Annual Report of the Anti Malaria Campaign 2008

Introduction

The number of malaria cases reported during the year 2008 continued to decline. The total number of reported case was 670 positives, which comprised of 623 vivax infections and 47 falciparum &/or mixed infections. Out of 670, positive cases, 500 were from security forces due to prevailed war condition in the northern province in the year 2008.

The continuing conflict remains the main such factors which could seriously affect malaria control efforts in the country. Considering these factors and the able guidance provided by the Hon. Minister of Healthcare & Nutrition and the Department of Healthcare & Nutrition, the Anti Malaria Campaign continues with the implementation of a programme of action to further reduce the burden of malaria in the country.

The campaign continues to develop and implement a programme of work that can be successfully implemented in both the cleared areas of the country, and the uncleared areas of the Nothern Province. This programme has taken into account the difficulties faced in implementing a control programme in the conflict-affected areas of the country and the recently cleared eastern districts and has succeeded in reducing the burden of the disease in these areas as well.

A matter of serious concern to the campaign and the malaria control efforts in the country is the lack of interest shown by provincial health staff in some districts to continue carrying out the activities under the malaria control programme. The mistaken belief that malaria is no longer a cause for concern in these districts could result in jeopardizing the malaria control efforts not only in these particular districts but could affect the entire country as well. It is therefore important for all concerned to continue to contribute actively to the malaria control efforts in the country.

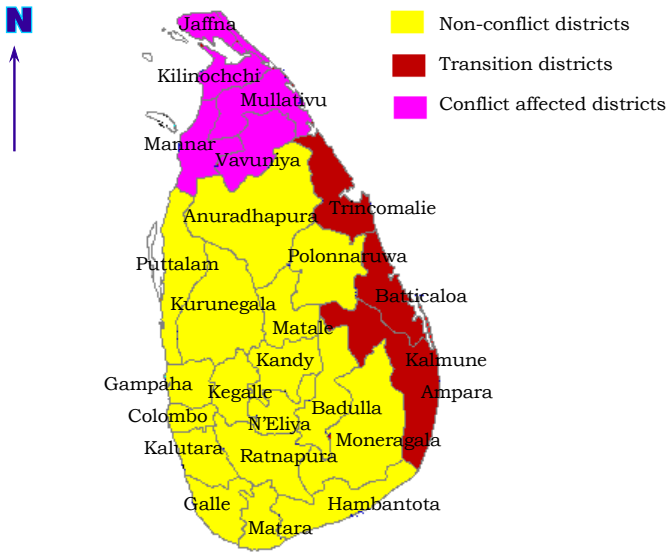
Considering the present favourable malaria situation in the country the Anti Malaria Campaign reorganized the objectives and strategies of the campaign .The revised objectives and strategies of the Anti Malaria Campaign are as follows;

Objectives of the Anti Malaria campaign

- To eliminate indigenous *P. falciparum* malaria by the year 2012 in non-conflict & transitional areas of the country.
- To eliminate indigenous *P. vivax* malaria by the year 2012 in 75% of non-conflict & transitional areas of the country
- To reduce API in conflict affected areas to 75% of the API reported in 2007, by the year 2012.
- To maintain zero mortality from malaria in Sri Lanka

Strategies of the Anti Malaria campaign

- To provide early diagnosis and prompt treatment of malaria patients and asymptomatic parasite carriers.
- To plan and implement selective & sustainable vector control measures based on the principles of IVM.
- Forecasting, early detection, prevention of outbreaks, and the rapid & effective containment of outbreaks.
- To reassess regularly the country's malaria situation, in particular the ecological, social and economic determinants of the disease and evaluation of malaria control activities.
- Enhance community participation and partnership building for effective and sustainable malaria control.
- Promotion of human resource development and capacity building
- Promotion of operational research.


N
Non-conflict districts
Transition districts
Conflict affected districts
Jaffna
Kilinochchi
Mullativu
Mannar
Vavuniya
Trincomalie
Anuradhapura
Puttalam
Polonnaruwa
Batticaloa
Kurunegala
Matale
Kandy
Kalmune
Gampaha
Kegalle
Ampara
Colombo
Badulla
N'Eliya
Moneragala
Kalutara
Ratnapura
Galle
Hambantota
Matara

Epidemiology

The district-wise morbidity pattern in Sri Lanka has undergone drastic changes during the last two decades due to the conflict situation prevailing in several districts of the Northern and Eastern Provinces. Prior to the period of conflict, only a very small percentage of the total country-wide morbidity was recorded from these districts. From the year 2000, there has been a reduction in the incidence of malaria. A total no. of 1047104 blood smears were examined by the Anti malaria Campaign during the year 2008. There were 670 confirmed malaria cases out of which 623 were *P.vivax* infections and the rest had *P. falciparum, P.m.* or mixed infections (29- *Pf* , 1- pm and 17 -mixed infection).Out of 670 confirmed malaria cases, 24 infections were imported from other countries. The highest recorded no. of malaria infections was reported from Kilinochchi district (60%) in the year 2008. The prevailing war condition in Kilinochchi district contributed to this situation. The districts of Kilinochchi, Mullativu, Mannar and Vavuniya contributed largely to the total country morbidity in the year 2008. The proportion of indigenous falciparum cases reported was 5% in year 2006 to 3% in year 2007 and 5% in year 2008.

Table 1 : Parasite formula 2001- 2008

Year	Proportion of P.vivax infections	Proportion of P.falciparum infections
2003	88	12
2004	85	15
2005	92	8
2006	95	5
2007	97	3
2008	93	7

When compared with other South-East Asian countries mortality due to malaria in Sri Lanka is extremely low. There was no deaths reported in the year 2008.

