requires a project document with defined obligations

and commitments of all parties involved. Such a project document signed at the highest level (Minister or Deputy Minister) would secure Government support at the level sometimes needed to assure funding of local running costs of large projects. It is apparent from the aforementioned recommendations of the Agency experts and Area Officer that a written commitment from all parties concerned endorsed at the highest level in the two ministries of agriculture are needed to assure full Government support for the project.

The mass-rearing facility and staff of TTRI on the Tanzania mainland, entomological monitoring field teams of the TTRI and DLDZ on Zanzibar, and the co-operating FAO project staff have acquired the expertise needed to mount an integrated full-scale tsetse eradication programme on Zanzibar. However, all teams involved will have to expand in order to perform an island-wide eradication programme. The TTRI and DLDZ will have to increase its staff. It will be mostly a matter of expanding current mass rearing and field activities with the technology already acquired. This will incur on the part of recipient institutions even higher running costs than ever before experienced. Commitment on behalf of the Tanzanian and Zanzibari Ministries of Agriculture to meet the costs of such a large programme will be needed. On-the-job training of new staff members of the TTRI and DLDZ to support an eradication programme should be provided by local scientists and technicians.

The country is now ready to launch a full-scale integrated SIT effort to eradicate the tsetse fly, G. austeni, from Zanzibar by the year 1996. Successful control and eradication of the tsetse fly from Zanzibar could provide significant returns to the economy and well being of the Zanzibari people. Additional inputs of mainly equipment and expert services will be necessary to assist the United Republic of Tanzania in reaching this goal.

RECOMMENDATIONS

(1) The basic technology for tsetse eradication, acquired through project URT/5/007, now exists in the United Republic of Tanzania. Further support from IAEA resources and external organizations is recommended to help the country achieve tsetse eradication on Zanzibar. Concrete Government commitment should be an essential proviso for any full-scale tsetse eradication project.

(2) A Joint Agreement or Project Document between the Ministry of Agriculture and Livestock Development, Tanzania and Ministry of Agriculture, Livestock and Natural Resources, Zanzibar on SIT for tsetse eradication is recommended to help establish a standing collaborative arrangement between the two autonomous ministries. This Agreement, if signed at the highest level (Deputy Minister or Minister), could pledge strong Government support for a full-scale tsetse fly eradication project and would help to secure sufficient provisions for running costs and support staff from both ministries.

(3) Delays in implementation of the project were caused by insufficient local inputs. When large projects, which can have significant impact on social and

economic development, are implemented in least developed countries (LDCs), the IAEA should consider contributing to local inputs for project implementation.

(4) Prior to the approval of a large technical co-operation project a thorough cost benefit analysis should be made. Such an analysis could provide an indication of economic returns from the successful outcome of the project, which could furnish concrete criteria for the setting of technical co-operation priorities with recipient Member States and donor countries or institutions.

(5) Tsetse fly eradication on Zanzibar is the long-term goal of project URT/5/007. The immediate objectives of this project should have been clearly delineated in official IAEA documents. For future projects, the objectives should be defined in order to provide a clear picture of the expected outcome at the end of the approved programme cycle.

(6) Tsetse fly eradication and control should remain a sustainable activity in the country under Tanzanian management after the eradication of tsetse from Zanzibar. Therefore, the recipient institutions, TTRI at Tanga and the DLDZ at Zanzibar, should be encouraged to make use of existing local facilities and know-how to provide training to all new staff that join the project in tsetse mass rearing, field entomological studies, and other techniques required for an integrated SIT programme. Fellowship training at the IAEA's Seibersdorf Laboratory should be provided when new techniques or advances not yet used in Tanzania must be learned. Eradication of the tsetse fly on Zanzibar will require staff increases to accommodate expansion of mass rearing and field studies. On-the-job training of new local staff should be provided to a large extent by local scientists at the TTRI and DLDZ.

I

INTRODUCTION

The United Republic of Tanzania was formed in 1964 when the former Republic of Tanganyika, which became independent from the U.K. in 1961, became a union with Zanzibar. The estimated population of the United Republic of Tanzania in 1992 was 25.9 million of which 721,000 resided on the islands of Zanzibar. Although the population of Zanzibar represents less than 3% of persons on the mainland, the population density in Zanzibar (260 persons per km^2) is ten times that of mainland Tanzania (26 persons per km^2). The land area of Unguja Island (1,650 km^2) is about 0.2% of that of mainland Tanzania (883,750 km^2).

The political structure of the United Republic of Tanzania is of relevance to the management of project URT/5/007. The country has two vice presidents; one is the union president or prime minister, and the other is the President of Zanzibar. The isles of Zanzibar are internally self-governed with the election of the president and House of Representatives conducted under the terms of a separate Zanzibari Constitution. Zanzibar has a government with full autonomy in many matters with the exception of defence, external affairs, internal security, telecommunications, and higher education. The United Republic of Tanzania has, therefore, two autonomous agriculture ministries: the Ministry of Agriculture and Livestock Development at Dar es Salaam on the mainland and the Ministry of Agriculture, Livestock and Natural Resources, Zanzibar. The implementation of Project URT/5/007 requires two recipient institutions, one in Zanzibar and the other in mainland Tanzania and, therefore, co-operation between two independent agriculture ministries. The details of this co-operation is described further on in this review.

Agriculture constitutes close to 45% of the gross domestic product (GDP) of Zanzibar, and agricultural produce accounts for more than 96% of domestic exports. Productivity in agriculture is a mainstay for economic growth of Zanzibar. A major factor limiting the agricultural productivity and well being of the Zanzibari people is poor animal health. The parasitic disease, trypanosomiasis, transmitted by the tsetse fly, Glossina austeni, prevents livestock development of Zanzibar needed to fulfill its meat and milk requirements. G. austeni is the only specie of tsetse and the sole vector of trypanosomiasis on Zanzibar, Unguja Island. The island has about 35,000 cattle, and on the average about 17 to 25% of the animals are infected with trypanosomiasis. Infection reaches up to 80% of some herds.

To satisfy its needs, Zanzibar imports about 10,000 live cattle each year and large quantities of powdered milk. The other major island of Zanzibar, Pemba Island, is free of the tsetse fly and trypanosomiasis. This island, however, is used mostly for clove plantations, the principal cash crop of Zanzibar.

Wide-scale use of insecticides, such as aerial spraying or ground spraying is either technically not feasible due to climatic conditions, or is ruled out by impenetrable vegetation. The only durable solution to the trypanosomiasis problem is eradication of the tsetse fly using the SIT in combination with other tsetse suppression and trypanosomiasis control methods tested on the island. Once tsetse is removed from the island, trypanosome transmission will in turn disappear, and livestock production should grow to numbers beyond those imported yearly by Zanzibar. With the absence of this disease, cattle productivity can be further enhanced by cross-breeding local cattle with exotic breeds, thus improving meat and milk production and usefulness for traction. Furthermore, animal traction will be beneficial for the proposed mixed farming systems on Unguja Island. The technology gained from the eradication of tsetse on Zanzibar can be extended to tsetse control and eradication on mainland Tanzania.

No thorough study has been made on the economic returns of eradication of tsetse from Zanzibar. However, taking into account losses due to reduced productivity, medical treatments, live animal imports, and reduced income of livestock producers, the Joint FAO/IAEA Division estimated economic benefits to Zanzibar of US$ 2.25 million per year or US$ 22.5 million over a ten-year period following eradication. The calculations were based on an average cost of US$ 200/head of cattle. The actual cost for cattle range from US$ 130 for a calf to US$ 570 for exotic breeds, and an accurate economic evaluation of animal expenditures for imported cattle also needs to reflect the type of livestock purchased. If all direct and indirect benefits are included, economic returns from tsetse eradication may be considerably higher than that previously calculated.

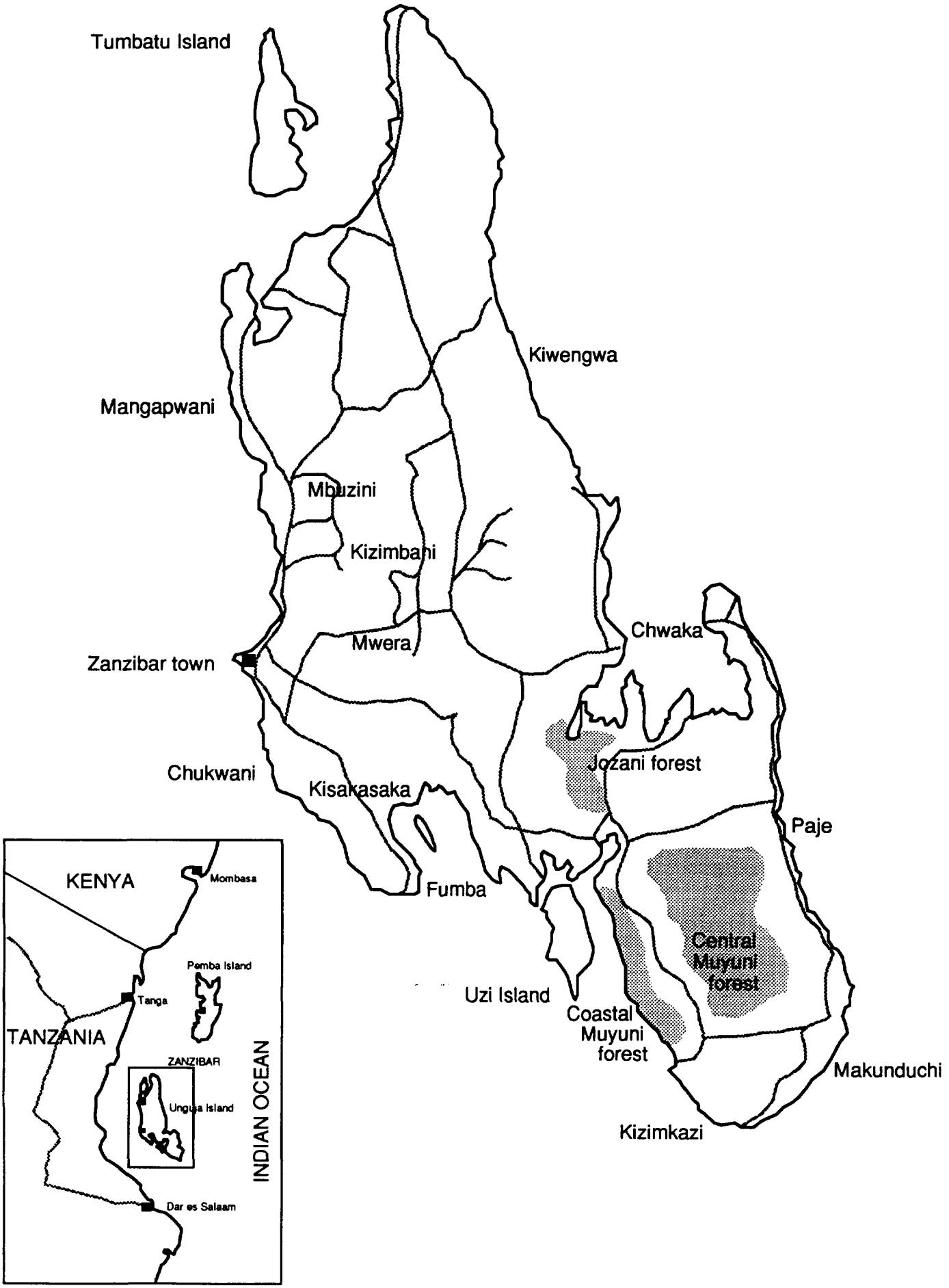
The sterile insect technique was not new to the country when it submitted a technical co-operation project request in 1983 for tsetse fly eradication in Zanzibar. Assistance to the United Republic of Tanzania in the field of the sterile insect technique began in 1974 with a USAID programme to study the feasibility of eradication of another species of the tsetse fly, G. morsitans, from a study area of mainland Tanzania. The USAID project terminated in 1980 leaving behind the infrastructure of SIT facilities including five buildings with three insectaries and trained manpower at Tanga. The Tsetse and Trypanosomiasis Research Institute (TTRI) at Tanga on mainland Tanzania then took over the project. The TTRI continued

studies on G. morsitans, but interest turned to G. austeni, which is the sole vector of trypanosomiasis on Zanzibar.

Project URT/5/007 was initiated in 1984 to assist the Government of the United Republic of Tanzania in developing membrane feeding technology for the mass breeding of tsetse flies, which is required for the application of the sterile insect technique, and to initiate a programme using SIT to eradicate the tsetse fly from the island of Zanzibar. Over the following years the Government of the United Republic of Tanzania had made new requests for project continuation and programme changes have been made to accommodate the needs of the recipient institutions.

The Africa Section of the IAEA Department of Technical Co-operation has requested a Desk Evaluation Review (DER) of project URT/5/007 to provide an assessment of project achievements, and to determine to what end the project may lead in the near future. Also the review could help determine how experiences gained during the development of this project might be utilized in the management and implementation of similar projects in Tanzania or other countries of the world.

Fig. 1. **UNGUJA ISLAND OF ZANZIBAR**



II

PROJECT UNDER REVIEW

The following section contains a Desk Evaluation Review of the IAEA Technical Co-operation project URT/5/007, "Tsetse Fly Eradication".

The review was undertaken upon request of the Africa Section to assess the overall performance of this ongoing ten-year project. The project has encountered obstacles to implementation, and the experiences gained may provide some useful guidelines for the management of similar IAEA Technical Co-operation projects in Tanzania and other countries of the world. It must be borne in mind, however, that a desk evaluation review is but one element of a critical examination to which there must be a tentative approach and continual testing of its conclusions. As the Joint Inspection Unit concluded,

> One of the most difficult problems which internal evaluation systems face is the tendency to regard them as a self-contained management technique which merely needs to be introduced into an organization to swiftly improve operations. In fact, evaluation is only a phase - although an important one - in the basic management cycle. It cannot have its full impact until it becomes part of a continuing commitment to development and improvement of the overall management system. (Second Report on Evaluation in the United Nations System, para.28, Joint Inspection Unit, JIU, rep.6)

Findings and recommendations are in Sections III and IV of this report.

