Disease control and surveillance

CONTRAST final report; 1. October 2006 – 30. September 2010

Kristensen, Thomas K.

Publication date:
2010

Document version
Peer reviewed version

Citation for published version (APA):
Kristensen, T. K. (2010). *Disease control and surveillance: CONTRAST final report; 1. October 2006 – 30. September 2010*. DBL-Centre for Health Research and Development, University of Copenhagen.

SIXTH FRAMEWORK PROGRAMME

DISEASE CONTROL AND SURVEILLANCE

CONTRAST Final Report
1. October 2006 – 30. September 2010

SPECIFIC TARGETED RESEARCH AND INNOVATION PROJECT

Full title:	***A multidisciplinary alliance to optimize schistosomiasis control and transmission surveillance in sub-Saharan Africa.***
Acronym:	***CONTRAST***
Contract No.:	***PL 032203***
Project duration:	**4 years – 1. October 2006 – 30. September 2010**
Date of Preparation of report:	**15th November 2010**

Project coordinator (partner 1)
Prof. Thomas K. Kristensen
DBL - Centre for Health Research and Development
Phone: +45 3533 1425
tkk@life.ku.dk

2.1 CONTRAST Final Report

(1 October 2006 – 30 September, 2010)

CONTRAST

"A multidisciplinary alliance to optimize schistosomiasis control and transmission surveillance in sub-Saharan Africa"

Contract no.: 032203

Table of contents

Publishable executive summary

"A multidisciplinary alliance to optimize schistosomiasis control and transmission surveillance in sub-Saharan Africa"

Acronym
CONTRAST

Project summary

CONTRAST is a multidisciplinary alliance bringing together key skills and expertise to generate new knowledge on biological, environmental and socio-economic factors relating to schistosomiasis in sub-Saharan Africa. The project complements ongoing chemotherapy campaigns based on the drug praziquantel and will deliver more effective strategies for long-term control of this debilitating disease.

What is schistosomiasis?
Schistosomiasis, or bilharzia, is a tropical disease caused by intestinal worms of the genus Schistosoma. The transmission cycle requires contamination of surface water by excreta, specific freshwater snails as intermediate hosts, and human water contact.
According to WHO 200 million people are infected worldwide and more than 650 million people live in endemic areas, a majority of these in Africa. As a result schistosomiasis leads to the loss of 1.53 million disability-adjusted life years (DALY), although these figures need revision.

Aim of project
CONTRAST focused on integrated long term solutions leading to improved and sustainable local control of schistosomiasis. To reach this goal, **CONTRAST**s five European partners (established research institutes and a representative from the commercial sector) have together with 9 African institutions established a strong research node network across sub-Saharan Africa.

The research nodes in Africa have been established and are focusing on:

- innovative molecular tools to characterize both snails and schistosomes.
- the importance of host-parasite dynamics across different ecological and epidemiological settings.
- developing new spatial models for disease risk maps and prediction.
- encouraging and assessing novel local control interventions using a social science approach.
- ensuring widespread dispersal of knowledge and access to information facilitating research into practice.

CONTRAST is committed to creating a new and much needed platform for integrated schistosomiasis control in Africa, which will be effective and sustainable at the local, national and regional level.

CONTRAST has created strong south/south collaboration, and will secure a more effective dissemination.

Contractor/Partner list

Partner no.	Partner	Country
1 (coordinator)	DBL - Institute for Health Research and Development	Denmark
2	Natural History Museum	UK
3	Swiss Tropical Institute	Switzerland
4	Imperial College London	UK
5	Makerere University	Uganda
6	University of Zambia	Zambia
7	National Museums of Kenya	Kenya
8	Institut Senegalais de Recherches Agricoles	Senegal
9	Programme National de la lutte contre la Bilharziose	Niger
10	Centre for Schistosomiasis and Parasitology	Cameroon
11	Ministry of Health- Helminth Control Laboratory	Tanzania (Zanzibar)
12	National Institute of Medical Research	Tanzania
13	Coris Bioconcept	Belgium
14	Ministry of Health-Vector Control Division	Uganda

Project coordinator (partner 1)
Prof. Thomas K. Kristensen
M-B Research Centre, DBL, Faculty of Life Sciences, University of Copenhagen.
Thorvaldsensvej 57
1871 Frederiksberg, Denmark
Phone: +45 35331425
tkk@life.ku.dk

Work performed

The official starting date of the project was 1st October 2006, when a kick-off workshop for all partners was held in Entebbe, Uganda.

Having finalised the project period all 23 work packages have been implemented and finalised.

CONTRAST has established 5 new state-of-the-art research nodes that have formed the back bone of the CONTRAST project they are ready for future research work on neglected tropical diseases at partners and their associated institutes. The research nodes and their aims are:

1. A node for molecular biological studies creating innovative molecular tools to characterize both snails and schistosomes. This is placed at the Makerere University (MU) in Kampala, Uganda.
2. A node who defines the importance of host-parasite dynamics across different ecological and epidemiological settings. The research node is placed at Centre for Schistosomiasis and Parasitology (CSP) in Yaoundé, Cameroon
3. A GIS research node for developing new spatial models for disease risk maps and prediction. This is placed at the University of Zambia (UNZA), in Lusaka, Zambia.
4. Node 4 is working for encouraging and assessing novel local control interventions using a social science approach. This is placed National Institute of Medical Research (NIMR), in Mwanza, Tanzania and
5. The aim of research node 5 is twofold: 1) to ensure widespread dispersal of knowledge and access to information facilitating research into practice (this include a comprehensive Database called Fireflower), and 2) create reference collections for all parasites and snails. The reference collection is established at the National Museums of Kenya, (NMK) in Nairobi, Kenya.

Field activities took place in all the planned field sites in Senegal, Niger, Cameroon, Uganda, Kenya, Zambia, Tanzania and Zanzibar. Control treatments, snail samples and other material were collected in the field. This made it possible to initiate laboratory research. Georeferenced field data were used to develop predictive models in CONTRAST's third objective group.

Below the outcome of the work in CONTRAST is summarized for each of the 5 obejctive groups.

Objective 1

Within **objective group 1** the research node was established according to the schedule and at the involved partners all work packages has been engaged and exciting results have been obtained. Barcodes for schistosomes and intermediate host snails has been established to the extent it is possible, what seems to be a new snail species has been found and new tools has been developed. Insight in genetic diversity of schistosomes and snails has been revealed and genetic consequences of chemotherapy have been established. Findings from these studies are currently being implemented in the studies on host-parasite relationship in optimizing control of the disease.

The expected outcome of Objective group 1 was

(1)) An established molecular research node in Uganda and a biological reference research collection node in Kenya.

(2) An international standardized molecular nomenclature based upon DNA barcoding and selected micro-satellite loci for classification of genetic variation within schistosomes, and their associated snail hosts. (3) Real-Time PCR rapid diagnostic tests for detection of schistosome DNA in freshwater snails and establish patterns of schistosome infestation in aquatic environments through time.

The actual outcome has been:

(ad 1) – A fully functional well equipped molecular biology laboratory at an internationally acceptable standard has been established at Partner no 5.

(ad 2) - Species specific DNA sequence barcodes for the schistosomes has been established for *Schistosoma mansoni*, *S. haematobium* and *S. bovis*. The application of DNA barcodes for the differentiation of both the intermediate host snail genera *Biomphalaria* and *Bulinus* across Africa has been shown as a promising method.

(ad 3) - The use of the Dra1 repeat Real-Time PCR assay for the detection of schistosome infections in snails is now developed. The method has been used to detect parasites in naturally infected species of snails.

Objective 2

Within **objective group 2** a full functional host-parasite relationship research node was established and susceptibility experiments have been carried out. A parasitology training course for technicians in field collection and laboratory facilities and the latest techniques in packing, preservation, shipment and infection in laboratory has been performed. Extremely interesting results concerning co-infection and treatment aspects has been obtained. It has been shown how different parasites from different regions react to chemotherapy and how different some parasites are in productivity in different snails . These results will have significant influence on planning of future control regimes.

The expected outcome of objective group 2 was:

(1) Identification of key biological factors that shape the distribution of schistosomiasis by ascertaining exact compatibility spectra of key snail species, with particular attention paid to snail infection rate population dynamics such as seasonality and major ecological transformations.
(2) Key biological data concerning the distribution of *Bulinus* and *Biomphalaria* and their associated compatibility with schistosomes to annotate spatial databases and verify transmission predictions.
(3) An established snail-parasite research node in Cameroon.

The actual outcome has been:

(ad 1) A significant increase in knowledge os schistosomiasis prevelance in the investigated reas has been revealed, both in single and co-infections. This will have outstanding importance for future control initiatives.
(ad 2) - Knowledge of susceptibility of possible intermediate host snails and their distribution in place and time has been revealed.
(ad 3) – A fully functional research node has been established at Partner 10

Objective 3

A unique and very comprehensive open access database of historical and present information on schistosomiasis prevalence revealing disease distribution in sub-Saharan Africa has been produced in **objective group 3**. These data has been used and are being used in mapping disease distribution in Sub/Saharan Africa. This is useful in planning schistosomiasis control interventions. The research node is fully up and running. The node has implemented several course activities both for CONTRAST partners and other sub-Saharan participants. The open access database including disease distribution data is not to be confused with the other CONTRAST database, Fireflower, which include CONTRAST provided data only and has been established at research Node 5. In objective group 3 also risk mapping for the areas involved has been carried out. This will also contribute to a better and more optimized planning of control initiatives.

The expected outcome of objective group 3 was:

(1) Comprehensive GIS databases and schistosomiasis risk maps for selected eco-epidemiological settings across sub-Saharan Africa.
(2) Spatial refinement of control interventions for cost-effective allocation of scarce resources.
(3) Spatially-explicit databases of schistosome and snails annotated by molecular nomenclature maintained on a web-based interface.
(4) Integration of spatial databases with other neglected diseases.
(5) An established spatial epidemiology research node in Zambia.

The actual outcome has been:

(ad 1) Gis data base on climate and other environmental data has been established at the research Node and risk maps developed.
(ad 2) Optimised spatial refined risk mapping is under development.
(ad 3) CONTRAST database, Fireflower, created for all data collected in the project period on schistosomes and intermediate host snails.
(ad 4) An open access database for schistosomiasis (later extended to NTD) has been created with about 10 000 locations from Africa.
(ad 5) A fully functional GIS and remote sensing Research Node capable of investigate spatial epidemiology has been established at Partner no 6 in Zambia

Objective 4

Within **objective group 4** the research node has been established and the work packages implementing KAP (Knowledge, attitudes and practices) toward schistosomiasis control and PHAST (Participatory Hygiene and Sanitation Transformation) approach have been implemented. The results is very promising and PHAST has shown to have an impact on peoples performance and attitudes concerning their water contact behaviour. A manual for PHAST in schistosomiasis control has been developed.

The expected outcome of objective group 4 was:
(1) An established research node in Tanzania for integrated social and economic policy analyses.
(2) Evaluation of PHAST strategy .
(3) The performance of biological control of *S. haematobium* using refractory snail species and feasibility of using this method in coastal eastern Africa.

The actual outcome has been
(ad 1) A research node for integrated economic and social policy analysis has been established
(ad 2) The PHAST strategy has been implemented and evaluated successfully
(ad 3) Experiments are ongoing but final results not revealed.

Objective 5

Within **objective group 5** a website for the project was launched in January 2007: http://www.eu-contrast.eu. In this website two levels of access were created; one public 'popular' website, presenting news and stories relating to CONTRAST and other schistosomiasis related information, and one restricted to CONTRAST partners and the European Commission (as well as those bodies with local relevance and any others appointed by the EU.

The CONTRAST website has received over half a million hits during the three years it has been active. During the last 12 months there has been over 250.000 hits on the website. The project coordinator and the secretariat has agreed to continue supporting the website up to 2 years after the project ends.

CONTRAST has been proactive in dissemination of its results through publications in special issues of the well recognised International Journal Parasitology and an upcoming special issue exclusively for CONTRAST in Acta Tropica another well recognised international Journal. Also CONTRAST has reach out to national and international health care stakeholders by participating in meetings and arranging press conferences in correspondence to annual meetings. In this way CONTRAST has been made known through newspapers, radio and television. Like wise CONTRAST partners has played an important role at WHO expert and technical review meetings.

Open access database of schistosomiasis prevalence

CONTRAST have throught he work accomplished in WP13 established a unique georeferenced database on schistosomiasis prevalence throughout Africa. In September 2010, a scientific paper was submitted PLoS Neglected Tropical Diseases, describing the database, and the visions we have for it. The database can be found at www.globalntddatabase.org, where you can register for access to all data. The database currently features data on 10.000 individual schistosomiasis surveyed locations.

