

Activity report

1st July 1991 - 31st March 1992

Kenyan-Belgian Project in Marine Sciences

Prof. Dr. P. Polk - KBP - Director - KMFRI - Dr. E. Okemwa

Yvette Vermeulen - Manager

ACTIVITY REPORT

I. GENERAL DATA

1. Period of the report : 1st July 1991 - 31st March 1992

2. Identification of the project

- name project :
"Higher Institute for Marine Sciences"
- country :
Kenya - Mombasa
- promotor :
Prof. Dr. Ph. Polk
- coordinating institute :
Free University of Brussels
Laboratory of Ecology and Systematics
Pleinlaan 2,
1050 Brussels 5
Telephone : 02 / 641 3402
Fax : 02 / 641 3403
- cooperating institute :
Kenya Marine and Fisheries Research Institute
P.O. Box 81651, Mombasa, Kenya
Telephone : 00254 11 / 47 22 66
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3. Duration of the project : 4 year

- start date : 01/07/1989
- end date : 31/06/1993

4. References of previous activity reports :

- KENYA-BELGIUM PROJECT IN MARINE SCIENCES
"Higher Institute for Marine Sciences"
Progress Report : January 1990 - July 1990
Dr. K. Delbeke
Progress Report : August 1990 - October 1990
Dr. K. Delbeke
Progress Report : November 1990 - June 1991
Dr. K. Delbeke

II. DATA CONCERNING THE PROJECT INPUT

A. Financing by A.B.O.S. (V.L.I.R.)

1. Financing

- by A.B.O.S. agreed allowance : 20.000.000
- divided in parts of 300.000 bef
- already paid amount : 17.538.000

2. Number of employees :

- experts for a long term :

Prof. Dr. Ph. Polk : 26/08/1991 - 12/09/1991
7/11/1991 - 12/11/1991
27/01/1992 - 04/02/1992

Prof. Polk is director of the project. he visited several times the project.

Dr. K. Delbeke :

Dr. Delbeke is working at the Free University of Brussels as F.A.M.E.-employee. She was the Resident Manager of the project during the period 1 June 1990 - 31 August 1991. She is still the supervisor of the project "Assessment of pollution in the coastal and marine environment around Mombasa", a project started by her. The part "Theoretical Assessment of the pollution sources and loads of the Creeks around Mombasa" and the part "Monitoring of Pollution levels in the coastal and estuarine environment around Mombasa" is in cooperation with Mr. J. Munga, Mr. S. Mwangi, Mrs. M. Owili of K.M.F.R.I. and Drs. J. Wijnant. The third part. "Assessment of pollution impact on the mangrove oyster *Crassostrea cucullata*" is in cooperation with Drs. Omolo of K.M.F.R.I.. She assumes also the responsibility of mentor for the Ph. D. of Drs. Omolo.

Drs. Y. Vermeulen :

Manager of the project since the 1st of September 1991. Besides this job, she is also responsible for the development of the research on benthos at K.M.F.R.I.; the training of two research officers, Mrs. A. Nduhiu and Mr. J. Okondo and some technicians in benthos methodology, in cooperation with the Marine Biology Section of the Zoology Institute of the University of Ghent.

Drs. J. Wijnant :

Drs. J. Wijnant began the section bacteriology at K.M.F.R.I. in cooperation with Dr. K. Delbeke, Mr. J. Munga, Mrs. M. Owili and Mr. S. Mwangi. Mr. J. Wijnant is active as V.V.O.B.-expert at K.M.F.R.I. and doing research under Kenya Belgium Project.

Drs. J. Tack :

Drs. J. Tack is also active as V.V.O.B.- expert, linked with K.M.F.R.I. . He is in function since the 22th October 1991 for a period of 2 years. He has within the project the responsibility to start the laboratory of malacology and the expansion and commercialisation of the experimental oysterfarm in Gazi.

- visiting guests and coordination missions :

Dr. E. Coppejans : 2/09/1991 - 27/09/1991

Dr. E. Coppejans is active at the Laboratory of Botany at the University of Ghent. On the one hand his mission was the supervision and guidance of the fieldwork of two theses and the training of Mr. Wakibya in identification, zonation and succession of seaweeds and seagrasses. On the other hand his personal work on the inventarisation and distribution of seaweeds has been carried on.

His report can be found in Appendix 2.

Dr. A. Zwaenepoel : 2/09/1991 - 27/09/1991

Dr. A. Zwaenepoel is also active at the Laboratory of Botany at the University of Ghent.

He was charged with the guidance of the fieldwork of Mr. Provoost's thesis and teaching the methodology of the transect method for vegetation studies to Mr. Wakibya of K.M.F.R.I. In function of the botanical research, grasses and sedges were collected at different sites and prepared as herbariumspecimens.

Prof. Dr. E. Schockaert : 22/09/1991 - 12/10/1991

Prof. Dr. E. Schockaert, professor at the Limburgs University Centre and Director of the Department S.B.G. worked together with Drs. G. De Clerck on tropical marine Turbellaria along the Kenyan Coast around Mombasa.

A report of this mission is in Appendix 2.

Dr. J. Moens : 22/09/1991 - 12/10/1991

During 3 weeks, Dr. J. Moens worked together with Dr. E. Martens and Drs. G. Janssen on the project parasitological study of marine fish species of the Kenyan coast. 2 research officers of K.M.F.R.I., Mrs. M. Mitoko and Mr. Kimani have been trained in the specific methodology used in parasitology.

A report of this mission is in Appendix 2.

Dr. M. Vincx : 3/02/1992 - 13/02/1992

Dr. Vincx, working at the Marine Biology Section of the University of Ghent, was here to start the benthos section at K.M.F.R.I., together with Drs. Y. Vermeulen and Drs. J. Schrijvers. Two important aspects of benthos were studied during their stay of one month. The influence of epifaunal activities on the infaunal distribution in the mangrove sediment, this in cooperation with Drs. J. Schrijvers and Mr. J. Okondo of K.M.F.R.I. and the vertical migration of the meiobenthos in mangrove sediments during a tidal cycle, this in cooperation with Mrs. Y. Vermeulen and Mrs. A. Nduhiu of K.M.F.R.I. .

Another important item of the mission was the training of different technicians of K.M.F.R.I. in the specific methodology used in benthos research.

A report of this mission is in Appendix 2.

Prof. Dr. A. Coomans : 14/02/1992 - 28/02/1992

Prof. Dr. A. Coomans is lecturer at the University of Ghent and Director of the Laboratory of Zoology. He visited for the first time the Institute. Besides the marine benthos research he carried on his investigation on terrestrial nematodes.

Mrs. W. Gijselinck : 3/02/1992 - 28/02/1992

Mrs. W. Gijselinck was responsible for the training of Mr. J. Okondo, Mrs. A. Nduhiu and the technicians of K.M.F.R.I. concerning the different laboratory techniques used in benthos research; preservation, treatments of the samples as rinsing, decantation and centrifugation to separate the animals from the sediment, staining and mounting of nematodes. She assisted in the experiments concerning the relation epi- and infauna and the 12-hours cycle in the Ceriopsplot (Gazi) for the vertical migration study.

Mr. D. Van Gansbeke : 3/02/1992 - 28/02/1992

Mr. Van Gansbeke was responsible for the experiments started to study the influence of epifauna on the infauna and the sampling related to the 12-hours cycle.

The technique for the isolation of interstitial water for nutrient analysis has been explained in detail to Mr. J. Kazungu of K.M.F.R.I. .

Furthermore he assisted in the training of technicians in sampling techniques in the field and the treatment methods of both macro- and meiobenthos samples in the laboratory.

Prof. Dr. Neiryneck : 7/11/1991 - 12/11/1991

Prof. Dr. Neiryneck from the Free University of Brussels, visited as responsible for development cooperation, the Kenya Belgian Project and Recoscix-Wio.

Dr. E. Martens : 19/09/1991 - 12/10/1991
23/01/1992 - 29/01/1992

Dr. E. Martens is working as V.V.O.B. - expert at the University of Nairobi. Within the project she is involved in the parasitological study of marine fish species in cooperation with Drs. G. Geets from Kenyatta University and Dr. Jos Moens from the Limburgs University Centre. She was responsible for the training in parasitology of 2 research officers from K.M.F.R.I., Mrs. M. Mitoko en Mr. Kimani.

The report of the research is in Appendix 2.

She is also responsible for the M. Sc. Program of Mrs. J. Kasyi from the University of Nairobi : "Zooplankton distribution and diversity in Tudor Creek in relation with abiotic parameters".

Tuesday the 28th of January she gave a lecture on the coral reefs for the Fort Jesus Museum Society in Mombasa.

Dr. Van Speybroeck : 3/11/1991 - 7/11/1991
6/01/1992 - 8/01/1992

Dr. Van Speybroeck is also a V.V.O.B. - expert connected to the University of Nairobi. Within the project he is responsible for the M. Sc. Programm of Mr. J.C. Kairo, M. Sc. Student of the University of Nairobi, on afforestation. He is also involved in the program of M.Sc. Student Mr. Mwangi of the University of Nairobi, on photosynthetic activity in mangroves.

On Tuesday the 7th of January he gave a lecture on mangroves for the Fort Jesus Museum Society in Mombasa.

Dr. E. Vanden Berghe : 23/09/1991 - 27/09/1991
6/10/1991 - 13/10/1991
13/2/1992 - 16/2/1992
27/3/1992 - 30/3/1992

Dr. E. Vanden Berghe is active as V.V.O.B. - expert at the University of Nairobi. Within the project he is doing research on different species of crabs in Gazi. He is responsible for the program zonation of crabs from B. SC. Student K. Moses from the University of Nairobi. This research is in collaboration with Dr. Ian Gordon, also lecturer at the University of Nairobi.

Drs. G. Geets : 7/10/1991 - 9/10/1991

Drs. G. Geets is V.V.O.B. - expert at Kenyatta University. Together with Dr. E. Martens and Dr. J. Moens she is involved in the project parasitological study of marine fish species.

Prof. Dr. Vannini is lecturer at the University of Florence (Italy). He visited the project in function of future cooperation with the Kenya Belgium Project, the EEC-project on mangroves and the University of Nairobi. During his mission he was involved in different projects around ecology, biology and taxonomy of mangrove crabs (Familie Sesarmidae), mangrove hermit crabs (genus *Clibanarius*) and their role in the litter degradation and the ecology and biology of the mangrove swimming crabs, *Scylla serrata* en *Thalamita crenata*.