URT/5/007: Tsetse Fly Eradication

1st Recipient Institution:

Ministry of Agriculture, Livestock and Natural Resources, Department of Livestock Development (DLDZ), Tsetse Control Unit, Zanzibar
Counterpart:
Kassim M. Biwi (former)
I. Shambwana (current)

2nd Recipient Institution:

Ministry of Agriculture and Livestock Development, Research and Training Department, Tsetse and Trypanosomiasis Research Institute (TTRI), Tanga
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	A. Ericson, TCPM, (former)

Acronyms Used:

ADRI - Animal Disease Research Institute
DLDZ - Department of Livestock Development, Zanzibar
IOM - Interoffice Memorandum
SIT - Sterile Insect Technique
TALIRO - Tanzania Livestock Research Organization
TCP - Technical Co-operation Programme
TO - Technical Officer
TTRI - Tsetse and Trypanosomiasis Research Institute

Project: URT/5/007 TSETSE FLY ERADICATION — **FINANCIAL SUMMARY**

Current Budget ($)	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	Total
Experts:	15 400	-	-	25 850	62 880	9 100	8 400	58 115	99 200	62 100	64 800	405 845
Equipment:												
Regular CC	50 000	82 000	25 500	-	44 000	15 000	26 000	50 000	44 500	30 000	25 000	402 755
Regular NCC					6 000	4 755						
Fellowships:	-	-	-	-	-	1 200	759	-	-	-	-	1 959
Sub-contracts	-	-	-	-	-	-	-	-	-	-	10 000	10 000

Disbursements ($)	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	Total
Experts:	1 630	3 186	12 242	410	57 054	21 289	19 233	44 883	30 523	40 712	-	231 166
Equipment:												
Regular CC	241	5 030	147 772	6 458	29 201	9 082	24 748	47 337	71 977	12 870	-	365 474
Regular NCC							10 755					
Fellowships:	-	-	-	-	-	-	776	1 181	-	-	-	1 958

Current Financial Status (4 May 1993): $ 598 600

Unliquidated Obligations	- experts	8/28	mm/dd
	- equipment	$ 7 283	
Earmarkings	- experts	5/10	mm/dd
	- equipment	$ 29 997	

APPROVED PROJECT OBJECTIVES AND ACTIVITIES

The immediate objective of the project proposed in 1983 by the United Republic of Tanzania was to assist the Government of Tanzania in developing membrane feeding technology for the mass breeding of tsetse flies, which is required for the application of the sterile insect technique, and to initiate a programme using SIT to eradicate the tsetse fly from the island of Zanzibar. Eradication of the tsetse fly, Glossina austeni, from Zanzibar would eliminate altogether the transmitting vector of the debilitating disease trypanosomiasis, which is the major factor limiting the development of the livestock industry on Zanzibar.

As the project progressed the objectives focused on the development of inter-related management practices with SIT to control and eventually eradicate the tsetse species infesting Zanzibar. This includes the development of an integrated programme of SIT with other methods of fly suppression and control. As depicted by the project title, tsetse fly eradication on Zanzibar is anticipated to be the eventual outcome of on-going work of project URT/5/007; however, tsetse fly eradication is not the immediate objective of this project per se. Once the project objectives are met, the basic technical infrastructure should exist in the United Republic of Tanzania to implement tsetse fly eradication on Zanzibar. It is foreseen that, after successful completion of the project, the acquired technology would prepare the country for the future application of tsetse control programmes on mainland Tanzania.

The IAEA has assisted the Government of the United Republic of Tanzania through the provision of equipment, including a gamma-irradiation source for the sterilization of blood as tsetse diet and of tsetse flies for release, and additional equipment prepared at the Agency's Seibersdorf Laboratories, expert services, and fellowship training. The project is ongoing to 1994, and the IAEA is continuing to provide assistance for the elaboration of strategies of release of sterile flies, and tsetse population monitoring and suppression. The Agency's Seibersdorf Laboratories will continue to provide support through the maintenance of a back-up tsetse colony by sub-contract.

Successful control and eradication of tsetse from Zanzibar could provide significant returns to the economy and well being of the Zanzibari people through the increased productivity of livestock and eventual freedom from costly importation of meat and milk products.

PROJECT SUMMARY

The tsetse fly, through its blood-sucking habits is the vector of transmission of trypanosomiasis (human sleeping sickness and nagana in livestock) affecting human health and livestock development over a large portion of the African continent. In all of Africa some 30 species of the tsetse fly (Glossina sp.) are known, and on the mainland of Tanzania several species are found. On Unguja Island of Zanzibar only one species of tsetse is found, Glossina austeni; this species of tsetse is the sole vector of trypanosomiasis on Zanzibar, the key constraint limiting the livestock industry in this region of the United Republic of Tanzania. Eradication of the fly from Zanzibar would eliminate altogether the disease and improve livestock development and well being of the Zanzibari people.

Activities prior to URT/5/007

The Tsetse and Trypanosomiasis Research Institute (TTRI) at Tanga on mainland Tanzania occupies the site and buildings used in a technical assistance programme supported by the USAID to determine the feasibility of using the sterile insect technique to eradicate G. morsitans, a species of tsetse fly, from an experimental test site in Tanzania. The programme started in 1974, and IAEA staff member, H. Baumgartner, was seconded that year by the FAO as an expert in fly rearing and sterilization to work on the project at Tanga where he continued to provide expert services until the project ended in 1980. The project was successful as a feasibility study for the control of G. morsitans using an integrated programme of SIT and insecticides.

The TTRI then took over and continued research on tsetse control. Interest turned from the mainland to Zanzibar where the eradication of G. austeni as the sole vector of trypanosomiasis was considered feasible with facilities available.

The USAID project left behind much of the facilities needed for a SIT programme of tsetse control and eradication, including five buildings with three insectaries used for the maintenance and breeding of tsetse colonies. The use of the facilities at Tanga was continued by the TTRI. Subsequent to the USAID project, staff of the TTRI had the capacity to mass rear G. morsitans using in-vivo feeding techniques; however, they had no experience in in-vitro mass rearing of G. austeni prior to 1983.

In 1983, prior to initiation of the IAEA technical co-operation project URT/5/007, an Agency Expert (Feldmann) spent five months (July - November) at the TTRI initiating a colony

of G. austeni and training the staff in the latest techniques for mass rearing the fly in vitro. Previous work at the TTRI in the USAID programme employed only in-vivo mass rearing techniques, which required live animals for feeding and maintenance of tsetse colonies. Between November 1983 and February 1984 another Agency expert (Turner) assisted local scientists in carrying out field studies and tsetse population surveys on Zanzibar.

Pre-project scientific visit awards were provided in March 1983 to Mr. C.S. Tarimo, then Director of TTRI and in May 1983 to Mr. S. Mbise, Senior Scientist of the TTRI. The programmes included visits to the IAEA Seibersdorf Laboratories to discuss ongoing research on in-vitro artificial membrane feeding for tsetse mass rearing and to Nigeria to see an ongoing tsetse control programme in the field.

Activities under URT/5/007

In July of 1983 the Tanzania National Scientific Research Council submitted a request for a project entitled "Tsetse Fly Eradication by the Sterile Insect Technique" for inclusion in the IAEA's Regular Programme for 1984-1986 to be carried out at the TTRI, Tanga. Assistance was requested in the development of in-vitro membrane feeding technology for the mass production of tsetse flies (G. austeni) to be employed for the sterile insect technique as a precursor to tsetse and trypanosomiasis eradication on the Island of Zanzibar.

Under the project request the Government of Tanzania noted that several staff of the TTRI were experienced to various degrees in tsetse rearing, release and sterilization techniques. The IAEA was asked to provide 21 months altogether in expert services to develop mass rearing procedures, to evaluate the efficiency of sterile male flies and to develop tsetse survey techniques in the country. Fellowship training was also requested for six months in each of the aforementioned fields of work. Equipment including two Land Rover vehicles, a gamma radiation source, insecticides and trypanocide drugs, and tsetse rearing equipment and supplies were requested at an estimated cost of US $ 210 000.

Facilities available for implementing the project included insectaries for mass rearing of tsetse, standby electrical generators, sterilizing oven, autoclaves, gamma-radiation source, and a Land Rover vehicle. The Government had also authorized the TTRI to establish a Field Station in Zanzibar to initiate field work on tsetse. Local staff available to work on this project included C.S. Tarimo, Director of TTRI, which at the time was under the then existing Tanzania Livestock Research Organization (TALIRO) and six other staff including three scientists and three technicians experienced in various aspects of SIT, including mass

rearing, radiation sterilization, and field release.

The Technical Officer (Lindquist) supported a three-year project to assist the Government of Tanzania in developing membrane feeding for the mass rearing of tsetse required for SIT, and to initiate a programme to eradicate the tsetse fly from the island of Zanzibar. He noted that this technical co-operation project would also prepare the country for future tsetse eradication programmes on mainland Tanzania. In his initial evaluation of the project request the technical officer warned, however, he could foresee that local funds would be lacking for such items as petrol, vehicle maintenance, and repair of air conditioners, etc.

Project approval included plans over a three-year period to include an expert specialized in tsetse mass rearing techniques in 1984, an ecologist in 1985, and a specialist in tsetse fly survey in 1986. One month of expert services each year was planned for project review and evaluation. Funds were allocated for equipment to include a radiation source as the source left behind by the USAID project was no longer adequate, mass rearing and field equipment and two Land Rovers for field work. Fellowship training was foreseen to be financed from global funds available outside of the project. Total approved IAEA inputs for the period of 1984-86 included 15 months of experts services and $132 000 for equipment. Government inputs would include the staff at TTRI, Tanga, insectaries and facilities formerly used under the USAID project, a Land Rover vehicle already available, and salaries for local personnel.

For the period of 1987-90 the Tanzania Livestock Research Organization (TALIRO) Council submitted a technical assistance request for continuation of the project. The Government of Tanzania requested an additional 24 months of expert services, equipment including three Land Rover vehicles, items needed for mass rearing of tsetse, and insecticides and drugs, and fellowship training. Additional equipment reported to be already available for the project according to the technical assistance request included two Land Rover vehicles. Approval under the 1987 Regular Programme included 5 months of expert services. For 1988 approval was made for 11 months of expert services to initiate a survey of tsetse on Zanzibar and prepare selected areas of the island for trial releases of sterile flies, and laboratory and field equipment at an estimated cost of $50 000.

For the biennial period of 1989-90, provision was made for two months of additional expert services to address progress made on field studies on Zanzibar and the operation of mass-rearing facilities at the TTRI on the Tanzania mainland. An additional $30 000 was

approved for items needed to sustain the field work and tsetse mass-rearing. A non-convertible currency (NCC) component of $10 000 was allocated for the 1989 programme to be used apparently for the purchase of a Lada 4-wheel drive vehicle for field work. Project approval also provided for nine months of fellowship training in mass-rearing and diagnostic techniques applied to disease vectors and their hosts.

During late 1989 the Government of the United Republic of Tanzania submitted a request for continuation of the project under the 1991-92 Biennial Programme. The request included expert services for nine months, equipment at an estimated cost of $118 400 to include two Land Rover vehicles, equipment for tsetse mass-rearing and a computer, and 36 months of fellowship training. Government inputs listed in the project request included professional staff, three insectaries, veterinary laboratory, office building, workshop, gamma radiation source provided by the IAEA, facilities for mass-rearing of the tsetse fly, and two 4-wheel drive Land Rover vehicles already available. It was noted that one or two additional vehicles might be made available by the Government during the financial year 1989-90.

The Technical Officer (Van der Vloedt) recommended continuation of the project provided the following pre-conditions could be satisfied by the national authorities:

> There must be a mutual agreement between the counterparts concerned on the future plan of action so that
> - The field team of TTRI can be stationed on the island and conduct, in close co-operation with the DLDZ/FAO teams, ecological/entomological investigations (including pilot releases) in the Jozani Forest and elsewhere as required.
> - Provision can be made that sterile flies produced at Tanga can be transferred to Zanzibar according to operational needs.
> - Provision can be made by the national authorities for travel and field allowances of participating staff.

Project approval for the 1991-92 biennial period provided for eight months of expert services to assist in sterile fly release and eradication strategy. Under the equipment component $110 000 were allocated for the upgrading of mass-rearing facilities at TTRI on mainland Tanzania, for the procurement of traps, attractants and other equipment for field work on Zanzibar, and for a contract for the transport of sterile flies from Tanga on the mainland to Zanzibar for fly release. Twelve months of fellowship training in insect ecology was also approved.

In November 1991 the Ministry of Finance, Zanzibar submitted a request for project continuation for the 1993-94 biennial programme. Requested were eight months of expert services and an estimated $115 000 in equipment. The project request was supported by the Technical Officer (Offori). Project approval provided for three months of expert services in the

elaboration of sterile fly release strategies, population monitoring in the field, and population suppression techniques, $55 000 for laboratory and field equipment, and $10 000 for the maintenance of a back-up tsetse colony at Seibersdorf through a sub-contract.

Between June 1986 and March 1993, a total of 16 programme changes were made and three re-phasing exercises took place to respond to developments on the project. The total current budget for the years 1984 through 1994 amounts to $820 559 and includes $405 845 (46.5 man-months) for expert services, $402 755 for equipment, $1 959 for fellowship training and scientific visits, and $10 000 for sub-contract. Funds approved for expert services and equipment were almost equally shared among the total funds available for the project. Relatively very little was allocated to training, because global fellowship funds were available outside of this project.

As of 4 May 1993, total disbursements under the project amount to $598 600, total unliquidated obligations to $7 283, and total funds earmarked to $29 997 (see FINANCIAL SUMMARY, PAGE 7). The project has provided a total of 32.5 months of expert services, $365 474 worth of equipment, and one fellowship for a total of three months of training abroad. Also twelve fellowships and three scientific visits for a total of 57 months of training abroad were provided to project staff from global fellowship funds.

IMPLEMENTATION

Experts

A total of 14 man-months of expert services were planned and approved for the first two years of the project. Obstacles to recruitment arose. However, during the initial delays in recruitment, missions to Tanzania undertaken by IAEA technical officers from Headquarters and the Seibersdorf Laboratories helped establish project momentum. Two missions, implemented during the early stages of the project were carried out by IAEA staff (Gingrich in Nov.-Dec '84 for 9 days, Hamann in Feb. '85 for 17 days) in lieu of Task 01 and charged to the project's expert component (Task 90).

Three experts (Van der Vloedt, Hall, and Offori) provided services in 1986 for a total duration of six weeks. It was only in April 1988, over four years into the project, that an expert was recruited to provide long-term services (Madubunyi, 12 months).

Expert Task 01 - Mass-Rearing and Radiation Sterilization

In October 1984 the Africa Section informed the Tanzania National Radiation Commission of the interest of recruiting M. Weiss from the former Federal Republic of Germany for a 12-months assignment in mass-rearing techniques and field experimentation. This was acceptable to the authorities of Tanzania; however, the proposed expert withdrew due to the inappropriate timing and duration of the assignment. Another expert (Baumgartner) was proposed by the IAEA in early 1986; however, this expert was not accepted by the national authorities due to differences between the tasks of the assignment and background of the expert.

- R.E. GINGRICH (IAEA) Nov - Dec 84 9 days
  - To assess the present situation in the laboratory mass-rearing and field studies;
  - To advise on present problems and future actions.

The expert reviewed the facilities and activities at the Tsetse and Trypanosomiasis Research Institute (TTRI) at Tanga and met with the Director (Tarimo) and staff of TTRI, and with the Director General (Macha) of the Tanzanian Livestock Research Organization (TALIRO). Discussions were held on the progress and problems encountered in organizing and implementing a project on tsetse eradication from Zanzibar by the Sterile Insect Technique (SIT). The expert found the physical facilities at the TTRI sufficient to house all the operations needed to conduct a SIT programme against the tsetse fly on Zanzibar. In addition to technical recommendations to the counterpart institutions, the expert's recommendations to

the Government and IAEA were the following:

TO THE GOVERNMENT:

Assistance should be provided to support certain field activities relating to the SIT programme against G. austeni on Zanzibar. These activities are absolutely essential for the success of the project and should be started immediately. The personnel required for the work are available in the TTRI, but money is needed to accommodate them on Zanzibar for a few days each month.