CONTRAST Final Report

Section 1
Project objectives and major achievements
(1 October 2006 – September 30, 2010)

CONTRAST

"A multidisciplinary alliance to optimize schistosomiasis control and transmission surveillance in sub-Saharan Africa"

Contract no.: 032203

Partners/Contractor:

Partner 1. DBL, Denmark. Coordinator
Partner 2. NHM, United Kingdom
Partner 3. STI, Switzerland
Partner 4. ICL, United Kingdom
Partner 5. MU, Uganda
Partner 6. UNZA, Zambia
Partner 7. NMK, Kenya
Partner 8. ISRA, Senegal
Partner 9. PNLB, Niger
Partner 10. CSP, Cameroon
Partner 11. HCL, Zanzibar
Partner 12. NIMR, Tanzania
Partner 13.CB, Belgium
Partner 14.VCD, Uganda

Projects current relation to the State of the art and innovation of the project:

Schistosomiasis is a chronic, debilitating and poverty-related disease and in many areas within Sub-Saharan Africa it continues to drain the socio-economic development of already impoverished rural communities. The availability of low-cost praziquantel (PZQ) together with political leverage for initiation of national control programs has stimulated a shift in the global control strategy from transmission containment to morbidity control. Today control is a dual approach of morbidity reduction followed by consolidation of most appropriate measures in low transmission environments.

There are some real and potential limitations of strategies based upon the sole use of chemotherapy. While PZQ treatment can be straightforward, schistosomes remain present in aquatic environments such that re-infection can be rapid, eroding the longer lasting beneficial impact of treatment. Furthermore, the indefinite dependence on the drug itself can potentially reduce its effective life-span. Similarly although PZQ is cheap, costs associated with its delivery may not be. Cost-effectiveness has to be given careful consideration both from short and long-term perspectives, to minimize wastage and maximize the beneficial impact. If for example, mass-treatment continues in areas where treatments were not actually required (as initial geographic targeting was poor) or that levels of re-infection were subsequently low (owing to local dynamics of transmission), the economic rationale for repeated mass-treatment is altered.

To promote longer-term sustainability, control resources need to be targeted and streamlined to meet the local needs of both present and future drug delivery requirements. Detailed consideration of suitable methods to identify areas of high transmission and re-infection are therefore needed together with local solutions for reduction of environmental contamination and transmission of schistosomes. In so doing, this will help rationalise and maximise the beneficial impact of chemotherapy-based morbidity control during the maintenance phase. Such detailed information should be integrated with other control programmes and – where resources allow – safe-water initiatives, to build towards more streamlined delivery of essential drug packages and environmental modifications.

To identify areas associated with high transmission and re-infection risk, further information on the snail-schistosome relationship is required as the dynamics of snail-schistosome interactions (together with human water contact patterns) are major determinants of the local, often complex, geographic pattern of disease. From a control perspective, this biological complexity has sometimes been over-looked, leading to superficial understanding of major processes shaping the local pattern of disease and weakening the forecasting ability of spatial models.

It is well known that the distribution of schistosomiasis closely follows the distribution of susceptible snails and it is around these habitats that re-infection can also be highest. As not all aquatic snail species have the ability to transmit schistosomiasis it is important to identify susceptible hosts from those that are not. With morphological methods, however, reliable incrimination of intermediate host populations has been elusive such that molecular DNA approaches are required. Through phylogenetic analysis of DNA sequences, stable classification systems can be derived as well as development of rapid identification assays based upon polymerase chain reaction (PCR). Increasing interest has been placed upon classification of parasites and pathogens using DNA barcodes or multi-locus sequence tags. By taking advantage of mitochondrial DNA sequences information from both snails and schistosomes, a DNA barcode nomenclature could be developed to shed new light on the schistosome-snail cross-talk. In addition, variation within microsatellites may document the genetic changes influenced by selection pressures imposed by PZQ.

This will provide important information for annotation of geographic information system (GIS) databases, further validating initial schistosomiasis forecasting models, similar to that used for malaria. Once high transmission areas are identified further focusing of available control resources would be best applied for environmental improvement and initiation of local behavioural change. Assessing the most appropriate local method of environmental improvement and behavioural change can be problematic but a PHAST (Participatory Hygiene and Sanitation Transformation) strategy could be useful. It hopes to empower the local community to find their own most appropriate interventions.

Operating at a smaller scale a multidisciplinary approach has already had proof of principle in Zanzibar as part of the "*Piga vita Kichocho*" or "*Kick out Kichocho*" programme. **CONTRAST** will develop this approach and provide new molecular DNA assays for detection of schistosomes in the environment and establish a much needed biological nomenclature for classification of the schistosome-snail relationship. The information gathered from these new systems and tools will provide fresh insight into the spatial epidemiology of schistosomiasis and identify the factors that maintain the disease at high levels. Integration of new biological information with demographic, environmental and socio-economic factors will greatly improve understanding of disease management, and be an effective step towards sustainable control.

It was the overall aim of the CONTRAST project to achieve sustainable schistosomiasis control at the public health level in selected countries in sub-Saharan Africa through development of locally adapted and appropriate intervention strategies, complementary with ongoing morbidity control using the anthelmintic drug praziquantel (PZQ).

Background for the project

Schistosomiasis is a chronic, debilitating and poverty-related disease and in many areas within Sub-Saharan Africa it continues to drain the socio-economic development of already impoverished rural communities. The availability of low-cost praziquantel (PZQ) together with political leverage for initiation of national control programs has stimulated a shift in the global control strategy from transmission containment to morbidity control. Today control is a dual approach of morbidity reduction followed by consolidation of most appropriate measures in low transmission environments.

There are some real and potential limitations of strategies based upon the sole use of chemotherapy. While PZQ treatment can be straightforward, schistosomes remain present in aquatic environments such that re-infection can be rapid, eroding the longer lasting beneficial impact of treatment. Furthermore, the indefinite dependence on the drug itself can potentially reduce its effective life-span. Similarly although PZQ is cheap, costs associated with its delivery may not be. Cost-effectiveness has to be given careful consideration both from short and long-term perspectives, to minimize wastage and maximize the beneficial impact. If for example, mass-treatment continues in areas where treatments were not actually required (as initial geographic targeting was poor) or that levels of re-infection were subsequently low (owing to local dynamics of transmission), the economic rationale for repeated mass-treatment is altered.

To promote longer-term sustainability, control resources need to be targeted and streamlined to meet the local needs of both present and future drug delivery requirements. Detailed consideration of suitable methods to identify areas of high transmission and re-infection are therefore needed together with local solutions for reduction of environmental contamination and transmission of schistosomes. In so doing, this will help rationalise and maximise the beneficial impact of chemotherapy-based morbidity control during the maintenance phase. Such detailed information should be integrated with other control programmes and – where resources allow – safe-water initiatives, to build towards more streamlined delivery of essential drug packages and environmental modifications.

To identify areas associated with high transmission and re-infection risk, further information on the snail-schistosome relationship is required as the dynamics of snail-schistosome interactions (together with human water contact patterns) are major determinants of the local, often complex, geographic pattern of disease. From a control perspective, this biological complexity has sometimes been over-looked, leading to superficial understanding of major processes shaping the local pattern of disease and weakening the forecasting ability of spatial models.

It is well known that the distribution of schistosomiasis closely follows the distribution of susceptible snails and it is around these habitats that re-infection can also be highest. As not all aquatic snail species have the ability to transmit schistosomiasis it is important to identify susceptible hosts from those that are not. With morphological methods, however, reliable incrimination of intermediate host populations has been elusive such that molecular DNA approaches are required. Through phylogenetic analysis of DNA sequences, stable classification systems can be derived as well as development of rapid identification assays based upon polymerase chain reaction (PCR). Increasing interest has been placed upon classification of parasites and pathogens using DNA barcodes or multi-locus sequence tags. By taking advantage of mitochondrial DNA

sequences information from both snails and schistosomes, a DNA barcode nomenclature could be developed to shed new light on the schistosome-snail cross-talk. In addition, variation within microsatellites may document the genetic changes influenced by selection pressures imposed by PZQ.

This will provide important information for annotation of geographic information system (GIS) databases, further validating initial schistosomiasis forecasting models, similar to that used for malaria. Once high transmission areas are identified further focusing of available control resources would be best applied for environmental improvement and initiation of local behavioural change. Assessing the most appropriate local method of environmental improvement and behavioural change can be problematic but a PHAST (Participatory Hygiene and Sanitation Transformation) strategy could be useful. It hopes to empower the local community to find their own most appropriate interventions.

Operating at a smaller scale a multidisciplinary approach has already had proof of principle in Zanzibar as part of the *"Piga vita Kichocho"* or *"Kick out Kichocho"* programme. **CONTRAST** will develop this approach and provide new molecular DNA assays for detection of schistosomes in the environment and establish a much needed biological nomenclature for classification of the schistosome-snail relationship. The information gathered from these new systems and tools will provide fresh insight into the spatial epidemiology of schistosomiasis and identify the factors that maintain the disease at high levels. Integration of new biological information with demographic, environmental and socio-economic factors will greatly improve understanding of disease management, and be an effective step towards sustainable control.

CONTRAST Final Report

Section 2
Final status of Work packages
(as of 30 September 2010)

CONTRAST

"A multidisciplinary alliance to optimize schistosomiasis control and transmission surveillance in sub-Saharan Africa"

Contract no.: 032203

Partners/Contractor:

Partner 1. DBL, Denmark. Coordinator
Partner 2. NHM, United Kingdom
Partner 3. STI, Switzerland
Partner 4. ICL, United Kingdom
Partner 5. MU, Uganda
Partner 6. UNZA, Zambia
Partner 7. NMK, Kenya
Partner 8. ISRA, Senegal
Partner 9. PNLB, Niger
Partner 10. CSP, Cameroon
Partner 11. HCL, Zanzibar
Partner 12. NIMR, Tanzania
Partner 13.CB, Belgium
Partner 14.VCD, Uganda

Summary of work performed and the main achievements during the project.

The CONTRAST activities were focussed on field work in partner countries (Senegal, Niger, Cameroon, Uganda, Kenya, Tanzania, Zanzibar and Zambia) coupled with establishment of the 5 research nodes carrying out the scientific analyses. The figure below shows the location and role of each of the five research nodes.

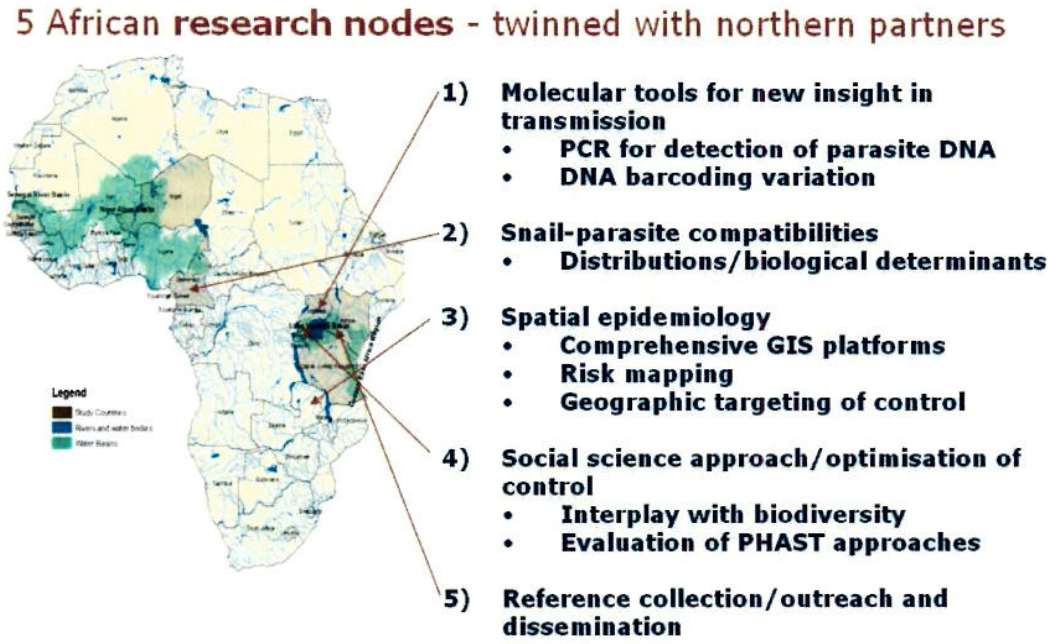

Figure 1. The location of the five research nodes in Africa, Partner countries and study areas.

Below each work package and it's deliverables will be reported upon. A full list of work package titles, deliverables and milestones can be found in Appendix XXX on p. XXX

> ***Objective 1.*** ***Molecular tools for new insight into snail-schistosome transmission biology.***
> *The objectives were to develop and implement novel molecular DNA assays based upon polymerase chain reaction (PCR) approaches upon collections of schistosomes and snails, from selected West- Central- and East African environments.*

Work Package 1 ***"Establishment of a molecular research node in Africa"***
WP 1 was implemented in order to enhance the facilities at partner 5 to a level of a fully functional well equipped molecular biology laboratory at an internationally acceptable standard. The laboratory has been set up at Makerere University (partner 5). It is fully operational. WP 1 has also enabled adequate storage facilities for the collected DNA samples including initial voucher specimen collection referencing WP 10-12 and has developed a regional capacity to train researchers in use of DNA tools and their application in molecular epidemiology. Deliverables D1 has been fulfilled.