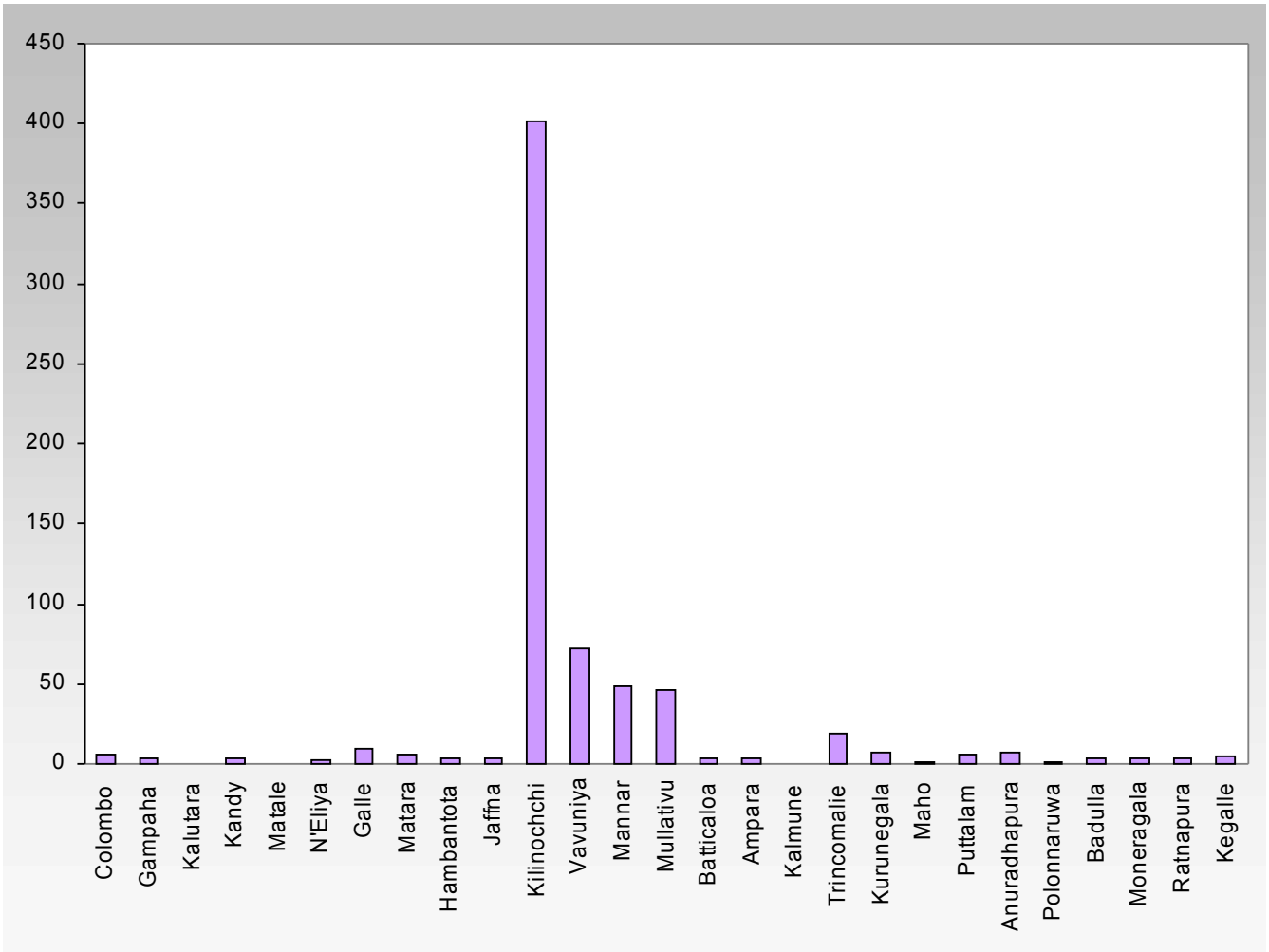


Figure 1. Microscopically confirmed malaria cases (district wise) - 2008

Factors influencing the morbidity and its distribution

Several districts in the North-East Province became hyper endemic for malaria during the last decade as a result of the conflict situation which prevail in this province. Various problems encountered during the malaria control activities, specially the ones which are field-based, and additional factors like the presence of displaced populations who are highly vulnerable to malaria infections, have contributed towards the high incidence. During the year 2008 there seems to be a significant increase in malaria transmission in the districts of Kilinochchi, Mullativu, Vavuniya, Mannar.

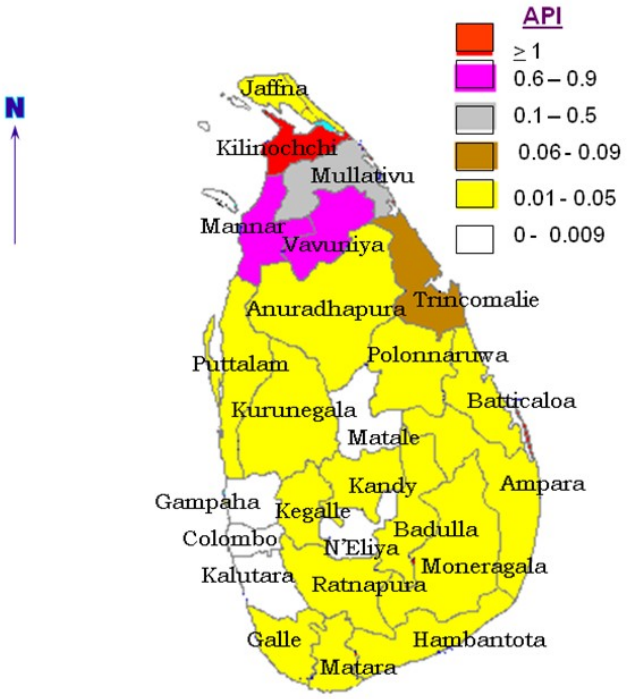


Figure 2 : Intensity of malaria Transmission in Sri Lanka (represented district-wise) 2008

Surveillance

Surveillance mechanism of the malaria control programme is implemented mainly through Activated Passive Case Detection (APCD). All fever patients attending State Medical Institutions located in malarious areas are screened for malaria parasites by examination of a blood smear. Inaddition Passive Case Detection (PCD) is carried out in the other State Medical Institutions by screening suspected malaria patients. Active Case Detection (ACD) is carried out through Mobile Malaria Clinics which operate in malarious localities situated far away from Medical Institutions. Detection of cases by home visits is done under special circumstances (egs. local outbreaks). The Anti Malaria Campaign recommends screening all fever patients that come to an APCD institution for malaria. However, the number of blood smears taken in such institutions has decreased over the years, as the malaria disease burden has fallen down drastically. In spite of that during this year, as in the previous years, screening suspected malaria patients that come to activated medical institutions (APCD) is the most important method of detection of malaria cases, accounting for 77% of the cases detected. Active case detection (ACD) and Mobile clinics (Other methods) are done as a

measure to detect malaria cases early (including asymptomatic parasite carriers) there by preventing transmission.

Information Management

Many of the Regional Malaria Offices have been equipped with computer facilities to enable the officers to utilise the gathered data (parasitological and entomological) in a meaningful manner. Monthly reports are received at the Anti Malaria Campaign Headquarters which regard to the following.

(a) malaria morbidity and mortality (age-wise and sex-wise)
(b) entomological data regarding adult vector and larvae.
(c) vector control activities carried out.
    - adulticiding
    - larviciding

Action is underway to complete provision of computer facilities to all the Regional Malaria Offices and subsequently to establish networking facilities (with the assistance of GFATM Project).

Epidemics/outbreaks

The following parameters are used to forecast epidemics.

(a) monitoring of larval densities in sentinel stations.
(b) monitoring of adult vector densities in sentinel stations, and by random spot checks.
(c) regular observation of fever incidence / and malaria morbidity in Medical Institutions.

There were no major epidemics reported in the year 2008. Few outbreaks were reported in the districts of Kilinochchi, Mullativu, Mannar and Vavuniya.

Action taken to prevent and control of these outbreaks:

(a) Enhanced case detection and treatment
    - By field surveys
    - At Medical Institutions

(b) Vector Control Activities

- Chemical larviciding
- Indoor Residual Spraying of insecticides.
- Health education programmes.

Status of Drug Resistance and Drug Policy

Drug resistance

P.vivax - no chloroquine-resistance reported.

P.falciparum - resistance to chloroquine reported since 1984.

During the year 2008, the treatment regimen for falciparum malaria has been changed in line with the global practice and in view of eliminating falciparum malaria from Sri Lanka by 2012. The artimisinin combination therapy was introduced to Sri Lanka for the treatment of falciparum malaria and Director General of Health Services was issued a circular No 01-14/2008 on 7th May 2008 regarding change of treatment for falciparum malaria and management of malaria patients. The circular was attached in Annexure 1.