TO THE IAEA:

(i) As soon as possible expert advice should be provided for two weeks on the methods to be used to prevent and control microbial infections in laboratory colonies of tsetse flies; (ii) Expert advice should be provided for six months, beginning not before June 1985, on field methods for the SIT; and (iii) Resources of the Agency should be used to procure for the TTRI various supplies and pieces of equipment which must be purchased outside of Tanzania.

- H.J. HAMANN (IAEA) Feb. 85 17 days
  - o To provide training and assistance to staff at the TTRI, Tanga, Tanzania, in handling microbial problems associated with the in-vitro rearing of tsetse.

The expert provided training in methods of detecting, overcoming and avoiding microbial contamination of diets and flies. He took part in field activities on the island of Zanzibar and assisted in searching for puparia and in a first attempt to light-trap adult G. austeni. Specific methodology was recommended to reduce bacterial contamination in mass-rearing facilities, and alternatives to biconical trap design and testing were recommended. The expert was impressed by the good organization and management of the project. The staff involved in the rearing and field activities was found to be skilled, well disciplined, highly motivated, and able to accept new knowledge and practical experiences.

Expert Task 02 - Tsetse Survey on Zanzibar

- A. VAN DER VLOEDT (IAEA) April 86 7 days
  - o To assess the status of the tsetse/trypanosomiasis field survey work on Unguja Island, Zanzibar, and to provide advice for future work;
  - o To evaluate the progress made by the administration and technical staff of the TTRI at Tanga; and
  - o To discuss and demonstrate practical techniques for in-vitro rearing of G. austeni.

Administrative and technical matters related to project implementation were discussed between the expert and TALIRO Director of Planning and Research and TTRI Director. Laboratory staff were provided demonstrations on specific handling procedures and quality control during in-vitro rearing and production of tsetse. In appraisal of project objectives and achievements the expert found survey work on Zanzibar progressing well with results providing a picture of the incidence of trypanosomiasis infections in cattle in defined zones of the island.

Recommendations were made for continued regular surveys and techniques to be used to complete the picture of trypanosomiasis prevalence on the island, and to intensify co-operation between the TTRI, Tanga, field team and the local Zanzibar field team through a well-defined and properly timed plan of action. The expert provided advice on the procedures for survey of G. austeni of Unguja Island by puparia searching and use of biconical traps.

The expert's conclusions are the following:

> CONCLUSIONS: In spite of some serious problems, mainly related to irregular availability of petrol, the difficulty in the acquisition of pieces of laboratory and field equipment, the lack of hard currency to purchase spare parts from foreign markets, there has been substantial progress made in the projects visited during the present mission. The good level of local technical expertise and the suitable infrastructure at TTRI offer good opportunity to conduct, in close co-operation with the teams of the Ministry of Livestock Development, a successful integrated vector and trypanosomiasis control programme on Zanzibar Island.
>
> The progress made to-day and the priorities, which the Tanzanian authorities are according to the tsetse/trypanosomiasis problem, are good justification for both FAO and IAEA for making further technical and financial inputs.

• M.J.R. HALL (UK) June - July 86 29 days

- To assist local staff on the testing of methods for the survey of the tsetse fly (G. austeni) on Zanzibar Island.

Together with local staff and an FAO Associate Professional Officer (Bouvry-Stratford) the expert tested a number of tsetse survey techniques, including bait animals (goats), traps, sticky targets and electric nets. Based on the results of fly catches the expert concluded that biconical and similar traps are ineffective against the target species, G. austeni, and should not be relied upon for sampling populations of this species. However, he recommended the use of bait animals, particularly goats, and electric nets for sampling G. austeni and further studies on the comparative efficiencies of these devices.

Due to the attachment of the expert's mission to an on-going FAO Livestock Development Project (URT/81/107) equipment and facilities available for the field work were good. Among other facilities, attachment to the FAO project provided a Suzuki 410 pick-up vehicle for use during the expert's assignment. The expert indicated, however, that the facilities would not have been so good in the absence of support from the FAO Livestock Development Project scheduled to terminate during late 1986. He recommended, among other equipment, the procurement by the IAEA of two vehicles for field work and a trailer for animal transport for long-term continuation of the project. The vehicles recommended were a long wheel base Land Rover pick-up and a Suzuki pick-up.

The expert's recommendations as supported by the TO:

i. Long-term multidisciplinary ecological studies of trypanosomiasis should be undertaken in Zanzibar. The FAO has initiated such a study and the Tanzanian officials responsible for project URT/5/007 should work closely with the FAO team.

ii. A tsetse survey on Zanzibar island should be undertaken as a prerequisite to control, and an expert will be recruited to undertake a 12-month assignment in tsetse survey.

iii. A small field sub-station should be made available in a village near Jozani Forest to facilitate ecological studies. Such a field station would in fact aid operations and facilitate handling of sterile flies to be flown in from Tanga, when the release phase of the project becomes operational. The Tanzanian authorities should give serious consideration to this recommendation.

- E.D. OFFORI (IAEA) Oct. 86 8 days
  - To meet with Government officials of the Ministry of Agriculture and TALIRO at Dar-es Salaam and with staff of the TTRI at Tanga to discuss administrative and technical operational matters relating to the project.

The current laboratory activities of the TTRI at Tanga were first reviewed by the expert before proceeding to Dar-es-Salaam to discuss administrative matters with authorities of the Ministry of Agriculture and TALIRO. The expert found good progress being made at the Tanga mass-rearing laboratory with a current total of 24,000 female flies in the colony mostly (80%) maintained by in-vitro diet. The proposed target of 50,000 female flies could be possible in 6 months time, barring unforeseen circumstances. At Dar es Salaam discussions emphasized streamlining administrative procedures by TALIRO, the Ministry of Agriculture and Livestock Development, the National Radiation Commission, and the Tsetse Control Unit of the Department of Livestock Development, Zanzibar (DLDZ).

The expert's recommendations were the following:

It was revealed that although TALIRO and the Ministry of Agriculture "have responsibility for research and tsetse control respectively, in the United Republic of Tanzania" primary responsibility for these activities in Zanzibar rests with the Zanzibar authorities. The need was therefore stressed for closer co-operation between the Zanzibar and mainland groups, and among all local and international organizations involved in tsetse/trypanosomiasis control activities in the United Republic of Tanzania. Accordingly, I recommended that TALIRO, the Ministry of Agriculture and the Zanzibar Tsetse/Trypanosomiasis Control Unit should convene a meeting as soon as possible to:

i. discuss on-going tsetse research/control activities in Zanzibar and elsewhere in Tanzania;
ii. agree on procedures for executing the field component of the project;
iii. prepare an overall project document for eradicating G. austeni on Zanzibar Island; and
iv. identify possible donors for external funding for the project.

The Director-General of TALIRO (Macha) assured the expert that the Government of Tanzania would continue to support the project, and that a project document would be drafted and submitted to the IAEA by the end of 1986.

Expert Task 90 -	Consultant	
• A. VAN DER VLOEDT (IAEA)	March 88	11 days

- o To discuss with TALIRO the management, administrative, and technical aspects related to the TC project;
- o To visit the TTRI at Tanga and advise staff on future expansion of G. austeni mass-rearing, irradiation experiments and pilot release studies;
- o To visit Unguja Island, Zanzibar, and discuss with representatives of Ministry of Agriculture and Livestock, staff involved in the FAO TCP/URT/87/002, and the Zanzibar Veterinary Services team technical aspects of on-going activities on tsetse fly population monitoring and cattle trypanosomiasis;
- o To discuss future involvement of the IAEA expert (Madubunyi, 12 m/m) on the island.

This mission was timed appropriately to assess the current situation in light of the start of a long-term expert assignment (Madubunyi, 12 m/m) scheduled to begin the following month. Among the offices and institutions directly involved in the project the expert met with senior staff of (i) TALIRO at Dar es Salaam including the Director General (Macha) and Director, Research and Training (Tarimo), (ii) TTRI at Tanga including the Director (Gao) and staff, and (iii) DLDZ on Unguja island (Shambwana, Deputy Director). Following in-depth discussions and on-site visits at the aforementioned institutions the expert made the following conclusions and recommendations:

i. The main problems found by the TALIRO administration are insufficient funds and lack of transportation means.

ii. The TALIRO management expressed concern about the non-availability of reliable transportation means for field work on Zanzibar. There are no vehicles available in the country for purchase with local funds. In order not to hamper Dr. Madubunyi's and TTRI field staff activities, management agreed to repair the old Land Rover (TX 6496). Immediate action was promised in this respect. However, it should be appreciated that the nature of field work related to tsetse-trypanosomiasis control (i.e. at least 20 working days per month with 4-6 people isolated in remote area; the need for splitting up teams which can move independently; difficulties in moving bulky field equipment) requires 100% flexibility as far as the use of vehicles is concerned. For these reasons, it is recommended that the IAEA reconsider its decision not to supply project URT/5/007 with a suitable 4 WD (e.g. Suzuki type) vehicle which should be considered as a highly valuable and necessary piece of equipment for field work.

iii. The information system and exchange of information between Vienna and Tanzania, but also internally between TALIRO headquarters, TTRI Tanga and the Zanzibar Services need drastic improvement.

iv. The existing infrastructure, built and developed during USAID involvement in the 1970s, and the more recently constructed laboratory facilities are in excellent condition, well maintained and appropriate to meet the requirements for mass-rearing tsetse flies and conducting supporting research on the use of SIT for trypanosomiasis control.

v. It was recommended that in order to guarantee sustained releases of sterile males, a colony of at least 50,000 breeding females G. austeni should be established and maintained during at least 24 months.

vi. The Government of the United Republic of Tanzania through the Ministry of Agriculture and Livestock Development and through TALIRO should submit an official request to the IAEA so that TC project URT/5/007 can be

extended through 1990. Additional provisions should be made for expert services, equipment, fellowships, and at least one additional vehicle.

Upon submission of the expert's report to the Government of the United Republic of Tanzania a cover letter was sent by the Area Office (Ericson) to TALIRO, Director General (A.M. Macha) dated 30 May 1988. The following reference was made in the letter to the transportation needs of the project:

> I regret the problems that are being faced on Zanzibar because of unreliable transport. There is nothing the Agency can do about it this year, but a request will be made for funds to be approved in 1989 for a 4-wheel-drive Lada. As you know, it is no longer the general policy of the Agency's technical co-operation programme to provide vehicles. In addition to this, one vehicle (a Land Rover) was provided to the project at the end of 1984. (This vehicle was provided to the TTRI mass rearing laboratory at Tanga, mainland Tanzania.)

Expert Task 02 - Tsetse Survey on Zanzibar (Cont'd.)

- L.C. MADUBUNYI (NIGERIA) April 88 - April 89 12 months
  - o To assist project staff to determine the distribution and density of G. austeni on Unguja island by means of surveys, with emphasis on the Jozani Forest area;
  - o To assist in identifying more effective survey and monitoring techniques and improve present knowledge of the behavior and ecology of G. austeni;
  - o To assist the TTRI in the preparation of a sterile male release strategy for integration with other suggested techniques (e.g. discriminate bush clearing, odor-baited and insecticide-treated traps and target devices, treatment of cattle with a residual acaricide toxic to tsetse) for total eradication of tsetse from Zanzibar.

This was the first long-term expert assignment with the project well into its 4th year of implementation. Intensive field work was required to complete the duties of this mission. Three field reports were submitted to the IAEA in the course of the expert's assignment, and a final report with findings and recommendations was received after the expert's departure. During the larger part of this mission severe constraints were encountered by the expert due to the lack of a vehicle for field work and funds to cover some running costs. Some relevant passages from the expert's field (progress) reports and replies from the IAEA are presented here. The findings and recommendations of the expert will be provided subsequently.

Field Report No.1 (Madubunyi) 19 Apr.-12 May 1988:
Local Constraints:

> Absence of project vehicle. Neither TALIRO nor DLDZ can provide a reliable project vehicle due to lean finances and foreign exchange limitations. TALIRO has an UNRELIABLE Leyland Land Rover which has been out of service and grounded in Zanzibar for several months. An attempt to rehabilitate this vehicle, which started five days after my arrival in Zanzibar, has been at a standstill since 11 May 1988 due to unavailability of the spare parts required for the major mechanical repairs entailed. Even if these parts were available, it is very doubtful that much could be expected from this vehicle given its notorious record on unreliability in the past and the demanding terrain and remoteness of the project area.

In light of the information received in the expert's 1st report the Area Office (Ericson) informed the Government of the United Republic of Tanzania of action to be taken concerning the lack of transport. This was provided by letter to the Director General (Macha) of TALIRO dated 14 June 1988. A relevant statement of that correspondence is the following:

> To relieve the transport problem, it has been agreed that a 4-WD Lada should be purchased for the field work as soon as possible. I hope that delivery can be expected in 3-4 months. However, I must point out that project funds are not intended for the running costs of the vehicle. These are expected to be budgeted for by the institute receiving assistance.

Field Report No.2 of L.C. Madubunyi for 20 May - 30 Sept. 1988:

The frustration of the expert over the constraints encountered remained clear from his 2nd progress report and the delay in project implementation was evident. His following statement concerning these constraints and inability to perform project objectives is important to note:

> Since my arrival in Zanzibar on 5 May 1988 it has been possible to visit Jozani Forest only ONCE and this was in a vehicle generously provided by the Director, Department of Livestock Development, Zanzibar (DLDZ). Unfortunately ever since then he has found it absolutely impossible to assist with transport for a repeat visit. Deployment of meteorological equipment has not been feasible since items on order are yet to be received. Nevertheless, even if all these were available it would be pointless setting them up at Jozani in the absence of a project vehicle. Unavailability of transport made it impossible to initiate activity in this area. (Establish the diurnal activity pattern of G. austeni in Jozani Forest using trapping devices). Without transport this activity could not be started (Long-term sampling for establishing the spatial distribution, population statistics, trophic spectrum and pattern and trypanosome infection rate of G. austeni in Jozani area),
>
> LOCAL CONSTRAINTS:
>
> The absence of a functioning project vehicle continues to stagnate the work programme and to checkmate realization of project objectives. The unreliable Land Rover TX 6496 assigned to URT/5/007 has once again broken down and been grounded since 1 August 1988. All effort to obtain a vehicle even for an occasional field trip proved fruitless. Even my request made by telex since 6 September that Agency authorize hire of transport for field trips from imprest remains unanswered to date.

Field Report No.3 of L.C. Madubunyi for 1 Oct - 31 Dec 1988:

Six months into the assignment the expert received authorization on 13 Oct. 1993 to hire transport from project imprest account for field trips to Jozani Forest. Field work at Jozani Forest could then begin, and the expert provided the following observations concerning the impact this had on project implementation and the vital need for adequate field vehicles:

> Between 18 October - 31 December 1988 a total of 26 trips were made to Jozani Forest in a double cabin Datsun 4-wheel drive pick-up hired from the Oman and Zanzibar trading and Contracting Co., Zanzibar. During this period, in addition to creating access paths totaling 6,000 metres long through parts of the forest, four experiments were undertaken during which 636 G. austeni were caught and the catching ability of a new trap designed and made in Zanzibar was successfully established.