The implementation of this work package was achieved in collaboration between partner 1, 2, 4 and 5.

Work Package 2 ***"Establishment of a resource database and biological reference collection research node".***

At partner 7, National Museums of Kenya, fascilities has been established for database housing and reference collection in spirits as well as frozen. An advanced database, Fireflower, has been created. The database creation entering parasitological and malacological survey data references into the database has been done but will also continue under the auspice of National Museums of Kenya, . The database are continiously being uploaded. Thus the objectives of this workpackages has been fulfilled and delverables D2 and D3 satisfied.

Work Package 3 ***"Development of DNA sequence barcoding nomenclature for characterization of schistosomes and snails".***

WP 3 had the following objectives 1) to determine specific DNA barcodes for schistosomes and snail host species from Cameroon, Niger, Senegal, Kenya, Tanzania, Uganda and Zambia referencing WP 10-12; 2) to develop less technologically demanding PCR assays for species identification (RFLP and species specific primers) to be implemented in laboratories with modest resources; 3) to conduct molecular phylogenetic and evolutionary analyses on the acquired DNA sequences and 4) to deposit DNA and voucher specimen collections for future reference at research node 5, referencing WP 2.

Species specific DNA sequence barcodes for the schistosomes were established for *Schistosoma mansoni*, *S. haematobium* and *S. bovis.*

Barcode of 450 Bp from the Cox1 gene for *Schistosoma mansoni* has been located and identify the species. However, based on material from Senegal, Niger, Cameroon, Uganda, Coastal Kenya and Zambia the gene has shown very high genetic diversity. Five distinct clades has been found: One including Ugand and Coastal Kenya, one including Senegal and Niger, one including Cameroon and Niger, one includig Coastal Kenya and Zambia and one Zambia exclusively.

A special study in Lake Victoria showed very high diversity between different populations of *S. mansoni* within the Lake.

Barcoding of *S. haematobium* showed a less variable genetic barcode of 956 Bp of Cox1 identifying the species. In this study we had material from 15 mainland African countries and 4 islands. Analysis included as well miracidiae as worms. Three clades were found: one including populations from mainland Africa, one including Coastal Kenya and Zanzibar and one including Madagascar and Mauritius.

The application of DNA barcodes for the differentiation of both the intermediate host snail genera *Biomphalaria* and *Bulinus* across Africa has proven to be a promising method. It has been suggested that a barcoding approach may offer the best method for characterization of populations and species within *Bulinus* from different geographical locations. High levels of cytochrome c oxidase subunit I (Cox 1) sequence variation within the *B. africanus* and *B. forskalii* species groups. The presence of ancient evolutionary lineages within *B. globosus* and *B. forskalii* might suggest the presence of ancient cryptic species. The taxonomic statuses of these lineages are still being investigated using a compensatory base change approach. The DNA barcodes from a major study of the *Biomphalaria* spp. from the Lake Victoria region is currently being analysed and will be published in the near future. Deliverable D4 of the project has therefore been fulfilled.

In relation to deliverable no. 5, work has progressed to satisfaction for Development of PCR assays for species identification (RFLP and specific primers) which are less technologically demanding to be implemented in laboratories with modest resources (Deiverable D5), but it is realised that technical issues stop further application of markers. For example 1) *Bulinus*: sequence variation is too variable for broad application but some opportunities remain for local population distinctions viz. *nasutus/contrasticus/globosus/ugandae*. 2) B*iomphalaria*: no sufficient variation between species exist to design confident PCR species markers. This satisfy Deliverable 5,

The overall conclusion is that it has become apparent through this novel research that actually unlikely ever to get a single bar code for a single species. You can identify each species – but there is so much internal variation within each species, further analyses is subsequently necessary – which is all new CONTRAST finding in itself. Furthermore, all novel CONTRAST sequences on Genbank and open access databases, so the results is fully available.

Work is ongoing for establishing DNA and voucher specimen collections as a taxonomic resource for future reference (D6) and samples are presently held in the UK and DBL and there has been sharing of samples with MU. NMK is building up the collection of material on FTA cards and in spirits which satisfy Deliverable 6.

Publications nr 5, 6, 7, 14, 16, and 26 has until now been published based on workpackage 3.

Work Package 4 ***"Development of rapid SNaPshotTM DNA barcodes for multi loci sequence typing (MLST) for schistosome and snails.***

DNA barcoded information has been gathered for several Schistosome and snail populations. Primary analysis has been carried out to design primers for rapid SNaPshotTM.

Very high genetic diversity has been found within and between *S. mansoni* populations from several geographical areas. In contrast very low genetic diversity has been found within and between *S. haematobium* populations from several geographical areas on mainland Africa. But *S. haematobium* on Zanzibar also shows high genetic diversity.

On this background we have come to the result Snapshot packages have been developed for some schistsosomes:, *S.haematobium*, *S. bovis* and *S. curassoni*, but as it was discovered that there is no specific barcode per snail – so SNAPSHOT is not really appropriate. Moreover, molecular techniques moved on, and now no obvious future for snapshot – and could not really publish with snapshot analyses alone – so partly done, partly inappropriate now. D 7 satisfied.

Work Package 5 ***"Detection, identification and quantification of schistosome DNA in snails by Real-Time PCR assays.***

Using the Dra 1 repeat a Real-Time PCR assay using multiplexed TaqMan® probes were developed for the detection of schistosome infections in snails. Several assays were run on the Real Time PCR machine at the NHM. Visits to the NHM by Aslak Jørgensen (DBL), Silvester Nyakaana (MU) and Allen Nalugwa (MU) has facilitated the transfer of this technology to the molecular research node at Makerere University in Uganda

The use of the Dra1 repeat Real-Time PCR assay for the detection of schistosome infections in snails is now developed. The method has been used to detect parasites in naturally infected species of snails. The results are not yet published. Deliverable 8 satisfied.

Work Package 6 ***"Use of oligochromatography: adaptation of Real-Time PCR assays to low technology laboratories.***

The result of this workpackage has partially met Deliverable 9. Prototypes have been transferred to Makerer University (Partner 5). Existing IGS probe targets appear to function for *S haematobium* whilst for *S. mansoni* there is some non-specific cross reactions and need further optimisation.
Developed – but now realised unlikely to be a viable commercial option – 4 years ago it looked great, worth exploring, we explored it, and now found it has no real need- it is now cheaper to sequence than this. Results not published yet.

Work Package 7 ***"Characterisation of the (microsatellites) population structure of*** **Bulinus** ***over space and time.***

Under this work package, population genetic structure of snails belonging to the *Bulinus africanus* group was to be elucidated using polymorphic microsatellite loci previously isolated and characterised from the *Bulinus globosus* genome. The scope of the work covered in this work package was guided by two deliverables, namely: 1) The development of suitable polymorphic microsatellite marker loci for *Bulinus* species and 2) Generating population genetic information for *Bulinus* across project working areas for WP14-17.

The work was to culminate in the analysis of the generated population genetic information to provide insights into how genetic variation is partitioned within and between the different sampled localities across the Lake Victoria basin and coastal Kenya. Analysis of 180 samples collected and analyzed in 19 populations from Kenya (7 populations) and Uganda (12 populations) across 4 microsatellite loci revealed significant genetic differentiation between populations at all hierarchical levels coupled with excess homozygosity and private alleles at most loci. Findings from this work package highlight the role of the reproductive biology of *Bulinus* (being simultaneously selfing and out-crossing), their sedentary nature which negates gene flow between populations and their patchy seasonal habitats that are characterized by recurrent extinction and recolonization events in shaping the population structure of this species. Overall, the deliverables (D10 and 11) of this work package have all been achieved in the stipulated time frame of the project. Publications are in preparation.
Deliverables considered satisfied.

Work Package 8 ***"Characterization of the (microsatellite) population structure of*** **S. mansoni** ***parasites over space and time in relation to habitat, chemotherapeutic pressure, and human infection and morbidity levels.***

In WP 8 novel microsatellite markers, Whole Genome Analyses (WGA) and multiplex analyses were developed and optimised for both *Schistosoma mansoni* and *S. haematobium.* Field work to collect samples was performed by ICL partners in Niger, Uganda, Kenya, Tanzania and Cameroon (and non-CONTRAST country of Mali). Additional field samples were supplied by CONTRAST partners for Niger (and Uganda).
Key findings revealed significant sub-structuring within *S. mansoni* and, for both Tanzania and Uganda within East Africa, a clear impact of PZQ on population genetic structure, with a significant bottleneck in genetic diversity post Mass drug administration (MDA). Such a bottleneck was not consistently apparent within *S. mansoni* from Kenya in East Africa nor Niger in West African.
Preliminary analyses of *S. haematobium* from Tanzania, Cameroon, Niger (and Mali) revealed very limited genetic sub-structuring, indicating few barriers to gene flow in these populations, and less impact of MDA on genetic diversity. Further analyses are ongoing.

In regions of sympatric *S. mansoni* and *S. haematobium*, there was evidence that coinfections within the indivual human host do alter the genetic diversity of both parasite species, with genetic diversity indices and inbreeding being higher in coinfections relative to single infections. MDA with PZQ also had an impact on the genetic diversity of species populations, where, for instance, the impact of coinfections on *S. haematobium* diversity as observed at baseline appeared to be removed 12 months post MDA, potentially indicating a disruption of interspecific interactions by MDA. Likewise in regions of sympatric *S. mansoni* and *S. haematobium*, there was evidence that coinfections alter the morbidity profile observed within the human host, where, for example, *S. haematobium*-associated morbidity was lower in the coinfected group relative to single *S. haematobium* infections, even when accounting for infection intensities. Thus an inter-specific interaction between the two species is suspected to affect the outcome of schistosomiasis-associated morbidity profiles. By these results Deliverables 12 and 13 were satisfied. Publicatiosn 12, 13 and 16 based on this WP.

***Objective 2.* Characterisation of schistosome-snail relationships and transmission potential**

To investigate the schistosome-snail relationship in greater detail in various eco-epidemiological settings across West-, Central- and East Africa to assess and quantify disease transmission potential.

Work Package 9 *"Establishment of a snail-parasite research node".*

The objective in WP 9 was to establish a research node for snail-parasite relationship by strengthening the laboratory capacity of partner 10 for culturing and compatibility testing of living parasites and snails and to develop a regional capacity to train researchers in experimental parasitological methods. Also it was the objective to develop snail parasite information and establish live biological specimen collection. This has been finalized and these facilities are in use used according to need in the Su-Saharan countries. Deliverable 14 is by this satisfied.

Work Package 10 *"Dynamics of transmission and interactions between schistosomes in sub-Saharan Africa.*

WP 10 is a very comprehensive work package involving nine partners 2, 4, 6-11 and 14. It is the objectives to assess the competitive dynamics of schistosome species in mixed infection foci of *S. mansoni* and *S. haematobium* from study areas in Cameroon, Niger, Senegal, Kenya, Tanzania, Uganda and Zambia, and to provide biological material for molecular studies. Referencing WP 3-8. Also re-infection patterns at mixed infection loci following PZQ administration referencing WP 12 will be determined.

Extensive field work has been carried out in the project period. Follow-up cohort studies, as well as research activities at new sites, have been conducted in Senegal, Niger, Cameroon, Uganda, Kenya and Zambia. Interesting results has been obtained showing differences of how effective praziquantal is on the two schistosomes species *S. mansoni* and *S. haematobium* both in single infections and and co-infections. Also it has been found that the parasites in Senegal and Niger react differently on prz treatment than those parasites from Cameroun. Some of the results are published, some are under publications and results will also be directly disseminated to relevant parties because of its immediate importance for disease control taking place in several countries..

.

As a spin-off of the work done on Zanzibar excellent results has been found for complimentary intestinal parasites: Facilitated by the CONTRAST programme, the existing research partnership between the Natural History Museum (NHM; London, UK) and the Helminth Control Team of Zanzibar has been expanded, with the Swiss Tropical Institute (STI; Basel, Switzerland) becoming a new partner. Joint activities pertain to

epidemiological investigations and control interventions focusing on soil-transmitted helminthiasis with an emphasis on strongyloidiasis.

Delivarables 15 and 16 have been satisfied.

From this WP publications nr. 2, 3, 8, 9, 10, 23, 29, 30 and 31 has been published.

Work Package 11 ***"Role of the different species of intermediate hosts in the transmission of schistosomiasis in sub-Saharan Africa."***

In WP 11 it is currently examined which role *Bulinus* and *Biomphalaria* species have in the transmission of schistosomiasis in project study areas referencing WP 10. Also this work package provided biological material for molecular studies, referencing WPs 3-8, and it is also the objective to determine factors that promote changes in schistosome-snail relationship referencing WP 14.