Drugs Policy

Plasmodium vivax

Chloroquine - 3 days Primaquine - 14 days

Plasmodium falciparum

First-line treatment

Artemether- Lumefantrine (20mg/120mg) – for 3 days

Primaquine - Single dose treatment

Second line treatment

Quinine

Primaquine (given only if no primaquine has been administered within the preceding week).

Parasitological surveillance

For the year 2008 there were 670 microscopically confirmed malaria cases in the country. Of these, there were only 46 *Plasmodium falciparum* cases 1 *P.malariae* case. Majority of cases were reported from Army personnel in the North and East districts. *Plasmodium* malariae case was an imported case reported from a person who has gone to Liberia.

The number of blood smears examined and number of microscopically confirmed malaria cases in each district is given in table 1.

DISTRICT	B.F.	+VES	*P.v.*	*P.f.*	*P.m.*
Colombo	66552	6	3	3	
Gampaha	47563	3	1	2	
Kalutara	12976	0	0	0	
Kandy	28464	3	3	0	
Matale	16922	0	0	0	
N' Eliya	575	2	2	0	
Galle	9800	10	2	8	
Matara	19312	6	1	5	
Hambantota	32158	4	2	2	
Jaffna	67088	4	4	0	
Kilinochchi	35655	402	393	9	
Vavuniya	49297	72	70	2	
Mannar	23526	48	44	4	
Mullativu	31449	46	45	1	
Batticaloa	55045	4	4	0	
Ampara	23394	4	3	1	
Kalmune	42835	0	0	0	
Trincomalie	73791	19	17	2	
Kurunegala	80550	7	7	0	
Maho	31239	1	0	1	
Puttalam	38631	6	6	0	
Anuradhapura	114315	7	5	1	1
Polonnaruwa	55458	1	1	0	
Badulla	25595	3	3	0	
Moneragala	39637	4	3	1	
Ratnapura	19317	3	3	0	
Kegalle	5960	5	1	4	
Total	1047104	670	623	46	1

Provision of Laboratory Items

The Central laboratory distributes laboratory items required for malaria microscopy to regional malaria offices. Some laboratory items (required for microscopy) issued during the year 2008 are given in table 4.

Table 4: Laboratory items distributed :

District	Lancets	Giemsa stain	Slides	Methanol	Anisole	Ethanol	Cotton wool
Ampara	30000	2	2376	0	0	0	1
Anuradhapura	20000	11	13640	6	1	0	0
Baddulla	0	0	0	0	0	0	0
Batticaloa	25000	3	5000	1	2	1	1
Colombo	0	0	0	0	0	0	0
Embilipitiya	0	0	936	0	0	0	2
Galle	0	0	0	0	0	0	0
Gampaha	2000	3	1008	1.5	0	0	0
Hambantota	40000	3.25	20760	2.5	2.1	0	0
Kalmune	0	6	10000	0	0	2	1
Kalutara	0	0	0	0	0	0	0
Kandy	0	4	0	0	0	0	0
Kegalle	10800	3	2500	0	1	0	0
Kilinochchi	50000	8	15000	1	2	1	2
Kurunegala	60000	9	17500	2.5	3	0	0
Jaffna	30000	4.5	5000	0	3	0	0
Maho	20000	4	12500	1	2	0	0
Mannar	10000	3	2500	0	1	0	0
Matale	0	0	0	0	0	0	0
Matara	0	0	0	0	0	0	0
Moneragala	10000	1	3600	0	0	0	0
Mullaitivu	60000	9	5000	0	3	2	0
Nuwara eliya	0	0	0	0	0	0	0
Polonnaruwa	20000	1	2500	0	1	1	1
Puttalam	45000	0	9708	3.5	0	0	1
Trincomalee	75000	18	35040	2	3	0	0
Vavuniya	0	0	0	0	0	0	0
GRAND TOTAL	507,800	93	164,568	21	24	7	9

Cross checking

Central laboratory of the AMC directorate, also functions as the reference laboratory for malaria microscopy. One of the main functions of the central laboratory is the cross checking

of the blood smears received from different regional malaria offices. All positive blood smears and a percentage of randomly selected negative blood smears are cross checked to confirm the accuracy. Based on the cross checking results and the supervision of the PHLTT, if a PHLT is found to be performing poorly refresher training is given to that person. During the year 2008, 23,427 negative blood smears, 79 *P. vivax* positive blood smears and 1 *P. falciparum* and *P. vivax* mixed blood smear were received for cross checking.

Vector surveillance

A total of 27 malaria vector surveillance programmes were carried out by three central entomological investigation teams in 13 Districts during the year 2008. These included routine sentinel monitoring investigations and foci investigations. Districts covered were Galle (four times), Anuradhapura, Puttalam, kurunegala and Moneragala (three times each), Matale, Ratnapura, Ampara and Polonnaruwa (two times each), Kalutara, Badulla and Hambanthota (once each). In addition, several programmes were carried out for Dengue and Leishmaniasis vector surveillance in Ratnapura and Hambantota districts respectively.

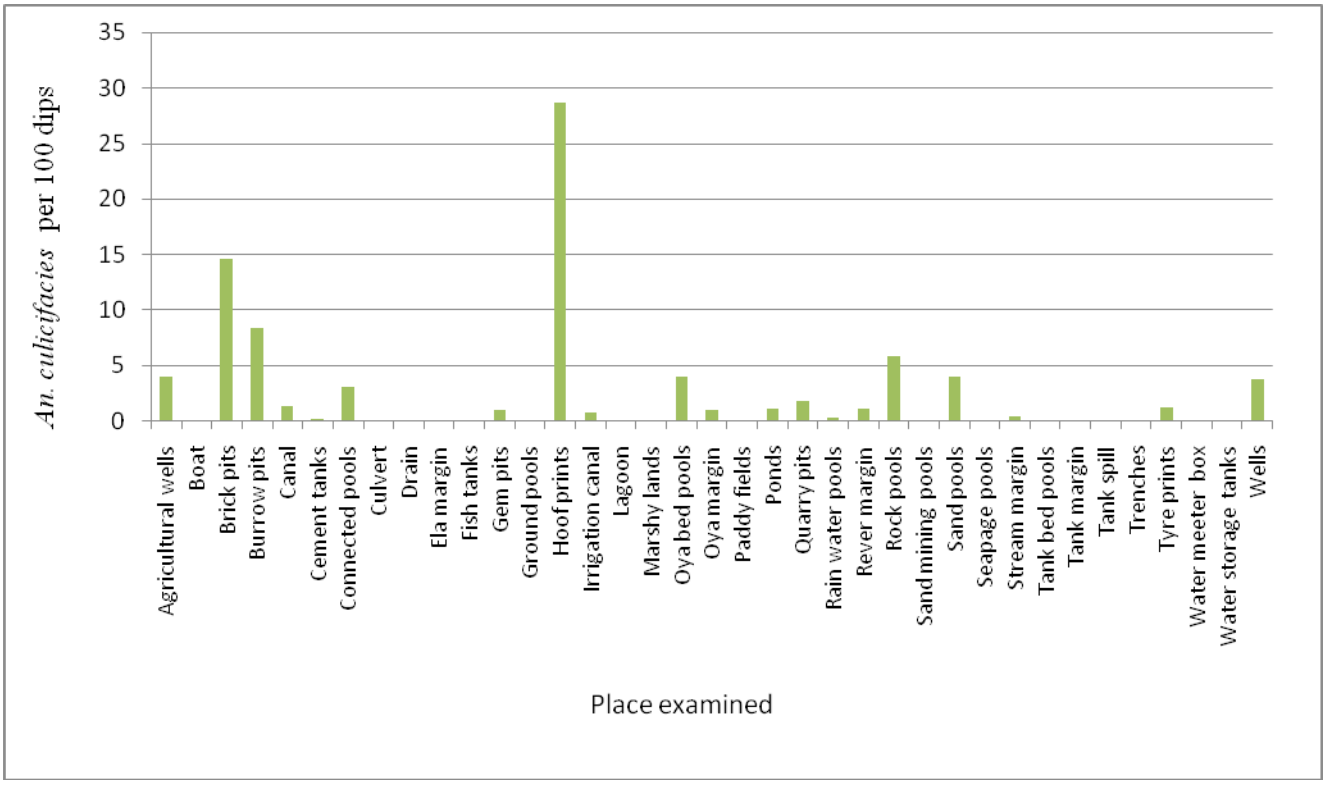
Data obtained from the investigations of the central teams and the data sent by the regional teams were computerized. Summarized results are shown in Table 1 to 10.