LOCAL CONSTRAINTS:

From what has been accomplished between 13 October (when authority was received to hire transport from project imprest for field trips) and 31 December 1988, the negative effect that lack of transport has had on the level of attainment of project objectives is glaringly obvious. Now that the imprest has been completely exhausted (55% of it consumed by transport hire), project activity has once more come to a complete halt, which regrettably will certainly cause undesirable loss of momentum. Hiring a commercial vehicle for trips to Jozani Forest, though better than nothing, is far from satisfactory. While it lasted, it was never possible to depart for or from the field as desirable in accordance with the day's targets, without incurring overtime charges which would constitute additional strain on the meager imprest.

The accomplishments of the expert during this assignment included a critical review of the available information on the ecology of G. austeni in Zanzibar particularly recent trapping data; a comparison of G. austeni catching ability of various types of traps in the Jozani Forest of Unguja Island, Zanzibar; and the design, construction and testing of a new trap (Chuka trap), which emerged as the least expensive and most effective device available for catching G. austeni. However, in the viewpoint of the expert, from the standpoint of coverage of mission terms of reference, only one-third (33%) of the mission objectives could be addressed caused mainly by the shortcomings of lack of transport during most of the assignment.

The expert's recommendations as supported by the TO:

TO THE GOVERNMENT:

i. There appeared to be no standing collaborative arrangement between either TTRI or DLDZ or their parent organizations. The respective Governments of the United Republic of Tanzania and Zanzibar should request the Ministry of Agriculture and Livestock Development (Dar es Salaam) and the Ministry of Agriculture, Livestock Development and Natural Resources (Zanzibar) to articulate a formal protocol or collaboration between their respective departments/institutes on tsetse eradication in Zanzibar.

ii. In view of the requirements of and expectations from, the on-going project URT/86/022, the Government of Zanzibar should submit a request to the IAEA for extension of TCP-URT/5/007 activity in Jozani Forest for a 12-month period and later submit a project proposal for IAEA assistance in integrated area-wide eradication of G. austeni with a SIT component.

iii. Government executing agencies of technical assistance projects should be persuaded to take more seriously their on-the-job training aspects so as to ensure continuity upon an expert's departure.

TO COUNTERPART INSTITUTIONS:

TTRI should reassess its ability to conduct sustained tsetse research and control activities in Zanzibar in the light of the heavy recurrent expenditure involved, its professional manpower capabilities vis-a-vis expected short-term outputs and its achievements between 1983 and the present. TTRI may find it prudent for now, at least for economic reasons, to concentrate on achieving the production target of its tsetse mass-rearing programme and limit its field activities in Zanzibar to supplying sterilized G. austeni for release.

TO THE AGENCY:

The IAEA should continue to provide assistance to TCP-URT/5/007. In so

doing, the Agency should be guided by the following:

i. Although a part of the United Republic of Tanzania, Zanzibar has a Government which exercises full autonomy in all except union matters, namely defence, external affairs, internal security, telecommunications, and higher education.

ii. A bill to dissolve TALIRO which was recently passed by parliament is awaiting Presidential assent. Soon, when this bill becomes law, TTRI will revert to the Ministry of Agriculture and Livestock Development, Dar es Salaam.

iii. Tsetse and trypanosomiasis research and control (and in fact all livestock matters) in Zanzibar are under the jurisdiction of the Ministry of Agriculture, Livestock Development and Natural Resources, Zanzibar, which is not only separate from but also independent of the Ministry of Agriculture and Livestock Development, Dar es Salaam.

iv. Direct discussion between the Agency and the Government of Zanzibar is essential for realizing the goals of TCP-URT/5/007.

While submitting the expert's final report to the Tanzania National Radiation Commission (Nyanda) the Area Office in a letter dated 16 August 1989 alerted the Government of Tanzania of urgent action which must be taken. The following statements from that letter are important to note:

> The immediate problem of lack of transport for the field studies will have to be overcome by the national authorities since it is not the policy of the Agency to provide vehicles. The exception that was made in 1988 to purchase a 4-wheel drive Lada for this project may not materialize because the Soviet Union has so far not been able to fulfil this request. There must be a mutual agreement between the counterparts concerned on a future plan of action... For this (project) to succeed there must be written commitments from all parties concerned and a good team spirit.

Expert Task 03 - Tsetse Rearing and Field Work for SIT on Zanzibar

- A. VAN DER VLOEDT (IAEA) Nov. - Dec. 89 11 days
  - To critically review the current situation of project URT/5/007;
  - To discuss with authorities of the Ministry of Agriculture, Livestock and Natural Resources, Zanzibar, and the Ministry of Agriculture and Livestock Development, Dar es Salaam, the management of the project and future plan of action;
  - To assist the national staff in the preparation of a future plan of action.

The expert travelled to (i) Dar es Salaam for meetings with officials of the Ministry of Agriculture and Livestock Development (Semuguruka, Commissioner Research and Training Department), National Radiation Commission (Nyanda), (ii) Tanga for meetings with the Director (Gao) and staff of TTRI, and (iii) Zanzibar for meetings with officials and staff of the Ministry of Agriculture, Livestock and Natural Resources, Department of Livestock Development (DLDZ). In the course of the mission the expert also held meetings with FAO officials on project co-operation.

Following a visit and review of work at the mass-rearing facilities at the TTRI, Tanga, the expert reported genuine success in the on-going mass-rearing of G. austeni (42,000 mated

females) fed in-vitro on locally collected blood. The immediate objective of the TTRI team was to expand the colony to 60,000 female flies and produce an average monthly surplus of 25,000 males for pilot releases on Unguja island during the earlier part of 1990. Another positive achievement was the confirmation of the usefulness of the sticky-target approach and the apparent successful introduction of the simpler and cheaper 'Chuka target' of local design.

The expert's recommendations were the following:

TO THE GOVERNMENT:

i. The Ministry of Agriculture and Livestock Development through its Commissioner of the Research and Training Department, and the Ministry of Agriculture, Livestock and Natural Resources, Zanzibar, through the Director of the Department of Livestock, should prepare a formal protocol of collaboration between the perspective departments and institutes involved in the projects;

ii. There must be a mutual agreement between the counterparts concerned on a future plan of action;

iii. Requests for continued assistance to project URT/5/007 beyond 1990 should be prepared and submitted to IAEA as soon as possible;

iv. The national authorities should be aware that island-wide action requires more field staff than available at present to ensure that the entomological and disease control activities can be sustained. The immediate problem of lack of transport for the field studies (also the biggest constraint during Dr. Madubunyi's assignment) will have to be overcome by the national authorities since it is not the policy of the IAEA to provide vehicles.

TO THE COUNTERPART INSTITUTION TTRI:

i. The TTRI management should insist on the need to transfer the most experienced technical officers and field technicians to Unguja island for sustained field work;

ii. The scientific officers responsible for the mass-rearing operations should give immediate follow-up to all technical suggestions made during the mission;

iii. Expansion of the G. austeni (target size: 60,000 mated females fed in vitro) should be continued.

Expert Task 05 - Tsetse Mass-Rearing and Deployment of Sterile Males

- U. FELDMANN (IAEA) March - April 90 14 days
  - To assist the national staff of the Tsetse and Trypanosomiasis Research Institute (TTRI) at Tanga in refining the mass-production of G. austeni for release of sterile flies;
  - To advise national staff at Tanga and Zanzibar in preparation of sterile male releases and related quality control/monitoring.

The expert provided advice to assist the national staff in tsetse mass-rearing and in preparations for initiation of sterile fly releases as part of the tsetse fly eradication project. He noted that with assistance of the IAEA Fellowship Programme most of the TTRI research officers and technicians had received training in relevant aspects of the SIT. All of the staff who received training through an IAEA fellowship were available for the project, except Mr. P. Chuwa, who was attending a university course. The TTRI was reported to have a competent

and very eager team. At the time of the expert's mission a colony of 40,000 female flies was maintained by the TTRI staff. More equipment was recommended by the expert in order to permit the TTRI to reach a colony size of 60,000 females needed for the operational release phase.

A suitable means of transport of sterile flies from TTRI, Tanga, on the mainland to Zanzibar had to be found. The expert discovered that regular flights of Air Tanzania were discontinued and former ferry services no longer existed. The only reliable connection was to charter aircraft.

The expert discussed further co-operation with the FAO team on Zanzibar (Project URT/86/022), which was studying the use of insecticides to suppress the tsetse population. The expert noted that the FAO team on Zanzibar was fully aware of the environmental implications of using insecticides in forest reserves with protected wildlife and the practical constraints of their conventional control methods (i.e. insecticide treatments can only control the insect and not eradicate the pest). Initially the FAO team did not want interference from the IAEA/TTRI team by the introduction of sterile flies in their experimental areas. However, the FAO team recognized the feasibility of SIT and its advantages over the use if insecticides, and the FAO Team Leader, Dr. J. Sevar, welcomed the TTRI/IAEA team to support eradication of G. austeni from Zanzibar.

Many technical recommendations were provided by the expert to the counterpart institutions concerning mass-rearing and release techniques. The expert's other recommendations were the following:

TO THE GOVERNMENT:

i. The TTRI through the Ministry of Agriculture and Livestock Development and the DLDZ through the Ministry of Agriculture, Livestock and Natural Resources should enforce co-ordination of project objectives;

ii. The applicability of integrating all available methods for the control or eradication of G. austeni from agriculturally used land or from protected sites such as forestry reserves should be reviewed with reference to their efficiency and environmental implications;

iii. For the establishment of optimal transport procedures for sterile flies the assistance of involved state institutions or authorities at Tanga and Zanzibar will be beneficial;

iv. With the initiation of sterile fly releases on Zanzibar extensive fly population monitoring operations have to be conducted by the TTRI team. It is essential that a) sufficient government funds are budgeted for travel and field allowances of the TTRI staff; b) the field staff can be stationed on the island with accommodation in one house to facilitate early morning departures to the field; and c) a field station can be erected close to the monitoring area where dissections of captured flies can be conducted.

TO THE IAEA:

The TTRI field team has no reliable independent transport on the island. The national authorities are not in a position to provide transport to the team on Zanzibar. If the Lada, which was purchased in 1988, cannot be delivered in due time, action on an alternative transport, such as the purchase of a 4-wheel drive vehicle from Dubai, should be explored. The assignment of consultants or experts to Zanzibar should not be considered unless there is reliable transport.

Expert Task 06 - Production and Deployment of Sterile Males

- M.J.B. VREYSEN (FAO/IAEA) July - August 90 19 days
  - o To assist the national staff in optimizing blood processing, quality control procedures and the production of sterile males;
  - o To demonstrate the impact of radiation on the tsetse fly's reproduction system and introduce the principle of using irradiated females as sentinel insects;
  - o To assist in the preparation of experimental releases.

All aspects of the laboratory operations were reviewed by the expert and advice was given on improvements of blood quality testing procedures, production and handling of the males and optimizing the use of colony males in order to obtain a maximum output for releases. Experiments were initiated to assess (i) mating and insemination potential of colony males, (ii) quality of the males after various treatments, and (iii) competitiveness of the males after packing and transport in release cages. The expert also provided demonstrations on the impact of mating with sterile flies on the female reproductive system and the dynamics of follicle development of gamma irradiated females.

The female colony size at this time was 45,000 mated females, which could supply 1,800 - 2,000 excess males per week. With arrival of additional mass rearing equipment the expert forecasted an increase in colony size to 60,000 females in the next 4-5 months with a production of 20,000 excess male flies per month. In view of the current situation in the mass-rearing laboratory and anticipated progress in the next 3-4 months, it was foreseen that pilot releases of sterile flies could be initiated at Jozani Forest by mid-October 1990.

The Assistant Commissioner (Mpiri) of the Ministry of Agriculture and Livestock Development, Department of Research and Training, stressed the high priority given to the programme and assured that sufficient provisions would be made available for the Tanga team to conduct field work on Zanzibar for 2-3 weeks per month for the first half of 1991.

Many technical recommendations were made by the expert for the scientific staff at TTRI. The expert's recommendations to the Government and IAEA were the following:

TO THE GOVERNMENT:

The Ministry of Agriculture and Livestock Development, through the Department of Research and Training, should come to an agreement with the Ministry of Agriculture, Livestock and Natural Resources, Zanzibar, to ensure full collaboration between the Departments with special reference to: (i) secure sufficient provisions for the field teams to work on Zanzibar throughout 1991 for 15-20 days per month; (ii) participation of the field team of DLDZ in the releases and monitoring activities; (iii) installment of a field camp to facilitate entomological monitoring; and (iv) accommodation for the field team.

TO THE IAEA:

(i) Expand the present experimental colony of G. austeni, maintained at the Entomology Unit of the IAEA Laboratory in Seibersdorf, to a level of 10,000 producing females, as a back-up for the colony at the Tanga facilities; (ii) One of the air charter companies should be approached for contractual arrangements for the planned flights for 1990; (iii) Explore the possibility of opening an imprest account to obtain more flexibility for arranging flights to Zanzibar (for sterile fly release).

Expert Task 04 - Tsetse Monitoring During Control Operations

- M.J.R. HALL (UK) Sept. 90 13 days
  - o To evaluate entomological field work under project URT/5/007 and consult with the FAO Team working in Tanzania;
  - o To assist national teams in target/trap device work for enhanced detection of adult tsetse particularly at Jozani Forest.

The expert provided an evaluation of all methods used for the survey of tsetse on Zanzibar. Field work of the expert included a bait animal survey, and the preliminary testing of canopy traps and a modified target. Another region of Zanzibar, Muyuni Forest, was recognized as a possible major focus of G. austeni in the south of the island; and the expert recommended a detailed survey of this sector. Recommendations for further target and trap work were made; however, to cover any immediate need of a target design for a major monitoring exercise, the expert recommended a simple, suspended wooden target as a standard design.

The expert's recommendations as supported by the TO:

(i) Senior staff from the Headquarters of FAO and IAEA responsible for projects URT/86/022 and project URT/5/007 respectively, should meet with the staff of those projects and senior representatives of the Tanzanian veterinary authorities on Zanzibar island to plan a collaborative control strategy based on conventional and SIT methods. This planning meeting should be held as soon as possible; (ii) The use of bait animals, in particular goats, should be reconsidered in survey operations, especially for the capture of live flies for dissection; if time and funds do not allow this, monitoring operations could be conducted using a sticky target; (iii) A more analytical development programme should be followed for the improvement of target and trap design; (iv) A detailed tsetse survey should be made of the Muyuni Forest; and (v) To consolidate the successful operations against tsetse in the northern half of Zanzibar and to reduce the danger of re-invasion from the more intractable tsetse foci of the Jozani Forest from southern Zanzibar, it is recommended that a barrier zone be created to the west of Jozani Forest.

Expert Task 06 - Production and Development of Sterile Males (cont'd.)