A total of ten partners are involved: 1, 2, 6-12 and 14. The laboratory studies were planned to take place at partner 10 at the snail-parasite relationship research node in Yaoundé, but because of restriction in shipment of infective material between different countries in Africa, some experiments has also taken place at other partner institutions. As reported in the first report preliminary results of the malacological surveys and cercarial shedding were found. However, the compatibility studies have caused problems. This is also a very delicate and difficult exercise, and requires much hands-on training.
In an experimental study from Cameroon it was shown how *Bulinus truncates* was by far the most important intermediste host snail for *S. haematobium* compared to the other two species involved in transmission *B. globosus* and *B. senegalensis*

In Uganda succesfull experiments has take place and the result showing surprisingly that *Biomphalaria stanley* and *B. choanomphala* were more compatible to *S. mansoni* than *B. sudanica* and *B pfeifferi* and snails form Lake Victoria produced more cercariae than snails from Lake Albert. An important results was also that it was clearly demonstrated that cercariae shedding primarily takes place from 8 to 11 in the morning. Deliverable 17 is by this satisfied. The results will be published in the special issue of Acta Tropica which is in preparation.

Work Package 12 ***"To develop novel mathematical predictive models of schistosomiasis transmission under different selective pressures.***

WP 12 has finalised the compiling existing data from other WP 8 and WP 10. Novel stochastic mathematical models which predict and describe the effects of parasite transmission on the genetic diversity of parasite populations, and to elucidate the optimum genetic sampling protocols, were developed and evaluated using field collected CONTRAST data from Tanzania. The results indicate that in order to sample as effectively as possible, increasing the number of hosts sampled, rather than the number of miracidia per host, produces more robust estimates of population genetic diversity pertaining to this location and specific parasite population genetic structure. We hope that the results derived here will be useful to new research and control programmes, and help inform their M&E approaches. This work satisfy deliverables 18 and 19.

Objective 3. Spatial epidemiology for schistosomiasis risk mapping and prediction

To identify key risk factors that govern the frequency and transmission dynamics of schistosomiasis and to quantify spatio-temporal disease patterns in selected eco-epidemiological settings across Africa.

Work Package 13 ***"To establish a GIS and spatial epidemiological research node."***
A GIS research node facilitating spatial epidemiological modelling and mapping of schistosomiasis transmission and other vector-borne diseases has been established at partner 6, The Department for Communicable Diseases, School of Medicine, University of Zambia. The research node has assisted the partners in fulfilling the objectives of Objecticve 3 and has settled plans for sustainabilites post CONTRAST. By this Deliverable 20 is satisfied.

Work Package 14 ***"Creation of comprehensive GIS databases for selected study areas."***
WP 14: *Development of a GIS database*

Historical schistosomiasis survey data extracted from published and unpublished sources have been compiled to an open access georeferenced database. The database includes surveys conducted in over 10 000 unique locations in Africa from 1900 onwards. Todate, this is the only open access database of actual data on schistosomiasis. It is continuous being updated and extended to include other neglected tropical diseases with worldwide coverage. It is developed on MySQL language with a web-interface and can be accessed via www.globalntddatabase.org. A manuscript by Hürlimann et al (2010) reporting on the results has been submitted for publication to PLoS NTD.

Data base of climate and environmental data has been established and is continuously being updated. Already 351 GB worth of land surface temperature and normalised difference vegetation (NDVI) has been archived. Land surface temperature data at 1KM has been downloaded for the whole Sub-Saharan Africa and has been archived at the GIS Research node, Normalised Difference Vegetation Index at km resolution will be has also been loaded in the data base.

During the work in this work packages it has been demonstrated how to utilize Google Earth in CONTRAST.

This result satisfy deliverable 21.

Work Package 15 ***"Development of Bayesian spatial models for risk factor analysis and mapping of high-risk areas."***

Bayesian geostatistical models have been developed to analyse *S. haematobium* and *S. mansoni* survey data in (i) West Africa including Cameroon (Riedel et al 2010a) and (ii) East Africa (Riedel et al 2010b) in order to identify climatic and environmental factors related with the disease transmission and obtain spatially explicit estimates of risk and number of infected individuals of high geographical resolution. The above analyses involved development of data-driven statistical methodology to model very large geostatistical data (over 1000 locations). Methods have also been developed to standardise age-heterogeneous survey data across locations when spatial analyses are carried out on historical survey data. The writing up of this work is currently in progress by. A statistical issue in the spatial analysis of schistosomiasis intensity data is the large number of not infected individuals resulting to excess zeros in the data, not accounted by the negative binomial distribution which is typically considered for egg intensity data. To address this problem, we developed Bayesian geostatistical zero-inflated models (ZIM) and analysed schistosomiasis egg count data in school-age children from Cote-d'Ivoire showing that ZIM produce more accurate maps of helminth infection intensity than their standard counterparts.

Publication 15 and 33 are published, several are in preparation. With this WP Deliverables 22-25 are fully satisfied.

Work Package 16 ***"Predicting infection risk in ecological zones similar to those of the study area"***

This work package is partly covered by WP 15.In WP 16 a large scale pattern analysis of schistosomiasis and its host snails across the CONTRAST study areas is prepared. In this study risk maps based on environmental, - climate -, human - and biotic data and their interactions has been developed. The results will be published in the special issue of Acta Tropica.

Publications 20, 22 and 24 has been published. Deliverable 26 is by this satisfied.

Work Package 17 ***"Construct integrated infection risk maps for schistosomiasis and other vector-borne diseases of socioeconomic importance in sub-Saharan Africa."***

Integrated risk mapping often relies on overlaying disease-specific maps. This approach leads to incorrect estimates of disease co-existence because it implies that the diseases are independent, an assumption which is not justified for diseases influenced by common climatic and environmental drivers. To enable reliable estimation of co-integrated disease risk, geostatistical shared component models have been developed to estimate the geographical distribution and burden of co-infection risk from independent single disease surveys allowing for between diseases correlation. The models have been validated on simulated data and applied on real data from Cote d'Ivoire to assess *S. mansoni* and hookworm co-infection. This work has been further extended to estimate co-integration risk between *S. mansoni*, hookworm and malaria in Cote d'Ivoire as part of an
Deliverbles 27 and 28 are by this satisfied

In this work package also studies from Uganda and Zambia is finalised. Manuscripts are to be prepared.

Three publications are in preparation. More might come.

Objective 4. ***Social sciences approaches to better understand and encourage local control interventions***

To assess and quantify the negative effect of schistosomiasis on the daily lives of people living in endemic areas, and to measure beneficial effects following local control interventions.

Work Package 18 ***"Establish a research node for integrated economic and social policy analyses."***
The research node has been established at partner 12, National Institute of Medical Research, Mwanza, Tanzania. The facilities were established in the first period and fieldwork & course activities have been carried out. By this Deliverable 29 was fulfilled.

Work Package 19 ***"Knowledge, attitudes and practices towards schistosomiasis control, and dynamics of socio-economic status."***
A baseline KAP study (KAP stands for "Knowledge, attitudes and practices") was conducted and completed in the field study area. Data analysis has been performed and a publication is submitted.
Furthermore the baseline study on observations of human-water contact activities was conducted and completed and also that will be included in the publications. Also baseline study on the dynamics of

people's socio-economic status was conducted and completed and the study will be published. Like this Deliverables 30 and 31 are satisfied.

Work Package 20 ***"Evaluation of "Participatory Hygiene and Sanitation Transformation" (PHAST) approach."***

Five training workshops on PHAST strategy facilitated by 18 Community-Owned Resource People (CORPs) have so far been completed involving 750 members of the community. The initiative has now fully been implemented and a manusl has been prepared in Shahili and English

It can be concluded that respondents' knowledge about causes, transmission, symptoms and consequences of intestinal schistosomiasis improved significantly after PHAST intervention.

The traditional beliefs of attributing schistosomiasis-related symptoms to seeing a python and having a house gutted down by fire was significantly reduced during the follow-up;

Generally water contact behaviour of the study population changed. The following (good practices) were observed during the follow-up phase (12 Months after PHAST intervention):

- Frequency of contacts was significantly reduced;
- Timing of contacts changed (mid-day times were avoided);
- Duration of activities were significantly reduced;
- Extent of body surface exposed in water was significantly reduced.

Thus evaluation suggest that PHAST intervention had positive impact on KAP of the study population . By this Deliverables D32 and D33 has been fulfilled.

Work Package 21 ***"Role of snail biodiversity in management of schistosomiasis and use of refractory snails to block schistosome transmission for biological control."***

Snail habitats along the Kenyan Coast were examined over a period and the snail diversity was revealed. It was shown that *B.globosus* was the dominating *Bulinus* species on the northern coast and *B. nasutus* was the dominat species on the Southern Coast. These results will be further investigated. This study satisfied Deliverable 34.

In order to do the necessary studies on refractory snails, snail breeding facilities were established in a snail laboratory facility at Fort Jesus in Mombasa. Collection and set-up of the first snail colonies were done in May, 2008 and currently species are breeding. Infection experiments has taken place until the end of September 2010 and the final results will be presented in publications.
A planned study examining the possibility for using refractory snail from Zanzibar on the Coast of Kenya and vice versa showed to be impossible to implement. Deliverable 35 still wait for the final analysis in Fort Jesus to see if it is fulfilled.

Objective 5. Outreach and dissemination facility established

To collate all information generated by the project and make available to partners and global audience.

Work Package 22 ***"Outreach and dissemination of knowledge."***

The objectives of Work Package 22 was to 1) to promote outreach and dissemination of knowledge between participants, different level stakeholders and end-users using a combination of WWW, electronic and hard copy materials; 2) to promote publication of scientific results at the highest level and 3) to disseminate actively and promote results amongst health decision making structures.

The website inaugurated during the first project is still running successfully (http://www.eu-contrast.eu). The site is frequently used by both CONTRAST partners and external visitors. The site has received almost 50.000 hits during the project period. This gives CONTRAST partners access to information from all the activities of the project, gives the European Commission permanent update on state of progress, and provides access to information to the general public.

In CONTRAST we have deliberately worked on making the work and results known to decision makers in health Ministries, organisations etc. in the partner countries and at each annual meeting we utilized the activity to highlight our work through high profiled openings including Ministers and Permanent secretaries from relevant Ministries, and through television radio and news papers.

Besides the promotion of our work and results to stakeholders in the governmental organisers and planners the results have been disseminated through publication in highly international recognised peer reviewed scientific journals.

Also CONTRAST partners has been used by WHO as experts in committees and by that brought our extended information further on to decision makers.

Peer-reviewed CONTRAST publications as of 30 September 2010 (n=42)

French,M.D., T.S.Churcher, Gambhir, A.Fenwick, J.P.Webster, and M.-G.Basañez. Observed reductions in *Schistosoma mansoni* transmission from large-scale administration of praziquantel in Uganda: a mathematical modelling study. submitted to PLoS NTD 2010.

Garba,A., S.Touré, R.Dembelé, P.BOISIER, Z.TOHON, E.Bosqué-Oliva, A.KOUKOUNARI, and A.Fenwick. 2009. "Present and future schistosomiasis control activities with support from the Schistosomiasis Control Initiative in West Africa." *Parasitology*. 136:1731-1737.

Garba,A., N.Barkire, A.Djibo, M.S.Lamine, B.Sofo, A.N.Gouvras, E.Bosque-Oliva, J.P.Webster, J.R.Stothard, J.Utzinger, and A.Fenwick. 2010. "Schistosomiasis in infants and preschool-aged children: Infection in a single Schistosoma haematobium and a mixed S. haematobium-S. mansoni foci of Niger." *Acta Tropica*. 115:212-219.

Huyse,T., B.L.Webster, S.Geldof, J.R.Stothard, O.T.Diaw, K.Polman, and D.Rollinson. 2009. "Bidirectional introgressive hybridization between a cattle and human schistosome species." *PLoS Pathogens*. 5.

Jørgensen,A., T.K.Kristensen, and J.R.Stothard. Phylogeny and biogeography of African *Biomphalaria* (Gastropoda: Planorbidae) with special emphasis on the endemic species of the great East African lakes. Zoological Journal of the Linnean Society 151[1], 337-349. 2007.

Jørgensen,A., L.v.G.Jørgensen, T.K.Kristensen, H.Madsen, and J.R.Stothard. Molecular phylogenetic investigations of *Bulinus* (Gastropoda: Planorbidae) in Lake Malawi with comments on the topological incongruence between DNA loci. Zoologica Scripta 36[6], 577-585. 2007.

Kane,R.A., J.R.Stothard, A.M.Emery, and D.Rollinson. Molecular characterization of freshwater snails in the genus *Bulinus*: a role for barcodes? Parasites & Vectors 1[1], 1-15. 2008.