Larval surveys were carried out to determine the breeding places of vector mosquitoes in all the districts of the island except in Kilinochchi, Mullaitivu,Vavuniya and Mannar districts as they were war affected during the year 2008.

Table 1: Results of larval survey carried out during 2008

Type of breeding place	No of dips	No. of I& II instar larvae	No of III & IV instar larvae	*An.culicifacies* per 100 dips	*An. subpictus* per 100 dips	*An. annularis* per 100 dips	*An. varuna* per 100 dips
Agricultural wells	3639	1588	1238	3.92	0.329	0.082	1.73
Unused boats	20	0	0	0	0	0	0
Brick pits	3039	1176	870	14.61	8.19	0	0.065
Burrow pits	18125	6461	3856	8.29	9.46	0.071	0.364
Canal	16466	6424	2924	1.336	4.081	0.103	2.392
Cement tanks	2889	44	62	0.138	0.311	0.173	0.069
Connected pools	6220	1950	874	3	0.59	0.08	5.932
Culvert	80	3	9	0	0	0	0
Drain	355	0	0	0	0	0	0
Ela margin	9190	904	441	0.087	0.141	0.15	0.75
Fish tanks	160	2	12	0	0	0	0
Gem pits	500	157	83	1	4	0	1.8
Ground pools	29158	3086	2000	0.061	1.622	0.209	0.092
Hoof prints	1223	494	648	28.61	12.42	0.24	1.96
Irrigation canal	17676	1092	1549	0.7	0.639	0	1.27
Lagoon	1292	25	52	0	4.02	0	0
Marshy lands	1959	81	69	0	0.56	0	0
River bed pools	1592	821	693	3.95	3.89	0	16.45
Paddy fields	25559	2994	3047	0.043	1.91	0.031	0.24
Ponds	19270	2214	1149	1.027	2.24	0.3	1.17
Quarry pits	10980	2297	2231	1.81	2.23	0.93	0.3
Rain water pools	11407	3158	2202	0.25	4.733	0.236	2.831
River margin	66866	10443	7180	1.023	0.016	0.158	5.982
Rock pools	20923	4591	3746	5.82	1.95	0	3.12
Sand mining pools	88	2	32	0	10.27	0	0
Sand pools	17177	5559	3214	3.96	5.89	0	4.57
Seapage pools	544	163	123	0	4.04	0	0.18
Stream margin	8316	2296	1309	0.324	0.432	0.432	11.14
Tank bed pools	250	25	33	0	0	0	7.6
Tank margin	14239	3106	1963	0.035	0.386	1.39	0.344
Tank spill	200	27	38	0	0	0	0
Trenches	846	79	91	0	0.827	0	0
Tyre prints	760	1134	224	1.18	8.81	0	0
Water meeter box	140	12	29	0	20.71	0	0
Water storage tanks	310	47	6	0	0.322	0	0
Wells	83591	11655	9204	3.67	4.62	0.001	1.238

Figure 1: Breeding places of *An. culicifacies*



The larval collection data obtained for the major vector species *Anopheles culicifacies* and other three minor vector species are summarized in the Table 1 and Figure 1. Brick pits, burrow pits, rock pools, sand pools, river bed pools, agricultural wells and hoof prints were the main habitats for breeding of the major vector *Anopheles culicifacies*. Several atypical breeding places of *Anopheles culicifacies* sampled were found to be negative for *Anopheles culicifacies* larvae.

The indoor resting densities of major vector *Anopheles culicifacies* and other potential vector species were determined by the Pyrethrum Spray Sheet Collections in localities sprayed with residual insecticides and in unsprayed areas. The results obtained are summarized in Table 2.

Table 2: Results of Pyrethrum Spray Sheet Collections carried out during 2008

Insecticide	Days after spray	No. of houses examined	No. of houses negative	Species	No. of houses positive	Total No. of		No. of females				No. per house	
						Male	Female	UF	BF	SG	G	Male	Female
Bifenthrin	01-30	18	18	Neg									
Cyfluthrin	31-60	30	15	*An. cul*	2		4		3		1		0.13
				An. sub	15	7	33			16	17	0.23	1.2
	61-90	45	18	*An. cul*	4		10		1	4	5		0.2
				An. sub	23	11	92			51	41	0.24	2.03
	91-120	30	12	*An. cul*	2	2	5	2		3	2	0.06	0.16
				An. sub	16	3	36			18	18	0.1	1.2
	121-150	40	19	*An. cul*	2		2		2				0.05
				An. sub	19	11	42	4		25	13	0.27	1.05
	151-180	27	15	*An. sub*	12	14	15	1	3	4	7	0.51	0.55
Deltamethrin	01-30	66	65	*An. sub*	1		1				1		0.015
	31-60	40	40	Neg									
	61-90	20	19	*An. var*	1		1		1				0.05
Etofenprox	01-30	127	115	*An. sub*	12	10	44	2		39		0.08	0.35
	31-60	27	25	*An. cul*	1		1		1				0.037
				An. sub	1	1						0.03	
	61-90	20	15	*An. sub*	5		18			6	12		0.9
	91-120	35	21	*An. cul*	3		3		2	1			0.09
				An. sub	11	2	12			8	4	0.06	0.34
	121-150	14	10	*An. sub*	4	6	11	5		4	2	0.43	0.79
	151-180	45	21	*An. sub*	24	22	73	1	1	37	34	0.49	1.62
Fenitrothion	01-30	93	84	*An. sub*	9	5	30			21	9	0.05	0.32
	31-60	37	36	*An. sub*	1		2			2			0.05
	61-90	20	17	*An. sub*	3	1	10			5	5	0.05	0.5
	91-121	10	10	Neg									
Lambda-cyhalothrin	01-30	30	28	*An. sub*	2		3			1	2		0.1
	61-90	20	20	Neg									
	91-120	10	9	*An. sub*	1		1			1			0.11
	121-150	30	26	*An. sub*	4	1	4			3	1	0.03	0.13
	151-180	8	7	*An. sub*	1	1						0.13	
ITN		20	19	*An. sub*	1		1			1			0.05
LLIN		625	604	*An. sub*	14	17	11	1		4	6	0.03	0.017
				An. vag	7	1	13	3	1	4	5	0.001	0.02
Unsprayed		10750	8586	*An.cul*	180	22	550	7	97	294	152	0.002	0.04
				An.sub	1965	3034	10959	1031	249	3803	5876	0.28	1

				An.var	7	3	6	2	3		1		

Human Landing collections showed low rates of indoor human biting compared to outdoor biting of *Anopheles culicifacies* in sprayed areas. Outdoor biting the potential vectors was also common in sprayed areas. Summarized results of partial night collections are shown in Table 3.