Dr. G. Messana also from the University of Florence (Italy) studied the ecology and biology of mangrove root borers (especialy Isopods, Sphaeromatidae en Cirolanidae) in collaboration with Mr. Osore from K.M.F.R.I. .

Dr. I. Gordon is senoir lecturer in ecology at the University of Nairobi. He started research on 2 species of *Uca*, *U. lactea* and *U. inverse*. Agepatterns and distribution are determined. Enclosure experiments will be carried out.

Dr. R. Speir from the 'The Gaia Guest Trust, Indian Ocean Marine Environmental Research' visited on the 24th of January 1992 K.M.F.R.I. and K.B.P..

3. Scholarship students in Belgium

- 2 Kenian students obtained the degree of Master of Science in the international postgraduate training course on F.A.M.E. (Fundamental and Applied Marine Ecology) at the Free University of Brussels

- Mr. P. Oduor : M.Sc. Student F.A.M.E. with the thesis :

"EFFECTS OF ISOPROTERENOL, SALBUTAMOL, FENOTEROL AND CLENBUTEROL ON BODY COMPOSITION AND GROWTH OF THE AFRICAN CATFISH, *CLARIAS GARIEPINUS* (BURCHELL, 1822)

- Mr. M.J. Mengi : M.Sc. Student F.A.M.E. with the thesis :

"I. THE EFFECT OF DIETARY SODIUM CHLORIDE ON THE GROWTH RATE, FEED CONVERSION, SURVIVAL, CANNIBALISM AND MORTALITY RATE OF LARVAL AFRICAN CATFISH *CLARIAS GARIEPINUS* (BURCHELL, 1822)

II. THE EVOLUTION OF BODY MUSCLE COMPOSITION OF FINGERLING *CLARIAS GARIEPINUS* (BURCHELL, 1822)"

Promotor for both studies were :

Prof. Dr. F. Ollevier
Laboratory for Ecology and Aquaculture
Zoological Institute
Catholic University of Leuven, Belgium.

4. Material and equipment

- chemicals and sampling bottles, necessary for all different investigations
- laboratory equipment as beakers, pipets, counters
- flowmeters (planktonresearch)
- planktonnets
- rubber dinghy
- the necessary material for the expansion of the oysterculture and the equipment for the start of the laboratory for malacology (e.g. grazing chambers)
- cores, slicing equipment for the benthos samples
- dessicator

5. Functioning

- Maintenance of all scientific material is necessary. Parts have been bought for the reparation of the waterdistiller, the repair of the heat oven and the freezer
- Lamps for the microscopes, binocular microscopes
- Maintenance of the engines, boots and cars

B. Contribution by local institute

1. Financing

The contribution of K.M.F.R.I. includes all the costs for the infrastructure, the research vessel 'Maumba' - both boat and crew -, and all the salaries of the research officers, technicians and drivers working for the different investigations and sampling programs.

2. Employees

Research Officers,
technicians,
drivers,
sekretary

3. Infrastructure

The total infrastructure, buildings, offices, library and laboratories are provided by K.M.F.R.I. . The costs of restructuring are done by K.M.F.R.I. Appeal can be done on Government Chemistry Department. Housing of the residential manager and the V.V.O.B. - experts, Mr. Tack and Mr. Wijnant is provided by the institute. The organisation of the guesthouse and the cost of the staff (manager, housegirl ...) is in hands of K.M.F.R.I. .

4. Material and equipment

- All laboratories including the material, microscopes, drying ovens, balances, centrifugator, etc., are placed at everybody's disposal. In the laboratory new airconditioning has been installed.
- Also the library from the institute is open for each research officer and technician.
- Personal computers are used by all research officers.
- The research vessel 'Maumba'

5. Recurrent local expenses

- All current expends, water and elektrikity

6. Evolution local contribution

The evolution is in different directions. The increase in use of places as laboratories and offices is important. An effort is made to have for the different types of research separate laboratories; In the future the institute will try to separate optical laboratories of those where chemicals and other consumables are used.

III. DATA CONCERNING THE ACTIVITIES AND RESULTS

1. Training

1.1 local

- Mrs. M. Owili and Mr. Kimani from K.M.F.R.I., got a training in the specific methodology used in parasitology by Dr. E. Martens from the University of Nairobi. Dr. J. Moens from the Limburgs University Centre, and Drs. G. Geets from Kenyatta University.

- Mrs. J. Kasyi, M. Sc Student from the University of Nairobi, started a program on the zooplankton in Tudor Creek : "Zooplankton distribution and diversity in Tudor Creek, in relation with abiotic parameters". Responsibles are Dr. E. Martens and Prof. Jaccarini from the University of Nairobi.

- Mr. J.G. Kairo, M. Sc. Student from the University of Nairobi, started in Gazi some forestation experiments. The germination and growth of some indigeneous mangrove species are being studied in nursery as well as under natural tidal conditions from the point of view of rehabilitation and restoration of mangroves in deforested areas. This research is under the guidance of Dr. D. Van Speybroeck and Dr. Kinyamario from the University of Nairobi and Drs. Slim from the EEC project "Dynamics and Assessment of Kenyan Mangrove Ecosystems".

- Mr. P.M. Mwangi, M. Sc. Student from the University of Nairobi, started in Gazi a fieldexperiment concerning the photosynthetic activity of 2 mangrove species, *Ceriops tagal* and *Rhizophora mucronata*. This research is under the guidance of Dr. D. Van Speybroeck and Dr. Kinyamario from the University of Nairobi and Drs. Slim from the EEC project "Dynamics and Assessment of Kenyan Mangrove Ecosystems".

- Mr. Moses, B. Sc. Student from the University of Nairobi, works in Gazi on the density and zonation of crabs. This program is under the supervision of Dr. E. Vanden Berghe and Dr. I. Gordon from the University of Nairobi.

- Mrs. A. Nduhiu and Mr. J. Okondo got both a training in sampling techniques and the treatment methods of macro- and meiobenthos samples by Dr. Vincx, Mr. D. Van Gansbeke and Mrs. W. Gijssels from the University of Ghent. Mrs. Nduhiu started a study on "Vertical migration of the meiobenthos in mangrove sediments : influence of a tidal cycle" and Mr. Okondo began a study concerning the "Epifaunal influence on infaunal communities in mangroves", both under supervision of Dr. Vincx, Drs. J. Schrijvers and Drs. Y. Vermeulen.

- *Mr. M. Van Zele* : 2/09/1991 - 27/09/1991

Mr. M. Van Zele from the Laboratory of Botany of the University of Ghent, started in function of his thesis, a study of the microphytobenthos in the intertidal zone of Gazi Bay under supervision of Dr. E. Coppejans and Dr. A. Zwaenepoel.

- *Mr. S. Provoost* : 2/09/1991 - 27/09/1991

Mr. S. Provoost also from the Laboratory of Botany of the University of Ghent, started under guidance of Dr. E. Coppejans his thesis which has as aim to produce a vegetation map of the intertidal vegetation of the southernmost part of Bamburi Bay.

- *Drs. G. De Clerck* : 08/09/1991 - 12/10/1991

Drs. G. De Clerck started in the frame of a Ph.D., a study on tropical marine Turbellaria along the Kenian coast around Mombasa under supervision of Prof. Schockaert from the Limburgs University Centrum.

- *Drs. Jan Schrijvers* finished in September 1991 his thesis 'Ecological study of the benthos of the mangroves and beaches of Gazi Bay, Kenya'. He now started in function of a Ph.D. under the responsibility of Dr. Vincx, a study on the "Epifaunal influence on infaunal communities in mangroves", together with Mr. Okondo.

- *Drs. Y. Vermeulen* started also in funktion of a Ph. D. a study concerning the structure and variability in populations of meiobenthos in mangrove areas (Gazi Bay) and the fluctuations in time, under supervision of Dr. Vincx.

1.2 In Belgium

Effort has been made to get new Kenian students to the international postgraduate F.A.M.E. of the Free University of Brussels and also to the new postgraduate on Nematology of the University of Ghent.

2. Research activities

In Appendix 1 there is an overview of the different sampling programs done during the period.

- new- and current research subjects :

The list below gives an overview of the different subjects with the respective research officers, as well from K.M.F.R.-I., as the University of Nairobi and V.V.O.B.

- Fisheries : Dr. Nitba
Mr. Wakwabi
Mrs. Okoth
- Zooplankton : Dr. Okemwa
Mr. Osore
Mrs. Kasyi
- Phytoplankton : Mr. Wawiye
- Nutrients : Mrsr. Woitchik (EEC)
Mr. Kazungu
Mr. Ohowa
- Primary production mangroves : Mr. Slim (EEC)
Mr. Gwada
- Pollution : Mr. Munga
Mr. Omolo
Dr. Delbeke
- Bacteriology : Mr. Mwangi
Mrs. Owili
Mr. Wijnant
- Seaweeds : Mr. Wakibya
Mevr. Oyieke
- Oysters : Mr. Tack
Mr. Kimani
- Benthos : Mrs. A. Nduhiu
Mr. J. Okondo
Mrs. Y. Vermeulen
- Corals : Mrs. Mutere
- Shrimps : Mr. Oketchi
- Tar Balls : Dr. Mweu
- ~~Fysical~~ Physical Oceanografy : Mr. Mutua

- Internationale seminars-colloquia

In the " Workshop on Ecological Research in Coastal Lagoons", Inhaca, Maputo (Mozambique) - 3 till 7 December 1991, a paper has been presented by Dr. Ntiba for the group of Fisheries with the following title :

" A PRELIMINARY STUDY ON THE ICHTHYOCOMMUNITY OF GAZI MANGROVE CREEK, KENYA"

Participants : Dr. Okemwa, Dr. Mweu, Dr. Ntiba, Mr. Ruwa,
Mr. Wakwabi

- Publications

Tack, J.F. (in press). Ecomorphology of the Mangrove Oyster *Saccostrea cucullata* (von Born, 1978). *Academiae Analecta*.