Kazibwe,F., B.Makanga, C.Rubaire-Akiiki, J.Ouma, C.Kariuki, N.B.Kabatereine, B.J.VENNERVALD, D.Rollinson, and J.R.Stothard. Transmission studies of intestinal schistosomiasis in Lake Albert, Uganda andexperimental compatibility of local Biomphalaria spp. Parasitology International 59, 49-53. 2010.

Knopp,S., K.A.Mohammed, D.Rollinson, J.R.Stothard, I.S.Khamis, J.Utzinger, and H.Marti. Changing patterns of soil-transmitted helminthiases in Zanzibar in the context of national helminth control programs. American Journal of Tropical Medicine and Hygiene 81[6], 1071-1078.

Knopp,S., K.A.Mohammed, I.S.Khamis, A.F.Mgeni, J.R.Stothard, D.Rollinson, H.Marti, and J.Utzinger. Spatial distribution of soil-transmitted helminths, including *Strongyloides stercoralis*, among children in Zanzibar. Geospatial Health 3, 47-56. 2008.

Knopp,S., A.F.Mgeni, I.S.Khamis, H.Steinmann, J.R.Stothard, D.Rollinson, H.Marti, and J.Utzinger. Diagnosis of soil-transmitted helminths in the era of preventive chemotherapy: effect of multiple stool sampling and use of different diagnostic techniques. PLoS Neglected Tropical Diseases 2[e331]. 2008.

Knopp,S., I.S.Khamis, J.R.Stothard, D.Rollinson, M.Maurelli, P.Steinmann, H.Marti, G.Cringoli, and J.Utzinger. A single FLOTAC is more sensitive than triplicate Kato-Katz for diagnosis of low-intensity soil-transmitted helminth infections. Transactions of the Royal Society of Tropical Medicine and Hygiene 103[4], 347-354. 2009.

Nalugwa,A., T.K.Kristensen, S.Nyakaana, and A.Jørgensen. Mitochondrial DNA Variations in Sibling Species of the Bulinus truncatus/tropicus Complex in Lake Albert, Western Uganda. Zoological Studies 49[4], 515-522. 2010.

Nalugwa,A., A.Jørgensen, S.Nyakaana, and T.K.Kristensen. Molecular phylogeny of Bulinus (Gastropoda: Planorbidae) reveals the presence of three species complexes in the Albertine Rift freshwater bodies. International Journal of Genetics and Molecular Biology 2[7], 130-139. 2010.

Norton,A.J., J.P.Webster, R.A.Kane, and D.Rollinson. Inter-specific parasite competition: mixed infections of *Schistosoma mansoni* and *S. rodhaini* in the definitive host. Parasitology 135, 473-484. 2008.

Norton,A.J., C.M.Gower, P.H.L.Lamberton, B.L.Webster, N.J.S.Lwambo, L.Blair, A.Fenwick, and J.P.WEBSTER. Genetic Consequences of Mass Human Chemotherapy for Schistosoma mansoni: Population Structure Pre- and Post-Praziquantel Treatment in Tanzania. American Journal of Tropical Medicine and Hygiene 83[4], 951-957. 2010.

Plam,M., A.Jørgensen, T.K.Kristensen, and H.Madsen. Sympatric *Biomphalaria* species (Gastropoda: Planorbidae) in Lake Albert, Uganda, show homoplasies in shell morphology. African Zoology 43[1], 34-44. 2008.

Riedel,N., L.Gosoniu, G.RASO, J.Utzinger, and P.Vounatsou. Modelling co-infection risk from single-disease surveys. Statistics in Medicine [Revised and resubmitted].

Rollinson,D., J.P.Webster, B.L.Webster, S.Nyakaana, A.Jørgensen, and J.R.Stothard. 2009. "Genetic diversity of schistosomes and snails: implications for control." *Parasitology*. 136:1801-1811.

Rollinson,D. A wake up call for urinary schistosomiasis: reconciling research effort with public health importance. Parasitology 136, 1593-1610. 2009. Cambridge Journals.

Rollinson,D., B.L.Webster, O.T.Diaw, N.B.Kabatereine, I.S.Khamis, and J.R.Stothard. A new molecular epidemiology of African schistosomiasis with focus upon schistosome diversity. Tropical Medicine and International Health 14[Issue Suppl. S2], 8. 2009.

Rollinson,D., J.P.Webster, B.Webster, S.Nyakaana, A.Jørgensen, and J.R.Stothard. 2009. "Genetic diversity of schistosomes and snails: implications for control." *Parasitology*. 136:1801-1811.

Sengupta,M.E., T.K.Kristensen, H.Madsen, and A.Jørgensen. 2009. "Molecular phylogenetic investigations of the Viviparidae (Gastropoda: Caenogastropoda) in the lakes of the Rift Valley area of Africa." *Molecular Phylogenetics.and Evolution*. 52:797-805.

Simoonga,C., J.Utzinger, S.BROOKER, P.Vounatsou, C.C.APPLETON, A.S.Stensgaard, A.OLSEN, and T.K.Kristensen. 2009. "Remote sensing, geographical information system and spatial analysis for schistosomiasis epidemiology and ecology in Africa." *Parasitology*. 136:1683-1693.

Standley,C., N.Lwambo, C.Lange, Kariuki, M.Adriko, and J.R.Stothard. Performance of circulating cathodic antigen (CCA) urine-dipsticks for rapid detection of intestinal schistosomiasis in schoolchildren from shoreline communities of Lake Victoria. Parasites & Vectors 3[7], 1-5. 2010.

Standley,C., M.Adriko, M.Alinaitwe, F.Kazibwe, N.B.Kabatereine, and J.R.Stothard. Intestinal schistosomiasis and soil-transmitted helminthiasis in Ugandan schoolchildren: a rapid mapping assessment. Geospatial Health 4[1], 39-53. 2009.

Standley,C., M.Adriko, M.Alinaitwe, A.Atuhaire, F.Kazibwe, A.Fenwick, N.B.Kabatereine, and J.R.Stothard. Epidemiology and control of intestinal schistosomiasis on the Sesse Islands, Uganda: integrating malacology and parasitology to tailor local treatment recommendations. Parasites & Vectors 3[64], 1-11. 2010.

Stensgaard,A.-S., C.F.Saarnak, J.Utzinger, P.Vounatsou, C.Simoonga, G.Mushinge, C.Rahbek, F.Møhlenberg, and T.K.Kristensen. Virtual globes and geospatial health: the potential of new tools in the management and control of vector-borne diseases. 2. Geospatial Health 3, 127-141. 2009.

Stothard,J.R. Improving control of African schistosomiasis: towards effective use of rapid diagnostic tests within an appropriate disease surveillance model. Transactions of the Royal Society of Tropical Medicine and Hygiene 103[4], 325-332. 2009.

Stothard,J.R., B.L.Webster, T.Weber, S.Nyakaana, J.P.Webster, F.Kazibwe, N.B.Kabatereine, and D.Rollinson. 2009. "Molecular epidemiology of *Schistosoma mansoni* in Uganda: DNA barcoding reveals substantial genetic diversity within Lake Albert and Lake Victoria populations." *Parasitology*. 136:1813-1824.

Stothard,J.R., L.CHITSULO, T.K.Kristensen, and J.Utzinger. 2009. "Control of schistosomiasis in sub-Saharan Africa: progress made, new opportunities and remaining challenges." *Parasitology*. 136:1665-1675.

Stothard,J.R., J.C.Sousa-Figueiredo, C.Standley, G.J.Van Dam, S.Knopp, J.Utzinger, H.Ameri, A.N.Khamis, I.S.Khamis, A.M.Deelder, K.A.Mohammed, and D.Rollinson. 2009. "An evaluation of urine-CCA strip

test and fingerprick blood SEA-ELISA for detection of urinary schistosomiasis in schoolchildren in Zanzibar." *Acta Tropica*. 111:64-70.

Stothard,J.R., M.D.French, I.S.Khamis, M.-G.Basañez, and D.Rollinson. 2009. "The epidemiology and control of urinary schistosomiasis and soil-transmitted helminthiasis in schoolchildren on Unguja Island, Zanzibar." *Transactions of the Royal Society of Tropical Medicine and Hygiene*. 103:1031-1044.

Tchuem Tchuente,L.A. and E.K.N'Goran. 2009. "Schistosomiasis and soil-transmitted helminthiasis control in Cameroon and Côte d'Ivoire: implementing control on a limited budget." *Parasitology*. 136:1739-1745.

Tchuem Tchuente,L.A., O.T.Diaw, A.Garba, B.L.Webster, J.R.Stothard, and D.Rollinson. Biological features of transmission and reinfection patterns of intestinal and urinary schistosomiasis after treatment. Tropical Medicine and International Health 14[Suppl. 2], 8. 2009.

Tchuem Tchuente,L.A. Control of soil-transmitted helminths in sub-Saharan Africa: Diagnosis, drug efficacy concerns and challenges. Acta Tropica [In Press]. 2010. Elsevier.

Utzinger,J., G.Raso, S.Brooker, D.De Savigny, M.Tanner, N.ÏRNBJERG, B.H.SINGER, and E.K.N'Goran. 2009. "Schistosomiasis and neglected tropical diseases: towards integrated and sustainable control and a word of caution." *Parasitology*. 136:1859-1874.

Vounatsou,P., G.Raso, M.Tanner, E.K.N'Goran, and J.Utzinger. 2009. "Bayesian geostatistical modelling for mapping schistosomiasis transmission." *Parasitology*. 136:1695-1705.

Webster,B.L., D.Rollinson, J.R.Stothard, and T.Huyse. 2009. "Rapid diagnostic multiplex PCR (RD-PCR) to discriminate Schistosoma haematobium and S. bovis." *Journal of Helminthology*. 84:107-114.

Webster,B. 2009. "Isolation and preservation of schistosome eggs and larvae in RNAlater(R) facilitates genetic profiling of individuals." *Parasites & Vectors*. 2:50.

Webster,J.P., C.M.Gower, and A.J.Norton. Evolutionary concepts in predicting and evaluating the impact of mass chemotherapy schistosomiasis control programmes on parasites and their hosts. Evolutionary Applications 1[1], 66-83. 2008. Wiley InterScience.

Webster,J.P., A.Koukounari, P.H.L.Lamberton, J.R.Stothard, and A.Fenwick. 2009. "Evaluation and application of potential schistosome-associated morbidity markers within large-scale mass chemotherapy programmes." *Parasitology*. 136:1789-1799.

Management

Work Package 23 " *Alliance management and project review and assessment*"

CONTRAST there have been no major problems in relation to consortium management and all partners have fulfilled their part of the work as described in Annex 1 of the project.

The management is a nested hierarchy like described in Annex 1. Day to day business is run by the Management Secretariat at the Coordinator (DBL). This secretariat reports to the Management Committee (MC), who has 13 members. The MC has a South and a North representative from each of the 5 objectives and the Coordinator, Webmaster and the Financial Administrator of the coordinating institute. An Optional member can be invited for specific meetings e.g. technical advisor from SCI, WHO or governmental representatives when appropriate.

It is the overall objective for the MC to plan, coordinate and control the project implementation through half yearly meetings. One or more are held at the annual workshop, the other is held 6 moths after the workshop as an electronic conference.

The annual meeting, of which we have had five (including one kick off workshop), is held at different sub-Saharan partner each year. The Kick-Off Workshop was held at partner 5 (responsible for research node 1) in Entebbe, Uganda in October 2006, and The Second Annual Meeting was held at partner 9 (responsible for research node 2) in Yaoundé, Cameroon in October 2007. The third was held in Zambia at the GIS research node in October 2008. The fourth was held in Kenya in October 2009 and also the 5th and final was kept in Kilifi, Kenya.

In case of emergency decisions the coordinator, overall financial administrator from DBL, David Rollinson and Russell Stothard from NHM, form a Executive Committee (EC) acting on the behalf of the overall coordination with reference to the Management Committee.

CONTRAST has successfully followed the timetable as set out in the Gantt diagram in Annex 1. CONTRAST is working in association with and compliment the findings of the Bill & Melinda Gates Foundation supported Schistosomiasis Control Initiative (SCI).

Periodic Activity Report 2

Section 3
Consortium management
(1 October 2007 – 30 September 2008)

CONTRAST

"A multidisciplinary alliance to optimize schistosomiasis control and transmission surveillance in sub-Saharan Africa"

Contract no.: 032203

Partners/Contractor:

Partner 1. DBL, Denmark. Coordinator
Partner 2. NHM, United Kingdom
Partner 3. STI, Switzerland
Partner 4. ICL, United Kingdom
Partner 5. MU, Uganda
Partner 6

Section 3 – Consortium management

Workpacakge 23: Alliance management and project review and assessment.

All partners involved

Overall responsible: Thomas K. Kristensen and Christian Gregart, DBL.

During the CONTRAST project there have been no major problems in relation to consortium management and all partners have fulfilled their part of the work as described in **Annex 1** of the project

The management is a nested hierarchy like described in **Annex 1** (project document). Day to day business is run by the Management Secretariat at the Coordinator (DBL). This secretariat reports to the Management Committee (MC), who have 13 members. The MC has a South and a North representative from each of the 5 objectives and the Coordinator, Webmaster and the Financial Administrator of the coordinating institute. An Optional member can be invited for specific meetings e.g. technical advisor from SCI, WHO or governmental representatives when appropriate.