Table 3 : Results of Human Landing collections – 2008

Insecticide Sprayed	Days after spray	areasNo. of Health	Anopheline species	Indoor						Outdoor					
				No. of baits	No. of mosquitoes				No. of *An. cul* per bait per hour	No. of baits	No. of mosquitoes				No. of *An. cul* per bait per hour
					6-7 pm	7-8 pm	8-9 pm	Total			6-7 pm	7-8 pm	8-9 pm	Total	
Bifenthrin	60-90	1	*An.cul*	3						3		4	3	7	2.33
Cyfluthrin	90-120	1	*An.cul*	2						4	2	3	1	6	1.5
	120-150	1	*An.cul*	5						7	3	2	5	10	1.43
	150-180	1	Neg	3						3					
	NI	6	*An.cul*	39		3		3	0.08	42	1	4	1	6	0.14
			An.ann								2	2	3	7	
Deltamethrin	.01-30	5	*An.cul*	20						36	3	5	7	15	0.42
			An.sub									2	7	9	
			an.var								1			1	
	60-90	1	Neg	2						5					
	90-120	2	Neg	8						22					
	NI		Neg	7						10					
Etophenoprox	.01-30	2	Neg	12						12					
	30-60	1	*An.cul*	8		1		1	0.13	10	1	1		2	0.2
	60-90	1	Neg	3						3					
	90-120	1	Neg	3						3					
	150-180	1	Neg	3						3					
	NI	2	Neg	9						10					
Fenitrothion	30-60	1	*An.sub*	3			2	2		3	8	5		13	
	60-90	1	Neg	7						6					
	90-120	1	Neg	3						3					
Lamda-Cyhalothrin	.01-30	1	Neg	3						3					
	90-120	1	Neg	3						3					
	150-180	1	Neg	3						3					
	NI	4	*An.cul*	24						36	4	7	2	13	0.36
			An.var								5	4	1	10	
			An.ann								5	6	3	14	

Unsprayed		26	*An.cul*	673	6	4	3	13	0.02	740	9	30	34	73	0.1
			An.sub		10	25	11	46			49	50	23	122	
			An.var								2	2	2	8	
			An.anu								5	8		13	

The susceptibility status of major malaria vector *Anopheles culicifacies* and other potential vectors to different insecticides was tested using standard WHO procedures. Results are given in Table 4.

Table 4: Results of Susceptibility testing in 2008

Health area	No of tests	Cyfluthrin 0 .15%	Deltamethrin 0.05%	Deltamethrin 0 .025%	Lamda cyhelothrin 0.1%	Permethrin 0.75%	Fenitrothion 1%	Alphacypermethrin 0.1%	Etofenprox 0.5%	Malathion 5%	D.D.T 4%	Propoxue0.1%	Bendiocarb0.1%	Fenthion 1%
An.culicifacies														
Buttala	2				40(100%)									
Buttala	3									15(53.3%)				
Buttala	3			60(100%)										
Kinniya	4									60(93.3%)				
Kinniya	2											30(100%)		
Rikillagaskada	1											10(90%)		
Rikillagaskada	5											100(100%)		
Sewanagala	1									6(66.7%)				
Sewanagala	1									18(94.4%)				
Sewanagala	1									24(70.8%)				
Sewanagala	1												10(90%)	
An.subpictus														
Addalachchena	3				60(100%)								60(100%)	
Buttala	1			20(95%)										
Damana	2		20(100%)											
Galgamuwa	3						60(88.3%)							
Galgamuwa	5													100(100%)
Hikkaduwa	1		11(100%)											
Hikkaduwa	1		15(100%)											
Hikkaduwa	4		80(100%)											
Karuwalagaswewa	1		10(80%)											
Kinniya	1	15(100%)		15(73%)					15(93.33%)	15(100%)				
Kinniya	6											90(100%)		
Maho	3			60(100%)		60(100%)								
Sewanagala	1									12(8.3%)				
Sewanagala	1									14(92.8%)				
Tangalle	1	20(100%)			20(100%)	20(100%)					20(90%)			
Tangalle	2		40(100%)							40(100%)				
Thabuththegama	2			24(83.3%)										
Thissamaharama	1	20(85%)		20(90%)		20(90%)								

Trincomalee	1									15(93.3%)		15(100%)		
Wellawaya	1						14(14.2%)							

Table 4 contd. Results of Susceptibility testing in 2008

Health area	No of tests	Cyfluthrin 0 .15%	Deltamethrin 0.05%	Deltamethrin 0 .025%	Lamda cyhelothrin 0.1%	Permethrin 0.75%	Fenitrothion 1%	Alphacypermethrin 0.1%	Etofenprox 0.5%	Malathion 5%	D.D.T 4%	Propoxue0.1%	Bendiocarb0.1%	Fenthion 1%
An.annularis														
Buttala	1									15(93.3%)				
Buttala	1									19(100%)				
Buttala	1									8(87.5%)				
Buttala	1									10(90%)				
Kekirawa	3			60(100%)										
Wellawaya	1												7(14.2%)	
An.varuna														
Buttala	1							15(100%)						
Buttala	2							40(100%)						
Higurakgoda	1								6(100%)					
Higurakgoda	1												15(73%)	
Hikkaduwa	1		14(100%)											
Hikkaduwa	1		20(100%)											
Hikkaduwa	1		10(100%)											
Thamankaduwa	1												20(90%)	
Thamankaduwa	1												15(100%)	
Uhana	1									5(100%)				

The persistence of the insecticides used for Indoor Residual Spraying on various insecticides were determined using the standard WHO bioassay test procedures. The data obtained for susceptible female mosquitoes of *Anopheles culicifacies* and other three potential vector species are summarized in Tables 5 and 6.