• M.J.V. VREYSEN (FAO/IAEA) Sept. 90 - July 91 10 months

- o To assist national staff in optimizing production of sufficient numbers of competitive sterile males with emphasis on:
  - modification of existing system of blood collection and processing to fulfill increased demands for in-vitro diet;
  - establishing adequate routine quality control procedures for G. austeni colony maintenance and sterile male production;
  - development of procedures for optimal handling, transport and release of sterile G. austeni males.
- o To assist the national staff at Zanzibar in deployment of sterile males and establishment of methods to assess the status of control and eradication of G. austeni.

Since September 1990 to the present time the expert has worked continuously at Tanga and Zanzibar under various expert tasks. As a staff member of the FAO and Professional Officer at the Entomology Unit of the IAEA's Seibersdorf Laboratories, the expert undertook the duties of this assignment in September 1990. At contract termination his work continued in mainland Tanzania and Zanzibar under various contracts of the FAO and IAEA and other expert tasks, which will be described further on in this evaluation review.

Following the first three months on duty the expert reported good progress in sterile fly release studies on Zanzibar island. Four releases of sterile flies were carried out. The flies survived well under transport conditions from Tanga.

A schedule was adopted for the irradiation, transport, and release of flies on the island. To avoid having to leave flies overnight in Zanzibar before release, a schedule was arranged for the plane to pick up the flies in Tanga at 7:00 a.m. for a morning release of flies at Jozani Forest between 9:30 and 10:00 a.m. The schedule for the irradiation and feeding of flies had to be worked out. Initial studies showed only an average 5.1% mortality of flies prior to release, which was considered acceptable in light of the length of transport and very bad road to Jozani Forest. Fly dispersal after release was also good with many of the flies found outside of the experimental area after eight days.

On 21 December 1990, the expert relayed more good news by letter to the IAEA concerning the availability of the Lada vehicle, and the excellent support provided on a regular basis by the TTRI, Tanga, staff and DLDZ staff on Zanzibar island. The following statements of the expert relay the optimistic and promising situation:

> Today is a historical day for our programme, as our Lada vehicle could be finally used for the first time. Another piece of good news is that since last week our Tanga team is finally accommodated in Pete Village. They can operate completely independent now so it becomes unnecessary for me to go

> to Jozani every day. We intend to put the Land Rover TX 9496 (has still some mechanical problems) or the Toyota Land Cruiser TX 55 (if Dr. K. Biwi agrees) in Jozani to enable the Tanga team to operate freely and economize on time. Our working force is slowly expanding with now permanently four people from Tanga stationed in Zanzibar (with a rotating cycle of 3 weeks).

Yet better results concerning sterile fly release and field performance were provided in a report of the expert dated 14 January 1991. An early morning (7:00 a.m.) flight could be scheduled for the flies to Zanzibar to manage release of all flies at Jozani Forest between 9:30 and 10:00 a.m. Avoiding the overnight of flies in Zanzibar improved fly survival; more than 90% of all males were released. Fly activity during release was also improved as indicated by the rates of fly "take off" upon release. The flies were definitely more vigorous than in previous releases.

A lapse of support from TTRI, Tanga, did present some problems. In a letter dated 19 April 1991 to the TO (Van Der Vloedt), the expert stated:

> No staff from Tanga has been in Zanzibar since 7 March 1990 with the exception of two people from 21 March till 4 April 1991. So for 5 weeks now we have been short on staff with no improvement in sight for at least another 2-3 weeks. Communication with Tanga is very difficult, but it is clear that TTRI is short on money. This of course means no money for fuel, casual laborers, etc.

The expert reports that despite the encountered problems, fly releases could be maintained as usual. Data on the survival and release of flies was reported to be very good. A total of 14,820 sterile males were transported with 88.8%, 95.9%, and 93.4% of the flies actually released for three release experiments.

During this expert assignment in Tanga and Zanzibar an exchange of correspondence between the Area Office (Ericson) and the authorities of Tanzania occurred. This correspondence has much relevance to the implementation of this project, and it can provide lessons concerning the need to define clearly obligations of recipient institutions or governments, particularly when more than one recipient institute and government (two independent ministries) are involved. Important excerpts of this correspondence are the following:

Letter of the Director of TTRI, Tanga (Gao) to the Area Office (Ericson) dated 4 December 1990:

> Firstly, I must express my sincere gratitude to the Agency for providing a vehicle to this project, this will alleviate the transport problem which has always been the main obstacle... Secondly, may I, at your earliest convenience, know who will be responsible for running and maintenance of this vehicle i.e. provision of fuel and repairs, etc.

Letter of the Director of TTRI, Tanga (Gao) to the IAEA expert (Vreysen):

> IAEA demands regular quarterly reports on the progress of the project (both laboratory and field). Since you are the IAEA Expert to spear-head this

project, you are requested to undertake this task without fail. Copies of the reports should be sent to: Commissioner, Research and Training, Dar es Salaam; Director, Veterinary Services, Zanzibar; and this office.

Letter of Area Office (Ericson) to Director of TTRI (Gao):

Your letter to me of 4 December about the project vehicle and the copy of the letter to Mr. Vreysen about quarterly reports have made me realize there is a complete misconception of the purpose of IAEA-funded technical co-operation. The need for technology transfer is defined by the Member States and relevant project proposals are prepared by national institutes. Thus, the project on tsetse eradication is a Tanzanian one and not an Agency one; its success depends on national interest and local commitments. The IAEA can, if requested, provide support through expertise, training and capital equipment. The consultant, Mr. Marc Vreysen, has been recruited for his expertise in sterile insect techniques so that he can transfer his knowledge and experience to the nationals through advice, guidance, and on-the-job training. He is required to report regularly to the IAEA but not to prepare reports on behalf of the project staff. The counterpart staff are obviously encouraged and are working long hours with Mr. Vreysen on the island. I would therefore had thought that everything possible should now be done to maintain these activities and the high working morale that has at last been achieved. Field trips into Jozani cannot be made without petrol for the vehicle. I understood from Mr. Vreysen that you are providing the funds for the petrol. The maintenance, repair, and running costs of all equipment (including project vehicles) are the responsibility of the national institutes and are not the concern of the IAEA. If adequate infrastructure is not available for running the project, outside support should not have been provided in the first place. According to the project proposal you signed in September 1989 and submitted to the Agency through your Government, "locally available equipment/supplies will be purchased as required"... and "one or two vehicles will be made available this financial year 1989/90." It is also stated that "All infrastructure and funds are already available for smooth implementation of the project." Now that tangible results are in sight, I am sure you will agree that all parties involved in the project should pull together towards its success.

The final report of Mr. Vreysen for this mission period showed yet more positive advances in the Tanga laboratory and Zanzibar field preparations. A colony size of approximately 52,000 female flies was maintained. An increase in pupae production was observed with fecundity rates ranging between 0.4 - 0.6 pupae per producing female per 10 days. Quality control in blood collection and irradiation treatment for feeding fly colonies was maintained.

The expert reported that a meeting was organized with the Director (Gao) TTRI, Tanga, to discuss achievements in Zanzibar, on-going activities in the Tanga laboratory, and future plan of action. At this meeting the expert was informed that funding for the project had been cut and consequently no TTRI staff could be stationed in Zanzibar for more than two months. The expert brought to the attention of Mr. Gao that the progress of the programme was seriously hampered due to the lack of trained staff (for dissections), and funds to cover

running costs. The expert made reference to the meeting of 22.2.91 where it was decided that the respective governments (Ministry of Agriculture and Livestock Development, Tanzania, and Ministry of Agriculture, Zanzibar) would come to an agreement with respect to the final destination of the project vehicle, Lada Niva 203 TX 655, and consequently, which government would take responsibility for running costs and maintenance. It was reported that Mr. Gao informed the expert that no such meeting had yet taken place but assured the expert that TTRI would continue to provide for the fuel, provided funds were available. With respect to future plan of action it was agreed that new sterile flies would be released every 10 days on Zanzibar.

The expert participated in a meeting with the Research Counsel of the Ministry of Agriculture, Zanzibar, to review achievements and discuss future activities. Officials present were Mr. M.K. Gao (Director, TTRI, Tanga), Mr. K. Biwi (Commissioner, Livestock and Agriculture), Dr. I. Shambwana (Ass. Comm. Livestock), and Ms. A. Draskau (FAO, URT/86/022). Mr. Gao emphasized the need for prior fly suppression in the northern half of the Jozani Forest, in view of high fly densities. It was decided that a strategy would be developed pending the availability of data. Mr. Biwi expressed the possibility that provisions could be made for renting the field camp in Pete Village as a permanent base camp in the vicinity of the Forest for smooth field operations, and he also voiced the possibility of providing two additional field officers to enforce the present field staff.

Expert's Recommendations:

TO THE GOVERNMENT OF TANZANIA:

The Ministry of Agriculture and Livestock Development, through the Department of Research and Training should: (i) make sufficient provisions of TTRI staff (minimum 2) in Zanzibar to ensure the smooth implementation of the releases and the related field work; (ii) come to an agreement with the Ministry of Agriculture, Livestock and Natural Resources of Zanzibar on terms of running costs of the project; and (iii) expand and improve equipment of the present field camp in Pete, and install a second field camp in Muyuni.

The Ministry of Agriculture, Zanzibar, should: (i) provide two more tsetse field officers, in addition to the two field officers assigned to the project at present; (ii) make provisions for the DLDZ field officers for training at the TTRI mass-rearing facility in dissection techniques and release-related laboratory operations; and (iii) make provisions for a permanent involvement of 5 to 10 casual laborers.

TO THE IAEA:

(i) Efforts should be directed towards a complete inter-project collaboration between IAEA project URT/5/007 and URT/86/022 as to fully implement the objectives of both projects; (ii) External financial inputs should be found to cover (a) the purchase of two 4-wheel drive vehicles, (b) a contract with the charter company "Air Zanzibar" for trial and operational aerial releases, (c) extension of present field camp and building of a second field camp in Muyuni, and (d) a stock of petrol (2,000-3,000 litres) as back-up during periods of fuel shortage; and (iii) The G. austeni colony at the Entomology Unit of the IAEA's Seibersdorf Laboratory should be expanded as

a back-up colony which in addition can provide the project with 10,000 pupae per month to supplement releases.

Expert Task 07- SIT-Related Field Work - Evaluation of Technical Progress

- A. VAN DER VLOEDT (IAEA) Feb. 91 7 days

  - o To evaluate the current progress in the field work on Zanzibar;
  - o To discuss the vital collaboration of all parties involved in this common project with due consideration to manpower and equipment needs with exchange of information and continuous backstopping by all staff involved.

The expert visited the Josani Forest where pilot releases of sterile male G. austeni (in the northern half of the forest) and the use of sticky and insecticide-impregnated targets (in the southern part of the forest under FAO project URT/86/022) were in progress. With assistance from the management of the DLDZ, the expert carried out an aerial survey over the central and southern parts of the island, with emphasis on the Josani and Muyuni Forests. Ground inspection was also made of the transects established for detailed entomological monitoring. The occasion was taken by the expert to participate in one of the pilot releases and collection of flies at reference sites.

At the end of the mission the expert participated in a planning session with representatives and staff of the DLDZ, TTRI, and FAO staff responsible for project URT/86/022. The meeting was used to discuss the phasing and implementation of the project within the context of a collaborative control and eradication strategy with all persons and institutions involved participating in an exchange of information and technical support.

The expert's conclusions are the following:

> Progress to date has indicated the tremendous effectiveness of the living target technology in areas where cattle are the prominent tsetse hosts. On the other hand, inside the forest, where a dense fly population feeds mainly on bushpig, conditions are more amenable to the use of sterile males. Although it might be envisaged that insecticide-impregnated screens will reduce the tsetse population in the forest, the SIT offers the best prospects for total eradication, because the sterile flies would carry out the forest penetration themselves, from a small number of release points.

Expert Task 08 - SIT-Related Field Work

- M.J.B. VREYSEN (FAO/IAEA) July 91 - May 92 10.5 months

The duties of this task are the same as previously described under Task 06, and they are an extension for continued work of the expert in providing advice in the development of fly colonies at TTRI, Tanga, and sterile fly release and population studies on Zanzibar island. During this duty period up to December 1991 the expert provided conclusive data that sterile males, reared at the TTRI in Tanga, can be successfully transported and released in Zanzibar without any loss in quality and performance.

The bulk of the field work carried out on Zanzibar island was concentrated on entomological monitoring activities. Apparent densities of the tsetse fly were found to be very high in certain areas of the Jozani Forest, and considerable variations in the apparent densities existed depending on the forest area (trapping site) and the season. Due to the high apparent densities of the fly observed in the north of the Jozani Forest, the trial sterile fly releases were interrupted as fly population suppression was necessary.

Experimental work was carried out to assess the catch efficiency for G. austeni of the monopanel in relation to panel shape, colour of the panel and type of sticky glue used. Legpanels colored white on one panel side and dark blue on the other side were found to be significantly more efficient in catching flies as compared to other color combinations.

From the information gained on fly population densities and fly distributions in the forested areas along with the possible existence of relic fly populations in Mangapwani, the expert concluded that more funds would be required than provided within the Technical Co-operation programme to accomplish the eradication of the tsetse fly from Unguja Island. He pointed out that an advantage, however, was the close collaboration obtained with the UNDP/FAO Animal Disease Control Project, which had entered its second phase (URT/91/006, Sept. '91 - Sept. '93).

The possibility of releasing large numbers of sterile male G. austeni on the island of Unguja was now soundly tested and validated. The expert reported that the most critical restraints for the successful implementation of the programme were transport and staffing. The personnel of the DLDZ engaged in tsetse control operations was at present insufficient to meet the requirements for an island-wide operation. He reported that the Lada Niva 4-wheel drive project car (203 TX 655) was the only vehicle available for the execution of all field activities. The old Toyota Landcruiser (TX 55) was grounded permanently. The Land Rover of TTRI (TX 6496) was never in use and was shipped back to Tanga for a major engine overhaul. Field activities were severely curtailed by the lack of sufficient reliable transport.

The expert made many technical recommendations for continued work at the TTRI mass-rearing laboratory at Tanga, and by the field teams of DLDZ and TTRI on Zanzibar. Other recommendations of the expert to the Government and IAEA as supported by the TO are the following:

TO THE GOVERNMENT OF TANZANIA:

The Ministry of Agriculture and Livestock Development should (i) continue to make sufficient funds available for TTRI field staff (minimum 2 for 21

days per month) to implement in close collaboration with the DLDZ sustainable releases of sterile males and carry out related field monitoring activities on Unguja Island; and (ii) come to an agreement with the Ministry of Agriculture, Livestock and Natural Resources, Department of Livestock Development, Zanzibar, on mutual contributions of running costs for the project.

The Ministry of Agriculture, Livestock and Natural Resources, Zanzibar, should (i) provide three or more field staff to enforce the team, a prerequisite for the successful implementation of release work and field monitoring activities; (ii) make provisions for new recruited staff to be trained at TTRI, Tanga, and (iii) pending arrival of new vehicles, make sufficient provisions for maintenance and adequate fuel supply.