It is the overall objective for the MC to plan, coordinate and control the project implementation through half yearly meetings. One or more are held at the annual workshop, the other is held 6 moths after the workshop as an electronic conference.

The annual meetings, of which there have been five (including the kick-off workshop), have been hosted by a different sub-Saharan partner each year. The Kick-Off Workshop was held at partner 5 (responsible for research node 1) in Entebbe, Uganda in October 2006. The Second Annual Meeting was held at partner 9 (responsible for research node 2) in Yaoundé, Cameroon in October 2007. The third was held in Zambia at the GIS research node in October 2008. The fourth was held in Kenya in October 2009. The final meeting was arranged by the coordinator, but was also held in Kenya, in September 2010.

CONTRAST successfully followed the timetable as set out in the project document (see Gantt diagram in **Appendix III**).

CONTRAST has worked in association with and complimented the findings of the EU INCO-DEV-2 supported project MUSTSchistUKEMA also coordinated from DBL and also with the Bill & Melinda Gates Foundation supported Schistosomiasis Control Initiative (SCI).

Appendix I: Final plan for using and disseminating knowledge

The management secretariat has created a structure for dissemination of the project results **(WP 22)**, which involves establishing a project website, a project logo and various publications promoting the project. The project website has helped to keep the project partners informed on the development in the project, and has enabled data to be uploaded as well as downloaded (e.g. claim forms and administrative protocols/regulations, DNA sequence and spatial epidemiological data).

CONTRAST follows the original PUDK guidelines.

CONTRAST logo

Immediately after inauguration of the project, a working group was established to create a logo for CONTRAST. The logo should display CONTRAST's geographical focus, and at the same time indicating that we are working for improved schistosomiasis control.

The logo created can be seen in the figure to the right. The curved 'O' symbolizes the snail transmitting schistosomiasis, and the African countries involved in CONTRAST are highlighted on the map.

At the same time the CONTRAST Executive Committee decided to incorporate a tagline to be displayed on CONTRAST publications and on the internet. The tagline is *'Towards control of schistosomiasis'*.

Figure 2. The CONTRAST logo

Open access database of schistosomiasis prevalence

CONTRAST have throught he work accomplished in WP14 established a unique georeferenced database on schistosomiasis prevalence throughout Africa. In September 2010, a scientific paper was submitted PLoS Neglected Tropical Diseases, describing the database, and the visions we have for it. The database can be found at www.globalntddatabase.org, where you can register for access to all data. The database currently features data on 10.000 individual schistosomiasis surveyed locations.

Figure 3. The logo-banner on the http://www.globalntddatabase.org website.

CONTRAST website

The project website was launched on 2 January 2007. The website has two levels of access; one open access for the general public and one restricted to partners and the European Commission (as well as those bodies with local relevance and any others appointed by the EU) restricting the only authorized users to inspect data which has to have restricted access for ethical reasons or is for reference and not corruptible.

The secretariat has regularly requested research project output material from partners to keep the website up to date such as unpublished field- or laboratory reports.

On the website to the left an automatic newsfeed updates the viewer with the latest news on schistosomiasis and neglected tropical diseases from WHO and TropIKA.

The website features a news section so that all partners are kept informed on progress being made within each scientific objective, and as the project as a whole moves forward. The website enables each partners to access the information from all the activities of the project, the European Commission to obtain regular updates of the progress of the project, and provide information to any interested audience.

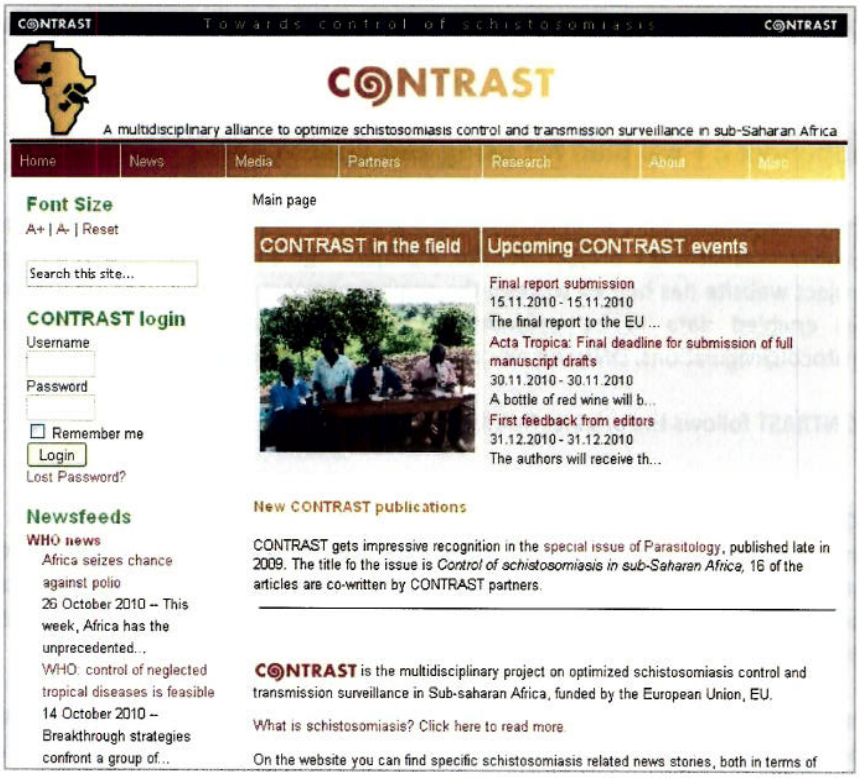

Figure 4. The fornt page of the CONTRAST website on 1 November 2010.

The website has educational materials such as images and video clips to enhance the public appeal **(WP 22)**.

The CONTRAST website has received over half a million hits during the three years it has been active. During the last 12 months there has been over 250.000 hits on the website. The project coordinator and the secretariat has agreed to continue supporting the website up to 2 years after the project ends.

Outreach

At the end of the project findings of this study will be fed back to members of the community in the district to facilitate discussions on the way forward in ensuring sustained schistosomiasis control. One dissemination workshop will be convened in the district to which members of the study community will be equally represented.

Community-owned Resource People, Staff from local health delivery facilities and other key district and regional officials are gong to be invited.

We will also hold one national stakeholders workshop to share our findings with officials from the Ministry of Health and Social Welfare (MOHSW), other relevant stakeholders such as members of CONTRAST

project, officials of the National Schistosomiasis and Soil-transmitted helminths Control Programme (NSSCP), officials of Schistosomiasis Control Initiative (SCI) and others to discuss ways of implementing study recommendations and come out with implementation strategies. Effective dissemination at both national and district levels will facilitate findings to be incorporated into NSSCP plans.

CONTRAST will organize a conference targeted at end-users and stakeholder in one of the African partner countries in 2011. Invited will be stakeholder and end-users in relation to schistosomiasis treatment and mass-drug administration. The findings in CONTRAST may very weel be able to lead to better local control solutions that are more sustainable. The strong research node network across sub-Saharan Africa are now able to establish innovative molecular tools to characterize both snails and schistosomes, define the importance of host-parasite dynamics across different ecological and epidemiological settings, develop new spatial models for disease risk maps and prediction, encourage and assess novel local control interventions using a social science approach and ensure widespread dispersal and access to information.

Appendix II: List of CONTRAST Work Packages, Deliverables and Milestones (and their deadlines)

WP1	**Establishment of a molecular research node in Africa**	**01/10/2006**	**30/09/2007**
D1	**Establishment of a well equipped laboratory facility capable of handling molecular analyses at internationally accepted standards**	**01/10/2006**	**01/10/2006**
wp1_m1	The enhanced physical facilities and initial information storage established in the laboratory	30/04/2007	30/04/2007
wp1_m2	A fully functional molecular research node	01/10/2007	30/09/2007
WP2	**Establishment of a resource database and biological reference collection research node**	**01/10/2006**	**30/09/2007**
D2	**Tangible facilities established for electronic and traditional database and collection at partner 7**	**01/10/2006**	**30/09/2007**
D3	**Database established and available on the WWW**	**01/10/2006**	**30/09/2007**
wp2_m1	The enhanced physical facilities to handle all present and future archival material requirements with except electronic accessibility	28/02/2007	28/02/2007
wp2_m2	A fully functional initial resource database and biological reference collection research node	01/10/2007	30/09/2007
WP3	**Development of DNA sequence barcoding nomenclature for characterization of schistosomes and snails**	**01/01/2007**	**30/09/2010**
D4	**Species specific DNA sequence barcodes for the schisto and intermediate host snails will be established 2 aid future molecular based id**	**01/01/2007**	**30/09/2010**
D5	**Dev of PCR assays for species id (RFLP and specific primers), less tech demanding to be implemented in laboratories with modest resources**	**01/01/2007**	**30/09/2010**
D6	**DNA and voucher specimen collections as a taxonomic resource for future reference will be established**	**01/01/2007**	**30/09/2010**
wp3_m1	Established preliminary classification system of DNA barcodes for Schistosoma, Biomphalaria and Bulinus	01/03/2008	29/02/2008
wp3_m2	Refinements of classification system for Biomphalaria and Bulinus as encountered from East and West Africa	30/09/2008	30/09/2008
wp3_m3	Establishment of comprehensive classification system for Schistosoma, development of lower technology assays and transfer to partner laboratories	01/03/2009	28/02/2009
wp3_m4	Establishment of comprehensive classification system for Biomphalaria and Bulinus, development of lower tech assays & transfer to partner labs	30/09/2010	30/09/2010
WP4	**Development of rapid SNaPshotTM DNA barcodes for multi loci sequence typing (MLST) for schistosome and snails**	**01/10/2007**	**30/09/2010**
D7	**A standardized SNaPshotTM protocol for rapid DNA barcoding of biological specimens and generation of electronic database in WP2**	**01/10/2007**	**29/09/2010**

wp4_m1	Development of initial assays for schistosomes and snails	01/03/2008	29/02/2008
wp4_m2	Application of standardized assays for Schistosoma spp	30/09/2008	30/09/2008
wp4_m3	Application of standardized assays for Bulinus spp. and Biomphalaria spp	01/03/2009	28/02/2009
wp4_m4	Finalization of SNaPshot database	30/09/2010	30/09/2010
WP5	**Detection, identification and quantification of schistosome DNA in snails by Real-Time PCR assays**	**01/10/2007**	**30/09/2010**
D8	**A standardized Real-Time PCR protocol for rapid detection of schisto DNA in aquatic snails leading to generation of info for electronic database**	**01/10/2007**	**30/03/2010**
wp5_m1	Validated Real-Time PCR assay using multiplexed TaqMan® probes for detection and identification of schisto DNA in biological spec in single tube format	30/04/2008	30/04/2008
wp5_m2	Generating data for WP 13,14,15,16 by identification of schistosome infected snail species	30/09/2008	30/09/2008
wp5_m3	Technology transfer to MU	30/09/2008	30/09/2008
wp5_m4	Generating of data for WP 20, 21 by assessing numbers of infected snails collected in study sites at both MU and NHM labs	30/09/2009	30/09/2009
wp5_m5	Completion of generation of data for WP 20, 21	30/09/2010	30/09/2010
WP6	**Use of oligochromatography: adaptation of Real-Time PCR assays to low technology laboratories**	**01/10/2008**	**30/09/2010**
D9	**Dev of oligochromatographic method for post-PCR detection of schisto DNA as an alternative, low tech format, to complement Real-Time PCR assays**	**01/10/2008**	**30/04/2010**
wp6_m1	Development of initial working protocol for oligochromatography of PCR amplified fragments	31/03/2009	31/03/2009
wp6_m2	Standardization of protocol for oligochromatography for detection of schistosome PCR amplified fragments	01/05/2010	30/04/2010
wp6_m3	Development of an assay commercially available from Coris Bioconcept	30/09/2010	30/09/2010
WP7	**Characterisation of the (microsatellites) population structure of Bulinus over space and time**	**01/01/2007**	**31/12/2009**
D10	**Development of suitable polymorphic microsatellite marker loci for Bulinus spp.**	**01/01/2007**	**31/12/2009**
D11	**Population genetic information for Bulinus across project working areas for WP14-17**	**01/01/2007**	**31/12/2009**
wp7_m1	Standardized protocol for amplification of DNA marker loci and initial assessment of population genetic variation	31/12/2007	31/12/2007
wp7_m2	Population genetic information for Bulinus from East Africa	31/12/2008	31/12/2008
wp7_m3	Analysis of population genetic parameters	31/12/2009	31/12/2009
WP8	**Charact of microsat. pop. struct. of S. mansoni paras. o. space & time in relat. to habitat, chemotherapeutic press., & human infect. & morb. lvl.**	**01/10/2006**	**30/09/2009**
D12	**Elucidation of the potential impact of mass chemotherapy on the population genetic structure of the parasite host**	**01/10/2006**	**30/09/2009**