Table 5: Results of the Bio Assay tests on sprayed surfaces using wild caught blood fed mosquitoes (30 minutes exposure period)

Anopheles culicifacies

Heath Area	Insecticide	Days after spray	Type of Surface	Location	No. tested	Corrected mortality %
Kinniya	Cyfluthrin	41	Mud wall	upper	10	70
			Mud wall	middle	10	60
			Mud wall	lower	10	50
			Roof-Cadjan		10	70
			Door-Wooden		10	80
			Cupboard Wooden		10	0

Anopheles subpictus

Heath Area	Insecticide	Days after spray	Type of Surface	Location	No. tested	Corrected mortality %
Kuchchaweli	Cyfluthrin	73	Mud wall	upper	10	100
			Mud wall	middle	10	100
			Mud wall	lower	10	100
			Roof-Cadjan		10	80
			Door-Wooden		20	100
Kinniya	Etofenprox	4	Mud wall	upper	10	100
			Mud wall	lower	10	100
			Mud wall	middle	10	100
			Roof-Tile		10	100
			Door-Wooden		10	100
	Fenitrothion	2	Cement wall	upper	10	0
			Cement wall	lower	10	0
			Cement wall	middle	10	30
			Cement wall		10	0
		4	Mud wall	upper	10	100
			Mud wall	lower	10	100
			Mud wall	middle	10	100
			Table -Wooden		10	100
			Roof-Cadjan		10	100
		8	Mud wall	upper	10	100
			Mud wall	lower	10	100
			Mud wall	middle	10	90
			Table-Wooden		10	100
			Roof-Cadjan		10	100
		44	Mud wall	upper	10	100
			Mud wall	lower	10	50
			Mud wall	middle	10	90
			Roof-Cadjan		10	100

Heath Area	Insecticide	Days after spray	Type of Surface	Location	No. tested	Corrected mortality %
Kinniya	Deltamethrin	1	Mud wall	upper	10	100
			Mud wall	lower	10	100
			Mud wall	middle	10	100
			Roof - Cadjan		10	100
			Table-Wooden		10	100
		4	Mud wall	upper	10	100
			Mud wall	Lower	10	90
			RooF-Tin		10	100
		28	Mud wall	upper	10	10
			Mud wall	lower	10	10
			Mud wall	middle	10	30
			Roof-Cadjan		10	70
Trincomalee	Deltamethrin	1	Mud wall	upper	10	100
			Mud wall	lower	10	100
			Mud wall	middle	10	100
			Roof-Tile		10	100
			Table-Wooden		10	0

Anopheles varuna

Heath Area	Insecticide	Days after spray	Type of Surface	Location	No. tested	Corrected mortality %
Buttala	Etofenprox	118	Lime plastered wall	upper	10	100
			Lime plastered wall	lower	10	100
			Wooden Door	upper	10	100
			Wooden Door	lower	10	100
			Mud wall	upper	10	100
			Wall - Card Board		10	100
		110	Brick wall	middle	10	100
			Brick wall	upper	10	100
			Lime plastered wall	middle	10	100
			Wooden Door	upper	10	100
			Wooden Door	lower	10	100
			Lime plastered wall	upper	10	100
			Roof-Tile		10	100
Pallegama	Etofenprox	41	Wall	upper	10	100
			Wall	middle	10	100
			Wall	lower	10	100
			Door-Wooden		10	100
			Roof-Cadjan		10	100
Wariyapola	Fenitrothion	59	Mud wall	upper	10	20
			Lime plastered wall	lower	10	10
			Roof-Cadjan		6	100
			Roof-Cadjan		8	75

			Roof-Tin		7	71

Table 6: Results of the Bio Assay tests on sprayed surfaces using sugar fed mosquitoes (30 minutes exposure period)

Anopheles subpictus

Heath Area	Insecticide	Days after spray	Type of Surface	Location	No. Tested	Corrected mortality %
Thambalagamuwa	Fenitrothion	3	Mud wall	Upper	10	100
			Mud wall	Lower	10	100
			Mud wall	Middle	10	100
			Roof -Cadjan		10	100
Thambalagamuwa	Etofenprox	2	Cement wall	Upper	10	80
			Cement wall	Lower	10	80
			Cement wall	Middle	10	70
			Roof -Cadjan		10	50
			Table-Wood		10	0
			Table-Wood		10	90
Trincomalee	Fenitrothion	3	Cement wall	Upper	10	100
			Roof -Cadjan		10	100
			Wall-Concreet		10	100
Muthur	Etofenprox	28	Mud wall	Upper	10	100
			Mud wall	Lower	10	100
			Mud wall	Middle	10	100
			Table-Wooden		10	100
			Table-Wooden		10	100
			Roof -Cadjan		10	100
			Mud wall	Upper	10	100
			Mud wall	Lower	10	100
			Mud wall	Middle	10	100
			Table-Wooden		10	100
			Roof -Cadjan		10	100

Anopheles culicifacies

Heath Area	Insecticide	Days after spray	Type of Surface	Location	No. Tested	Corrected mortality %
Kuchchiweli	Fenitrothion	14	Mud wall	Upper	10	50
			Mud wall	Lower	10	10
			Mud wall	Middle	10	20
			Table-Wooden		10	0
			Roof -Cadjan		10	60

The bio efficacy of Long Lasting Insecticidal Nets were investigated using the standard cone bio assay test using *Anopheles culicifacies* and other vector mosquito species and they are summarized in Tables 7 and 8.

Table 7: Results of the Bio Assay tests carried on LLINs using wild caught blood fed mosquitoes (3 minutes exposure period)

Anopheles culicifacies

Health Area	Insecticide	No. of washes	Days after wash	Location on surface	No. of replicates	No. of mosquitoes	Corrected mortality %
Horowpothana	Deltamethrin	3	90	Upper	4	20	50
		3	0	Middle	4	20	50
		3	90	Lower	4	20	45
Buttala	Deltamethrin	1	7	Upper	2	10	100
		1	7	Middle	2	10	100
		1	7	Lower	2	10	100

Anopheles subpictus

Health Area	Insecticide	No. of washes	Days after wash	Location on surface	No. of replicates	No. of mosquitoes	Corrected mortality %
Buttala	Deltamethrin	0		Upper	3	30	100
		0		Middle	3	30	100
		0		Lower	3	30	100
		4	7	Upper	5	30	73.33
		4	7	Middle	3	30	90
		4	7	Lower	3	30	76.67
Kinniya	Deltamethrin	0	0		1	5	100
		3	2		3	5	100

The results obtained for Cattle Baited Cadjan hut collections, Cattle baited Trap Collections and window Trap Collections are summarized and given in Tables 8,9 and 10.

Vector Control Activities

In Sri Lanka, malaria vectors are mainly controlled by a strategy of integrated vector management. Integral components of this strategy are the rational use of insecticides in rotation for indoor residual spraying (IRS), distributing long lastuing insecticide treated nets (LLINs), breeding and introduction of larvivorous fish, environmental modulation and modification through the filling of abandoned gem pits, imprefnation of mosquito nets with permethrin and space spraying for special occasions. Table shows the insecticides that had been used for indoor residual spraying in different districts.

Lavivorous fish mainly "Guppi" (Pocilia reticulate) were introduced in to wells and abandoned gem-pits as a biological method of vector control.

Table 8. Insecticides that had been used in different districts for indoor residual spraying

District	Deltamethrin	Cyfluthrin	Etofenprox	ICON	Fenithrithion
Colombo					
Gampaha					
Kalutara					
Kandy					√
Matale		√	√		
N' Eliya					
Galle					
Matara					
Hambantota	√			√	√
Jaffna	√				
Kilinochchi				√	
Vavuniya	√				
Mannar	√		√		
Mullativu	√				√
Batticaloa	√			√	√
Ampara	√				√
Kalmune	√				√
Trincomalie	√	√	√		√
Kurunegala	√	√			√
Maho	√	√	√	√	√
Puttalam		√	√		
Anuradhapura	√		√	√	
Polonnaruwa	√				
Badulla	√				
Moneragala	√	√	√	√	
Ratnapura					
Kegalle	√				

The total number of houses fully sprayed were 189090, partially sprayed 17551 during the year of 2008, and the total population covered was 727432. .