Oduor, P., 1991. Effects of isoproterenol, salbutamol, fenoterol and clenbuterol on body composition and growth of the African catfish, *Clarias gariepinus* (Burchell, 1822). M. Sc. Thesis.

Mwengi, M.J., 1991. I. The effect of dietary sodium chloride on the growth rate, feed conversion, survival, cannibalism and mortality rate of larval African *Clarias gariepinus* (Burchell, 1822). II. The evolution of body muscle composition of fingerling *Clarias gariepinus* (Burchell, 1822). M. Sc. Thesis.

Schrijvers, J., 1991. Ecologische studie van het benthos van de mangroves en aanpalende stranden van Gazi Bay, Kenia. Licentiaatsverhandeling. 127 pp.

- Scientific Awards

Laureates Price Biology Mac Leod granted by the Royal Academie for Science, Literature and Arts of Belgium :

Tack, J.F. Ecomorphology of the Mangrove Oyster *Saccostrea cucullata* (von Born, 1978).

Van Hove, S. Studie van de benthische meiofauna van vijf mangrove-vegetatietypes van Gazi Bay (Kenia).

- For the next working period a number of propositions have been done by Kenian research officers concerning new research subjects. In function of the possibilities, technical and financial, some have been selected.

The benthos research, although already present in the instituut will be expanded on several topics. Expansion will be mainly in the field of the meiofauna and relation with the epifauna.

Malacological research will be started, in the first place in function of the research on mangroves.

Physiological research on the feeding methods of the mangrove oyster *Saccostrea cucullata* will be initialised. In function of that research a new laboratory will be arranged.

In order to satisfy the highly, current requirements of research and to stimulate the writing of scientific publications, a permanent cooperation with experts from abroad will be necessary. Also cooperation of different projects must continue, exchange of information and methods is essential.

3. Service

- 2 lectures were hold for the 'Fort Jesus Museum Society':

Dr. E. Van Speybroeck : "Mangroves" (7 January 1992)
Dr. E. Martens : "Coral Reefs" (28 January 1992)

- international relations

Cooperation with the VLIR project 'RECOSCIX - WIO' is fundamental and essential for K.B.P.. Literature is necessary for the start and the evolution of a research. Comparison with other results of other areas is mandatory. Communication with other research officers, exchange of experiences, discussions can easily been established. Information on workshops and congresses are distributed and received directly.

Collaboration with the EEC-project "Dynamics and Assessment of Kenyan Mangrove Ecosystems" which started 1st November 1989, is very intense and in different fields. For a number of new projects, as for the oyster- and longterm benthos research, the mangroves in Gazi has been chosen as work-area. Same for plankton and bacteriological research. The main aim is to get a general view of the different factors composing the mangrove and this can not been reached if there is no cooperation between the variuos branches.

The project 'Pollution' links completely with UNEP's East-African action plan (EAF/6) "Assessment and control of pollution in the coastal and marine environment". UNEP financed already the gaschromatograaf and the atomaire absorption-spectrophotometer

Cooperation with other institutes in Kenya as the Universities of Nairobi and Kenyatta, with Universities in Belgium, the Netherlands, and also Italy is important because this means that the number of experts in different disciplines increases. New contacts are and must be established to get more knowledge information, experience and skills.

The project remains participating in the organisation of the International Symposium and Workshop "Status and future of Large Marine Ecosystems of the Indian Ocean". Several research officers working under the project will present a paper.

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V. PLANNING NEXT PROJECT PERIOD

1. Outlook for the next period

In the first place attention will be spent to the further expansion of the different investigations already going on, with accent on writing up of the results in publications.

In a second step our attention will go to the start, follow-up and support of a number of new selected investigations in benthos research, malacological research and pollution as the investigations on the relation epi- en infauna, population studies of meiobenthos, studies on the role of meiobenthos in secondary production of the mangroves, studies on the feeding behaviour of the mangrove oyster *Saccostrea cucullata*, etc.. In function of this last investigation, a new laboratory for malacology will be installed. A multidisciplinary group of scientists (zooplankton, phytoplankton, chemical analysis, nutriëntanalysis, mariculture, animalphysiology, etc...) will find within the research their needs. Their will be worked on cooperation with other experts.

2. Expected results

From the current investigations a number of publications will be prepared for international journals. The project is becoming in a phase in which the research started in the beginning will come to results. The laboratory for malacology must be operational by the end of the next period.

3. The necessary means

3.1 Means

3.1.1. Employees

The general coordination of the project will be again in the hands of a local project manager.

3.1.2. Equipment

In view of the fact that the basic equipment for scientific research is already present, attention will mainly go to the maintenance of the existing material and the purchase of chemicals and smaller equipment.

3.1.3. Operation

The organisation of the ongoing research exists in the composition of a monthly sampling schedule (see Appendix 1 for an overview of the samplings done for the last period).

In function of the demand, transport and eventually a boat with engine is provided. Both project cars, the two Toyota's, and one car of the institute are involved.

For the preparation of a number of publications, help and back up of a number of international experts is necessary (help, comments,...). The project will try to establish communication with specialists all over the world. Therefore we will be grateful to use the facilities of the other VLIR project RECOSCIX-WIO.

3.2. Activities

3.2.1. Education

The education of Kenyan research officers in the next period will be based on three factors.

First of all, education is only possible through the intensive cooperation of the project with the V.V.O.B.-experts (one of them is directly linked to the project) already in Kenya and other experts permanently working in the country. V.V.O.B.-experts, working in the country at the different Kenyan Universities, are visiting regularly the institute with the aim of educating research officers, eventually in function of a B. Sc., M.Sc. or Ph. d.

A second important factor of education are the visits of several Belgian experts from the different universities (Free University of Brussels, University of Ghent, Limburgs University Centre).

Last but not least, we will try to send Kenyan research officers to universities abroad for short term trainings. Effort will be made to find scholarships for sending people to the postgraduate training courses as F.A.M.E. and the postgraduate training in Nematology.

3.2.2. Research

Main aim is to continue support in function of equipment and information to the research already going on. Expansion of the current research and initiating new topics as already mentioned above.

3.2.3. Extension

On the one hand, existing research will be extended. On the other hand, some new research topics will be started as in the field of macro- and meiobenthos, the malacological research and the physiological investigations on the feeding mechanism of the mangrove oyster *Saccostrea cucullata*. In function of this last investigation, the laboratory of malacology will be started.

APPENDIX

Appendix 1.

Sampling schedules for the period July 1991 - March 1992

WORKPLAN SAMPLING SCHEDULE FOR THE MONTH OF JULY 1991

DATE	TIDE	DEPT.TIME	AREA	RES.OFFICER	TRANSPORT	ACTIVITY
Mon.1	LT:12.28	9.00	Diani	Wakibya	LR/boat	Seaweed (VLIR)
	HT:06.39 & 18.42	8.00	Changamwe	Munga et.al	Car	Pollution (VLIR)
Tue.2	LT:13.04	9.00	Shimoni	Oyieke	Car	Mar.algae (VLIR)
	HT:07.13	8.00	Shimoni Changamwe	Wakibya Munga et.al	Car	Seaweed (VLIR) Pollution (VLIR)
Wed.3	LT:13.45	13.00	Vipingo	Wakibya	Car	Seaweed (VLIR)
	HT:07.49	8.00	Gazi	Munga et.al	LR	Pollution (VLIR)
Thu.4	LT:14.32	9.00	Lamu	Oyike	LR	Mar. algae (VLIR)
	HT:08.32	(2days) 8.00	Changamwe	Munga et al	Car	Pollution (VLIR)
Fri.5	LT:15.31		Lamu	Oyieke	LR	Mar. algae (VLIR)
	HT:09.22	8.00	Changamwe	Munga et al	Car	Pollution (VLIR)
Sat.6	LT:16.49					
	HT:10.27					
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Mon.8	LT:19.41	10.00	Gazi	Wawiye	LR/boat	Phytoplankton (EEC+VLIR)
	HT:12.29		Gazi	Wynant		Bacteriology (EEC+VLIR)
		11.00	Vipingo	Omondi	Car	Art. fisheries (KFRI)
Tue.9	LT:20.43	10.00	Gazi	Osore et al	LR/boat	Zooplankton (EEC+VLIR)
	HT:14.09		Gazi	Kazungu		Nutrients (EEC+VLIR)
			Gazi	Gwada/ Mwachirea		Litter fall (EEC)
		8.00	Changamwe	Munga et al	Car	Pollution (VLIR)
Wed.10	LT:08.36	8.00	Coastal area	Munga et al	LR/boat	Pollution (VLIR)
	HT:15.10	8.00	Port Reitze	Kairu	Car	Scolemnts (EEC+VLIR)
Thu.11	LT:09:31	8.00	Kilifi	Mweu et al	Car	Tar balls (VLIR)
	HT:16.06	8.00	Tudor	Omondi	Car/boat	Art. fisheries (KFRI)
		8.00	Four season	Wakibya	-	Seaweed (VLIR)
Fri.12	LT:10.19	8.00	Vipingo	Mutere	Car	Corals (VLIR)
		8.00	Kikambala/ Mtwapa	Mweu		Tar balls (VLIR)
	HT:16.48	14.00	Gazi	Wakwabi et al	LR	Fisheries (EEC+VLIR)
		3 days sampling	Ntiba (UN)			