	populations		
D13	**Identification of parasite genotypes and/or parasite genotype combination with potential of causing severe morbidity for targeted control**	**01/10/2006**	**30/09/2009**
wp8_m1	Standardized protocols for the collection of samples from the project areas (incl hatching, storage and multiplex PCR)	01/10/2006	31/03/2007
wp8_m2	Optimisation and processing of current Ugandan samples	01/12/2006	01/12/2006
wp8_m3	First CONTRAST sampling Uganda & any further training (tbc - Narcis)	31/01/2007	31/01/2007
wp8_m4	First CONTRAST sampling & field techniques training Niger (tbc - Amadou)	31/01/2007	31/01/2007
wp8_m5	Initial assessment of population of variation with S. mansoni	01/10/2007	30/09/2007
wp8_m6	Completion of first year field sampling	01/10/2007	30/09/2007
wp8_m7	Longitudinal sampling of schistosomes with regard to chemotherapy	31/12/2007	31/12/2007
wp8_m8	Longitudinal follow-up field samples (field teams & IC staff) and PCR analyses (IC)	01/10/2007	29/09/2008
wp8_m9	Completion of longitudinal sampling of schistosomes	30/09/2008	30/09/2008
wp8_m10	Completion of year-1 follow-up field sampling	30/09/2008	30/09/2008
wp8_m11	Analyses of data and peer reviews paper submission	30/09/2008	30/09/2009
wp8_m12	Completion of genetic analyses of schistosome material	30/09/2009	30/09/2009
wp8_m13	Completion (final revisions of publications)	30/09/2009	30/09/2009
WP9	**Establishment of a snail-parasite research node**	**01/10/2006**	**31/03/2008**
D14	**Fully functional host-parasite relationship research node established**	**01/10/2006**	**31/03/2008**
wp9_m1	The enhanced physical facilities to culture and maintain parasites and snails	01/10/2007	30/09/2007
wp9_m2	A fully functional initial resource database and biological reference collection research node	31/03/2008	31/03/2008
WP10	**Dynamics of transmission and interactions between schistosomes in sub-Saharan Africa**	**01/01/2007**	**31/12/2009**
D15	**Assembly of comprehensive core collection of biological specimens for selected project areas established**	**01/01/2007**	**31/12/2009**
D16	**Assimilation of comprehensive knowledge concerning natural population dynamics of schisto & snails in key transmission environments in E&W Africa**	**01/01/2007**	**31/12/2009**
wp10_m1	The initial collection of biological material from all study areas	01/07/2007	30/06/2007
wp10_m2	Commencement of longitudinal monitoring of dynamics of schistosomes	31/12/2007	31/12/2007
wp10_m3	Start of longitudinal following after chemotherapy	30/06/2008	30/06/2008
wp10_m4	Completion of first round of baseline longitudinal monitoring	01/03/2009	28/02/2009
wp10_m5	Final analysis of follow up data	31/12/2009	31/12/2009
WP11	**Role of the different species of intermediate hosts in the transmission of schistosomiasis in sub-Saharan Africa**	**01/01/2007**	**31/12/2009**
D17	**Deliver a precise understanding of the roles of intermediate**	**01/01/2007**	**31/12/2009**

	host spectrum of urinary and intestinal schistosomes in East and West Africa		
wp11_m1	Selection of key transmission environment for fieldwork	01/07/2007	30/06/2007
wp11_m2	Completion of initial baseline studies and reference collection assembled	01/10/2007	30/09/2007
wp11_m3	Initiation of longitudinal monitoring in selected site	31/12/2007	31/12/2007
wp11_m4	Completion of longitudinal monitoring at key sites	31/12/2009	31/12/2009
WP12	**To develop novel mathematical predictive models of schistosomiasis transmission under different selective pressures**	**01/10/2007**	**30/09/2010**
D18	**Provision of deterministic (and/or stochastic) mathematical models which incorporate genetic structure**	**01/10/2007**	**30/09/2010**
D19	**Validation of models against field collected data in Niger and Uganda**	**01/10/2007**	**30/09/2010**
wp12_m1	Collection of existing data from other WP8 (&10) and literature survey	31/12/2007	31/12/2007
wp12_m2	Development of initial (deterministic) model and preliminary evaluation	30/06/2008	30/06/2008
wp12_m3	Formulation of fully stochastic models for the investigation of transient dynamics of allele frequencies under selective pressures	31/03/2009	31/03/2009
wp12_m4	Evaluation of first year and longitudinal follow-up molecular data to the model	01/04/2009	31/03/2010
wp12_m5	Finalization of models	31/03/2010	31/03/2010
WP13	**To establish a GIS and spatial epidemiological research node**	**01/10/2006**	**30/09/2007**
D20	**Fully functional research node established at partner 6**	**01/10/2006**	**30/09/2007**
wp13_m1	Assessment and inventory of requirements necessary for schistosomiasis mapping needs finalized	01/01/2007	31/12/2006
wp13_m2	Procurement and installation of hard and software finalized	01/04/2007	31/03/2007
wp13_m3	Fully operational research node ready to receive data for risk mapping and prediction	01/10/2007	30/09/2007
WP14	**Creation of comprehensive GIS databases for selected study areas**	**01/03/2007**	**28/02/2009**
D21	**Comp. GIS databases, including demographic, environmental, malacological, parasitological and socio-economic data, for selected eco-zones of sub-S. Africa**	**01/03/2007**	**28/02/2009**
wp14_m1	Database of historical parasitological and snail survey data and gaps identified (i.e. non-sampled locations)	31/08/2007	31/08/2007
wp14_m2	Database of available demographic and socio-economic data and gaps identified (i.e. non-sampled locations)	29/02/2008	29/02/2008
wp14_m3	Database of climatic and environmental data	01/09/2008	31/08/2008
wp14_m4	Cross-sectional surveys completed and aforementioned data gaps filled	01/03/2009	28/02/2009
WP15	**Development of Bayesian spatial models for risk factor analysis and mapping of high-risk areas**	**01/03/2007**	**28/02/2009**

D22	**Epidemiologic risk factors for S. mansoni and/or S. haematobium infection**	**01/03/2007**	**28/02/2009**
D23	**Predictive risk maps of infection prevalence and intensity**	**01/03/2007**	**28/02/2009**
D24	**Validated spatial predictive models of schistosomiasis transmission in project study areas**	**01/03/2007**	**28/02/2009**
D25	**Innovative approaches developed for risk mapping and prediction of tropical parasitic diseases**	**01/03/2007**	**28/02/2009**
wp15_m1	Preliminary risk factors derived from non-spatial models for Lake Victoria basin	01/07/2007	30/06/2007
wp15_m2	Bayesian spatial predictive models for Lake Victoria basin	31/12/2007	31/12/2007
wp15_m3	Preliminary risk factors derived from non-spatial models for coastal East Africa zone	29/02/2008	29/02/2008
wp15_m4	Bayesian spatial predictive models for coastal East Africa zone	30/06/2008	30/06/2008
wp15_m5	Preliminary risk factors derived from non-spatial models for Cameroon, Niger and Senegal river basin	31/10/2008	31/10/2008
wp15_m6	Bayesian spatial predictive models for Cameroon, Niger and Senegal river basin	01/03/2009	28/02/2009
WP16	**Predicting infection risk in ecological zones similar to those of the study areas**	**01/06/2008**	**30/09/2010**
D26	**Climatic and statistical model based infection risk maps for schistosomiasis in different agro-ecological zones across sub-Saharan Africa**	**01/06/2008**	**30/09/2010**
wp16_m1	Preliminary risk factors derived from non-spatial models for agro zone corresponding to lake Victoria basin study area (zones A)	01/09/2008	31/08/2008
wp16_m2	Development of Bayesian spatial predictive models for zones A	02/03/2009	01/03/2009
wp16_m3	Smooth maps of zones A	01/06/2009	31/05/2009
wp16_m4	Preliminary risk factors derived from non-spatial models for agro zone corresponding to coastal East Africa study area (zones B)	31/07/2009	31/07/2009
wp16_m5	Bayesian spatial predictive models for zones B	01/11/2009	31/10/2009
wp16_m6	Smooth maps of zones B	31/12/2009	31/12/2009
wp16_m7	Preliminary risk factors derived from non-spatial models for agro zone corresponding to Cameroon, Niger and Senegal river basin study area (zones C)	01/03/2010	28/02/2010
wp16_m8	Bayesian spatial predictive models for zones C	01/08/2010	31/07/2010
wp16_m9	Smooth maps of zones C	30/09/2010	30/09/2010
WP17	**Construct integrated infection risk maps for schistosomiasis and other vector-borne diseases of socio-economic importance in sub-Saharan Africa**	**01/10/2008**	**30/09/2010**
D27	**Integrated risk maps on transmission of schistosomiasis and other relevant vector borne diseases developed**	**01/10/2008**	**30/09/2010**
D28	**Micro-geographic spatial variation within an existing demographic surveillance site (DSS)**	**01/10/2008**	**30/09/2010**
wp17_m1	Defined physical structure of an integrated database	31/03/2009	31/03/2009

wp17_m2	Functional integrated GIS database	30/09/2009	30/09/2009
wp17_m3	Developed integrated transmission risk maps	31/03/2010	31/03/2010
wp17_m4	Dissemination workshops held and hands-on orientations	31/05/2010	31/05/2010
wp17_m5	All risk maps available on the project web-site	30/09/2010	30/09/2010
WP18	**Establish a research node for integrated economic and social policy analyses**	**01/10/2006**	**30/09/2007**
D29	**Establishment of a fully functional research node for integrated economic and social policy analysis**	**01/10/2006**	**30/09/2007**
wp18_m1	Needs assessment	01/10/2006	31/12/2006
wp18_m2	Assessment of needs completed	01/01/2007	31/12/2006
wp18_m3	Purchase of material	01/01/2007	30/06/2007
wp18_m4	Training	28/02/2007	28/02/2007
wp18_m5	1-month economics training course	28/02/2007	28/02/2007
wp18_m6	1-week PHASE for core/TOTs	01/04/2007	31/03/2007
wp18_m7	The enhanced physical facilities established and training completed	01/07/2007	30/06/2007
wp18_m8	Refreshment of TOTs	01/10/2007	30/09/2007
wp18_m9	Establishment of functioning research node	01/10/2007	30/09/2007
WP19	**Knowledge, attitudes and practices towards schistosomiasis control, and dynamics of socio-economic status**	**01/10/2007**	**30/09/2010**
D30	**People's KAP towards schisto and local means of control at beginning of the project and two years after implementation of loc adapted schisto control intervention.**	**01/10/2007**	**30/09/2010**
D31	**Dynamics of people's soc-eco status over a 2-year period following schisto control intervention in two different eco-epidemiological settings**	**01/10/2007**	**30/09/2010**
wp19_m1	KAP 1 (People's Knowledge, Attitude and Practices)	01/10/2007	30/09/2007
wp19_m2	KAP 2	30/09/2008	30/09/2008
wp19_m3	KAP 3	30/09/2010	30/09/2010
wp19_m4	Socio-economy	01/10/2007	30/09/2010
wp19_m5	Water contact observations	01/10/2007	30/09/2010
wp19_m6	PHAST	01/01/2008	30/09/2008
wp19_m7	Process monitoring	01/01/2008	30/09/2008
wp19_m8	One study populations have been selected and data collection launched	30/09/2008	30/09/2008
wp19_m9	Baseline KAP carried out between months 9-12, first socio-economic and water contact patterns collected at month 12	01/12/2008	30/11/2008
wp19_m10	2nd KAP survey completed m 24. 2nd & 3rd soc-eco and water contact surveys completed m18 & 24. For detailed time see frame	30/09/2010	30/09/2010
WP20	**Evaluation of "Participatory Hygiene and Sanitation Transformation" (PHAST) approach**	**01/10/2007**	**30/09/2010**
D32	**Adapted and pre-tested PHAST manual readily available for deployment in selected study sites**	**01/10/2007**	**30/09/2010**