Table 9 Utilization of insecticides for malaria vector control operations in 2008

Insecticides	**Usage during 2008**
Indoor Residual Spraying	
Deltamethrin 5% wdp (1 barrel = 11.25kg)	11428.63 kg
Cyfluthrin 10% wdp (1 barrel = 9 kg)	3056.26 kg
Fenithrothion 40% wdp (1 barrel = 9.25 kg)	16263 kg
Lambdacyhalothrin 10% wdp (1 barrel = 20kg)	22539.04 kg
Etofenprox 20% wdp (1 barrel = 9kg)	7546.5 kg

Two hundred and fifty three thousand Permethrin impregnated long lasting insecticide impregnated nets, which were donated by the World Health Organization, were distributed among the malarious areas.

Table 10 Distribution of Long Lasting insecticides treated nets for Malaria Control

District/Institution	**No. of LLINs distributed during 2008**
1. Kalmunai	4000
2. Trincomalee	15000
3. Killinochchi	11500
4. Mannar	11500
5. Pollonnaruwa	10000
6. Anuradhapura	12000
7. Mullathavi	11500
8. Puttalam	20000
9. Moneragala	20000

10. Kurunegala	19000
11. Maho	18000
12. Matale	18000
13. Batticoloa	9500
14. Hambantota	20000
15. Ratnapura	18000
16. Jaffna	20500
17. Vavuniya	11500
18. Ampara	3000
Total	**253000**

Administration

At the end of year 2008, AMC Headquarters had following category of staff. The below table shows the number of staff in each category as at the end of year 2008.

Table 11. Staff position at Anti Malaria campaign Headquarters - 2008

Category of Staff		Approved cadre	In position	
			Male	Female
1	Administrative Grade MOO	02	-	-
2	Community Physicians	03	01	01
3	Parasitologist	01	-	01
4	Entomologist	02	-	02
5	MOO Gr I	01	-	-
6	MOO Gr II	04	02	02
7	MOO Preliminary	-	-	-
8	Accountant	01	-	01
9	Development Assistant	-	02	02
10	Management Assistant	-	-	-
11	Data Entry Operator	02	-	01
12	Public Management Assistant Services	-	-	01
13	Store keeper	03	03	-
14	Public Health inspectors	02	-	-
15	Entomological Assistant	05	03	02
16	Public Health Field Assistant	10	04	02
17	Public Health Laboratory Technicians	22	03	09
18	Cinema Operator	01	-	-
19	Driver	19	08	-
20	K.K.S.	01	01	-
21	Roneo Operator	01	01	-

22	Lab Orderly	03	-	01
23	Spray Machine Operator	19	13	-
24	Ordinary Labourer	-	07	03
25	Sanitary Labourer	-	35	02
26	Labourer (Casual)	-	01	-
27	Registered Medical officer	-	-	01
28	Ward Clerk	-	-	02
	Total	**102**	**84**	**33**

Vehicles-

Adequate number of vehicles in good condition is an important factor in effective malaria control activities throughout the country including the north and east. At present AMC Headquarters has the following number of vehicles. In 2008 there were two new vehicles added to the pool and another two had been removed from the pool.

Table 12 Vehicles available at Anti Malaria Campaign Headquarters

Type	**Road Worthy**	**Available at HQ**
Mitsubishi Fuso Lorry i. 42-1607 ii 42-9399 iii LC-0249	Yes Yes Yes	Yes Yes Yes
Mitsubishi Pajero jeep 32-6520	Yes	Yes
Mitsubishi L200 i. 42-1615 ii GP-2558 iii GP-2556	Yes Yes Yes	Yes Yes Yes
Mitsubishi Double-cab JL 8129	Yes	Yes
Toyota D/Cab GQ-2646	Yes	Yes
Nissan Caravan NA-3117	Yes	Yes
Ford Ranger D/Cab PA-4589	Yes	Yes
Micro D/Cab PB 6537	Yes	Yes
Micro D/Cab PB 6539	Yes	Yes

Drugs

A buffer stock of antimalarial drugs to face any emergency is available in the Headquarters. The following table shows the number of different types of tablets distributed to the RMO regions in the year of 2008.

Chloroqunine tablets

Amount in stores in January 2008	- 45 500
Amount received in 2008	- 421 000
Amount issued in the year 2008	- 416 000

Table 13 .the Distribution of Chloroqunine tablets from Headquarters

RMO region	Amount
Maho	10000
Embilipitya	5000
Matale	18000
Puttalam	9000
Hambanthota	75000
Kurunagala	5000
Anuradhapura	55000
Kandy	6000
Mannar	5000
Vavuniya	10000
Badulla	2000
Kegalle	2000
Ampara	3000
Kalmunai	2000
Batticaloa	13000
Monaragala	7000
BH Horana	2000
Headquaters	3000
D/ Army/ MS	157000
Air Force	27000
Total issued -	

Primaquine tablets

Amount in stores in January 2008	- 400 000
Amount received in 2008	- 72 000
Amount issued in the year 2008	- 59 750

Table 14 Issue of Primaquine tablets from Anti Malaria Campaign Headquarters 2008

RMO Region	Amount
Kandy	5000
Hambanthota	3750
Maho	2500
Ampara	2000
Kurunagala	2000
Batticloa	5000
Embilipitiya	9000
Monaragala	2000
Kalmunai	2000
Vavuniya	10000
Polonnaruwa	2000
Puttalum	2000
Kilinochchi	2000
Jaffna	500
Badulla	500
Matale	500
Anuradhapura	5000
D/Army/MS	1000
Air Force	1000
Total	59750

Quinine

Amount in stores in January 2008	- 27800
Amount received in 2008	- 10000
Amount issued in the year 2008	- 9450

Table 15 Issue of Quinine tablets from Anti Malaria campaign Headquartes 2008

RMO Region	Amount
Kandy	1800
Maho	1500
Batticalo	2000
Anuradhapura	1000
Mulathive	1000
Vavuniya	2500
Kegalle	250
Monaragala	100
Headquarters	2400
Hambanthota	200

Quinine injection

Amount in stores in January 2008	- 4140
Amount received in 2008	- 740
Amount issued in the year 2008	- 230

Table 16 Issue of Quinine injection vials from Anti Malaria Campaign Headquarters

RMO Region	Amount
Anuradhapura	20
Hambanthota	10
Kegalle	100
Headquarters	100
Total	230

Buildings

The Anti Malaria Campaign Headquarters is located at the Public Health Complex at 555/5, Elvitigala Mawatha, Colombo 5. The Director's room, the project director's room of GFATM, Consultant Community Physicians room, Medical officers room, Accounts division of GFATM project, the Public Health Inspectors room, The Library, The Computer room, the telephone exchange and the Auditorium are in the 3rd floor. The Administration branch, finance branch, the Accountants room and stores are located in the 5 th floor. The Central Parasitology Laboratory and Parasitologist's room, Entomology Laboratory and Entomologist's room and Record room are located in the 6th floor.

Foreign funded malaria control activities in the year of 2008

During the year 2007 GFATM WHO assisted malaria control activities in Sri Lanka.

WHO technical assistance to the malaria control programme in 2008 was under the 2007/2008 biennium programme of the Country Budget and consisted of the following activities.