Sat.13	LT:11.04 HT:17.32		Gazi	Wakwabi et al Ntiba (UN)	LR	Fisheries (EEC+VLIR)
Sun.14	LT:11.4 6 HT:18.12		Gazi	Wakwabi et al Ntiba (UN)	LR	Fisheries (EEC+VLIR)
Mon.15	LT:12.29 HT:06.41	9.00	Gazi Shelly beach Shelly beach	Wakwabi et al Ntiba (UN) Kairu Wakibya	LR Car	Fisheries (EEC+VLIR) Coastal erosion Seaweed (VLIR)
Tue.12	LT:13.14 HT:07.21	10.00 8.00	Tudor Vipingo Changamwe	Kazungu Mutere Munga et al	LR/boat Car Car	Nutrients (VLIR) Corals (EEC) Pollution (VLIR)
Wed.17	LT:14.02 HT:14.21	8.00 12.00 8.00	Vanga Kanamai Changamwe	Dyieke Wakibya Munga et al	LR Car LR	Mar. algae (VLIR) Seaweed (VLIR) Pollution (VLIR)
Thu.18	LT:14.57 HT:08.51	14.00 9.00	Vipingo Port Reitz	Wakibya Munga et al	Car LR	Seaweed (VLIR) Pollution (VLIR)
Fri.19	LT:16.03 HT:09.46	10.00 8.00	Mambrui Changamwe	Wakibya Munga et al	Car Car	Seaweed (VLIR) Pollution (VLIR)
Sat.20	LT:17.33 HT:10.58					
Mon.22	LT:06.57 HT:13.37	12.00 8.00	Vipingo Changamwe	Omondi Munga et al	Car Car	Art. fisheries (KMFRI) Pollution (VLIR)
Tue.23	LT:08.09 HT:14.34	8.00 14.00	Gazi River	Gwada/ Mwachirea Munga et al	Car LR	Litterfall (VLIR) Pollution (VLIR)
Wed.24	LT:08.57 HT:15.18	8.00 8.00 8.00	Tiwi + Diani Tudor Changamwe	Mweu Omondi Munga et al	LR Car/boat Car	Tar balls (VLIR) Art. fisheries (KMFRI) Pollution (VLIR)
Thu.25	LT:09.35 HT:15.53	8.00 12.00	Vipingo Vipingo Gazi Gazi	Wakibya Mutere Wawiye Wynant	Car LR/boat	Seaweed (VLIR) Corals (VLIR) Phytoplankton (EEC+VLIR) Bacteriology (EEC+VLIR)
Fri.26	LT:10.07 HT:16.23	8.00 8.00 8.00	Gazi Gazi Msambweni Changamwe	Osore Kazungu Mweu Munga et al	LR/boat Car Car	Zooplankton (EEC+VLIR) Nutrient (EEC+VLIR) Tar balls (EEC+VLIR) Pollution (VLIR)

Mon.29	LT:11.37					
	HT:17.51	10.00	Diani	Kairu	Car	Coastal erosion (VLIR)
		9.00	Tudor	Wakwabi	LR/boat	Fisheries (VLIR)
			Tudor	Omondi		Art. fisheries (KMFRI)
Tue.30	LT:12.06	10.00	Vipingo	Wakibya	Car	Seaweed (VLIR)
	HT:18.21	8.00				
	& 06.17		Gazi	Kairu	LR	Sediments (EEC+VLIR)
Wed.31	LT:13.19	8.00	Port Reitz	Munga et al	LR	Pollution (VLIR)
	HT:06.17					
	& 07.17	11.00	Shelly beach	Wakibya	Car	Seaweed (VLIR)

WORKPLAN: SAMPLING SCHEDULE FOR THE MONTH OF AUGUST 1991

DATE	TIDE	DEPT.TIME	AREA	RES.OFFICER	TRANSPORT	ACTIVITY	
Mon 5	LT:17.56	8.00	Changamwe Mtongwe	Munga	Car	Pollution (VLIR)	
	HT:11.02	10.00		Omolo	Car	Pollution (VLIR)	
Tue 6	LT:19.33	8.00	Changamwe Miritini	Munga	Car	Pollution (VLIR)	
	HT:12.42	10.00		Omolo	Car	Pollution (VLIR)	
Neap							
Wed 7	LT:07.26	10.00	Gazi	Ohoma	Car/boat	N ₂ Fixation (EEC)	
	HT:14.04	8.00	Gazi	Osore	LR/Boat	Zooplankton (EEC+VLIR)	
			Gazi	Kazungu		Nutrients (EEC+VLIR)	
		Changamwe	Munga	Car	Pollution (VLIR)		
Thu 8	LT:08.33	10.00	Gazi	Hawiye	LR/Boat	Phytoplankton (EEC+VLIR)	
	HT:15.04	14.00	Gazi	Wynant		Bacteriology (EEC+VLIR)	
			Vipingo	Wakibya	Car	Seaweed (VLIR)	
		KMC	Omolo	Car	Pollution (VLIR)		
Fri 9	LT:09.25	8.00	Kanamai Kikambala + Mtwapa	Kairu	Car	Coastal erosion (VLIR)	
	HT:15.53			Mweu		Tar balls (VLIR)	
Sat 10	LT:10.10						
	HT:16.35						
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Mon 12	LT:11.30	8.00	Vipingo	Mutere	Car	Coral (VLIR)	
	HT:17.53	9.00	Bamburi	Kairu	Car	Coastal erosion (VLIR)	
Tue 13	LT:12.10	8.00	Gazi	Wakwabi et al + Ntiba (UN)	LR	Fisheries (EEC+VLIR)	
	HT:18.27	3 days sampling					
		10.00			Tudor	Kazungu Omendi	Car/boat
Wed 14	LT:12.48		Gazi	Wakwabi et al	LR	Fisheries (EEC+VLIR)	
	HT:19.02 or 06.50	10.00	Vipingo	Ntiba (UN)			
			10.00	Kilifi	Mutere	Car	Corals (VLIR)
		10.00	KMC	Mweu		Tar balls (VLIR)	
				Omolo	Car	Pollution (VLIR)	
Thu 15	LT:13.28		Gazi	Wakwabi et al	LR	Fisheries (EEC+VLIR)	
	HT:08.02	11.00			Miritini	Ntiba (UN)	
				Omolo	Car	Pollution (VLIR)	
Fri 16	LT:14.12	11.00	Vipingo Mtongwe	Wakibya	Car	Seaweed (VLIR)	
	HT:08.02	12.00				Omolo	Car

Sat 17	LT:15.08 LT:08.46					
Mon 19	LT:18.45 HT:11.37	9.00	Vipingo	Omondi	Car	Art. fisheries
Tue 20	LT:06.35 HT:13.17					
Neap						
Wed 21	LT:07.59 HT:14.20	8.00	Port Rietz Gazi	Kairu Dhowa	Car Car/boat	Sediments (EEC) N ₂ Fixation (EEC)
Thu 22	LT:08.46 HT:15.03	10.00 8.00	Gazi Gazi Tiwi & Diani	Wawiye Wynant Mweu	LR/Boat Car	Phytoplankton (EEC+VLIR) Bacteriology (EEC+VLIR) Tar balls (VLIR)
Fri 23	LT:09.21 HT:15.35	12.00 8.00	Gazi Gazi Vipingo	Osore Kazungu Wakibya	LR/Boat Car	Zooplankton (EEC+VLIR) Nutrients (EEC+VLIR) Seaweed (VLIR)
Sat 24	LT:09.52 HT:16.04	8.00	Gazi	Kudoja (UN)	Car	Nutrients (EEC)
Sat 25		8.00	Gazi	Kudoja (UN)	Car	Nutrients (EEC)
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Mon 26	LT:10.47 HT:17.01	8.00 8.00	Tudor Msambweni	Wakwabi et al Omondi Mweu	LR/Boat Car	Fisheries (VLIR) Art. Fisheries (VLIR) Tar balls (VLIR)
Spring						
Tue 27	LT:11.16 HT:17.29	9.00 9.00	Vipingo Diani	Mutere Wakibya	Car LR/Boat	Corals (VLIR) Seaweed (VLIR)
Wed 28	LT:11.46 HT:17.56	9.00 8.00	Gazi Gazi Mambrui Malindi	Kazungu Kairu Wakibya Dhowa	LR/Boat Car	Nutrient (EEC+VLIR) Sediments (EEC) Seaweed (VLIR) Nutrients
Thu 29	LT:12.18 HT:18.25	9.00 8.00	Shelly beach Shelly beach Tudor	Kairu Wakibya Omondi	Car LR/Boat	Sediments (VLIR) Seaweed (VLIR) Art. fisheries (VLIR)
Fri 30	LT:12.53 HT:06.43	8.00	Tudor Vipingo	Wynant et al Wakibya	Car/boat Car	Bacteriology (EEC+VLIR) Seaweed (VLIR)
Sat 31	LT:13.33 HT:07.17					

WORPLAN: SAMPLING SCHEDULE FOR THE MONTH OF SEPTEMBER 1991

DATE	TIDE	DEPT. TIME	AREA	RES. OFFICER	TRANSPORT	ACTIVITY
Mon 2	LT:15.32 HT:08.58	8.00	Port Reitz	Munga et al	LR/Boat	Pollution (VLIR)
Tue 3	LT:17.50 HT:10.41					
Wed 4	LT:19.28 HT:12.43	10.00	Gazi Gazi	Kazungu Osore	LR/boat	Nutrient (EEC+VLIR) Zooplankton (EEC+VLIR)
Thu 5	LT:02.30 HT:14.10	9.00 12.00	Gazi Gazi Vipingo	Wawiye Wynant Omondi	LR/boat Car	Phytoplankton (EEC+VLIR) Bacteriology (EEC+VLIR) Art. fisheries (KMFRI)
Fri 6	LT:08.30 HT:14.10	8.00 8.00	Kilifi Vipingo	Mweu Wakibya	Car LR	Tar balls (VLIR) Wakibya (VLIR)
Sat 7	LT:09.17 HT:15.39					
Mon 9	LT:10.35 HT:16.35	8.00 3 days 8.00	Gazi Kanamai Vipingo	Wakwabi et al +Ntiba+Kudoja (UN) Mutere Kairu	LR Car	Fisheries (EEC+VLIR) Corals (VLIR) Coastal erosion (VLIR)
Tue 10	LT:11.11 HT:17.29		Gazi Port Rietz	Wakwabi et al Ntiba (UN) + Kudoja (UN) Kairu	LR Car	Fisheries (EEC+VLIR) Sediments
Wed 11	LT:11.46 HT:18.00	9.00	Gazi Tudor Tudor	Wakwabi et al Ntiba (UN) Kazungu Omondi	LR Car/boat	Fisheries (EEC+VLIR) Nutrients (VLIR) Art. fisheries (KMFRI)
Thu 12	LT:12.21 HT:18.59 & 06.15	8.00 10.00	Port Rietz Kanamai Kikambala/ Mtwapa	Munga et al Mutere Mweu	LR/boat Car	Pollution (VLIR) Corals (VLIR) Tar balls (VLIR)
Fri 13	LT:12.56 HT:18.59 & 19.31	10.00	Vipingo	Wakibya	Car	Seaweed (VLIR)