D33	**Efficacy and cost-effectiveness of PHAST approach examined in different eco-epidemiological settings**	**01/10/2007**	**30/09/2010**
wp20_m1	Adapted and pre-tested PHAST manual available.	31/12/2008	31/12/2008
wp20_m2	Trained personnel who will implement PHAST approach	31/03/2009	31/03/2009
wp20_m3	Community empowered to implement PHAST approach on a larger scale	30/06/2009	30/06/2009
wp20_m4	Efficacy and cost-effectiveness of PHAST assessed and cross-site comparison completed	30/09/2010	30/09/2010
WP21	**Role of snail biodiversity in management of schistosomiasis and use of refractory snails to block schistosome transmission for biological control**	**01/10/2007**	**30/09/2010**
D34	**Information on the distribution of intermediate and some non-intermediate host snails of human schistosomiasis at the selected study regions.**	**01/10/2007**	**30/09/2010**
D35	**Feasibility of use of refractory snails for biological control**	**01/10/2007**	**30/09/2010**
wp21_m1	Field study tools/equipment and personnel sourced	31/12/2007	31/12/2007
wp21_m2	Identification of study areas/sites established and aquaria	31/03/2008	31/03/2008
wp21_m3	Initial data on intermediate host snails interactions with targeted snails for biological control	31/03/2009	31/03/2009
wp21_m4	Initial data on feasibility of selected non-intermediate host snails as decoys of miracidia	01/06/2009	31/05/2009
wp21_m5	Study progress report, more malacological survey data, collection material & database including...	30/09/2010	30/09/2010
wp21_m6	...information on intermediate host snails interactions with targeted snails for biological control as well as decoy effect	30/09/2010	30/09/2010
WP22	**Outreach and dissemination of knowledge**	**01/10/2006**	**30/09/2010**
D36	**Establishment of the project website, including the project presentation and admittance to data for partners and EU**	**01/10/2006**	**30/09/2010**
D37	**Online MySQL database at partner 1, containing all sample data, and which should be accessible for all CONTRAST**	**01/10/2006**	**30/09/2010**
D38	**Media awareness events for the public and decision makers in each of the involved endemic countries**	**01/10/2006**	**30/09/2010**
D39	**Updates and electronic uploads of project results & key findings in appropriate format for potential end-users and decision-making bodies**	**01/10/2006**	**30/09/2010**
D40	**Publication of results in scientific peer-reviewed international literature and review articles in the general press**	**01/10/2006**	**30/09/2010**
wp22_m1	Project website online, including project presentation	01/04/2007	31/03/2007
wp22_m2	Detailed plan for use and dissemination of knowledge to use throughout the project	01/07/2007	30/06/2007
wp22_m3	Special sessions of dissemination for representative stakeholders, NGOs and general public within the annual meeting	01/10/2007	30/09/2007
wp22_m4	Special sessions of dissemination for representative stakeholders, NGOs and general public within the annual meeting	30/09/2008	30/09/2008

wp22_m5	Special sessions of dissemination for representative stakeholders, NGOs and general public within the annual meeting	30/09/2009	30/09/2009
wp22_m6	Conference presenting, results revealed and tools developed for all potential end-users including decision makers	30/09/2010	30/09/2010
WP23	**Alliance management and project review and assessment**	**01/10/2006**	**30/09/2010**
D41	**Effective coordination and control of day to day running of the project (Incl. workshop planning)**	**01/10/2006**	**30/09/2010**
D42	**Optimized communication (Exchange of information)**	**01/10/2006**	**30/09/2010**
D43	**Facilitation of EU progress reporting**	**01/10/2006**	**30/09/2010**
D44	**Facilitation of partner information**	**01/10/2006**	**30/09/2010**
D45	**Qualified general administration and accounting procedures**	**01/10/2006**	**30/09/2010**
D46	**Delivering of continuous financial management and administration during the project**	**01/10/2006**	**30/09/2010**
D47	**Delivering of final administration and audit report at the end of the project**	**01/10/2006**	**30/09/2010**
wp23_m1	Org of start up workshop for the alliance & detailed methodological protocols for all work packages and their compilation	31/10/2006	31/10/2006
wp23_m2	Project management committee meeting and progress report. Interim financial reporting	01/04/2007	31/03/2007
wp23_m3	General project meeting and annual report. EU reporting period 1 - Annual financial and audit report	01/10/2007	30/09/2007
wp23_m4	Project management meeting and progress report. Interim financial reporting	31/03/2008	31/03/2008
wp23_m5	General project meeting and annual report. EU reporting period 2 - Annual financial and audit report	30/09/2008	30/09/2008
wp23_m6	Project management meeting and progress report. Interim financial reporting	31/03/2009	31/03/2009
wp23_m7	General project meeting and annual report. EU reporting period 3 - Annual financial and audit report	30/09/2009	30/09/2009
wp23_m8	Project management meeting and progress report. Interim financial reporting	31/03/2010	31/03/2010
wp23_m9	Final general project meeting and final report. Annual financial and audit report	30/09/2010	30/09/2010

Appendix III: Work plan list, Gantt diagram of activities.

Obj.	Work package	Year 1				Year 2				Year 3				Year 4			
1	WP 1																
1	WP 2																
1	WP 3																
1	WP 4																
1	WP 5																
1	WP 6																
1	WP 7																
1	WP 8																
2	WP 9																
2	WP 10																
2	WP 11																
2	WP 12																
3	WP 13																
3	WP 14																
3	WP 15																
3	WP 16																
3	WP 17																
4	WP 18																
4	WP 19																
4	WP 20																
4	WP 21																
5	WP 22																
	WP 23																

Appendix IV: Final status on the CONTRAST Gender Action Plan.

GENDER ACTION PLAN (GAP)
FINAL IMPLEMENTATION REPORT

This GAP implementation report is part of the final reporting to be completed by the project coordinator and each contractor of IPs and NoEs as indicated. It details the activities undertaken and assesses the progress made in implementing a Gender Action Plan for the project.

Appendix 13 – Science and society reporting questionnaire

All projects

1. GENERAL INFORMATION

1.1. Contract No.: 032203

1.2. Thematic priority: HEALTH

1.3. Instrument: STREP

1.4. Project Acronym:[1] CONTRAST

1.5. Period covered (Start Date – End Date)[1]: 01 October 2006 – 30 September 2010

1.6. Name and title of co-ordinator[1]: Thomas K. Kristensen, University of Copenhagen

1.7. Name and title of contractors:
Partner 1. University of Copenhagen, Thomas K. Kristensen
Partner 2. Natinoal History Museum, David Rollinson
Partner 3. Swiss Tropical Institute, Penelope Vounatsou
Partner 4. Imperial College, Joanne Webster
Partner 5. Makerere University, Silvester Nyakaana
Partner 6. University of Zambia, Christopher Simoonga
Partner 7. National Museums of Kenya, Charles Lange
Partner 8. ISRA, Oumar Talla Diaw
Partner 9. PNLB, Amadou Garba
Partner 10. CSP, Louis Albert Tchuem Tchuente
Partner 11. HCP, Kahlfan Mohammed
Partner 12. NIMR, Nicholas Lwambo
Partner 13. Coris Bioconcept, Thierry Leclipteux
Partner 14. VCD, Narcis Kabatereine

[1] Pre filled when applicable

2. GENDER ACTION PLAN PUBLISHABLE RESULTS TO BE COMPLETED BY COORDINATOR

2.1. **Please give a comprehensive short description of the GAP main achievements (publishable)**

The following is the standard GAP presented by CONTRAST in the official agreement and Annex 1 of the project. All members of the project have agreed to follow these guidelines. On the following pages, the gender balance of each partner will be given. However, since many of the members have had 1) very little staff appointed to the project and/or 2 (have not recruited any staff during the project, several of the fields in the questionnaire are redundant, hence they have not been included.

The GAP of **CONTRAST** has been two fold, 1) to promote and encourage equity of gender and 2) the conducted research must be sensitive to gender concerns. Throughout the project period the gender balance has been kept in mind at all partner institutions, and both sexes have been encouraged to apply on an equal level.

Partner 1, UC, has during the CONTRAST project had a gender ratio of 1/2 (women/male employees). Associates with the project not directly funded have been of the ratio ½ (w/m).

The ratios for the other partners are as follows

Partner 2, NHM 4/4
Partner 3, STI 6/2
Partner 4, ICL 4/1
Partner 5, MU 2/2
Partner 6, UNZA 2/5
Partner 7, NMK 1/1
Partner 8, ISRA 1/2
Partner 9, PNLB 2/5
Partner 10, CSP 0/1
Partner 11, NIMR 5/3
Partner 12, HCP 2/6
Partner 13, Coris 0/0
Partner 14, VCD 8/7

CONTRAST overall, 38/41

Please note that items 4-7 have not been addressed. Mangers from all partners were questioned at the final annual CONTRAST meeting on September 13-17, in order to finalize the forms. Though keeping the CONTRAST GAP in mind, as a project, there was no need to put extra manpower in actively maintaining a gender awareness programme.

2.2. **Please give a short summary on future plans and prospects for the GAP (publishable)**

The CONTRAST partners will continue to encourage women's participation in research and management at all levels.

3. SCIENTIFIC LEADERSHIP AND MANAGEMENT, AND WORKFORCE STATISTICS FOR THE PROJECT TO BE COMPLETED BY CONTRACTORS

The table below gives a summary of all employees at CONTRAST partners

Type of Position	Number of Women	Number of Men	Total	% Women	% Men
Scientific manager	2	11	13	15	85
Scientific team leader / work package manager		9	9		100
Experienced researcher (> 4 years)	2	4	6	33	67
Early researcher (<= 4 years)	4	2	6	67	33
PhD students	11	1	12	92	8
Technical staff	18	14	32	56	44
Other	1	0	1	100	
Total	**38**	**41**	**79**	**48**	**52**

4. GENDER ACTIONS UNDERTAKEN - TO BE COMPLETED BY CONTRACTORS

The table below has been compiled based on your input to the periodic report. Please use the table to elaborate further on the results achieved and to rate the performance level. Please add as many rows as necessary

	Actions taken	Description	Results achieved	Success rate (score 1 - 5)[2]	Comment
Gender balance within Project workforce	**No new project staff has been appointed at UC during the four years.**				
Raising gender awareness	N/A	N/A	N/A	N/A	N/A
Promotion of Women in Science	N/A	N/A	N/A	N/A	N/A
Monitoring Action Plan implementation	N/A	N/A	N/A	N/A	N/A
Other – please specify	N/A	N/A	N/A	N/A	N/A

5. GENDER ACTION PLANS – PROBLEMS ENCOUNTERED – TO BE COMPLETED BY COORDINATOR

The table below has been compiled based on your input to the periodic report. Please use the table to elaborate further on the types of problems encountered and the reasons why the expected outcomes and results could not be achieved. Please add as many rows as necessary.

PLANNED ACTIONS[3]	PROBLEM ENCOUNTERED	CHANGES BEING INTRODUCED

[2] 1 indicates a poor result, 5 indicates a good result

1.		

6. TOTAL EXPENDITURE ON THE GENDER ACTION PLAN FOR THE PROJECT TO BE COMPLETED BY THE COORDINATOR

Please specify the budget allocated to the Gender Action Plan

Encoded budget to be added automatically

N/A

7. GENDER ISSUES IN THE RESEARCH CONTENT TO BE COMPLETED BY PROJECT COORDINATOR

The table below has been compiled based on your input to the periodic report. Please use the table to elaborate further on the results achieved at each stage of the research and to rate the performance level. Please add as many rows as necessary

Gender issues	Description	Outcomes / Results achieved	Stage of research	Success rate (score 1 - 5)[4]	Comments

[3] Pre filled when applicable

[4] 1 indicates a poor result, 5 indicates a good result

Appendix V: Final status on the socio-economic research in CONTRAST.

SOCIO-ECONOMIC REPORTING QUESTIONNAIRE

All partners were queried on their share of socio-economic science as part of the CONTRAST work. Partners answering 'no' to any of the intro questions have been left out. A total of five partners answered 'Yes'. In total 270.000 € were spent on socio-economic research in the CONTRAST project.

Only one partner carried out foresight research (partner 2, future schistosomiasis scenarios), with an estimated total spending of 13.000 €.

Partner 2, STI

1.1 Do your tasks in the project include socio-economic research activities ?	Yes
1.2 If "Yes", what is the estimated total budget allocation that addresses these activities ?	10%, 13.000 €
2.1 Do your tasks in the project include foresight methods ?	Yes
2.2 If "Yes", what is the estimated total budget allocation that addresses these activities?	10%, 13.000 €
3. How many person/months (estimated) are allocated to researchers with a background in social sciences, to perform your tasks for the project ?	2

Partner 6, UNZA

1.1 Do your tasks in the project include socio-economic research activities ?	Yes
1.2 If "Yes", what is the estimated total budget allocation that addresses these activities ?	10%, 27.000€

Partner 7, NMK

1.1 Do your tasks in the project include socio-economic research activities ?	Yes

1.2 If "Yes", what is the estimated total budget allocation that addresses these activities ?	10%, 13.000€

Partner 9, PNLB

1.1 Do your tasks in the project include socio-economic research activities ?	Yes
1.2 If "Yes", what is the estimated total budget allocation that addresses these activities ?	10%, 12.000€

Partner 11, HCP

1.1 Do your tasks in the project include socio-economic research activities ?	Yes
1.2 If "Yes", what is the estimated total budget allocation that addresses these activities ?	25%, 15.000€

Partner 12, NIMR

1.1 Do your tasks in the project include socio-economic research activities ?	Yes
1.2 If "Yes", what is the estimated total budget allocation that addresses these activities ?	100%, 190.000€