- **National Strategic Plan for Malaria Control Programme 2008-2012 was formulated and printed.**
- **Introduction of revised Malaria Control Strategies to district and provincial level health staff including COMBI strategy.**

Four programmes were conducted in 4 districts to introduce revised malaria control strategies

- **Training of one Medical Officer engaged in fulltime malaria control to participate in the "International Training Course on management of malaria" in Thailand.**

  One officer was trained in Thailand on management of malaria

- **Training of clinicians in management of malaria patients including use of ACT.**

  Five programmes were conducted in 5 malaria endemic districts on management of malaria

- **Procurement of S&E necessary for entomological surveillance and some drugs for management of malaria patients**

  Critical equipment for entomological and parasitological laboratories were procured and distributed

- **Introduction and implementation of revised monitoring and evaluation tools to district**

  Ten programmes were conducted to introduce revised M&E tools at province level

Assistance from the Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM)

During the year 2008, National Malaria Control Programme continued to receive support from the GFATM in the form of two grants for malaria control under the Round 1 and Round 4. Both assistance projects are jointly implemented through a partnership between the Ministry of Healthcare & Nutrition and Lanka Jathika Sarvodaya Shramadana Sangamaya of Sri Lanka. The GFATM Round 1 Malaria Control Project was started in 2003, and the Round 4 project in 2005.

GFATM Round 1 Malaria Control Project

This project funds malaria control activities in 12 conflict-affected districts in Northern, Eastern, North Central & Uva provinces. The project mainly focuses marginalized populations in the districts of Anuradhapura, Polonnaruwa, Jaffna, Killinochchi, Mullaitivu, Mannar, Vavuniya, Trincomalee, Ampara, Kalmunai, Batticaloa and Moneragala.

The following activities were carried out during the year 2008

- **Conducting malaria mobile clinics in high risk areas.**

Under the GFATM project, malaria mobile clinics were conducted in all the project districts for early detection & prompt treatment of malaria patients and asymptomatic carriers. A total of 1209 malaria mobile clinics were conducted (98% of target achieved) at which 107,058 blood smears examined during 2008 from the 12 project districts.

In general, the criteria for selection of a site to conduct mobile malaria clinics were

- malaria case/s reported from the locality
- remote areas with poor access to health care institutions (>10 kms from institution)
- traditionally malarious areas
- mobile population groups – displaced people due to war
- development areas
- new settlers

- **Distribution of Rapid Diagnostic Test-kits (RDTs) to improve diagnostic facilities.**

A total of 10,000 RDTs were purchased and distributed among project districts. These RDTs were mainly distributed to Medical Institutions without a Public Health Laboratory Technician to carry out microscopy. In addition other Government Medical Institutions in project districts were also provided with RDTs to enhance diagnosis and improve case management.

- **Enhanced entomological surveillance**.

Four additional days per month in a district were funded through the project to augment the entomology component of the Provincial Malaria Control Programmes with the view of forecasting and preventing malaria outbreaks and epidemics in the districts. Overall a total of 570 entomological days of surveillance were carried out using project funds.

Sites for entomological surveillance are

- sentinel sites in each district
- random sites based on case load, fever cases and other development activities.

- **Maintenance of vehicles used for malaria control in project districts**.

Vehicles repairs were done in Mullativu, Vavuniya, Kilinochchi, Kalmunai & Trincomalie using GFATM Project funds.

- **District level in-service training programmes**.

  Five hundred and seventy five field staff were given refresher training in year 2008 (PHFOO, PHII, PHLLT, PHFOO & SMOO) in project districts

- **Procurement of essential laboratory equipment and reagents**

Twenty microscopes were purchased & distributed among project districts to enhance parasitological and entomological activities.

- Twelve monthly reviews on GFATM activities in project districts with the participation of Regional Malaria Officers, Technical Staff of AMC Headquarters and representatives of Sarvodaya / Lions, were conducted at Anti Malaria Campaign Headquarters to assess the progress of work qualitatively and quantitatively. These meetings were chaired by the Deputy Director General of Public Health Service, Dr. P.G. Mahipala.

GFATM Round 4 Malaria Control Project

This project aims at scaling up efforts of the national Malaria Control Programme focus on poor, vulnerable populations living in six epidemic-prone districts which are at increased risk for malaria due to occupational factors. The districts are Moneragala, Matale, Ratnapura, Kurunegala, Puttalam and Hambantota. The Project is jointly implemented through a partnership between the Ministry of Healthcare & Nutrition and Lanka Jathika Sarvodaya Shramadana Sangamaya of Sri Lanka

The following activities were carried out during the year 2007 under this project.

- **Conducting malaria mobile clinics in high risk areas.**

Four hundred and eighty eight malaria mobile clinics were conducted (99 % of target achieved) to reduce malaria transmission among vulnerable and mobile populations through early detection and treatment. A total of 29,903 blood smears examined from all 6 project districts and one positive case of *P.vivax* was detected from mobile clinics in Puttalam.

In general, the criteria for selection of a site to conduct mobile malaria clinics were

- malaria case/s reported from the locality
- remote areas with poor access to health care institutions (>10 kms from an

institution)

- traditionally malarious areas
- mobile high risk occupational groups – eg. Chena cultivators, gem miners, people working in quarry pits
- development areas
- new settlers

- **Distribution of Rapid Diagnostic Test-kits (RDTs) to improve diagnostic facilities**.

A total of 15,000 Rapid Diagnostic Test kits were purchased & distributed among project districts in 2008 to enhance malaria diagnosis. These RDTs were mainly distributed to medical institutions without a Public Health Laboratory Technician to carry out microscopy. In addition other government medical institutions in project districts were also provided with RDTs to strengthen diagnosis and management of malaria patients.

- **Enhanced entomological surveillance**.

Four additional days of entomological surveillance were funded through the project to augment the entomology component of the Provincial Malaria Control Programme with a view to forecasting and preventing malaria outbreaks and epidemics. Accordingly 270 additional entomological surveillance days were funded by the project.

- Strengthening of entomological & parasitological laboratories at district level by providing necessary equipment & consumables

Hand lenses, digital hygrometers, dissecting sets, forceps, larval vial tubes and chemicals for entomological investigations were purchased during this period for strengthening of regional laboratories.

- **District level in-service training programmes.**

Five hundred and eighty two field staff were (PHII, PHFOO, PHLTs, PHFO & SMOO) received refresher training for updating knowledge and skills in environment friendly malaria control methods.

- **Operational research studies.**

A research project to evaluate the relative efficacy of two larvicides (Temephos & Pyriproxifen) was carried out in Kurunegala and Puttalam districts.
Another research study was initiated in February 2007 in Matale district to study anopheline vector bionomics in Sri Lanka.

- Twelve monthly reviews on GFATM activities in project districts with the participation of Regional Malaria Officers, Technical Staff of AMC Headquarters and representatives of Sarvodaya / Lions, were conducted at Anti Malaria Campaign Headquarters to assess the progress of work qualitatively and quantitatively. These meetings were chaired by the Deputy Director General of Public Health Service, Dr. P.G. Mahipala.

- Four District Level Review Meetings with Regional Malaria Officers and other provincial level health authorities were conducted in Hambantota, Matale, Moneragala and Puttalam for the purpose of assessing the progress of activities in the project districts, and also to discuss various matters with the intention of improving the project implementations.