Mon 16	LT:15.27 HT:08.37					
Tue 17	LT:17.40 HT:10.16	8.00	Gazi	Munga et al	LR/boat	Pollution (VLIR)
Neap						
Wed 18	LT:19.37 HT:12.43	10.00	Vipingo	Omondi	Car	Art. fisheries (KMFRI)
Thu 19	LT:07.40 HT:13.52					
Fri 20	LT:08.26 HT:14.34	8.00 8.00	Vipingo Tudor	Wakibya Omondi	Car Car/boat	Seaweed (VLIR) Art. fisheries (KMFRI)
Sat 21	LT:09.00 HT:15.07					

Mon 23	LT:09.56 HT:16.07	8.00 8.00	Gazi Tiwi + Diani Diani	Kairu Mweu Wakibya	Car LR/boat	Sediments (EEC) Tar balls (VLIR) Sea weed (VLIR)
Tue 24	LT:10.24 HT:16.35	13.00 9.00	Gazi Gazi Shelly beach	Wawiye Wynant Wakibya	LR/boat Car	Phytoplankton (EEC+VLIR) Bacteriology (EEC+VLIR) Seaweed (VLIR)
Wed 25	LT:10.54 HT:17.04	12.00 8.00 8.00	Gazi Gazi Msambweni Four season	Kazungu Osore Mweu Wakibya	LR/boat Car	Nutrients (EEC+VLIR) Zooplankton (EEC+VLIR) Tar balls (VLIR) Seaweed (VLIR)
Thu 26	LT:11.25 HT:17.33	9.00 8.00	Tudor Tudor Shimoni	Wakwabi et al Omondi Wakibya	LR/boat Car	Fisheries (VLIR) Art. fisheries (VLIR) Seaweed (VLIR)
Fri 27	LT:11.58 HT:18.04	10.00 8.00 8.00	Gazi Kanamai Vipingo Tudor	Kairu Mutere Wakibya Kazungu	LR Car Car/boat	Sediments (EEC) Corals (VLIR) Seaweed (VLIR) Nutrients (VLIR)
Sat 28	LT:12.35 HT:18.38					

Mon 30	LT:14.05 HT:20.11					
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WORKPLAN : SAMPLING SHEDULE - DECEMBER 1991

DATE TIDE	TIME	AREA	RES.OFFICER	TRANSPORT	ACTIVITY
MON. 2 H 13.47 L 19.35	08.00	GAZI	Wawiye	pickup/boat	Phytoplankton
TUE.3 H 14.42 L 08.33	08.00 08.00 08.00	GAZI GAZI GAZI	Kazungu Ohowa Osore	pickup/boat pickup/boat pickup/boat	Nutrients N ² fixation Zooplankton
	- 2 days sampling -				
WED. 4 H 15.27 L 09.15	08.00	GAZI	Osore	pickup/boat	Zooplankton
	- 2 days sampling -				
THU. 5 H 16.04 L 09.52	08.00 08.00 08.00 08.00 12.00	GAZI TUDOR VIPINGO VIPINGO KILIFI, KIKAMBALA	Osore Munga et al. Wakibya Omondi Mweu	pickup/boat pickup car car/boat car	Zooplankton Pollution Seaweeds Art.Fisheries Tar Balls
FRI. 6 H 16.37 L 10.26	08.00 06.00 08.00 08.00	GAZI GAZI SBHOTEL GAZI	Gwada Vermeulen Wakibya Ntiba,Okoth, Wakwabi	car car — pickup	R-Litterfall Meiobenthos Seaweeds Fisheries
	- 3 days -				
SAT.7 H 17.06 L 10.57	08.00	GAZI	Ntiba,Okoth, Wakwabi	pickup	Fisheries
	- 3 days -				
SUN.8 H 17.36 L 11.27	08.00	GAZI	Ntiba,Okoth, Wakwabi	pickup	Fisheries
	- 3 days -				
MON. 9 H 18.05 L 12.00	08.30	DIANI	Wakibya	car	Seaweeds
TUE.10 H 06.08 L 12.31	08.00 08.00	GAZI GAZI	Munga et al. Gwada	pickup/boat car	Pollution C-Litterfall
WED.11 H 06.41 L 13.03	08.00 09.00	TUDOR VIPINGO	Kazungu Wakibya	car car	Nutrients Seaweeds

THU.12
H 07.16
L 13.37

FRI.13
H 07.55 08.00 Malindi Ohowa car/boat N² fixation
L 14.16

MON.16
H 11.18 08.00 TUDOR Munga et al. KTT/boat Pollution
L 17.13

TUE.17
H 12.43 08.00 GAZI Wawiye pickup/boat Phytoplankton
L 18.29 08.00 GAZI Ohowa car N²-Fixation

WED.18
H 13.52 09.00 VIPINGO Wakibya car Seaweeds
L 19.37

THU.19
H 14.50 08.00 GAZI Ohowa pickup N² Fixation
L 08.42 08.00 GAZI Kazungu pickup Nutrients

FRI.20
H 15.39 08.00 GAZI Gwada car R-Litterfall
L 10.26 08.00 VIPINGO Wakibya car Seaweeds

MON.23
H 16.18 08.00 TIWI/ Mweu car Tar balls
L 11.33 DIANI
08.00 FSHOTEL Wakibya — Seaweeds
08.00 GAZI Gwada car R-Litterfall

TUE.24
H 18.31 08.00 GAZI Vermeulen car Meiobenthos
L 12.14 08.00 GAZI Tack car Oysters
10.00 MSAMBWENI Mweu car Tar Balls

WED.25 CHRISTMASS

THU.26
H 07.28 08.00 TUDOR Omondi car/boat Art.Fisheries
L 13.37

FRI.27
H 08.15 08.00 VIPINGO Wakibya car Seaweeds
L 14.22

MON.30
H 11.44 08.00 TUDOR Kasyi car/boat Zooplankton
L 17.32 08.00 TUDOR Omondi car/boat Art.Fisheries

TUE.31
H 15.11 08.00 GAZI Osore pickup/boat Zooplankton
L 07.10

WORKPLAN : SAMPLING SCHEDULE - JANUARY 1992

DATE TIDE	TIME	AREA	RES. OFFICER	TRANSPORT	ACTIVITY
WED. 1 H 14.23 L 08.22	NO SAMPLING				
THU. 2 H 15.14 L 09.10	08.00 08.00	JOMVUU KUJ GAZI	Okechi Wawiye	car KIT/boat	Prawns/Shrimps Phytoplankton
FRI. 3 H 15.54 L 09.48	08.00 08.00 09.00	GAZI GAZI VIPINGO	Osore Gwada Wakibya	KIT/boat car car	Zooplankton R-Litterfall Seaweeds
MON. 6 H 17.27 L 11.18	08.00 08.00 08.00	TUDOR MTWAPA KANAMAI	Omondi Mweu Wakibya	car car car	Fisheries Tar balls Seaweeds
TUE. 7 H 17.55 L 11.46	08.00 - 3 days 08.00 08.00	GAZI sampling - GAZI MALINDI	Ntiba, Okoth. Wakwabi Gwada Okechi	KIT KIT car	Fisheries C-Litterfall Prawns/Shrimps
WED. 8 H 18.24 L 12.12	08.00 - 3 days 09.00 08.00	GAZI sampling - GAZI KILIFI/ KIKAMBALA	Ntiba, Okoth. Wakwabi Tack Mweu	KIT car car	Fisheries Oysters Tar balls
THU. 9 H 18.53 L 12.40	08.00 08.00 - 3 days 08.00 08.00	VIPINGO GAZI sampling - GAZI GAZI	Omondi Ntiba, Okoth. Wakwabi Vermeulen Tack	car/boat KIT car car	Fisheries Fisheries Meiobenthos Oysters
FRI. 10 H 19.25 L 13.08	08.00	VIPINGO	Wakibya	car	Seaweeds
MON. 13 H 08.49 L 14.58	08.00	MALINDI	Mweu	car	Tar Balls
TUE. 14 H 09.57 L 16.00	08.00 08.00	JOMVUU MTONGWE	Okechi Omolo	car/boat car	Prawns/Schrimps Oysters

WED. 15						
H 11.44	08.00	TUDOR	Kasyi	car/boat	Zooplankton	
L 17.33	08.00	MIRITINI	Omolo	car	Oysters	
THU. 16						
H 13.32	08.00	GAZI	Omolo	car	Oysters	
L 07.34	08.00	GAZI	Gwada	car	R-Litterfall	
	- 2 days -					
	08.00	GAZI	Wawiye	KTT/boat	Phytoplankton	
	08.00	MALINDI	Ohowa	car	Nutrients	
FRI. 17						
H 14.40	08.00	GAZI	Osore	KTT/boat	Zooplankton	
L 08.37	08.00	GAZI	Gwada	car	R-Litterfall	
	- 2 days -					
MON. 20						
H 16.53	08.00	GAZI	Gwada	car	R-Litterfall	
L 10.43						
TUE. 21						
H 17.33	08.00	TUDOR	Omondi	car	Fisheries	
L 11.19	08.00	JOMVUU KUU	Okechi	car	Prawns/shrimps	
WED. 22						
H 18.11	07.00	SHIMONI	Wakibya	car	Seaweeds	
L 11.56						
THU. 23						
H 18.50	08.00	MSAMBWENI	Mweu	car	Tar balls	
L 12.32	08.00	GAZI	Vermeulen	car	Meiobenthos	
	08.00	GAZI	Tack	car	Oysters	
FRI. 24						
H 19.30	08.00	VIPINGO	Omondi	car	Fisheries	
L 13.08	08.00	VIPINGO	Wakibya	car	Seaweeds	
TUE. 28						
H 10.37	08.00	GAZI	Gwada	car	Seedling	
L 16.21	- 3 days -					
	08.00	TUDOR	Okechi	car	Prawns/Shrimps	
WED. 29						
H 12.55	08.00	GAZI	Gwada	car	Seedling	
L 06.53	- 3 days -					
	08.00	TUDOR	Kasyi	car	Zooplankton	
THU. 30						
H 14.22	08.00	GAZI	Gwada	car	Seedling	
L 08.15	- 3 days -					
	08.00	GAZI	Osore	KTT/boat	Zooplankton	
FRI. 31						
H 15.10	08.00	VIPINGO	Wakiby	car	Seaweeds	
L 09.02						