TO THE IAEA:

(i) Continue to provide technical assistance to support SIT on Zanzibar. However, it is obvious that extra funding is absolutely required to fully implement the objectives of the programme, i.e. the eradication of the tsetse fly from Unguja Island; (ii) provide two additional 4-wheel drive vehicles, (A minimum of three such vehicles is required for the project to become fully operational), and financial support for aerial releases of flies in collaboration with Air Zanzibar; (iii) continue to expand the G. austeni colony maintained at the Seibersdorf Entomology Unit (target size 80,000 female flies) and provide technical backstopping and regular shipments of additional tsetse pupae to the TTRI, Tanga; and (iv) in view of possible presence of relic fly populations in the Mangapwani area, outline a new overall strategy with the Governments of Tanzania and Zanzibar, staff of TTRI and DLDZ, FAO technical officers and project staff of URT/91/006, and IAEA technical officers and staff of project URT/5/007.

Expert Task 09 - Production and Development of Sterile Flies:Action Plan

- A. VAN DER VLOEDT (IAEA) Nov. 91 13 days
  - o To inform counterparts on changes in the eradication programme;
  - o To discuss the new scheme for the production of sterile flies and define requirements for release of 10,000 sterile flies per 10-day period;
  - o To assist the field team in a programme to tackle residual tsetse fly foci and in conducting infection rate studies.

Upon return from Tanzania Mr. Andre Van der Vloedt became ill and passed away rather suddenly. The IAEA and counterpart staff lost a dear friend who dedicated much of his time and efforts for the success of this project. There was no final report available concerning this mission. The Technical Officer (Feldmann) did make use of the expert's notes to take further action where necessary to continue project implementation.

Expert Task - Bridging Assistance to Tsetse Control

- M.J.B. VREYSEN (FAO/IAEA) June 92 - Dec. 92 7 months
  - o To provide technical assistance to the TTRI for the mass rearing and sterilization of tsetse;
  - o To plan and implement the transport of pupae to Unguja and their release in the project area;
  - o To evaluate progress through surveys.

This expert assignment was financed by the FAO to permit continuity of the expert's

activities in Tanzania. IAEA funds were not available for the remainder of 1992, and new funds to support the work of the expert would become again available in 1993. The mission was an extension of previous work of the expert with the TTRI, Tanga, mass rearing laboratory and with TTRI and DLDZ field staff on Zanzibar Island. The work was carried out in co-operation with the FAO/UNDP Animal Disease Control Project (URT/91/006), whereby the release of sterile male flies on Zanzibar was integrated with techniques, such as insecticide "pour on" with domestic animals and stationary insecticide-impregnated screens in cattle-free zones.

During the period covered by this mission the expert reported an increase in the production capacity of the mass rearing facility of the TTRI at Tanga. The colony size had reached 85,000 female flies. This, the expert reported, amply demonstrated the feasibility of rearing the tsetse fly G. austeni at large numbers under local African conditions with relative moderate means. During the assignment reported for this period the production capacity of the colonies maintained at the TTRI increased from 80,538 pupae/month (June '92) to 120,524 pupae/month (October '92). The back-up colony of flies, maintained at the IAEA's Seibersdorf Laboratories, increased to a level of 45,000 producing females, could supply an additional 10,000 pupae/month for shipment to TTRI, Tanga. Several test shipments were undertaken to establish the best procedures and determine the optimum pupal phase. Transport did not affect the survival, fecundity or insemination capacity of the males.

From June 1992 to November 1992 a total of 121,715 sterile males were transported by light aircraft from the TTRI to the Jozani Forest, Unguja Island. Losses during transport were minimal with on average over 91% of the flies being released. The releases were carried out in the southern half of the Jozani Forest, while fly suppression techniques were conducted in the northern half of the forest, using insecticide-impregnated screens in collaboration with staff of FAO/UNDP Animal Disease Control Project URT/91/006. Fly-monitoring in the field using sticky monopanels in the release sectors revealed: (i) maintenance of a low relative abundance of the indigenous fly population, (ii) evidence of induced sterility in the female population, and (iii) good sterile male survival and dispersal.

The expert reported that the Toyota Hilux pick-up truck, purchased under project URT/5/007 on 2 March 1992, was cleared from customs in Dar es Salaam and arrived at Zanzibar port on 3 July 1992. Clearance from Zanzibar Customs authority was obtained on 31 July 1992.

Co-operation of the various research groups from the Tanzania mainland and Zanzibar and integration of the different methodologies of these groups with SIT as the eradication

component were reported to be firmly consolidated during this assignment. The expert reported that all partners involved were convinced of the need for close collaboration between (i) the FAO/UNDP Animal Disease Control Project, (ii) the Animal Diseases Research Institute (ADRI) team from Dar es Salaam (using the serological Antigen-ELISA test for trypanosomiasis surveys), and (iii) the SIT project as a prerequisite for the successful eradication of the tsetse fly from Unguja Island.

According to the expert increased inputs, to be provided under the next phase of URT/5/007, will be required to meet the increased demands in terms of fly material and logistics. Four to five mobile teams will be the minimum required for the successful implementation of the release programme in the southern forest areas (Jozani and Muyuni). SIT activities in the other areas of the island (e.g. in the north), depending on the existence of relic fly populations will require additional inputs.

The most critical constraint reported remains trained manpower. The personnel of the DLDZ on Zanzibar was insufficient to meet the requirements for an island-wide control operation.

The expert provided many technical recommendations to the staff of TTRI, Tanga, DLDZ, Zanzibar, and project staff of URT/91/006. In addition to these, the following recommendations to the government and IAEA were provided:

TO THE GOVERNMENT OF ZANZIBAR:

It is recommended that (i) the Government of Zanzibar continue to give high priority to projects involved in the eradication of the tsetse fly; (ii) enough technical staff be provided to man five mobile operational teams for a successful implementation of the release programme; and (iii) sufficient funds be made available for maintenance and fuel supply for the project vehicles and for general operational costs of the project.

The expert did not provide this time any recommendations to the Government of Tanzania.

TO THE IAEA:

It is recommended that (i) two Toyota Hilux 4 x 4 Double Cabin pick-up trucks be purchased immediately for the field teams in Zanzibar (to be available in January '93 for the next phase of URT/5/007) and one car be purchased for Tanga to have reliable transport from Dar es Salaam to the TTRI; (ii) expert services be provided in tsetse fly mass rearing to assist the staff at TTRI, Tanga, in the upgrading of the fly colony, streamlining of the laboratory activities, and implementation of the release programme; (iii) aerial photographs, especially of the forested areas in the south be purchased to enable more appropriate planning of the field operations; (iv) donors be approached to replace the weak ^{137}Cs gamma-ray source with a stronger source to increase dose rates; and (v) the back-up colony of G. austeni tsetse flies at the Seibersdorf Laboratory be expanded to a size of 100,000 producing females and surplus pupae be shipped to the TTRI, Tanga.

Expert Mission — Fact Finding and Planning
(not financed from URT/5/007 funds)

- E. D. OFFORI (FAO/IAEA)
- C. J. OOIJEN (FAO/IAEA) — August 92 — 8 days
  - To review on-going tsetse/trypanosomiasis control activities;
  - To plan future operations aimed at eradicating animal trypanosomiasis and its tsetse fly vector from the island of Zanzibar.

The experts reported visiting the office of the FAO Project Manager (Sevar) to discusses the mission and project activities. Visits were made to tsetse trapping points in Jozani and Muyuni Forests as well as to farmsteads in Mangapwani in the north-west of the island. Although in 1988 the Mangapwani area was declared free of tsetse, recent Antigen-ELISA tests indicated the presence of trypanosomiasis in cattle there.

During a meeting at the Ministry of Agriculture, Zanzibar, the Deputy Principal Secretary (Biwi) assured the experts of the Government's full co-operation and support to the project. Present at the meeting were also the Commissioner of Livestock and Development (Shambwana), and the FAO Project Manager on Zanzibar (Sevar). The experts reported the following agreements and recommendations made at the meeting:

> It was agreed that: (i) the project would be handled henceforth as a single project, the objectives being to assist Zanzibar authorities with the eradication of G. austeni and animal trypanosomiasis; (ii) the SIT would play a prominent role in tsetse control activities; (iii) fly and trypanosomiasis monitoring activities currently in progress would be intensified and extended to other areas of the island as soon as possible; and (iv) assuming funds become available, the plan of operations should aim to eradicate G. austeni by the end of 1994.

At the meeting it was pointed out that the Head of the Insect and Pest Control Section of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture should have overall responsibility for the project since project success will depend heavily on the application of the Sterile Insect Technique. This statement refers to the important participation of the FAO team and the need for the Joint FAO/IAEA Division to take the leading role in the technical aspects of eradication. The FAO had been carrying out work for several years on Zanzibar with insecticide treatments in parallel with the TC project URT/5/007. Now the efforts of both organizations against the tsetse fly on Zanzibar are merging, however, the eradication of tsetse will depend mainly on SIT.

The experts reported the main problem that the mass-rearing laboratory of the TTRI at Tanga would face was availability of funds to pay for vital services, such as collection of blood and other activities requiring payment of allowances to junior staff.

Discussions were held with the Head of the Department of Parasitology (Mbwambo) of

the Animal Disease Research Institute (ADRI) at Dar es Salaam. The institute is participating in the on-going Antigen-ELISA tests to monitor for trypanosomiasis disease in livestock. The experts noted that a working procedure had to be established whereby the FAO team could collect sera from cattle on Zanzibar, which would be then transported to ADRI at Dar es Salaam for analysis. The test results would then have to be sent to the FAO project team.

At the Ministry of Agriculture, Dar es Salaam, the Deputy Commissioner (Mpiri) promised the continued support for the TTRI, Tanga, laboratory but lamented that lack of funds has continued to hamper their good intentions. The Deputy Commissioner hoped external funds could be made available for some of the essential day-to-day running costs in TTRI, such as payment of allowances for weekly blood collection, etc.

Expert's recommendations to the IAEA:

It is recommended that the IAEA take the following actions as soon as possible: (i) Prepare a detailed plan of action for project operations involving the SIT; (ii) Prepare an organizational scheme in which the Joint FAO/IAEA Division has full responsibility for the project. The plan should provide for a project co-ordinator to be stationed in Tanga or on Zanzibar; (iii) Initiate or intensify action to locate extrabudgetary fund sources for the project; and (iv) Increase financial and other support to the Tanga tsetse laboratory to ensure that the fly colony size reaches the recommended target of 100,000 producing females by March 1993.

Expert Task 10 - Prepare Programme to Eradicate Tsetse Fly from Zanzibar

- I. SHAMBWANA (URT)
- J.W. SNOW (USA) Jan. 93 - Feb. 93 14 days

  - To assist the Joint FAO/IAEA Division prepare a project document for the programme, inputs, and work plan required for the eradication of the tsetse fly on Zanzibar.

Together with staff of the Insect and Pest Control Section of the Joint FAO/IAEA Division the experts have prepared a project document for the eradication of the tsetse fly on Zanzibar. The document delineates the programme, activities, components, work plan, management, local inputs, and equipment, experts, and training required for the eradication of tsetse. The activities outlined in detail include the strategy, quarantine, surveillance, population reduction, Sterile Insect Technique, and data collection systems. Included in the document is a detailed outline of the work plan for eradication, together with risk assessment and criteria for the measurement of success. The cost of the tsetse eradication programme is estimated at US $3.9 million for a two-year operational phase. This amount includes the Government contribution and $3.7 million donor support. Additional contingency funding will be required primarily for post-eradication quarantine reinforcement, and epidemiological surveys to confirm eradication. The programme is scheduled to start on 1 January 1994 and the essential eradication activities should be completed by December 1996.

Expert Task 11 - Eradication of the Tsetse Fly G. austeni by the SIT

- M.J.B. VREYSEN (FAO/IAEA) Jan. 93 - Jan. 94 12 months
  - o To plan and co-ordinate laboratory and field activities to eradicate G. austeni from the island of Unguja in collaboration with staff of the DLDZ, UNDP/FAO, and the TTRI;
  - o To maintain close contact with Government officials and UNDP to ensure required administrative support;
  - o To advise on equipment and materials needed for laboratory and field operations.

On 3 March 1993 the expert sent a fax message to the TO (Lindquist) to inform of his concern that the Ministry of Agriculture was not currently in a position to provide the TTRI mass-rearing laboratory with sufficient funds to cover all running costs. An outstanding electricity bill of approximately $6,000 had to be paid by the TTRI. This would incur a deficit of funds for running costs and staff allowances. The large colony of female flies maintained at the laboratory was in jeopardy. The expert recommended, therefore, that the IAEA consider the payment of $5,000 in the event that Government funds could not be allocated and at least $1,500 per month for recurrent costs (e.g. electricity, water supply, and staff allowances).

In the interest of saving the project and the large investment made, the IAEA agreed on an exceptional basis to take emergency action to step in and settle the outstanding electricity bill. However, in the end, the emergency financing by the IAEA was not necessary following a telex sent on 16 March 1993 by the Area Office (Maudarbocus) to the Registrar (Nyanda) of the National Radiation Commission of Tanzania urging his intervention with the Government of Tanzania to find an immediate solution to the problem. Subsequently a telex was received on 30 March 1993 from the Director (Gao) of TTRI at Tanga informing the IAEA of the payment of the outstanding electricity bill by the Ministry.

A short report dated 14 April 1993 has been received since from the expert indicating that the work is continuing without major problems. He reports that the two vehicles for field work are still running, and they are awaiting to receive one or two more vehicles to expand the field operations, especially the work in Muyuni Forest.

Releases of sterile male flies have continued during the months of January to March '93 and the ratio of sterile to wild males in the field has remained stable. With the use of sticky-panel traps tsetse fly population densities were found to be low in the Central Muyuni Forest. Arrangements are underway with Air Zanzibar for the installment of a chute system to begin experimental aerial releases of sterile flies.

Equipment

Items purchased and supplied to the United Republic of Tanzania for project URT/5/007 are listed in the table provided in this part of the review. In addition to the equipment listed, funds were provided from the equipment component of the project for the following: (i) an imprest account available to the IAEA expert for local purchases in emergency situations, (ii) entomology equipment produced and provided by the Entomology Unit of IAEA's Seibersdorf Laboratories, (iii) transportation funds for the hiring of a vehicle for field work on Zanzibar, (iv) air transport of tsetse pupae from the IAEA's Seibersdorf Laboratories to Dar es Salaam, United Republic of Tanzania, and (v) air transport of sterile flies from Tanga to Zanzibar and aerial release of sterile flies over Zanzibar island.

Gamma Irradiator

A new gamma-radiation source was needed for the irradiation of blood for in-vitro feeding of tsetse flies for mass rearing and for tsetse sterilization. The radiation source at the TTRI, Tanga, left behind at the termination of the USAID project in 1980, was too weak. The Technical Officer (Lindquist) recommended the Gamma Irradiator Model IBL 337 from the CEA, France, with a 10,000 Curie source of Caesium-137 and 3.8 litre volume cylindrical chamber. The sample chamber of the gamma-irradiator is operated through an electro-mechanical device to provide remote irradiation of samples.