WORKPLAN: SAMPLING SHEDULE FEBRUARY 1992

DATE TIDE	TIME	AREA	RES. OFFICER	TRANSPORT	ACTIVITY
MON. 3 H 16.40 L 10.31	08.00	GAZI	Wawiye	KTT//boat	Phytoplankton (VLIR)
TUE. 4 H 17.06 L 10.56	08.00 08.00 09.00 08.00	TUDOR TUDOR GAZI (2 days) GAZI	Okechi Omondi Gwada Okoth	car/boat car/boat KTT KTT	Prawns/Shrimps (VLIR) Fisheries (KMFRI) C-Litterfall (EEC) Fisheries (VLIR)
WED. 5 H 17.31 L 11.20	08.00 08.00 08.00	MIDA CREEK MTWAPA GAZI	Wakibya Mweu Osore	car car KTT/boat	Seaweeds (VLIR) Tar Balls (VLIR) Zooplankton (VLIR)
THU. 6 H 17.57 L 11.44	08.00	GAZI (3 days)	Ntiba, Wakwabi et al.	KTT/boat	Fisheries (EEC)
FRI.. 7 H 18.23 L 12.08	08.00 06.00	GAZI (3 days) VIPINGO GAZI	Ntiba, Wakwabi et al. Wakibya Vermeulen	KTT/boat car car	Fisheries (EEC) Seaweeds (VLIR) Meiobenthos (VLIR)
SAT. 8 H 18.52 L 12.34	08.00	GAZI (3 days)	Ntiba, Wakwabi et al.	KTT/boat	Fisheries (EEC)
MON.10 H 07.30 L 13.31	08.00 08.00	KANAMAI GAZI	Wakibya Gwada	car car	Seaweeds (VLIR) Litterfal
TUE.11 H 08.09 L 14.08	08.00	JOMVU KUU	Okechi	car	Prawns/Shrimps (VLIR)
WED.12 H 09.08 L 15.04	08.00	KILIFI/ KIKAMBALA	Mweu	car	Tar Balls (VLIR)
THU.13 H 11.08 L 16.50	08.00 08.00 08.00 08.30	GAZI GAZI (2 days) TUDOR TUDOR	Wawiye Gwada Kasyi Omondi	KTT/boat KTT car/boat car/boat	Phytoplankton (VLIR)L R-Litterfall (EEC) Zooplankton (VLIR) Fisheries (KMFRI)
FRI.. 14 H 13.29 L 19.02	08.00 08.00 07.00	GAZI GAZI (2 days) VIPINGO	Osore Gwada Wakibya	KTT/boat car car	Zooplankton (VLIR) R-Litterfall (EEC) Seaweeds (VLIR)
MON.17 H 15.58 L 09.47	08.00	GAZI	Okoth	KTT	Fisheries (VLIR)

TUE.18					
H 16.35	08.00	MALINDI	Okechi	KTT/boat	Prawns/shrimps (VLIR)
L 10.22	08.00	MALINDI	Mweu	KTT	Tar Balls (VLIR)
	08.00	GAZI	Gwada	car	C-Litterfall (EEC)
WED.19					
H 17.11	08.00	SHIMONI	Wakibya	KTT/boat	Seaweeds (VLIR)
L 10.56	09.00	TIWI/DIANI	Mweu	KTT	Tar Balls (VLIR)
THU.20					
H 17.47	08.00	MALINDI	Ohowa	car	Nutrients (KMFRI)
L 11.29					
FRI.21					
H 06.02	06.00	GAZI	Vermeulen	car	Meiobenthos (VLIR)
L 12.02	07.00	GAZI	Kazungu	car	Nutrients (EEC)
	08.00	VIPINGO	Wakibya	car	Seaweeds (VLIR)
		VIPINGO	Omondi	car	Fisheries (KMFRI)
MON.24					
H 07.46	08.00	JOMVU KUU	Okechi	car	Prawns/Shrimps (VLIR)
L 13.40					
TUE.25					
H 08.26	08.00	MSAMBWENI	Mweu	car	Tar Balls (VLIR)
L 14.17					
WED.26					
H 09.32					
L 15.14					
THU.27					
H 12.42	09.00	TUDOR	Kasyi	car/boat	Zooplankton (EEC)
L 06.20	08.00	GAZI	Gwada	car	R-Litterfall (EEC)
		(2 days)			seedling growth
		GAZI	Kazungu	car	Nutrients (EEC)
FRI..28					
H 14.12	07.00	VIPINGO	Wakibya	car	Seaweeds (VLIR)
L 07.56	08.00	GAZI	Gwada	car	R-Litterfall (EEC)
		(2 days)			seedling growth

WORKPLAN : SAMPLING SHEDULE - MARCH 1992

DATE TIDE	TIME	AREA	RES.OFFICER	TRANSPORT	ACTIVITY
MON. 2 H 15.48 L 09.37	NO SAMPLING				
TUE.3 H 16.12 L 10.02	NO SAMPLING				
WED. 4 H 16.37 L 10.25	NO SAMPLING				
THU. 5 H 17.01 L 10.49	10.00 08.00	GAZI GAZI	Tack Vermeulen	car car	Oysters Meiobenthos
FRI. 6 H 17.27 L 11.12	12.00 08.00 08.00	GAZI TIWI/ DIANI NYALI BEACH	Okoth Mweu Munga,Owili, Mwangi	KTT car boat	Fisheries Tar balls Pollution Bacteriology
MON. 9 H 06.33 L 12.29	08.30	SHIMANZI	Munga,Owili, Mwangi	car	Pollution Bacteriology
TUE.10 H 07.06 L 13.00	13.00 08.00	CHANGAMWE KILIFI/ KIKAMBALA	Munga,Owili, Mwangi Mweu	car car	Pollution Bacteriology Tar balls
WED.11 H 07.46 L 13.39	08.00 - 3 days sampling - 09.00	GAZI GAZI	Gwada Tack	car car	R-Litterfall Oysters
THU.12 H 08.48 L 14.38	08.00 08.00 08.00 - 3 days sampling -	KILINDINI TUDOR GAZI	Munga,Owili, Mwangi Kasyi Gwada	R.V.Maumba car/boat	Pollution Bacteriology Zooplankton R-Litterfall
FRI.13 H 16.46 L 04.56	12.00 08.00 - 3 days sampling - 09.00	GAZI GAZI VIPINGO	Kazungu Gwada Wakibya	KTT KTT car	Nutrients R-Litterfall Seaweeds

MON.16					
H 14.58	08.00	GAZI	Wawiye	KIT/boat	Phytoplankton
L 08.45	08.00	MIRITINI	Munga.Owili.		Pollution
	08.00	MIRITINI	Mwangi	car	Bacteriology
			Omolo	car	Oysters
TUE.17					
H 15.36					
L 09.22	08.00	GAZI	Gwada	car	Litterfall
	08.00	GAZI	Vermeulen	car	Meiobenthos
	08.00	GAZI	Tack	car	Oysters
WED.18					
H 16.12	08.00	KIPERU	Munga.Owili.		Pollution
L 09.56			Mwangi	R.V.Maumba	Bacteriology
	08.00	GAZI	Omolo	car	Oysters
THU.19					
H 16.46	08.00	GAZI	Ntiba.Okoth.	KTT	Fisheries
L 10.29	- 3 days -		Wakwabi		
	08.00	KMC	Omolo	car	Oysters
	08.00	VIPINGO	Wakibya	car	Seaweeds
FRI.20					
H 17.20	08.00	GAZI	Ntiba.Okoth.	KTT	Fisheries
L 11.01	- 3 days -		Wakwabi		
	08.00	GAZI	Munga.Owili.		Pollution
			Mwangi	car/boat	Bacteriology
	08.00	MTONGWE	Omolo	car	Oysters
SAT.21					
H 17.54	08.00	GAZI	Ntiba.Okoth.	KTT	Fisheries
L 11.33	- 3 days -		Wakwabi		
MON.23					
H 18.59	08.00	MTWAPA	Mweu	car	Tar balls
L 12.35	08.00	MALINDI	Okechi	KTT	Artemia/Shrimps
TUE.24					
H 06.43	08.00	KILINDINI	Munga.Owili.		Pollution
L 13.07		/TUDOR	Mwangi	R.V.Maumba	Bacteriology
	08.00	GAZI	Gwada	car	R-Litterfall
	- 4 days sampling -				
	10.00	GAZI	Tack	car	Oysters
	09.00	TIWI/DIANI	Mweu	car	Tar balls
WED.25					
H 07.54					
L 13.42	08.00	VIPINGO	Wakibya	car	Seaweeds
	08.00	GAZI	Gwada		R-Litterfall
	- 4 days sampling -				

THU. 26					
H 08.53	08.00	TUDOR	Munga, Owili.		Pollution
L 14.36		CREEK	Mwangi	R.V. Maumba	Bacteriology
	08.00	MSAMBWENI	Mweu	car	Tar balls
	08.00	GAZI	Gwada		R-Litterfall
	- 4 days sampling -				
FRI. 27					
H 11.49	08.00	GAZI	Tack	car	Oysters
L 17.11	08.00	GAZI	Kazungu	car	Nutrients
	08.00	GAZI	Gwada		R-Litterfall
	- 4 days sampling -				
MON. 30					
H 14.44	08.00	FORT	Munga, Owili.		Pollution
L 08.30		JESUS	Mwangi	R.V. Maumba	Bacteriology
TUE. 31					
H 15.11	08.00	MALINDI	Okechi	KTT	Artemia/Shrimps
L 08.58	08.00	GAZI	Ohowa	Car	Nutrients
	08.00	GAZI	Gwada	car	C-Litterfall

Appendix 2. Mission reports

Report on the stay of the botanists of the University of Ghent (RUG) in Mombasa (2 - 27/9/1991).
Dr. E. Coppejans.

Preliminary report of the scientific visit to the Kenya Marine and Fisheries Research Institute (K.M.F.R.I.) Mombasa Kenya on the tropical marine Turbellaria (8/9 - 12/10/1991).
Drs. Gert De Clerck

Parasitological study of marine fish species of the Kenyan coast.
Dr. E. Martens

Benthic research in mangroves in Gazi Bay (Kenya).
Report of the University of Ghent, Zoology Institute, Marine Biological Section.
Dr. M. Vincx.