A procurement request for the gamma irradiator was signed by the Technical and Area Officers on 12 July 1984, and the equipment was ordered from the Office des Rayonnements Ionisants (ORIS), Gif-sur-Yvette, France, on 1 October 1984. ORIS informed the IAEA on 30 September 1985 that the gamma irradiator was ready and had been tested for one month. It would be shipped by the end of October 1985 by air freight to Dar es Salaam, and then taken by lorry to the TTRI at Tanga. Delivery would be expected on 30 October or 7 November 1985. The gamma irradiator was shipped on 24 July of the following year. No reason could be found for this delay.

Vehicles

The original TC project request submitted by the United Republic of Tanzania to the IAEA in July 1983 listed a Land Rover vehicle among the facilities available locally for the implementation of the project. The Land Rover (TX 646), however, turned out to be an old vehicle left behind by the former USAID project. In spite of attempts to overhaul this vehicle

during the course of project URT/5/007, the vehicle never became roadworthy for the terrain and field work of Zanzibar.

The Agency procured a Land Rover 109 Station Wagon on 20 September 1984 (Purchase Order No. URT/5/007/348E) from funds outside of the project (charged to 35.G.71). This vehicle was procured for use by the TTRI at Tanga on mainland Tanzania. The Land Rover was received by the TTRI on 4 April 1985.

The first expert to undertake field work on Zanzibar was M.J.R. Hall (UK) during June - July 1986. Fortunately in his case, the expert had a vehicle at his disposal (Suzuki 410 pick-up) due to his attachment to an ongoing FAO Livestock Development Project (URT/81/107). For continuation of project URT/5/007 the expert recommended the procurement of two vehicles for field work on Zanzibar.

A procurement request for a Lada Niva 4-wheel drive vehicle for field work on Zanzibar was signed on 10 June 1988. A purchase order to Technoexport (USSR) for the Lada vehicle was sent on 5 August 1988. The Lada was purchased mainly to make use of non-convertible currency available to the IAEA. However, on March 1989 the IAEA was informed by telex from Technoexport that, due to limited plant production capacity, vehicles could not be supplied within 1989. The Technoexport proposed the IAEA either cancel the order or accept a delivery in 1990. On 19 January 1990 a telex was received from Technoexport confirming delivery time of the Lada during the 2nd quarter of 1990. On 5 April 1990 it was decided to cancel the purchase of the Lada and request authorization of purchase of a Land Rover. Authorization was requested by IOM of the Area Office (Ericson) to Dir-TCPM approved on 6 April 1990. The IAEA was informed, however, on 16 May 1990 by Technoexport that it would not be possible to cancel the order for the Lada, as "the vehicle was already on the vessel to Dar es Salaam". The order for the Land Rover was therefore canceled. The vehicle was needed urgently for field work of the IAEA expert (Vreysen), and Technoexport was therefore urged by telex dated 20 July 1990 to inform the IAEA of the estimated time of arrival of the Lada. The vehicle arrived in Zanzibar on 4 December 1990, two years and four months from the time of purchase.

A second vehicle (Toyota Hi Lux 4 x 4, 5-seater double cab, 0.5 ton pick-up) was ordered on 2 March 1992 and received on 7 August 1992. This vehicle was ordered to accommodate needed personnel and equipment in field work on rough terrain of Zanzibar.

Supplies Provided by Seibersdorf Laboratory

The Entomology Unit of the IAEA's Laboratory at Seibersdorf and the Seibersdorf Mechanical Workshop have prepared and provided many necessary items and services to support the implementation of project URT/5/007. Equipment and materials were provided by the Agency's Seibersdorf Laboratory since the early stages of project development in 1985 to the present time. Among the items supplied were the following:

- several chillers constructed by the Seibersdorf Mechanical Workshop,
- hundreds of fly cages made of PVC for mass rearing,
- blood collection kits,
- aluminum feeding trays,
- moulds for hundreds of fly holding cages,
- emergence cages and materials for constructing cages,
- modified deep freezer for chilling flies,
- PVC tubing for pupae holding,
- conical mould for making pupae containers for emergence cages,
- sawing frame for pupae containers,
- fly separation tubes,
- tsetse puparia.

LIST OF EQUIPMENT PROVIDED			
ORDERED	SUPPLIER	ITEMS	SHIPPED(S) RECEIVED(R)
84-07-16	CEA, FRANCE	Gamma-irradiator, 10,000 Ci Caesium-137	86-07-24 (S)
85-06-14	Landrover, UK	Parts: short block, starter motor, flywheel housing	85-08-22 (S)
86-06-14	PHILIPS, NETH.	Deepfreezer and refrigerator	86-03-05 (S)
86-02-27	DEFENSOR, SWI	Air conditioning equipment	86-04-16 (S)
86-05-23	BONAR, ZIM	Entomological electric traps	86-06-10 (S)
86-10-02	S & T LTD, UK	Entomological equipment, terilene netting	86-11-21 (S)
87-07-03	Cole-Parm,USA	Meteorological equipment, thermograph papers	87-07-16 (S)
87-12-10	PHILIPS, NETH	Refrigerator and freezer	88-01-29 (S)
87-12-10	BONAR, ZIM	Electrocuting nets, spark generators, batteries	88-03-03 (S)
88-02-26	ZEISS, GFR	Microscopes, stereo and binocular	88-02-27 (S)
88-01-25	ARP LTD., UK	Biconical tsetse traps, Mannitoba traps	88-01-30 (S)
88-01-15	TANGLE, USA	Entomological equipment, Tangle-traps	88-01-16 (S)
88-01-15	NISSEI, JPN	Generator, stand-by electric	88-02-29 (S)
88-01-25	Sonnstrahl,AUS	Heating equipment, heating mats	88-04-27 (S)
88-01-25	SATORIUS, AUS	Analytical balance	88-02-09 (S)
88-08-05	TECHNOEXPO, USSR	Vehicle, Lada, Niva 4-wheel drive car	90-05-30 (R)
89-07-13	HAACK, AUS	Sterilium, blood defibrination material, lab. suppl.	89-09-15 (S)
90-03-08	Sonnstrahl,AUS	Heating mats and regulators	90-05-30 (R)
90-03-08	HAACK, AUS	Autoclave sterilizer	90-06-21 (R)
90-03-08	DEFENSOR, SWI	Air conditioning equipment, humidifier	90-06-21 (R)
90-11-19	FULLER, AUS	Entomological equipment, traps, glue, solvent	91-03-14 (R)
90-05-09	ALSHAAF, URT	Deep-freezers	90-10-01 (R)
91-01-09	ZEISS, GFR	Zoom stereomicroscopes	91-08-03 (R)
91-07-24	NEMETH, AUS	Freezer converted for tsetse flies	92-06-30 (R)
91-08-28	CHEMI, URT	Computer system, IBM PS/2 desk top with Epson printer	91-12-14 (R)
91-09-19	CHEMI, URT	Computer system, IBM PS/2 desk top with Epson printer	92-02-14 (R)
92-03-19	ZEISS. GFR	Microscope, Phase contrast compound	92-05-27 (R)
92-03-02	TOYOTA, JPN	Vehicle, Pick-up, Toyota Hi Lux 4 x 4 double cab	92-08-07 (R)
92-04-03	Canberra, AUS	Computer software	92-06-18 (R)
92-05-22	FULLER, AUS	Entomological equipment	92-08-31 (R)
92-06-11	HETTICH, GFR	Centrifuge accessories	92-07-29 (S)

Training

Three months of fellowship training were financed from the project budget. Training to local staff was provided mostly from funds outside of the project. A total of 12 project-related fellowships and three project-related scientific visits have provided 57 man-months of training for local staff. Three project-related fellowships, which started on 1 April 1993 at the IAEA's Seibersdorf Laboratories, will provide an additional 12 months training.

The following are details of the project-funded (PF) and project-related (PR) fellowships and scientific visits provided:

URT/83VA	TARIMO, Christopher Simon (TTRI)	
(PR)	Scientific Visit, Mar 83 and Apr/May 85	
	IAEA - Seibersdorf Laboratory	5 days
	UK - Univ. of Bristol	4 days
	NIR - Biological Control Project (BICOT), Vom	5 days
	Sterile Insect Technique (5D)	
	o To get familiar with advances made in SIT for tsetse control, including mass rearing of the tsetse fly.	
URT/8401	MRAMBA WALES, Furaha Makishe (TTRI)	
(PR)	Type I Fellowship, Jun/Sep 85	
	IAEA - Seibersdorf Laboratory	4 months
	Sterile Insect Technique (5D)	
	o Training in mass rearing of the tsetse fly within a Sterile Insect Technique programme.	
URT/8602	KIWIA, Ndeweso Eliamini (TTRI)	
(PR)	Type I Fellowship, Jun 86/Jun 87	
	USA - Univ. of Florida, Gainesville	12 months
	Entomology (5D)	
	o Research and course work in entomology including the application of radiation and radioisotopes in entomological research, possibly leading to an MSc degree.	
URT/8603	CHALO, Omari (TTRI)	
(PR)	Type I Fellowship, May/Aug 86	
	IAEA - Seibersdorf Laboratory	3 months
	Entomology (5D)	
	o Practical training in tsetse fly mass rearing within a SIT programme.	

URT/8604 (PR) — BAKULI, Bonaventura G. (TTRI)
Type I Fellowship, Sep/Dec 86
IAEA - Seibersdorf Laboratory — 3 months
Entomology (5D)
- o Practical training in tsetse fly mass rearing within a SIT programme

URT/8611(V) (PR) — GAO, Mohammed Kallaghe (TTRI)
Scientific Visit, Sep/Oct 86
IAEA - Seibersdorf Laboratory — 14 days
NIR - Biological Control Project, Vom
Sterile Insect Technique (5D)
- o To review mass rearing, planning and field activities in a SIT programme for tsetse control.

URT/8709 (PR) — KITWIKA, Wiston (TTRI)
Type I Fellowship, Jan/Apr 88 and Jun 88
IAEA - Seibersdorf Laboratory — 3 months
ZIM - Dept. of Veterinary Services — 12 days
Entomology (5D)
- o Training in in-vitro mass rearing of Glossina species and use of equipment, materials and facilities for feeding. in Zimbabwe - training in the use of traps and targets for tsetse population management.

URT/8714 (PR) — KIWIA, Ndewwso Eliamini (TTRI)
Type II Fellowship, Jun 87/Jun 88
USA - Univ. of Florida, Gainesville — 12 months
Entomology (5D)
- o To enable fellow to complete her Msc degree programme, write up thesis and complete research project.

URT/8817 (PF) — KIIMBISA LUBAZIBWA, Benedict (TTRI)
Type I Fellowship, Sep/Dec 90
KEN - International Centre of Insect Phys. & Ecol — 3 months
Tsetse Fly (5D)
- o Training as a technician on laboratory and field techniques for detection and determination of trypanosomes in tsetse fly hosts.

URT/8819 (PR) — MGALULA, Elizabeth (TTRI)
Type I Fellowship, May 89
KEN - International Lab. for Res. on Animal Disease — 26 days
Tsetse Fly (5D)
- o Training as technician on parasitology diagnostic techniques applied to both disease vectors, tsetse and their hosts.

URT/8822 (PR) CHUWA, Pantaleon C. (TTRI)
Type I Fellowship, Mar/Jul 89
IAEA - Seibersdorf Laboratory — 3 months
Tsetse Fly Mass Rearing (5D)
- o On-the-job training on the use of larger cages, different temperature regimes in tsetse mass rearing.

URT/8824 (PR) KIWIA, Ndeweso Eliamini (TTRI)
Type I Fellowship, Jun 88/Jul 89
USA - Univ. of Florida, Gainesville — 13 months
Entomology (5D)
- o To enable fellow to complete her MSc degree programme, write up thesis, and complete research project.

URT/92014 (PR) GAO, Mohammed Kallaghe (Min. of Agric., Tanga)
Scientific Visit, Nov 92
BKF - Centre des Rech. Sur Les Trypanosomoses Anim. — 13 days
IAEA - Seibersdorf Laboratory — 13 days
Entomology (5D)
- o To gain experience in tsetse mass rearing and handling.

URT/93009 (PR) MASHENGA, Godfrey Rweyemamu (Min. of Agric., Tanga)
Type I Fellowship, Apr. 93 (Prop. duration: 4 months)
IAEA - Seibersdorf Laboratory — (in progress)
Entomology (5D)
- o On-the-job training in entomology with emphasis on tsetse fly mass rearing, quality control procedures, fly dissection techniques relevant to SIT.

URT/93010 (PR) MUTALEMWA, Kyela Scarion (Min. of Agric., Tanga)
Type I Fellowship, Apr. 93 (Prop. duration: 4 months)
IAEA - Seibersdorf Laboratory — (in progress)
Entomology (5D)
- o On-the-job training in entomology with emphasis on tsetse fly mass rearing, radiation sterilization and quality control.

URT/93012 (PR) KHAMIS, Issa Said (Min. of Agric., Zanzibar)
Type I Fellowship, Apr. 93 (Prop. duration: 4 months)
IAEA - Seibersdorf Laboratory — (in progress)
Entomology (5D)
- o On-the-job training in entomology with emphasis on tsetse flies, rearing techniques and SIT methodology.

ACCOMPLISHMENTS

The project has provided, as of 4 May 1993, 32.5 man-months of expert services, equipment valued at $365 474, and three months of fellowship training. Training to local staff was provided mostly from funds outside of the project. A total of 12 project-related fellowships and three project-related scientific visits have provided 57 man-months of training abroad for local staff. Three project-related fellowships, which started on 19 April 1993 at the IAEA's Seibersdorf Laboratories, will provide an additional 12 months training.

To meet project objectives and to eventually eradicate the tsetse fly, Glossina austeni, from Zanzibar, efforts have had to concentrate on the following tasks:

- to build up the expertise and capacity of local staff on mainland Tanzania with the know-how and facilities to maintain large colonies of tsetse capable of supporting a SIT programme on Zanzibar,
- to establish a field team on Zanzibar island with the facilities and capability of mapping tsetse and monitoring population densities and fecundity of tsetse prior to and during a SIT eradication programme, and
- to establish with local staff the teamwork and logistics required to implement appropriate surface and aerial sterile fly releases.

Accomplishments of project URT/5/007 must be measured, therefore, according to the degree to which the above tasks have been performed by local staff. The achievements of project objectives can be assessed by the preparedness of staff on mainland Tanzania and Zanzibar to carry out the above tasks for an eradication programme.

Early in the project, artificial membrane technology for in-vitro feeding was established in the Tsetse and Trypanosomiasis Research Institute (TTRI) at Tanga. Most of the TTRI research officers and technicians received training in relevant aspects of the SIT. Staff of the TTRI at Tanga had achieved good expertise in mass rearing including good blood quality testing procedures, fly production and handling procedures, and optimum use of colony males to obtain a maximum output for release.