Report on the stay of the botanists of the University of Ghent
(RUG) in Mombasa
(2 - 27/9/1991).

1. Dr. Eric Coppejans.

- a. The main activity was the supervision and guidance of the fieldwork of both thesis (see 3 & 4). This more specifically included help with the field identification of seagrasses and seaweeds as well as information on their zonation and succession. Of each plant species present in the transect a reference herbarium specimen has been prepared.
- b. The personal research on inventorisation and distribution of seaweeds was carried on. The coast of Musambweni was visited for the first time by us. The intertidal zone is way wide at extreme low tide, contains some large pools and is extremely species - rich. Especially the infralittoral fringe contains rare species (e.g. *Dictyurus purpurascens*) and several *Sargassum* spp. The study of the sublittoral zone was more difficult because of the extremely turbid water.

2. Lic. Arnout ZW AENEPEOL.

- a. The help with the fieldwork of S. Provoost's thesis was a full-time job. The methodology of the transect method for vegetation study was also explained and showed to the counterpart Mr. Wakibya.
- b. Next to the purely marine botanical research, grasses and sedges were collected at different sites and prepared as herbariumspecimens. These specimens are actually studied by Dr. Paul GOETGHEBEUR (RUG).

3. M.Sc. student Marc VAN ZELE.

The subject of this thesis is the study of the microphytobenthos of the intertidal zone of Gazi Bay; this includes the mangrove as well as the midlittoral seagrassbeds. Samples were taken in as much varied biotopes as possible (different mangrove zones, different seagrass vegetations, exposed areas (at low tide), in pools In a few cases samples were taken along transects perpendicurlly on the tidal range. Sampling was done by pushing a plexiglass tube (diameter 2,2 cm) in the soil and collecting the upper 1 cm. These samples were then pickled with formaldehyde (4%) for analysis in Ghent. Another sample was taken at the same place for particle size analysis. A description of the profile was also done. Temperature and conductivity of the water were measured on the spot.

With the help of the canoe of Mr. Erick Slim we had the opportunity to take samples upstream along the mangrove creek of the Kidogoweni river. Salinity gradually dropped from 35‰ to 2‰.

The aim of the study is:

- To start with the identification and inventarization of the

- microphytobenthic organisms (partim diatoms - Bacillariophyceae);
- Study their relative abundance and distribution over the different biotopes;
 - Seek correlations between this distribution and some abiotic factors such as: particle-size of the sediment, salinity, level above low water mark.

Some samples of periphyton have also been taken as well as phytoplankton samples in the Kidogoweni creek. The last has been done with a phytoplankton net (mesh width 25 um) at high tide, close to the fishermen's harbour and at low tide high stream upward in the Kidogoweni creek.

The counterpart Mr. Peter WAWIYE joined us during one sampling day and was extremely interested in the intertidal ecology.

4. M.Sc student Sam PROVOOST

The aim of this thesis is to produce a vegetation map of the intertidal vegetation of the southernmost part of Bamburi Bay (called Mwamba Beach by some fishermen, but other names have also been mentioned).

The first days of the field have been used to get an idea of the species composition and of the general zonation scheme of the area. Meanwhile a characteristic specimen of each seagrass and seaweed species was collected and prepared as herbarium specimens.

The ecological fieldwork consisted in a series of phytosociological relevés. These were made along 5 transects, perpendicular on the tide. The relevés of 20 by 20 cm were done every 10 m along these transects: all macroalgae and seagrasses were noted; their cover was estimated by means of the Londo scale. For each of these relevés some abiotic factors were measured such as relative height in the intertidal (this was done by means of a waterpass instrument and reference points along the shore which had previously been painted at high water of a known amplitude (tide table), thickness of the soil samples were taken for a grain size analysis. These samples were sieved on > 1 mm, > 250 um, > 150 um, > 63 um. this analysis was done in KMFRI. Along the transects upper and lower limit of the different species were noted. Next to these relevés along the transects, another series of relevés was made as to include the rare species.

Further identification of some seaweeds as well as computer analysis (DCA, CCA, TWINSpan) will be done on the relevé dataset in Ghent.

Preliminary report of the scientific visit to the Kenya
Marine and Fisheries Research Institute (K.M.F.R.I.).
Mombasa, Kenya.

Period: 08.09.91 to 12.10.91

Gert De Clerck
Dept.S.B.G., Zoology Researchgroup
Limburgs University Centrum
BELGIUM

Introduction

In the framework of a planned Ph.D. on tropical marine Turbellaria, the Kenya Coast around Mombasa was sampled during a five weeks stay at the K.M.F.R.I. This study is the third of its kind, the first two were carried out by Drs. Jouk Ph. (September - October 1985 and May - June 1987) and resulted amongst others in the description of 4 new Schizorhynchia (Jouk P.E.H. and De Vocht A.J. - P., 1989).

Material and Methods

In total, 49 samples were studied consisting of either algae or sand. The animals were extracted by stirring the sand or algae in a MgCL₂ - solution isotonic to seawater (Martens, 1984) and studied alive under the lightmicroscope. If more than one specimen was found, some individuals were fixed using the hot Bouins solution or stieve solution. These specimens will be sectioned serially to give additionally information on the internal structures.

Results

A preliminary list of the found species is given below. A lot of new species were found which will be described as soon as possible. These species and those which could not yet be determined at the species level are indicated as spec x.

Microturbellaria 1: Non - rhabdoceles

Catenulida spec.

1 juvenile

Acoel spec 1

Acoel spec 2

Macrostomida spec 1

Macrostomida spec 2

Macrostomum spec 1

Macrostomum spec 2

Prolecitophora spec 1

Prolecitophora spec 2

Prolecitophora spec 3

Prolecitophora spec 4

Prolecitophora spec 5

Proseriata spec 1

Coelogynoporidae spec

Monocelididae

Archiloa spec 1

Archiloa spec 2

Monocelis spec 1

Duplominona spec 1

Duplominona spec 2

Otoplanidae spec

Nematoplanidae several juveniles

Microturbellaria 2: Rhabdozoa

Typhloplanoida

Typhloplanida spec 1

Typhloplanida spec 2

Typhloplanida spec 3

Typhloplanida spec 4

Typhloplanida spec 5

Typhloplanida spec 6

Typhloplanida spec 7

Promesostomidae

Brinkmaniella spec 1

Brinkmaniella spec 2

Brinkmaniella spec 3

Promesostominae

Promesostoma spec

Solenopharyngidae spec 1

Solenopharyngidae spec 2

Lenopharynx tubatus

Trigonostomidae

Trigonostomum spec 1

Trigonostomum spec 2

Trigonostomum spec 3

Ptychoptera scutilifera

Microvahine carralina

Kalyptorhynchia

Schizorhynchia

Karkinorhynchidae

Cheliplana asica cfr. *teminalis*

Cheliplana textilis

Cheliplana spec

Schizorhynchidae spec

Schizochilus spec

Carchorodorhynchus spec 1

Carchorodorhynchus spec 2

Carcharodorhynchus involutus?

Eukalyptorhynchia spec
Cicerinidae spec?
Koinocystididae
 Utelga spec
Polycystidae nov spec
Polycystidae nov spec
 Duplacrorhynchus spec 1
 Duplacrorhynchus spec 2
 Typhlopolycystis spec
 Phonorhynchoides spec
 Cincturorhynchus spec 1
 Cincturorhynchus spec 2
 Cincturorhynchus spec 3 (cfr 'diademata')
 Cincturorhynchus karkingi
 Polycystis cfr contorta/felis
 Alcha evelinae
 Polycystis ali
 Djeziraia pardi
 Gyratrix hermafroditus

Macroturbellaria

Three different Polycladida spec, were found and fixed with Bouins solution.

References

- Jouk, P.E.H. and De Vocht, A.J. -P. 1989. Kalyptorhynchia (Plathelminthes Rhabdozoela) from the Kenyan Coast, with description of four new species. Trop. Zool. 2: 145 - 157.
- Martens, P.M. Comparison of three different extraction methods for Turbellaria. Mar.Ecol.Prog.Ser. 14: 229 - 234.

PARASITOLOGICAL STUDY OF MARINE FISH SPECIES OF THE KENYAN COAST

Dr. E. Martens (Nairobi University), in collaboration with Drs. G. Geets (Kenyatta University) and Dr. J. Moens (University of Limburg)

Introduction

Fish parasites form an important component in aquatic ecosystems and can have a significant impact on the host populations. Parasitological research may reveal valuable information for studies of the structure of aquatic ecosystems, as the ongoing research on the Kenyan mangrove ecosystem in the framework of the EEC project.

The literature study done till now (through University collaboration of RECOSCIX in Mombasa) indicates that the current knowledge of parasitic fauna of marine fish and invertebrates is very limited for the Eastern African coast and that this research is new for Kenya.

Aim of this study

The aim of the proposed study is to make a taxonomic survey of the different parasite species and to gain knowledge of the ecological aspects of parasitology such as host- and sitespecificity, population dynamics, lifecycles and influence on the host's condition.

The study started on commercially important fish species of the Sigandae, Lethrinidae and Lutianidae. A first parasitological study was carried out on *Siganus sutor* (rabbit fish) which forms an important part of the human diet, especially in the coastal region. Siganids, mainly *Siganus sutor* contribute 50% of the total artisanal catch of inshore reef fishery, which is the most important fishery for Kenya. In the first survey fresh fish samples were obtained from the fish market in Mombasa, so that only adult size classes of the fish could be studied.

Results

Fresh fishes are sampled for a qualitative study or taxonomic survey of marine fish parasites: well stretched and flattened specimens as needed for identification can only be obtained from live parasites. The specimens are being stained and prepared for light- and electronmicroscopic study, in collaboration with Limburg University, Belgium. The identification of the different parasites found has been hampered by the lack of basic taxonomic literature which is now being gathered by Limburg University.

The different parasites are now distinguished as "types". Some types however might be allometric forms of one species. Representatives of the following parasite groups were found in the fish species studied until now :

FISH SPECIES : (nr studied)	GILLS	INTESTINAL ORGANS
<i>Siganus sutor</i> (58)	Monogenea: 4 types Caligidea: 2 types Hatchekiidae: 1 type Isopoda: 1 type	Digenea : 8 types Acanthocephala : 1 type Nematoda : 1 type
<i>Lutjanus rivulatus</i> (12)	Monogenea: 3 types Caligidea: 1 types Hatchekiidae: 1 type Copepoda: 2 type	Digenea : 3 types Acanthocephala : 1 type
<i>L. fulviflammus</i> (9)	Monogenea: 1 types Hatchekiidae: 1 type Crustacea : 1 type	Digenea : 2 types
<i>Lethrinus nebulosus</i> (7)	Monogenea: 3 types Hatchekiidae: 1 type	Digenea : 1 type Acanthocephala : 1 type
<i>Scarus ghobban</i> (15)	Monogenea: 2 types Hatchekiidae: 2 type Copepoda: 1 type	Digenea : 2 types
<i>Leptoscarus vaigiensis</i> : (5)	Monogenea: 2 types Hatchekiidae: 1 type Isopoda: 1 type	Digenea : 1 type
<i>Abudefduf saxatilis</i> (11)	Monogenea: 3 types Copepoda: 1 type	Digenea : 3 types

The quantitative data will be published once the parasites types have been identified.

Training

At KMFRI the research officers Mrs. Mitoko and Mr. E. Kimani have been trained in the specific methodology used in parasitology : dissection of the fish, identification of parasite groups, specific preservation techniques of the different parasite groups, staining and mounting of specimens, use of camera lucida to make drawings of prepared specimens, quantitative study of parasites. Microscopic preparations of the parasites will also be used for the practicals of invertebrate zoology and M.Sc. parasitology course on fish parasites.

Dr. E. Martens (31/03/1991)

Benthic research in mangroves in Gazi Bay (Kenya).

Report of the University of Gent, Zoology Institute, Marine Biology Section, K.L. Ledeganckstraat 35, B 9000 Gent, Belgium.

Two research items were studied during our one month stay (February 1992) in the Kenyan Marine and Fisheries Research Institute (Mombasa, Kenya) : (1) the influence of epifaunal activities on the infaunal distribution in mangrove sediments; (2) the vertical migration of the meiobenthos in mangrove sediments during a tidal cycle.

(1) Epifaunal influence on infaunal communities in mangroves

Introduction.

The effects of heavy consumers on the infauna in mangrove sediments will be examined in an integrated research plan with teamwork on meiobenthos, epibenthos, mangrove productivity and soil ecology (cf. EEC project). The 'heavy' consumers are the crabs (Sesarmidae, Gecarcinidae, Portunidae and Ocypodidae), Gastropods (especially *Terebralia palustris*), fish and shrimp larvae and several shore birds. Their 'heavy' effect consists in (1) litter and leave removal and degradation by animals mostly or totally depending on mangrove leaves; (2) direct predation on infauna; (3) ground mixing by digging activity of all the crabs and some Thalassinid species. Burrowing effect on root respiration, soil oxidation and meiofauna distribution is unknown but presumably very relevant.

Species of crabs and/or molluscs can be removed (or increased) for more or less long periods, and the effect on soil, infauna and mangrove trees can be analysed.

Numerous studies have explored the phenomena of biological interactions between infaunal assemblages and, generally larger, epifaunal groups. Many efforts have been aimed at elucidating the effect of predation and bioturbation on infaunal (meiofauna and macrofauna) communities either by introducing or excluding the epifauna. Cages made with screening with a variety of mesh sizes have been used to both exclude and include large predators such as fish, shrimp and crabs and subsequently monitor infaunal abundance and composition in cage treatments compared to treatments with no alteration of epifaunal activity (uncaged areas = controls).

Especially in mangrove sediments, the bioturbating activities of the epifaunal organisms on the structure and the composition of the infauna seem to be very important.

The actual research program aims at the quantification of the importance of this bioturbation.

Cages.

With the samples of February, the effect of the epifauna on the infauna will be investigated in 4 different mangrove vegetation types, i.e. *Avicennia*, *Cerriops*, *Rhizophora* and *Sonneratia* in Gazi Bay (Kenya).

The cages are made of Al-profiles and PVC-plates pushed into the sediment and the walls are made of a nylon 2 mm mesh. They have a surface of 1 m² and are installed in the beginning of February 1992 and the first experiment on the effect of exclusion of epifauna takes two weeks. Within this period, the construction of the cage is tested as well as the short term influence of the exclusion of the epifauna on the infauna. The construction is found to be stable enough to last for several weeks. We have only failed with the *Sonneratia* cage which is fallen down because of the height, the extreme spring tide and the strong currents at that time.

Excluding epifauna.

After settling the cages, the epifauna has to be taken away. This is easily done for Gastropoda but is more difficult for the Decapoda. Different methods (life-traps with or without glue, mouse traps, removal by hand,...) have been tried. Especially for the *Rhizophora* and *Sonneratia* zones the right method has not yet been established. For the other zones, the methods mentioned above seem to be efficient.

Sampling.

In the beginning of February and after two weeks, samples of macrofauna and of meiofauna are taken within the cages, and outside the cages (i.e. blanco).

A PVC-core of 8.8 cm diameter is used for the macrobenthos and each core is separated in two slices (0-2, 4-r cm). The minimum depth is always 10 cm (especially nematodes are living in the deeper layers). Both slices are brought into a plastic bag and clearly coded.

For the meiobenthos, a PVC-core of 3.5 cm diameter is cut into four slices (0-2, 2-4, 4-10, 10-r cm).

The process of sieving and fixating the samples is done in the laboratory in the usual way.

The sampling methods for macrobenthos are the same as used for the M.Sc.Thesis 'Ecological study of the benthos of the mangroves and surrounding beaches at Gazi Bay, Kenya', J.Schrijvers, 1991. This time though, the division of the cores in two halves (in order to study the migratory effects), the complex and strong root system in the sediment, the cage samples and the size of the cores give some problems. These factors have to be brought into account to make a new efficient and practical sampling method for macrobenthos.

Analysis of the data and results.

Data on the structural characteristics of the meiofauna and of the macrofauna (i.e. densities of the different higher taxa

such as polychaetes, molluscs, nematodes, copepods,....) with or without short term cage influence will be determined and analysed in a statistical way. This will be done in cooperation with KMFRI (Julius Okondo). The results will be brought together in August '92 in order to look for some patterns and cage - non cage differences. Discussion about migratory patterns of crabs will be discussed with Prof. Vannini (Florence) and Dr VandenBerghe (Nairobi University).

Future.

During a period from August '92 to August '93 the infauna of the mangrove sediments in Gazi Bay, Kenya, will be studied structurally as well as dynamically.

Each month blanco samples for macro- and meiobenthos will be taken in four different mangrove types (*Avicennia marina*, *Ceriops tagal*, *Rhizophora mucronata* and *Sonneratia alba*). They are all monospecific areas, situated far from human influence, two of them being close to the EEC-plots of *R. mucronata* and *C. tagal*.

By doing so, it will be possible to measure the secondary production of these animals and to relate them structurally with existing abiotic factors of the sediment. Only taxa which are ecologically and numerically important will be examined in detail.

From August '92 to December '92, cage experiments will be carried out in two different mangrove zones : *A. marina* and *C. tagal*. In each zone entire and partial cages with a 2 mm mesh size and a surface of 1 m² have to exclude all the predatory epifauna bigger than 2 mm. By sampling these cages, it will be possible to study the structural (bioturbation, feeding behaviour,...) as well as the dynamical characteristics (trophic relationships, leaf degradation,...) of the epifauna, mainly crabs and gastropods.

The same will be done for *R. mucronata* and *S. alba* from August '93 to December '93.

(2) Vertical migration of the meiobenthos in mangrove sediments : influence of a tidal cycle.

Introduction

Vertical zonation of meiobenthic animals is typically controlled by the depth of the redox potential discontinuity (RPD) level, i.e. the boundary between aerobic and anaerobic sediments. The primary factor responsible for vertical gradients in the RPD is oxygen, which determines the redox potential as well as the oxidation state of sulfur and various nutrients (cf. Coull, 1988 for a review).

Especially in intertidal areas, dessication is also important in determining the vertical distribution patterns. Mc Lachlan et al. (1977) found meiofauna migrated downwards on an ebbing tide and upwards on a flooding tide. Vertical migration was

less in the winter than in the summer and appeared to be related to lower winter temperatures and therefore less desiccation at low tide than in summer. Furthermore, vertical migration was reduced at night, probably in response to cooler night temperatures at low tide, and again, less desiccation. In temperate intertidal areas, it was shown that some species migrate up with high tide, others migrate down while still others do not move at all in relation to the tide. Warwick & Gee (1984) found for nematode communities in an intertidal mudflat of the Tamar estuary (U.K.) that vertical segregation may be a mechanism to avoid interspecific competition. For tropical areas, no studies are available on the vertical migration patterns in relation to tide (desiccation).

Aim of the study

The vertical profiles of the meiobenthos in sediments of a *Cerriops* vegetation in Gazi Bay are investigated in relation to tidal cycles. Also the effect of the wet/dry season can be investigated for this purpose. The knowledge about the vertical migration of the meiofauna is necessary to adjust the data of the meiobenthos densities in relation to sampling time and tidal regime; this 'correction' factor is extremely important to know when temporal variation in meiofauna densities is investigated in order to get an idea about the available biomass of meiofauna for the higher trophic levels (surface animals are under a higher predation pressure than animals living deeper down into the sediment).

Sampling

The meiobenthos of the *Cerriops* sediments was sampled in Feb 1992 (dry season) at spring tide during five sampling times with 3 hours interval each.

Three (3) replicate samples were taken for the meiobenthos which are split up in 6 slices in the following way (0-1; 1-2; 2-3; 3-4; 4-5; 5-10 cm).

Meiofauna taxa will be determined to the higher taxonomic levels in a first approach. The vertical profile of the genera of the nematodes will be determined in a later phase; for this, 100 nematodes from each vertical slice will be brought into slides and identified to the genus level.

The same sampling will take place during spring tide in the wet season as well (date will be determined later).

Analysis of the data

Statistical treatment of the data will be done using several multivariate analysis in order to define relationships between the biotic and the abiotic environment.

Y. Vermeulen, in collaboration with Agnes (sorry ^{Agnes,} I forgot her ^{your} last name) will analyse the data.