Excellent work has been accomplished at the mass-rearing laboratory of the TTRI at Tanga with the establishment and maintenance of a large colony of female flies fed in-vitro on locally collected blood. Evidence for the achievements at the TTRI was provided by the growing mass-rearing productive capacity of the TTRI facility over the years as the local staff expertise and facilities improved. The colony of female flies maintained at the TTRI facility has increased from 42,000 in 1989 to 85,000 in December 1992. To put these numbers into perspective the IAEA's mass-rearing facility at Seibersdorf has now a back-up colony of 122,000 producing females, and to initiate a full-scale eradication programme on Zanzibar female fly colony sizes of about 250,000 at Tanga and 150,000 at the Seibersdorf Laboratory will be required.

Achievements in the field on Zanzibar Island were also assessed during expert missions. In 1990 the usefulness of the sticky target approach for trapping flies in the field was confirmed and some simpler and cheaper sticky panels were designed locally. Furthermore, closer coordination of the activities of the UNDP/FAO/DLDZ Animal Disease Project, URT/86/022, and the IAEA/TTRI/DLDZ Project, URT/5/007 was agreed upon. The FAO team recognized that the use of insecticide treatments would not result in eradication of the pest and supported the integration of the SIT for eradication.

In July 1991 Agency expert (Vreysen) reported that staff of TTRI and Department of Livestock Development, Zanzibar (DLDZ) have achieved expertise in good entomological monitoring activities on Zanzibar. A good survey and mapping of apparent densities of flies was established in the north and south of Jozani Forest (a primary habitat for the tsetse fly on Zanzibar Island). More recently Agency expert (Vreysen) reported in December 1992 that TTRI and DLDZ in co-operation with FAO field staff have well established fly suppression techniques using insecticide-impregnated screens in north Jozani Forest.

Excellent progress in sterile fly release programme, logistics and implementation has been achieved. A programme schedule and logistics were established for the transport of sterile flies from Tanga to Jozani Forest. By late 1990 four releases of sterile flies were already accomplished at Jozani Forest. The field teams on Zanzibar island were able to utilize the sticky targets they had designed to recapture flies in the field to study the effect of sterile fly releases. They found the recapture rates of sterile flies and the mating of sterile flies to be good. All female flies caught five to six days after release were found to be inseminated.

Obstacles to recruitment of a long-term expert arose during the early stages of the project. Efforts to recruit M. Weiss from the former FRG for 12 months in 1985 were promising; however, the proposed expert withdrew in 1986 due to the inappropriate timing and duration of the assignment. Another expert, IAEA staff member (Baumgartner) was proposed by the IAEA in 1986; however, this expert was not accepted by the national authorities of Tanzania due to differences in the background of the expert and the tasks of the assignment. The Agency might have further consulted with the authorities at this time to reconsider the case of Mr. Baumgartner, who's services could have saved time in project implementation.

During the initial delays in recruitment, missions to Tanzania undertaken by IAEA technical officers from Headquarters and the Seibersdorf Laboratories (Gingrich in Nov.-Dec.'84 for 9 days and Hamann in Feb. '85 for 17 days) helped establish project momentum.

Three other experts (Van der Vloedt, Hall, and Offori) provided services in 1986 for a total duration of six weeks. It was only in 1988, over four years into the project, that an expert was recruited to provide long-term services (Madubunyi, 12 months).

The assignment of Mr. Madubunyi from Nigeria (April '88 to April '89) was hampered by the absence of a reliable vehicle for field work on Zanzibar. The TC project request submitted to the IAEA in 1983 stated that a Land Rover was already available for the execution of the project. However, the vehicle (Land Rover TX 64), left behind in Tanzania after the termination of the USAID project in 1980, was not roadworthy. The national counterparts had agreed to repair it prior to Madubunyi's assignment. However, as this was not done, the Agency decided then to purchase a Lada 4-wheel drive vehicle. Seeing that the vehicle ordered would not reach the expert during his assignment, the Agency authorized an imprest account to provide funds for hiring a vehicle needed for field trips to Jozani Forest. It was only in October 1988, six months into his assignment, that the expert was able to hire a vehicle and begin field work with the local staff. At the conclusion of his mission the expert reported that only one-third of the assignment objectives was accomplished due to the lack of a proper vehicle. Assurance should have been provided to the IAEA by the national counterparts of the availability of a functioning vehicle for field work on Zanzibar before the arrival of the expert. Another vehicle (Land Rover 109 Station Wagon) was provided to the TTRI at Tanga and received in April 1985.

The lack of a project vehicle at Zanzibar hindered the field work during the initial years of project implementation. Since the arrival of the first vehicle in Zanzibar in 1990, field work had progressed rapidly.

Throughout most of the project years there were signs of a need for stronger Government support for the project at a high level (Deputy Minister or Minister). There even existed at times a lack of adequate collaborative arrangements between TTRI and DLDZ, and even a need to define the obligations of the two institutions. Funds were not always available for running costs either at TTRI, Tanga on mainland Tanzania, or for field work with the DLDZ on Unguja island. The problem of lack of funds for local running costs was foreseen as a possibility by the TO (Lindquist) in the evaluation of the initial project request received by the IAEA in 1983.

The need for a project document with agreements on procedures for execution of field components of the project was first recommended by Agency expert (Offori) following a mission to Tanzania in 1986. Mr. Offori expected to meet with the Minister or Deputy Minister

of Agriculture on this matter in 1986, but the meeting could not take place. The Director General (Macha) of the existing Tanzania Livestock Research Organization (TALIRO) at that time assured the expert of Government support, and that a project document would be drafted and submitted to the IAEA by the end of 1986.

Also, in 1989 Agency expert (Madubunyi) informed the IAEA that there appeared to be no standing collaborative arrangement between either TTRI or DLDZ or their parent organizations. He recommended the respective Governments of the United Republic of Tanzania and Zanzibar request the two ministries of agriculture to articulate a formal protocol of collaboration between their respective institutes on tsetse eradication in Zanzibar. In turn, the Area Officer (Ericson) informed the Registrar (Nyanda) of the Tanzania National Radiation Commission that, for the project to succeed there must be written commitment from all parties concerned.

Agency expert (Vreysen) in late 1990 recommended that the Ministry of Agriculture and Livestock Development, Tanzania should come to an agreement with the Ministry of Agriculture, Livestock and Natural Resources, Zanzibar to secure sufficient provisions and staff. The expert repeated his recommendation in his report of April-June 1991 that the two ministries come to an agreement on terms of running costs of the project.

By July 1991 some consensus on tsetse suppression and releases of sterile flies had been achieved with all persons and institutions (TTRI, DLDZ, and FAO) involved. A schedule of sterile fly releases every ten days on Zanzibar was established. From June to November 1992 a total of 121,715 sterile males were transported from the TTRI to Jozani. Losses were minimal in transport with over 91% of all flies released. Transport was found not to affect the survival, or insemination capacity of the males. Releases of sterile males continued from January to March 1993 having considerable impact on the reproductive status (induced sterility) of wild target female flies. The logistics of sterile fly shipments and conditions of fly transport have been worked out. The possibility of releasing large numbers of sterile male G. austeni on Zanzibar Island was now soundly tested and validated.

Integration of the various teams and persons involved has been established. The mass-rearing facility of TTRI on the Tanzania mainland, field teams of TTRI and DLDZ on Zanzibar, and the FAO project staff have acquired the expertise and established the teamwork to mount a concerted, integrated, full-scale operation using different tested and effective methods for monitoring and eradication, including the SIT.

III

FINDINGS

While tsetse fly eradication on Zanzibar is anticipated to be the eventual outcome of the on-going work of project URT/5/007, tsetse fly eradication is not the immediate objective of this project per se, and consequently the project title can be misleading. The purpose of this project is to assist the Government of Tanzania in developing the technical infrastructure capable of mounting a tsetse eradication effort using SIT. This includes the development of the know-how, facilities and teamwork needed for the mass rearing and release of sterile male flies and good entomological field monitoring teams on Zanzibar working together with staff trained to employ other methods of fly suppression and control. The project objectives encompass the development of the inter-related management practices with the Sterile Insect Technique, which is required to control and eventually eradicate the tsetse species infesting Zanzibar.

The objectives of project URT/5/007 have been mainly achieved. Improved facilities and local expertise needed to mount an integrated SIT effort against the tsetse fly on Zanzibar have been established. An effective transfer of technology has taken place.

The TTRI staff have acquired the expertise needed to maintain good quality control in tsetse fly mass-rearing. To carry out a full-scale eradication programme on Zanzibar, a colony size of about 250,000 producing females flies must be achieved and maintained. This would require a three-fold increase over the current female colony size maintained at the TTRI. The technology to achieve this colony size is now at the TTRI, Tanga; only enlarged facilities and additional inputs of equipment and staff will be needed.

Likewise the entomological monitoring teams of the TTRI and DLDZ on Zanzibar have acquired the expertise needed to trap flies and measure their apparent population densities and dynamics needed to plan and assess the progress of an SIT programme. The teams have also established the co-operation with the FAO field staff for the employment of fly suppression techniques using insecticides wherever needed on Zanzibar prior to sterile male releases. Close co-operation between the laboratory and field teams of TTRI, DLDZ, and FAO will be

vital to the success of tsetse eradication on Zanzibar.

A regular schedule of sterile fly release has been carried out since June 1992. Field studies of flies trapped in the wild have provided positive results in terms of sterile male survival, dispersal, mating competitiveness and insemination capacity with sterile sperm. The possibility of releasing large numbers of sterile male tsetse flies on Zanzibar Island was now soundly tested and validated.

Project URT/5/007 was first approved for the period of 1984 to 1986 to provide assistance to the Government of the United Republic of Tanzania in acquiring membrane feeding technology, which is required for tsetse fly mass rearing. Project approvals during subsequent years up to 1994 provided for continuation of IAEA and national inputs to prepare the country for a costly tsetse eradication programme. An additional US$ 3.7 million from donor funds will be required after 1994 for tsetse eradication on Zanzibar. At the inception of this project no study was made of the economic returns of a tsetse eradication programme. A thorough study of the economic returns of this project at the beginning could have provided information useful for making project approvals and for acquiring support from the Tanzanian and Zanzibari Government Ministries and donor countries or organizations concerned.

Factors which contributed to significant delays in implementation were mainly, among others, obstacles to recruitment of a long-term expert during the early stages of the project; lack of a roadworthy vehicle for the field work on Zanzibar Island during the initial years of project implementation, and occasional lack of sufficient running costs of the recipient institutes for electricity, gasoline, staff salaries, etc. Project objectives have been achieved after almost ten years of project implementation; however, one can only speculate as to how shorter a time period would have been required to reach project objectives had the obstacles been avoided.

Obstacles to a smooth implementation of the project were caused, inter alia, by the complexity of managing a project between mainland Tanzania and Zanzibar and the need for a project document with defined obligations and commitments of all parties involved. In this context we must keep in mind the structure of the Government of the United Republic of Tanzania in the management of this project. Project URT/5/007 is being implemented at two host institutions, namely, the TTRI at Tanga on mainland Tanzania and the DLDZ on Unguja island, Zanzibar. Although Zanzibar is part of the United Republic of Tanzania, it is self-governed with the election of its President and House of Representatives conducted under the terms of a separate Zanzibari Constitution. Zanzibar has a Government with full autonomy in

many matters. The United Republic of Tanzania has two vice presidents; one is the union president or prime minister and the other is the President of Zanzibar. The United Republic of Tanzania has, therefore, two agriculture ministries, one on mainland Tanzania and another on Zanzibar. The implementation of project URT/5/007 requires co-operation and financial support from two host institutions and two agriculture ministries.

The complexity of managing a project with two independent host institutions and two autonomous Governments (Ministries) requires a project document with defined obligations and commitments of all parties involved. Such a project document signed at the highest level (Minister or Deputy Minister) would secure Government support at the level sometimes needed to assure funding of local running costs of large projects. It is apparent from the aforementioned recommendations of the Agency experts and Area Officer that a written commitment from all parties concerned endorsed at the highest level in the two ministries of agriculture are needed to assure full Government support for the project.

The mass-rearing facility and staff of TTRI on the Tanzania mainland, entomological monitoring field teams of the TTRI and DLDZ on Zanzibar, and the co-operating FAO project staff have acquired the expertise needed to mount an integrated full-scale tsetse eradication programme on Zanzibar. However, all teams involved will have to expand in order to perform an island-wide eradication programme. The TTRI and DLDZ will have to increase its staff. It will be mostly a matter of expanding current mass rearing and field activities with the technology already acquired. This will incur on the part of recipient institutions even higher running costs than ever before experienced. Commitment on behalf of the Tanzanian and Zanzibari Ministries of Agriculture to meet the costs of such a large programme will be needed. On-the-job training of new staff members of the TTRI and DLDZ to support an eradication programme should be provided by local scientists and technicians.

The country is now ready to launch a full-scale integrated SIT effort to eradicate the tsetse fly, G. austeni, from Zanzibar by the year 1996. Successful control and eradication of the tsetse fly from Zanzibar could provide significant returns to the economy and well being of the Zanzibari people. Additional inputs of mainly equipment and expert services will be necessary to assist the United Republic of Tanzania in reaching this goal.

IV

RECOMMENDATIONS

(1) The basic technology for tsetse eradication, acquired through project URT/5/007, now exits in the United Republic of Tanzania. Further support from IAEA resources and external organizations is recommended to help the country achieve tsetse eradication on Zanzibar. Concrete Government commitment should be an essential proviso for any full-scale tsetse eradication project.

(2) A Joint Agreement or Project Document between the Ministry of Agriculture and Livestock Development, Tanzania and Ministry of Agriculture, Livestock and Natural Resources, Zanzibar on SIT for tsetse eradication is recommended to help establish a standing collaborative arrangement between the two autonomous ministries. This Agreement, if signed at the highest level (Deputy Minister or Minister), could pledge strong Government support for a full-scale tsetse fly eradication project and would help to secure sufficient provisions for running costs and support staff from both ministries.

(3) Delays in implementation of the project were caused by insufficient local inputs. When large projects, which can have significant input on social and economic development, are implemented in least developed countries (LDCs), the IAEA should consider contributing to local inputs for project implementation.

(4) Prior to the approval of a large technical co-operation project a thorough cost benefit analysis should be made. Such an analysis could provide an indication of economic returns from the successful outcome of the project, which could furnish concrete criteria for the setting of technical co-operation priorities with recipient Member States and donor countries or institutions.

(5) Tsetse fly eradication on Zanzibar is the long-term goal of project URT/5/007. The immediate objectives of this project should have been clearly delineated in official IAEA documents. For future projects, the objectives should be defined in order to provide a clear picture of the expected outcome at the end of the approved programme cycle.

(6) Tsetse fly eradication and control should remain a sustainable activity in the country under Tanzanian management after the eradication of tsetse from Zanzibar. Therefore, the recipient institutions, TTRI at Tanga and the DLDZ at Zanzibar, should be encouraged to make use of existing local facilities and know-how to provide training to all new staff that join the project in tsetse mass rearing, field entomological studies, and other techniques required for an integrated SIT programme. Fellowship training at the IAEA's Seibersdorf Laboratory should be provided when new techniques or advances not yet used in Tanzania must be learned. Eradication of the tsetse fly on Zanzibar will require staff increases to accommodate expansion of mass rearing and field studies. On-the-job training of new local staff should be provided to a large extent by local scientists at the TTRI and DLDZ.